EcoForce™
Wall mounted gas fired condensing water heater

Installation, Commissioning, User and Maintenance instructions

MODELS:

EF+ 35/230

EF+ 55/230

Installation manual_EF_May 2026
Original manual

Lochinvar®
HIGH EFFICIENCY BOILERS & WATER HEATERS

TABLE OF CONTENTS

INTRODUCTION

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

abbreviations	NB	NOTICE
symbols		Warning: important information related to the safety of people and/or the appliance
terminology	Flow Return	Water heater hot water out Water heater cold water in

1 SAFETY GUIDELINES

1.1 General

Carefully read all these instructions before commencing installation.
Keep this manual near the water heater for quick reference.

The appliance should be installed by a skilled installer according to all applicable standards and regulations. Failure to comply with these regulations could deem the warranty invalid.

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.

Commissioning, maintenance and repair must be done by a skilled installer/engineer, according to all applicable standards and regulations.

 What to do if you smell gas:

- Do NOT use any electrical equipment
- Do NOT press any switches
- Close the gas supply
- Ventilate the room (open the windows and/or outside water heater room doors)
- Immediately warn the installer.

The manufacturer/supplier is not liable for any damage caused by inaccurately following these mounting instructions. Only original parts may be used when carrying out any repair or service works.

This appliance is not intended for use by people (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning use of the appliance by a person responsible for their safety. Children should be supervised to ensure that they do not play with the appliance.

1.2 Important technical warnings and guidelines

For **FAULT CODES** *see* Ch. 16 *on page* 93

The EF+ Domestic Hot Water systems will, for a long period, comfortably meet your requirement for 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, especially the ones concerning the next important topics:

- Water quality (also see § 8.1 on page 38)

  The first necessary condition is the quality of the water to be heated in the DHW water heater. Three values matter: hardness, total amount of dissolved solids and acidity. If water quality does NOT meet the requirements the system may be seriously damaged in time !

  - Hardness should not exceed 205 PPM $CaCO_3$ (11.5°dH=14°e)
  - TDS (Total Dissolved Solids) should not exceed 450 PPM
  - Hardness and TDS together may not exceed 450 PPM
  - pH value should be between 6.5 and 7.5, measured cold

  The actual value can be retrieved from your local water supplier.

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

- Water flow velocity and pump

  Always use the supplied pump for this heater, the software and parameters are specially set for this type of pump. All specifications and settings in this manual also refer to this specific pump.
  The maximum water flow velocity must be lower than 1 m/sec when using copper pipes.

The applied pump must be controlled by the EF+ water heater control only. If, for any reason, an external pump control is applied *without written approval of Lochinvar Ltd.*, then the complete warranty on the EF+ water heater and all delivered parts will become invalid.

Warnings and guidelines (continuation)

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

- ! *Never use aluminum or aluminum containing flue gas outlet*
- ! *Always fill the siphon before commissioning the water heater*
- ! *Always set the gas valves during commissioning the water heater, for the first time and after maintenance and/or installation changes*
- ! *Never change the parameters P4AD, P4AA and P5BI*
- ! *Never place a 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*

Lochinvar Ltd is not liable for any damage caused by inaccurately following these mounting instructions. Only original Lochinvar parts should 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.
By pressing the service button for a couple of seconds the water heater can be fired independently from the thermostat circuit. Firing the water heater without water flow (but filled with water) will cause a boiling noise.

The flow and return 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 EF+ water heater control. If, for any reason, an external pump control is applied *without written approval of Lochinvar Ltd.*, the complete warranty on the EF+ water heater and all supplied parts will become invalid.

Minimum water pressure 1 bar.

Fuel used should have Sulphur rates that comply with the next values: a maximum annual peak over a short period 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 contains these contents.

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.

The connection for a remote DHW Stat is based on an OpenTherm bus system or an on/off timer.
For correct connections of the thermostat see page 30.

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

LEGIONNAIRES' DISEASE

An anti-Legionella function is present in the software but is default turned OFF.
See § 8.3 on page 38 and for the programming options § 11.2.2 on page 79.

PROPANE GAS

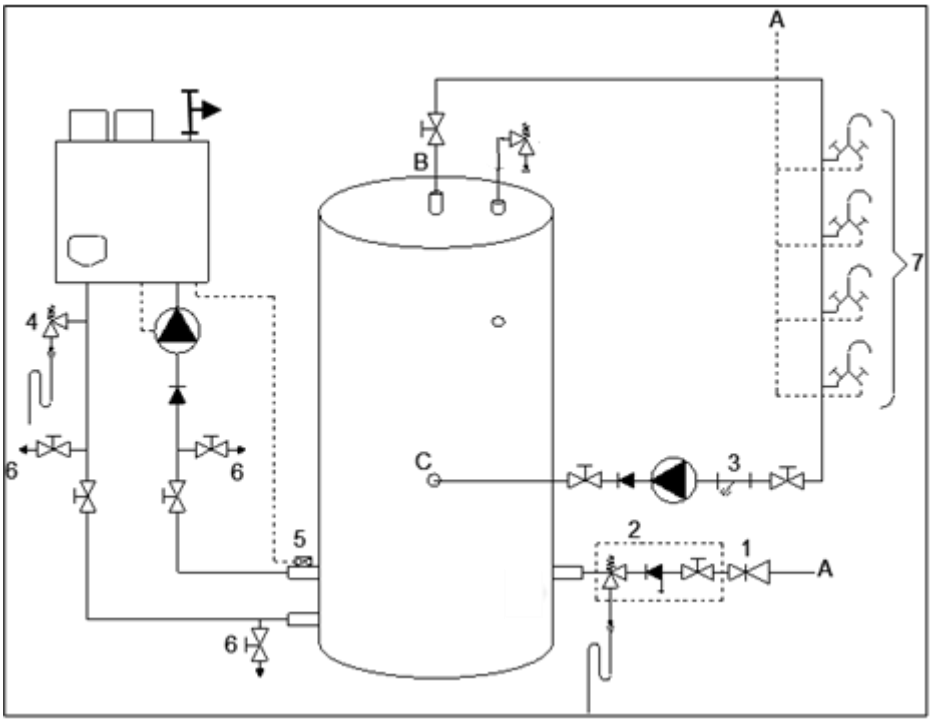
If propane gas is to be used for this water heater, fan speed must be reduced by changing parameter P4BD. See § 11.1.3 at page 77.

1.3 Safety valve

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

There is no Safety relief valve or other safety relevant component shipped with the heater. It is up to the judgement of the installer/system-designer and applicable standard(s) to subscribe and mount a properly dimensioned safety valve.

The EF+ 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 should be equipped with its own safety valve.



	PUMP
	NON RETURN VALVE
	VALVE
	SAFETY VALVE
	MANUAL AIRVENT

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

A) Service pipe inlet
B) Hot water supply circulation
C) Circulation return

1) Pressure regulating valve (mandatory in case service water pressure is too high)
2) Inlet combination with valve (mandatory)
3) Apply a water 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) Remote tank sensor (necessary) → mounting: see § **Fout! Verwijzingsbron niet gevonden.** on page 42
6) Drain valve (recommended)
7) Hot and cold water mixers

	When the water tank can be exposed to underpressure (e.g. when hot water demand is more than freshwater feed), an anti-vacuum valve must be fitted between the inlet combination and the tank, or on top of the tank.

SAFETY COMPONENTS

	NB! The picture shows an example of a functional installation. The safety components as shown in the picture do NOT necessarily conform to 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.

1.4 Diagrams and examples in this manual

Diagrams and examples show an example of a possible functional installation. Not all possible solutions are shown and described. For example, only 1 possible tank sensor is shown.
ALWAYS have the system installed by a qualified installer. The installation must comply with all applicable requirements, regulations and standards.

2 TECHNICAL DATA EF+ WATER HEATERS

2.1 Functional introduction

The EF+ water heater is standard set for Natural gas G20
Gases used must meet the European standard EN 437.
Fuel used should have Sulphur rates according to the European standard, a maximum annual peak over a short period of 150 mg/m^3 and an annual average of 30 mg/m^3.

Water heater control includes the next programmable features:
- Remote operation and heat demand indication from each water heater
- Anti-Legionnaires' disease function
- 0-10 VDC remote flow temperature (set point) control
- NB ! 0-10 VDC remote *burner power input* control is NOT possible for this type of direct fired water heaters.

0-10 VDC connection available
The water temperature can be controlled by an external 0-10 VDC signal. A signal of 1.48 Volt or more will switch on the water heater(s), less than 1.4 Volt will switch off the water heater(s).

Time program
Time programs with three programmable periods per day are available. These time programs can be activated at the control panel and offer great flexibility in controlling the water heater's day and night temperatures as well as the anti-Legionella settings.

2.2 Table technical specifications

GENERAL				
Product Identification number			**CE 0063 BR3537**	
Classification			II2H3P	
Gas Appliance Type			B23; C13, C33, C43, C53, C63, C83	
Type water heater			**EF+35/230**	**EF+55/230**
Dimensions (h x w x d)		mm	**1574 x 700 x 1000**	
Water content est.		Litre's	240	240
Weight dry		kg	114	117
In- and outlet water connection		inch	R 1½"	R 1½"
Gas connection		inch	R ¾"	R ¾"
Flue/air concentric		mm	80 / 125	80 / 125
Flue/air twin pipe		mm	80 / 80	80 / 80
DOMESTIC HOT WATER		**Values min-max:**		
Nominal input (Net)		kW	10.1 – 33.7	14.0 – 52.9
Nominal input (gross) (G20)		kW	11.2 – 37.4	15.6 – 58.8
Nominal input (gross) (G31)		kW	11.0 – 36.6	15.2 – 55.4
Nom. output 80/60°C		kW	9.6 - 32.1	13.4 – 50.5
Nom. output 50/30°C		kW	10.4 – 34.7	14.2 – 53.7
Nom. output 37/30°C at 30% input		kW	10.8 – 36.3	15.1 – 57.1
Water heater Seasonal Efficiency		%	95.3	95.4
Recovery rate at ΔT = 50°C		l/h	550	837
GAS CONSUMPTION gases acc. to EN437		**Values min-max:**		
Natural gas G20		m³ / h	1.07 – 3.57	1.48 – 5.40
Propane gas G31 [1]		m³ / h	0.41 – 1.38	0.57 – 2.09
Gas supply pressure	G20	mbar	20	
	G31		30/37	

EMISSION			**Nominal values at min-max load**	
O_2 flue gas min-max [3]	G20	%	5.4 - 4.9	5.4 - 4.9
	G31	%	6.6 - 4.7	6.6 - 4.7
CO_2 flue gas min-max [3]	G20	%	8.7 - 9.0	8.7 - 9.0
	G31	%	9.5 - 10.5	9.5 - 10.5
NOx class [EN15502-1]		-	**6**	
Temperature flue gas at combustion air temp = 20°C		°C	~ 85-95	
Mass flow flue gas [min-max] $Q_{fluegas}$ condensing		g/s	3.86 - 17.48	5.78 - 27.44
Available pressure for the flue system [4]		Pa	100	120

INSTALLATION		
Max. water temperature	°C	75
Pressure WW-system min-max	bar	1.0 – 8.0
Relief valve pressure max	bar	10

Type water heater		EF+35/230	EF+55/230
ELECTRIC			
Power consumption (without pump).	W	160	195
Power supply	V / Hz	230 / 50 Single phase	
Protection class		IPX4D	

NOTES

1 Using propane G31, maximum fan speed needs to be reduced (parameter P4BD)

2 Below, a table is given in which the min. and max. gas supply pressures are mentioned acc. to EN437

	p nom.[mbar]	*p min [mbar]*	*p max [mbar]*
G20	*20*	*17*	*25*
G31	*30* *37*	*25* *25*	*35* *45*

3 O_2 / CO_2 of the unit measured/set without the water heater front door in place

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

2.3 Table technical specifications ERP

Type water heater:		**EF+35**	**EF+55**
Load profile		XL	XXL
Water heating energy efficiency class		**A**	**A**
	Unit:		
Water heating energy efficiency (η_{wh})	**%**	**85.5**	**86.9**
Daily fuel consumption (Q_{fuel})	GJ	0.079	0.100
Daily electricity consumption (Q_{elec})	kWh	0.169	0.194
Annual fuel consumption (AFC)	GJ	17	22
Annual electricity consumption (AEC)	kWh	37	43
Emissions (NOx) of nitrogen oxides (EN15502-1:2012+A1:2015)	mg/kWh	33	29
Thermostat temperature setting	ºC	55 - 70	55 - 70
Sound power level, indoor (Lwa) (EN 15036-1:2006)	dB(A)	61	61

An EF+ water heater appliance must be installed with a water tank.
The efficiency of the complete installation depends on:

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

Depending on the applied tank volume, the load profile might be higher.

2.4 ERP specifications water tanks.

Water Tank Type:		**EWD230**
Energy label		C
Standing loss (S)	Watt	78.8
Storage volume (V)	liter	240

2.5 Performance

The amount of hot water which can be tapped is related to:

- The temperature of the stored water in the tank
- The size of the tank
- The capacity of the water heater
- The temperature at the tap.

Example: Set temperature tank: 75°C, cold water 10°C
Temperature at the tap: 38°C (for a bath or shower) – for kitchen use 60°C is available.
Combination EF+35 and 230-litre tank

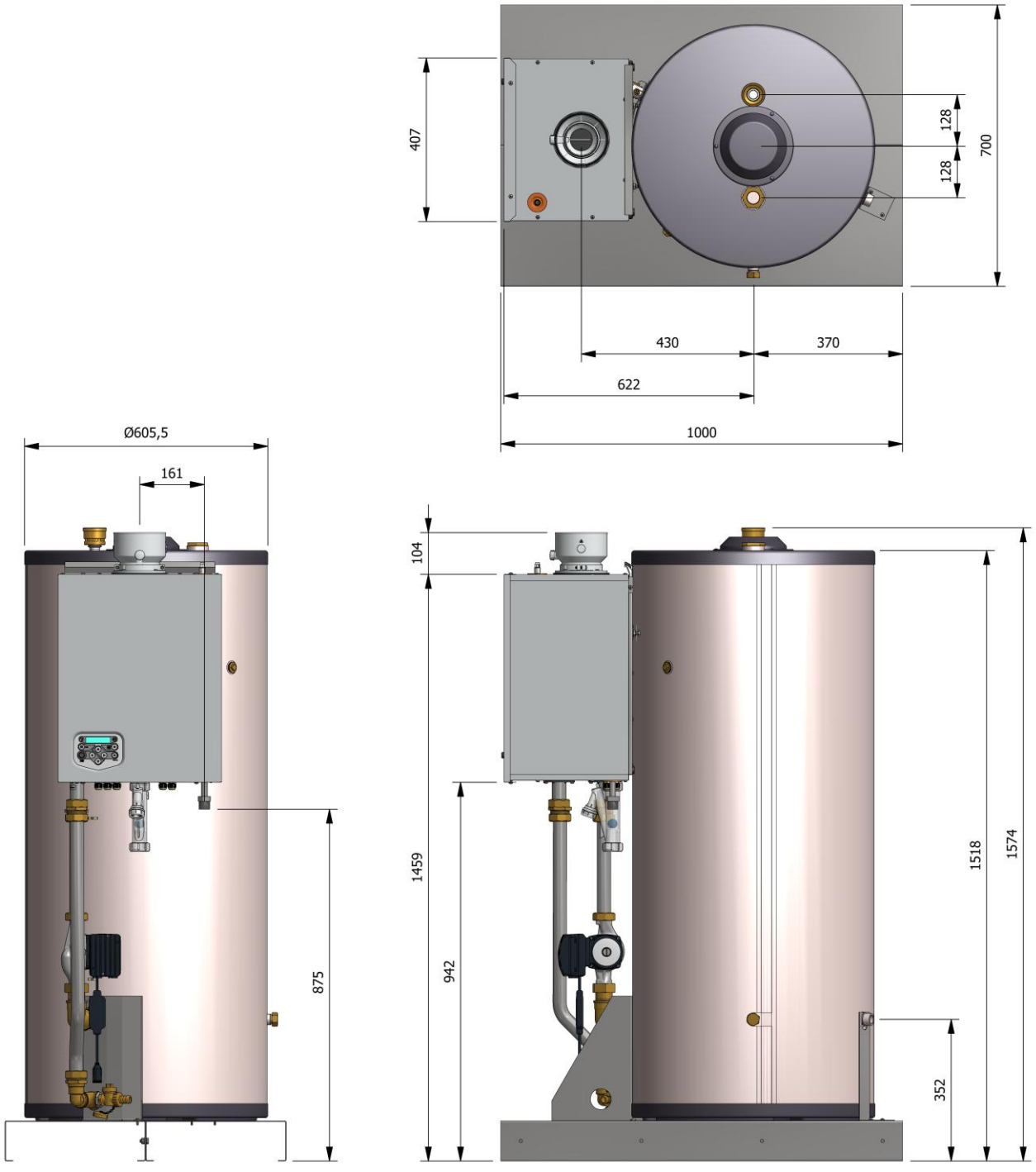
Result:
1. Continuous tapping: up to 16 l/min (hot water 38°C; cold water 10°C)
2. Amount of water in l/min, before the tank temperature is lower than 38°C: by 25 l/min: 42 minutes.

To make calculation easier, hereby some information:

l/min of 38°C	EF+35 with 230 L. tank	EF+55 with 230 L. tank
10	continuous	continuous
15	continuous	continuous
20	143 minutes	continuous
25	42 minutes	continuous
30	24.6 minutes	161.4 minutes
35	17.4 minutes	43.5 minutes
40	13.5 minutes	25.2 minutes
45	11 minutes	17.7 minutes
50	9.3 minutes	13.6 minutes

3 DIMENSIONS

3.1 Water heaters EF+ 35/230 and EF+55/230



4 ACCESSORIES AND UNPACKING

4.1 Unpacking

The EF+ hot water system comes with the following documents and accessories:
- One “EF+ systems Installation and User instructions.
- One “EcoForce+ ”Installation, Commissioning, Users and Maintenance instructions”.
- Attached to the gas valve:
  Two spare fuses, three spare nuts for mounting the burner plate and a gas conversion sticker

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

4.2 Accessories

The EF+ hot water appliance is supplied as a complete system:

- Modulating water heater including control for the complete hot water system
- Stainless steel water tank
- Stainless steel pump
- Stainless steel piping
- Complete wiring
- Drain valve at the bottom of the tank
- Siphon drain hose

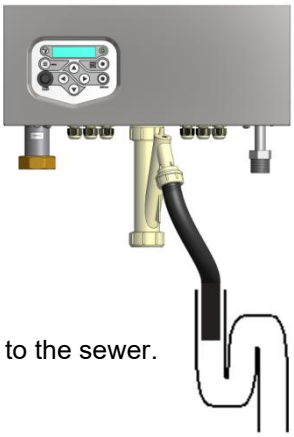
5 INSTALLATION OF THE EF+

5.1 General notes

At every side of the water heater at least 50 mm of clearance should be applied to walls or wall units, 350 mm above the top side of the water heater and 250 mm from the bottom of the water heater.

The installation area / room must have the following provisions:

- 230 V - 50 Hz Single phase power source socket with earth connection.
- Open connection to the sewer system for draining condensing water
- Gas connection.
- Water connection.



Open connection to the sewer.

Other considerations related to the water heater location:

- The ventilation of the plant room must meet all applicable standards and regulations, regardless of the selected supply of fresh air to the water heater location.
- Both the air supply and the flue gas tubes 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 generates noise, depending on the total heating demand. The water heater location should minimize any disturbance this might cause. Preferably it is suggested to mount the water heater on a brick wall.
- There must be sufficient lighting available in the plant room to work safely on the water heater.
- 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 should be lower than the condensate drain level of the water heater.

The water heater must be positioned and installed by a certified installer in accordance with all applicable standards and regulations. Commissioning of the water heater must be done by a skilled service/commissioning engineer, trained for this type of water heater.

6 FLUE GAS AND AIR SUPPLY SYSTEM

6.1 General

The water heater has a positive pressure flue system. The available combined pressure drop for the air inlet and flue gas outlet system, for a single water heater type **EF+35, is 100 Pa and for an EF+55 :120 Pa maximum.**
It is not allowed to use an overpressure system for a multiple water heater installation, always contact the manufacturer for advice.

Notice:

- Install the 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.
- When using a wall terminal, there is the possible risk of ice building-up on surrounding parts/structures, because the condensate will freeze. This risk should be considered during the design phase of the DHW installation.

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

For fluegas type B23, C13, C33, C43, C53, 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 or Burgerhout.

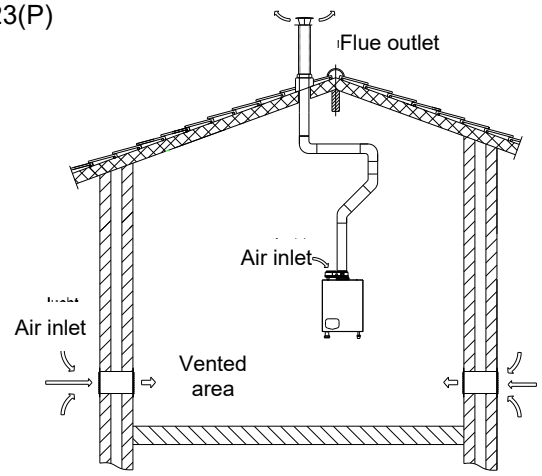
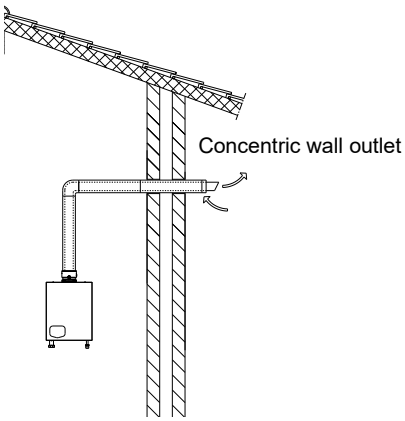
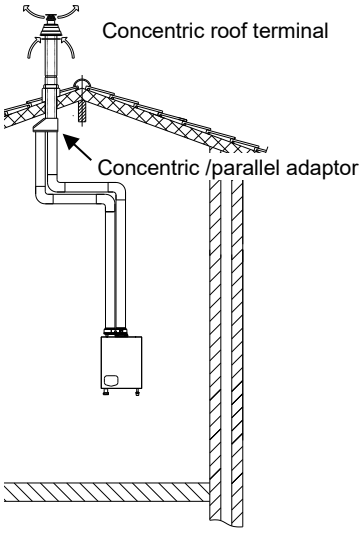
Before installing, read the installation manual(s) of the supplier of the flue gas and air supply parts included with the parts. Manuals for parts supplied can be found at:
http://burgerhout.nl/documenten/handleidingen/.

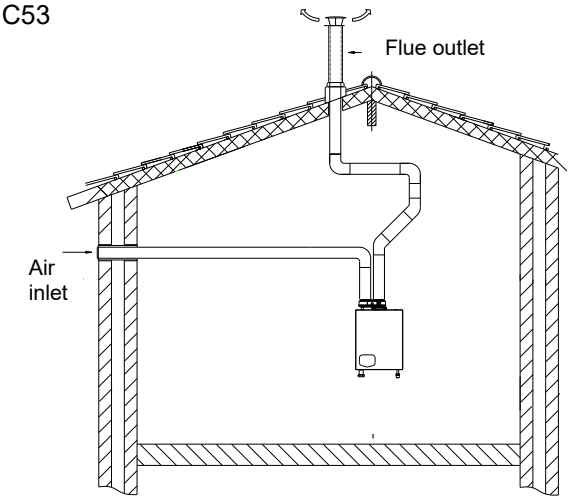
Undermentioned manuals for parts supplied by ECO HS are applicable:

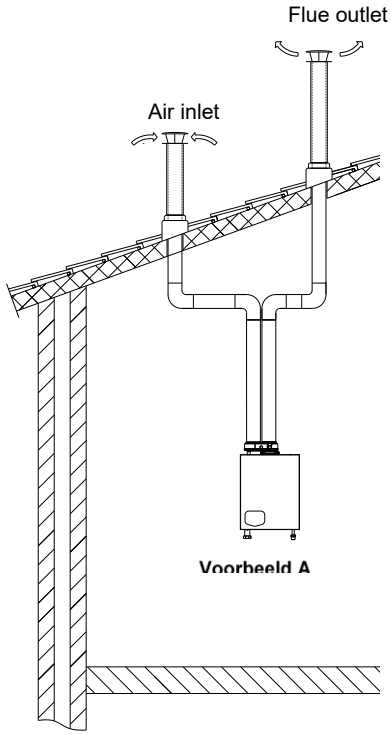
- Regulations regarding flue gas systems PP(s)
- Installation instructions clamps : Checklist
- Installation instructions Skyline 3000

6.2 Type of flue gas systems.

Please contact your supplier in case of C43 and C83 applications.

Type according to EN 1749	Perfor-mance	Description
B23(P)  	Open Air supply from room	* Roof terminal * Without draught diverter * Water heater room air supply. * P = overpressure systems See: Six typical examples - example C **Be aware:** The installation room must have sufficient air supply vents. These vents must be open and may not be closed or blocked. Requirements at BS 6644
C13  	Closed Air supply from outside	*Wall outlet. *Air supply inlet and flue gas outlet in the same air pressure zone. (a combined wall outlet e.g.). See: Six typical examples - example E
C33  	Closed Air supply from outside	* Flue terminal at the roof. * Air supply inlet and flue gas outlet located in the same air pressure zone (a combined roof terminal e.g.). See: Six typical examples - example B

<table>
<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: Six typical examples - example F</td>
</tr>
<tr>
<td>C63
 
</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 water heater. 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 can go to the water heater.
* 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 2.2[1)]</td></tr>
<tr><td>maximum $T_{fluegas}$</td><td>95°C</td></tr>
<tr><td>minimum load $T_{fluegas}$</td><td>35°C</td></tr>
<tr><td>minimum load $Q_{fluegas}$</td><td>See 2.2[1)]</td></tr>
<tr><td>nominal % O_2</td><td>See 2.2[1)]</td></tr>
<tr><td>max. allowed draft</td><td>70Pa</td></tr>
<tr><td>max. pressure drop inlet-outlet</td><td>See 2.2</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) table technical specifications

See: Six typical examples - example A</td>
</tr>
</table>

6.3 C63 certified

In general, water heaters are certified with their own flue gas material for flue types B23, C13, C33, C43, C53, C83 systems.

If a water heater is C63 certified, no specific brand of flue gas material has been certified in combination with the water heater. In this case the flue gas and air supply parts should comply with the applicable European standards (EN14989).
So, for type C63 systems flue gas and air supply parts from other suppliers can be used. It must be able to handle the condensate forming (W) and transport, overpressure (P1) and must have a minimum temperature class of **T120**. Also, it must meet the requirements in the following chapters "air supply" and "flue terminal".

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 behaviour	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 the water heaters:
CE String for Plastic PPs: 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.

Never use aluminium containing flue gas pipes in these water heaters.

Connecting diameters and tolerances:

mat	water heater	d_{nom}	$D_{outside}$	d_{inside}	L_{insert}
SS	C35 / C55	80	80 + 0.3 / -0.7	81 + 0.3 / -0.3	50 + 2 / -2
PP	C35 / C55	80	80 + 0.6 / -0.6		50 + 20 / -2

Multiple water heaters can be connected to a common duct. These flue gas systems for multiple water heater installations must always be engineered as zero or negative pressure systems; this to prevent the risk of recirculation of the flue gases. Consult the flue gas supplier for detailed information and engineering. See also the cascade manual for these multiple water heater installations.
More information about these common flue gas systems can be found at the cascade-installation manual which can be retrieved from your supplier upon request.

6.4 Air supply

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

- PVC / PP
- Thin-walled aluminium
- Stainless steel

6.4.1 COMBUSTION AIR QUALITY

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

6.4.2 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 water heater.
No water is allowed to enter the water heater through the air inlet canal at any time.

6.5 Flue Terminal

	Never use aluminium containing flue gas materials for this boiler range

The flue terminal duct can be made of:

- Stainless steel in combination with T120 gaskets.
- PP temperature class T120

6.5.1 HORIZONTAL FLUE TERMINAL POSITIONING

Please refer to the relevant British Standard:

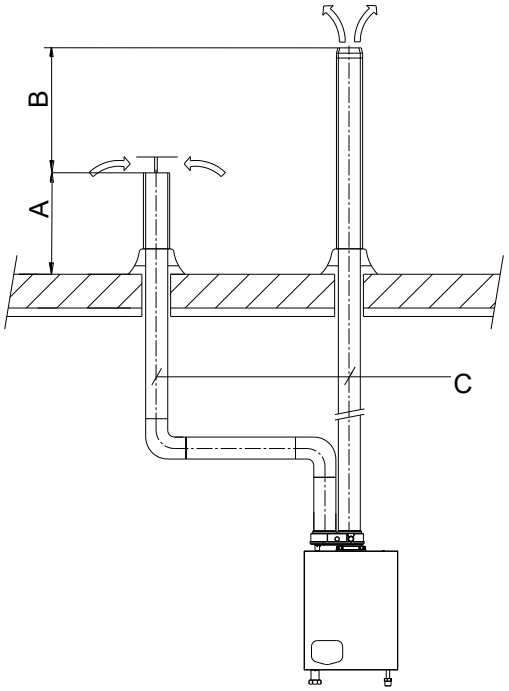
- BS 5440-2 – Chimneys, flue pipes and ventilation for gas appliances of rated input not exceeding 70 kW net

6.5.2 VERTICAL FLUE TERMINAL POSITIONING

Please refer to the relevant British Standard:

- BS 5440-2 – Chimneys, flue pipes and ventilation for gas appliances of rated input not exceeding 70 kW net

6.6 Heights above the roof.



Height A

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

Example 1:
When the maximum snow level on the roof surface is 45 cm then the air inlet should be at 45 + 30 = 75 cm. 75 cm is more than the minimum 60 so the height will be 75 cm.

Example 2:
When the maximum snow level on the roof surface is 15 cm then the air inlet should be at 15 + 30 = 45 cm. 45 cm is less than the minimum 60 cm so the height will be 60 cm.

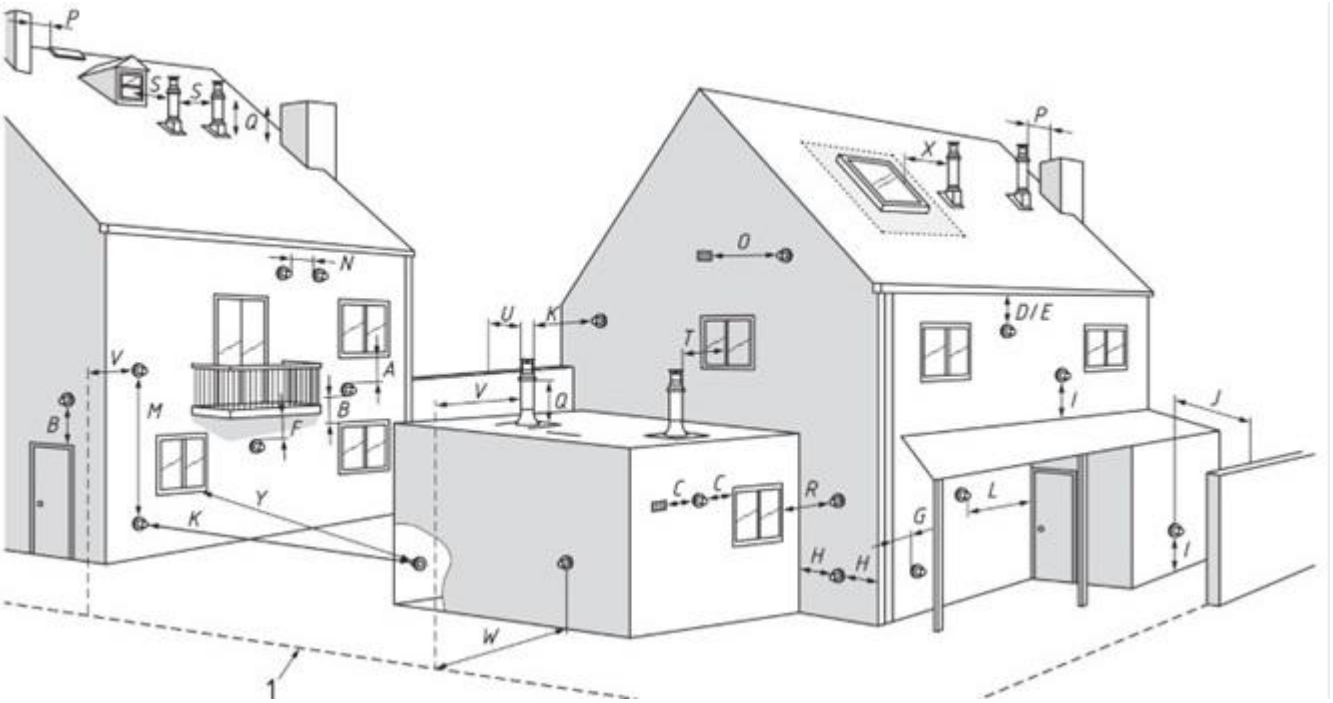
Height difference B

This is the height difference between the flue outlet and the air inlet.
The flue gas outlet should be at least 70 cm above the air inlet. It is advised to be equipped with a conical outlet.
A single flue outlet should be situated at least 100 cm above the roof surface.

Distance C

The horizontal distance between the flue gas pipe and air inlet pipe at roof level.
This distance should be at least 70 cm.

6.7 *Flue Terminal positioning*



Location	Description		EF+35/230	EF+55/230
	Water heater nett input	**kW**	**33.7**	**52.9**
A	Directly below an opening, air brick, opening windows etc.	mm	300	300
B	Above an opening, air brick, opening windows etc.	mm	300	300
C	Horizontally to an opening, air brick, opening windows etc.	mm	300*	300*
D	Below a gutter or sanitary pipework	mm	75	75
E	Below the eaves	mm	300	300
F	Below a balcony or car port roof	mm	200*	200*
G	From a vertical drain or soil pipe	mm	150	150
H	From an internal or external corner	mm	300	300
I	Above ground, roof or balcony level	mm	300	300
J	From a surface facing the terminal	mm	600	600
K	From a terminal facing the terminal	mm	1200*	1200*
L	From an opening in the car port (e.g. door, window) into the dwelling	mm	1200*	1200*
M	Vertically from a terminal on the same wall	mm	1500	1500
N	Horizontally from a terminal on the same wall	mm	300	300
O	Horizontally from a ventilation intake	mm	1000*	1000*
P	From a vertical structure on the roof	mm	300	300
Q	Above intersection with the roof	mm	150	150
R	Diagonally from an opening (window, air brick) on a different wall	mm	600	600
S	Vertical terminal from another vertical terminal	mm	600	600
T	Vertical terminal to an opening into a building	mm	1500	1500
U	Vertical terminal from a wall	mm	500	500
V	Terminal alongside a boundary	mm	300	300
W	Terminal facing a boundary	mm	600	600
X	Adjacent to an opening into a building on a pitched roof	mm	**	**
Y	Terminal facing an opening into a building	mm	2000	2000

*Position not recommended
**Contact Lochinvar technical support

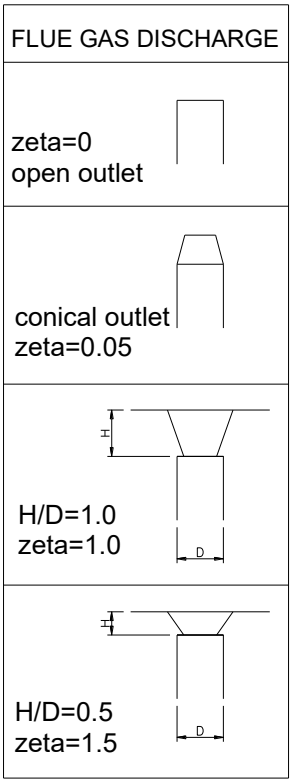
6.8 Flue gas and air supply resistance

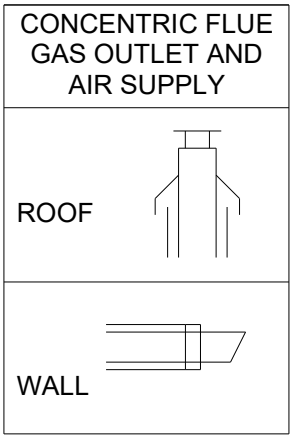
The load of the heater is affected by the resistance of the air supply and flue gas system. This is caused by the controller of the heater regarding the gas-/ air link. The maximum power does not drop more than 5% of the power mentioned at the heaters data plate at a total (flue gas and air supply) resistance of 100 Pa (EF+35) and 120 Pa (EF+55).

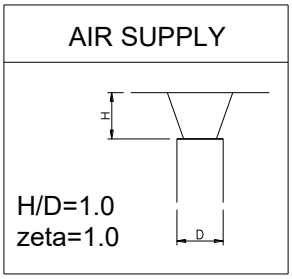
In the next sections, calculation examples will be given to determine allowed lengths of the flue gas and air supply pipes. First, the component resistance data are given in the next table:

6.8.1 FLUE GAS AND AIR SUPPLY RESISTANCE TABLE

		Ø [mm]	Resistance [Pa]	
Item			**EF+35**	**EF+55**
Flue gas discharge	straight tube/m	80	1.5	3.4
	45° bend	80	1.3	3.1
	90° bend	80	3.2	7.3
	outlet zeta = 0.05	80	0.2	0.5
	outlet zeta = 1.0	80	4.0	9.1
	outlet zeta =1.5	80	5.9	13.6
Air supply	straight tube/m	80	1.7	3.9
	45° bend	80	1.6	3.6
	90° bend	80	3.7	8.5
	inlet zeta =1.0	80	4.6	10.5
Concentric	roof terminal	80/125	22.7	51.7
	outside wall terminal	80/125	16.5	37.7
	straight tube/m	80/125	3.7	8.6
	90° bend	80/125	5.9	13.5
	45° bend	80/125	3.2	7.3
	Concentric /parallel adaptor	80/125	13.9	31.9







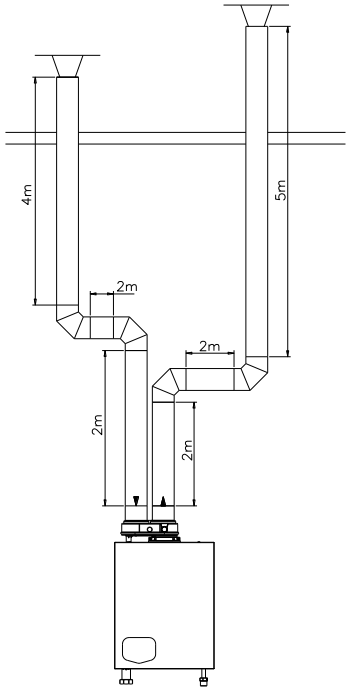
NOTICE: This table can only be used for a single flue/air system for one water heater. Do NOT use this table for common flue/air systems with cascaded water heaters.

Also, using concentric pipes there is a second restriction. The maximum allowed length of straight concentric pipe to be used is 20 m. (flue gas pipe + air supply pipe).

6.9 Six 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**

6.9.1 EXAMPLE A: TWIN PIPE SYSTEM (C63).

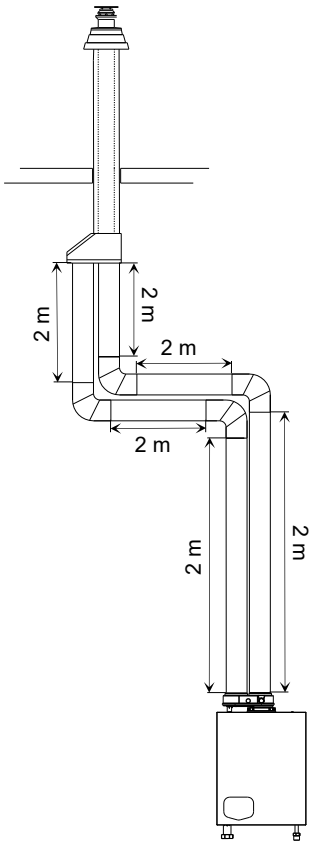


Calculation example with given lengths: checking resistance

Water heater type:		**EF+35**			
Flue gas	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	9	1.5	13.5
	Bend	90°	2	3.2	6.4
	Flue outlet	zeta = 1	1	4	4
	Total resistance flue gas outlet:				**23.9**
Air supply	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	8	1.7	13.6
	Bend	90°	2	3.7	7.4
	Air inlet	zeta = 1	1	4.6	4.6
	Total resistance air supply:				**25.6**
Total resistance flue gas outlet and air supply:					**49.5 Pa**

The total resistance is less than 100 Pa. This flue gas / air supply system is functional.
Be aware: specific resistance values are used in this example. Flue and air pipes of other supplier can have other values

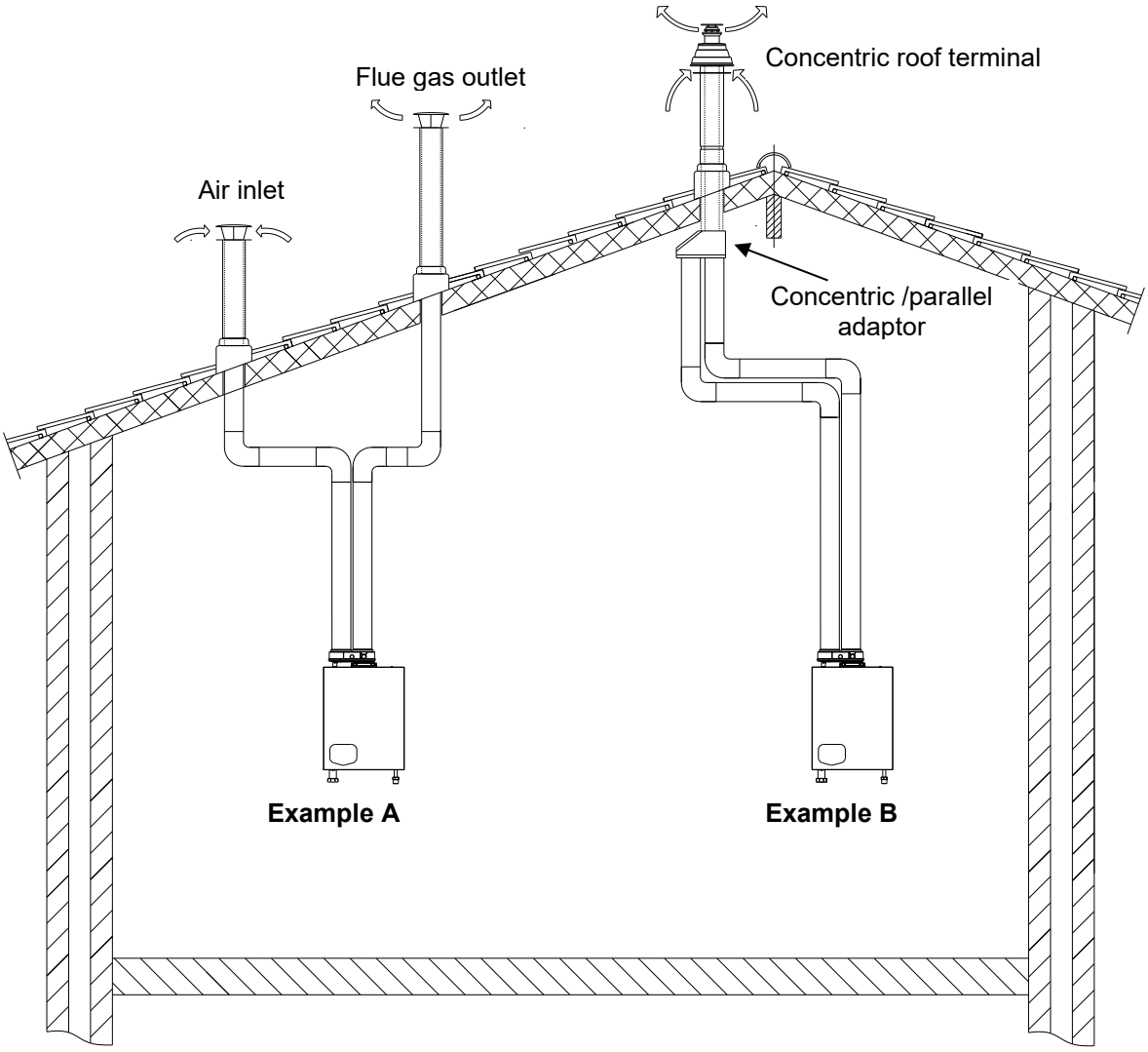
6.9.2 EXAMPLE B: TWIN PIPE SYSTEM WITH SEPARATE PIPES AND CONCENTRIC ROOF TERMINAL (C33).



Water heater type:		**EF+55**			
Flue gas	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	6	3.4	20.4
	Bend	90°	2	7.3	14.6
	Total resistance flue gas outlet:				**35.0**
Air supply	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	6	3.9	23.4
	Bend	90°	2	8.5	17
	Total resistance air supply:				**40.4**
Roof terminal		concentric 80/125	1	51.7	**51.7**
Adaptor		par-conc	1	31.9	**31.9**
Total resistance flue gas outlet and air supply:					**159.0 Pa**

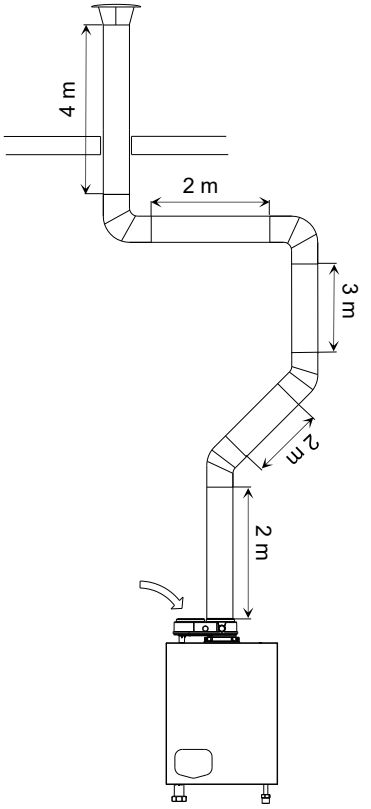
The total resistance exceeds 120 Pa. This flue gas / air supply system is NOT functional.

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



	Example A (C63)			Example B (C33)	
Water heater type →	**C+ 35**	**C+ 55**		**C+ 35**	**C+ 55**
Diameter air inlet [mm]	80	80		80	80
Diameter flue outlet [mm]	80	80		80	80
Diameter roof terminal [mm]	80	80		80/125	80/125
Maximum pipe length [m] (inlet + outlet together)	**45**	**17**		**34**	**1.5**

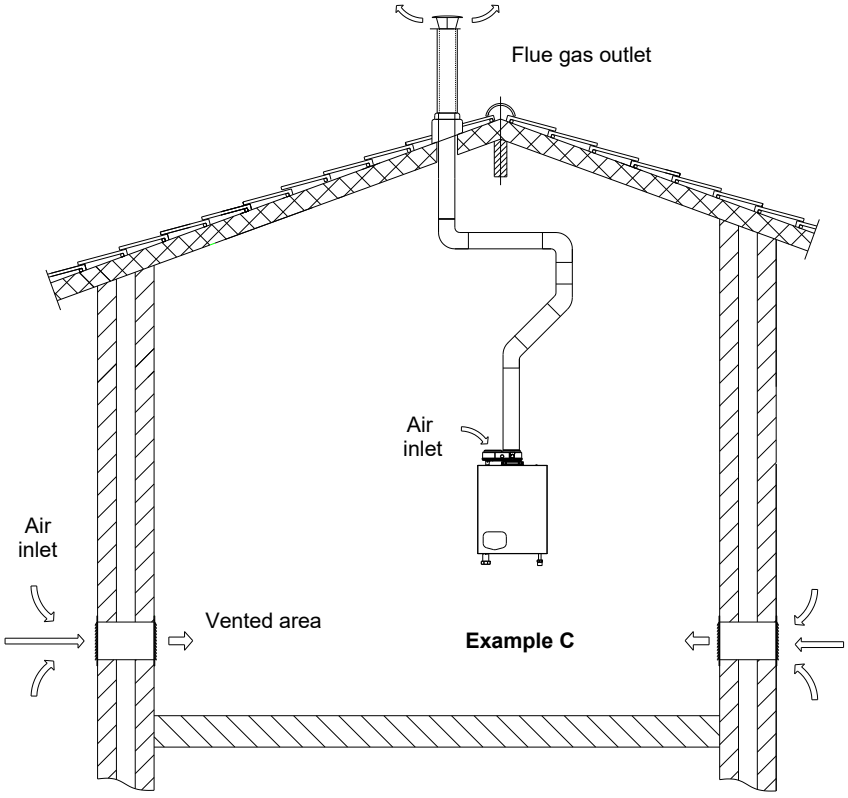
6.9.3 EXAMPLE C: SINGLE PIPE FOR FLUE GAS AND AIR SUPPLY FROM WATER HEATER ROOM. (B23. B23P)



Calculation example with given lengths: checking resistance

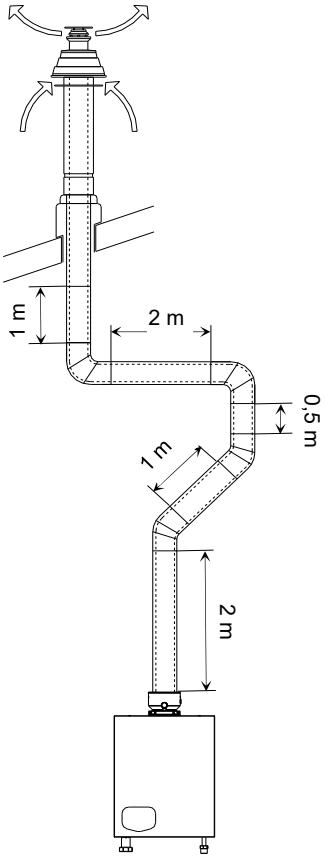
Water heater type:		**EF+35**			
Flue gas	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	13	1.5	19.5
	Bend	90°	2	3.2	6.4
	Bend	45°	2	1.3	2.6
	Flue outlet	H/D = 1.0	1	4.0	4.0
	Total resistance flue gas outlet:				**32.5 Pa**

The total resistance is less than 100 Pa. This flue gas / air supply system is functional.



Maximum pipe lengths		**Example C (B23, B23P)**	
Water heater type →		**C⁺ 35**	**C⁺ 55**
Diameter air inlet	[mm]	80	80
Diameter flue outlet	[mm]	80	80
Diam. roof terminals	[mm]	80	80
Maximum pipe length (inlet + outlet together)	**[m]**	**58**	**26**

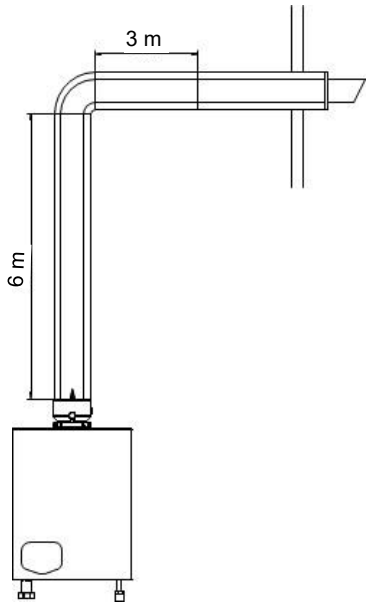
6.9.4 EXAMPLE D: CONCENTRIC PIPE WITH ROOF OUTLET (C33).



Water heater type:		EF+55			
Flue gas and air supply	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	6.5	8.6	55.9
	Bend	90°	2	13.5	27.0
	Bend	45°	2	7.3	14.6
	Outlet/Inlet	80/125	1	51.7	51.7
	Total resistance flue gas outlet and air supply				**149.2 Pa**

The total resistance exceeds 120 Pa so this flue gas / air supply system is NOT functional. Use larger pipe diameters, less bends or a shorter total pipe length.

6.9.5 EXAMPLE E: CONCENTRIC SYSTEM (WALL OUTLET C13).

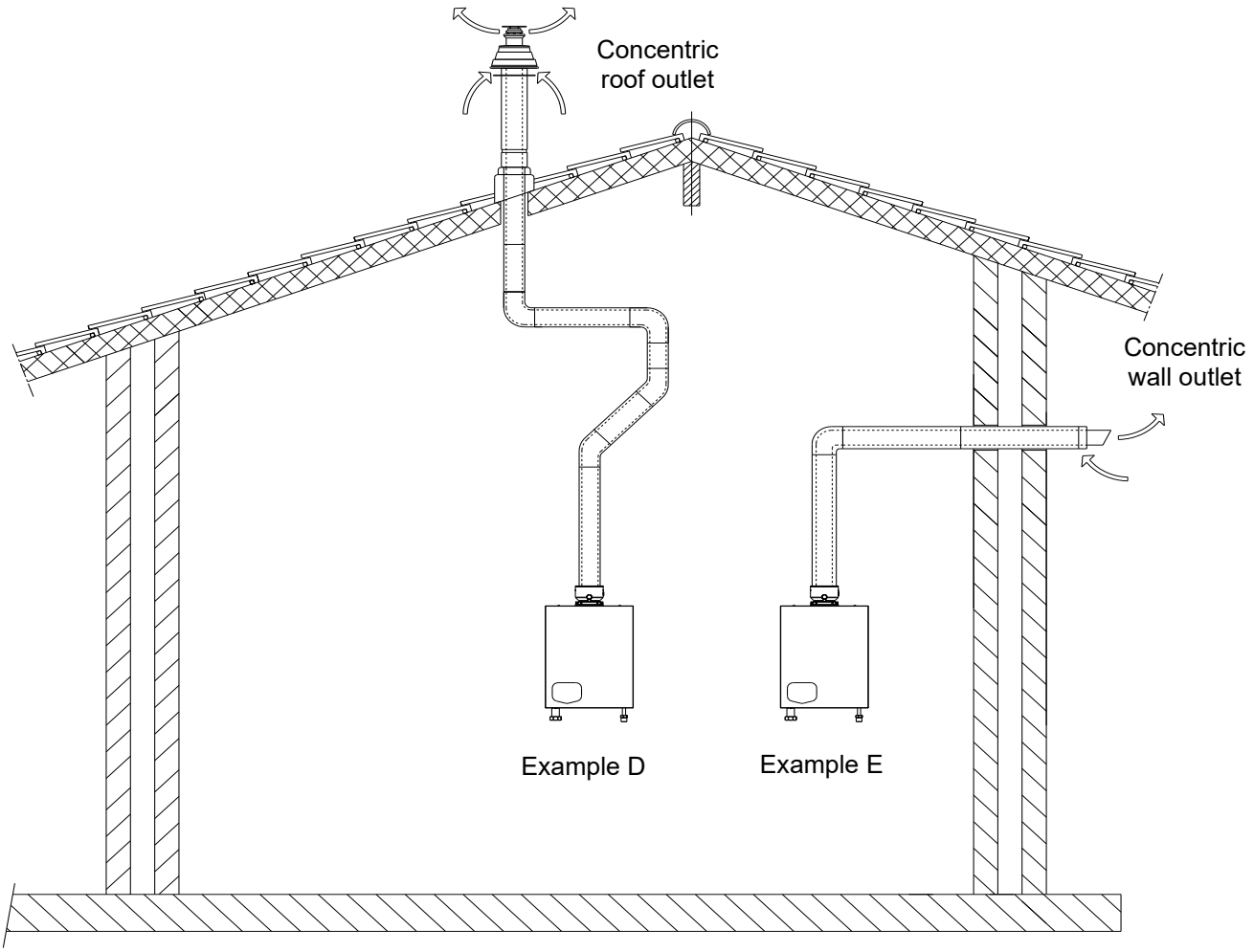


Calculation example with given lengths: checking resistance

Water heater type:		EF+35			
Concentric	**Diameter: 80/125 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	9	3.7	33.3
	Bend	90°	1	5.9	5.9
	Concentric wall outlet	wall	1	16.5	16.5
	Total resistance flue gas and air outlet: (concentric)				**55.7 Pa**

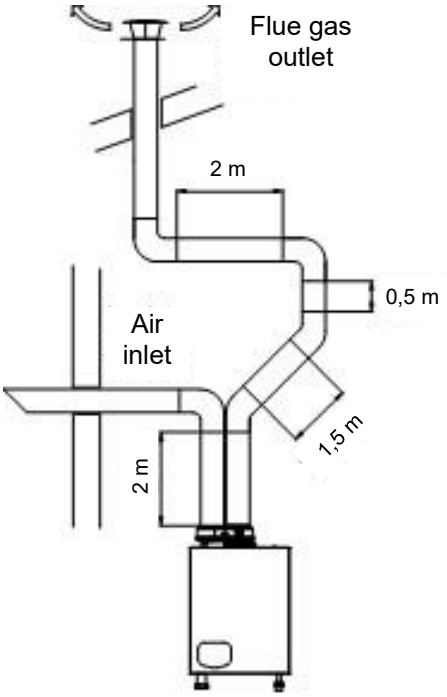
The total resistance is less than 100 Pa. This flue gas / air supply system is functional.

Example D and E maximum pipe lengths



	Example D (C33)				Example E (C13)	
Water heater type →	**C+ 35**	**C+ 55**			**C+ 35**	**C+ 55**
Diameter conc. pipe [mm]	**80/125**	**80/125**			**80/125**	**80/125**
Conc. Roof outlet [mm]	**80/125**	**80/125**			**80/125**	**80/125**
Maximum pipe length [m]	**16**	**3**			**21**	**8**

6.9.6 EXAMPLE F: AIR SUPPLY AND FLUE GAS OUTLET AT DIFFERENT PRESSURE ZONES (C53)

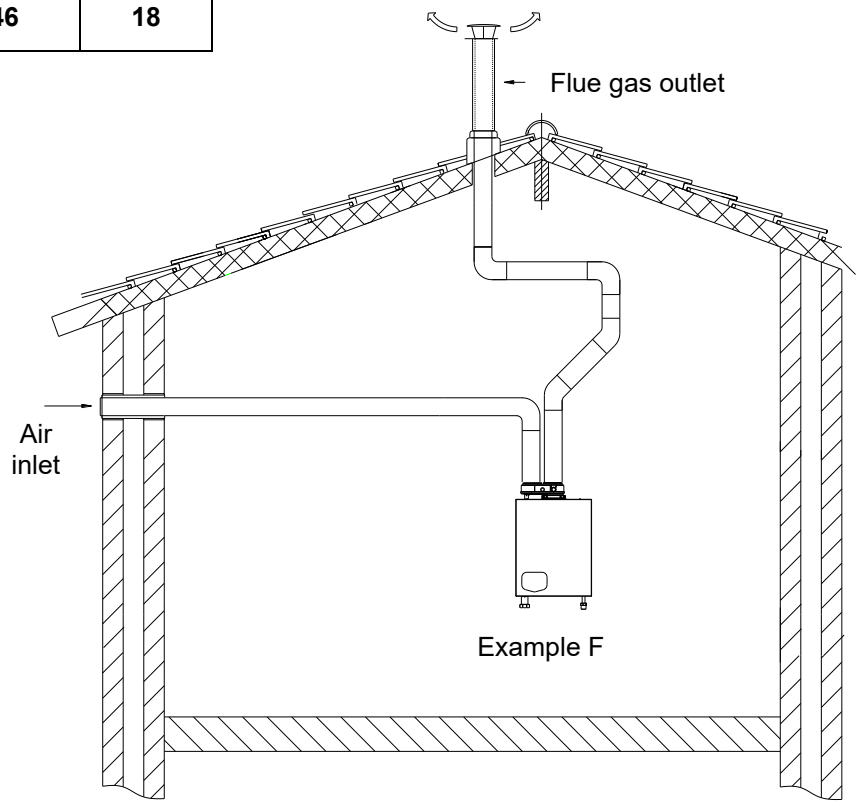


Calculation example with given lengths: checking resistance

Water heater type:		EF+ 55			
Flue gas	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	totaal	6	3.4	20.4
	Bend	45°	2	3.1	6.2
	Bend	90°	2	7.3	14.6
	Flue gas outlet	zeta = 1	1	9.1	9.2
	Total resistance flue gas outlet:				**50.4**
Air	**Diameter: 80 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	totaal	2	3.9	7.8
	Bend	90°	1	8.5	8.5
	Air inlet	H/D = 1.0	1	10.5	10.5
	Total Resistance Air supply:				**35.3**
Total Resistance Air supply en Flue gas outlet:					**85.7 Pa**

The total resistance is less than 120 Pa. This flue gas / air supply system is functional.

	Example F	
Water heater type →	**C+ 35**	**C+ 55**
Diameter wall outlet [mm]	**80**	**80**
Diameter air inlet [mm]	**80**	**80**
Diameter flue gas outlet [mm]	**80**	**80**
Diameter roof outlet [mm]	**80**	**80**
Maximum pipe length [m] (inlet and outlet)	**46**	**18**



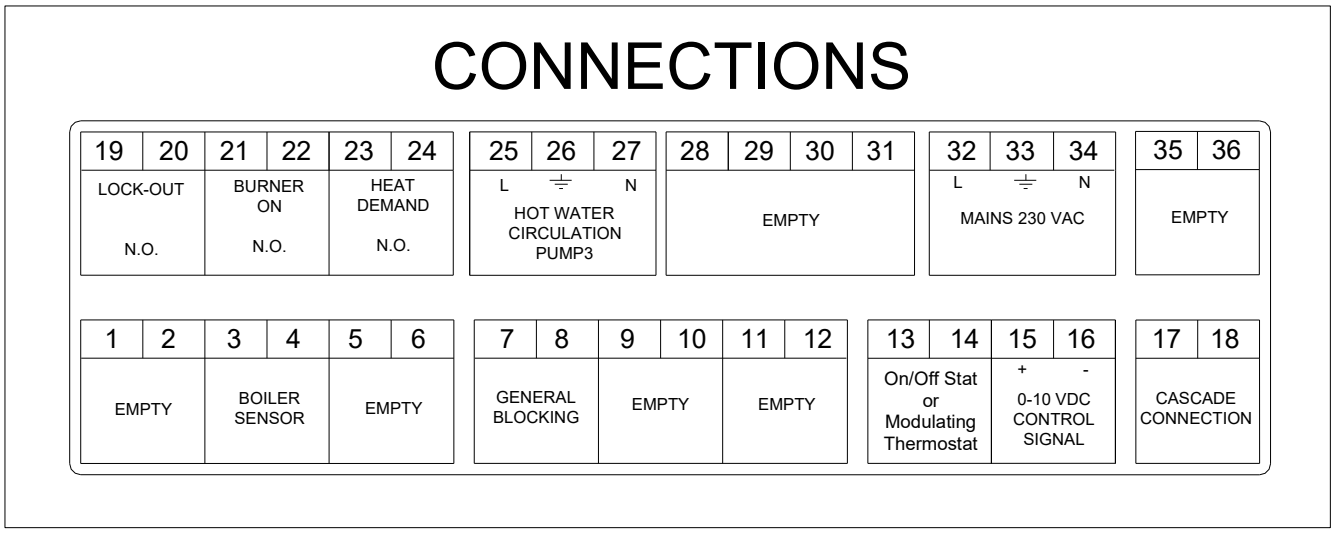
7 ELECTRICAL INSTALLATION

7.1 General

The connections are placed on top of the display panel and can be accessed by removing the water heater front door and the connector protection cover.

- For operation, the water heater needs a power supply of 230 Vac 50 Hz.
- The water heater connections are not live/neutral sensitive (the water heater is not phase-sensitive).
- 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.
- Working on the water heater should only be done by a skilled service engineer/installer and according to all applicable standards and regulations.

7.2 Electrical connections



7.3 Function of the electrical connections of the water heater

1-2	**EMPTY**
Do not connect any cable to these connections	
3-4	**TANK SENSOR**
This external tank sensor measures the water temperature at the system side. The sensor must be mounted on the return pipe at the system side, close to the tank. PARAMETER: No parameter settings needed.	
5-6	**EMPTY**
Do not connect any cable to these connections	
7-8	**GENERAL BLOCKING**
A heat demand that will start the burner will be blocked when terminals 7 and 8 are not bridged. This connection is for the use of external safety devices (terminals must be bridged for allowing burner to fire).	
9-10	**EMPTY**
11-12	**EMPTY**
Do not connect any cable to these connections	

13-14	ON/OFF STAT OR MODULATING THERMOSTAT WATER TANK
OPTION 1: an ON/OFF thermostat can be connected. The water heater will use the set/programmed tank temperature when these terminals 13 and 14 are bridged. OPTION 2: a modulating controller can be connected to terminals 13 and 14. The water heater software will detect and use this modulating signal automatically.	
15-16	**0-10 VDC CONTROL SIGNAL**
These terminals are used for an external 0-10 VDC control signal. PARAMETER: A parameter change is needed. NOTICE: Terminal 15 [+] (positive) and terminal 16 [-] (negative).	
17-18	**CASCADE CONNECTION**
These connections are used when boilers are cascaded with the internal cascade manager for controlling the total cascade. NOTICE: Connect all terminals 17 and all terminals 18 together, do not switch between these terminals.	
19-20	**LOCK-OUT OR PUMP ON/OFF**
This contact is N.O. (normally open). When the unit is in lock-out this contact will close. This contact can also be used for the switching of a pump with a separate control input connection. (PARAMETER: A parameter change is needed).	
21-22	**BURNER ACTIVE OR EXTRA WATER HEATER OR PUMP ON/OFF**
This contact is N.O. (normally open). When the unit starts the burner and detects the flame, this contact will be closed. This contact can also be used to control an external (extra) water heater. This contact can also be used for the switching of a pump with a separate control input connection. (PARAMETER: A parameter change is needed).	
23-24	**BURNER DEMAND OR PUMP ON/OFF**
This contact is N.O. (normally open). When the unit receives a heat demand this contact will close. This contact can also be used for the switching of a pump with a separate control input connection. (PARAMETER: A parameter change is needed).	
25-26-27	**CIRCULATION PUMP P3**
This contact can be used to connect an “old type” on-off pump. (Not a high efficiency pump). The pump is switched off when there is no heat demand, after post running time.	
28-29-30-31	**EMPTY**
Do not connect any cable to these connections.	
32-33-34	**POWER SUPPLY**
The power supply connection of the unit. 32 = phase wire; 33 = ground wire; 34 = neutral wire.	
35-36	**EMPTY**
Do not connect any cable to these connections.	

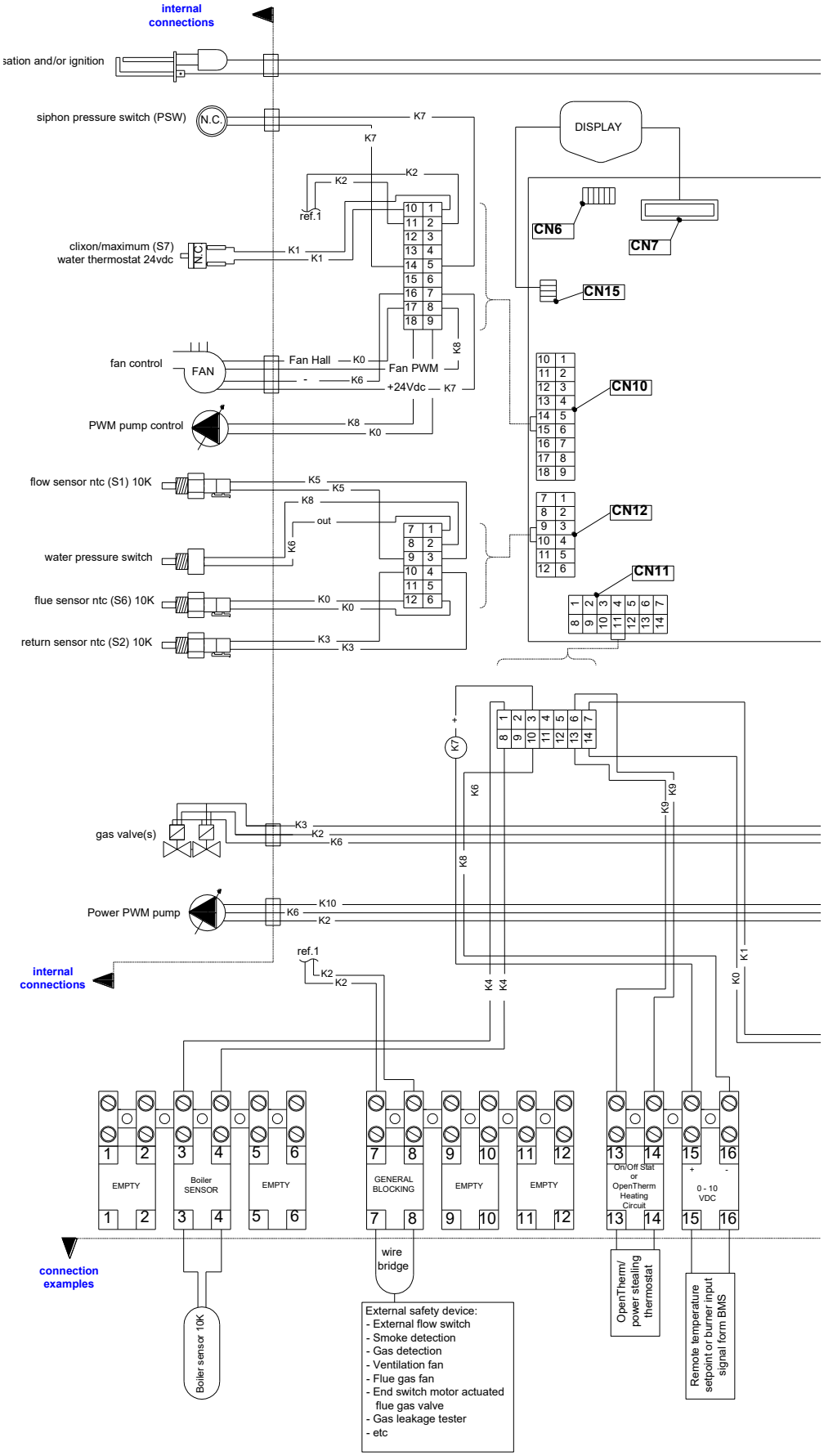
7.4 Sensor values

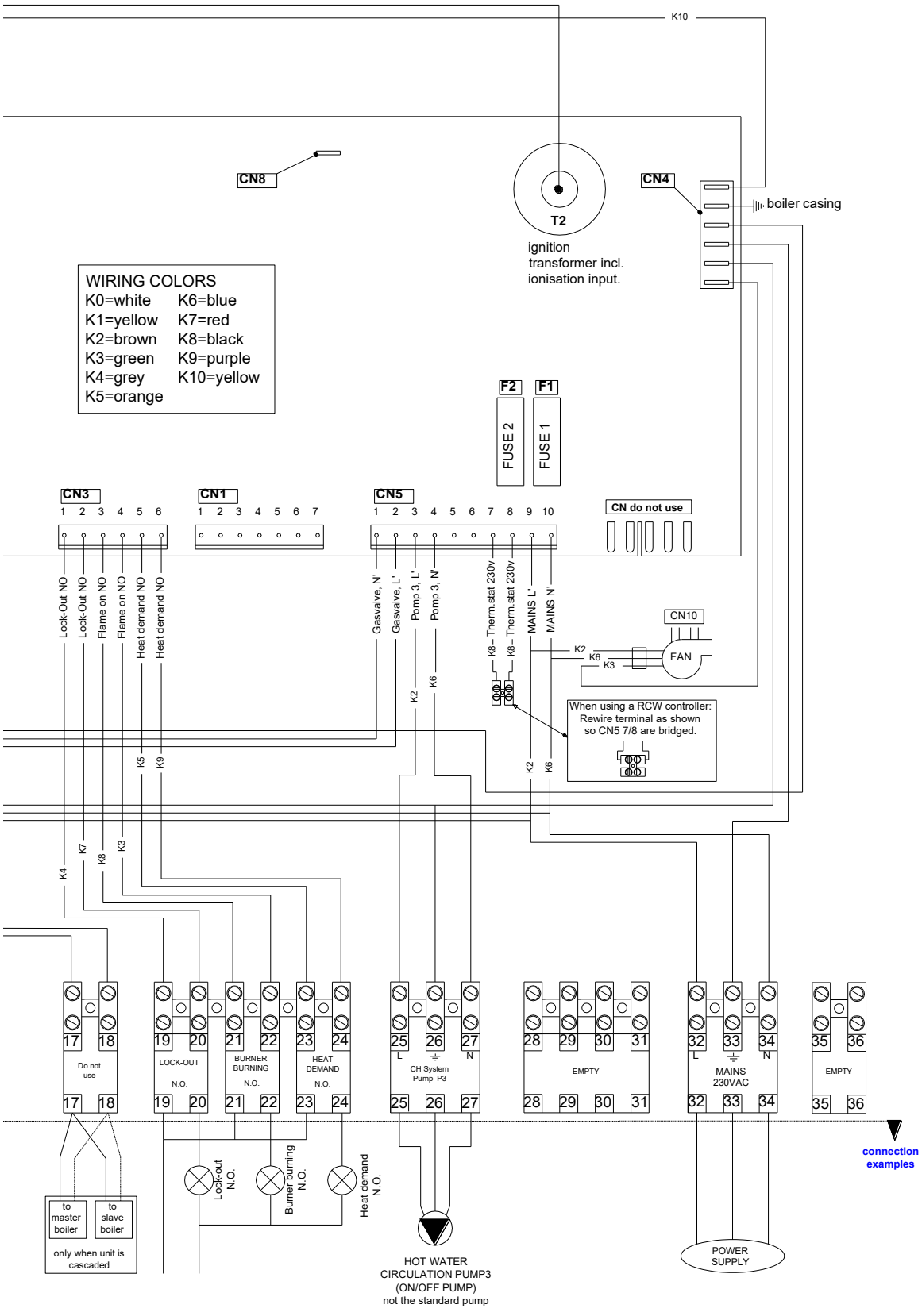
SENSOR	SENSOR TYPE	SENSOR VALUE
S1	Internal flow sensor	NTC-10K
S2	Internal return sensor	NTC-10K
S3	Tank sensor	NTC-10K
S6	Flue gas sensor	NTC-10K

Conversion table: temperature vs. resistance for all sensors NTC-10k

Temperature (°C)	Resistance (Ω)	Temperature (°C)	Resistance (Ω)	Temperature (°C)	Resistance (Ω)	Temperature (°C)	Resistance (Ω)
-30	175203	20	12488	70	1753	120	387
-25	129289	25	10000	75	1481	125	339
-20	96360	30	8059	80	1256	130	298
-15	72502	35	6535	85	1070	135	262
-10	55047	40	5330	90	915	140	232
-5	42158	45	4372	95	786	145	206
0	32555	50	3605	100	677	150	183
5	25339	55	2989	105	586	155	163
10	19873	60	2490	110	508	160	145
15	15699	65	2084	115	443	165	130

7.5 Electrical schematics




K10
CN8
T2
ignition
transformer incl.
ionisation input.
CN4
boiler casing
WIRING COLORS
K0=white K6=blue
K1=yellow K7=red
K2=brown K8=black
K3=green K9=purple
K4=grey K10=yellow
K5=orange
F2
F1
FUSE 2
FUSE 1
CN3
CN1
CN5
CN do not use
Lock-Out NO
Lock-Out NO
Flame on NO
Flame on NO
Heat demand NO
Heat demand NO
Gasvalve, N'
Gasvalve, L'
Pomp 3, L'
Pomp 3, N'
Therm.stat 230v
Therm.stat 230v
MAINS L'
MAINS N'
CN10
FAN
When using a RCW controller:
Rewire terminal as shown
so CN5 7/8 are bridged.
Do not use
LOCK-OUT
N.O.
BURNER BURNING
N.O.
HEAT DEMAND
N.O.
CH System Pump P3
EMPTY
MAINS 230VAC
EMPTY
connection examples
to master boiler
to slave boiler
only when unit is cascaded
Lock-out N.O.
Burner burning N.O.
Heat demand N.O.
HOT WATER CIRCULATION PUMP3 (ON/OFF PUMP) not the standard pump
POWER SUPPLY

8 EF+ WATER HEATER

8.1 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 several standards.
The values are the following:

Water temperature max. = 75°C
Maximum allowed water hardness is 205 PPM or 205 mg/L $CaCO_3$ (= 11.5°dH / 14°e)
TDS (total dissolved solids) may not exceed 450 PPM
Water hardness and TDS together may not exceed 450 PPM
The pH value of the water may not be under 6.5 and not above 7.5 (measured cold)
If water hardness is too high a water softening system is necessary.
If TDS alone or the combined value is higher than the abovementioned, the water should be heated by means of an indirect water heating appliance.
Minimum water hardness = 80 PPM or 80 mg/L $CaCO_3$ (= 4.5°dH)
Minimum TDS = 100 PPM
Water below these minimum values normally has a pH value which is aggressive and corrosive.

NEVER install a direct heated water system in an area where water quality does not comply with above mentioned values.

If the water hardness is too high, a water treatment installation should be installed reducing the water hardness within acceptable level.

8.2 Frost protection

The water heater has a built-in frost protection that is automatically activating the pump when the water heater return (water) temperature drops below 5°C (programmable). When the water heater return temperature drops below 3°C (programmable), the burner is also ignited. The pump and/or burner will shut down as soon as the return temperature has reached 10°C (programmable). The abovementioned temperatures are related to the temperatures measured by the tank sensor of the water heater. This frost protection function will not fire up the water heater in case of a “general blocking” of the burner demand.

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

8.3 Legionella program

To avoid contamination of the water with Legionnaires’ disease, a special anti-Legionella program is present in the software of the water heater control, the settings of which are freely programmable.
NB! This option is default turned ‘OFF’, the responsibility for a Legionella-free installation lies with the end-user.
See § 11.2.2 on page 79 for an extensive explanation of how to use this option.

8.4 Flow monitoring

Flow
In the control of the water heater an extensive flow monitoring function has been implemented. If the temperature difference between incoming cold water and outgoing hot water gets too high, this indicates a too small water flow through the appliance.

Safety actions
- If the temperature difference exceeds the maximum at a certain load, *for a longer time than specified in the software*, the display will show 'Delta direct block' and the appliance will *block:* it switches immediately to reduced power. Power is then slowly increased to the required level again. The fourth time, so after three of these blockings, the water heater will go in *lock-out* (F16) and the display shows 'FlowReturn dT fault'.
- At very low flow rates (*temperature difference for 10 seconds exceeding a certain entered safety value*), the appliance will skip the blockings and immediately go in lock-out: F16, display 'FlowReturn dT fault'.
- In *Service mode* the appliance will immediately go in lock-out when the maximum value corresponding to the applied power is exceeded, skipping the blocking procedures that apply at normal operation. Again F16, display 'FlowReturn dT fault'.

NB! All values of this flow monitoring have been programmed to get the best performance combined with a long-life time.

8.5 Water pressure switch
Water pressure getting too low indicates a blocking of the water flow. If that is the case, heat from the flue gases cannot be transferred and will flow away through the flue gas channels. Also overheating of the heat exchanger and/or other parts of the system could occur, if no measures would have been taken. For this reason a water pressure switch, *WPS*, has been integrated in all EF+ system models.

Operating values
The water pressure switch has one Normally Open (NO) contact, meaning the contact is open in rest position when no pressure is applied. As soon as the system has been filled and the pressure exceeds 0.85 bar, the switch closes, enabling operation. If, by any cause, the pressure drops below 0.75 bar, the system will be blocked.

In this case the display will show:

Display message	**W**	**a**	**t**	**e**	**r**	**p**	**r**	**e**	**s**	**s**	**u**	**r**	**e**		**f**	**a**	**u**	**l**	**t**	
												9	**9**	**9**	**.**	**5**		**h**	**r**	**s**
Reason	Water pressure is too low or high.																			

Check if there is any leakage or maybe the pressure in the service pipe has dropped down.
See also § 16.2 'Blocking codes', from page 98 on.

9 THE EF+ SANITARY SYSTEM: INSTALLATION INSTRUCTIONS

9.1 The EF+ system

The system is set up as shown in the next example showing a combination of a water heater and a tank. Other combinations are possible as well. Contact your supplier regarding cascading possibilities.

SAFETY COMPONENTS

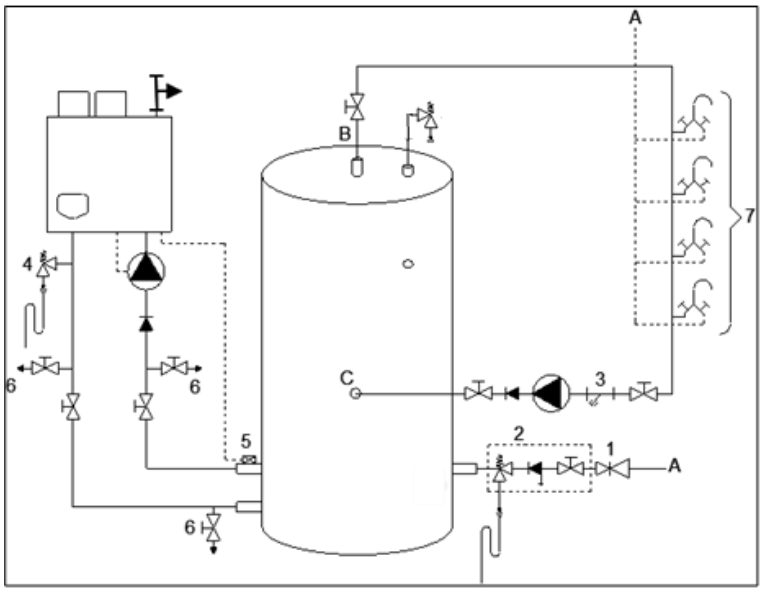
NB! The pictures in §§ 9.1.1 and 0 show examples of functional installations. The safety components as shown in these pictures do NOT necessarily conform to all applicable standards and regulations.

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

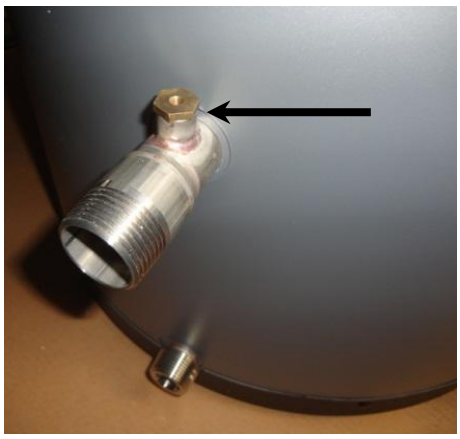
When the watertank can be exposed to underpressure (e.g. when hot water demand is more than fresh water feed), an anti-vacuum valve must be fitted between the inlet combination and the tank, or on top of the tank.

9.1.1 STAND-ALONE SET-UP

The basic form of an EF+ installation is one water heater with one tank.
Shown in the picture are the principal components and connections.



Example of a combination of one water heater and one tank



Tank sensor: see § 9.2.1 on page 42.

	PUMP
	NON-RETURN VALVE
	VALVE
	SAFETY VALVE
	FILTER
	INLET COMBINATION - Overflow - Controllable return valve - Valve
	PRESSURE REGULATING VALVE
	Manual Air vent.

Extra explanation:

1) Pressure reducing 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) [1]
   This safety valve shall never be isolated from the water heater by means of a valve
5) Mount remote tank sensor in the screw hole on the return pipe (see picture) (necessary)
   When screwing is not possible, mount the tank sensor on the return pipe as close as possible to the tank [2]
6) Drain valve (recommended)
7) Hot and cold water mixers

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

9.2 Control

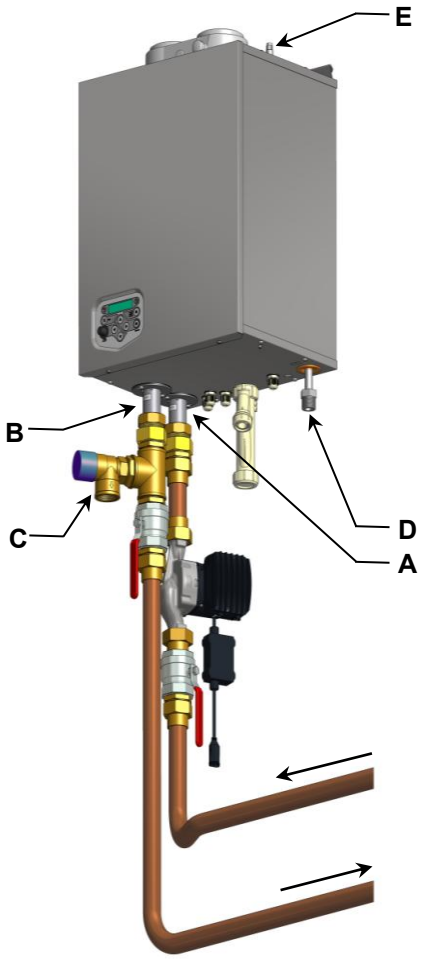
9.2.1 GENERAL CONTROL

- There is no need for a sensor *in* the tank, because when the pump starts to run, the tank sensor of the water heater measures the water temperature of the tank.
- When no water is drawn from the tank, the tank sensor measures the water temperature in the tank.
- After ending a heat demand, the pump has a post turning time.
- On the control panel, the tank or hot water temperature can be set.
- During a period of no tapping, the temperature inside the tank is maintained at the setting temperature automatically.
- A safety control stops the water heater from firing, when the temperature difference between flow and return gets higher than allowed at the actual load (flow monitoring (ΔT function)).
- Parameters: the default parameters of the water heater control have been set for these type of tanks.

9.3 Water heater and tank: connections and connection sizes

9.3.1 CONNECTING THE TANK TO THE WATER HEATER

- Connect the **pump** by means of couplings and a piece of copper pipe to connection A of the water heater (note the flow direction of the pump).
- Connect both pump cables (Power supply and control) to the right pump connectors. Cables are located at the bottom of the heater (Strapped with a ty-rap)
- Connect the inlet of the pump to the **upper** of the two close above each other located connections of the tank, labelled 'return to water heater'.
- Connect connection B of the water heater to the **lower** of the two close above each other located connections of the tank, labelled 'flow from water heater'. Also, make a tap point in this line at the lowest point.



WATER HEATER CONNECTIONS

A = inlet cold water

B = outlet hot water

C = overpressure safety valve

D = gas

E = Manual air vent

9.3.2 CONNECTING THE TANK TO YOUR DHW INSTALLATION

(See picture on next page →)

- Connect the fresh water supply to the **single** connection C, labelled 'cold in', opposite to A and B which are used for connecting the water heater. For the application of inlet combination, (control) valves, etc. all applicable regulations should be met.
- Connect the DHW connection on top of the tank, labelled 'hot out', to your DHW installation.
- Connect the recirculation line to connection F, labelled 'circulation return', on the side of the tank, at the same height as inlet C.

The tanks have the following DHW connections:

- COLD IN for inlet of fresh water
- HOT OUT for outlet of DHW
- water heater return for connection to inlet of water heater
- water heater flow for connection to outlet of water heater
- CIRCULATION RETURN for recirculation of DHW from installation to tank

There are also connections for:

- Thermometer (on the side at ± ¾ of height of the tank)
- Connection for T&P valve (mounted on top) according to the applicable standards and regulations. Even if a T&P valve must be applied, the safety at the water heater's side, on position C (← see previous page), should be always maintained.

Tank connection sizes:

Code	Connection	M / F[*1]	Remarks	EWD230
A	return to water heater	M	incl. reducing ring excl. reducing ring	- R 1"
B	flow from water heater	M	incl. reducing ring excl. reducing ring	- R 1"
C	cold water inlet	M	incl. reducing ring excl. reducing ring	- R 1"
D[*2]	DHW outlet	M	incl. reducing ring excl. reducing ring	R1½" R 1"
E[*3]	free connection (T&P valve)	F	incl. plug	Rp1½"
F	circulation return	M	incl. cap	R ¾"
G	bleed valve	-	-	-
H	thermometer connection	F	incl. plug	Rp ½"

[*1] M = Male / External thread ; F = Female / Internal thread.

[*2] The reducing ring is factory-fitted.

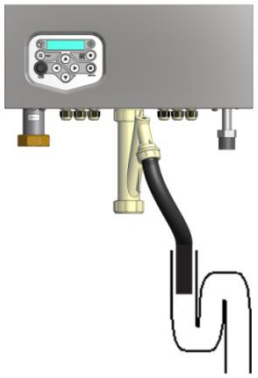
[*3] On a factory-built S-WG+System (S-WG+ with tank assembled at the factory) this connection is used for a pressure relief valve and not available as a free connection anymore.

9.3.3 CONDENSATE DRAIN CONNECTION

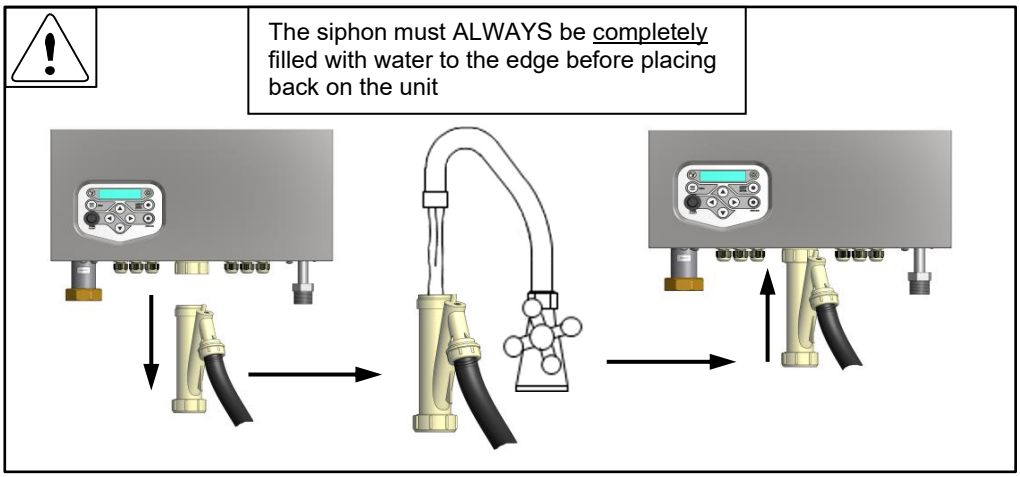
The condensate drain is placed at the center at the bottom of the water heater and has a ¾ inch hose discharge. Connect this flexible hose to the sewer system.
Use only plastic parts with the condensate drain. Metal lines are not allowed.

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

There should be an open connection between the condensate hose and the sewage system, to make sure that any pressure difference between the two can never affect the condense water level and hence the functioning of the water heater.



open connection

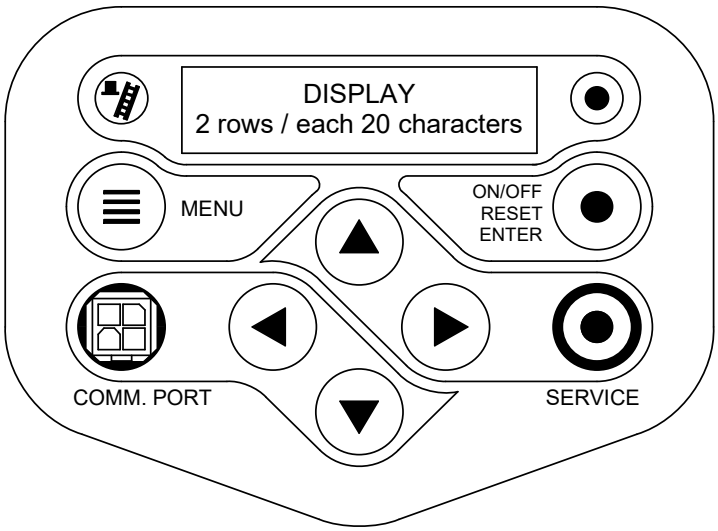


When mounting the bottom part of the siphon, before commissioning the water heater and/or after maintenance, it must **ALWAYS** be completely filled with water.

This is a safety measure: the water in the siphon keeps the flue gases from entering the boiler room via the condensate drain.

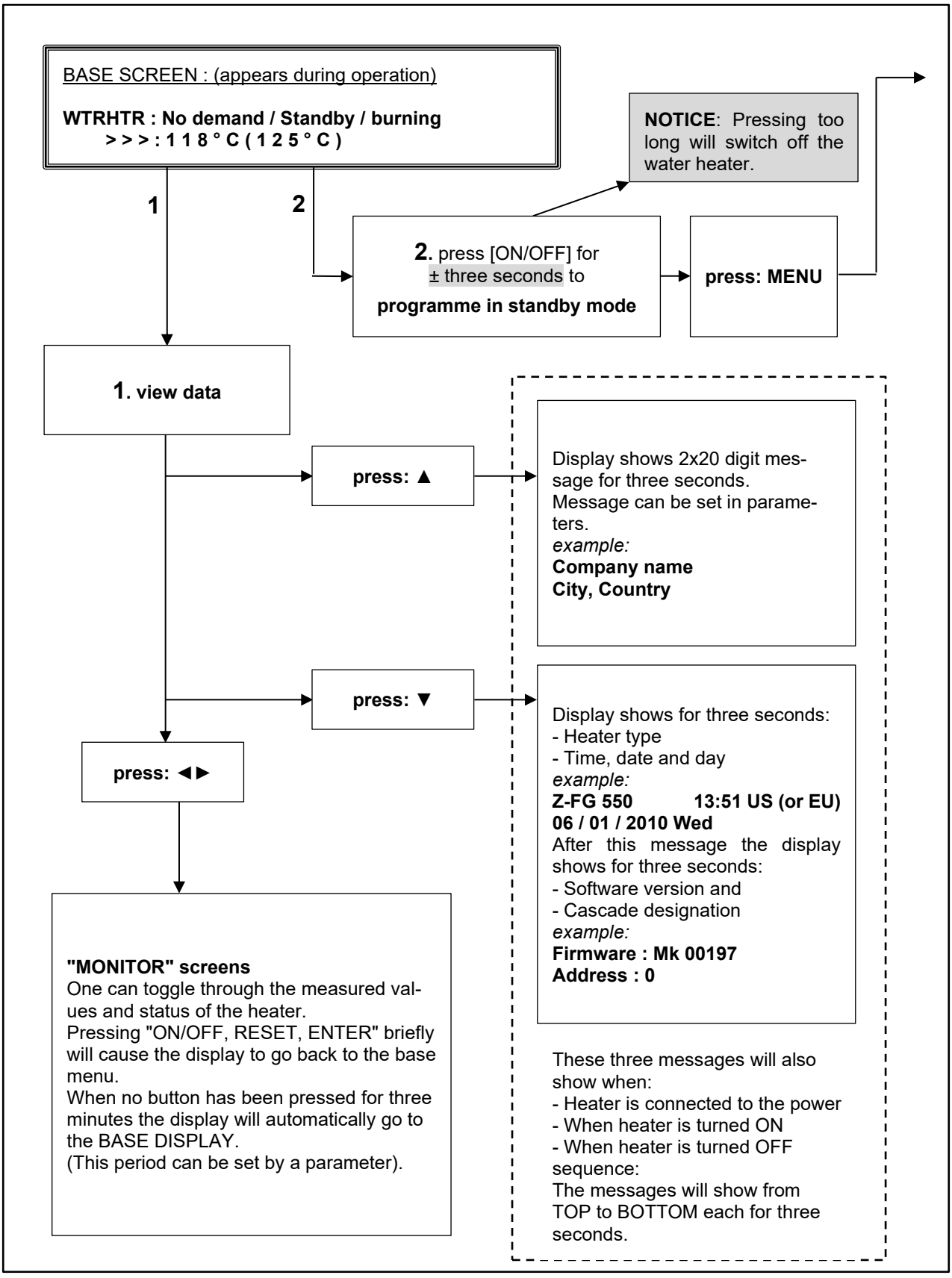
10 USER INTERFACE

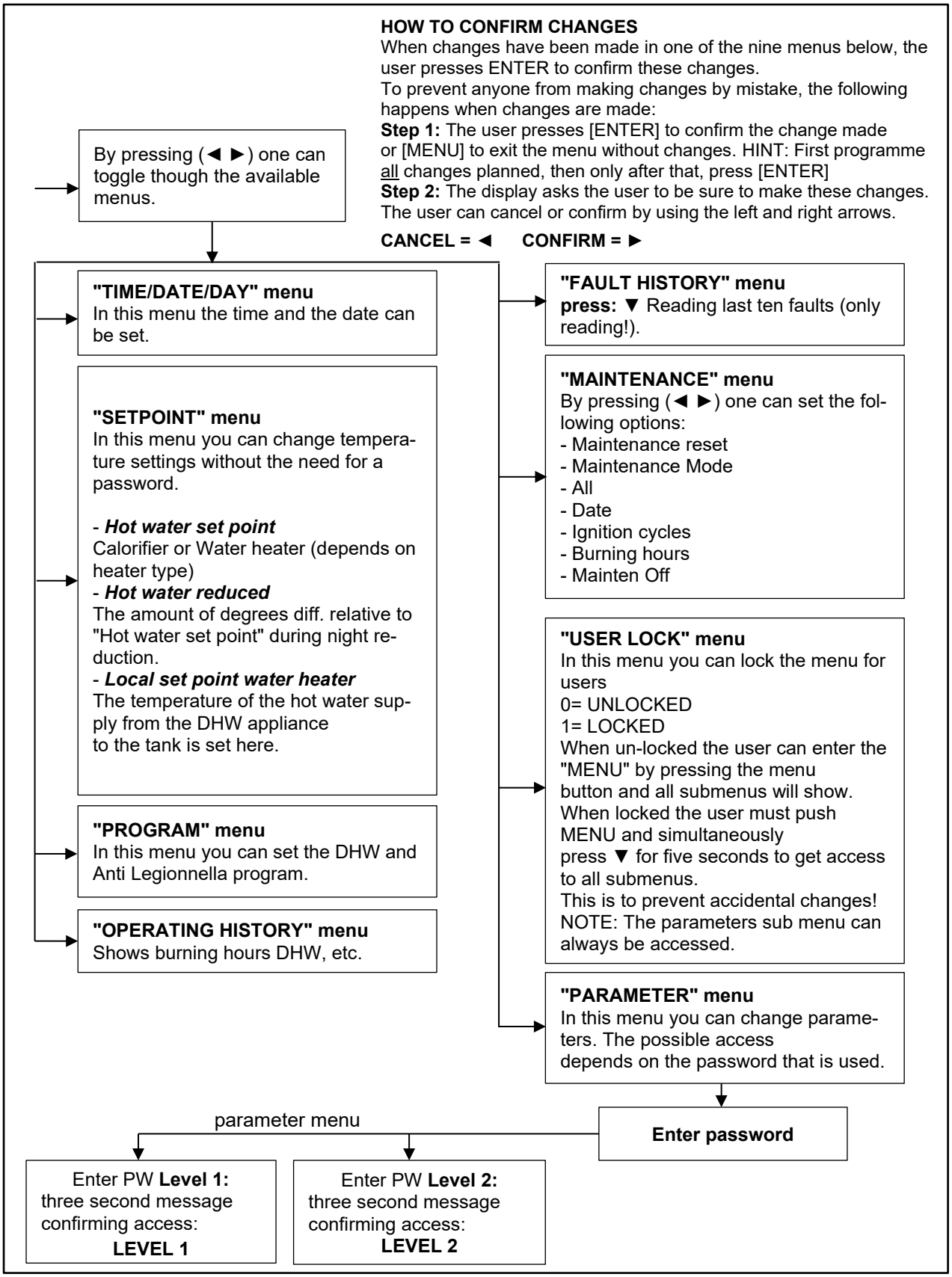
10.1 Control panel / display unit



ON/OFF RESET ENTER	Press and hold for three seconds for stand-by/progr. mode Press and hold for six seconds to switch boiler on/off. Used as RESET and ENTER button when programming.
COMM. PORT	Connector for connecting computer cable.
MENU	Buttons can be pushed to open menu [hold for one second].
◀ ▶ ▼ ▲	Buttons to toggle through measured temperatures. These are also used for navigating through the menus and used for changing values.
SERVICE	Button to activate service function. [hold for three seconds].
	Schornsteinfeger function (only for Germany).
	Light: will light up when controller sees good flame signal. Lights when burner is burning.

10.2 Control panel menu structure




HOW TO CONFIRM CHANGES
When changes have been made in one of the nine menus below, the user presses ENTER to confirm these changes.
To prevent anyone from making changes by mistake, the following happens when changes are made:
Step 1: The user presses [ENTER] to confirm the change made or [MENU] to exit the menu without changes. HINT: First programme all changes planned, then only after that, press [ENTER]
Step 2: The display asks the user to be sure to make these changes. The user can cancel or confirm by using the left and right arrows.
CANCEL = ◄ CONFIRM = ►
By pressing (◄ ►) one can toggle though the available menus.
"TIME/DATE/DAY" menu
In this menu the time and the date can be set.
"SETPOINT" menu
In this menu you can change temperature settings without the need for a password.
- Hot water set point
Calorifier or Water heater (depends on heater type)
- Hot water reduced
The amount of degrees diff. relative to "Hot water set point" during night reduction.
- Local set point water heater
The temperature of the hot water supply from the DHW appliance to the tank is set here.
"PROGRAM" menu
In this menu you can set the DHW and Anti Legionnella program.
"OPERATING HISTORY" menu
Shows burning hours DHW, etc.
"FAULT HISTORY" menu
press: ▼ Reading last ten faults (only reading!).
"MAINTENANCE" menu
By pressing (◄ ►) one can set the following options:
- Maintenance reset
- Maintenance Mode
- All
- Date
- Ignition cycles
- Burning hours
- Mainten Off
"USER LOCK" menu
In this menu you can lock the menu for users
0= UNLOCKED
1= LOCKED
When un-locked the user can enter the "MENU" by pressing the menu button and all submenus will show.
When locked the user must push MENU and simultaneously press ▼ for five seconds to get access to all submenus.
This is to prevent accidental changes!
NOTE: The parameters sub menu can always be accessed.
"PARAMETER" menu
In this menu you can change parameters. The possible access depends on the password that is used.
Enter password
parameter menu
Enter PW Level 1: three second message confirming access: LEVEL 1
Enter PW Level 2: three second message confirming access: LEVEL 2

10.3 Display during operation

During normal operation, the text in the display shows the status of the water heater. In the following graphs the several displays during normal operation are explained.

Display at WATER HEATER / HOT WATER DEMAND

Heat demand type:								Actual status:											
W	**A**	**T**	**R**	**H**	**T**	**R**	**:**	**S**	**T**	**A**	**N**	**D**	**-**	**B**	**Y**				
>	**>**	**>**	**:**	**1**	**2**	**3**	**.**	**4**	**°**	**C**	**(**	**1**	**2**	**3**	**.**	**4**	**°**	**C**	**)**
cascade communica-tion indicator				setpoint water temp.							temperature measured by tank sensor. Can be turned off by P5 BJ								

Explanation "Actual status" screen

Actual status:
B o i l e r o f f
When water heater is switched off (only text in the display during this status).
N o d e m a n d
No heat demand signal coming from the room thermostat and tank sensor (open).
S t a n d - b y
Room thermostat & tank sensor/thermostat detect heat demand but set point is reached.
P r e - p u r g e
The fan is purging before a burner start attempt.
P r e - i g n i t i o n
Ignition starts before opening of the gas valve.
I g n i t i o n
The igniter is igniting.
P o s t - p u r g e
The fan is purging after burner is switched off.
B u r n i n g 1 0 0 %
When the burner is firing, also the actual rpm% is shown.

Explanation "Cascade communication indicator"

NO CASCADE COMMUNICATION

>	**>**	**>**	no.1

Always showing the fixed ">>>"

CORRECT CASCADE COMMUNICATION

>		**>**	no.1
	>		no.2

Showing alternating no.1 & no.2 with one second interval.

10.4 Monitor screens

During normal operation and standby, the [◄] and [►] buttons can be used to show some water heater information, including measured temperatures, settings and data. In the following graphs is explained which values can be shown at the display. When no button is activated for three minutes, the display will return to its status display.

Pressing [◄] or [►] while being at the "operating screen" toggles through the screens below.
When pressing [ON/OFF, RESET, ENTER] or [MENU] at any time the display returns to the base menu.

SCREEN: 1		
T1 Flow	123.9°C	Measured value by the internal flow sensor.
T2 Return	123.9°C	Measured value by the internal return sensor.
	Open	Shown when controller doesn't detect this sensor.
	Shorted	Shown when sensor wires or sensor itself is shorted.

SCREEN: 2		
T3 External	123.9°C	Measured value by the external sensor.
T4 Calorifi	123.9°C	Measured value by the tank sensor.
	Open	Shown when controller doesn't detect this sensor.
	Shorted	Shown when sensor wires or sensor itself is shorted.

SCREEN: 3		
T5 Outdoor	123.9°C	Measured value by the outdoor sensor.
T6 Flue	123.9°C	Measured value by the flue gas sensor.
	Open	Shown when controller doesn't detect this sensor.
	Shorted	Shown when sensor wires or sensor itself is shorted.

SCREEN: 4		
dT FlowReturn	123.9°C	Temp. difference between internal flow & return.
dT FlueReturn	123.9°C	Temp. difference between flue gas & internal return.

SCREEN: 5		
dT ExtReturn	123.9°C	Temp. difference between external & internal return (ΔT LLH).
Signal	Power	External supplied 0-10 Volt dc signal.
	Setpoi	"Power" = power input control or "Setpoi" = set point control.

SCREEN: 6		
Fan speed	9999 rpm	Actual fan speed in rpm.
Fan speed	100 %	Actual fan speed % of maximum allowable fan speed.

The maximum actual rpm may be lower than the maximum rpm set point. The fan may not be able to reach the maximum rpm set point, because of the unit's resistance, which is still correct according to its design.

SCREEN: 7		
Flamesignal	100 µA	Flame signal given in µA.
WaterPressur	1.0 bar	Shows water pressure when sensor is connected.

SCREEN: 8		
Pump1 Heater	Off	Pump 1 (HEATER PUMP) On or Off.
Pump1 Signal	100 %	Modulating signal Pump 1 in (%).

SCREEN: 9		
Pump2 Calori	Off	Shows when the calorifier pump is "ON" or "OF".
3-way Valve	Heating	Signal to the 3-way valve: "HEATING" or "HOTWATER".

SCREEN: 10		
Pump3 System	Off	Shows when the system pump is "ON" or "OF".
hh:mm DDD/MM/YYYY	Day	hh=hour; mm=minutes; DD=day; MM=month; YYYY=yr; Day of the week

SCREEN: 11	
Casc Design 0	0 = MASTER, 1 ..... 11 = SLAVES
Casinf 0 1 2 3 4 5 6 7 8 9 A B	Displays number, priority and state of cascade water heaters.

DESCRIPTION "CASCINFO" Screen 11

Shows the number of water heaters connected with the cascade. The master/lead water heater is designated as 0. Slave/lag water heaters will be designated 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B. When a "-" is used instead of a number, then that water heater is either not connected, or in a lockout mode and not available for the cascade. When an "x" is used instead of a number, then that water heater is connected, but in lockout mode.
When the number is flashing, then that water heater provides heat to the cascade. When the leading water heater is changed according to the set priority change time, then that water heater's address will be shown first in the row of numbers.

Example 1: "3 4 5 - - - - - - 0 1 2"
There are six water heaters present and no. 3 has priority.

Example 2: "3 4 x - - - - - - 0 1 2"
There are six water heaters present and no. 3 has priority. Water heater 5 is present, but in a lock-out.

SCREEN: 12	
Casc Power 999% 999%	% heat demand of total (cascade) power available (%).
Dual Burner: No	One heat exchanger equipped with two burners: "Yes" or "No".

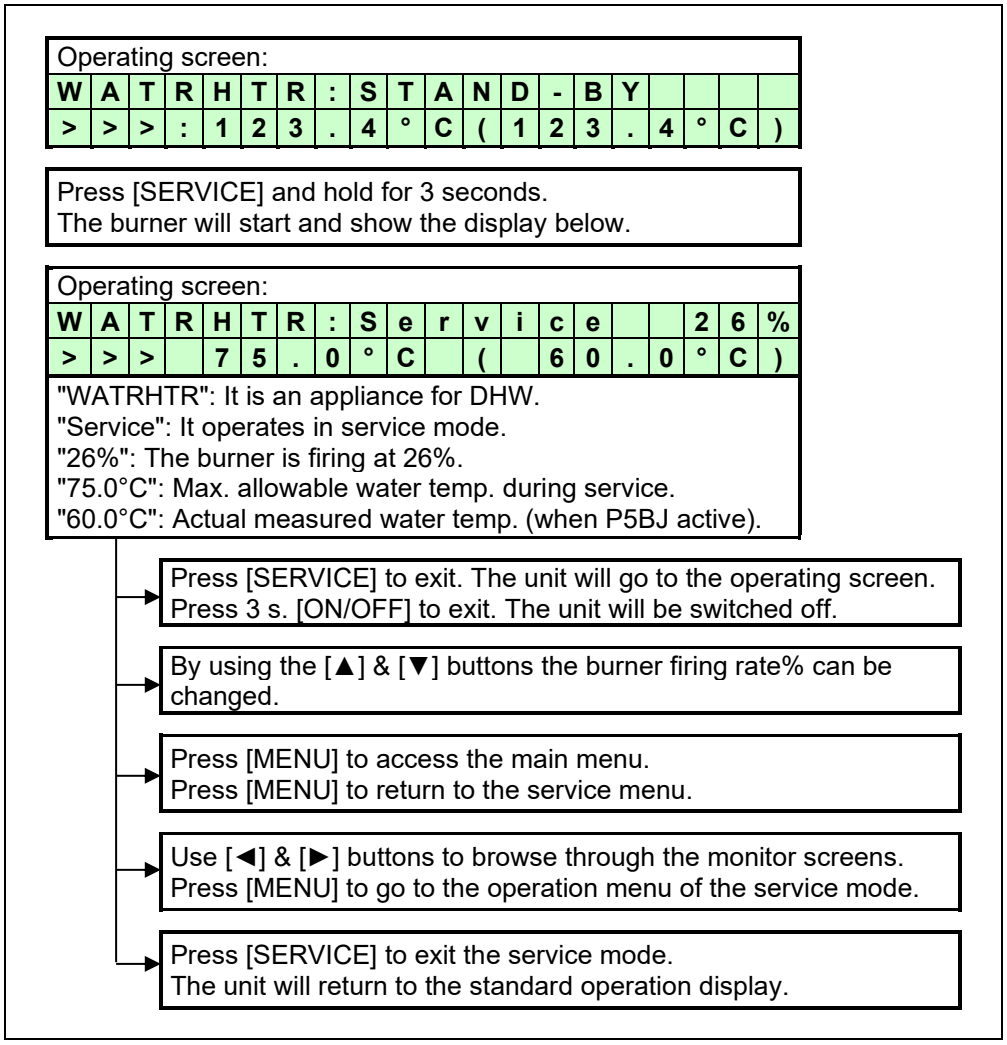
SCREEN: 13	
Max Therm Open	Status of the maximum thermostat: "Open" or "Closed".
Gen Block Closed	Status of the general blocking contact: "Open" or "Closed".

SCREEN: 14	
Siphon press Closed	Status of the siphon pressure switch: "Open" or "Closed".
NRV Contact Open	Status of the non-return valve contact: "Open" or "Closed".

* REMARK at screen 14: No NRV used in this type of heater.

10.5 Service function

The following graphs describe how to use the service function.



10.6 Schornsteinfeger function

The purpose of this function is to have an easy interface for the "Schornsteinfegers" in Germany, to be able to do their required testing on the water heater. This is a simplified function like the normal service function of the water heater. The standard factory setting for this function is “OFF”., use parameter P5BK to set this function to on.

When the "Schornsteinfeger" button is pressed for 3 seconds:
the heater will fire at **<u>minimum firing rate (%)</u>**
In this state the display shows:

F	**l**	**u**	**e**		**s**	**e**	**r**	**v**	**i**	**c**	**e**		**m**	**o**	**d**	**e**			
P	**o**	**w**	**e**	**r**		**:**		**M**	**i**	**n**	**i**	**m**	**u**	**m**					

When the button is pressed (briefly) again:
the heater will fire at **<u>50% firing rate</u>**
In this state the display shows:

F	**l**	**u**	**e**		**s**	**e**	**r**	**v**	**i**	**c**	**e**		**m**	**o**	**d**	**e**			
P	**o**	**w**	**e**	**r**		**:**		**5**	**0**	**%**									

When the button is pressed (briefly) again:
the heater will fire at **<u>maximum firing rate (%)</u>**
In this state the display shows:

F	**l**	**u**	**e**		**s**	**e**	**r**	**v**	**i**	**c**	**e**		**m**	**o**	**d**	**e**			
P	**o**	**w**	**e**	**r**		**:**		**M**	**a**	**x**	**i**	**m**	**u**	**m**					

When the button is pressed briefly again: the heater will return to the normal operation mode.
The "Schornsteinfeger" function is switched off.

NOTES:

When the heater is burning during Schornsteinfeger function (when top display line shows "Flue service mode") and no button is pressed for 12 minutes, the water heater will return automatically to the normal operation mode. The "Schornsteinfeger" function will be switched off.
The "Schornsteinfeger function" can be activated for the user by programming a parameter (P5 BK)
All regular temperature safety controls remain active, and the water heater pump and system pump are running.

10.7 Programming in standby mode

Standby
Use the standby mode for modifying water heater settings without interaction with the water heater control. Changes are effectuated by leaving standby mode.

Properties of standby mode:

- Keys are active and the menu is accessible.
- Burner does NOT respond to an external heat demand.
- All control functions are ON: pumps, fans and cascade are operational, recirculation and frost protection are active.

How to program the water heater:

- Disconnect or shut down the DHW thermostat and/or other external controllers from the water heater. The pump and fan will stop after a short time.
- Switch the water heater in standby mode by pressing [ON/OFF] for three seconds.
- The next display screen should appear:

Display message	W	A	T	R	H	T	R	:	b	o	i	l	e	r		o	f	f		
	>	>	>	:	1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)

- Program the water heater at the control panel (see the following sections).
- HINT: First program all changes planned, then only terminate programming mode by pressing [MENU], or [ENTER] and NO ◄ or YES ►.
- Reactivate the water heater by pressing [ON/OFF] for three seconds again.

10.8 Setting the time & date

The following graphs describe how to program the time and date of the unit.

Operating screen:

W	A	T	R	H	T	R	:	b	o	i	l	e	r		o	f	f		
>	>	>	:	1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)

Press [MENU]

Main menu screen:

M	a	i	n		M	e	n	u											
C	l	o	c	k															

The display shows "CLOCK" press [ENTER]

Setting Time and Date:

S	e	t		t	i	m	e	/	d	a	t	e		0	8	:	3	3	
3	0	/	0	3	/	2	0	1	0		T	u	e						

The day is now blinking/selected and can be changed.
Use [▲] & [▼] to change the value.
Use [◄] & [►] to select another value.

Press [ENTER] for the confirmation screen after all changes are done.

Confirmation screen:

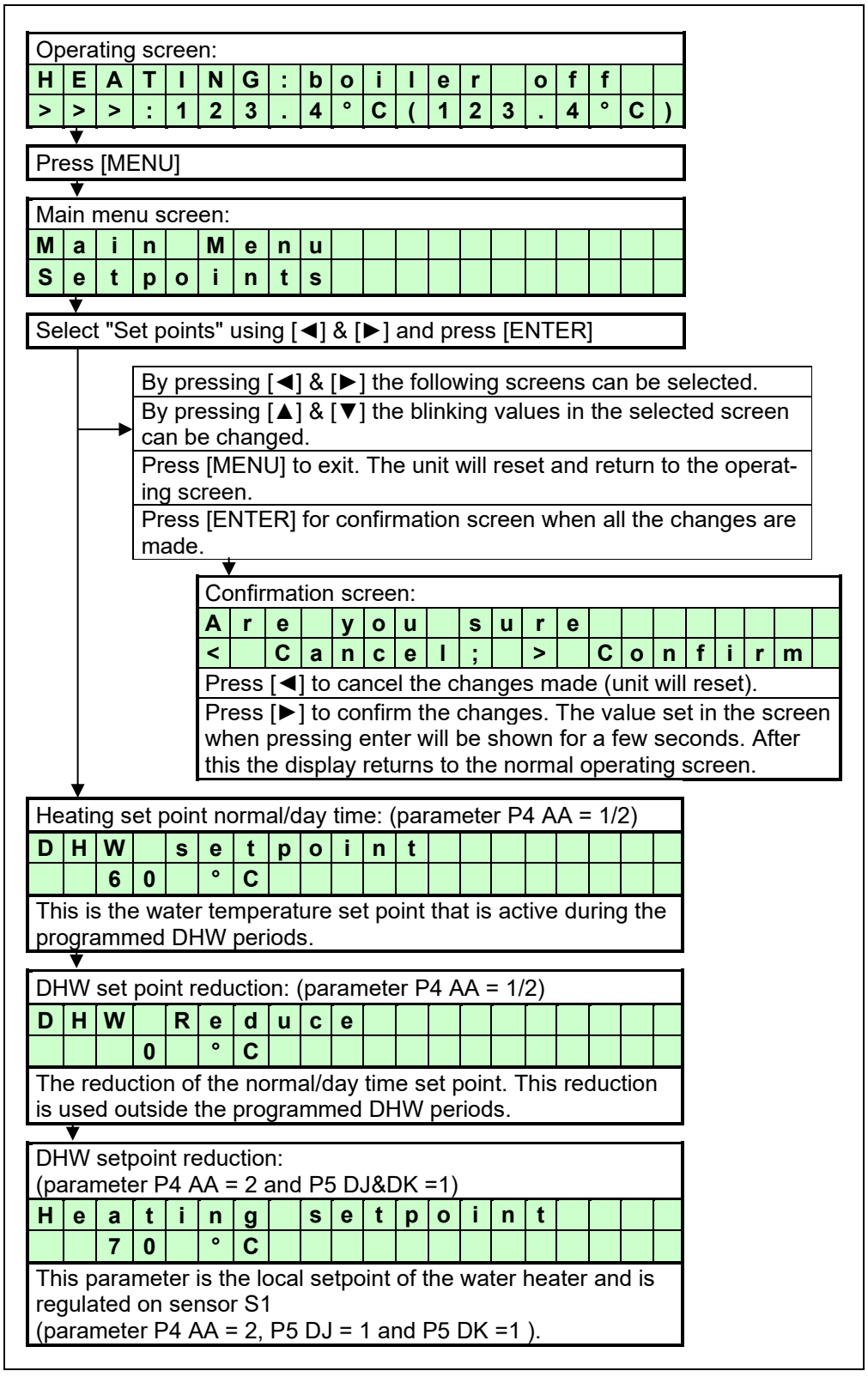
A	r	e		y	o	u		s	u	r	e								
<	C	a	n	c	e	l	;		>	C	o	n	f	i	r	m			

Press [◄] to cancel the changes made (display goes back to operating screen).

Press [►] to confirm the changes made. The time and day will start blinking for a few seconds. After this, the display returns to its operating screen.

10.9 Set points

The following graphs describe how to program the hot water set points.



BE AWARE:
The value set at “Heating Setpoint” has to be equal or higher as the value set at “DHW Setpoint”
“Heating Setpoint” sets the maximum possible flow temperature of the heater (The maximum temperature of the water flow to the tank).

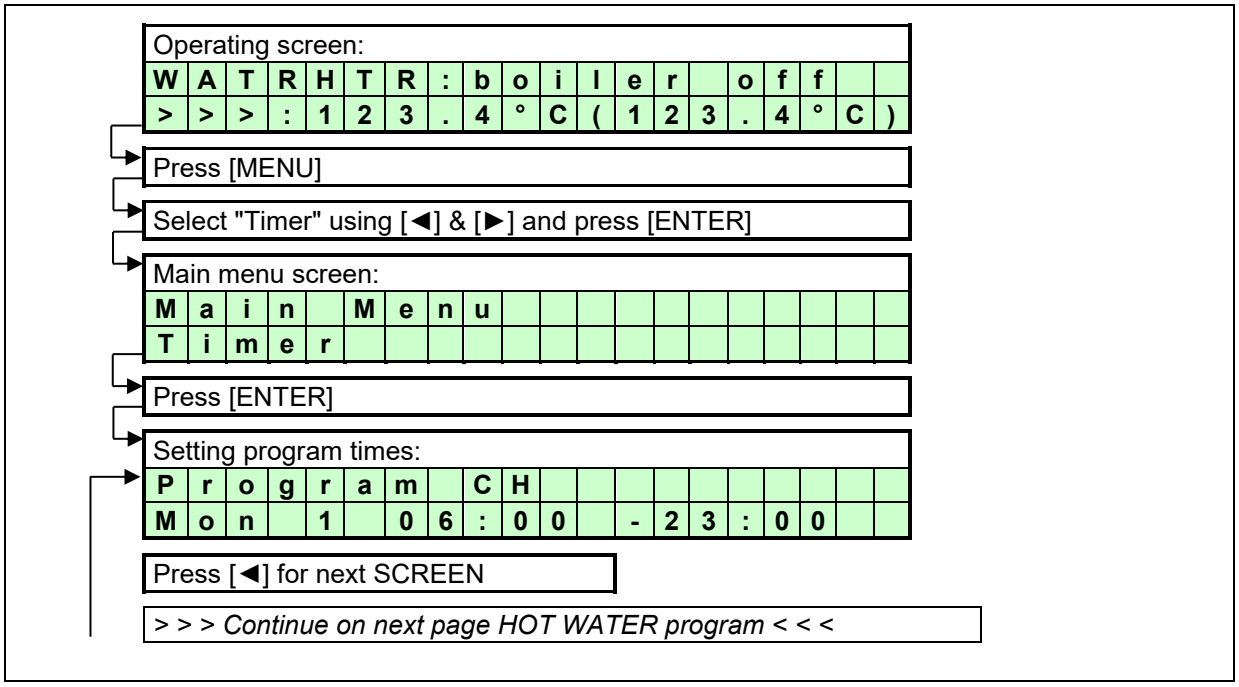
10.10 Setting the timer programs

Two different programs can be set with the water heater, these are:

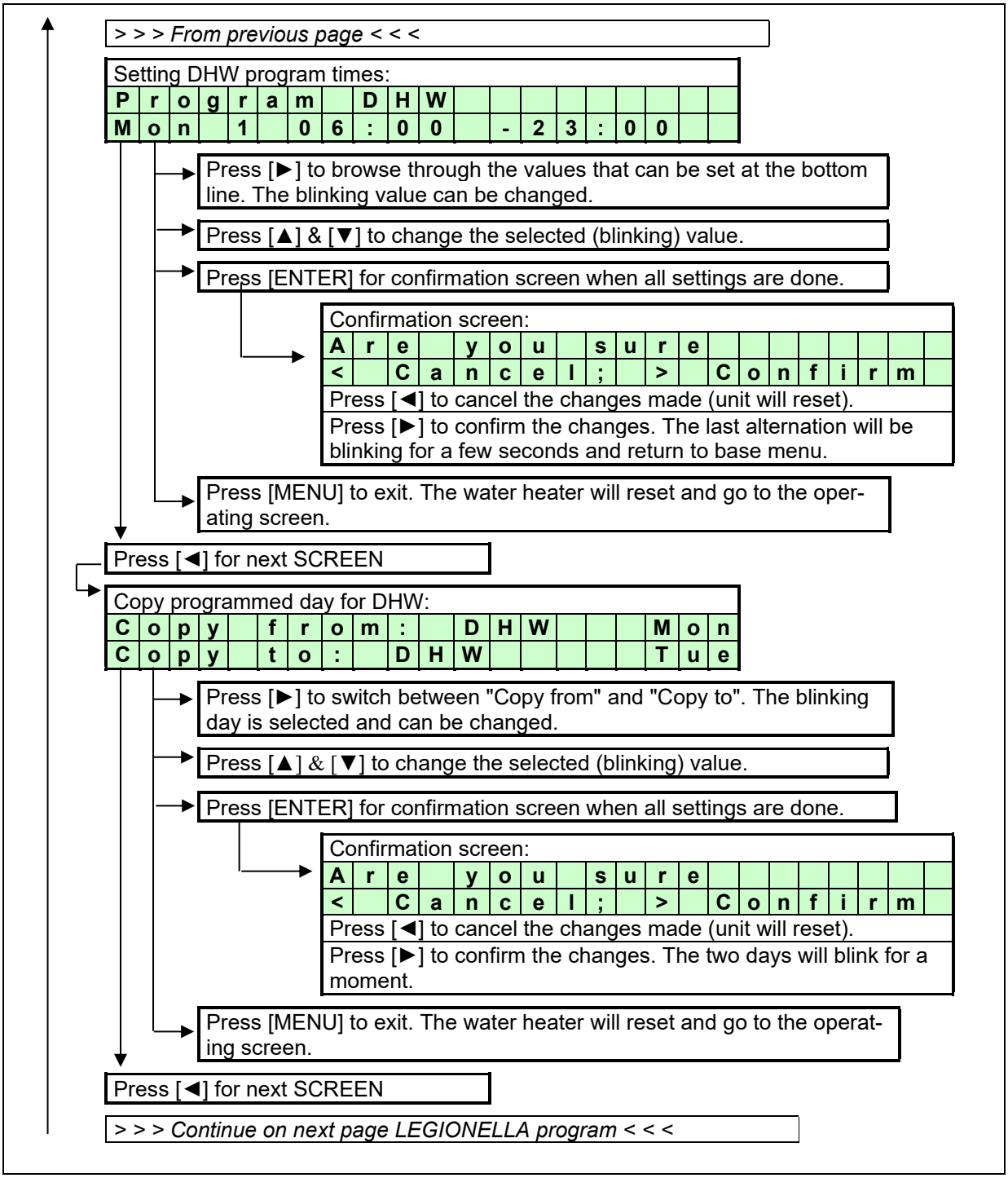
- DHW program
- Anti-Legionnaires' disease (pasteurization) program

START PROGRAMMING

Three programmed periods each day can be set (period 1, 2 and 3). During this period the unit will use the normal DHW set point. Outside the programmed period(s) the unit will use the reduced temperature as set point. When no time is scheduled for a period, it will not be used.
(Example no time programmed in period 3 on Monday > **"Mon 3 --:-- ---:--"**).

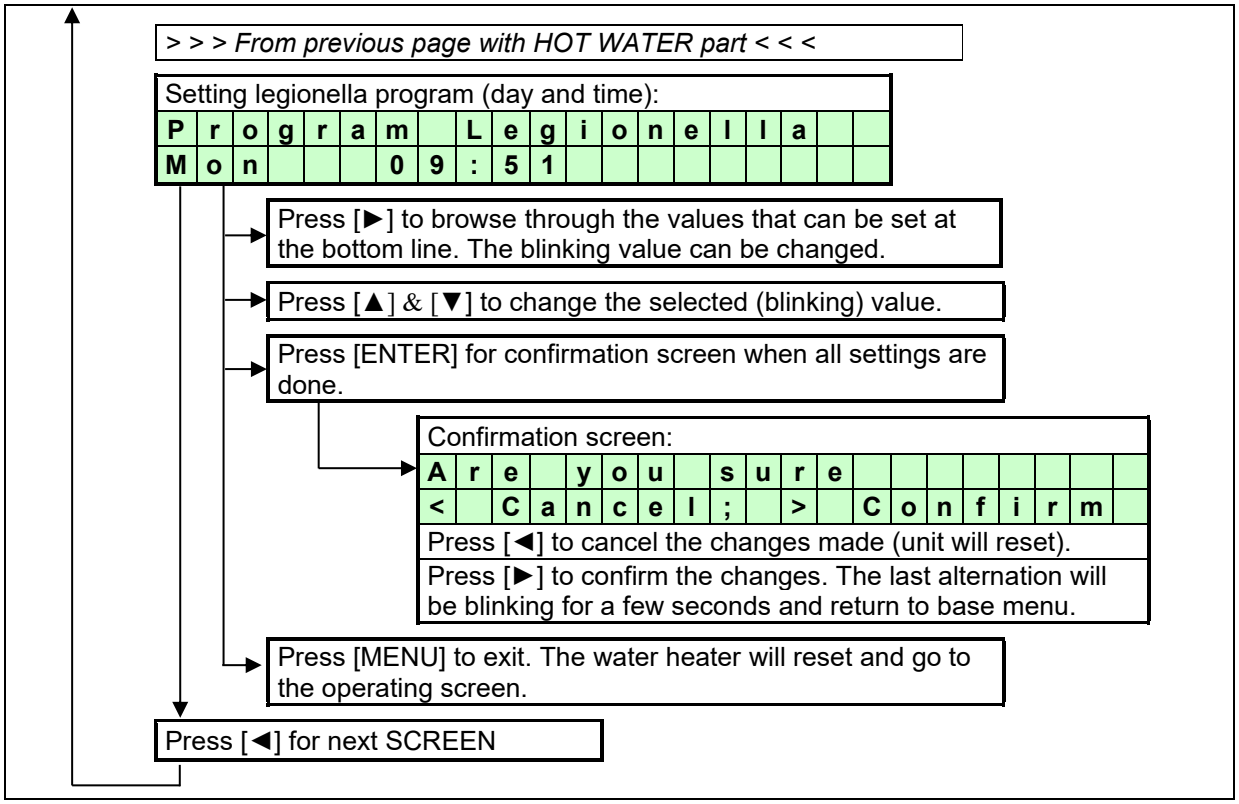


HOT WATER PROGRAM



ANTI LEGIONNAIRES' DISEASE PROGRAM

See the following description. The standard factory setting for this function is "OFF".



10.11 Checking the operating history

The following graphs describe how to check the operating history of the water heater.

Operating screen:
W A T R H T R : b o i l e r o f f
> > > : 1 2 3 . 4 ° C (1 2 3 . 4 ° C)

Press [MENU]

Select "Operate" using [◄] & [►] and press [ENTER]

Main menu screen:
M a i n M e n u
O p e r a t e

Press [◄] & [►] to browse through the 5 screens.

Press [MENU] or [ENTER] to exit. The unit will return to the operating screen.

SCREEN: 1

O	**p**	**e**	**r**	**a**	**t**	**i**	**n**	**g**		**h**	**i**	**s**	**t**	**o**	**r**	**y**		
P	**o**	**w**	**e**	**r**	**O**	**n**			**h**	**r**	**s**			**1**	**3**	**1**	**4**	**0**	**0**

Top line: Shows the operating history menu is activated.

Bottom line: Total hours the water heater is connected to power supply and switched on.

SCREEN: 2

h	**r**	**s**	**C**	**h**			**T**	**o**	**t**				**1**	**0**	**0**	**0**	**0**	**0**	**0**
h	**r**	**s**	**D**	**h**	**w**		**T**	**o**	**t**				**1**	**0**	**0**	**0**	**0**	**0**	**0**

Top line: Total burning hours for heating.

Bottom line: Total burning hours for domestic hot water.

SCREEN: 3

h	**r**	**s**	**C**	**h**				**<**	**5**	**0**	**%**		**1**	**0**	**0**	**0**	**0**	**0**	**0**
h	**r**	**s**	**C**	**h**			**=**	**>**	**5**	**0**	**%**		**1**	**0**	**0**	**0**	**0**	**0**	**0**

Top line: Burning hours for heating while the burner was firing less than 50%.

Bottom line: Burning hours for heating while the burner was firing equal or higher than 50%.

SCREEN: 4

h	**r**	**s**	**D**	**h**	**w**		**<**	**5**	**0**	**%**		**:**	**1**	**0**	**0**	**0**	**0**	**0**	**0**
h	**r**	**s**	**D**	**h**	**w**	**=**	**>**	**5**	**0**	**%**		**:**	**1**	**0**	**0**	**0**	**0**	**0**	**0**

Top line: Burning hours for hot water while the burner was firing less than 50%.

Bottom line: Burning hours for hot water while the burner was firing equal or higher than 50%.

SCREEN: 5

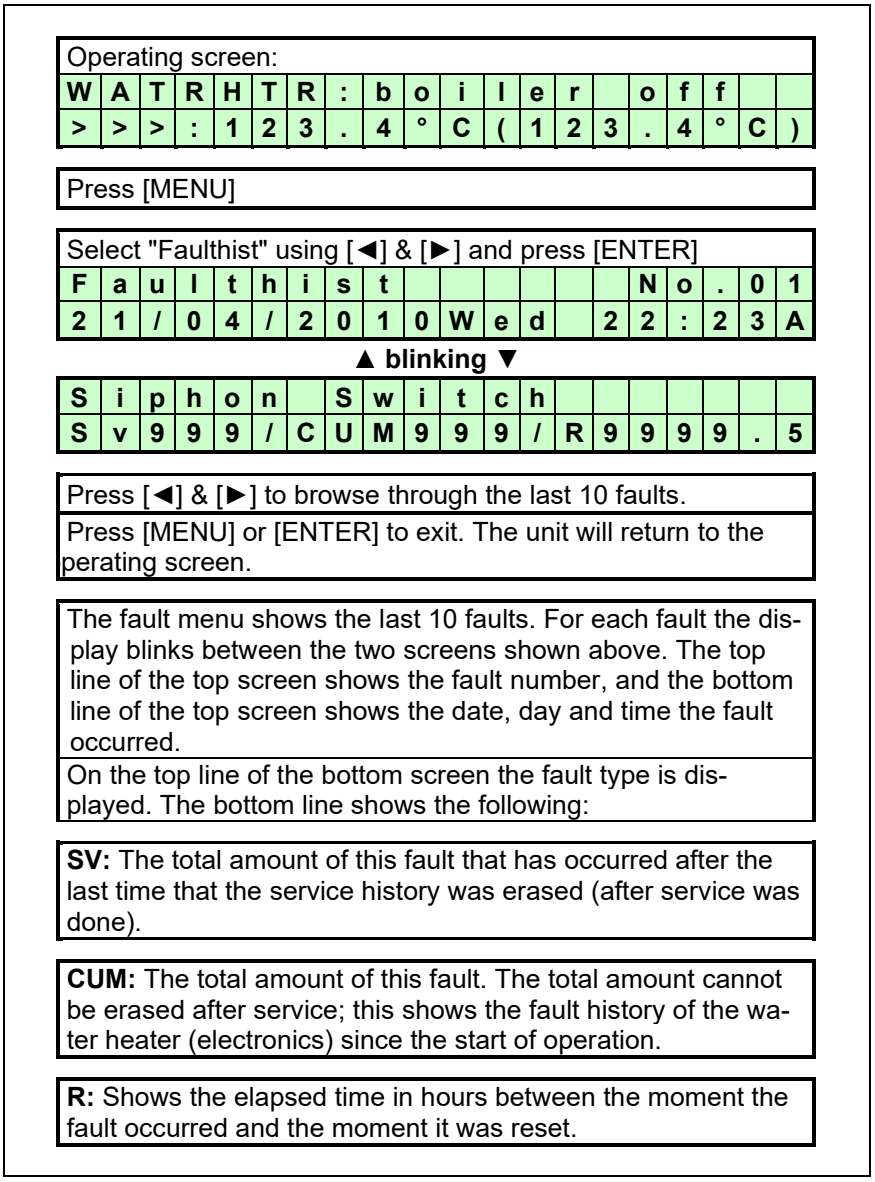
T	**i**	**a**	**1**	**0**	**0**	**0**	**0**	**0**	**F**	**i**	**a**			**1**	**0**	**0**	**0**	**0**	**0**
S	**s**	**l**	**1**	**0**	**0**	**0**	**0**	**0**	**S**	**s**	**t**			**1**	**0**	**0**	**0**	**0**	**6**

Top line: Shows Total Ignition Attempts (**Tia**) & Failed Ignition Attempts (**Fia**)

Bottom line: Shows Soft Starts last (**Ssl**) &
Soft Starts Total (**Sst**)

10.12 Checking the fault history

The following graphs describe how to check the fault history of the water heater.



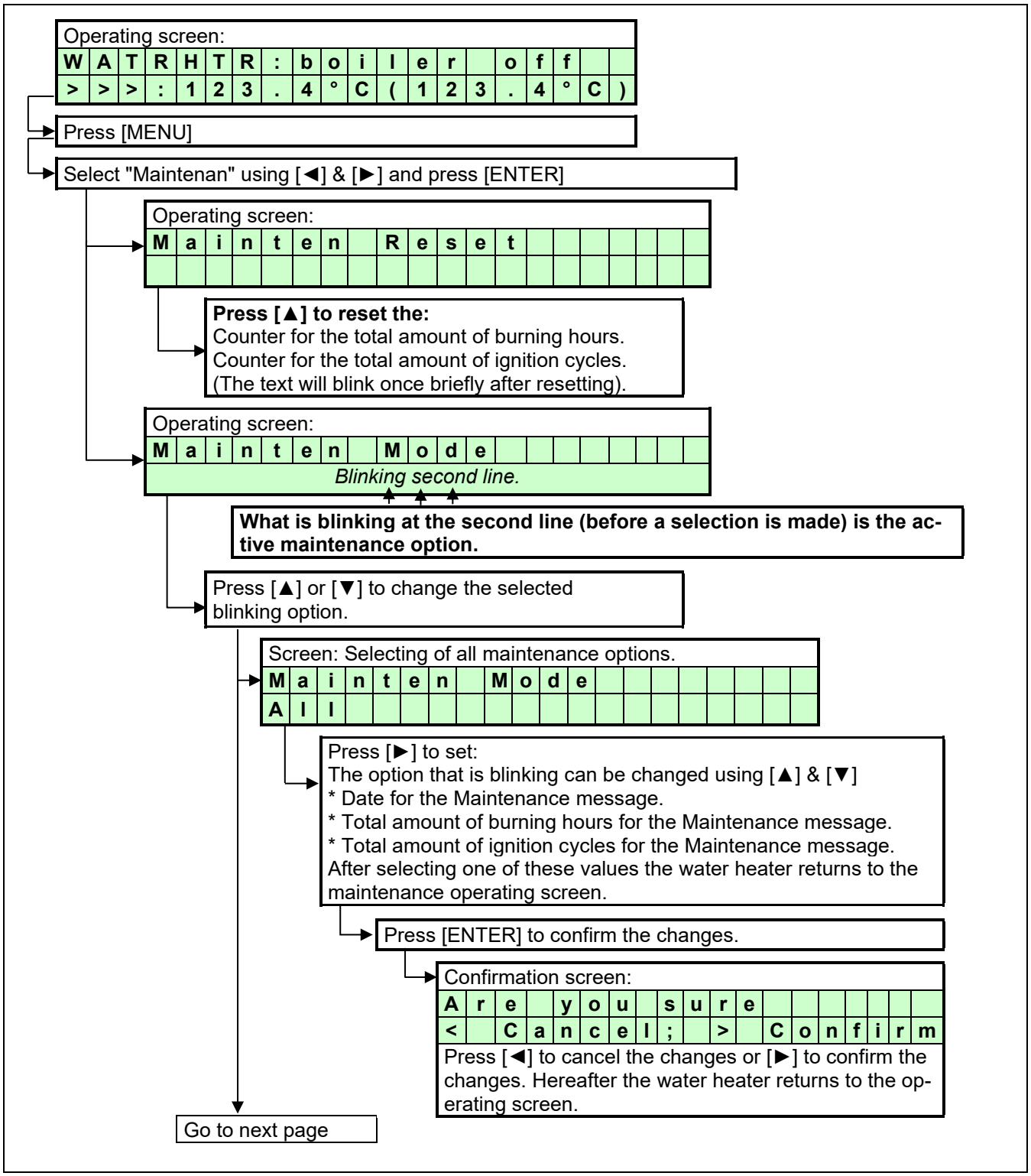
10.13 Setting the maintenance specifications

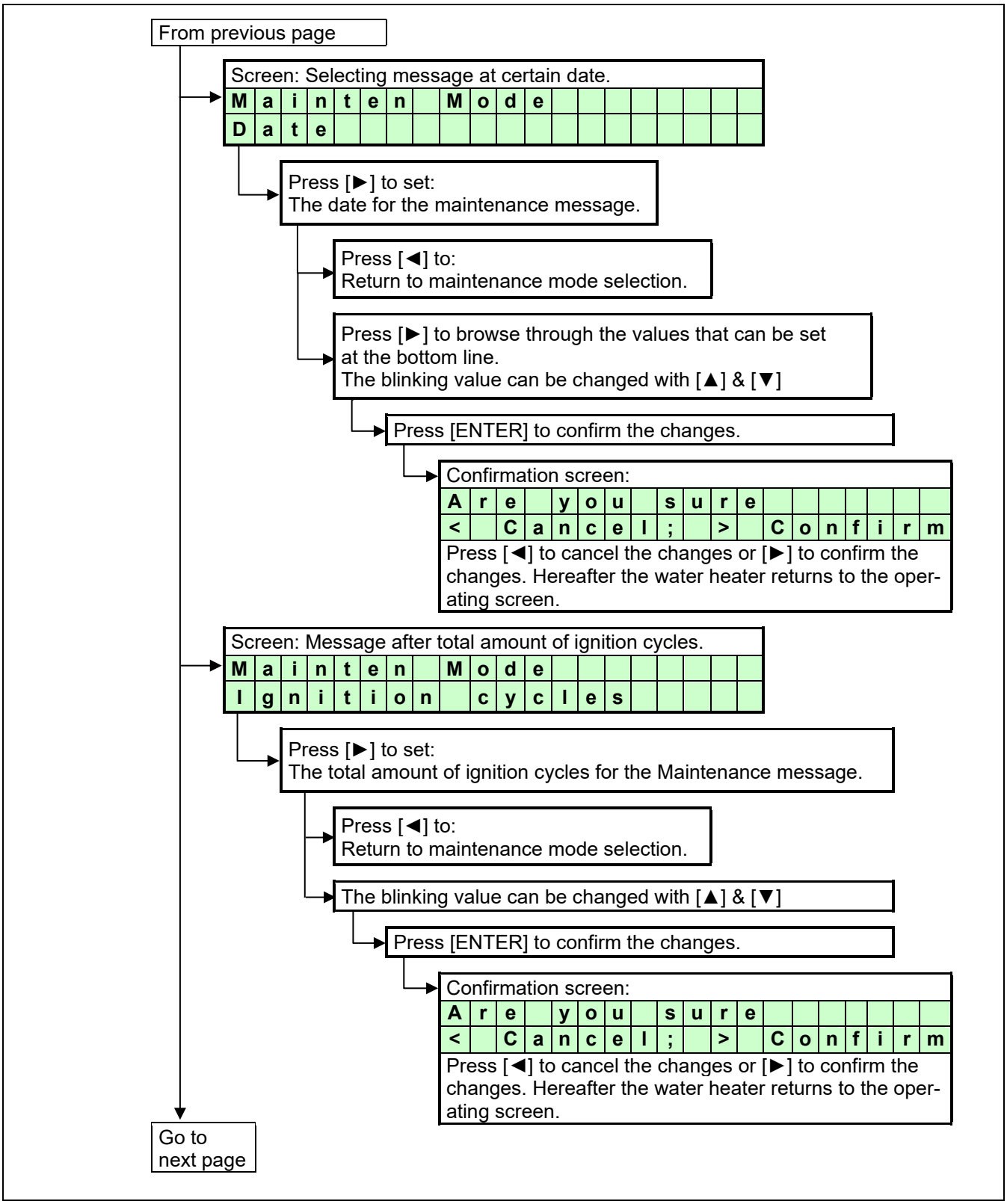
MAINTENANCE SETTINGS

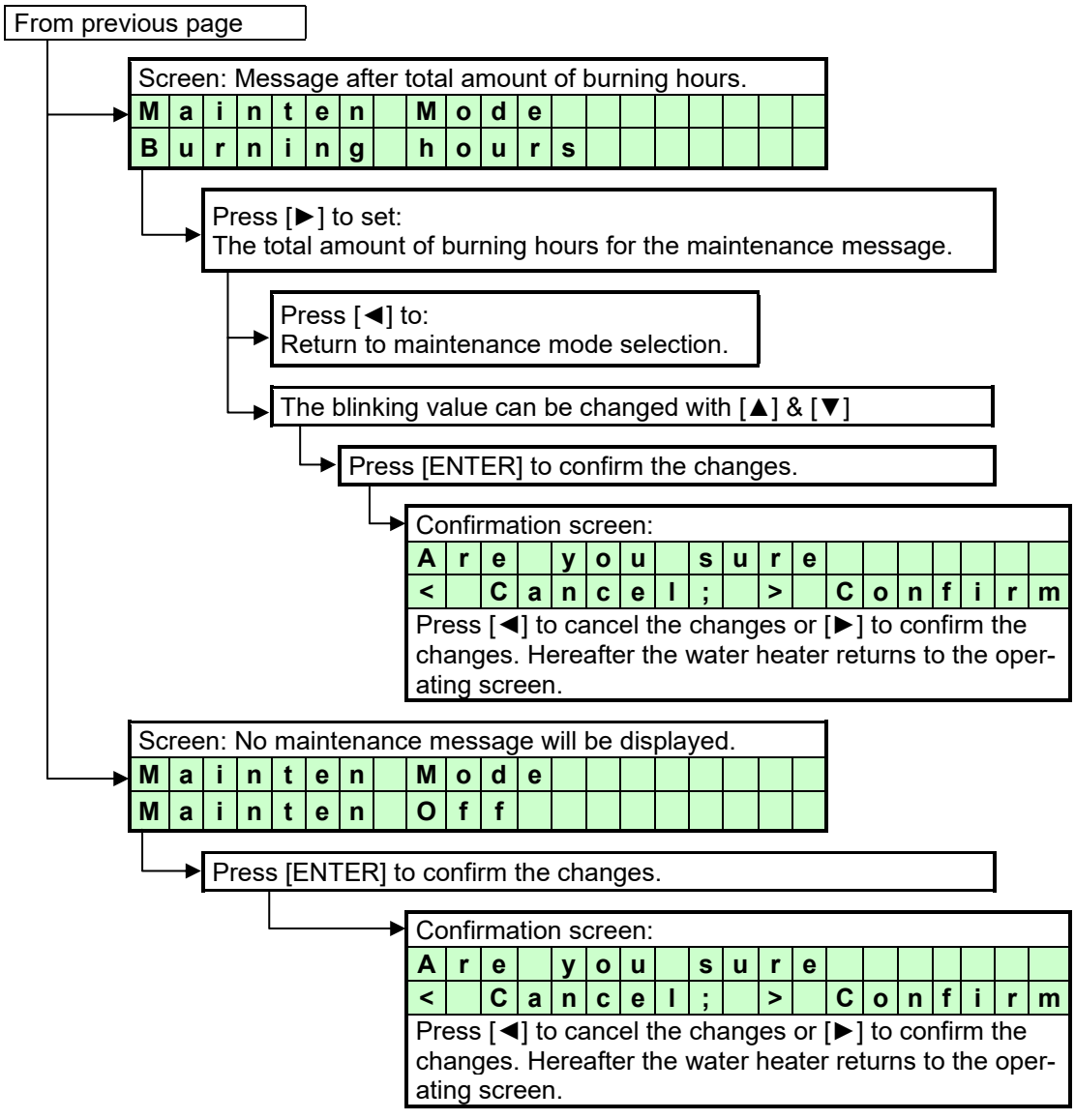
The unit can be programmed in such a way that an automatic maintenance message is displayed.
There are three options that can be selected. A maintenance message appears after:

* A programmed date is reached.
* An amount of burning hours is reached.
* An amount of ignition cycles is reached.

A single option can be activated or all three options.




From previous page
Screen: Selecting message at certain date.
Maintenn Mode
Date
Press [►] to set:
The date for the maintenance message.
Press [◄] to:
Return to maintenance mode selection.
Press [►] to browse through the values that can be set at the bottom line.
The blinking value can be changed with [▲] & [▼]
Press [ENTER] to confirm the changes.
Confirmation screen:
Are you sure
< Cancel; > Confirm
Press [◄] to cancel the changes or [►] to confirm the changes. Hereafter the water heater returns to the operating screen.
Screen: Message after total amount of ignition cycles.
Maintenn Mode
Ignition cycles
Press [►] to set:
The total amount of ignition cycles for the Maintenance message.
Press [◄] to:
Return to maintenance mode selection.
The blinking value can be changed with [▲] & [▼]
Press [ENTER] to confirm the changes.
Confirmation screen:
Are you sure
< Cancel; > Confirm
Press [◄] to cancel the changes or [►] to confirm the changes. Hereafter the water heater returns to the operating screen.
Go to next page



BE AWARE: This function is standard turned OFF. We offer this programmable function to the installer to use as a reminder. Because it concerns a free programmable function the use of it cannot be used as an argument in warranty cases.
Our units must be maintained every twelve months and/or after 2000 burning hours maximum whatever the settings/working of this function.

It is and remains the responsibly of the end user to have the unit maintained every twelve months and/or after 2000 burning hours maximum, whichever comes first

10.14 Setting the user lock

The following graphs describe how to activate the user lock of the display. The standard factory setting for this function is “OFF”.

The "**USER LOCK**" menu.
In this menu the water heater can be locked for (end-) users. 0 = UNLOCKED 1 = LOCKED
When the water heater is unlocked, the user can enter the MENU by pressing the menu button and all screens will show up.
When the water heater is locked, the user must push the: [MENU] button together with the [▼] button for 5 s. to access all menu screens.
This function is to prevent accidental changes!
NOTICE: The PARAMETER screen is always accessible.

Operating screen:

H	E	A	T	I	N	G	:	b	o	i	l	e	r		o	f	f		
>	>	>	:	1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)

Press [MENU]

Select "User lock" using [◄] & [►] and press [ENTER]

User lock screen:

S	e	t		U	s	e	r	l	o	c	k	=	0						
			0																

The "0" is now blinking/selected and can be changed.
Use [▲] & [▼] to change the value.
0 = User lock function OFF
1 = User lock function ON

Press [ENTER] for the confirmation screen after the selection has been made.

Confirmation screen:

A	r	e		y	o	u		s	u	r	e								
<		C	a	n	c	e	l	;		>		C	o	n	f	i	r	m	

Press [◄] to cancel the changes (the unit will reset and the display returns to the operating screen).

Press [►] to confirm the changes. The changed value will be blinking for a few seconds. After this, the display returns to the operating screen.

NOTICE:

Using the [MENU] button during the User lock display, will reset the water heater and the water heater will return to the operating screen. Changes will be neglected in this case.

10.15 Setting the parameters at the control panel

The functions of the controller are embedded in the electronics by means of parameters. The values and settings hereof can be programmed by a skilled and trained service engineer with the help of a computer (laptop), the correct software and an interface cable. A selection of these parameters can be programmed at the control panel of the unit itself, without the use of a computer.

The following table gives a list of these last-mentioned parameters. NOTICE: Only the password for level 1 is issued in this manual. “More advanced” parameters need to be programmed by a skilled and trained service engineer with access to level 2.

When ‘Modify = no’, the parameter can only be programmed at level 2							PASSWORD: 1342
MENU			PARA-METER	DESCRIPTION	UNITS	TEXT DISPLAY	LEVEL 1 Modify
HEATING	A	1	P5BE	Step modulation (1=on 0=off)	-	Step mode	no
		2	P5AO	Blocking offset flow temperature control	°C	HE sOff	yes
		3	P5AP	Proportional range temperature control	°C	HE sPrb	no
		4	P5AL	Hysteresis CH Flow temperature control	°C	HE scDif	yes
		5	P2IC	Integration time temperature control	s	HE sInt	no
		6	P2MI	Blocking offset System CH temperature control	°C	HE cOff	yes
		7	P2MJ	Proportional range System CH temp. control	°C	HE cPrb	no
		8	P2MK	Integration time CH temperature control	s	HE cInt	no
		9	P5AB	Timer Contact (1=on)	-	Timer Co	yes
DHW	B	1	P4AB	DHW Pump Config 0=Pump 1=TWV	-	DHipmp/twv	yes
		2	P5CB	Flow temperature DHW tank low	°C	DHiflow L	yes
		3	P5CK	Flow temperature DHW tank hi	°C	DHiflow H	yes
		4	P5CL	Low Flow temperature time DHW	min	DHi LOtime	yes
		5	P5CD	Legionella temperature	°C	Legio tem	no
		6	P5CI	Legionella hyst DHW tank temperature	°C	Legio hys	no
		7	P5CJ	Legionella hold time (0=off)	min	Legio hol	no
		8	P2KI	CH interrupt by Legionella 0=yes 1=no	-	Legio int	no
		9	P2LC	Regulation temperature offset DHWd	°C	DHdsc Of2	yes
		A	P2MN	Proportional range DHWd modulation	°C	DHdsc Pr23	no
		B	P2LD	Regulation temperature hysteresis DHWd	°C	DHdsc Di2	yes
		C	P2MO	integration time DHWd modulation	s	DHdsc In23	no
		D	P2ML	Sys temp blocking offset DHW tank	°C	DHdsc Of3	yes
		E	P2MM	Sys temp blocking hysteresis DHW tank	°C	DHdsc Di3	yes
		F	P5CA	Hysteresis DHW tank temperature	°C	DHisc Di4	yes
		G	P2KH	Gradient heat demand detect DHW tank temp.	°C	DHidetgrad	yes
CASCADE	C	1	P2MA	Max number extra heaters	-	Max Cascade Unit	no
		2	P5DA	Bus address heater	-	Bus address	no
		3	P5DC	Dhw on entire cascade (0) only master (1)	-	DHicas/mas	no
		4	P5DE	Extra Heater output enable (1)	-	Extra out	yes
		5	P5DF	Cascade detection (0=standalone 1=Leader)	-	Cas Sl/Ma	no
		6	P5BL	Power off total cascade (1)	-	Pwr Off Ca	no
		7	P5DB	Number of heaters with common flue 0=None	-	Com Flue Nu	no
GENERAL	D	1	P5BB	Analogue input Config (0=off 1=temp)	-	An Inp Cfg	yes
		2	P5AI	Minimum Temperature 0-10V input	°C	0-10 Min T	yes
		3	P5BI	Altitude (in amounts of 100 ft.)	ft*100	Alt * 100	yes
		4	P2LK	Max cooling time	min	Max Cool T	yes
		5	P5BJ	Temperature display 1=on	-	Temp Disp	yes
		6	P4AA	DHW 0=off 1=Indirect 2=Direct	-	DHW =i =d	no
		7	P4AD	pressure 0=off 1=sensor and 2=switch	-	conf	no
		8	P4BD	Gas type values 0-2	-	gastype	no
		9	P4BE	Soft start type values 0-2	-	conf	no
		A	P5BN	Pump modes 0-3	-	conf	no

For extensive explanation see Ch. 11: ‘Controlling options and settings’, page 70 ff.

IMPORTANT: Do not change the parameters P4AA, P4AD and P5BI; they are present in the controller for different purposes than DHW control. Changing these parameters may affect water heater operation negatively and can cause unsafe situations.

Parameter screens + concise explanation see next pages →

Operating screen:

W	A	T	R	H	T	R	:	b	o	i	l	e	r		o	f	f		
>	>	>	:	1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)

Press [MENU]

Select "Parameter" using [◄] & [►] and press [ENTER]

Parameter menu:

I	n	s	t	a	l	l	e	r		c	o	d	e						
								0	0	0	0								

Enter the 4-digit code with the [◄] & [►] and the [▲] & [▼] buttons and select [ENTER]
The code will blink a few seconds and when entered correctly, the following parameters will be displayed.

NOTICE: These codes are user based and give access to a selected number of parameters, which can be changed (Installer level 1/2).

Menu A: Heating

	A	1				S	t	e	p		m	o	d	u	l				
											1								

Function to activate the step modulation:
0 = Off
1 = On

Menu A: Heating

	A	2				H	E		s		o	f	f	1	3				
											4		°	C					

CH supply temperature setting. This parameter is the offset of the programmed CH temperature.

Menu A: Heating

	A	3				H	E		s		P	r	b	1	3				
										2	5		°	C					

Select the CH supply temperature control. This parameter is the proportional range of the selected CH supply temperature.

Menu A: Heating

	A	4				H	E		s	c	D	i	f	1	3				
										1	0		°	C					

Select the CH supply temperature control. This parameter is the hysteresis of the selected CH supply temperature.

Menu A: Heating

	A	5				H	E		s		I	n	t	1	3				
										6	0		S	e	c				

Select the CH supply temperature control. This parameter is the integration time of the selected CH supply temperature.

The screen texts on these pages are standard part of the software and apply to CH systems (boilers) and/or DHW devices (water heaters).

Menu A: Heating

	A	**6**				**H**	**E**			**c**	**O**	**f**	**f**		**3**		
											4		**°**	**C**			

Select the cascaded heaters supply temperature control.
This parameter is the offset of the selected CH supply temperature of EACH water heater of the total cascade.

Menu A: Heating

	A	**7**				**H**	**E**			**c**	**P**	**r**	**b**		**3**		
										2	**5**		**°**	**C**			

Select the cascaded water heaters supply temp. control.
This parameter is the proportional range of the selected CH supply temperature of EACH water heater of the total cascade and of the external (cascade) sensor.

Menu A: Heating

	A	**8**				**H**	**E**			**c**	**I**	**n**	**t**		**3**		
										8	**0**		**S**	**e**	**c**		

Select the cascaded water heaters supply temp. control.
This parameter is the integration time of the selected CH supply temperature of EACH water heater of the total cascade and of the external (cascade) sensor.

Menu A: Heating

	A	**9**				**T**	**i**	**m**	**e**	**r**	**C**	**o**	**n**	**t**			
											0						

Function to activate "external time controller":
0 = Off
1 = On
Connect to 13-14. Contact closed = daytime setting,
Contact open = night-time setting.

Menu B: Hot water

	B	**1**				**D**	**H**	**i**	**p**	**m**	**p**	**/**	**t**	**w**	**v**		
											1						

Hot water function of the water heater by:
0 = pump
1 = 3-way valve

Menu B: Hot water

	B	**2**				**D**	**H**	**i**	**f**	**l**	**o**	**w**		**L**	**O**		
										2	**5**		**°**	**C**			

Hot water function of the water heater. This parameter is the CH supply temperature LOW level with an indirect hot water demand.

Menu B: Hot water

	B	**3**				**D**	**H**	**i**	**f**	**l**	**o**	**w**		**H**	**I**		
										8	**5**		**°**	**C**			

Hot water function of the water heater. This parameter is the CH supply temperature HIGH level with an indirect hot water demand.

The screen texts on these pages are standard part of the software and apply to CH systems (boilers) and/or DHW devices (water heaters).

Menu B: Hot water																		
	B	**4**				**D**	**H**	**i**		**L**	**O**	**t**	**i**	**m**	**e**			
											1		**M**	**i**	**n**			
Hot water function of the water heater. This parameter is the selectable period after which the water heater switches from LOW to HIGH set point with an indirect hot water demand.																		

Menu B: Hot water																		
	B	**5**				**L**	**e**	**g**	**i**	**o**		**t**	**e**	**m**	**p**			
										8	**5**		**°**	**C**				
Pasteurization function of the water heater. This parameter is the selected hot water temperature during the pasteurization function of the water heater.																		

Menu B: Hot water																		
	B	**6**				**L**	**e**	**g**	**i**	**o**		**h**	**y**	**s**	**t**			
											2		**°**	**C**				
Pasteurization function of the water heater. This parameter is the selected hysteresis during the pasteurization function of the water heater.																		

Menu B: Hot water																		
	B	**7**				**L**	**e**	**g**	**i**	**o**		**h**	**o**	**l**	**d**			
											2		**M**	**i**	**n**			
Pasteurization function of the water heater. This parameter is the selected time period for the pasteurization function of the water heater.																		

Menu B: Hot water																		
	B	**8**				**L**	**e**	**g**	**i**	**o**		**i**	**n**	**t**	**r**			
											0							
Pasteurization function of the water heater. This parameter controls if the CH demand can be interrupted by the pasteurization function of the water heater. 0 = Yes 1 = No																		

Menu B: Hot water																		
	B	**9**				**D**	**H**	**d**	**s**	**c**	**O**	**f**	**f**	**2**				
											4		**°**	**C**				
Function for the direct hot water heater. This parameter is de off set of the selected HW temperature of the water heater.																		

Menu B: Hot water																		
	B	**A**				**D**	**H**	**d**	**s**	**c**	**P**	**r**	**b**	**2**	**3**			
										2	**0**		**°**	**C**				
Function for the direct hot water heater. This parameter is the proportional range of the selected HW temperature of the water heater.																		

Menu B: Hot water																		
	B	**B**				**D**	**H**	**d**	**s**	**c**	**D**	**i**	**f**	**2**				
										1	**0**		**°**	**C**				
Function for the direct hot water heater. This parameter is the hysteresis of the selected HW temperature of the water heater.																		

The screen texts on these pages are standard part of the software and apply to CH systems (boilers) and/or DHW devices (water heaters).

Menu B: Hot water

	B	**C**				**D**	**H**	**d**	**s**	**c**	**I**	**n**	**t**	**2**	**3**			
									2	**0**	**0**		**S**	**e**	**c**			

Function for the direct hot water heater.
This parameter is the integration time of the selected HW temperature of the water heater.

Menu B: Hot water

	B	**D**				**D**	**H**	**d**	**s**	**c**	**O**	**f**	**f**	**3**				
											4		**°**	**C**				

Function for the cascaded direct hot water heaters.
This parameter is the offset of the selected HW temperature of the cascaded water heaters.

Menu B: Hot water

	B	**E**				**D**	**H**	**d**	**s**	**c**	**D**	**i**	**f**	**3**				
											8		**°**	**C**				

Function for the cascaded direct hot water heaters.
This parameter is the hysteresis of the selected HW temperature of the cascaded water heaters.

Menu B: Hot water

	B	**F**				**D**	**H**	**i**	**s**	**c**	**D**	**i**	**f**	**4**				
											5		**°**	**C**				

Function for the indirect hot water supply of the water heater (tank).
This parameter is the hysteresis of the selected DHW temperature of the calorifier/tank.

Menu B: Hot water

	B	**G**				**D**	**H**	**i**	**d**	**e**	**t**	**g**	**r**	**a**	**d**			
											3		**°**	**C**				

Function for the indirect hot water supply of the water heater (tank).
This parameter detects an (an accelerated) hot water demand, when a larger (water) amount is being used.

Menu C: Cascade

	C	**1**				**M**	**a**	**x**	**C**	**a**	**s**	**c**	**U**	**n**	**t**			
										1	**1**							

Function for the cascading of the water heater(s).
This parameter sets the total number of cascaded water heaters (max. twelve water heaters).

Menu C: Cascade

	C	**2**				**B**	**u**	**s**		**a**	**d**	**r**	**e**	**s**	**s**			
											0							

Function for the cascading of the water heater(s).
This parameter determines the address of the water heater for the total cascading control.
Master = 0, Slave 1 = 1 etc.

Menu C: Cascade

	C	**3**				**D**	**H**	**i**	**c**	**a**	**s**	**/**	**m**	**a**	**s**			
											0							

Function for the cascading of the water heater(s).
This parameter determines if only the Master water heater or all water heaters of the cascade are used for indirect hot water.
0 = All
1 = Master

The screen texts on these pages are standard part of the software and apply to CH systems (boilers) and/or DHW devices (water heaters).

Menu C: Cascade

C	4				E	x	t	r	a		u	n	i	t				
										0								

Function for the cascading of the water heater(s).
This parameter is activated when an external (extra) water heater is connected to the Master water heater. Connect to the Master connections 21-22.

Menu C: Cascade

C	5				C	a	s		S	i	/	M	a					
										0								

Function for the cascading of the water heater(s).
This parameter sets the function of the water heater at a cascade alignment
0 = Single / Slave unit
1 = Master unit

Menu C: Cascade

C	6				P	w	r	O	f	f	T	o	C	a				
										0								

Function for the cascading of the water heater(s).
This parameter determines the function of the Slave water heaters when the Master water heater is switched off.
0 = Slave water heater(s) continue operation
1 = Slave water heater(s) switch off

Menu C: Cascade

C	7				C	o	m	F	l	u	N	u	m					
										0								

Function for the cascading of the water heater(s).
This parameter determines the number of cascaded water heaters that are implemented with a common flue system.

Menu D: General

D	1				0	-	1	0	V	c	o	n	t	r				
										0								

Function for the external control of the water heater by using a 0-10 Volt signal (Connections 15-16).
0 = No external control
1 = Control based on temperature setting
2 = Control based on power setting (NOT possible for EF+)

Menu D: General

D	2				0	-	1	0	M	i	n	T	m	p				
									2	0		°	C					

Function for the external control of the water heater by using a 0-10 Volt signal (Connections 15-16).
Control based on temperature (setting 1).
The minimum (desired) CH water temperature when supplying a 1,4 Volt signal.

Menu D: General

D	3				A	l	t		*		1	0	0	f				
										0								

Function for setting the location height (above sea level) of the water heater.
NOTICE: dimensions in English feet. One unit = 100 ft.
Use this function only in consultation with the supplier/manufacturer.

The screen texts on these pages are standard part of the software and apply to CH systems (boilers) and/or DHW devices (water heaters).

Menu D: General																		
	D	**4**				**M**	**a**	**x**	**C**	**o**	**o**	**l**	**T**	**i**	**m**			
											2		**M**	**i**	**n**			

Function for setting the maximum overrun time of the fan (maximum 10 minutes).
0 = Switch off

Menu D: General																		
	D	**5**				**T**	**e**	**m**	**p**	**O**	**n**	**D**	**i**	**s**	**p**			
											1							

Function to show the (measured) temperature of the water heater at the display.

Menu D: General																		
	D	**6**				**D**	**H**	**W**		**1**	**=**	**i**	**2**	**=**	**d**			
											1							

Function to set up the CH and HW boiler options.
0 = CH only (direct)
1 = CH/HW function (indirect)
2 = HW only (direct)
For EF+ this parameter has been set to 2.

Menu D: General																		
	D	**7**				**c**	**o**	**n**	**f**	**i**	**g**							

Function for the setting of the water pressure measuring means. In water heaters a switch is used.
0 = off
1 = sensor
2 = switch

Menu D: General																		
	D	**8**				**g**	**a**	**s**	**t**	**y**	**p**	**e**						

Function to select the gas type (according to EN 437)
0 = standard
1 = G31
2 = Do NOT use.

Menu D: General																		
	D	**9**				**c**	**o**	**n**	**f**	**i**	**g**							

Function for setting the 'soft start' option
0 = normal start-up
1 = reduced fan ramp-up speed (I)
2 = reduced fan ramp-up speed (II)

Menu D: General																		
	D	**A**				**c**	**o**	**n**	**f**	**i**	**g**							

Function: Pump mode
0 = normal
1 = relay **1**, connector 19 and 20 (lock-out)
2 = relay **2**, connector 21 and 22 (burner burning)
3 = relay **3**, connector 23 and 24 (heat demand)
4 = Do not use (reserved for future applications).

The screen texts on these pages are standard part of the software and apply to CH systems (boilers) and/or DHW devices (water heaters).

10.16 Fault codes display

The following graphs describe the lock out codes of the water heater. A lock out code can only be removed by a manual reset of the water heater. NOTICE: Before resetting the water heater always check the water heater, DHW system and all components corresponding to the related lock out description. Never just reset the water heater, before analyzing the possible cause of failure.

10.16.1 LOCK-OUT CODES

Having a lockout means that the water heater needs a manual reset to start operating again.
When the water heater is in lockout the backlight of the display is blinking on and off.

Explanation > | 9 | 9 | 9 | . | 5 | : | h | r | s | = time elapsed after fault & message.

Explanation > | P | u | m | p | 1 | | o | n | = status of the pump during fault.

Display message	F	a	i	l	e	d		b	u	r	n	e	r		s	t	a	r	t	
F8	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Water heater is not starting after the programmed number of starting attempts.

Display message	F	a	l	s	e		f	l	a	m	e		s	i	g	n	a	l		
F10	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Flame signal is detected while it cannot be expected.

Display message	F	a	n		s	p	e	e	d		i	n	c	o	r	r	e	c	t	
F11	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason The controller does not detect a correct fan speed.

Display message	F	l	a	m	e		l	o	s	t										
F9	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Flame detected during normal operation, but was lost while running.

Display message	F	l	o	w		h	i	g	h		T	e	m	p						
F1	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Flow temperature exceeds the limit which has been set in the parameters.

Display message	F	l	o	w	R	e	t	u	r	n		d	t		f	a	u	l	t	
F16	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Temperature difference between flow and return exceeds limitation value, or 'dT block or delta direct block' has occurred three times.

Display message	F	l	o	w		s	e	n	s	o	r		e	r	r	o	r			
F0	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Flow sensor not detected by the water heater caused by faulty connection/sensor.

Display message	F	l	u	e		s	e	n	s	o	r		e	r	r	o	r			
F6	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Flue gas sensor not detected caused by faulty connection/sensor.

Display message	F	l	u	e		t	e	m	p		t	o	o		h	i	g	h		
F7	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Flue gas temperature exceeds the limit more than 3 times within a time frame.

Display message	P	a	r	a	m	/	H	a	r	d	w		f	a	u	l	t			
F13	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Fault during programming of the water heater software parameters.

Display message	p	r	o	g	r	a	m	m	i	n	g		e	n	d				
F12	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Software parameters have been programmed.

Display message	R	e	t	u	r	n		h	i	g	h		T	e	m	p			
F1	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason The maximum return temperature as set in the parameters is exceeded.

Display message	R	e	t	u	r	n		s	e	n	s	o	r		e	r	r	o	r	
F3	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Return sensor not detected caused by faulty connection/sensor.

Display message	S	i	p	h	o	n		s	w	i	t	c	h							
F19	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason The pressure switch detects a high pressure in the flue/siphon system.

Display message	W	a	t	e	r		h	i	g	h		l	i	m	i	t				
F17	p	u	m	p		o	n					9	9	9	.	5		h	r	s

Reason Maximum thermostat (clixon) measured a too high flow temperature.

10.16.2 BLOCKING CODES

The following graphs describe the blocking codes of the water heater. A blocking code is a temporary blocking of the water heater, because of an extraordinary situation. The water heater will continue to operate after stabilisation of this situation.

The display is not blinking but is lightened up during the blocking period.
The water heater is blocking an action because of an extraordinary situation. This action will be continued after elimination of the extraordinary situation.

Display message	A	n	t	i	c	y	c	l	e		t	i	m	e						
												9	9	9	.	5		h	r	s

Reason The controller received a new heat demand too quick after the last demand.

Display message	C	a	s	c	a	d	e		B	l	o	c	k							
												9	9	9	.	5		h	r	s

Reason One of the cascaded water heaters causes an error, because of a lock out.

Display message	D	e	a	i	r	a	t	i	o	n										
												9	9	9	.	5		h	r	s

Reason The heater starts its deairation function and will return to normal operation.

Display message	D	e	l	t	a		D	i	r	e	c	t		b	l	o	c	k		
												9	9	9	.	5		h	r	s

Reason Temperature difference T2-T1 has exceeded the blocking value.

Display message	F	l	o	w		h	i	g	h		D	H	W							
												9	9	9	.	5		h	r	s

Reason Setp.return (tank) temp. DHW (S3) is higher than Setp. heating = flow temp.

Display message	F	l	o	w		t	e	m	p		h	i	g	h						
												9	9	9	.	5		h	r	s

Reason The flow temperature has exceeded the blocking temperature.

Display message	F	l	u	e		t	e	m	p		h	i	g	h						
												9	9	9	.	5		h	r	s

Reason Flue gas temperature has exceeded the limit.

Display message	Gen Block	
		999.5 hrs

Reason The general blocking circuit is activated during operation = contact 7-8

Display message	Line fault	
		999.5 hrs

Reason Wrong electrical power supply is connected (not 50 or 60 Hz, 220-240 Volt).

Display message	Return temp high	
		999.5 hrs

Reason Return temperature has exceeded the blocking temperature, but the return temperature has not exceeded the lock-out value.

Display message	T2-T1 high	
		999.5 hrs

Reason Temperature difference T2-T1 has exceeded the blocking value.

Display message	Waterpressure fault	
		999.5 hrs

Reason Water pressure is too low or too high.

Display message	WATRHTR: T3	External
	>>>: 60.0 °C	(-30.7 °C)

Reason T3 external tank sensor is not connected to the terminals

10.16.3 MESSAGES

The following graphs describe the messages at the water heater display. Depending on the selected and activated options for the water heater, it is possible that some messages will show up at the display of the water heater. For example, a maintenance message after a certain programmed date has been reached. The water heater will operate independently of these messages.

MAINTENANCE ATTENTION MESSAGE

The display shows alternating the base screen and this message, while the backlight is blinking.
The water heater is operating but will count the exceeding hours.
A parameter must be changed, after service, to remove this message.

Display message	Needs Maintenan	0.0
	Ignition cycles	hrs

Reason Maintenance option of total amount of ignition cycles has been reached.

Display message	Needs Maintenan	0.0
	Date	hrs

Reason Maintenance option of the date has been reached.

Display message	Needs Maintenan	0.0
	Burning hours	hrs

Reason Maintenance option of total amount of burning hours has been reached.

Display message	Needs Maintenan	0.0
	All	hrs

Reason One of the above mentioned maintenance options has been reached.

11 CONTROLLING OPTIONS AND SETTINGS

11.1 General

The following sections describe some general functions of the water heater and their possible use.

11.1.1 MAX COOLING TIME

The fan will cool down the heat exchanger according to the temperature settings (parameters) of the software. With this cooling parameter the maximum run time of the fan can be programmed.

P2LK Max cooling time (display D4) [min.]

The fan will cool the heat exchanger according to parameter P2 LJ, but the fan will never run for cooling longer than the period programmed with this parameter P2LK. “0” = cooling function off.
For S1 > local set point P6BA – P2LJ → fan starts after 1 minute and stops after 3 minutes
During post pump circulation, no post ventilation takes place.

11.1.2 TEMPERATURE DISPLAY ON/OFF

Selection for showing the measured temperatures in the operation display of the water heater.

P5BJ Temperature display 1=on (display D5)

The measured temperature in the operation display.

0 = not visible
1 = visible

11.1.3 GAS TYPE SELECTION

Settings for gas types: natural gas or propane.

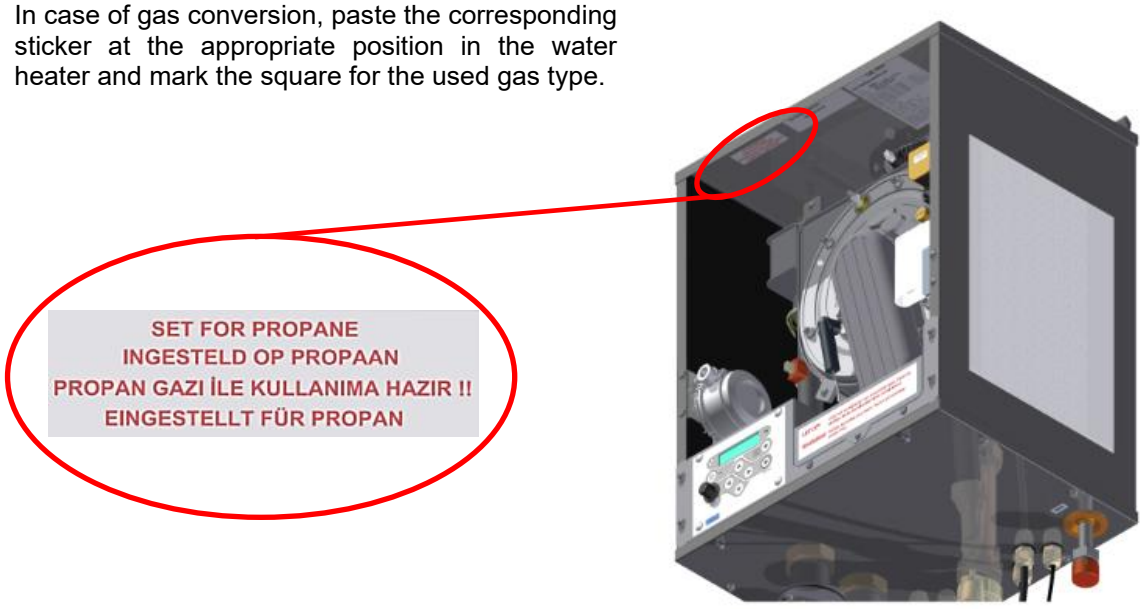
P4BD Gas type (display D8) 0=standard, 1=propane, 2=Do NOT use.

This parameter is set 0 for the commonly used gas types such as natural gas G20
By setting this parameter to 1 for propane (G31) the fan speed is reduced.

0 = standard gas (e.g.: natural gas)
1 = propane
2 = Do NOT use

At each setting, the relevant Soft start settings are automatically adjusted, depending on the main setting P4BE, see next section § 11.1.4.

⚠ In case of gas conversion, paste the corresponding sticker at the appropriate position in the water heater and mark the square for the used gas type.



11.1.4 SOFT START OPTION

Start parameters can be modified to achieve better start behavior, in case of noise or other difficulties. This is done by reducing the fan ramp-up speed. Two settings are available (I and II).

P4BE **Soft start (0=normal, 1=reduced fan ramp-up speed (I), 2= reduced fan speed ramp-up (II)) (display D9).**

0 = normal start-up
1 = reduced fan ramp-up speed (I)
2 = reduced fan ramp-up speed (II)

11.1.5 TANK SENSOR SENSITIVITY

P2KH **Gradient heat demand detection DHW tank temperature (display BG)** **[0.1°C]**

With S3 in use as tank sensor, it is possible to detect a fast cooling down of the tank through a large DHW flow. The sensitivity of this sensor can be set in parameter P2KH in tenths of degrees.

11.2 Water heater options

11.2.1 0-10 VDC REMOTE FLOW TEMPERATURE SET POINT

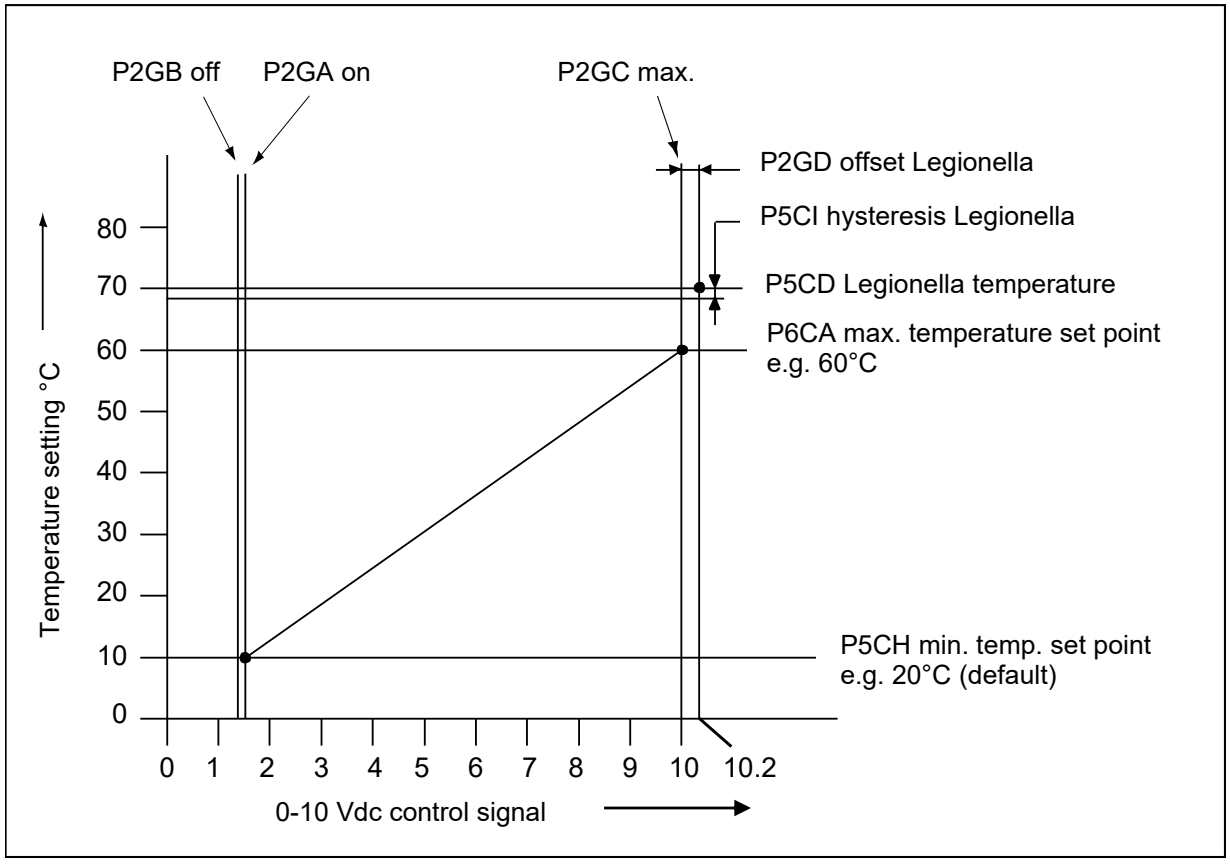
The hot water temperature is controlled by connecting an external 0-10 VDC signal to the water heater (connections 15-16).

P5BB **Analogue input Config (0=off 1=temp) (display D1).**

This parameter must be set at "1" so the supplied 0-10 V dc signal will control the temperature set point.
Possible settings are:

0 = 0-10V control off
1 = 0-10V temperature set point control active

See also the following graph for the relation between the temperature and the control signal.



The graph is only for illustration purposes, parameter values in the water heater can deviate.

BE AWARE: Legionella cycle starts at 10.2 Volts.

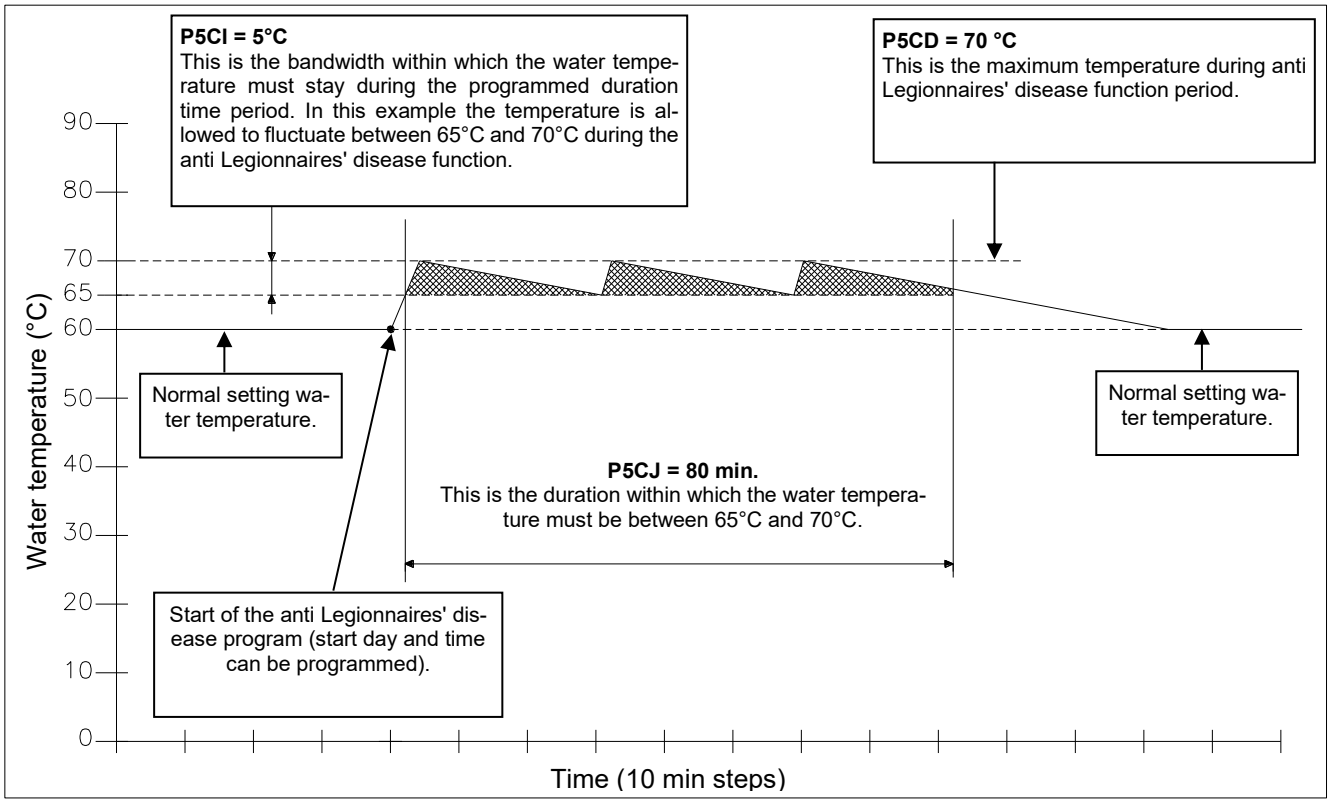
11.2.2 ANTI-LEGIONNAIRES' DISEASE (PASTEURIZATION) FUNCTION

To prevent Legionnaires' disease, the water heater (software) provides a function for heating up the hot water storage tank (once a week or every day) to a higher water temperature than the normal active hot water set point. Also, the period, that this "higher" water temperature function must be active, can be programmed in P7BV start time (0:00) and P7BW (8) and is standard switched off.

Also, an external 0-10 Vdc signal can be used to activate the pasteurization function, by making the 0-10 V signal higher than 10,2 V.

NOTICE: The standard factory setting for this Legionnaires' disease (pasteurization) function is "OFF". To activate this Legionnaires' disease function some parameters must be programmed by the manufacturer/supplier. The starting day and starting time of this Legionnaires' disease function can be programmed at the control panel of the water heater.

Several parameters are used for this function. Three of these parameters are shown in the following graph.



The graph is only for illustration purposes, parameter values in the water heater can deviate.

The settings of these parameters P5CI, P5CJ and P5CD must be programmed according to all applicable anti Legionnaires' disease prevention regulations.

The setting of these parameters can only be done by the manufacturer/supplier of the water heater or by a technician with access to programming level 2, at the control panel of the unit without the use of a computer.

NOTICE: The use and activation of this function won't guarantee a Legionnaires' disease-free installation. The responsibility for a Legionnaires' disease-free installation remains at the end-user/owner.

12 COMMISSIONING THE WATER HEATER

12.1 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 DHW 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.

12.2 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 by opening the water supply valve of the system and opening all the taps that are on the system. The water pressure of the system should be between a minimum of 1 bar and a maximum of 8 bar, also depending on the applied pressure safety valve.

BE AWARE: The EF+ water heater has a manual air vent situated at the top panel of the water heater. This vent must be opened during the filling of the water heater and the DHW system to make sure that no air/oxygen is trapped in the heat exchanger of the water heater.

NOTICE: Make sure that, during flushing and filling, no water can reach any electrical parts of the water heater.

12.3 Third: check the water flow

Before the water heater starts, be sure that the pump is functioning and that there is a water flow through the heat exchanger. Check the electrical power supply of the water heater. When this is connected correctly, the display will show:

Display message	**B o i l e r o f f**

Reason Water heater is not active. To activate the water heater press the [ON/OFF] button for six seconds.

Display message	**W A T R H T R : b o i l e r o f f**
	> > > : 1 2 3 . 4 ° C (1 2 3 . 4 ° C)

Reason The water heater is standby. To activate the water heater press the [ON/OFF] button for three seconds.

Activate the water heater by pressing the ON/OFF button for six resp. three seconds. After this the following message will appear:

Display message	**W A T R H T R : N o d e m a n d**
	> > > : 1 2 3 . 4 ° C (1 2 3 . 4 ° C)

Reason The water heater is active, but there is no heat demand.

When there is no water present in the water heater or the water pressure is too low, the water heater will go into lock-out and will show a corresponding message in the display.

Display message	**W a t e r p r e s s u r e f a u l t**
	9 9 9 . 5 h r s

Reason Water pressure is too low or too high.

By pressing the [SERVICE] button of the water heater, the water heater can be started without a heating demand. The water heater will start firing and the pump will start to run. Firing of the water heater without a water flow (but filled with water) will cause the so called “boiling noises”. Check during this “service function” operation also the flow and return temperatures of the water heater by pressing the [◄] button once. The temperature difference of the flow and return must be at least 13°C and maximum 25°C. This temperature difference indicates that there is (enough) water flow over the water heater; this water flow prevents the heat exchanger of possible damage caused by a thermal overload.

Flow monitoring
Another safety feature of the water heater, to make sure that there is enough water flow over the water heater, is the monitoring of the flow and return temperatures (T2 and T1). When the temperature difference (delta T) between flow and return exceeds a certain (set) value (load dependent), the following warning messages will be shown in the display.

Display message	**T2-T1 high**
	999.5 hrs

Reason Temperature difference T2-T1 has exceeded the blocking value, as set in the parameters.

Display message	**Delta Direct block**
	999.5 hrs

Reason The temperature difference between flow and return has exceeded the blocking value

When this temperature difference exceeds the lock-out setting, the water heater will switch off and the following lock out code will be shown at the display.

Display message **F16**	**Flow return dT fault**
	pump on 999.5 hrs

Reason Temperature difference between flow and return exceeds limitation value, or ‘dT block or delta direct block has occurred 3 times.

When these messages appear and/or the water heater will lock out, it means that there is not enough flow over the water heater. In this case check the functioning of the pump.

The water heater has a built-in water pressure switch. If water pressure of the system drops under a certain limit, the water heater will go in a lock-out.

During and after the commissioning of the water heater, the operation of the water heater pump must be checked, before leaving the installation room.

NOTICE: Always check the running of the pump before firing the water heater.

13 STARTING THE WATER HEATER

13.1 General

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. The gas pressure for the water heater, to operate properly under the correct load, must be at least 17 mbar.
The picture at page 77 shows the position of the gas pressure nipple (3) at the gas valve.

The EF+ water heater has a manual air vent situated at the top panel of the water heater. This vent must be opened during the filling of the water heater. Make sure that, during flushing and filling, **no water can reach any electrical parts of the water heater.**

13.2 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.

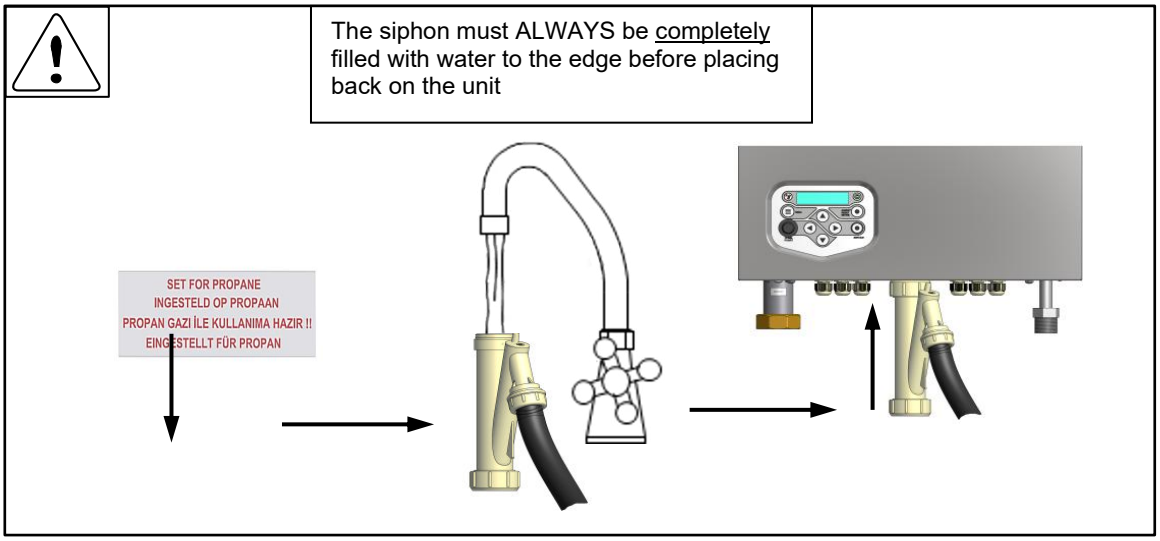
Display message	**W**	**A**	**T**	**R**	**H**	**T**	**R**	**:**	**N**	**o**		**d**	**e**	**m**	**a**	**n**	**d**			
	>	**>**	**>**		**1**	**2**	**3**	**.**	**4**	**°**	**C**	**(**	**1**	**2**	**3**	**.**	**4**	**°**	**C**	**)**
Reason	The water heater is active, but there is no heat demand.																			

The display describes:

- The actual operation
- If a heat demand is activated
- The temperature setting
- The temperature measured

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

This is a safety measure: the water in the siphon 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 burner must be adjusted and set at the minimum and maximum load.

14 ADJUSTING AND SETTING THE BURNER

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

14.1 Introduction

The burner must always be adjusted in the next situations:

A. - A new water heater is installed
- As part of a service/maintenance check, in case the O_2 / CO_2 values turn out to be incorrect

Adjustment procedures for situation **A** *are described in* **§ 14.2**.

B. - The gas control safety valve has been (re)placed
- Another type of gas is applied: gas conversion

Adjustment procedures for situation **B** *are described in* **§ 14.3**.

In either of the four cases described in **A** and **B**, always check the gas/air ratio of the combustion figure (O_2 / CO_2) at maximum and minimum input. First set the water heater at maximum load and subsequently at minimum load, and repeat if necessary.

Set-up of this chapter:
First, all necessary values are given in the tables at § 14.1.1. A drawing of the gas valve(s) and setting screws is given in § 14.1.3 on the next page. In § 14.1.4 a general scheme, conform which the adjustments must be carried out, is presented. After that, in §§ 14.2 and 14.3 a thorough description is given of how to proceed in cases **A** and **B** respectively. In § 14.4, finally, two main procedures used in the previous sections are described in detail.

14.1.1 GAS VALVE ADJUSTMENT: TABLES

Table 1

			gas type:	
water heater type	**load**	**output**	**nat.gas G20** [1]	**propane G31** [1, 3]
EF+ 35 [2] **& EF+ 55** [2]	**max. load**	**O_2 (%)**	**4.6 – 4.9**	**4.6 – 4.9**
		CO_2 (%)	9.0 – 9.2	10.5 – 10.7
	min. load	**O_2 (%)**	**5.4 – 5.7**	**6.4 – 6.7**
		CO_2 (%)	8.5 – 8.7	9.3 – 9.5

1 According to EN437
2 All values are measured without front panel. The O_2 / CO_2 values should always be between the values in this table. Nominal values can be found at the Technical specifications datasheet page
3 Fan settings must be changed by altering parameter P4BD (display D8) (only by a skilled service engineer)

Table 2

pre-adjustment settings gas valve for EF+ water heaters

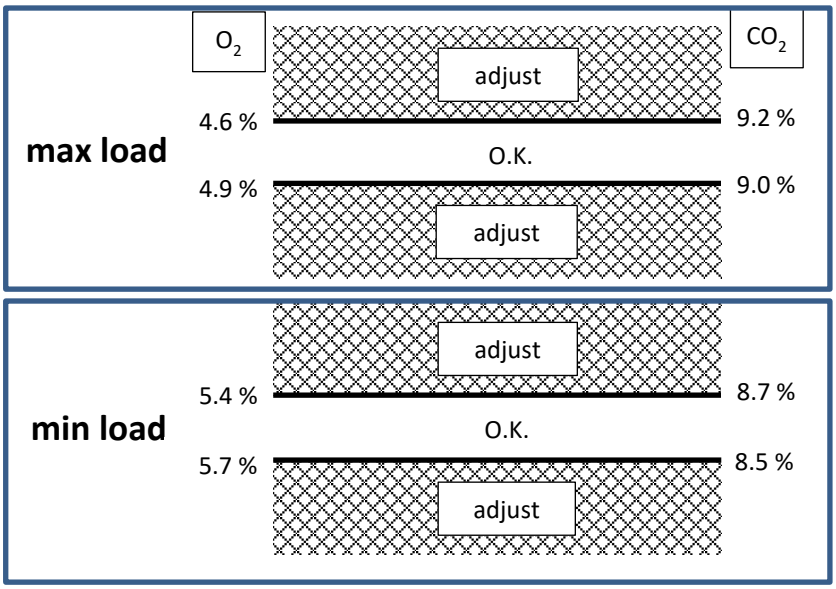
water heater type	**number of turns open (counter clockwise) screw 2 in §14.1.3**	
	nat. gas G20	**propane G31**
EF+ 35	0.5	0.25
EF+ 55	1.0	0.5

The maximum fan speed must be reduced to convert the water heater into a propane (G31) appliance. Set parameter P4BD.

14.1.2 ADJUSTMENT VALUES

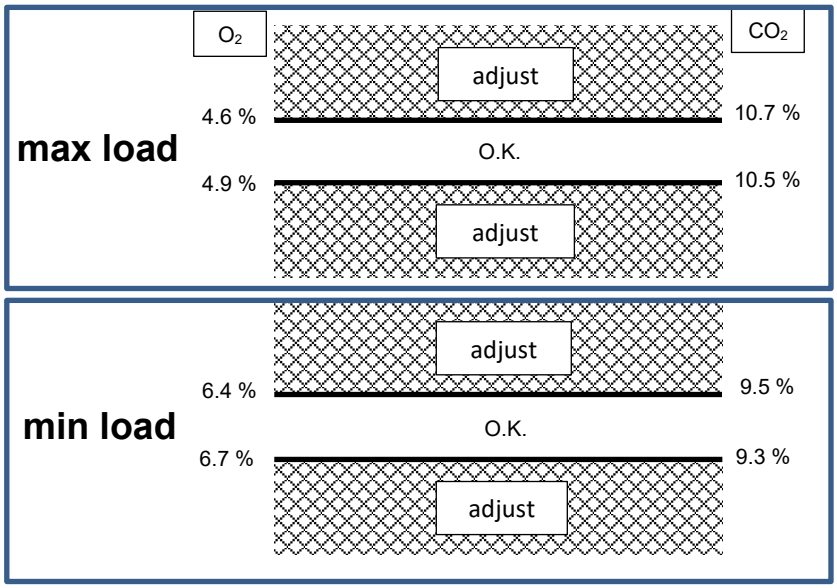
To make adjustments easier, values of table 1 are presented in the following figures.
The O_2 / CO_2 values should always be between the values set in this figure.
Nominal values can be found in the Technical specifications table at the beginning of this manual.
All values are measured without front door.

G20



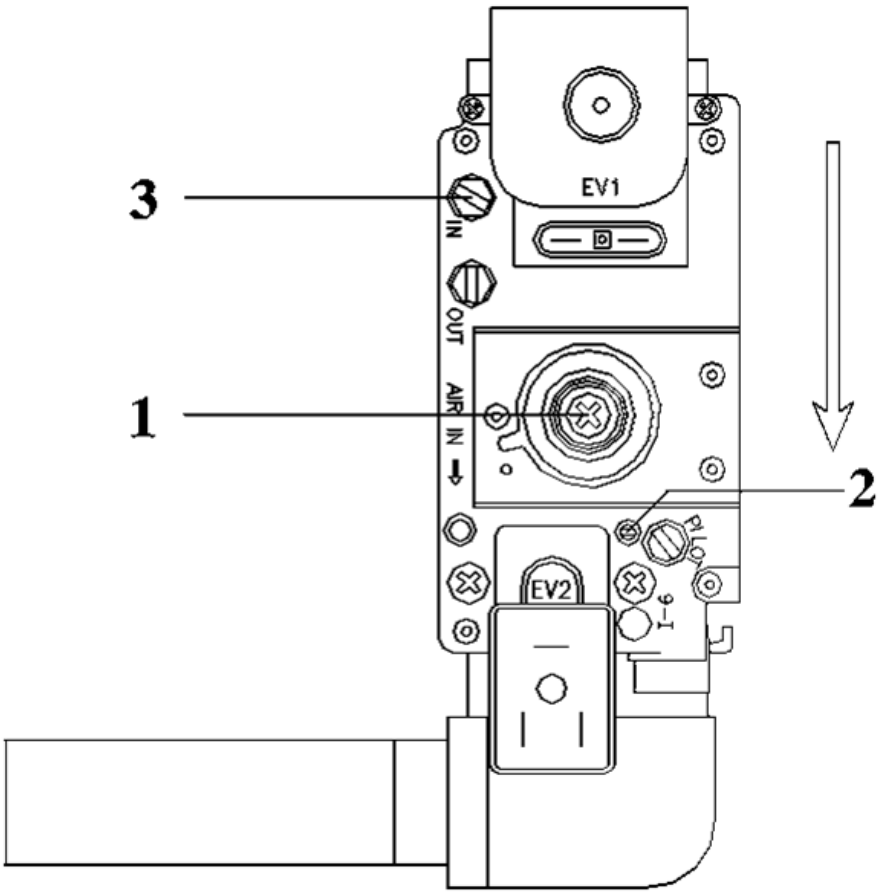
Propane G31
Fan settings must be changed by altering parameter P4BD (display D8). (only by a skilled mechanic).
The O_2 / CO_2 level may never be in the hatched area.

Propane: G31



14.1.3 SETTING SCREWS GAS VALVE(S): DRAWINGS

NOTICE: Do NOT mistake the screw marked ‘PILOT’ for screw 2.
→ Screw 2 is the SMALL screw immediately next to the pilot screw.



14.1.4 ADJUSTMENT ACTIONS: GENERAL SCHEME

General scheme for adjustment of the gas valve(s). Check this scheme for an overview.
To complete all necessary adjustments in right order, follow case **A** or **B** top-down through the scheme (**B** involves a few extra steps (grey fields)):

	GENERAL SCHEME SETTING STEPS	
	case A	**case B**
continue ↓		first close screw [2], then set it in accordance with table 2
	SWITCH TO SERVICE MODE	
continue ↓		If the burner does not start, open screw [2] ¼ turn extra
	setting at maximum load	
procedure 1	[▲] set burner at maximum load	
	measure O_2 / CO_2 at the flue gas outlet; use screw [2] to match value with table 1 or the figure **O_2 ↑** [2] **CO_2 ↓** **O_2 ↓** [2] **CO_2 ↑**	
	setting at minimum load	
procedure 2	[▼] set burner at minimum load	
	measure O_2 / CO_2 at the flue gas outlet; use screw [1] to match value with table 1 or the figure **O_2 ↑** [1] **CO_2 ↓** **O_2 ↓** [1] **CO_2 ↑**	
repeat procedure 1		
repeat procedure 2		
keep repeating until values match table or figure values best		
Water heater returns to NORMAL MODE after 40 min. OR by pressing [SERVICE] button		

For an extensive description consult the next two sections (choose which is applicable, **A** or **B**):

14.2 Adjusting in case of a new water heater, or after service (case A)

14.2.1 GENERAL REMARK

For all adjusting steps under **A**: If the measured O_2 / CO_2 values are according table 1 or figures, no adjustment will be necessary. If, however, larger deviations are measured, adjustment now must be made until the measured value is within the above-mentioned specifications.

14.2.2 ADJUSTING AT MAXIMUM LOAD

Adjust at maximum load by carrying out procedure 1, see p. 91.

14.2.3 ADJUSTING AT MINIMUM LOAD

Adjust at minimum load by carrying out procedure 2, see p. 91.

14.3 Adjusting after gas valve replacement, or in case of gas conversion (case B)

14.3.1 GENERAL REMARKS

All adjustments must result in O_2 / CO_2 percentages within the specification mentioned at the table or figure.

14.3.2 ADJUSTING AT MAXIMUM LOAD

The EF+ heaters have single gas valves, see the drawing on page 88.

- First, turn setting screw [2] of the gas valve clockwise until you feel resistance. This means that the valve is closed, *do not try to tighten the screw any further*.
- Now turn screw [2] counter clockwise (open), according to the number of turns in table 2 for the used water heater and gas type.

After this, adjust at maximum load by carrying out procedure 1 on page 91.
If the burner doesn't start up in service mode, turn screw [2] an extra quarter turn counter clockwise, and try again.

14.3.3 ADJUSTING AT MINIMUM LOAD

Adjust at minimum load by carrying out procedure 2 on p.91.

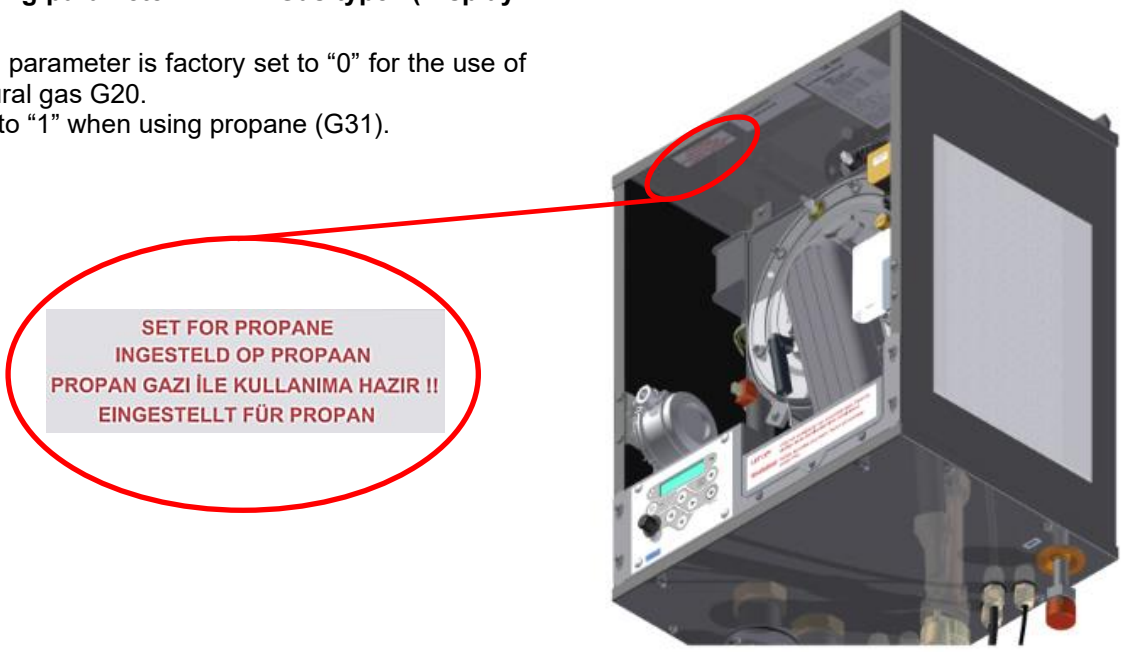
IMPORTANT: Toggle between high fire and low fire to make fine-tuning adjustments (adjusting the minimum setting affects the maximum setting and contrawise).

In case of gas conversion, paste the corresponding sticker at the appropriate position in the water heater.

SET FOR PROPANE
INGESTELD OP PROPAAN
PROPAN GAZI İLE KULLANIMA HAZIR !!
EINGESTELLT FÜR PROPAN

Changing to another type of gas also needs setting parameter "P4BD Gas type" (Display D8).

This parameter is factory set to "0" for the use of natural gas G20.
Set to "1" when using propane (G31).



14.4 Adjusting procedures

Procedures 1 and 2, referred to in the previous sections 14.2 and 14.3, are described here:

Procedure 1: adjust at maximum load
*In case **B** (gas conversion or replacement of gas valve): consult § 14.3. before starting procedure 1 below.*

Carry out the next 4 steps:

1. Press [SERVICE] button for about 3 seconds.

Display message	W	A	T	R	H	T	R	:	S	e	r	v	i	c	e			2	6	%
	>	>	>		1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)

The water heater is activated and operates in service mode at 26% (minimum).

2. Press [▲] button until maximum load is reached:

Display message	W	A	T	R	H	T	R	:	S	e	r	v	i	c	e		1	0	0	%
	>	>	>		1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)

The water heater is activated and operates in service mode at 100% (maximum).

3. Measure the O_2 / CO_2 percentage at the flue gas outlet.
4. By setting screw [2], adjust the gas valve to obtain the O_2 / CO_2 value of table 1 or figure.

The service operation of the water heater will be active for 40 minutes.
After this period the water heater will return to normal operation.

Increase O_2 percentage	**O_2 ↑** [2] **CO_2 ↓**	**Turn screw [1] right (clockwise)**
Decrease O_2 percentage	**O_2 ↓** [2] **CO_2 ↑**	**Turn screw [1] left (counterclockwise)**

Procedure 2: adjust at minimum load
*In case **B** (gas conversion or replacement of gas valve): consult § 14.3. before starting procedure 2 below.*

Carry out the next 3 steps:

1. Press [▼] button until minimum load is reached.

Display message	W	A	T	R	H	T	R	:	S	e	r	v	i	c	e			2	6	%
	>	>	>		1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)

The water heater is activated and operates in service mode at 26% (minimum).

2. Measure the O_2 / CO_2 percentage at the flue gas outlet.
3. By setting screw [1], adjust the gas valve to obtain the O_2 / CO_2 value of table 1 or figure.

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

The service operation of the water heater will be active for 40 minutes.
After this period the water heater will return to normal operation.

15 PUTTING THE WATER HEATER OUT OF OPERATION

It is recommended to have the water heater operational all year round to prevent any frost damage during the winter and/or rotating parts getting jammed during other times of the year (prevented by built in water heater safety features).

15.1 Out of operation: on/off function

To be used when the appliance must be put out of operation for a long period because of a defect or another safety risk.

Act as follows:

- Disconnect or switch off the tank thermostat and/or other external controllers from the water heater. The pump and fan will stop after a short time.
- Switch off the water heater by pressing the [ON/OFF] button for six seconds.
- Make sure the following display screen is visible.

Display message	**B**	**o**	**i**	**l**	**e**	**r**		**o**	**f**	**f**										

Properties of the ‘off’ function:

- The keys do NOT respond and the menu is NOT accessible.
- The burner does NOT respond to an external heat demand.
- The water heater CAN, however, be switched on again by pressing the [ON/OFF] button.
- Pump(s), fan(s) and cascade (if applicable) are operational, and so are both recirculation protection (if applicable) and frost protection.
- To reactivate the water heater, switch on the burner by pressing [ON/OFF] for six seconds again.

The frost protection module can still activate the burner(s).
To prevent this, switch off this protection or put the water heater in ‘power off’ mode (next paragraph).

15.2 Out of operation: power off

To assure that the water heater cannot become active at all anymore, power should be cut off completely.

Act as follows:

- Disconnect or switch off the tank thermostat and/or other external controllers from the water heater. The pump and fan will stop after a short time.
- Switch off the water heater by pressing the [ON/OFF] button for six seconds.
- Make sure the following display screen is visible.

Display message	**B**	**o**	**i**	**l**	**e**	**r**		**o**	**f**	**f**										

- Switch off the electrical power supply of the water heater (remove connection from the wall socket, or switch off the main power).
- Close the gas valve / gas supply.
- In case of possible frost damage: drain both the water heater and the DHW system.

- NOTICE: Before draining the water heater, first start draining the DHW system and subsequently open also the two drains of the water heater.

16 FAULT CODES, BLOCKING CODES

IMPORTANT:
To avoid electric shocks, disconnect electrical supply before performing troubleshooting. To avoid burns, allow the unit to cool before performing troubleshooting. Be aware that a fault code is an indication that the unit or the system needs attention. When repeatedly having faults these should not be neglected. The first step is to check if the unit is installed according to the instructions. If not, first make sure the installation complies with the installation manual. Always check the fuses on the control board before replacing any major components. A blown fuse can prevent the controller or other components from operating. Most faults can also be caused by a bad wiring and/or connections, even if it is not specifically mentioned. With every fault it is wise to check wiring and connections (at both ends) that connect to the safety device/component that generates the fault.

16.1 Lock-out codes

A lockout means that the water heater needs a manual reset to start operating again.
When the water heater is in lockout the backlight of the display is blinking on and off.

Explanation > **999.5 hrs** = time elapsed after fault message.

Explanation > **Pump1 on** = status of the pump during fault.

Display message **F8**	**Failed burner start** **pump on 999.5 hrs**
Reason	Water heater not operational after four starting attempts.
Cause: No spark.	
Corrective action:	
Check the ignitor/ignition electrode and replace/clean if necessary. Check the state of the ceramic insulator. A small crack can prevent the spark to form at the end of the electrode. Check the distance between the electrode pin, earth pin and burner. Check the state of the ignition cable and replace if necessary. Check the state of the earth wire/connection of the ignitor and replace if necessary. Check the state of the sparkplug cap and replace if necessary. Check power supply. Voltage must be 230 Vac nom. Check for proper electrical grounding of unit. Bad ignition transformer. Replace the burner control of the unit.	
Cause: Ignition spark is present, but no flame results.	
Corrective action:	
Check if all gas valves in the supply line are completely open. Check if there is no air in the gas supply (start-up new systems). Check if the gas valve opens. When there is power supply to the gas valve, but the valve does not open, the gas valve must be replaced. Check if the gas valve opens. When there is no power supply to the gas valve check the gas valve wiring/connections. Check if the gas valve settings are correct and adjust if necessary. Check if the gas pressure is correct and sufficient. Check if the air supply is open/not blocked.	
Cause: Flame, but not enough ionisation to establish the flame.	
Corrective action:	
Check the ignitor/ignition electrode and replace/clean if necessary. Check the state of the ceramic insulator. Check the distance between the electrode pin, earth pin and burner. Check the state of the ignition wire (also the ionisation wire) and replace if necessary. Check the state of the earth wire/connection of the ignitor and replace if necessary. Check for proper electrical grounding of unit. Check power supply. Voltage must be 230 Vac nom. Check the state of the sparkplug cap and replace if necessary.	

Display message F10	F a l s e f l a m e s i g n a l p u m p o n 9 9 9 . 5 h r s
Reason	Flame signal detected, while water heater should not fire for operation.
Cause: The flame detection circuit detects a flame which is not supposed to be present.	
Corrective action:	
Check the ignition/ionisation electrode and make sure it is clean (or replace it). Check the power supply voltage for a correct polarity. Check the power supply for bad frequency or voltage peaks. Check external wiring for voltage feedback. Check the internal wiring for bad connections. Check if the gas valve is closing correctly. Replace the burner control.	

Display message F11	F a n s p e e d i n c o r r e c t p u m p o n 9 9 9 . 5 h r s
Reason	Actual fan speed differs from the unit rpm set point.
Cause: An incorrect fan speed is detected.	
Corrective action:	
Check the 4-wired wiring and connections at the fan and at the main control board. Check the 3-wired power supply wiring and connections at both ends. Replace the fan. Replace the main control board.	

Display message F9	F l a m e l o s t p u m p o n 9 9 9 . 5 h r s
Reason	Flame signal lost during operation.
Cause: Bad gas supply pressure.	
Corrective action:	
Be aware that the specified gas pressure must be met during all operation conditions. Check if all gas valves in the supply line are completely open. Check if the dirt filters mesh in the gas valve inlet is clean. Check if the external dirt filter in the gas supply line is not blocked. Check if an external gas pressure regulator is selected/installed correctly. Check the gas pressure that is supplied to the building > call the supplier if necessary.	
Cause: Bad gas valve or gas valve settings.	
Corrective action: Check and set gas valve settings.	
Cause: Bad electrode, electrode wiring/connection (bad ionisation signal).	
Corrective action:	
Check ionisation signal. Check the ignitor/ignition electrode and replace/clean if necessary. Check the state of the ceramic insulator. Check the distance between the electrode pin, earth pin and burner. Check the state of the ignition wire (is also ionisation wire), and replace if necessary Check the state of the ignitor earth wire/connection and replace if necessary. Check for proper electrical grounding of unit.	
Cause: Bad flue gas and/or air supply system.	
Corrective action:	
Check if the design of the flue gas and air supply system complies with the max. combined resistance as specified. Check if the flue gas and air supply system is installed according to a good installation practice by a skilled installer. Check all seals in the flue gas and air supply system.	
Cause: External factors.	
Corrective action:	
Check if there were extreme weather/wind conditions when the fault occurred. Check if the water heater room pressure is equal to the pressure at the position of the flue gas outlet (when combustion air is drawn from the water heater room).	

Display message F1	Flow high Temp pump on 999.5 hrs
Reason:	Max. flow temperature exceeds limitation (lock-out) value.
Cause:	
The water flow is restricted.	
Corrective action:	
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.	

Display message F16	Flow Return dt fault pump on 999.5 hrs
Reason:	Temperature difference between flow and return exceeds limitation value, or 'dT block or delta direct block' has occurred three times.
Cause:	
The water flow through the unit is too low.	
Corrective Action:	
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 the flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump. Make sure the heat exchanger is clean. Heat exchanger fouling (partly blockage) will increase the resistance causing the water flow to drop.	

Display message F0	Flow sensor error pump on 999.5 hrs
Reason:	Flow sensor is not detected.
Cause:	
Bad wiring/connection in the flow sensor circuit.	
Corrective action:	
Check for loose wiring/connections in the flow sensor circuit.	
Cause:	
Bad temperature sensor causing a fault signal.	
Corrective action:	
Replace flow sensor.	

Display message F6	Flue sensor error pump on 999.5 hrs
Reason	Flue sensor is not detected by the water heater PCB.
Cause:	
Bad wiring/connection in the flue gas sensor circuit.	
Corrective action:	
Check for loose wiring/connections in the flue gas sensor circuit.	
Cause:	
Bad temperature sensor causing a fault signal.	
Corrective action:	
Replace flue gas sensor.	

Display message F7	F l u e t e m p t o o h i g h p u m p o n 9 9 9 . 5 h r s
Reason	Flue gas temperature exceeded 3 times limitation value within a certain period.
Cause: Heat exchanger polluted and not able to transfer enough heat to system water.	
Corrective action:	
Check and clean heat exchanger.	
Cause: Bad flue gas sensor or sensor connection (partly shorted).	
Corrective action:	
The sensor is of the type NTC. This means if the temperature rises, the resistance lowers. A partly shorted sensor will drop its resistance and therefore 'measure' a raise in temperature when there is none. Check for moist in the sensor connections or replace sensor.	
Cause: There is no water in the unit while firing.	
Corrective action:	
This is an unlikely situation while all the safeties for checking the water presence didn't detect anything. Only a lot of air in the system/unit (under pressure) can cause the water pressure switch to switch while no water is present. Also, the water leak detection did not react. Bleed all air from the unit so the heat from combustion can be transferred to the water and won't disappear through the flue system.	
Cause: Heat exchanger failure.	
Corrective action:	
This is an unlikely situation but when there is severe damage to the heat exchanger, the combustion product will not be able to transfer all heat to the system water. The heat that is not transferred will convert to an increased flue gas temperature.	

Display message F12	p r o g r a m m i n g e n d p u m p o n 9 9 9 . 5 h r s
Reason	Programming of the parameters completed successfully.
Cause: Programming of the parameters completed successfully.	
Corrective action:	
This message occurs to confirm the end of programming. Pressing RESET will return the unit in normal operating status.	

Display message F13	P a r a m / H a r d w f a u l t p u m p o n 9 9 9 . 5 h r s
Reason	Failure during programming of the parameters.
Cause: Programming of the parameters NOT successfully completed	
Corrective action:	
Unit is not in standby mode (fan must not run during programming). Check programming wire and connections and try again. Check if the software complies with the PCB. Replace the programming wire. Replace the display PCB.	

Display message F1	R e t u r n h i g h T e m p p u m p o n 9 9 9 . 5 h r s
Reason:	Maximum return temperature exceeds limit value.
Cause: Systems that pre-heats the water heater return temperature too much/high.	
Corrective Action:	
Reduce pre-heat temperature of external heat source.	
Cause:	
The need for heat in the system suddenly drops causing hot return water to the heater.	
Corrective Action:	
Dampen external heating system control to prevent sudden heater temperature rise.	

Display message F3	Return sensor error pump on 999.5 hrs
Reason	Return sensor is not detected by the water heater PCB.
Cause: Bad wiring/connection in the return sensor circuit.	
Corrective action: Check for loose wiring/connections in the return sensor circuit.	
Cause: Bad temperature sensor causing a fault signal.	
Corrective action: Replace return sensor.	

Display message F19	Siphon switch pump on 999.5 hrs
Reason	Siphon pressure switch detects high pressure in the flue/siphon system.
Cause:	
There is too much resistance in the flue gas circuit causing high pressure in the heat exchanger at the flue gas side.	
Corrective action:	
Check if the flue gas system is blocked. Extreme failing of the heat exchanger also causes the resistance to rise. Check the state of the heat exchanger and clean if necessary. Check the flue gas system diameter & length (most likely in a new system).	
Cause:	
The condensate drain system is blocked. The condensate will build up above the measuring point of the pressure switch and creates a static pressure larger than the measuring point.	
Corrective action:	
Check if the condensate drain hose between the heat exchanger and the siphon is open, so the condensate can flow freely to the siphon.	
Check if the siphon is free of debris that might block the condensate flow and clean the siphon if necessary.	
Check the condensate drain hose between the siphon and the condensate drain point in the external installation. Condensate must be able to flow freely.	
Cause:	
The condensate drain hose must have an open connection to the external system. If not, pressure fluctuations in the building drainage system can have effect on the pressure in the heat exchanger of the water heater.	
Corrective action:	
Make sure that there is an open connection between the siphon hose and the drainage system of the building installation. The condensate should flow in the drainage system through a freely "breathing" connection, so pressure fluctuations of the external drainage system cannot affect the pressure in the heat exchanger of the water heater.	
Cause: Blockage of the pressure signal hose going to the pressure switch.	
Corrective action: Check the pressure signal hose and clean or replace if necessary.	
Cause: Bad pressure switch causing a fault signal.	
Corrective action:	
Replace the pressure switch.	
Cause: Bad wiring/connection in the pressure switch circuit.	
Corrective action:	
Check for loose wiring/connections in the pressure switch circuit.	

Display message F17	Water high limit pump on 999.5 hrs
Reason	Maximum thermostat exceeds limitation value.
Cause: The water flow is restricted.	
Corrective action:	
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 the flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump.	

16.2 Blocking codes

The display is not blinking but is lightened up during the blocking period.
The water heater is blocking an action, because of an extraordinary situation. This action will be continued after eliminating the extraordinary situation.

Display message	**Anticycle time** **999.5 hrs**
Reason	The heater received a heat demand too fast after the last demand.
Cause: Opening and immediately thereafter closing of the external thermostat.	
Corrective action:	
Controlled water flow cools down too quickly after loss of heat demand. Controlled water flow heats up too quickly after start of heat demand. Immediately opening and closing of the external thermostat. Check switching differential of the ON/OFF thermostat. Controller settings need to be changed. Be aware that the standard settings work fine for all common systems. When anti-cycling is active, because of immediate heating or cooling of the controlled water flow/temperature, it concerns an unconventional system.	

Display message	**Cascade Block** **999.5 hrs**
Reason	One of the water heaters of the cascade is in a lock-out.
Cause:	
The unit is programmed in such a way that none of the heaters in a cascade will fire, if one has a lockout. One unit has a lockout and therefore the whole cascade is blocked.	
Corrective action:	
Troubleshoot the fault of the unit in lock-out.	

Display message	**Delta Direct block** **999.5 hrs**
Reason	Temperature difference between flow and return has exceeded the blocking value
Cause: The water flow through the unit is too low.	
Corrective action:	
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 the flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump. Make sure the heat exchanger is clean. Heat exchanger fouling (partly blockage) will increase the resistance causing the water flow to drop.	

Display message	**Flow high DHW** **999.5 hrs**
Reason:	Setpoint return (tank)temperature DHW (S3) is higher than setpoint heating = flow temperature (S1)
Cause: Wrong setting of parameter: P6BA Heating setpoint below P6CA DHW setpoint	
Corrective action:	
Adjust the heating setpoint through the display: menu, settings, heating setpoint	

Display message	**Flow temp high** **999.5 hrs**
Reason:	Flow temperature has exceeded the blocking temperature, but it has not exceeded the lock-out value.
Cause: The water flow is restricted.	
Corrective action:	
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 the flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump.	

Display message	F l u e t e m p h i g h 9 9 9 . 5 h r s
Reason	Flue gas temperature has exceeded the limit.
Cause: Heat exchanger polluted and not able to transfer enough heat to the system.	
Corrective action: Check and clean heat exchanger.	
Cause: Bad flue gas sensor or sensor connection (partly shorted.)	
Corrective action:	
The sensor is of the type NTC. This means when the temperature rises, its resistance decreases. A partly shorted sensor will drop its resistance and therefore 'measure' a raise in temperature when there is none. Check for moist in the sensor connections or replace the sensor.	
Cause: There is no water in the unit while firing.	
Corrective action:	
This is an unlikely situation while all the safeties for checking the water presence didn't detect anything. Only a lot of air in the system/unit (under pressure) can cause the water pressure switch to switch while no water is present. Also, the water leak detection did not react. Bleed all air from the unit so the heat from combustion can be transferred to the water and won't leave through the flue system.	
Cause: Heat exchanger failure.	
Corrective action:	
This is an unlikely situation but when there is severe damage to the heat exchanger, the combustion product will not be able to transfer all heat to the system water. The heat that is not transferred will convert to an increased flue gas temperature.	

Display message	G e n B l o c k 9 9 9 . 5 h r s
Reason	General blocking circuit is activated during operation (general blocking contacts 7-8).
Cause: The circuit connected to the general blocking terminals is not closed.	
Corrective action:	
Check all external components that are connected to the general blocking terminals and check why the contact is not closing during heat demand.	
Cause if used with flow switch: The water flow through the unit is too low.	
Corrective action:	
Check functioning of the pump and the flow switch. 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. Make sure the heat exchanger is clean. Heat exchanger fouling (partly blockage) will increase the resistance causing the water flow to drop.	

Display message	L i n e f a u l t p u m p o n 9 9 9 . 5 h r s
Reason	Bad power supply
Cause: The supplied power does not comply with the specifications.	
Corrective action:	
Check if the power supply is connected correctly to the unit. Check the voltage and frequency (should be Life Neutral, Gnd > 230 Vac / 50 Hz). Make sure there is no signal failing or voltage peaks in the power supply.	

Display message	R e t u r n t e m p h i g h 9 9 9 . 5 h r s
Reason	Return temperature has exceeded the blocking temperature, but it has not exceeded the lock-out value.
Cause: Systems that pre-heats the water heater return temperature too much/high.	
Corrective action: Reduce pre-heat temperature of external heat source.	
Cause: The need for heat suddenly drops causing hot return water to the water heater.	
Corrective action:	
Dampen external heating system control to prevent sudden heater temperature rise.	

Display message	T 2 - T 1 h i g h 9 9 9 . 5 h r s
Reason	Difference between T2 and T1 has exceeded the blocking value which has been set in the parameters. (return temp higher than flow)
Cause:	
The water flow through the unit is too low.	
Corrective action:	
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. Make sure the heat exchanger is clean. Heat exchanger fouling (partly blockage) will increase the resistance causing the water flow to drop.	

Display message	W a t e r p r e s s u r e f a u l t 9 9 9 . 5 h r s
Reason	Water pressure is too low or high.
Cause:	
The water pressure in the system is too high.	
Corrective action:	
Check if the system pressure is too high after (re)filling. Make sure that there is a pressure relief valve and expansion vessel installed in the system, according to the applicable standards. Check if there is an open connection between the unit and the relief valve plus expansion vessel. Be aware that if the unit is installed in the basement of a tall building, only the static pressure of the water column above the units can raise above the maximum allowable limits. Make sure that this is not the case.	
Cause:	
The water pressure in the system is too low.	
Corrective action:	
Check if there is no leakage in the system that causes the pressure to drop. Fix any leakage and fill the system. Check if there is an external system pump that sucks water through the water heater, causing an under pressure (bad installation design).	

Display message	W A T R H T R : T 3 E x t e r n a l > > > : 6 0 . 0 ° C (- 3 0 . 7 ° C)
Reason:	T3 external tank sensor is not connected to the terminals.
Cause:	
The sensor is not connected to the terminal, or the wire is broken. The sensor is malfunctioning.	
Corrective Action:	
Connect the sensor to the terminals 3 and 4. Check the wires from the sensor to the terminals. Check the sensor on resistance 10K at 25°C.	

16.3 Maintenance attention function

The display shows alternately the base screen and this message, while backlight is blinking.
The water heater is operating but will count the exceeding hours.
A parameter must be changed, after service, to remove this message.

Display message	**Needs Maintenan 0.0** **Ignition cycles hrs**
Reason	Maintenance option of total amount of ignition cycles has been reached.

Display message	**Needs Maintenan 0.0** **Date hrs**
Reason	Maintenance option of the date has been reached.

Display message	**Needs Maintenan 0.0** **Burning hours hrs**
Reason	Maintenance option of total amount of burning hours has been reached.

Display message	**Needs Maintenan 0.0** **All hrs**
Reason	One of the abovementioned maintenance options has been reached.

This function/message is standard not activated but can be activated/set by a trained engineer. This function does not overrule the need for annual maintenance. The end user is always responsible for arranging annual maintenance.

17 MAINTENANCE

17.1 General

For a good, safe and long-time operation of the water heater, it is advised to carry out maintenance and service at least every twelve months and/or after 2000 burning hours maximum. Both safety and lifespan will thus be improved. Omission of preventive and corrective maintenance can have warranty consequences.

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

- **When several 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 lack of maintenance will not be covered under warranty.

MAINTENANCE REMINDER FUNCTION.
See last page.
BE AWARE: This function is standard turned OFF. We offer this programmable function to the installer to use as a reminder. Because it concerns a free programmable function the use of it cannot be used as an argument in warranty cases. Our units must be maintained every twelve months whatever the settings/working of this function.
It is and remains the responsibly of the end user to have the unit maintained every twelve months and/or after 2000 burning hours maximum, whichever comes first and regardless the settings/working of this function.

For more information about this maintenance mode see section 10.13 ‘Setting the maintenance specifications’ on page 56.

Service intervals
The normal service interval for the water heater is once a year and and/or after 2000 burning hours maximum, whichever comes first. At 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 executed after already half a year. This to determine the frequency of the future service intervals. The maximum interval between two services is a year.

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

17.2 Inspection & maintenance

Inspection, maintenance and the replacement of water heater parts should only be done by a skilled service engineer. Apart from the maintenance proceedings it is advised to have a log chart for every water heater that describes the following aspects:

- 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.

During maintenance the following parts and aspects of the water heater should 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 analysed 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) of the water heater can be retrieved with the help of a computer, correct software and an interface cable. This information can be used to specify the maintenance and service proceedings in relation to the water heater (parts).

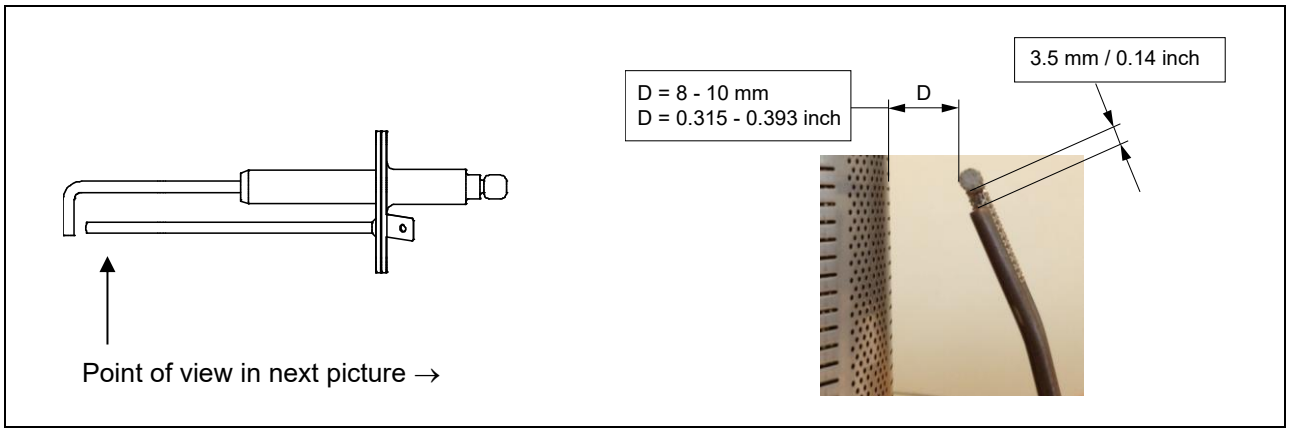
Flue gas & air supply
The flue gas pipes and the air supply pipes must be checked for gas tightness. Also check if the mounting of these pipes is correct, safe and not damaged. Check the top panel of the water heater housing for signs of water leakage and traces of water coming from the air supply pipe, the air vent or any condensate coming from the flue gas pipes.

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.

Remove complete burner unit
The complete burner unit consists of the fan, the burner plate and the internal burner. To remove this part for an internal heat exchanger check: remove the 6 x M6 nuts and the ignition cable. After this take out the complete burner unit by moving it forward out of the water heater housing. NOTICE: watch out for the burner plate insulation that it won't be damaged during this operation. While removing the complete burner unplug both electrical and controlling cables of the fan. After all this, disassemble the air/gas mixing box on the suction side of the fan and check the blade wheel of the fan.

Burner
Check the burner surface to see if it has damages, signs of oxidation and/or is cracked. 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 also 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 graph below. When these are not correct, try to bend the electrodes in the right position. Notice: the electrodes undergo high temperatures, therefore the electrodes become hard and are difficult to bend. While being bent, used electrodes might break or burst. Check the electrode, after bending, for any tear/crack and signs of oxide. When they are burst/cracked or oxidized, replace the electrode. Also replace the electrode when there is a crack in the ceramic insulation of the electrode. When the electrode is to be replaced, also the gasket should be renewed.

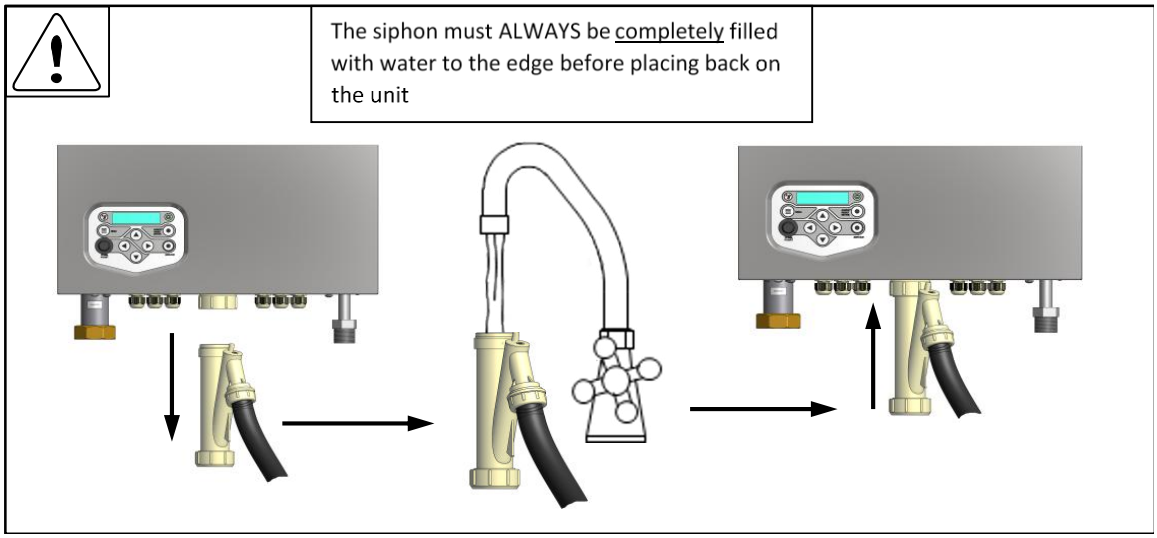


Burner door gaskets
When these gaskets have changed colours at some parts, the rubber has cured and/or has damages, these gaskets must be replaced. Notice: only use the gaskets that are supplied by the water heater manufacturer.

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.

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 disk shows any signs of (water) damage or degradation it should be exchanged. Also check if there are any indications of a high condensate level in the burner room (caused by a blocked siphon) that might have wetted the rear wall insulation. When this has happened the rear wall insulation should also be replaced. Only use the insulation disk that is supplied by the water heater manufacturer.
The same procedure must be applied on the insulation and gaskets fitted on the burner door.

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



Heat exchanger and burner room
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 burner room with water. Don't forget afterwards to clean the siphon once again.

Cleaning the burner room with acid or alkali products is prohibited.

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 / CO_2 percentage (flue gas) at the maximum and minimum load of the water heater. If necessary, adjust these values, see for information chapter 14 "Adjusting and setting the burner".

Pump
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.

When defects and abnormalities are found by the service engineer 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 defects and these defects 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.

Mounting the burner door correctly back onto the heat exchanger:

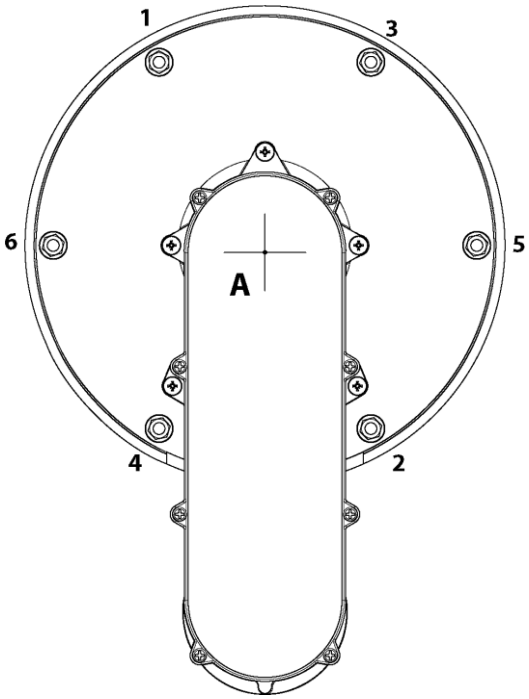
IMPORTANT:
Before mounting the burner door, make sure that its gaskets and insulation are in excellent shape.
If any signs of damage or ageing are present, these parts must be replaced.

The burner door must be mounted back on the heat exchanger as follows:
- Place the burner door with its holes over the six threaded studs.
  Careful! When handling too rough or misplacing the holes over the threaded studs, the burner door insulation and/or gaskets can be damaged.
  Assure yourself that the door is well positioned with respect to the threaded studs, before pushing it onto the exchanger.
- Now keep the burner door firmly in place by pushing the gas/air nose with one hand at the middle at point **A**.
- Then turn-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 key.
- Tighten the nuts in the order given in the picture below.
- The specified torque value for tightening the burner door flange nuts is **5 Nm.**

tighten in given order

torque value = 5 Nm



18 USER INSTRUCTIONS

After installing and commissioning of the water heater demonstrate the operation of the entire DHW 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 and/or after 2000 burning hours maximum, whichever comes first.
Regular service and maintenance are essential for a safe and proper operation of the water heater. Hand over the documents that are supplied with the water heater.

19 RECYCLING

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

Disposal

Old end-of-life appliances contain materials that need to be recycled. When you discard devices at the end of their service life, you must obey local legislation related to waste disposal.

Never discard your old device together with regular waste. Put the device into a municipal waste collection depot for electrical and electronic equipment. If necessary, ask your supplier or your service and maintenance engineer for advice.

20 INDEX

IMPORTANT INFORMATION

These instructions must be read and understood before installing, commissioning, operating or maintaining the equipment.

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