STREBEL
S-WG+ 80 - 180 Range

Wall Hung High Efficiency Condensing Water Systems

Installation, Operating & Maintenance Manual



Please read and understand before commencing installation and leave the manual with the customer for future reference.

STREBEL HEATING TECHNOLOGY

2019-06-01 v1

TABLE OF CONTENTS

INTRODUCTION 6

1 SAFETY GUIDELINES 6
1.1 GENERAL 6
1.2 IMPORTANT TECHNICAL WARNINGS AND GUIDELINES 7
1.3 SAFETY VALVE 9

2 TECHNICAL DATA S-WG+ 80 – 180 WATER HEATERS 10
2.1 FUNCTIONAL INTRODUCTION 10
2.2 TECHNICAL SPECIFICATIONS DATASHEET 11
2.3 TABLE TECHNICAL SPECIFICATIONS ERP 12

3 DIMENSIONS 13
3.1 WATER HEATERS WG+80 – WG+120 13
3.2 WATER HEATERS WG+150 AND WG+180 14
3.3 S-WG+ 80-180 TANKS 300L – 500L – 750L 15
3.4 ERP SPECIFICATIONS WATER TANKS. 16
3.5 CASCADE FRAMES WG+80 – WG+180 17

4 ACCESSORIES AND UNPACKING 19
4.1 ACCESSORIES 19
4.2 UNPACKING 19

5 INSTALLATION OF THE S-WG+ 80-180 20
5.1 GENERAL NOTES 20
5.2 MOUNTING THE WATER HEATER AND TANK 21
5.2.1 Water heater mounting 21
5.2.2 Tank positioning 21

6 FLUE GAS AND AIR SUPPLY SYSTEM 22
6.1 GENERAL 22
6.2 HEIGHTS ON ROOF 22
6.3 MINIMUM TERMINAL DISTANCE ON HORIZONTAL TERMINATIONS – TYPE C FLUES ONLY. 23
6.4 HORIZONTAL FLUE RUN RISK ASSESSMENT 23
6.4.1 Figure 12 – line G 24
6.4.2 Figure 7 – line Y 24
6.5 OTHER FLUE TERMINAL MINIMUM DISTANCES 24
6.6 WATER HEATER CATEGORIES - TYPES OF FLUE GAS SYSTEMS. 25
6.7 C63 CERTIFIED 26
6.8 FLUE TERMINAL 27
6.8.1 Horizontal Flue Terminal Positioning 27
6.8.2 Vertical Flue Terminal Positioning 27
6.8.3 Common Flue / Ducts 27
6.9 AIR SUPPLY 28
6.9.1 Combustion air quality 28
6.9.2 Air supply through humid areas 28
6.9.3 Flue gas and air supply resistance table 29
6.10 SIX TYPICAL EXAMPLES 30
6.10.1 Example A: Twin pipe system (C63) 30
6.10.2 Example B: Twin pipe system with concentric roof terminal (C33) 30
6.10.3 Example C: Single flue gas outlet. Air supply from water heater room (B23, B23P) 32
6.10.4 Example D: Concentric C33 (roof-mounted) 33
6.10.5 Example E: Concentric system Wall outlet C13(wall-mounted) 33
6.10.6 Example F: Separate air & flue pipes in different pressure zone (C53) 35

7 ELECTRICAL INSTALLATION 36
7.1 GENERAL 36
7.2 ELECTRICAL CONNECTIONS 36
7.3 FUNCTION OF THE ELECTRICAL CONNECTIONS OF THE WATER HEATER 36
7.4 SENSOR VALUES 37
7.5 ELECTRICAL SCHEMATICS 38

8 THE S-WG+ 80-180 WATER HEATER 40
8.1 WATER QUALITY - IMPORTANT 40

8.2 FROST PROTECTION 40
8.3 LEGIONELLA PROGRAM 40
8.5 FLOW MONITORING 41
8.6 WATER PRESSURE SWITCH 41

9 THE S-WG+ SANITAIRY SYSTEM: INSTALLATION INSTRUCTIONS 42
9.1 THE S-WG+ SYSTEM 42
9.1.1 Stand-alone set-up 42
9.1.2 Cascade set-up 43
9.2 CONTROL 44
9.2.1 Tank sensor 44
9.2.2 General control 44
9.2.3 Cascade control 44
9.3 WATER HEATER AND TANK: CONNECTIONS AND CONNECTION SIZES 45
9.3.1 Connecting the tank to the water heater 45
9.3.2 To connect the tank to your DHW installation 45
9.3.3 Condensate drain connection 47
9.4 CASCADE SYSTEMS: PIPE CODES 47
9.4.1 Pipe codes water heater side 47
9.4.2 Equivalent length 47
9.5 DIAMETERS – TABLES 48
9.5.1 Water manifolds 48
9.5.2 Tank headers 48
9.6 EQUIVALENT LENGTHS – TABLE 49
9.7 PUMP SELECTION – TABLES 50
9.7.1 Pump selection 50
9.7.2 Nominal flow per water heater type 50
9.7.3 Pump control 51
9.7.4 Pump: maximum electrical power 51
9.8 ELABORATED EXAMPLES 52
9.8.1 One S-WG+120 water heater with one 500L tank 52
9.8.2 Two S-wg+100 water heaters with two 500l tanks 53

10 USER INTERFACE 54
10.1 CONTROL PANEL MENU STRUCTURE 54
10.2 CONTROL PANEL DISPLAY AND KEYS 56
10.3 DISPLAY DURING OPERATION 57
10.4 MONITOR SCREENS 58
10.5 SERVICE FUNCTION 60
10.6 SCHORNSTEINFEGER FUNCTION 61
10.7 PROGRAMMING IN STANDBY MODE 62
10.8 SETTING THE TIME & DATE 62
10.9 SET POINTS 63
10.10 SETTING THE TIMER PROGRAMS 63
10.11 HOT WATER PROGRAM 64
10.12 ANTI LEGIONNAIRES' DISEASE PROGRAM 65
10.13 CHECKING THE OPERATING HISTORY 66
10.14 CHECKING THE FAULT HISTORY 67
10.15 SETTING THE MAINTENANCE SPECIFICATIONS 68
10.16 SETTING THE USER LOCK 71
10.17 SETTING THE PARAMETERS AT THE CONTROL PANEL 72
10.18 FAULT CODES DISPLAY 79
10.18.1 Lock-out codes 79
10.18.2 Blocking codes 80
10.18.1 Maintenance attention messages 82

11 CONTROLLING OPTIONS AND SETTINGS 83
11.1 GENERAL 83
11.1.1 Max cooling time 83
11.1.2 temperature display on/off 83
11.1.3 Gas type selection 83
11.1.4 Soft start option 84
11.1.5 Pump mode (EC technology) 84
11.1.6 Tank sensor sensitivity 84
11.2 WATER HEATER OPTIONS 85

11.2.1 0-10 VDC remote flow temperature set point ... 85
11.2.2 anti-Legionnaires' disease (pasteurisation) function ... 86
11.3 CASCADE CONTROL ... 87
11.3.1 Parameter settings for cascade set-ups ... 87
11.3.2 Monitor screens ... 89
11.3.3 Output control and water heater sequence ... 89

12 COMMISSIONING THE WATER HEATER ... 90
12.1 FIRST: FLUSHING THE WATER HEATER WITH WATER ... 90
12.2 SECOND: FILLING & VENTING THE WATER HEATER AND THE SYSTEM ... 90
12.3 THIRD: CHECK THE WATER FLOW ... 90

13 STARTING THE WATER HEATER ... 92
13.1 GENERAL ... 92
13.2 FIRING FOR THE FIRST TIME ... 92

14 ADJUSTING AND SETTING THE BURNER ... 93
14.1 INTRODUCTION ... 93
14.1.1 Adjustment tables ... 93
14.1.2 Adjustment values ... 94
14.1.3 Setting screws gas valve(s): drawings ... 98
14.1.4 Adjustment actions: general scheme ... 99
14.2 ADJUSTING IN CASE OF A NEW WATER HEATER, OR AFTER MAINTENANCE (CASE A) ... 100
14.2.1 General remark ... 100
14.2.2 Checking and adjusting at maximum load ... 100
14.2.3 Checking and adjusting at minimum load ... 100
14.3 ADJUSTING IN CASE OF VALVE REPLACEMENT OR GAS CONVERSION (CASE B) ... 100
14.3.1 General remarks ... 100
14.3.2 Checking and adjusting at minimum load WG+80 / WG+100 ... 100
14.3.3 Checking and adjusting at maximum load S-WG+120 / +150 / +180 ... 101
14.3.4 Checking and adjusting at minimum load S-WG+120 / +150 / +180 ... 101
14.4 ADJUSTING PROCEDURES ... 102

15 PUTTING THE WATER HEATER OUT OF OPERATION ... 103
15.1 OUT OF OPERATION: ON/OFF FUNCTION ... 103
15.2 OUT OF OPERATION: POWER OFF ... 103

16 FAULT CODES, BLOCKING CODES ... 104
16.1 LOCK-OUT CODES ... 104
16.2 BLOCKING CODES ... 110
16.3 MAINTENANCE ATTENTION FUNCTION ... 114

17 MAINTENANCE ... 114
17.1 GENERAL ... 114
17.2 INSPECTION & MAINTENANCE ... 115

18 USER INSTRUCTIONS ... 117

INTRODUCTION

This manual is written for:
- The Installer.
- The System Design Engineer.
- The Service Engineer.
- The User.

The following symbol is used in this manual:



Warning: Important information concerning the safety of persons and/or the appliance.

Strebel Ltd is not accountable for any damage caused by incorrect following the mounting instructions. For service and repair purposes use only original Strebel spare parts.

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

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 of 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 persons (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 Chapter 16

The Strebel S-WG+ 80-180 hot water systems will, for a long period, comfortably meet your requirement of hot water of the right temperature at the right hour, provided that a few important conditions have been fulfilled regarding the installation.
Please follow all instructions and recommendations presented in this manual, especially the ones concerning the next important topics:

- Water quality (See chapter 8.1)

  A 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)
  - TDS (Total Dissolved Solids) should not exceed 450 PPM
  - Hardness and TDS together may not exceed 450 PPM
  - pH value should be between 6,5 and 7,5, measured cold

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

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

- Water flow velocity and pump selection (see chapter 9.7)

  For a given combination of water heaters and tanks, pump selection is very important with respect to the required flow velocity.
  Strebel Ltd have done the calculations and provides a number of tables in which you can find the right pump type suitable for your particular installation.

- Water flow velocity and piping diameters and lengths (see chapter **Error! Reference source not found.**)

  The arguments that hold for pump selection, hold for piping design as well: all piping components added up are giving a certain total resistance which should not exceed a critical value at which the pump cannot realize the required flow velocity anymore.
  Strebel Ltd have done the calculations and provides a number of tables in which you can find the piping requirements suitable for your particular installation.

Following the instructions and recommendations given in the referred paragraphs will highly improve the functioning and considerably lengthen the life time of your S-WG+ DHW system.

Furthermore, for all S-WG+ appliances the next instructions and recommendations apply:

! *Never use aluminium or aluminium containing flue gas outlet*

! *Always fill the siphon before commissioning the water heater*

! *Always set the gas valves during commissioning the water heater, for the first time and after maintenance and/or installation changes*

! *Never change the parameters P2LC, P2LD, P2ML and P5BI*

! *Never place a ball valve between the safety valve and the water heater*

! *In a log, keep track of all situations regarding the appliance:*
what, when, by whom, what actions and/or changes, what communication has been performed

Warnings and guidelines (continuation)

Strebel Ltd is not liable for any damage caused by inaccurately following these mounting instructions.
Only S-WG+ parts may be used when carrying out any repair or service works.

Do not use chlorine based products for brazing.

When commissioning the water heater, the running of the water heater pump must be checked before leaving the installation.
By pressing the service button during 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 S-WG+ water heater control. If, for any reason, an external pump control is applied *without written approval of Strebel Ltd*, the complete warranty on the S-WG+ 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 time of 150 mg/m^3 and an annual average of 30 mg/m^3 maximum.

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

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 chapter 8.3 and for the programming options see chapter 11.2.2.

BUTANE GAS



If a butane/propane gas mixture has to be used for this water heater the fan speed must be reduced by altering parameter P4BD.
See chapter 11.1.3.

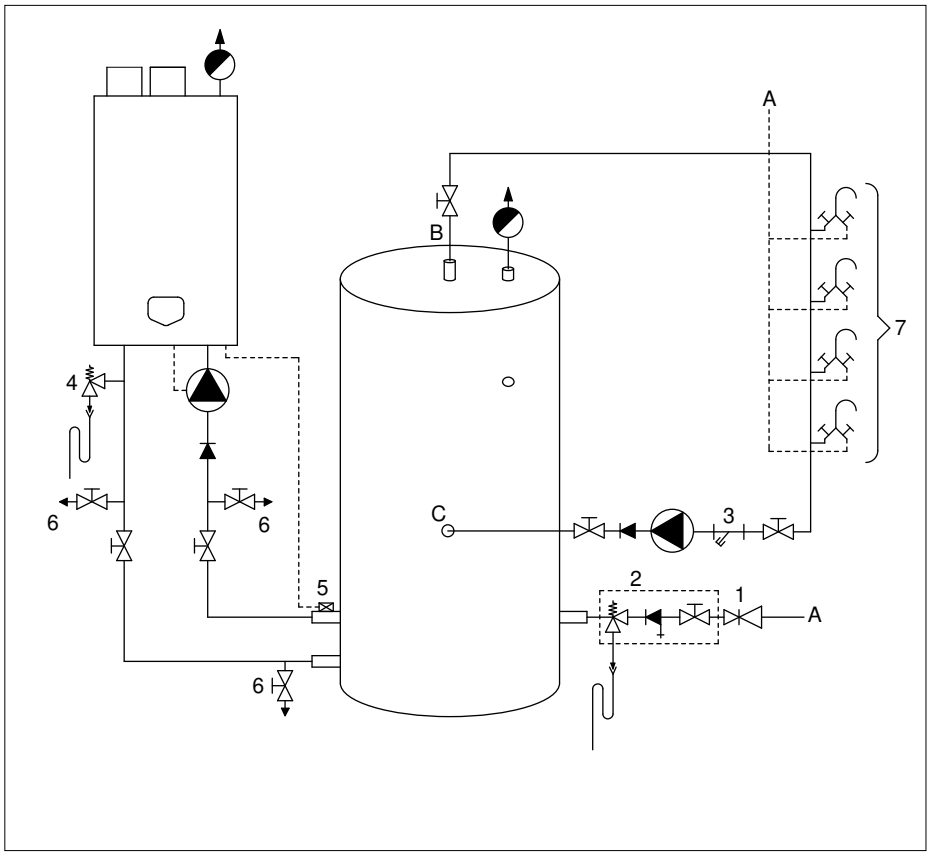
1.3 Safety valve

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.

The right sized safety valve as below will be required if isolation valves are installed in between the S-WG+ heater and cylinder.

Water heater	Safety valves
WG+ 80-120	¾" Safety Valve rated @ 8 bar
WG+ 150-180	1" Safety Valve rated @ 8 bar

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



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

1) Pressure relief valve. (mandatory in case service water pressure is too high)
2) Inlet combination with valve (mandatory).
3) Apply filter if necessary (recommended).
4) A suitable safety valve must be mounted near the water heater (mandatory). This safety valve may never be isolated from the water heater by means of a ball valve.
5) Remote tank sensor (necessary) → mounting hereof: see chapter 9.2.1.
6) Drain valve (recommended)
7) Hot and cold water mixers

	PUMP
	NON RETURN VALVE
	VALVE
	SAFETY VALVE
	AUTOMATIC VENT

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

SAFETY COMPONENTS

NB! The picture shows an example of a functional installation. The safety components as shown in the picture are NOT necessarily conform all applicable standards and regulations.

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

2 TECHNICAL DATA S-WG+ 80 – 180 WATER HEATERS

2.1 Functional introduction

The S-WG+ 80-180 water heaters are heaters with a maximum high efficiency. Such a performance can be reached by, amongst other things, using a special heat exchanger made of stainless steel. This allows the flue gases to cool down below the condensation point, and so release extra heat. This has an immediate positive impact on the efficiency, exceeding the 100%.

The S-WG+ 80-180 water heater is standard set for Natural gas G20 / G25.3
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 time of 150 mg/m^3 and an annual average of 30 mg/m^3.

Water heater control includes the next programmable features:
- Cascade control for up to twelve water heaters
- 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 input* control is NOT possible for this type of direct fired water heaters.

Cascade control
When using the integrated cascade control, a maximum of twelve heaters can be controlled in a cascade configuration. By the use of an appropriate external control, this number may be increased at will.

0-10 VDC connection available
The water temperature can be controlled by an external 0-10 VDC signal. When a number of water heaters are cascaded, the signal should be directed to the master only. A signal of 1.48 Volt 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 are 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 Technical specifications datasheet

GENERAL						
Product Identification number		CE 0063 BR3190				
Classification		II2EK3B/P (Country depending)				
Gas Appliance Type		B23, B23P, C13, C33, C43, C53, C63, C83				
Type water heater		**WG+80**	**WG+100**	**WG+120**	**WG+150**	**WG+180**
Dimensions (h x w x d)	mm	**842 x 476 x 486**			**898 x 476 x 677**	
Water content est.	Litres	5,0	6,5	8,3	10,4	12,9
Weight dry	kg	68	73	78	87	96
In- and outlet water connection union	inch	1½	2	2	2	2
Gas connection	inch	R ¾	R ¾	R ¾	R 1	R 1
Flue/air concentric	mm	80/125	100/150	100/150	100/150	100/150
Flue/air twin pipe	mm	80-80	100-100	100-100	130-130	130-130

DOMESTIC HOT WATER		**Values min-max:**				
Nominal input (Net)	kW	14,6 - 74,3	17,2 - 92,2	26,0 - 111	34,0 - 138	45,0 - 166
Nominal input (gross) (G20 G25.3)	kW	16,2 - 82,5	19,1 - 102	28,9 - 123	37,8 - 153	50,0 - 184
Nominal input (gross) (G31)	kW	15,9 - 80,8	18,7 - 100	28,3 - 121	37,0 - 150	48,9 - 180
Nominal input (gross) (G30/G31)	kW	15,8 - 80,2	18,6 - 99,7	28,2 - 120	36,8 - 150	48,8 - 180
Nom. output 80/60°C	kW	14,0 - 71,2	16,5 - 88,4	24,7 - 106	32,6 - 132	43,3 - 160
Nom. output 50/30°C	kW	15,2 - 77,5	18,0 - 96,2	27,2 - 116	35,5 - 144	47,3 - 175
Nom. output 37/30°C	kW	15,7 - 80,1	18,6 - 99,5	28,1 - 120	36,7 - 149	48,5 - 179
Efficiency 40/30°C DIN 4702-8	%	**up to 110,6 % within the WG+ range**				

GAS CONSUMPTION gases acc. to EN437			**Values min-max:**				
Natural gas G25.3		m^3_{st}/h	1,76 – 8,94	2,07 – 11,1	3,13 - 13,4	4,09 – 16,6	5,41- 20,0
Natural gas G20		m^3_{st}/h	1,54 - 7,86	1,82 - 9,76	2,75 - 11,8	3,60 - 14,6	4,76 - 17,6
Propane gas G31 [1]		m^3_{st}/h	0,60 - 3,04	0,70 - 3,77	1,06 - 4,54	1,39 - 5,65	1,84 - 6,79
Butane/Propane gas mixture G30/G31 (B/P) [1]		m^3_{st}/h	0,45 - 2,29	0,53 - 2,85	0,81 - 3,44	1,05 - 4,28	1,40 - 5,15
Gas supply pressure nom. [2]	G25.3	mbar	25				
	G20		20				
	G31 [1]		30/37				
	G30/G31 [1]		50				

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 nominal [mbar]	p min [mbar]	p max [mbar]
G25.3	25	20	30
G20	20	17	25
G31	30	25	35
	37	25	45
G30/G31	50	43	57

Type water heater			WG+80	WG+100	WG+120	WG+150	WG+180
EMISSION [EN437]			**Nominal values at min-max load:**				
CO_2 flue gas min-max [3]	G25.3/G20	%	8,7 - 9,0	8,7 - 9,0	8,7 - 9,0	8,7 - 9,0	8,7 - 9,0
	G31	%	9,3 - 10,3	9,3 - 10,3	9,3 - 10,3	9,3 - 10,4	9,3 - 10,5
	G30/G31 B/P	%	9,3 - 10,4	9,3 - 10,4	9,3 - 10,4	9,3 - 10,5	9,3 - 10,6
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	6,52-38,6	7,69-47,9	11,6-57,7	15,2-71,7	20,1-86,2
Available pressure for the flue system [4]		Pa	200				
INSTALLATION							
Max. water temperature		°C	75				
Pressure WW-system min-max		bar	1,0-8,0				
Relief valve pressure max			10				
Hydraulic resistance of the water heater at ΔT(in- and outlet) = 17 K		mWC	5,8	4,7	4,1	6,0	5,5
ELECTRIC							
Power consumption		W	136	142	151	214	229
Power supply		V / Hz	230 / 50				
Protection class			IPX4D				

NOTES

[3] 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:		WG+80	WG+100	WG+120	WG+150	WG+180
Load profile		XXL	XXL	XXL	3XL	3XL
	Unit					
Water heating energy efficiency (η_{wh})	%	**86,0**	**86,3**	**85,9**	**89,0**	**88,6**
Daily fuel consumption (Q_{fuel})	kWh	27,900	27,820	27,970	51,920	52,160
Daily electricity consumption (Q_{elec})	kWh	0,245	0,242	0,240	0,240	0,235
Emissions of nitrogen oxides (EN15502-1:2012+A1:2015)	mg/kWh	46	40	45	41	44
Sound power level, indoors (L_{WA} ; EN 15036-1:2006)	dB(A)	67	65	62	66	69

A S-WG+ 80-180 water heater appliance has to be installed with a water tank.

The efficiency of the complete installation depends on:

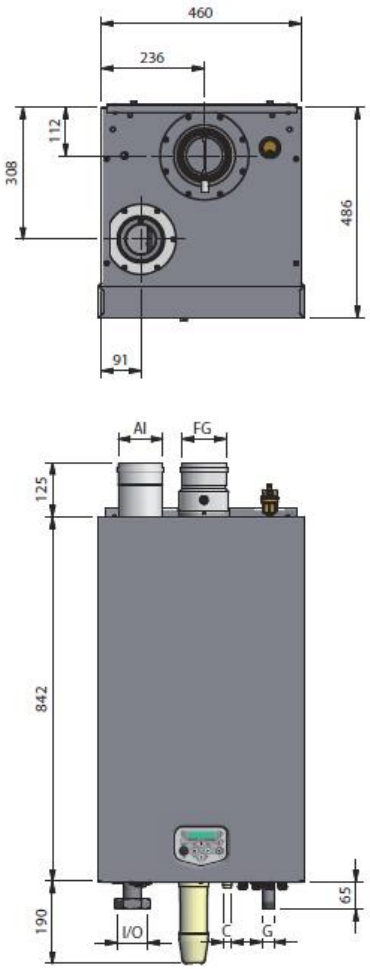
- Type of water tank.
- Volume of the water tank.
- Number of tanks
- Type of circulation pump.
- Length of the connecting pipes.
- Insulation of the connecting pipes.

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

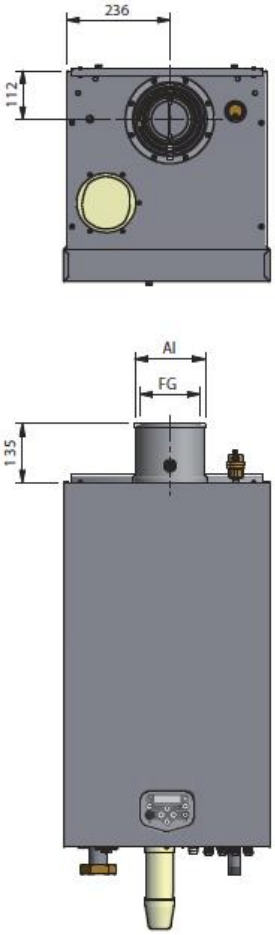
3 DIMENSIONS

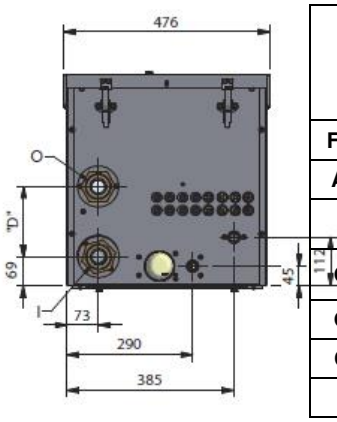
3.1 Water heaters WG+80 – WG+120

TWIN PIPE



CONCENTRIC

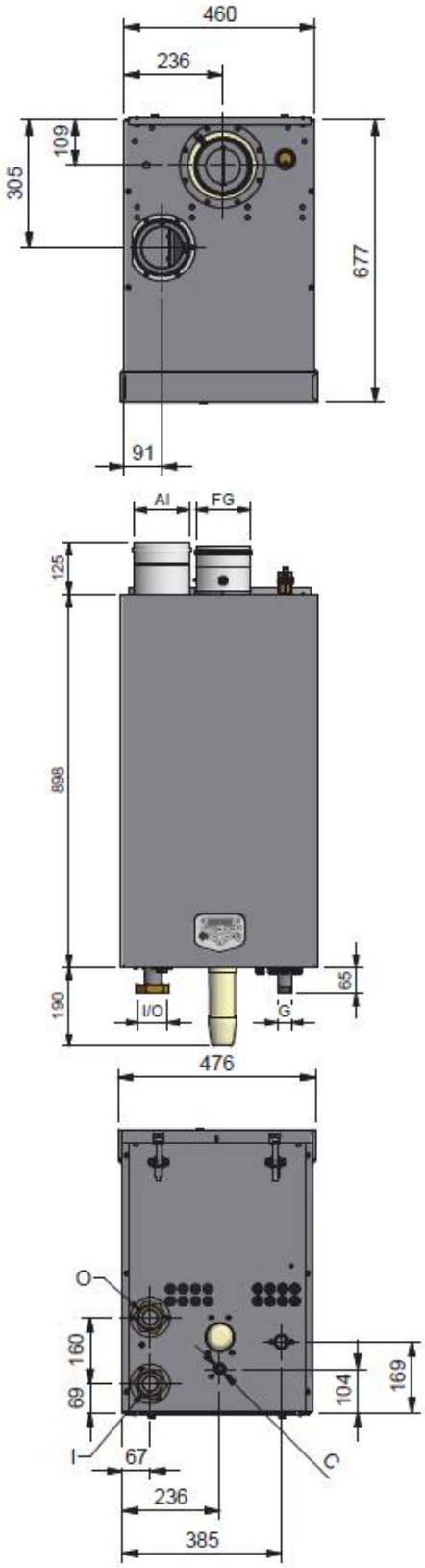




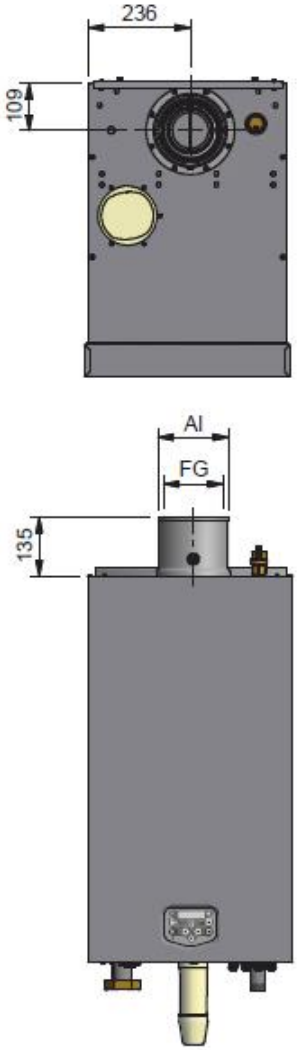
Connections (mm/")		Twin pipe			Concentric		
		WG+80	**WG+100**	**WG+120**	**WG+80**	**WG+100**	**WG+120**
FG	flue gas	Ø80	Ø100		Ø 80	Ø100	
AI	air inlet	Ø80	Ø100		Ø125	Ø150	
I	cold water inlet	R 1½" (swivel)	R 2" (swivel)		R 1½" (swivel)	R 2" (swivel)	
O	hot water outlet	R 1½" (swivel)	R 2" (swivel)		R 1½" (swivel)	R 2" (swivel)	
G	gas	R ¾" (male)					
C	condensate	flexible hose Ø25/21 x 750 mm.					
Value "D"		175	160		175	160	

3.2 Water heaters WG+150 and WG+180

TWIN PIPE



CONCENTRIC

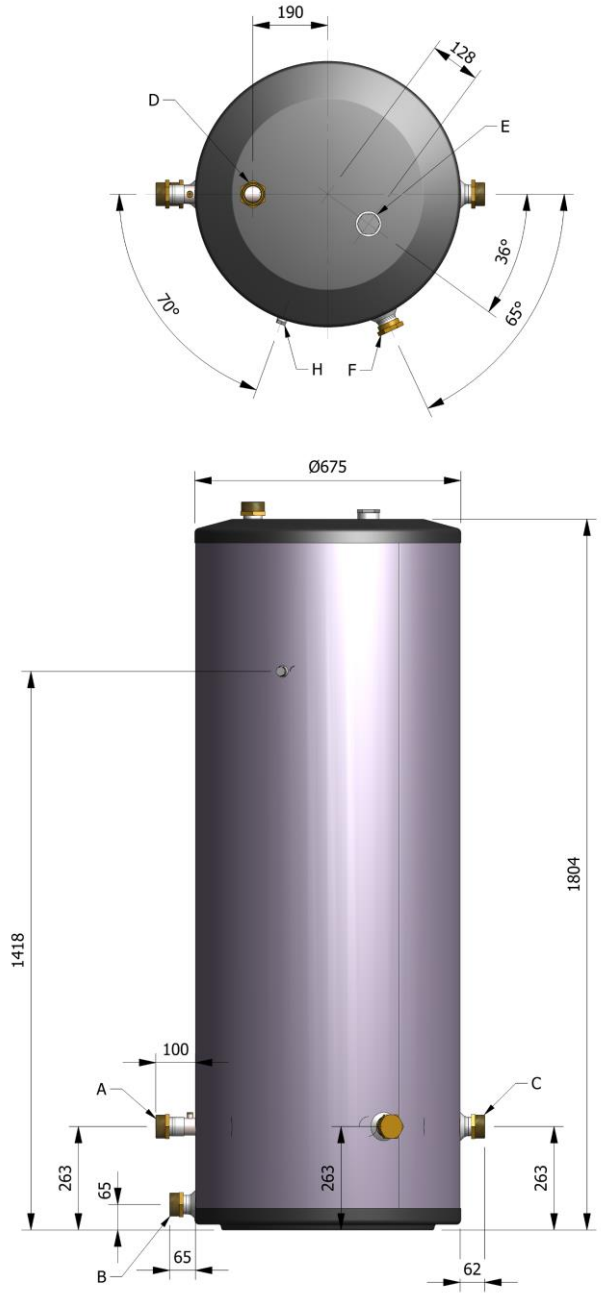


Connections (mm/")		Twin pipe	Concentric
		WG+ 150-180	**WG+ 150-180**
FG	flue gas	Ø130	Ø100
AI	air inlet	Ø130	Ø150
I	cold water inlet	Rp 2" (swivel)	Rp 2" (swivel)
O	hot water outlet	Rp 2" (swivel)	Rp 2" (swivel)
G	gas (male)	R 1"	R 1"
C	condensate	flexible hose Ø25/21 x 750 mm.	

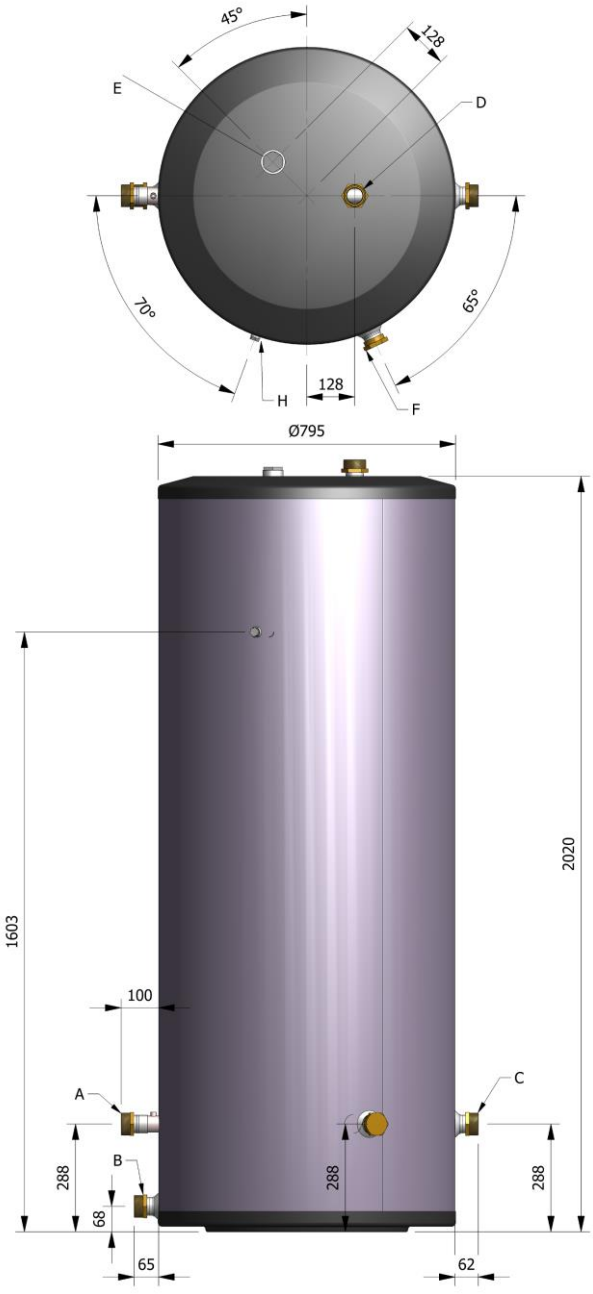
3.3 S-WG+ 80-180 Tanks 300L – 500L – 750L

For the connections marked **A-H** see chapter 9.3.2.

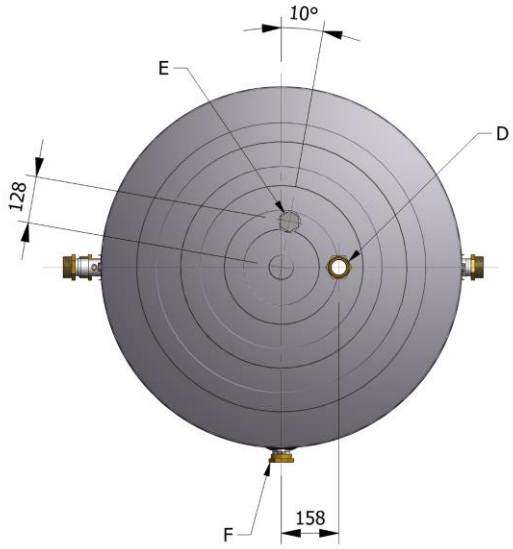
300 Litre

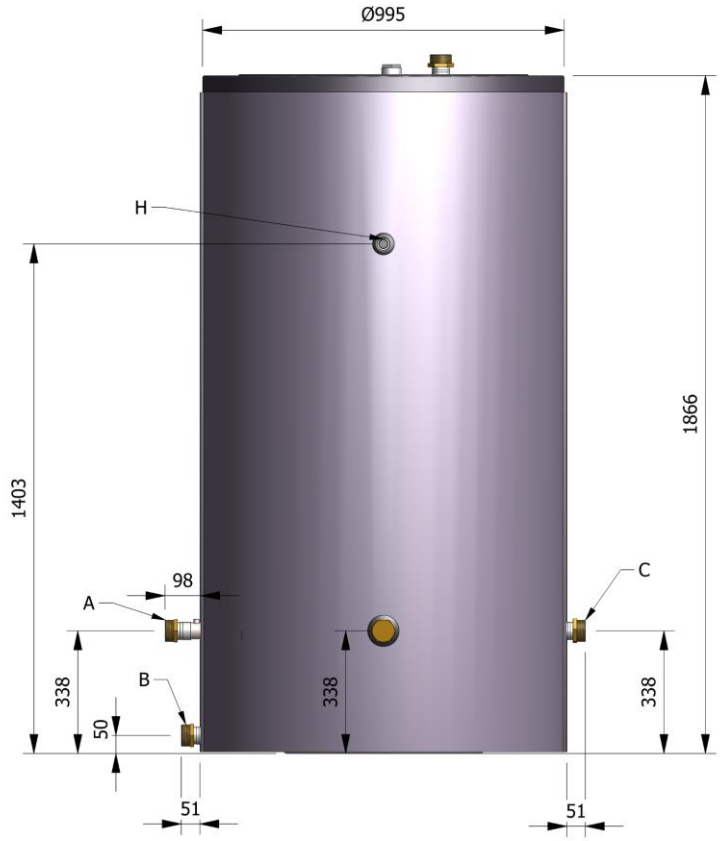


500 Litre



750 Litre



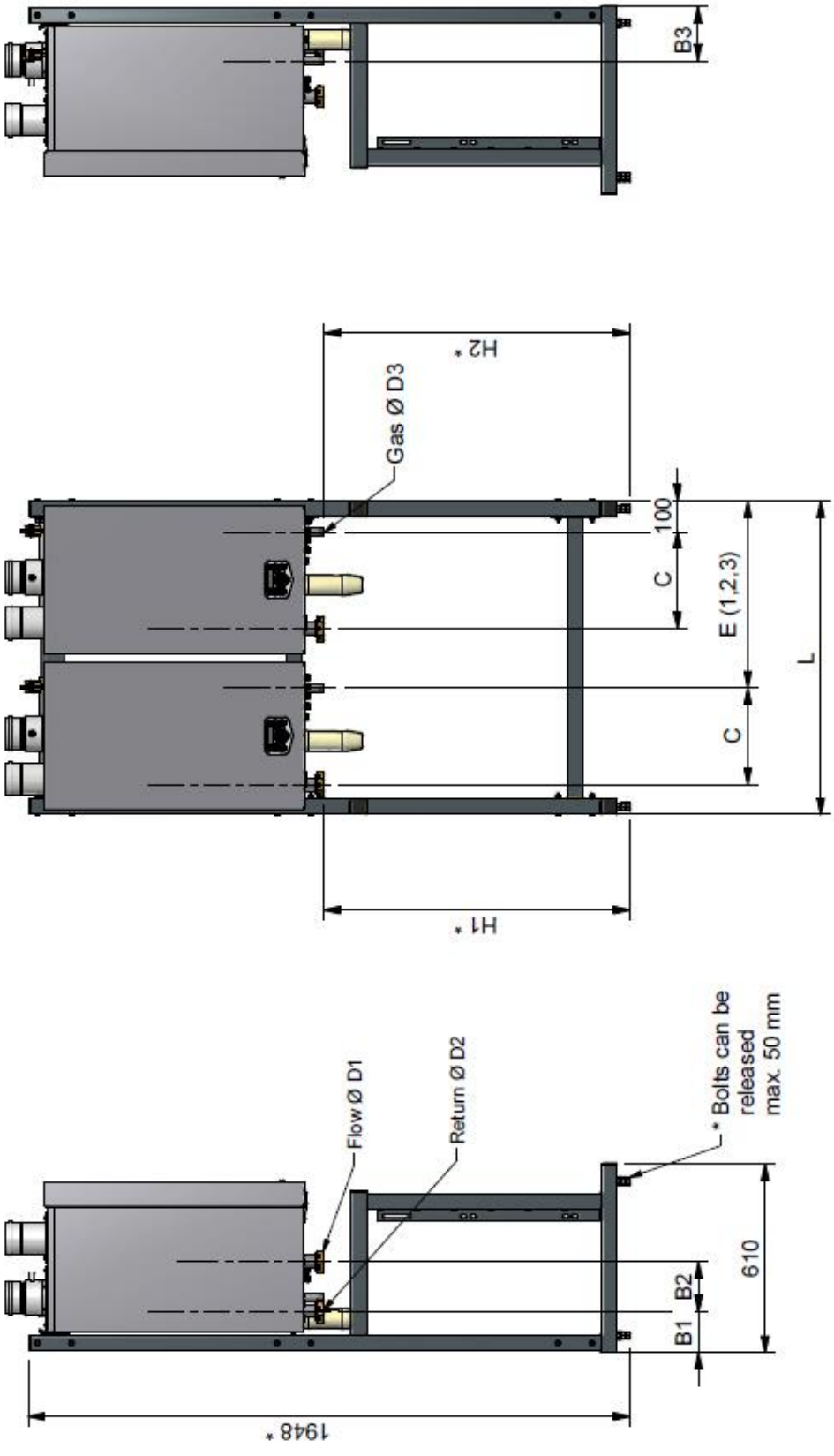


3.4 ERP specifications water tanks.

Type		**300L**	**500L**	**750L**
Energy efficiency class		B	B	C
Standing loss (S)	Watt	62	75	98
Volume (V)	Litre	304	491	764

3.5 Cascade frames WG⁺80 – WG⁺180

Frames for two, three and four water heaters WG⁺80 up to WG⁺180



		S-WG+ 80				S-WG+ 100 - 120				S-WG+ 150 - 180			
Number of water heaters cascaded →		1	2	3	4	1	2	3	4	1	2	3	4
L (frame)	mm	510	1015	1520	1980	510	1015	1520	1980	510	1015	1520	1980
B1 (return)	mm	133	133	133	133	133	133	133	133	133	133	133	133
B2 (return/flow)	mm	175	175	175	175	160	160	160	160	160	160	160	160
B3 (gas)	mm	177	177	177	177	177	177	177	177	235	235	235	235
C (water/gas)	mm	310	310	310	310	314	314	314	314	317	317	317	317
D1 (flow)	"	Rp 1½	Rp 1½	Rp 1½	Rp 1½	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2
D2 (return)	"	Rp 1½	Rp 1½	Rp 1½	Rp 1½	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2	Rp 2
D3 (gas)	"	R ¾"	R ¾"	R ¾"	R ¾"	R ¾"	R ¾"	R ¾"	R ¾"	R 1"	R 1"	R 1"	R 1"
E1 (gas 2nd water heater)	mm	n.v.t.	605	605	590	n.v.t.	605	605	590	n.v.t.	605	605	590
E2 (gas 3rd water heater)	mm	n.v.t.	n.v.t.	1110	1080	n.v.t.	n.v.t.	1110	1080	n.v.t.	n.v.t.	1110	1080
E3 (gas 4th water heater)	mm	n.v.t.	n.v.t.	n.v.t.	1570	n.v.t.	n.v.t.	n.v.t.	1570	n.v.t.	n.v.t.	n.v.t.	1570
H1 (flow/return)	mm	990	990	990	990	990	990	990	990	935	935	935	935
H2 (gas)	mm	990	990	990	990	990	990	990	990	935	935	935	935

4 ACCESSORIES AND UNPACKING

4.1 Accessories

Depending on the selected way of controlling the system, the following items can be supplied with the water heater. Ask your supplier for the specifications.

Item	Part Nº.
External DHW-Tank threaded temperature sensor 10kOhm@25°C (supplied with the water heater), to be mounted in the screw hole on the tank outlet to the water heater	E04.016.677
External DHW-Tank pipe temperature sensor 10kOhm@25°C for tank types without screw hole in the outlet to the water heater	E04.016.304
DHW thermostat RCH	S04.016.658
S-WG water tank, stainless steel, 300 Litre	100557
S-WG water tank, stainless steel, 500 Litre	103801
S-WG water tank, stainless steel, 750 Litre	100559
Software and interface cable to programme the water heater with a computer/laptop	E400278
S-WG water tank, 300 & 500 Litre Support Base Plate	E400302
S-WG water tank, 750 Litre Support Base Plate	E400309
DHW Grundfos UPMXL 25-125N without couplings	E400280
Couplings for the DHW Grundfos UPMXL 25-125N Pump	E400279
DHW Grundfos UPS 32-100N Pump	E400102
DHW Grundfos UPS 40-120 FB Pump	E400176

4.2 Unpacking

The S-WG+ 80-180 water heater will be supplied with the following documents and accessories:

- One “Installation, user and service instructions manual.”
- One suspension bracket with locking plate and bolts.
- Attached to the front of the gas valve:
  - three spare nuts for mounting the burner plate.
  - two spare fuses for the water heater control.
  - one sticker for propane or butane/propane operation.
- Bottom part of the siphon, tank sensor and connector.
- Two nipples with gaskets for inlet/outlet connections of the water heater.

NB! A pump is separately supplied, it is not included in the water heater supply. For pump selection, see chapter 9.7.

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.

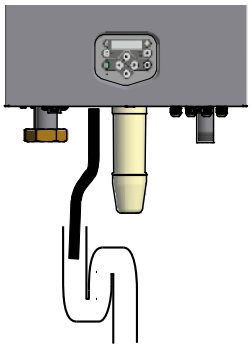
5 INSTALLATION OF THE S-WG+ 80-180

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 power source socket with earth connection.
- Open connection to the sewer system for draining condensing water.
- A sound-deadening wall.



Note:
The wall used for mounting the water heater must be able to hold the weight of the water heater. If this is not the case it is recommended to mount the water heater on a (cascade) frame.

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 will generate noise, depending on the total heat demand. The water heater location should minimise 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, who is trained for this type of water heater.

5.2 Mounting the water heater and tank

5.2.1 WATER HEATER MOUNTING

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

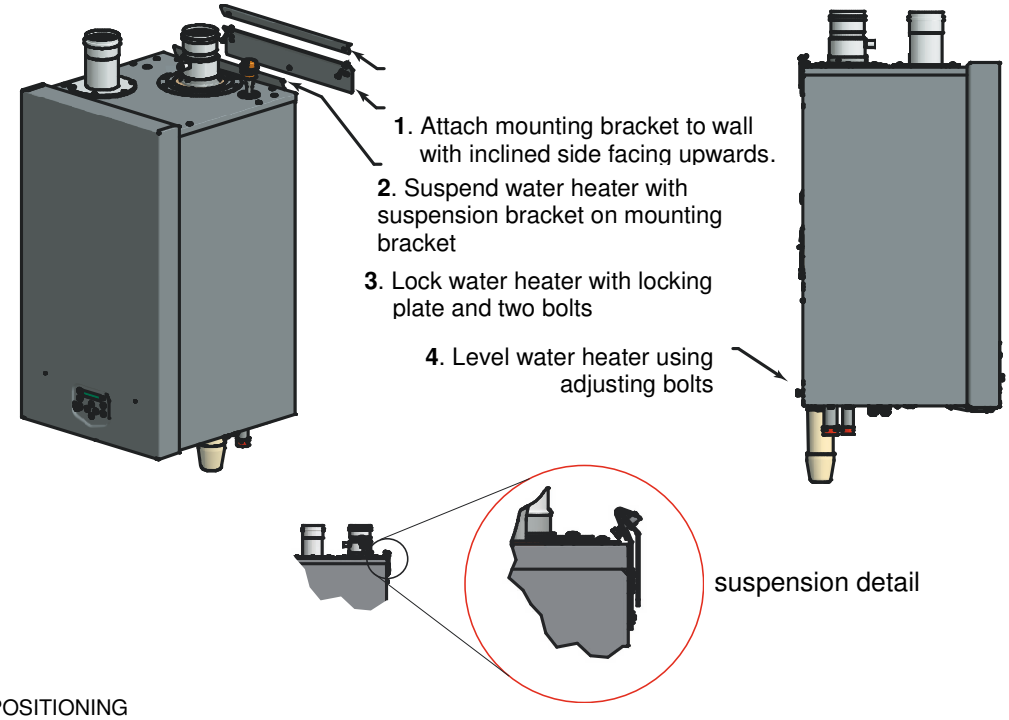
- Flue gas system and the flue gas pipe connections
- Air supply system and connections
- 'Cold in' and 'hot out' pipe connection
- Condensate and pressure relief valve drainage
- Power supply (preferably the power connection is positioned above the water heater)
- Gas pipe.

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

Determine the position of the flow and return pipes by using the included suspension bracket or a suspension frame (when supplied).
While marking the holes, ensure that the suspension bracket or frame is perpendicular and the water heater does not lean forward. If necessary, adjust the position with the adjusting bolts at the lower rear side of the back panel (see drawing). When the adjusting bolts aren't sufficient, fill the gap behind the bolts to get the water heater in position. The exact water heater position lies between the water heater hanging level and hanging slightly backwards.

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

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



5.2.2 TANK POSITIONING

The tank can be placed at will* on a stable floor, but not too far from the water heater(s). See chapter 9.6, 'Interconnecting pipes – equivalent length.

* NB! This floor must be able to hold the weight of the water filled tank(s).

6 FLUE GAS AND AIR SUPPLY SYSTEM

6.1 General

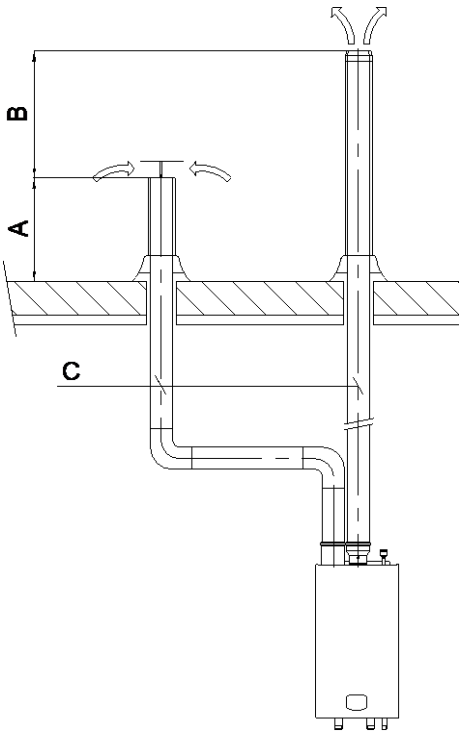
The water heater has a positive pressure flue system. The available combined pressure drop for the inlet and outlet system, for a single water heater, **is 200 Pa for the complete water heater range.** For a multiple water heater installation, always contact the manufacturer for advice.

Notice:

- Install the horizontal flue components with an angle of 3° downwards in the direction of the water heater (roughly equal to five centimetres for every linear meter). When not installed accordingly, it may result in condensate building-up in the flue gas tube, eventually causing component failure.
- Wall flue terminals are generally used up to 80 kW. Using these terminals with larger capacities will give unpleasant large condensate clouds.
- When using a wall terminal, there is the possible risk of ice building-up on surrounding parts/structures, because the condensate will freeze. This risk should be taken into account during the design phase of the DHW installation.

Note:
Because the flue gases can have a relatively low temperature, the water heater needs to have a high efficiency approved stainless steel or plastic flue system. These materials should be usable for the applied pressure in the flue gas system, be condensate proof and have a temperature class of **T120.**

6.2 Heights on 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 600 mm above the roof surface and at least 300 mm above the maximum snow level.

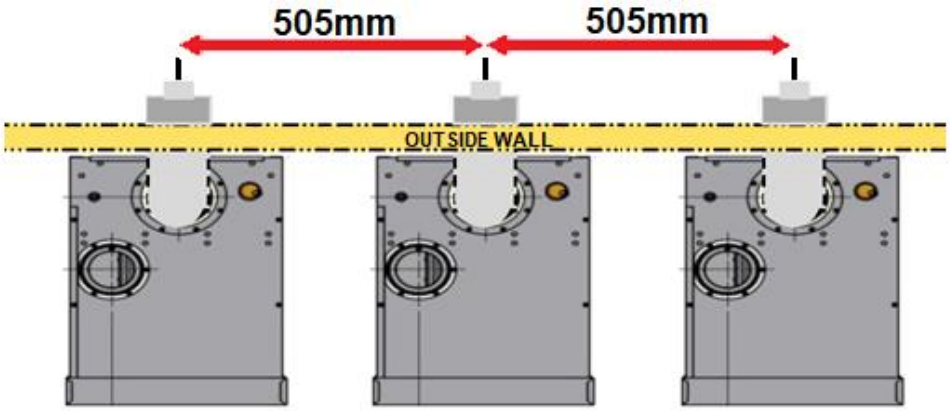
Example 1:
When the maximum snow level on the roof surface is 450 mm then the air inlet should be at 450+300=750 mm. 750 mm is more than the minimum 600 so the height will be 750 mm.

Example 2:
When the maximum snow level on the roof surface is 150 mm then the air inlet should be at 150+300=450 mm. 450 mm is less than the minimum 600 mm so the height will be 600 mm.

Height difference B
This is the height difference between the flue outlet and the air inlet.
The flue gas outlet should be at least 700 mm above the air inlet. It is advised to be equipped with a conical outlet.
A single flue outlet should be situated at least 1000 mm 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 700 mm.

6.3 Minimum Terminal Distance on Horizontal Terminations – Type C Flues Only.



IMPORTANT!
The location of the wall terminals must be considered with regards to products of combustion potentially building up around the terminals thus allowing products of combustion to flow down the air intake flue into the S-WG+ heaters. The build-up of products of combustion can be caused by certain conditions such as poor cross flow or air caused by weather conditions, enclosures or adjacent buildings. If there are any doubts, then we would recommend one of the following:

- Wall Terminal c/w Exhaust Plume Kit – A standard kit will move the exhaust terminal 1 metre higher than the fresh air intake.
- Stagger the Coaxial Wall Terminals to increase the distance between the terminals – With this method, stagger the even number terminals higher than the odd number terminals. For example, terminals 1 – 3 will be the same height and terminals 2 – 4 will be higher, high enough to prevent build-up of combustion around the terminals.

Any boiler faults / failures caused by products of combustion flowing down the air intake flue due to building up around the terminals will not be covered by our manufacturer's warranty.

6.4 Horizontal Flue Run Risk Assessment

Using the below risk assessment as per IGEM/UP/10 appendix 9 to work out if the horizontal flue terminal position is suitable or not.

Type C appliances with net heat input exceeding 70kW and not exceeding 333kW low level flue discharge risk assessment (including net heat input for groups of appliances)			
No.	**Flue Position**	**Yes**	**No**
1	Is the suggested flue terminal location within the distance of the formula shown in chapter 6.4.1 titled figure 12 line G of a road, path, track, thoroughfare, walkway, property boundary or an area which is used for general public access other than for maintenance purposes?		
2	Is the suggested flue terminal location within the distance of the formula shown in chapter 6.4.1 titled figure 12 line G to a playground, school yard, seating area where there may be public gathering?		
3	Is the suggested flue terminal location within the distance of the formula shown in chapter 6.4.1 titled figure 12 line G of a surface or building that may be affected by corrosion or deterioration from plume condensate?		
4	Is the suggested flue terminal location within the distance of the formula shown in chapter 6.4.1 titled figure 12 line G to an area where vehicles could be parked?		
5	Is the suggested flue terminal location within the distance of the formula shown in chapter 6.4.1 titled figure 12 line G of any trees, branches or shrubs?		
6	Is the suggested flue terminal location within the distance of the formula shown in chapter 6.4.2 titled figure 7 line Y to a wall when enclosed by two or more vertical walls		
7	Is the suggested flue terminal location within a light well?		
8	Are the products of combustion from the suggested flue terminal location likely to build up under certain conditions, due to poor cross flow or air caused by enclosures or adjacent structures that is likely to cause nuisance?		
9	is the suggested flue terminal location likely to cause a nuisance to adjoining properties?		
	Clean Air Act	**Yes**	**No**
10	Is the total net input of individual or group of flue terminals greater than 333kW net input?		
	Building Regulations Part J	**Yes**	**No**
11	Is the suggested flue terminal position less than 300mm from the boundary of the property, as measured from the side of the terminal to the boundary?		

All above answers are **NO**	Flue Position is Suitable	Any above answers **YES**	Flue Position in Unsuitable

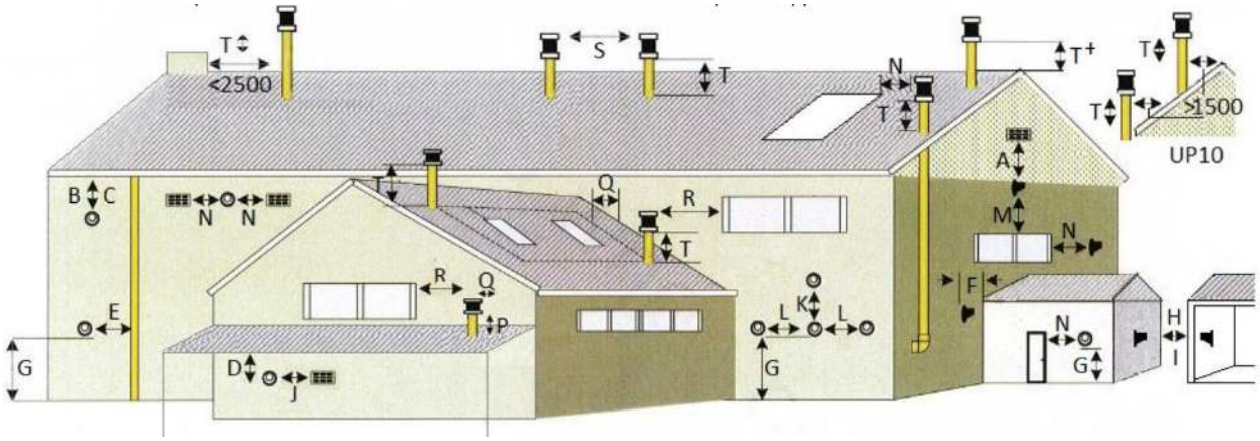
6.4.1 FIGURE 12 – LINE G

19.32 x (net heat input kW) + 647.59 = mm

6.4.2 FIGURE 7 – LINE Y

7.232 x (net heat input kW) + 93.708 = mm

6.5 Other Flue Terminal Minimum Distances



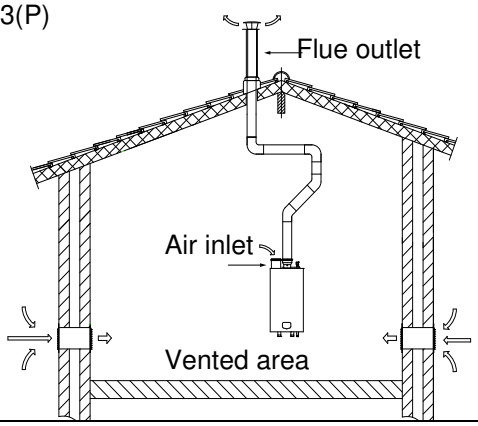
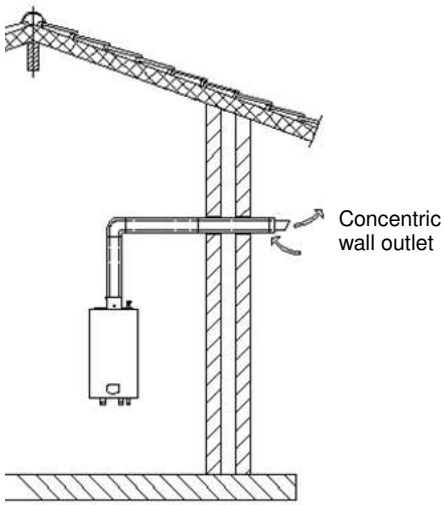
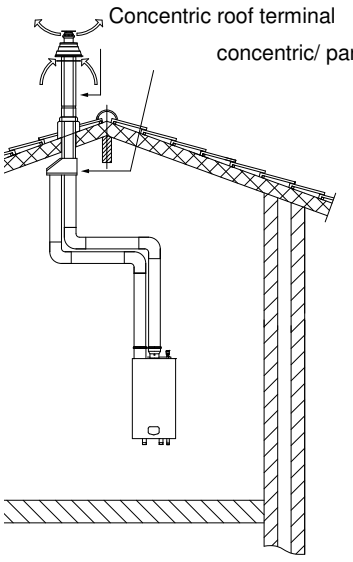
All measurements are in mm

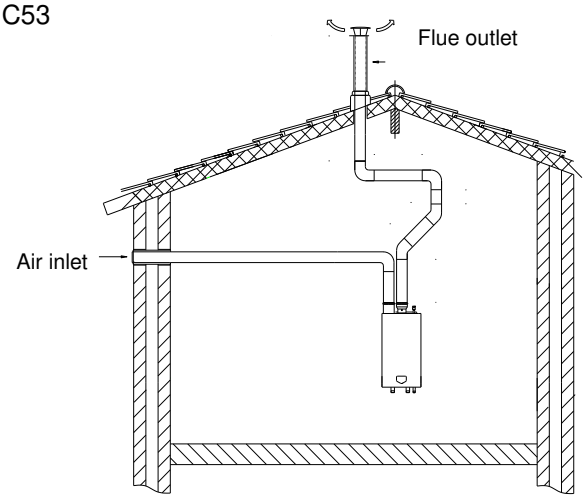
	Terminal Location	BS5440-2 Boilers rated < 70kW Net Input	Boiler Manufacturers & IGEM-UP-10 Boilers Rated >70kW <333kW Net Input (Fan Draught)
A	Directly below an opening into the building	300	2500
B	Below gutter soil pipes etc.	75	200
C	Below Eaves	200	200
D	Below balconies or car port roof	200*	Not Recommended **
E	From vertical drain or soil pipe etc.	150	150
F	From internal or external corners	300	If < 2500 - use plume kit & plume kit extensions
G	Above ground or balcony level	300	2000
H	From a surface facing the terminal	600	23.126 x (kW net input) + 618.84
I	From a terminal facing the terminal *	1200	19.32 x (kW net input) + 647.59
J	From opening in a carport into a dwelling	1200*	Not Recommended **
K	Vertically from a terminal on the same wall	1500	2500mm
L	Horizontally from a terminal on the same wall	300	See Chap 8.7 = 505mm centre to centre
M	Above an opening into the building	300	7.232 x (kW net input) + 93.708
N	Horizontally to an opening into the building	300*	7.232 x (kW net input) + 93.708
P	Above a flat roof (Obstacle > 2500mm)	300	7.232 x (kW net input) + 93.708
P+	Above a flat roof (Obstacle < 2500mm)	300	4.5675 x (kW net input) + 19.723
Q	From an adjacent wall (Edge of terminal)	300	4.5675 x (kW net input) + 19.723
R	To an opening into the building	1000	7.232 x (kW net input) + 93.708
S	From any other terminal	300	See Chap 8.6 = 700mm centre to centre
T	Above a >20 Deg Pitched Roof (BOT)	300	4.5675 x (kW net input) + 19.723
T+	Above a >20 Deg Pitched Roof (BOT) - Valley	300	4.5675 x (kW net input) + 19.723

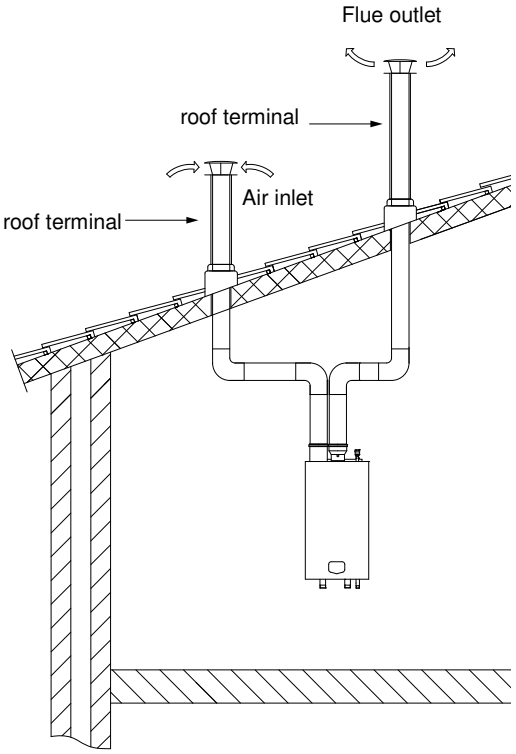
*Positions not recommended **Risk assessment required (Chapter 9.11) BOT = Base of Terminal

6.6 Water heater categories - types of flue gas systems.

For C43 and C83 see cascade manual:

Type according EN 15502-2-1: 2012	Performance	Description
B23(P)  	Open Air supply from room	* Roof terminal * Without draught diverter * Water heater room air supply. * P = overpressure systems See: Six typical examples - example C **Be aware:** The installation room has to have sufficient air supply vents. These vents must be open and may not be closed or blocked. Requirements at NEN 3028 paragraph 6.5
C13  	Closed Air supply from outside	*Wall outlet. *Air supply inlet and flue gas outlet at the same air pressure zone. (a combined wall outlet e.g.). When used with separated air supply inlet and flue gas outlet the outlets have to be within a square of : - 100 cm for water heaters between 70 to 1000 kW 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 at the same air pressure zone (a combined roof terminal e.g.). When used with separated air supply and flue gas outlet the outlets have to be within a square of : - 100 cm for water heaters between 70 to 1000 kW And the distance between the planes of the two transits must be smaller as: - 100 cm for water heaters over 70kW 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 - example

</td>
<td>Closed
Air supply from outside</td>
<td>* Appliance sold without flue/air-inlet ducts
* The flue gas parts are not part of the 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 is allowed to 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>min. load $T_{fluegas}$</td><td>35°C</td></tr>
<tr><td>min. load $Q_{fluegas}$</td><td>see 2.2[1)]</td></tr>
<tr><td>nominal % CO_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>200Pa</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>

6.7 C63 certified

In general, water heaters are certified with their own flue gas material. For type B23, C13, C33, C43, C53, C83 systems, only use flue gas and air supply parts approved according chapters 4.2 and 4.3.

If a heater is C63 certified, no specific type flue gas material has been certified in combination with the boiler. 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 has to 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	WG80	80	80 +0,3/ -0,7	81 +0,3/ -0,3	50 +2/ -2
SS	WG100, WG120	100	100 +0,3/ -0,7	101 +0,3/ -0,3	50 +2/ -2
SS	WG150, WG180	130	130 +0,3/ -0,7	131 +0,5/ -0,5	50 +2/ -2
PP	WG80	80	80 +0,6/ -0,6		50 +20/ -2
PP	WG100, WG120	100	100 +0,6/ -0,6		50 +20/ -2
PP	WG150, WG180	130	130 +0,9/ -0,9		50 +20/ -2

6.8 Flue Terminal



Never use aluminum 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.**

6.8.1 HORIZONTAL FLUE TERMINAL POSITIONING

Please refer to the relevant British Standards:

- BS 5440-2 – Flueing and Ventilation for Gas Appliances of Rated Input not Exceeding 70kW
- BS 6644 – Installation of gas fired hot water boilers of rated inputs between 70kW – 1.8MW.

Please refer to the Instition of Gas Engineers and Manager Documents (IGEM):

- IGEM/UP/10 Edition 4 – Installation of gas fired hot water boilers of rated inputs between 70kW – 20MW.
  ***** Appendix 9 – Risk Assessment for Postioning of Horizontal Flues Terminations.**

6.8.2 VERTICAL FLUE TERMINAL POSITIONING

Please refer to the relevant British Standards:

- BS 5440-2 – Flueing and Ventilation for Gas Appliances of Rated Input not Exceeding 70kW.
- BS 6644 – Installation of gas fired hot water boilers of rated inputs between 70kW – 1.8MW.

Please refer to the Instition of Gas Engineers and Manager Documents (IGEM):

- IGEM/UP/10 Edition 4 – Installation of gas fired hot water boilers of rated inputs between 70kW – 20MW.

6.8.3 COMMON FLUE / DUCTS

Multiple boilers can be connected to a common duct. These flue gas systems for multiple boiler installations must always be engineered as zero or negative pressure systems; this to prevent the risk of recirculation of the flue gases. **In circumstances where a zero or negative pressure cannot be achieved, please call Strebel Ltd Technical Department for advice.**

6.9 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

6.9.1 COMBUSTION AIR QUALITY

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

6.9.2 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.

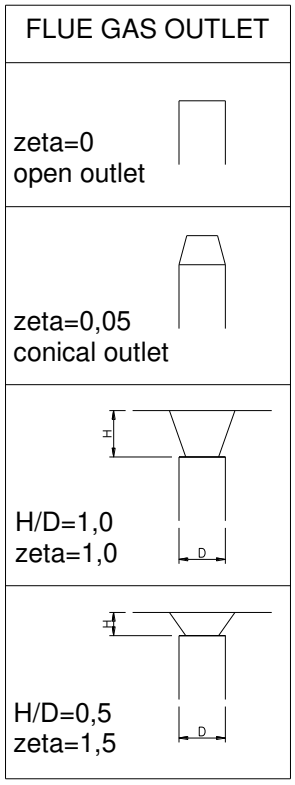
Flue gas discharge and air supply: elaborated examples
In the next sections, six calculation examples will be given to determine maximum lengths of the flue gas and air supply pipes. First, the component resistance data are given in the next table:

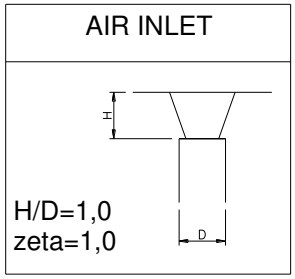
6.9.3 FLUE GAS AND AIR SUPPLY RESISTANCE TABLE

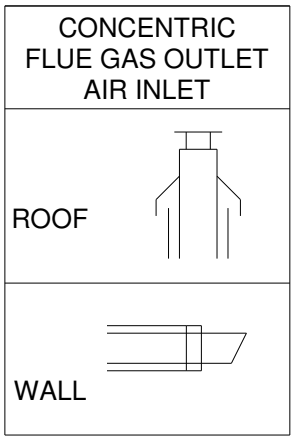
FLUE GAS PIPING		RESISTANCE [Pa]				
	Ø [mm] *	+80	+100	+120	+150	+180
straight tube/m	80	8,0	-	-	-	-
	100	3,5	4,0	6,5	-	-
	130	0,8	1,2	1,8	3,8	6,0
	150	-	0,5	0,8	1,7	3,0
45° bend	80	4,0	-	-	-	-
	100	1,7	2,0	3,2	-	-
	130	0,4	0,6	0,8	1,9	3,0
	150	-	0,2	0,4	0,8	1,5
90° bend	80	8,0	-	-	-	-
	100	3,5	4,0	6,5	-	-
	130	0,8	1,2	1,8	3,8	6,0
	150	-	0,5	0,7	1,7	3
Flue outlet zeta=0,05	80	1,2	-	-	-	-
	100	0,5	0,8	1,1	-	-
	130	0,18	0,3	0,4	0,6	0,9
	150	-	0,15	0,2	0,35	0,5
Flue outlet zeta=1,0	80	24	-	-	-	-
	100	9,8	15,2	22,1	-	-
	130	3,5	5,3	7,8	12	17,3
	150	-	3,0	4,4	6,8	9,8
Flue outlet zeta=1,5	80	36	-	-	-	-
	100	14,8	22,8	33,2	-	-
	130	5,2	8,0	11,6	18	26
	150	-	4,5	6,6	10,2	14,7

AIR SUPPLY PIPING		RESISTANCE [Pa]				
	Ø [mm] *	+80	+100	+120	+150	+180
straight tube/m	80	7,5	-	-	-	-
	100	3,0	3,5	4,0	-	-
	130	0,75	0,8	1,1	1,2	2,0
	150	-	0,3	0,4	0,6	1,2
45° bend	80	3,5	-	-	-	-
	100	1,5	1,7	2	-	-
	130	0,4	0,4	0,5	0,6	1,0
	150	-	0,15	0,2	0,3	0,6
90° bend	80	7,0	-	-	-	-
	100	3,0	3,5	4,0	-	-
	130	0,7	0,8	1,1	1,2	2,0
	150	-	0,3	0,4	0,6	1,2
Air inlet zeta=1.0	80	18,1	-	-	-	-
	100	7,4	11,4	16,7	-	-
	130	2,6	4,0	5,8	9,1	13,1
	150	-	2,3	3,3	5,1	7,4

CONCENTRIC PARTS		RESISTANCE [Pa]				
	Ø [mm] *	+80	+100	+120	+150	+180
roof terminal	80/125	61	-	-	-	-
	100/150	-	39	45	69	86
	130/200	-	-	-	15	23
outside wall terminal	80/125	22	-	-	-	-
	100/150	-	19	24	40	48
straight tube/m	80/125	12	-	-	-	-
	100/150	-	8,0	10	14	16
45° bend conc.	80/125	7	-	-	-	-
	100/150	-	8,0	9,0	14	16
90° bend conc.	80/125	13	-	-	-	-
	100/150	-	11	13	22	28
conc./par. adaptor	80/125	14	-	-	-	-
	100/150	-	16	22	40	56
*** Do not reduce pipe diameters relative to water heater connections**						





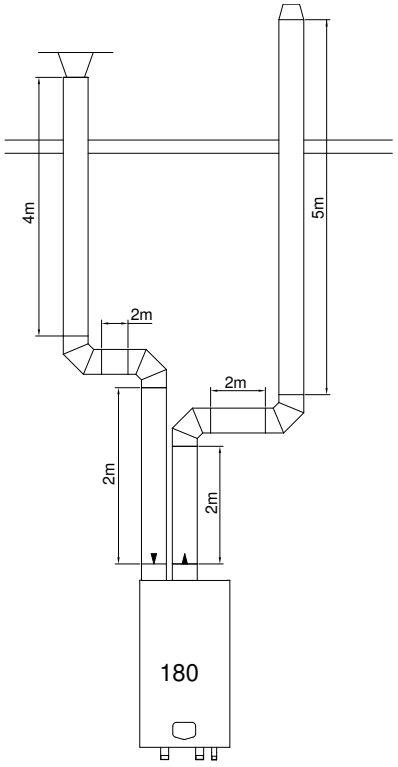


NOTICE: This table can only be used for a single flue/air system for one water heater. Do NOT use this table for common flue/air systems with cascaded water heaters.

6.10 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**

6.10.1 EXAMPLE A: TWIN PIPE SYSTEM (C63)



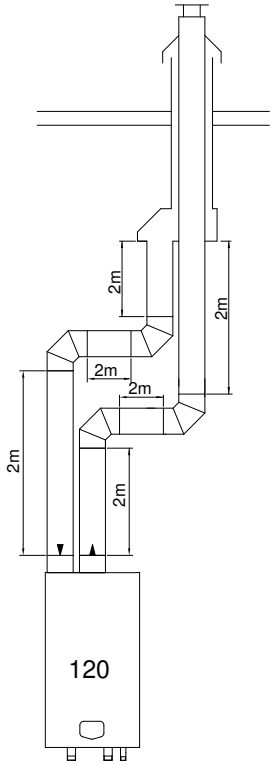
Calculation example with given lengths: checking resistance

Water heater type:		**S-WG⁺ 180**			
Flue gas	**Diameter: 130 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	9	6	54
	Bend	90°	2	6	12
	Flue outlet	conical	1	0,9	0,9
	Total resistance flue gas outlet:				**66.9**
Air supply	**Diameter: 130 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	8	2	16
	Bend	90°	2	2	4
	Air inlet	H/D = 1,0	1	13,1	13,1
	Total resistance air supply:				**33,1**
Total resistance flue gas outlet and air supply:					**100 Pa**

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

Be aware: Strebel Ltd specific resistance values are used in this example. Flue and air pipes of other supplier can have other values.

6.10.2 EXAMPLE B: TWIN PIPE SYSTEM WITH CONCENTRIC ROOF TERMINAL (C33)

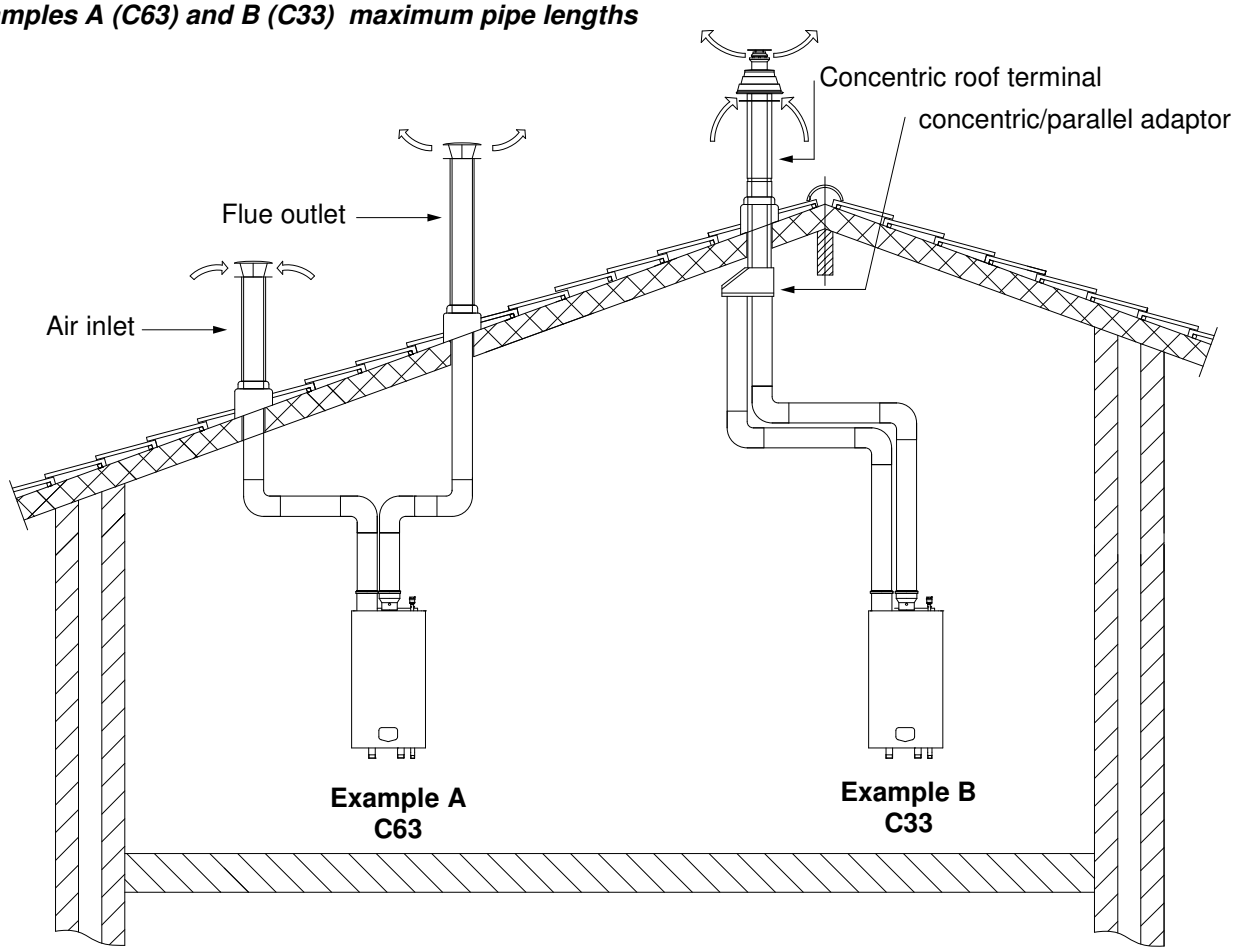


Calculation example with given lengths: checking resistance

Water heater type:		**S-WG⁺ 120**			
Flue gas	**Diameter: 100 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	6	6,5	39
	Bend	90°	2	6,5	13
	Roof terminal	concentric 150/100	1	45	45
	Adaptor conc./par.	150/100	1	22	22
	Total resistance flue gas outlet:				**119**
Air supply	**Diameter: 100 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	6	4	24
	Bend	90°	2	4	8
	Total resistance air supply:				**32**
Total resistance flue gas outlet and air supply:					**151 Pa**

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

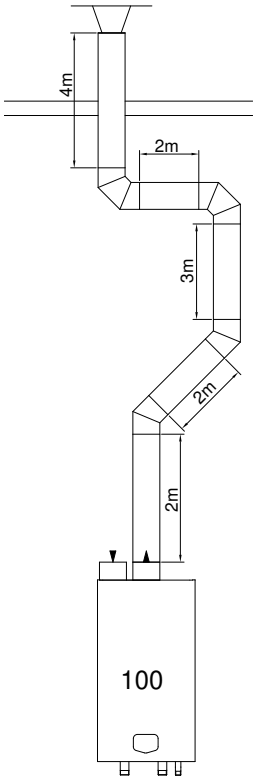
Examples A (C63) and B (C33) maximum pipe lengths



Example A max. pipe length						
Water heater type →		WG+80	WG+100	WG+120	WG+150	WG+180
Diameter air inlet	[mm]	80	100	100	130	130
Diameter flue outlet	[mm]	80	100	100	130	130
Diam. roof terminals	[mm]	80	100	100	130	130
Maximum pipe length (inlet + outlet together)	**[m]**	**18,0**	**31,5**	**24,0**	**44,5**	**30,0**

Example B max. pipe length						
Water heater type →		WG+80	WG+100	WG+120	WG+150	WG+180
Diameter air inlet	[mm]	80	100	100	130	130
Diameter flue outlet	[mm]	80	100	100	130	130
Concentric roof terminal	[mm]	80/125	100/150	100/150	130/200	130/200
Maximum pipe length (inlet + outlet together)	[m]	**12,0**	**23,0**	**16,5**	**40,5**	**25,5**

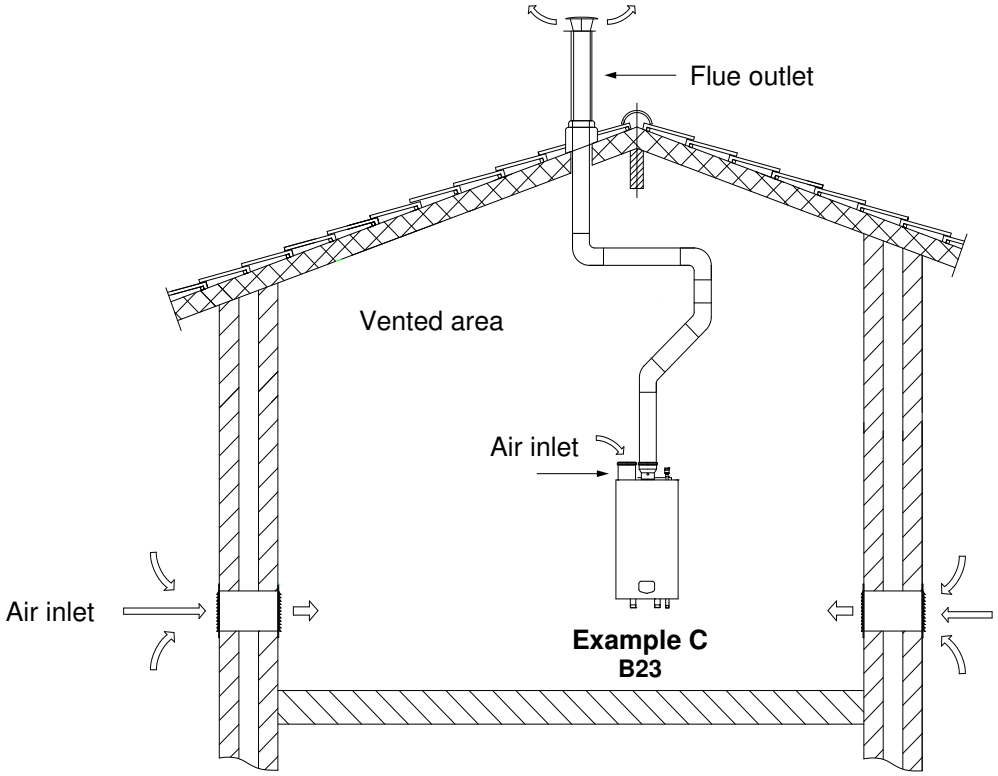
6.10.3 EXAMPLE C: SINGLE FLUE GAS OUTLET. AIR SUPPLY FROM WATER HEATER ROOM (B23, B23P)



Calculation example with given lengths: checking resistance

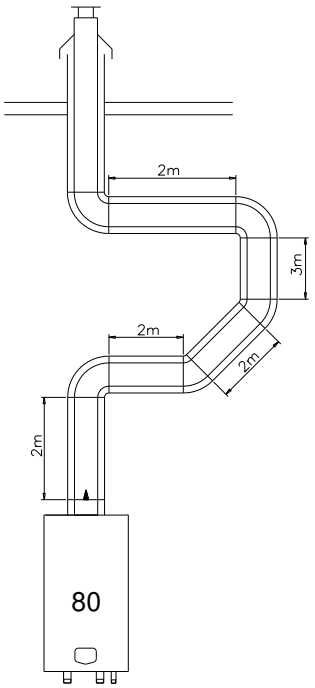
Water heater type:		**S-WG⁺ 100**			
Flue gas	**Diameter: 100 mm**		**Number**	**Pa**	**Pa total**
	Straight tube m¹	total	13	4	52
	Bend	90°	2	4	8
	Bend	45°	2	2	4
	Flue outlet	H/D = 1,0	1	15,2	15,2
	Total resistance flue gas outlet:				**79,2**

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



Example C (B23) max. pipe length						
Water heater type →		**WG⁺80**	**WG⁺100**	**WG⁺120**	**WG⁺150**	**WG⁺180**
Diameter air inlet	[mm]	80	100	100	130	130
Diameter flue outlet	[mm]	80	100	100	130	130
Diam. roof terminal	[mm]	80	100	100	130	130
Maximum pipe length (total outlet length)	**[m]**	**21,5**	**46,5**	**27,5**	**49,5**	**30,0**

6.10.4 EXAMPLE D: CONCENTRIC C33 (ROOF-MOUNTED)

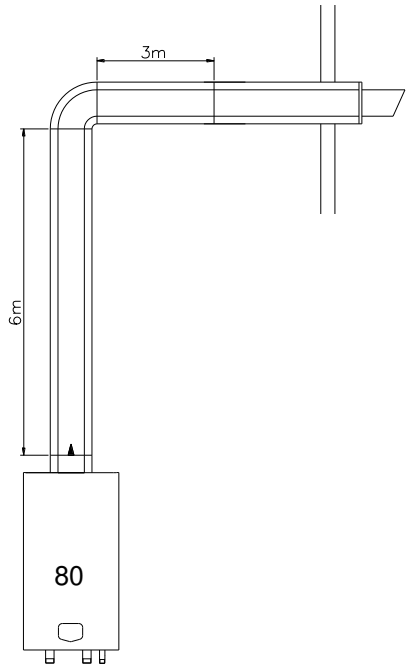


Calculation example with given lengths: checking resistance

Water heater type:		S-WG+ 80			
Concentric	Diameter: 80/125 mm.		Number	Pa	Pa total
	Straight tube m	total	11	12	132
	Bend	90°	3	13	39
	Bend	45°	2	7	14
	Concentric terminal	roof	1	61	61
	Total resistance flue gas outlet and air supply (concentric):				**246**

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

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

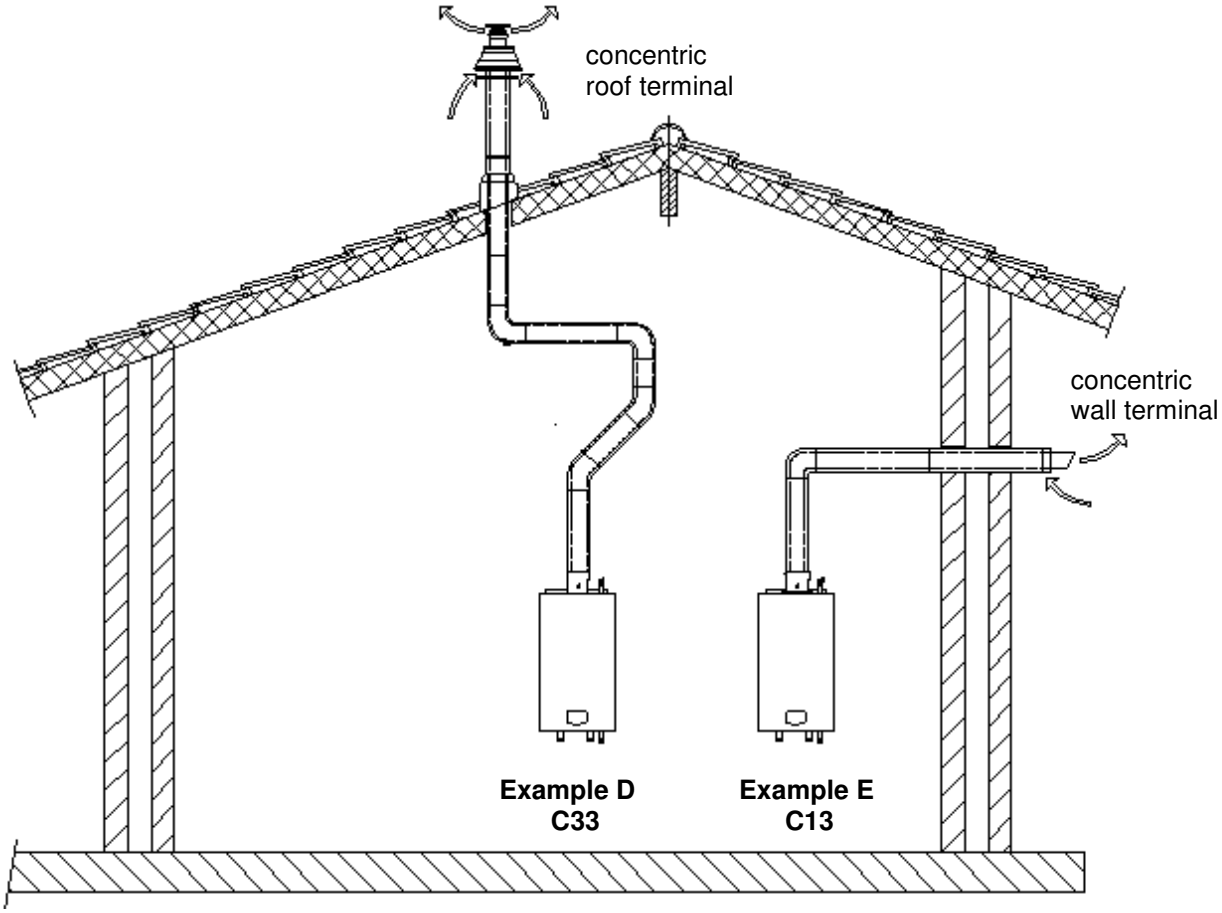


Calculation example with given lengths: checking resistance

Water heater type:		S-WG+ 80			
Concentric	Diameter: 80/125 mm		Number	Pa	Pa total
	Straight tube m	total	9	12	108
	Bend	90°	1	13	13
	Concentric terminal	wall	1	22	22
	Total resistance flue gas outlet and air supply (concentric):				**143**

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

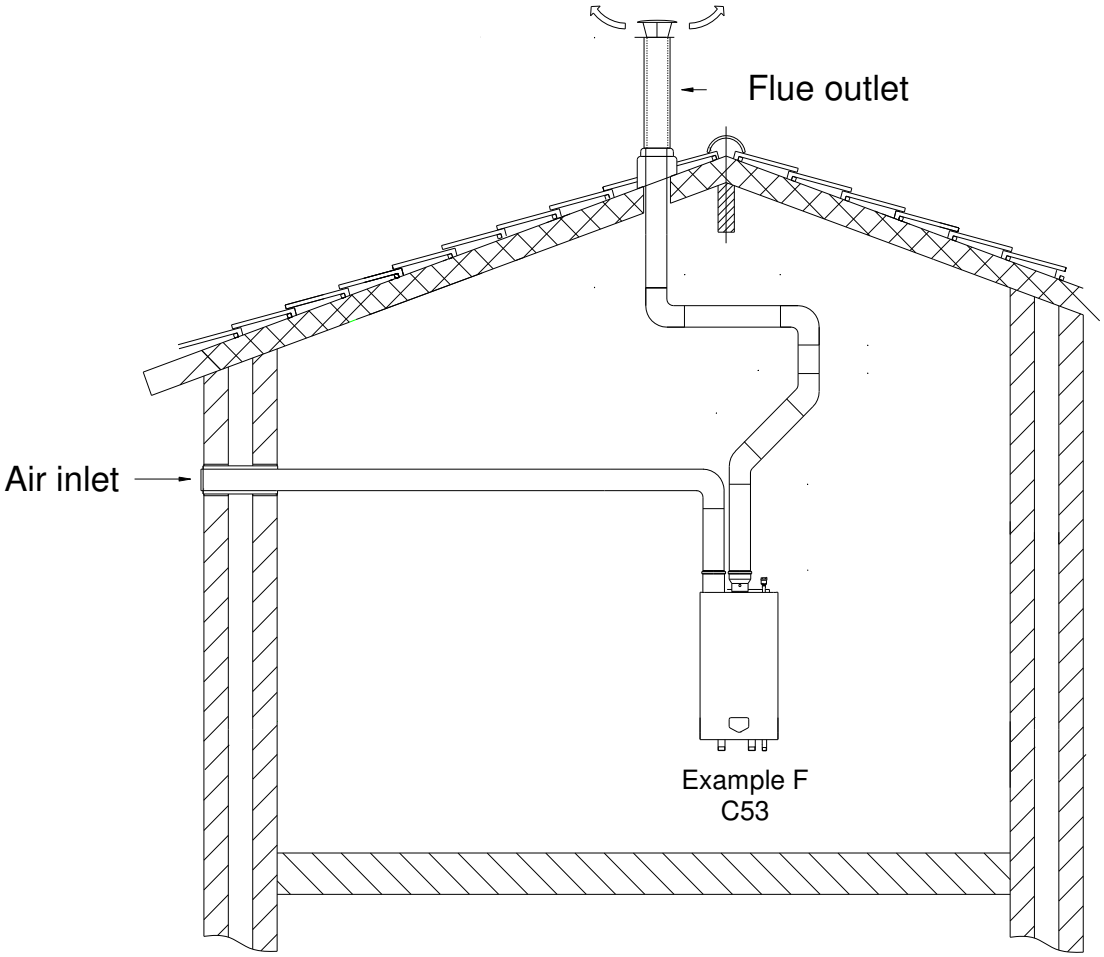
Examples D and E maximum pipe lengths



Example D (C33)						
Water heater type →		WG⁺80	WG⁺100	WG⁺120	WG⁺ 150	WG⁺ 180
Diameter concentric pipe	[mm]	80/125	100/150	100/150	NOT POSSIBLE (choose B,C or E)	
Concentric roof terminal	[mm]	80/125	100/150	100/150		
Maximum pipe length	**[m]**	**6,0**	**12,0**	**7,5**		

Example E (C13)						
Water heater type →		WG⁺80	WG⁺100	WG⁺120	WG⁺150	WG⁺180
Diameter concentric pipe	[mm]	80/125	100/150	100/150	100/150	100/150
Concentric wall terminal	[mm]	80/125	100/150	100/150	100/150	100/150
Maximum pipe length	**[m]**	**12,5**	**19,0**	**14,0**	**7,0**	**4,0**

6.10.6 EXAMPLE F: SEPARATE AIR & FLUE PIPES IN DIFFERENT PRESSURE ZONE (C53)



Example F (C53)						
water heater type →		WG+ 80	WG+ 100	WG+ 120	WG+ 150	WG+ 180
Diameter wall terminal	[mm]	80	80	100	100	130
Diameter air inlet	[mm]	80	80	100	100	130
Diameter air inlet/ flue outlet	[mm]	80	80	100	100	130
Diameter roof terminal	[mm]	80	80	100	100	130
Maximum pipe length (inlet + outlet together)	**[m]**	**14**	**38**	**19**	**42**	**23**

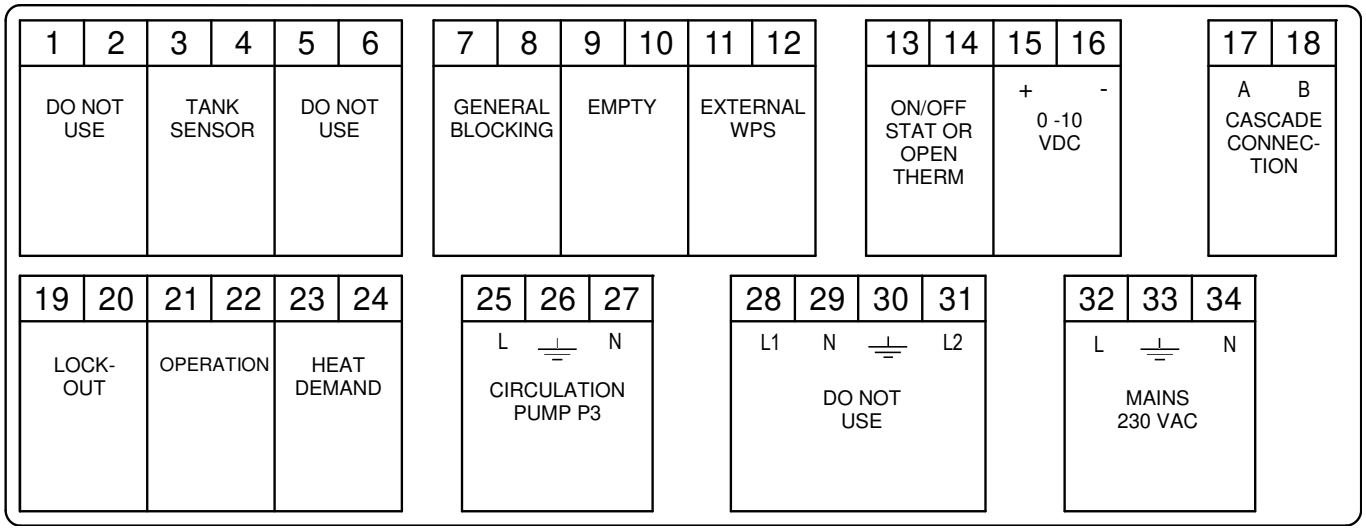
7 ELECTRICAL INSTALLATION

7.1 General

All the wiring is connected to a separate connector that is fitted in a socket. The connector can be taken from the sockets without loosening the wiring. 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 life/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	**DO NOT USE**
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. See also the drawings in § 9.1, pages 42 and 43. PARAMETER: No parameter settings needed.	
5-6	**DO NOT USE**
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	**EXTERNAL WATER PRESSURE SWITCH**
A water pressure switch is mounted in the water heater. As an option an external water pressure switch can be wired to the terminals. In this case remove connectors from 'internal water pressure switch'. When terminals 11-12 are not bridged, the water heater will lock-out. PARAMETER: A parameter change is needed.	

13-14	ON/OFF STAT OR OPENTHERM 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: an OpenTherm (OT) controller can be connected to the terminals 13 and 14. The water heater software will detect and use this OpenTherm 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 water heaters 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 any 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**
Each water heater should be installed with an external pump. **Make use of a relay between this pump and terminal 25-27, when the pump consumes <u>more than 450 Watt.</u>** Pump is switched off, when there is no heat demand, after post running time.	
28-29-30-31	**DO NOT USE**
Do not connect any cable to these connections. **TAKE CARE! 230 V electric voltage on these connections**	
32-33-34	**POWER SUPPLY**
The power supply connection of the unit. 32 = phase wire; 33 = ground wire; 34 = neutral wire.	

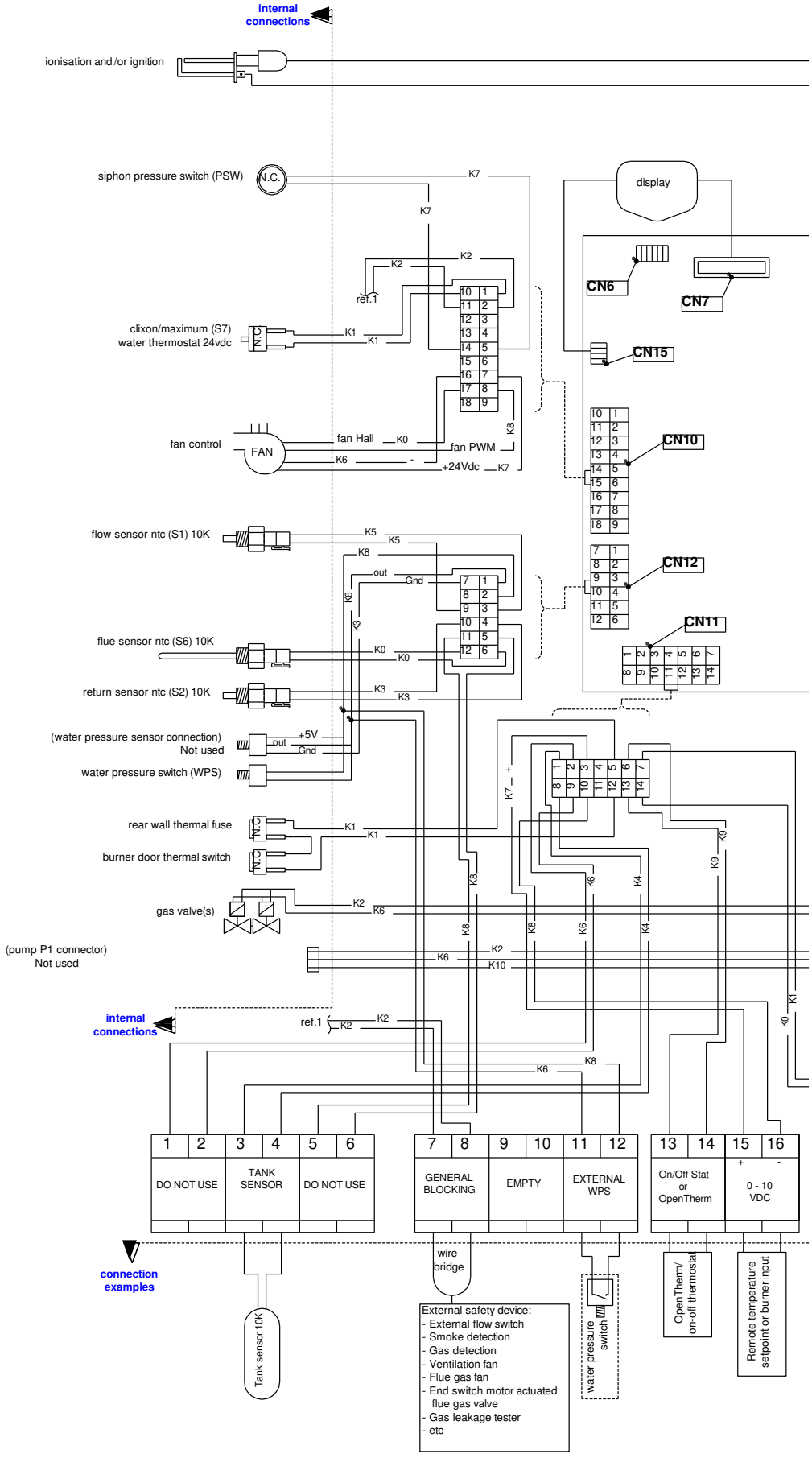
7.4 Sensor values

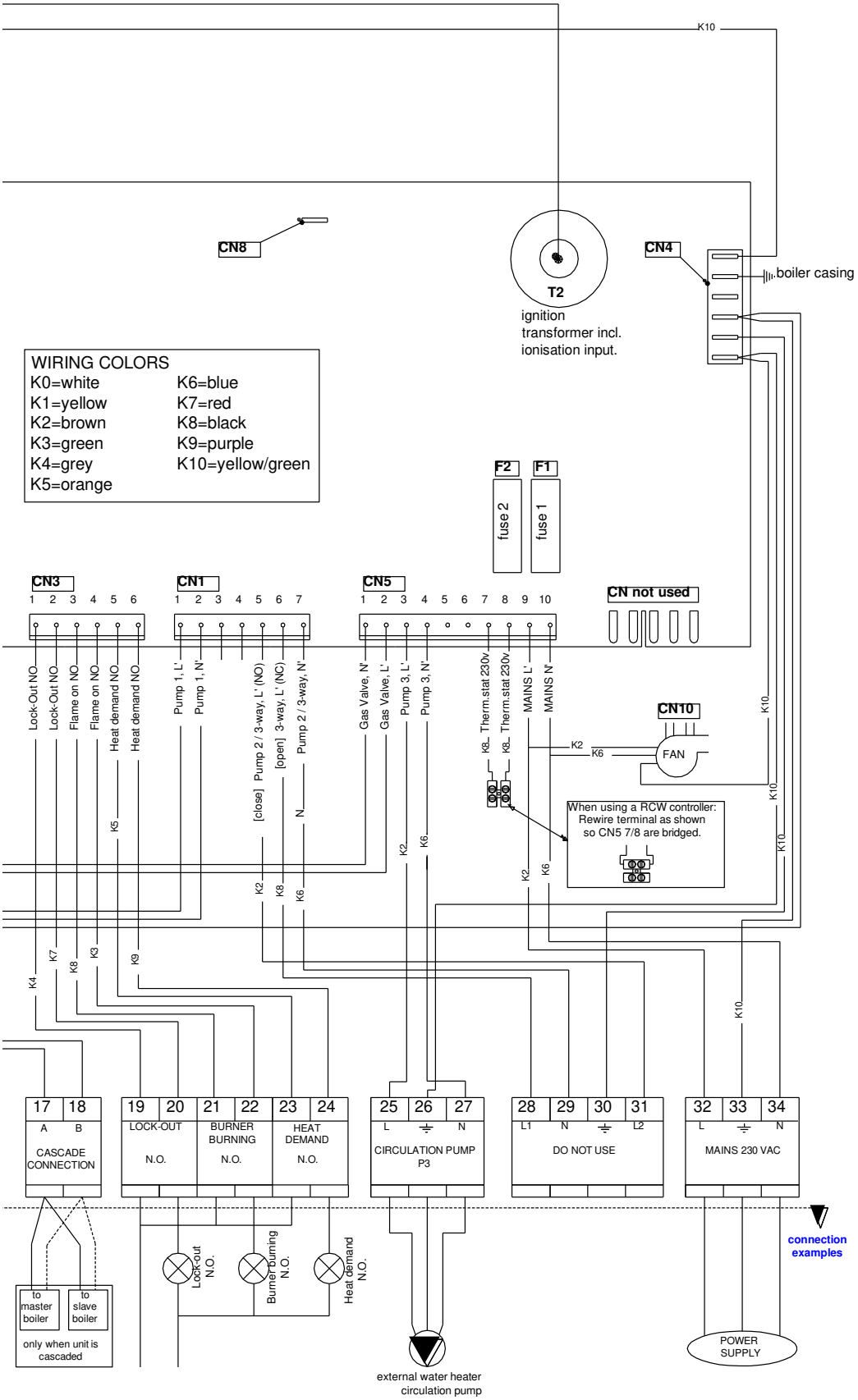
SENSOR	SENSOR TYPE	SENSOR VALUE
S1	Internal flow sensor	NTC-10K
S2	Internal return sensor	NTC-10K
S3	Tank sensor	NTC-10K
S6	Flue gas sensor	NTC-10K

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
K1=yellow
K2=brown
K3=green
K4=grey
K5=orange
K6=blue
K7=red
K8=black
K9=purple
K10=yellow/green
F2
F1
fuse 2
fuse 1
CN3
CN1
CN5
CN not used
Lock-Out NO
Lock-Out NO
Flame on NO
Flame on NO
Heat demand NO
Heat demand NO
Pump 1, L'
Pump 1, N'
[close] Pump 2 / 3-way, L' (NO)
[open] 3-way, L' (NC)
N
Pump 2 / 3-way, N'
Gas Valve, N'
Gas Valve, L'
Pump 3, L'
Pump 3, N'
K8_ Therm.stat 230v
K8_ Therm.stat 230v
MAINS L'
MAINS N'
CN10
FAN
When using a RCW controller:
Rewire terminal as shown
so CN5 7/8 are bridged.
17 18
A B
CASCADE CONNECTION
19 20
LOCK-OUT
N.O.
21 22
BURNER BURNING
N.O.
23 24
HEAT DEMAND
N.O.
25 26 27
L N
CIRCULATION PUMP P3
28 29 30 31
L1 N L2
DO NOT USE
32 33 34
L N
MAINS 230 VAC
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.
external water heater circulation pump
POWER SUPPLY

8 THE S-WG+ 80-180 WATER HEATER

8.1 Water Quality - Important

The on-site incoming cold water supply must not exceed the below valves:

- Hardness should not exceed 205 PPM CaCO3 (11.5 dH).
- 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 above values for the site where the water heater is going to fitted, can be retrieved from the local water supplier. If water quality doesn't meet the above-mentioned requirements, a water treatment installation / softener should be installed to improve water quality to the required levels. We do not recommend the use of magnetic type of water conditioners with these units, as experience of these fitted in the system with S-WG range has found that they DO NOT produce a satisfactory result.

Having an installation which meets or is better (lower hardness) than the above values does not guarantee that scale will not form in the heat exchanger as there are many variables to why scale can form i.e. temperature requirements, volume of water passing through the water heater, velocity through the units, etc. Therefore, failure of the heat exchanger due to scale formation or blockage due to other solids in the water is not covered by warranty.

Minimum Water Hardness = 80 PPM or 80 mg/L $CaCO_3$ (= 4.5°dH).
Minimum TDS = 100 PPM.
Water that's under 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 provided that water circulation through the system is possible - if not, the water heater goes in a lock-out.
- Because it concerns a programmable setting, a water heater damaged by frost is not covered under warranty.

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 chapter 11.2.2 for an extensive explanation of how to use this option.

8.5 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 bad 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 by Strebel in order to get the best performance combined with a long-life time.

8.6 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 S-WG+ 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 chapter 16.2 'Blocking codes'.

9 THE S-WG+ SANITAIRY SYSTEM: INSTALLATION INSTRUCTIONS

9.1 The S-WG+ system

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

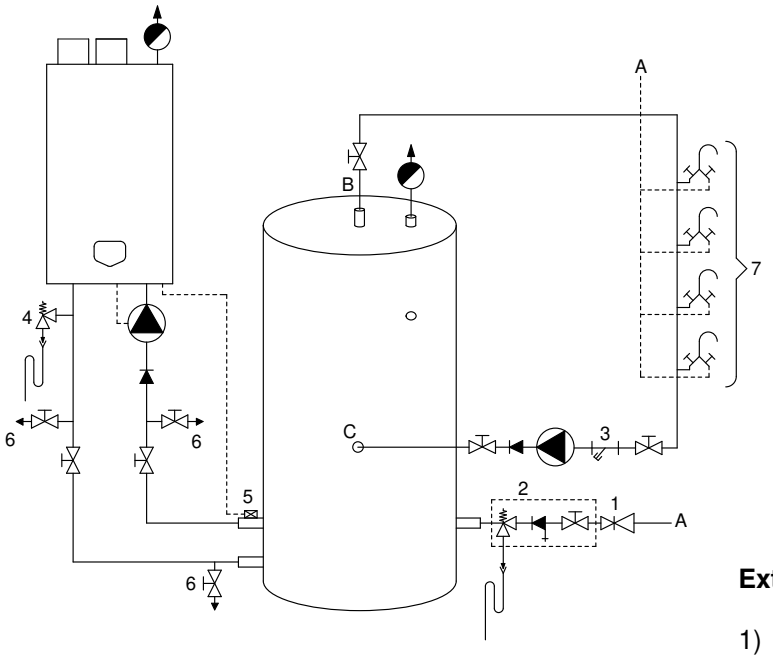
SAFETY COMPONENTS

NB! The pictures in chapter 9.1.1 and 9.1.2 show examples of functional installations. The safety components as shown in these pictures are NOT necessarily conform all applicable standards and regulations.

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

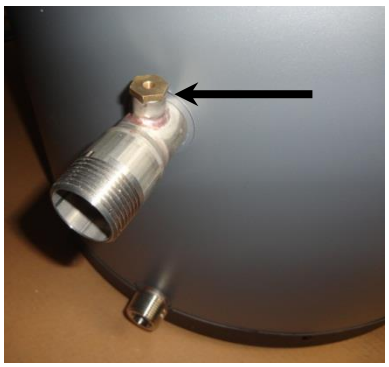
9.1.1 STAND-ALONE SET-UP

The basic form of a S-WG+ installation is one water heater with one tank. Shown in the picture are the principle components and connections.



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

Example of a combination of one water heater and one tank



Position tank sensor on ECO tanks

Tank sensor: see chapter 9.2.1.

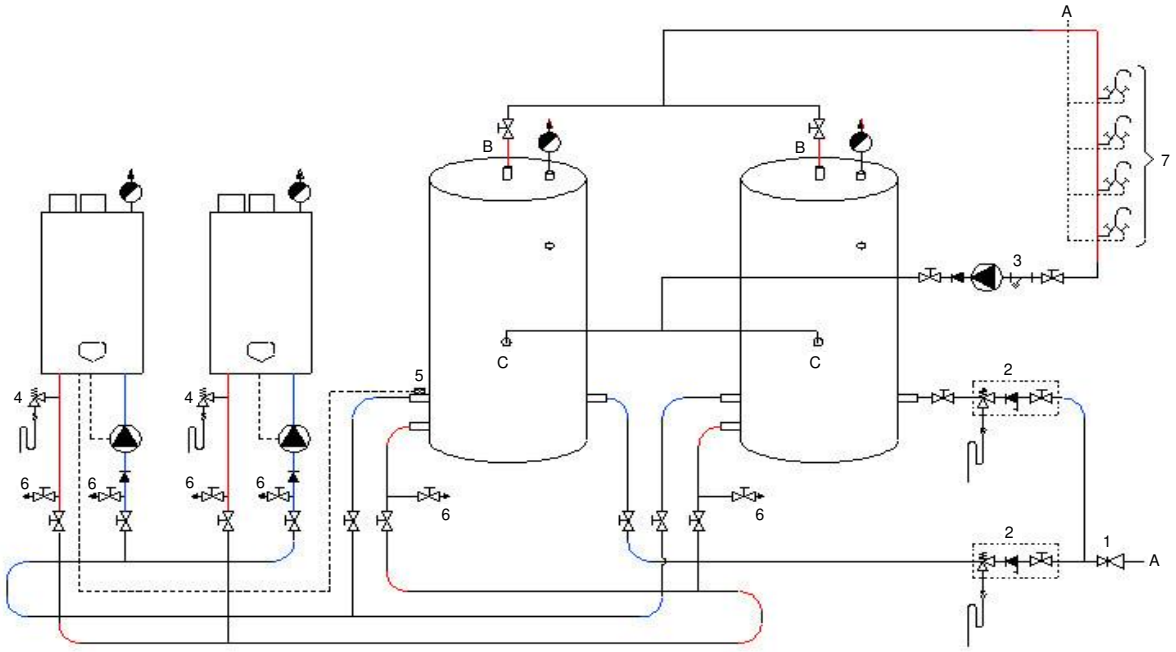
Extra explanation:

1) Pressure relief valve (mandatory in case service pipe pressure is too high)
2) Inlet combination with valve (mandatory)
3) Apply filter if necessary (recommended)
4) A suitable safety valve must be mounted near the water heater (mandatory) [1]
   This safety valve may never be isolated from the water heater by means of a ball 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

9.1.2 CASCADE SET-UP

S-WG+ water heaters and tanks can be installed cascaded in many possible combinations according to the instructions in the next paragraphs. Setups mostly used are 1 or 2 water heaters with 1 or 2 tanks, see the tables on the next pages. Contact Strebel Ltd if more heaters or tanks have to be cascaded.



Example of a combination of three water heaters and two tanks.

For the installation of cascaded water heaters and tanks, always consult the tables in chapter **Error! Reference source not found.**. All requirements concerning pipe diameters and lengths as well as pump selection are presented here. By applying these you'll improve both the well-functioning and the life time of your S-WG+ installation.

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

Extra explanation:

1) Pressure relief valve (mandatory in case water pressure is too high).
2) Inlet combination with valve (mandatory).
3) Apply filter if necessary (recommended).
4) A suitable safety valve must be mounted near the water heater (mandatory).
   This safety valve may never be isolated from the water heater by means of a ball valve.
5) Mount remote tank sensor in the screw hole on the return pipe of one tank (see picture) (necessary)
   When screwing is not possible, mount the tank sensor on the return pipe as close as possible to one of the tanks.
6) Drain valve (recommended)
7) Hot and cold-water mixers

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

Notes:

- Connections on the water heater side should **always** be executed as drawn in the picture above.
- *Always apply safety components according to all applicable regulations.*
- Sensor mounting: Next Page.
- In case of more than one tank, mount the tank sensor on one of the tank outlets. The temperature of this tank will be assumed to be representative for all, provided that the installation design is correct.
- In the inlet (return) connection of the water heater no check valve is recommended.
- All designs and tables in the next paragraphs go up to two water heaters max. If needed, the water heater control can handle up to twelve water heaters.
- For large capacity installations (more than two water heaters) consult Strebel Ltd.

9.2 Control

9.2.1 TANK SENSOR

With the S-WG+ water heater, a threaded sensor is supplied as tank sensor.
On a new tank, this sensor can be mounted on the return pipe right away.

The use of this threaded sensor is also recommended for existing tank set-ups, because its controlling behaviour is more stable than that of the strap-on pipe sensor.

When this threaded sensor is used on an existing tank set-up, a reducing nipple may be needed, to be able to mount the sensor on the return of the tank, provided that this return has a threaded socket, i.e. this tank is not older than from 2008.

On other tanks, generally the supplied threaded sensor cannot be applied; the existing pipe sensor must be kept in use and be connected to the water heater control. Check that this sensor has been placed on one tank return, as close as possible to this tank.



E04.016.677 Threaded sensor (M5x5) with Molex connection.

- Supplied with the water heater, cable with Molex connector included.



E04.016.304 Strap-on pipe sensor.

9.2.2 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 is measuring the water temperature of the tank.
- When no water is drawn from the tank, the tank sensor is measuring 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.
- When an RCW remote wall controller is connected to the wire terminal (13) and (14), the setting of the tank temperature can be done with this controller (Open Therm bus), also the night or weekend reduction of tank temperature.
- 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 of the parameters of the water heater control have been set for this type of tanks.

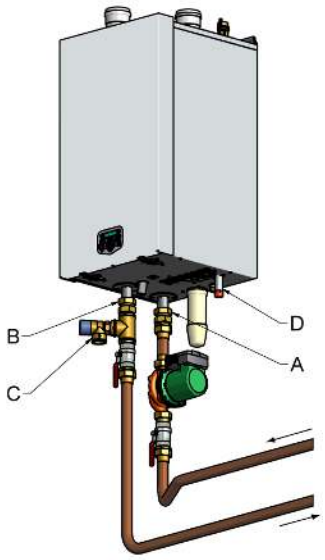
9.2.3 CASCADE CONTROL

- Up to twelve water heaters can be cascaded.
- One water heater has to be appointed master, the other water heaters are appointed slaves, each with his own address in the software.
- The slaves are connected with two wires to the master.
- Every individual water heater has a connection for a pump.
- An external tank sensor (S3) is placed at the inlet tube to the water heater(s) (see description on top of this page) measuring the tank water temperature.
- At a heat demand, the master water heater controls the heat output of the slaves, on base of the measured temperature of the tank sensor.
- When a slave stops burning, the pump connected to this slave has a post turning time.
- When one water heater in the cascade installation is burning, the fans of the other water heaters are turning at a low speed, preventing recirculation of the flue gases.
- Flow monitoring cf. chapter 8.4 remains active in every separate water heater of the cascade.
- Parameters: for cascade parameters see chapter 10.17. (parameter menu C).

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 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

9.3.2 TO CONNECT 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 were 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:

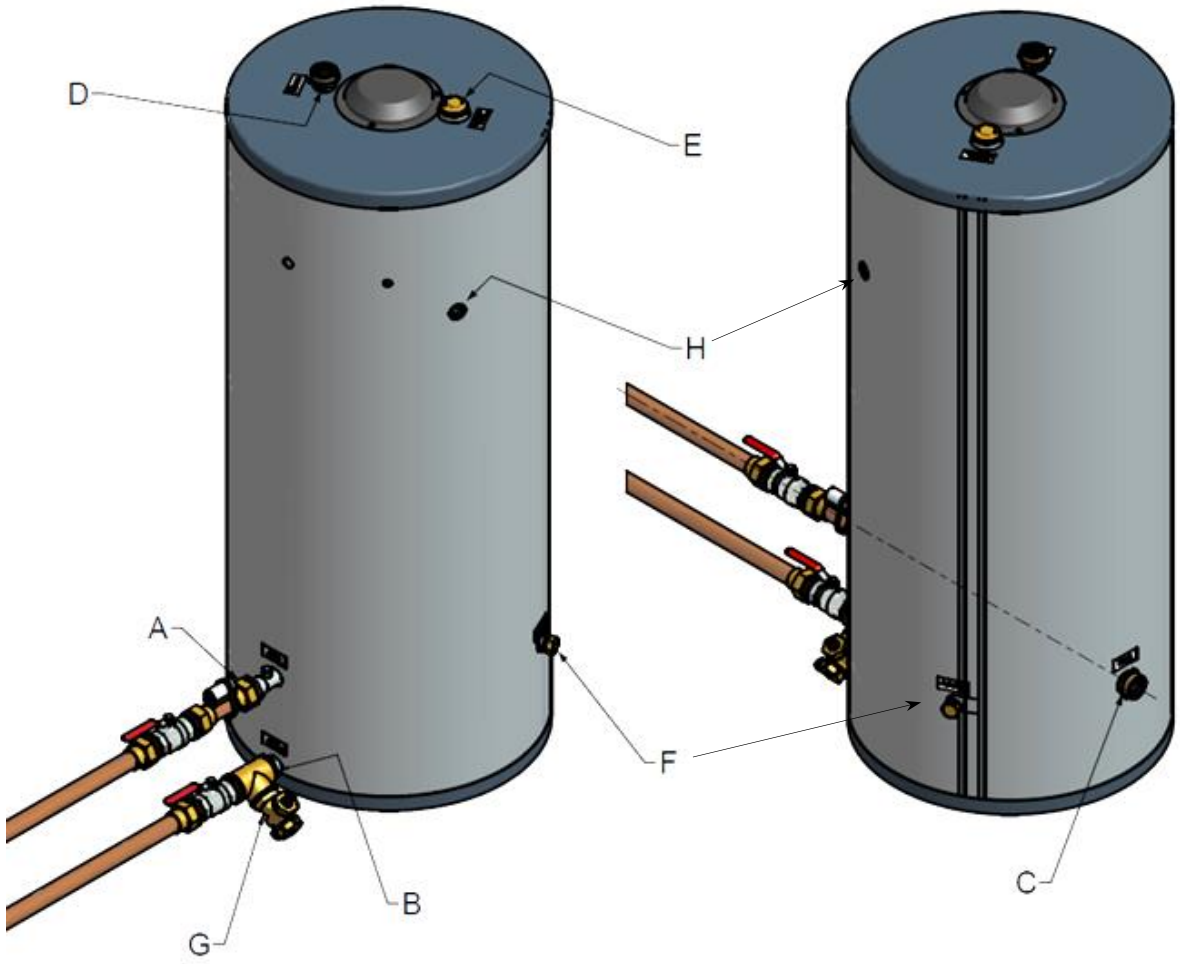
- COLD IN for inlet of fresh water
- HOT OUT for outlet of DHW
- water heater return for connection to inlet of water heater
- water heater flow for connection to outlet of water heater
- CIRCULATION RETURN for recirculation of DHW from installation to tank

Besides there are connections for:

- Thermometer (on side on ± 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 has to be applied, the safety at the water heater's side, on position C (← see previous page), should be maintained at all times.

Tank connection sizes:

Code	Connection	M / F	Remarks	300L	500L	750L
A	return to water heater	M	incl. reducing ring excl. reducing ring	R 2" R 1½"	R 2" R 1½"	R 2" R 1½"
B	flow from water heater	M	incl. reducing ring excl. reducing ring	R 2" R 1½"	R 2" R 1½"	R 2" R 1½"
C	cold water inlet	M	incl. reducing ring excl. reducing ring	R 2" R 1½"	R 2" R 1½"	R 2" R 1½"
D	DHW outlet	M	incl. reducing ring (Fitted) excl. reducing ring	R 2" R 1½"	R 2" R 1½"	R 2" R 1½"
E	free connection (T&P valve)	F	incl. plug	Rp 1½"	Rp 1½"	Rp 1½"
F	circulation return	M	incl. cap	R 1½"	R 1½"	R 1½"
G	bleed valve	-	-	-	-	-
H	thermometer connection	F	incl. plug	Rp ½"	Rp ½"	Rp ½"

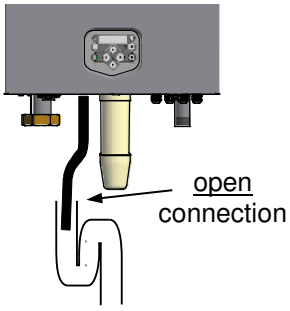


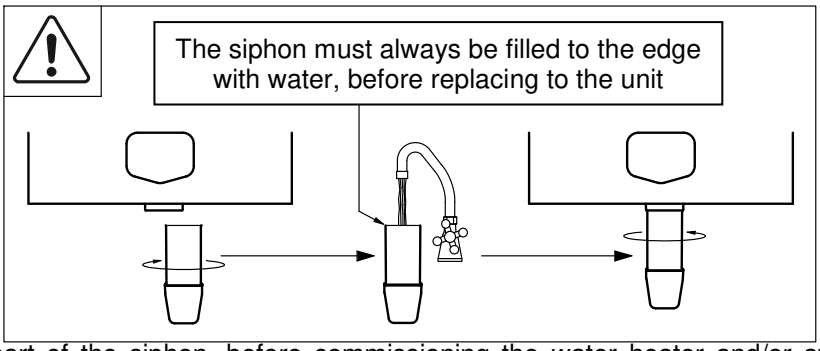
9.3.3 CONDENSATE DRAIN CONNECTION

The condensate drain is placed at the centre 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:





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 water heater room via the condensate drain.

9.4 Cascade systems: Pipe Codes

9.4.1 PIPE CODES WATER HEATER SIDE

Pipe codes for an installation of only one water heater:

- There's only one hot- and one cold-water pipe, both encoded D1, and also the main connection diameter D = D1.
  So water heater sided only one pipe diameter is needed. Values in table **A**, Chapter **Error! Reference source not found.**

9.4.2 EQUIVALENT LENGTH

Equivalent length:

- Length of the connecting pipes from the water heaters' cascade to the tank(s) may not exceed a certain measure. Components, such as bends and the like, contribute to the total length by their so-called 'equivalent lengths'.

  See table **E**: 'Equivalent lengths' in Chapter 9.6 on page 49.
- To achieve the new maximum length, the equivalent lengths of the applied components must be deducted from the allowed length without components (first column of the table).

ELABORATED EXAMPLES
At the end of this chapter, in chapter 9.8, three elaborated examples will be given, demonstrating how to apply the tables and values given in chapter **Error! Reference source not found.** up to chapter 9.7 (pump selection).

9.5 Diameters – tables

General remark: diameters may never be chosen smaller than specified in the tables; flow must remain guaranteed.

9.5.1 WATER MANIFOLDS

The figures in the tables refer to **diameter×wall thickness (mm×mm)** of the corresponding pipe.

Diameter D1 = (OUTLET and INLET of each water heater)	
S-WG⁺ 80	35×1,3
S-WG⁺ 100	42×1,4
S-WG⁺ 120	
S-WG⁺ 150	
S-WG⁺ 180	54×1,5

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

Diameters D = (MAIN CONNECTING PIPES to the tank(s))	
	2 Cascaded Water Heaters
S-WG⁺ 80	54×1,5
S-WG⁺ 100	
S-WG⁺ 120	67×1,9
S-WG⁺ 150	
S-WG⁺ 180	80×2,1
* D = D1 using a system having 1 water heater (see table A).	

Table **B:** *Main connecting pipes to the tank(s)*

9.5.2 TANK HEADERS

The numbers in the tank table are **diameter × wall thickness (mm × mm)** of the connecting pipe to each tank D_T

Diameters D_T =	**(TANK in- and outlet)**	
S-WG⁺ 80	**number of cascaded water heaters**	
	1	**2**
1 Tank	35×1,3	54×1,5
2 Tanks	28×1,2	35×1,3
S-WG⁺ 100	**number of cascaded water heaters**	
	1	**2**
1 Tank	42×1,4	54×1,5
2 Tanks	28×1,2	42×1,4
S-WG⁺ 120	**number of cascaded water heaters**	
	1	**2**
1 Tank	42×1,4	67×1,9
2 Tanks	35×1,3	42×1,4
S-WG⁺ 150	**number of cascaded water heaters**	
	1	**2**
1 Tank	54×1,5	67×1,9
2 Tanks	35×1,3	54×1,5
S-WG⁺ 180	**number of cascaded water heaters**	
	1	**2**
1 Tank	42×1,4	80×2,1
2 Tanks	54×1,5	54×1,5

Table **C:** *Tank connections D_T*

9.6 Equivalent lengths – table

When the water heaters and tanks are separated over some distance, the interconnecting pipes may only have a certain maximum length, dependent of the number of bends and the like components. For every applied component a so-called 'equivalent length' is deducted from the total allowed.

The meaning of the connection 'VL' can be seen in the drawing below.
The diameter of this connection VL should meet at least the specified pipe diameter D. For this pipe connection, the maximum straight length **of flow and return part added *** has been specified in the table below.

* The real available maximum distance VL between water heaters and tanks is therefore half of the length specified in the table!

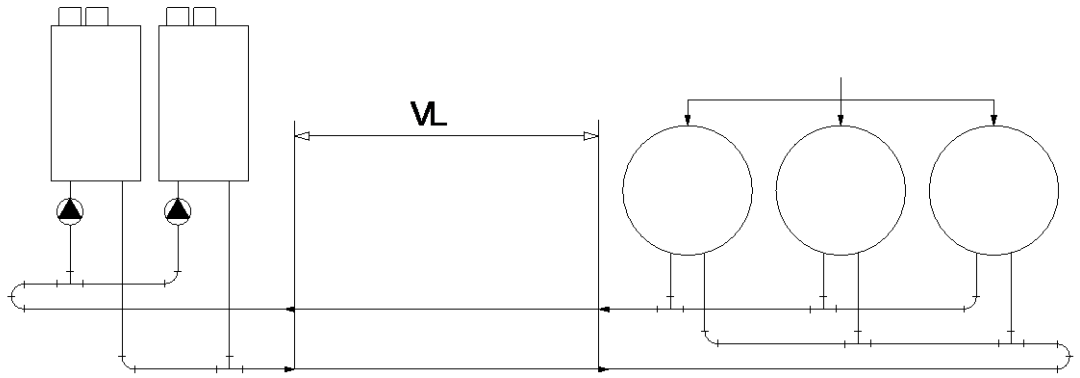


Figure 9.3 Drawing in which pipe connection 'VL' is displayed

Each component that's added to the straight pipes is contributing to the total resistance, and will therefore cause a necessary reduction of straight length. The table contains a number of commonly used components and their equivalent length:

Copper pipe diameter D	Maximum straight length **flow + return**	equiv. length 90° elbow R=0.5×D	equiv. length 90° elbow R=1.0×D	equiv. length 45° bend R=1.0×D	e.l. of fully ported ball valve
mm×mm	*m*	*m*	*m*	*m*	*m*
35×1,3	14,9	0,7	0,2	0,1	0,1
42×1,4	15,8	0,9	0,3	0,2	0,1
54×1,5	17,3	1,2	0,4	0,2	0,2
67×1,9	17,9	1,4	0,5	0,3	0,2
80×2,1	19,5	1,7	0,6	0,3	0,3

Table **E:** *Equivalent lengths*

Example:
Suppose, for a project the diameter D has been specified the value 67×1,9, so the maximum allowed straight length is 17,9 m (see table).
In the connection is added

- 4 × bend 90°, R=0,5×D
- 2 × fully ported ball valve

This gives a reduced allowed straight length of:
17,9 – (4×1,4) – (2×0,2) = 11,9 m
With this component configuration one may only use **11,9 m straight length**.

→ The distance between water heater main connections and tank main connections in this example is therefore ~6 m at max.

9.7 Pump selection – tables

Pump selection is important, because, in combination with the system's total resistance, it sets the water velocity in water heater and pipes. The right water velocity is essential for correct functioning and life time of the system.

9.7.1 PUMP SELECTION

Select the pump for your S-WG+ 80-180 installation using the following tables, by looking up, in the table that relates to the S-WG+ 80-180water heater type you installed, the applied combination of numbers of cascaded water heaters and tanks**.**

Three pump types: P1 = Grundfos UPMXL GEO 25-125N-180
P2 = Grundfos UPS 32-100N
P3 = UPS 40-120 FB

S-WG+ 80	**number of cascaded water heaters**	
	1	**2**
1 tank	P1	P1
2 tanks	P1	P1
S-WG+ 100	**number of cascaded water heaters**	
	1	**2**
1 tank	P2	P2
2 tanks	P2	P2
S-WG+ 120	**number of cascaded water heaters**	
	1	**2**
1 tank	P2	x
2 tanks	P2	P2
S-WG+ 150	**number of cascaded water heaters**	
	1	**2**
1 tank	P2	x
2 tanks	P2	x
S-WG+ 180	**number of cascaded water heaters**	
	1	**2**
1 tank	P3	x
2 tanks	P3	P3

Table F: *Pump table*

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

Water heater		**Pump**	**Part no.**
S-WG+ 80	(P1)	Pump UPMXL GEO 25-125N-180	E400280
S-WG+ 80-150	(P2)	DHW pump UPS 32-100N	E400102
S-WG+ 180	(P3)	DHW pump UPS 40-120 FB	E400176

9.7.2 NOMINAL FLOW PER WATER HEATER TYPE

Water heater	**Flow [m^3/h]**
S-WG+ 80	3,97
S-WG+ 100	4,77
S-WG+ 120	6,36
S-WG+ 150	7,15
S-WG+ 180	9,54

9.7.3 PUMP CONTROL



The applied pump must be controlled only by the S-WG+ 80-180 water heater control. If, for any reason, an external pump control is applied *without written approval of Strebel*, then the complete warranty on the S-WG+ 80-180 water heater and all delivered parts will become invalid.

9.7.4 PUMP: MAXIMUM ELECTRICAL POWER

General
- The inrush current of a conventional pump is approximately 2½ x its nominal current.
- The maximum switch current of the relay on the PCB is 5 A.

The conclusion from this is that nominal currents of pumps, controlled by the PCB, may not exceed 2 A.

S-WG+ pump.
The nominal current of the pump must be equal to or lower than 2 A.
All pumps of chapter 9.7.1 fulfil this condition.

Warning (EC pumps):
In case of using an electronic commutating pump, the relays 1, 2 or 3 may not be used for the power connection, because of the inrush current of the electronics of the pump.
Directly connect the pump to an external power supply.
Control connections of an EC pump can be established in several ways, set by parameter P5BN.
See chapter 11.1.5.

9.8 Elaborated examples

To work out the examples in this section:

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

– There's only one flow pipe and one return pipe, both encoded D1. For the right diameter value see table **A** in chapter **Error! Reference source not found.**. The main pipe diameter D equals this value.

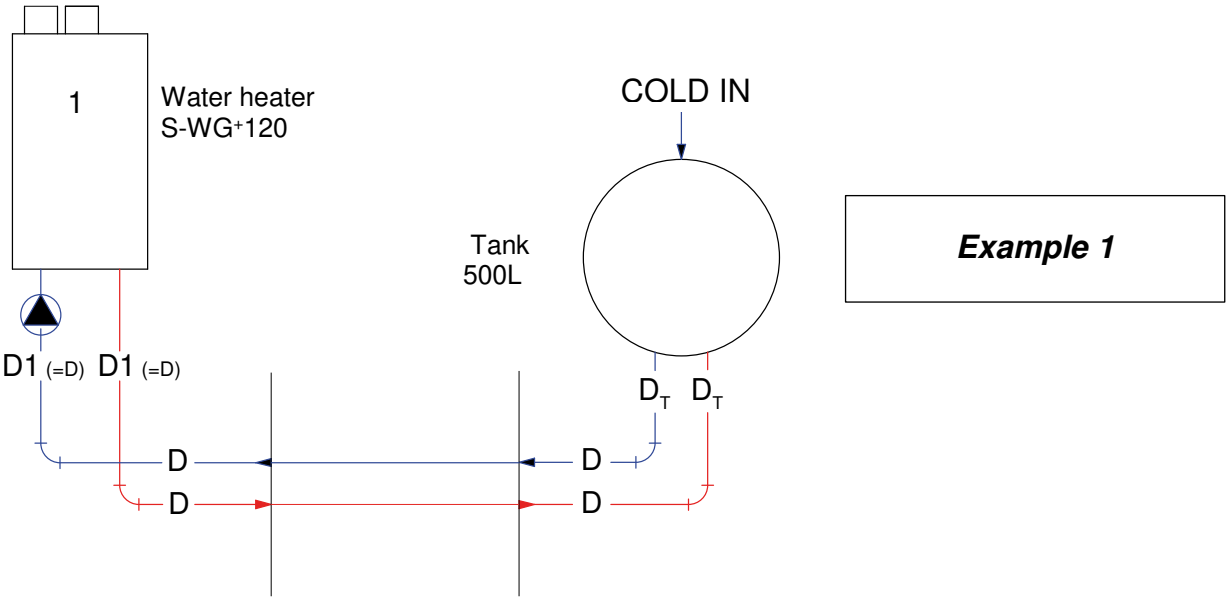
2. **Codes for cascades: two or more water heaters connected:**

- First number the water heaters: water heater-1 is the one whose hot water connection is situated the furthest away from the tank(s).
- Connections directly to the water heaters: D1 = 54×1,5 (mm×mm).
- Number the horizontal hot water pipes between water heaters: from D1 at water heater-1 to D at water heater-number-last (values: table **B** in chapter **Error! Reference source not found.**).
- Number the horizontal cold-water return pipes between water heaters 'reversely': from D1 at water heater-number-last to D at water heater-1.

3. **Codes for tank connections:**

- Pipes between the connections: D. Values from the water heater table **C** (chapter **Error! Reference source not found.**).
- Tank connections: D_T (entrance and exit). The values are found in the tank table **D** (chapter **Error! Reference source not found.**)

9.8.1 ONE S-WG+120 WATER HEATER WITH ONE 500L TANK



Example 1

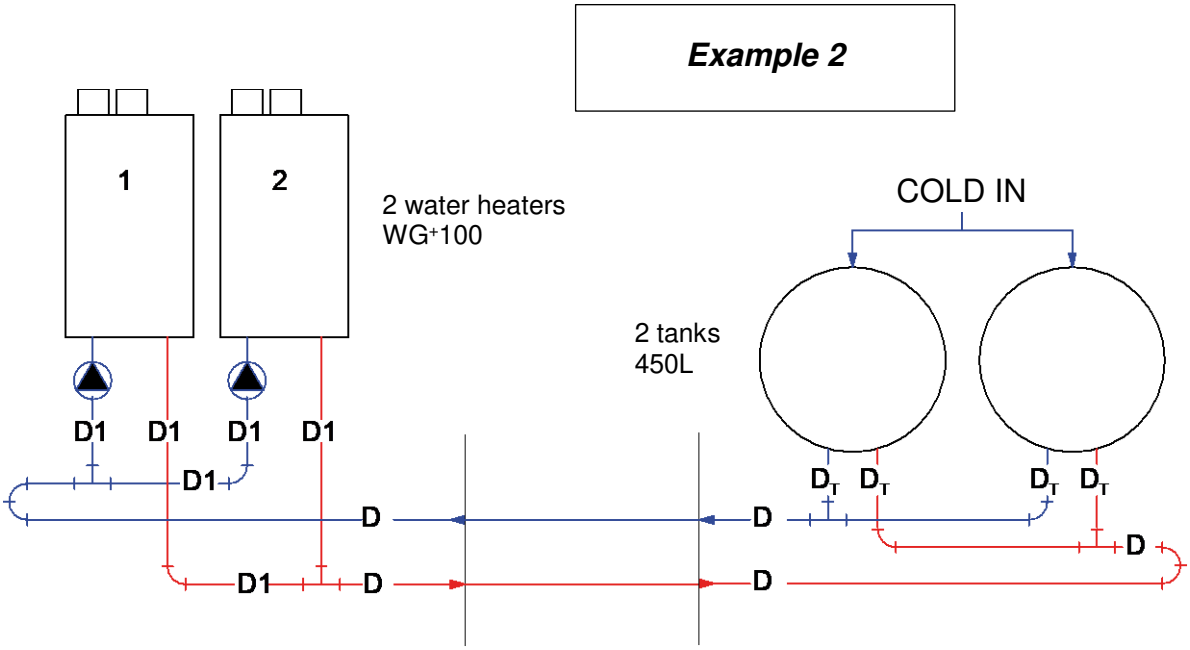
Water heater and tank connections:
For this system rule 1 must be applied, so only one pipe size is needed.
No numbering of water heaters, tanks and connections is required.
From table **A**: for 1 water heater is D1=D = 42×1,4 [mm×mm]
From table **D**: for 1 tank is D_T = 42×1,4 [mm×mm]

For this system, pipes sized at least 42 x 1.4 [mm×mm] are required for all connections.

Length of the connecting pipes water heaters ↔ tanks
From table **E**:
The maximum total length of flow and return pipes 42×1.4 [mm×mm] is 24,2 m.
So when 42×1,4 [mm×mm] is applied, the physical distance between water heaters and tanks may be half of this, so ~ 6 m, at max. In case bends and/or valves are used, this distance becomes less than 6 m. Use table **E.**

Pump
From table **F**: Use pump **P2**.

9.8.2 TWO S-WG+100 WATER HEATERS WITH TWO 500L TANKS

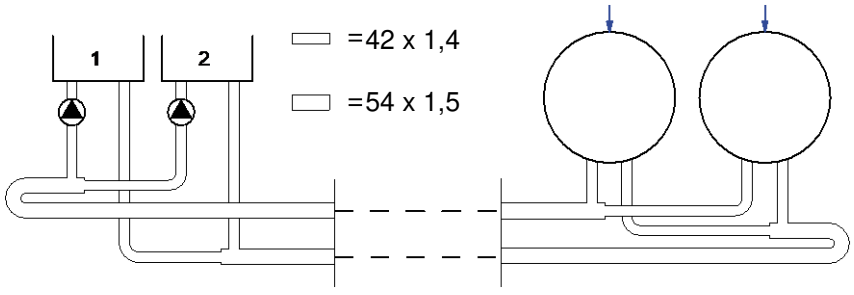


Water heater connections, encoding:
For this system rule 2 must be applied.
Number the water heaters: water heater-1 is the water heater furthest from the tank(s), see picture.
Encode de connection pipes directly connected to the water heaters: D1, see picture.
Encode de horizontal connection pipes: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

Pipe sizes, water heater side:
From tables **A, B** and **C**, WG+100:
- All pipes D1 in the picture must measure at least 42×1,4 [mm×mm] (tables **A** and **B**)
- The pipes D must measure 54×1,5 [mm×mm] (table **C**)

Tank connections:
From **table D**, 2nd block (CD+100): for 2 tanks D_T = 42×1,4 [mm×mm].

So, for this system, pipes sized at least 54×1,5 [mm×mm] are to be applied for all connections directly on water heaters and tanks, and pipes sized at least 67×1,9 [mm×mm] for the connections between them.

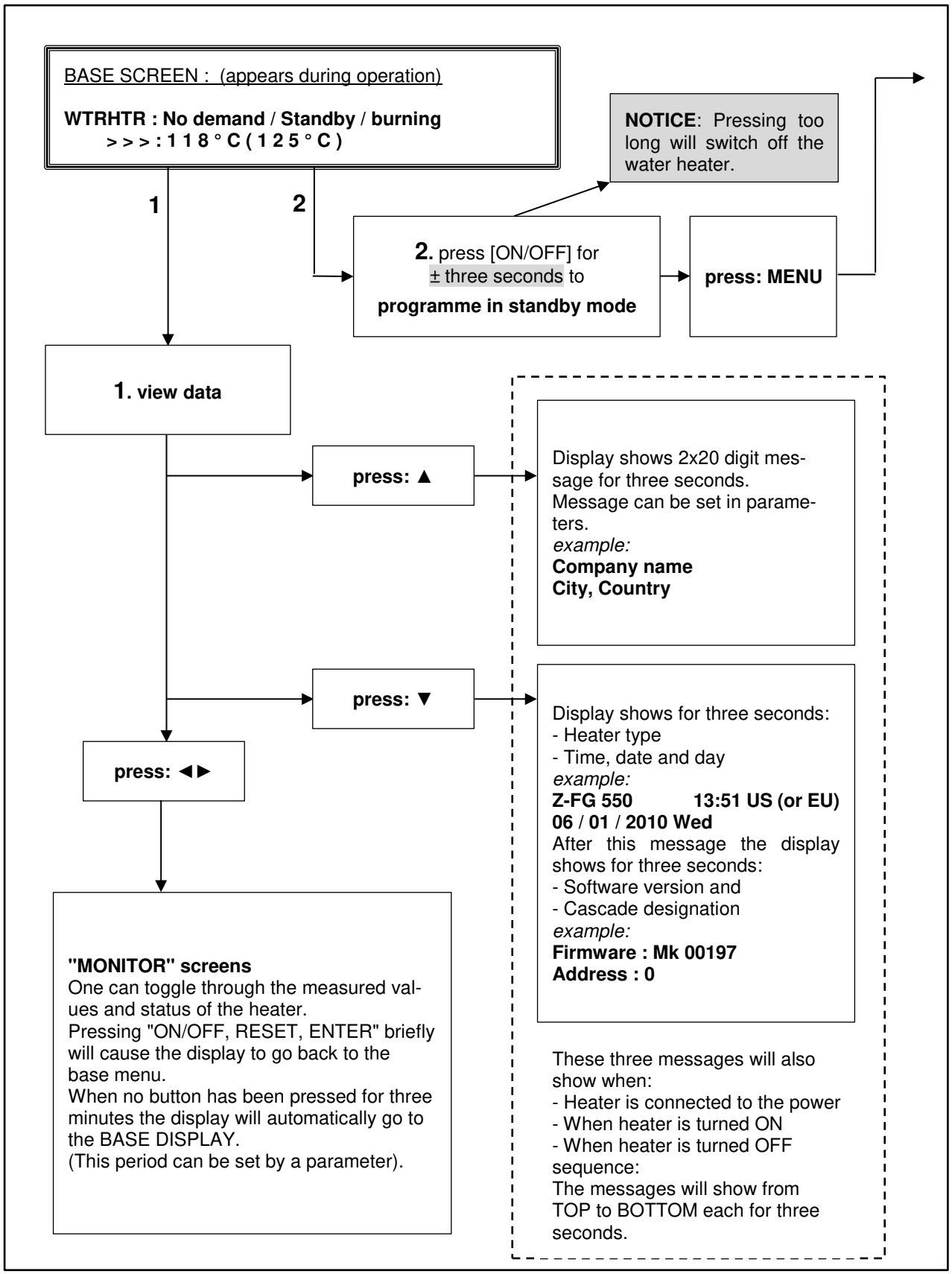


Length of the connecting pipes water heaters ↔ tanks
From **table E**:
The maximum <u>total</u> length of flow and return pipes 54 x 1,5 [mm×mm] is 17,3 m.
So, when 54 ×1,5 [mm×mm] is applied, the physical distance between water heaters and tanks may be half of this, so ~ 8 m, at max. Using bends and/or valves, this distance becomes less than 8 m. Use table **E**.

Pump
From table **F**: Use two pumps **P2**.

10 USER INTERFACE

10.1 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 one can set the time and the date.

"SETPOINT" menu
In this menu one 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 one can set the DHW and Anti Legionnella program.

"OPERATING HISTORY" menu
Shows burning hours DHW, etc.

"FAULT HISTORY" menu
press: ▼ Reading last fifteen 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 one 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 has to push the : MENU and simultaneously press ▼ for six 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 one can change parameters. The possible access depends on the password that is used.

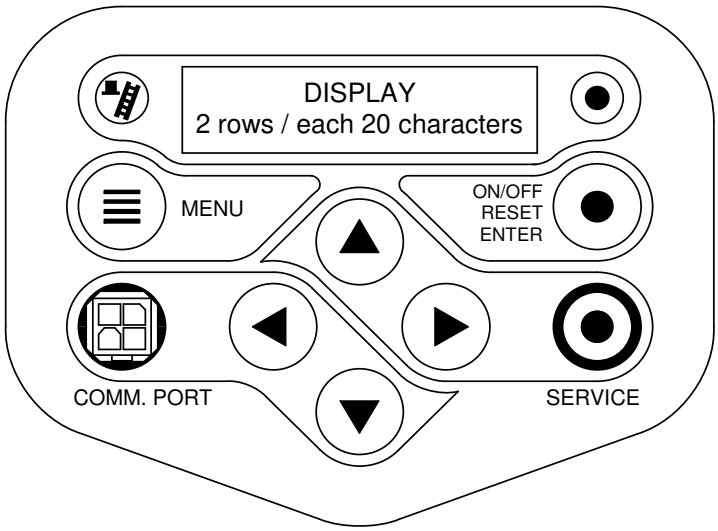
Enter password

parameter menu

Enter PW **Level 1:**
three second message confirming access:
LEVEL 1

Enter PW **Level 2:**
three second message confirming access:
LEVEL 2

10.2 Control panel display and keys



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.

10.3 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 communication indicator				set point water temp.							temp. 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 in 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		
dTFlowReturn	123,9°C	Temp. difference between internal flow & return.
dTFlueReturn	123,9°C	Temp. difference between flue gas & internal return.

SCREEN: 5		
dTExtReturn	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	9999rpm	Actual fan speed in rpm.
Fan speed	100%	Actual fan speed % of maximum allowable fan speed.

Fan maximum RPM: 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 the design of that specific unit.

SCREEN: 7		
Flamesignal	100µA	Flame signal given in µA.
WaterPressur	1,0bar	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-wayValveHeating		Signal to the 3-way valve: "HEATING" or "HOTWATER".

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

SCREEN: 11	
Casc Design 0	0 = MASTER, 1 ..... 11 = SLAVES
Cascinf 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 is providing 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 nr. 3 has priority.

Example 2: "3 4 x - - - - - - 0 1 2"
There are six water heaters present and nr. 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".

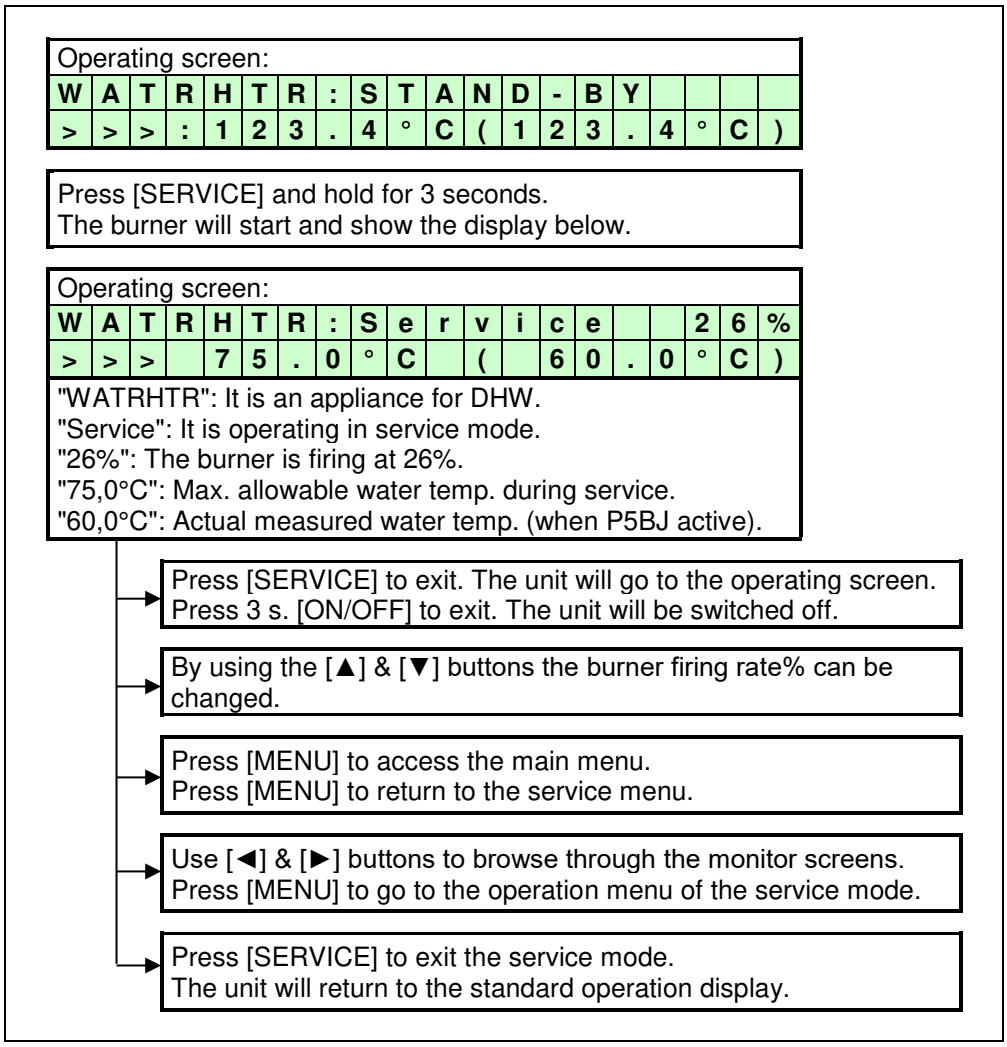
SCREEN: 13	
Max Therm Open	Status of the maximum thermostat: "Open" or "Closed".
Gen Block Closed	Status of the general blocking contact: "Open" or "Closed".

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 water heater.

10.5 Service function

The following graphs describe how to use the service function.



10.6 Schornsteinfeger function

The following graphs describe how to use the Schornsteinfeger function.
NOTICE: This function is required for Germany and can be activated by parameter (P5 BK).
The standard factory setting for this function is “OFF”.

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 similar to the normal service function of the water heater.



When the "Schornsteinfeger" button is pressed for 3 seconds:
the heater will fire at **minimum firing rate (%)**
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 **50% firing rate**
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 **maximum firing rate (%)**
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 programme 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)

- Programme the water heater at the control panel (see the following sections).
- HINT: First programme 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 programme 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.

Heating set point normal/day time: (parameter P4 AA = 1/2)
DHW setpoint
60 °C
This is the water temperature set point that is active during the programmed DHW periods (parameter P4 AA = 1/2)

DHW set point reduction: (parameter P4 AA = 1/2)
DHW Reduce
10 °C
The reduction of the normal/day time set point. This reduction is used outside the programmed DHW periods.

DHW setpoint reduction: (parameter P4 AA = 2 and P5 DJ&DK =1)
Heating setpoint
75 °C
This parameter is the local setpoint of the water heater and is regulated on sensor S1 (parameter P4 AA = 2, P5 DJ = 1 and P5 DK =1).

NOTICE:
The max. actual DHW temperature will never exceed the value set at Heating Setpoint Regardless the set DHW setpoint
If higher DHW setpoints are needed the Heating Setpoint has to be set higher also.

10.10 Setting the timer programs

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

- DHW program
- Anti-Legionnaires' disease (pasteurisation) 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 programmed for a period, it will not be used.
(Example no time programmed in period 3 on Monday > **"Mon 3 --:-- ---:--"**).

Operating screen:
WATRHTR: boiler off
>>>:123.4°C(123.4°C)

Press [MENU]

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

Main menu screen:
Main Menu
Timer

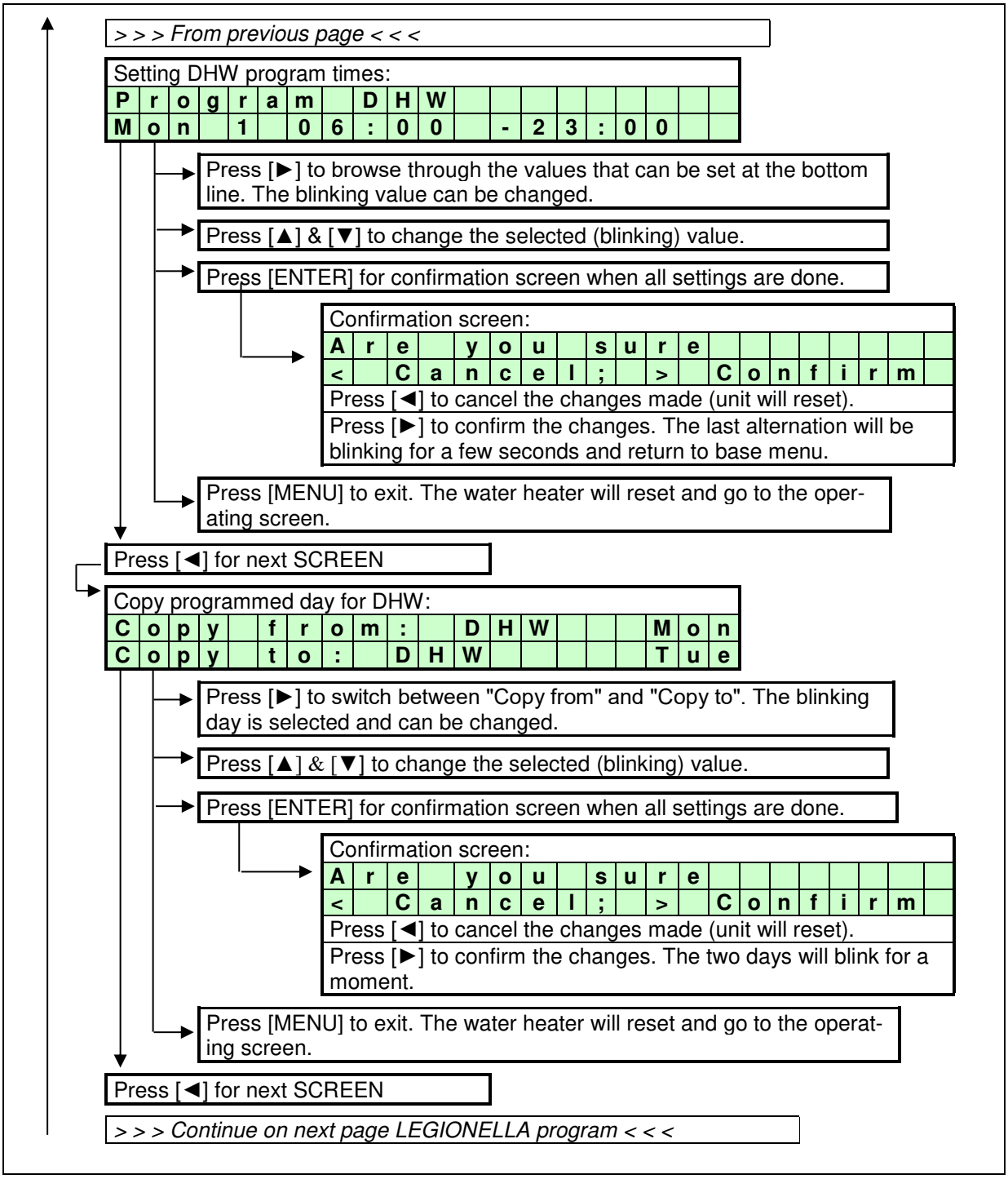
Press [ENTER]

Setting program times:
Program CH
Mon 1 06:00 - 23:00

Press [◄] for next SCREEN

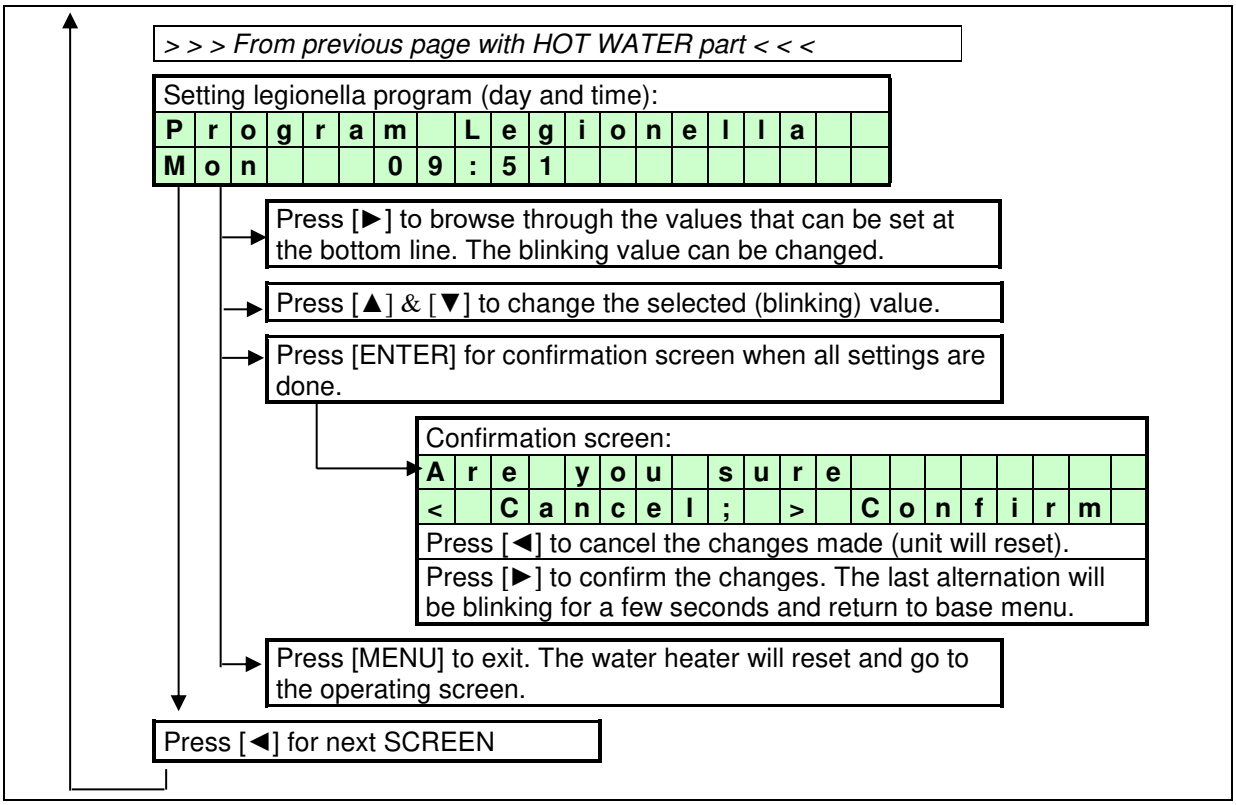
> > > Continue on next page HOT WATER program < < <

10.11 HOT WATER PROGRAM



10.12 ANTI LEGIONNAIRES' DISEASE PROGRAM

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



10.13 Checking the operating history

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

Operating screen:
WATRHTR: boiler off
>>>:123.4°C (123.4°C)

Press [MENU]

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

Main menu screen:
Main Menu
Operate

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

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

SCREEN: 1

Operating history
PowerOn hrs 13140

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

hrsCh Tot 100000
hrsDhw Tot 100000

Top line: Total burning hours for heating.

Bottom line: Total burning hours for domestic hot water.

SCREEN: 3

hrsCh <50% 100000
hrsCh =>50% 100000

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

hrsDhw <50% : 100000
hrsDhw =>50% : 100000

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

Tia 100000 Fia 100000
Ssl 100000 Sst 100006

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

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

10.14 Checking the fault history

The following graphs describe how to check the fault 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 "Faulthist" using [◄] & [►] and press [ENTER]																	
F	**a**	**u**	**l**	**t**	**h**	**i**	**s**	**t**						**N**	**o**	**.**	**0**	**1**
2	**1**	**/**	**0**	**4**	**/**	**2**	**0**	**1**	**0**	**W**	**e**	**d**		**2**	**2**	**:**	**2**	**3**	**A**

▲ blinking ▼

S	**i**	**p**	**h**	**o**	**n**		**S**	**w**	**i**	**t**	**c**	**h**							
S	**v**	**9**	**9**	**9**	**/**	**C**	**U**	**M**	**9**	**9**	**9**	**/**	**R**	**9**	**9**	**9**	**9**	**,**	**5**

Press [◄] & [►] to browse through the last 10 faults.

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

The fault menu shows the last 10 faults. For each fault the display blinks between the two screens shown above. The top line of the top screen shows the fault number and the bottom line of the top screen shows the date, day and time the fault occurred.

On the top line of the bottom screen the fault type is displayed. The bottom line shows the following:

SV: The total amount of this fault that has occurred after the last time that the service history was erased (after service was done).

CUM: The total amount of this fault. The total amount cannot be erased after service, this shows the fault history of the water heater (electronics) since the start of operation.

R: Shows the elapsed time in hrs between the moment the fault occurred and the moment it was reset.

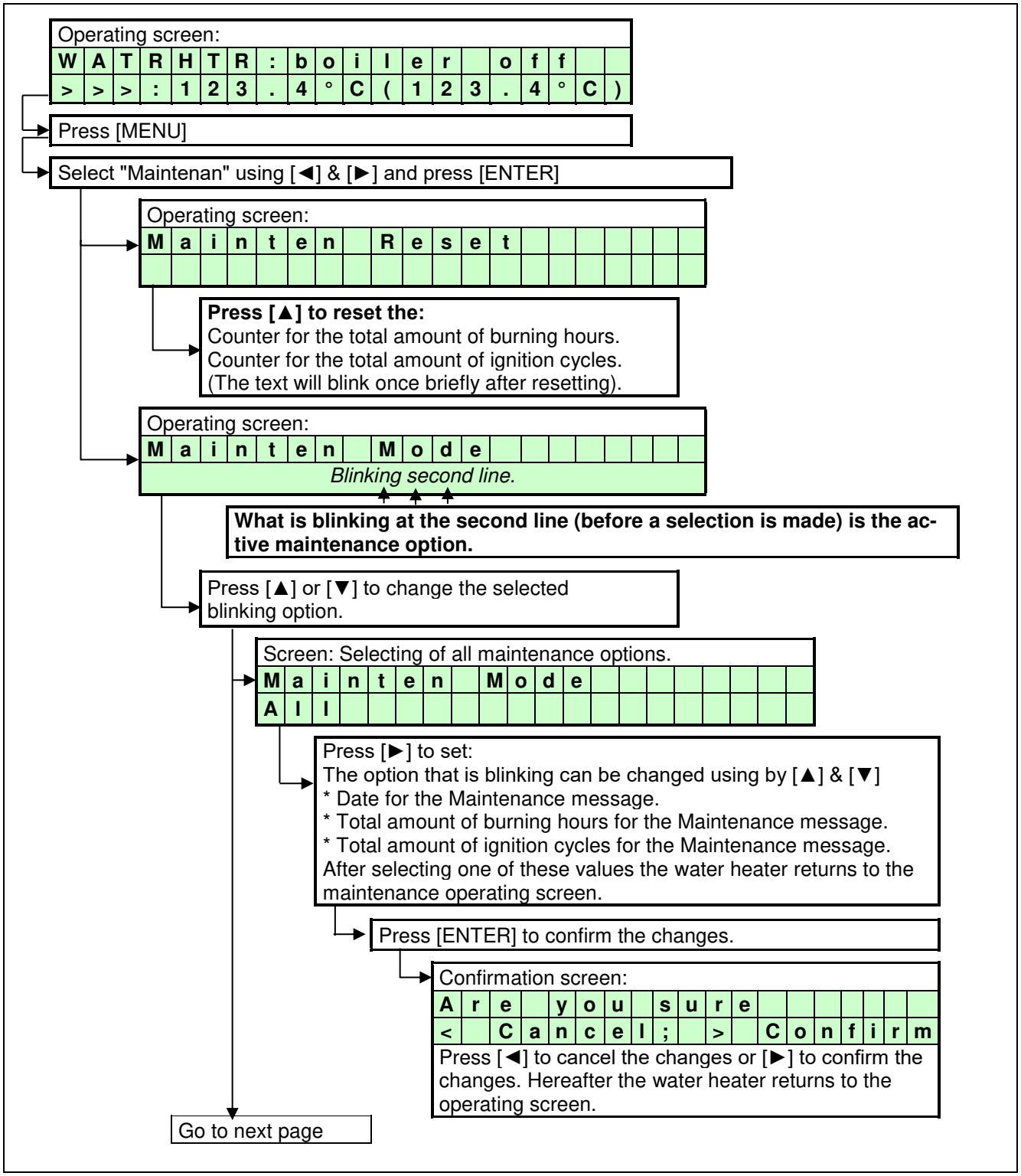
10.15 Setting the maintenance specifications

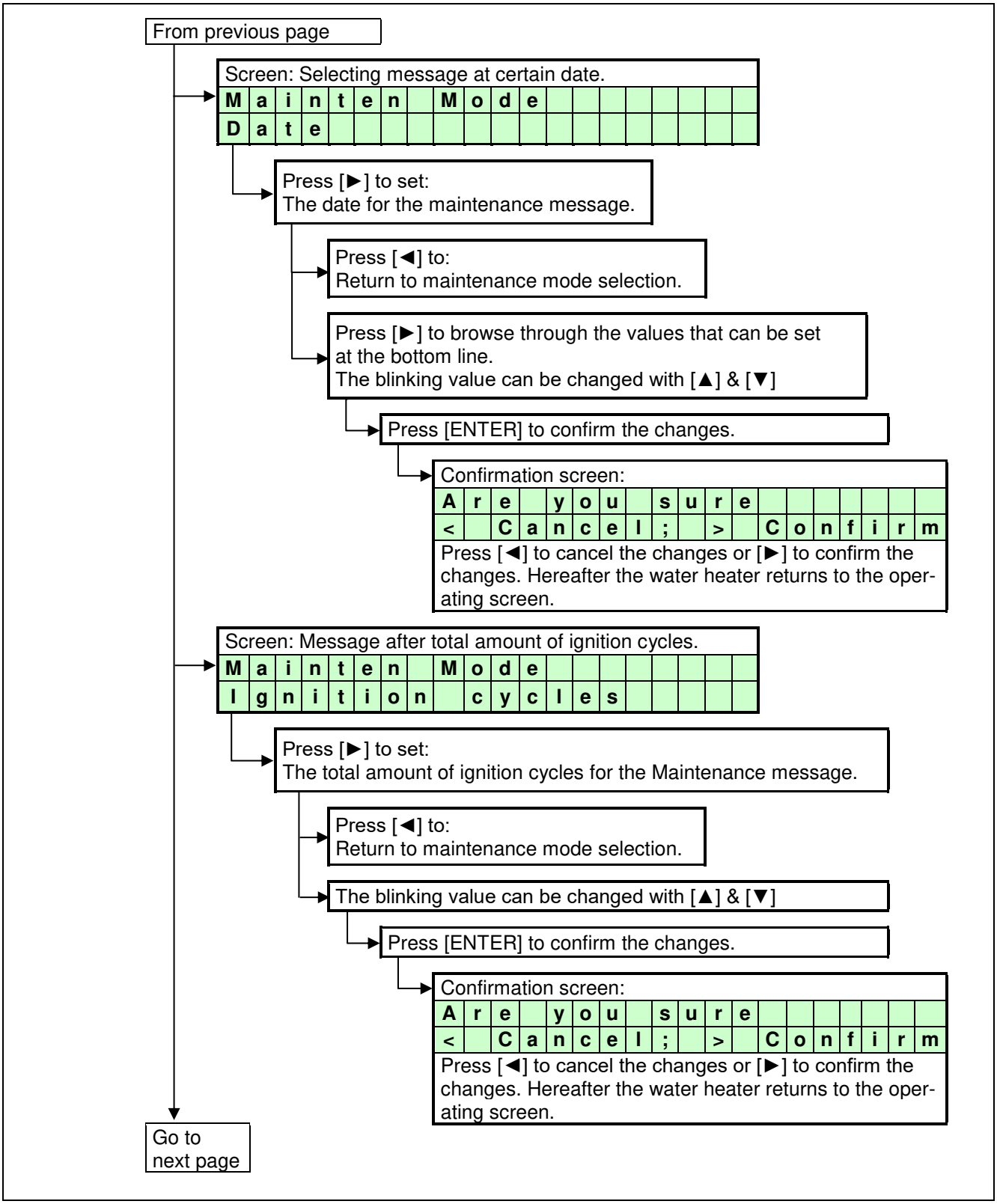
MAINTENANCE SETTINGS

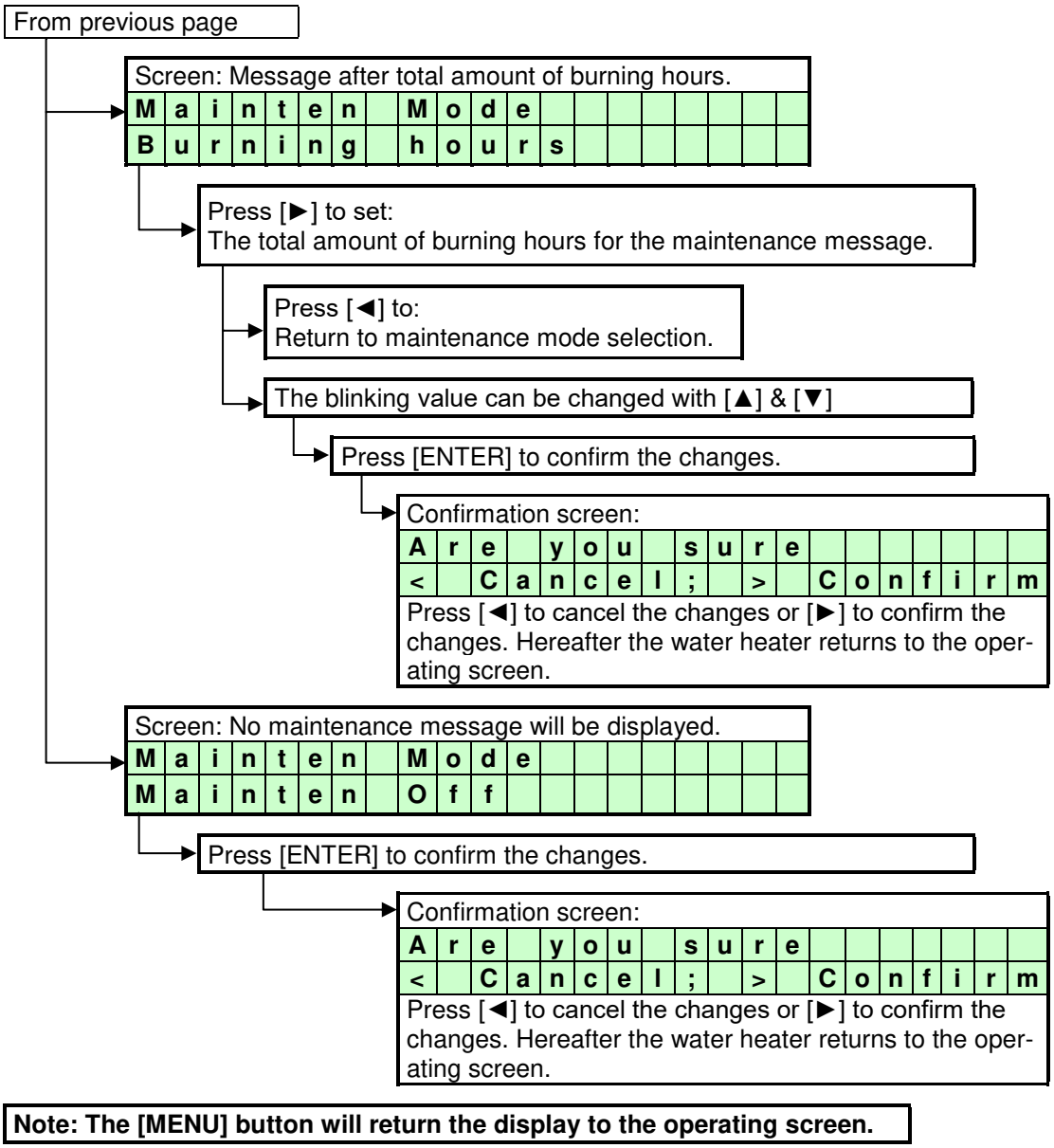
The unit can be programmed in such a way that an automatic maintenance message is displayed.
There are three options that can be selected. A maintenance message appears after:

* 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 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.

10.16 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 has to 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 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.

10.17 Setting the parameters at the control panel

The functions of the controller are embedded in de 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)	-	Stepmodulation	no
		2	P5AO	Blocking offset flow temperature control	°C	HEs Offset	yes
		3	P5AP	Proportional range temperature control	°C	HEs Prb 13	no
		4	P5AL	Hysteresis CH Flow temperature control	°C	HEs cDif 13	yes
		5	P2IC	Integration time temperature control	s	HEs cInt 13	no
		6	P2MI	Blocking offset System CH temperature control	°C	HE cOff 3	yes
		7	P2MJ	Proportional range System CH temperature control	°C	HE cPrb 3	no
		8	P2MK	Integration time CH temperature control	s	HE cInt 3	no
		9	P5AB	Timer Contact (1=on)	-	Timer Con	yes
DHW	B	1	P4AB	DHW Pump Config 0=Pump 1=TWV	-	DHpmp/twv	yes
		2	P5CB	Flow temperature DHW tank low	°C	DHif low LO	yes
		3	P5CK	Flow temperature DHW tank hi	°C	DHif low HI	yes
		4	P5CL	Low Flow temperature time DHW	min	DHi Low time	yes
		5	P5CD	Legionella temperature	°C	Legio temp	no
		6	P5CI	Legionella hyst DHW tank temperature	°C	Legio hysy st	no
		7	P5CJ	Legionella hold time (0=off)	min	Legio hold d	no
		8	P2KI	CH interrupt by Legionella (0=yes)(1=no)	-	Legio int nr	no
		9	P2LC	Regulation temperature offset DHWd	°C	DHds cOff 2	yes
		A	P2MN	Proportional range DHWd modulation	°C	DHds cPrb 23	no
		B	P2LD	Regulation temperature hysteresis DHWd	°C	DHds cDif 2	yes
		C	P2MO	integration time DHWd modulation	s	DHds cInt 23	no
		D	P2ML	Sys temp blocking offset DHW tank	°C	DHds cOff 3	yes
		E	P2MM	Sys temp blocking hysteresis DHW tank	°C	DHds cDif 3	yes
		F	P5CA	Hysteresis DHW tank temperature	°C	DHis cDif 4	yes
		G	P2KH	Gradient heat demand detect DHW tank temperature	°C	DHidetg rad	yes
CASCADE	C	1	P2MA	Max number extra water heaters	-	Max CascUnt	no
		2	P5DA	Bus address water heater	-	Bus adr ess	no
		3	P5DC	Dhw on entire cascade(0) only master(1)	-	DHic as/ mas	no
		4	P5DE	Extra Water heater output enable(1)	-	Extra unit	yes
		5	P5DF	Cascade detection (0=standalone 1=Leader)	-	Cas Si/ Ma	no
		6	P5BL	Power off total cascade (1)	-	Pwr OfTo Ca	no
		7	P5DB	Number of water heaters with common flue 0=None	-	Com FlueNu m	no
GENERAL	D	1	P5BB	Analogue input Config (0=off 1=temp)	-	An In pt Con	yes
		2	P5AI	Minimum Temperature 0-10V input	°C	0-10 Min Tm p	yes
		3	P5BI	Altitude (in amounts of 100 ft.)	ft*100	Alt * 100 ft	yes
		4	P2LK	Max cooling time	min	Max CoolTi m	yes
		5	P5BJ	Temperature display 1=on	-	Tempe rDis p	yes
		6	P4AA	DHW 0=off 1=Indirect 2=Direct	-	DHW 1=i 2=d	no
		7	P4AD	pressure 0=off 1=sensor and 2=switch	-	conf ig	no
		8	P4BD	Gas type values 0-2	-	gas typ e	no
		9	P4BE	Soft start type values 0-2	-	con fig	no
		A	P5BN	Pump modes 0-3	-	con fig	no

For extensive explanation see Ch. 0: ‘Controlling options and settings’.

IMPORTANT: Do not change the parameters P2LC, P2LD, P2ML, P2MM and P5BI; they are present in the controller for different purposes than DHW control. Changing these parameters may affect water heater operation negatively.

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 amount 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).

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 boilers supply temperature control. This parameter is the offset of the selected CH supply temperature of EACH boiler of the total cascade.																		

Menu A: Heating																		
	A	**7**				**H**	**E**			**c**	**P**	**r**	**b**		**3**			
										2	**5**		**°**	**C**				
Select the cascaded boilers supply temperature control. This parameter is the proportional range of the selected CH supply temperature of EACH boiler 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 boilers supply temperature control. This parameter is the integration time of the selected CH supply temperature of EACH boiler 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 boiler 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 boiler. 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 boiler. This parameter is the CH supply temperature HIGH level with an indirect hot water demand.																		

Menu B: Hot water																		
	B	**4**				**D**	**H**	**i**		**L**	**O**	**t**	**i**	**m**	**e**			
											1		**M**	**i**	**n**			
Hot water function of the boiler. This parameter is the selectable period after which the boiler 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**				
Pasteurisation function of the boiler. This parameter is the selected hot water temperature during the pasteurisation function of the boiler.																		

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

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

Menu B: Hot water																		
	B	**8**				**L**	**e**	**g**	**i**	**o**		**i**	**n**	**t**	**r**			
											0							
Pasteurisation function of the boiler. This parameter controls if the CH demand can be interrupted by the pasteurisation function of the boiler. 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 boiler. This parameter is de off set of the selected HW temperature of the boiler.																		

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 boiler. This parameter is the proportional range of the selected HW temperature of the boiler.																		

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

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

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 boiler.
This parameter is the integration time of the selected HW temperature of the boiler.

Menu B: Hot water

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

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

Menu B: Hot water

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

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

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 boiler (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 boiler (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 boiler(s).
This parameter sets the total amount of cascaded boilers (max. twelve boilers).

Menu C: Cascade

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

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

Menu C: Cascade																		
	C	4				E	x	t	r	a		u	n	i	t			
											0							

Function for the cascading of the boiler(s).
This parameter is activated when an external (extra) boiler is connected to the Master boiler. 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 boiler(s).
This parameter sets the function of the boiler at a cascade alignment
0 = Slave unit
1 = Single / Master unit

Menu C: Cascade																		
	C	6				P	w	r	O	f	f	T	o	C	a			
											0							

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

Menu C: Cascade																		
	C	7				C	o	m	F	l	u	N	u	m				
											0							

Function for the cascading of the boiler(s).
This parameter determines the number of cascaded boilers 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 boiler 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 CD+)

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

Function for the external control of the boiler 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 boiler.
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 boiler 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 CD+ this parameter has been set 2.																		

Menu D: General																		
	D	**7**				**c**	**o**	**n**	**f**	**i**	**g**							
Function for the setting of the water pressure. Up to 4 bar a sensor is used, up to 6 bar a switch. 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 = B/P G30/G31																		

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).

10.18 Fault codes display

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

10.18.1 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	C	l	i	x	o	n		F	a	u	l	t								
F15	p	u	m	p		o	n					9	9	9	,	5		h	r	s

Reason Heat exchanger fuse or burner door clixon exceeded maximum allowed value.

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 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	Param/Hardw fault																		
F13	pump on											999,5 hrs							

Reason Fault during programming of the water heater software parameters.

Display message	programming end																		
F12	pump on											999,5 hrs							

Reason Software parameters have been programmed.

Display message	Return high Temp																		
F1	pump on											999,5 hrs							

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

Display message	Return sensor error																		
F3	pump on											999,5 hrs							

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

Display message	Siphon switch																		
F19	pump on											999,5 hrs							

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

Display message	Water high limit																		
F17	pump on											999,5 hrs							

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

10.18.2 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	Anticycle time																		
												999,5 hrs							

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

Display message	Cascade Block																		
												999,5 hrs							

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

Display message	Deairation																		
												999,5 hrs							

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

Display message	Delta Direct block																		
												999,5 hrs							

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

Display message	Flow high DHW																		
												999,5 hrs							

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	G	e	n		B	l	o	c	k										
											9	9	9	,	5		h	r	s

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

Display message	L	i	n	e		f	a	u	l	t									
											9	9	9	,	5		h	r	s

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

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 the return temperature has not exceeded the lock-out value.

Display message	T	2	-	T	1		h	i	g	h									
											9	9	9	,	5		h	r	s

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

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.

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

10.18.1 MAINTENANCE ATTENTION 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. For example a maintenance message after a certain programmed date has been reached. The water heater will operate independently of these messages.

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	**N**	**e**	**e**	**d**	**s**		**M**	**a**	**i**	**n**	**t**	**e**	**n**	**a**	**n**			**0**	**.**	**0**
	I	**g**	**n**	**i**	**t**	**i**	**o**	**n**		**c**	**y**	**c**	**l**	**e**	**s**		**h**	**r**	**s**	

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

Display message	**N**	**e**	**e**	**d**	**s**		**M**	**a**	**i**	**n**	**t**	**e**	**n**	**a**	**n**			**0**	**.**	**0**
	D	**a**	**t**	**e**													**h**	**r**	**s**	

Reason Maintenance option of the date has been reached.

Display message	**N**	**e**	**e**	**d**	**s**		**M**	**a**	**i**	**n**	**t**	**e**	**n**	**a**	**n**			**0**	**.**	**0**
	B	**u**	**r**	**n**	**i**	**n**	**g**		**h**	**o**	**u**	**r**	**s**				**h**	**r**	**s**	

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

Display message	**N**	**e**	**e**	**d**	**s**		**M**	**a**	**i**	**n**	**t**	**e**	**n**	**a**	**n**			**0**	**.**	**0**
	A	**l**	**l**														**h**	**r**	**s**	

Reason One of the abovementioned 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, propane or butane/propane mixture (B/P).

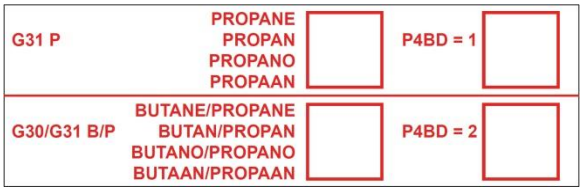
P4BD Gas type (0=standard, 1=propane , 2=butane/propane (B/P)) (display D8).

This parameter is set 0 for the common used gas types such as natural gas G20 or G25.3.
By setting this parameter 1 for propane, fan speed is reduced.
Set this parameter 2 for B/P.

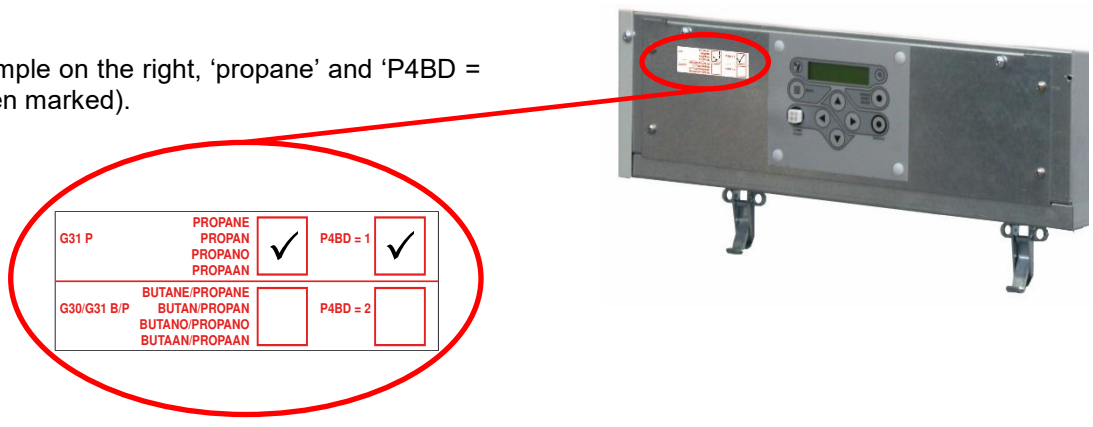
0 = standard gas (e.g.: natural gas)
1 = propane
2 = B/P

By each setting, the relevant Soft start settings are automatically adjusted, depending on its main setting P4BE, see next section chapter 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. Also mark the square, indicating that the correct value has been set for parameter P4BD.



(In the example on the right, ‘propane’ and ‘P4BD = 1’ have been marked).



11.1.4 SOFT START OPTION

Start parameters can be modified to achieve better start behaviour, in case of noise or other difficulties. This is done by reducing the fan ramp-up speed. Two reduced 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 PUMP MODE (EC TECHNOLOGY)

When using a pump with Electronic Commutation technology and start-stop function, with a separate control connection, this parameter determines the relay for switching the pump on and off.

P5BN **Pump mode (0=modulating, 1=relay1, 2= relay2, 3= relay3) (display DA).**



Do not use the 230 Vac relay for the main power supply of the pump, but directly connect the pump to an external power supply.

A modulating pump with PWM control: the power supply is directly connected to the mains, the PWM connection is connected to CN10, contacts 9 and 18.
Pumps with an on/off control can be switched by one of the relay connections “lock-out”, “burner burning” or “heat demand”. Choose a connection which is not yet used.

0 = PWM 0-100% modulating pump, connection **CN10**, connector 9 and 18
1 = Start-stop through relay **1**, connector 19 and 20 (lock-out)
2 = Start-stop through relay **2**, connector 21 and 22 (burner burning)
3 = Start-stop through relay **3**, connector 23 and 24 (heat demand)
4 = Do not use (reserved for future applications).

11.1.6 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

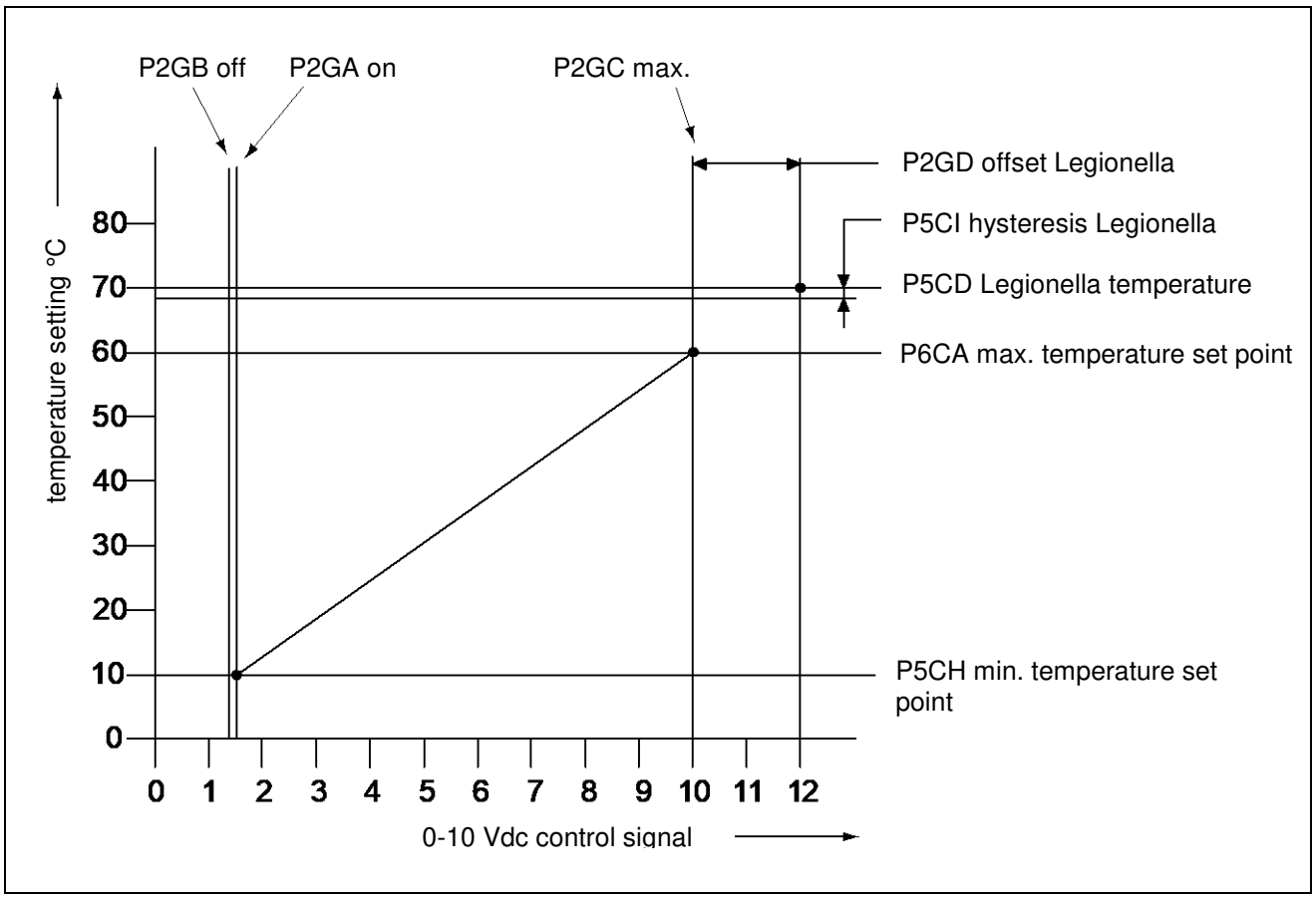
The hot water temperature is controlled by connecting an external 0-10 VDC signal to the water heater (connections 15-16).

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.

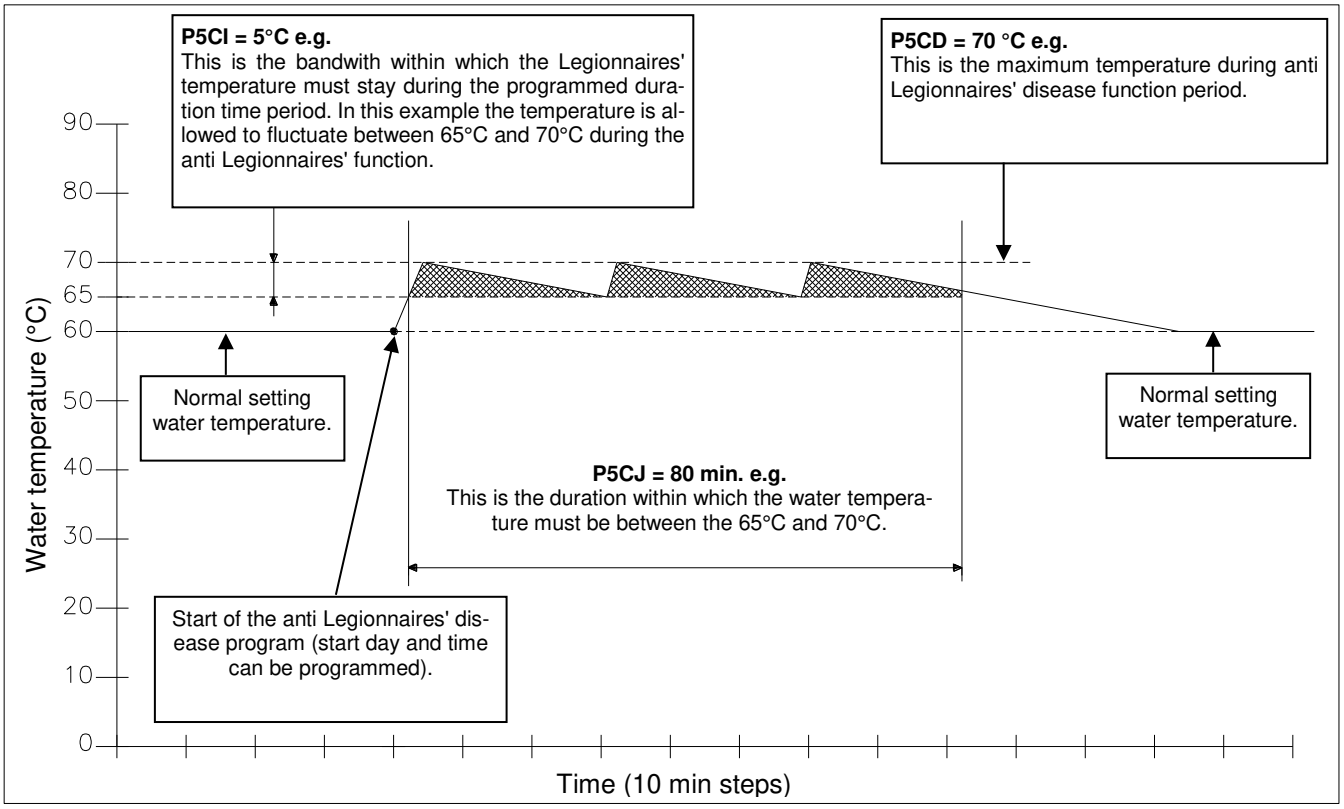
11.2.2 ANTI-LEGIONNAIRES' DISEASE (PASTEURISATION) FUNCTION

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 pasteurisation function, by making the 0-10 V signal higher than 10,2 V.

NOTICE: The standard factory setting for this Legionnaires' disease (pasteurisation) 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 preventing 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.

11.3 Cascade control

Before commissioning a cascade installation, a number of parameters has to be adjusted.
These parameters can be programmed on the unit itself, without the use of a computer.

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

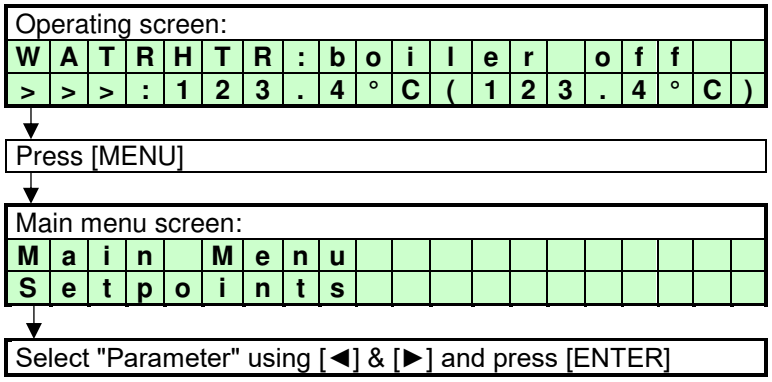
For programming **all parameters** of the water heaters, one needs to have an interface cable for connecting the laptop to the water heater control and a laptop with the appropriate software. Both are available as one service set, part.no. E400278. This software is used for programming but also shows all measured temperatures and cascade behaviour during operation and service/fault history.

11.3.1 PARAMETER SETTINGS FOR CASCADE SET-UPS

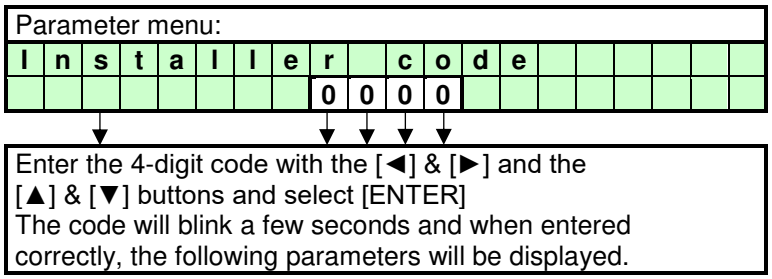
Before programming the cascaded water heaters, make sure that all water heaters are connected (wire) with each other. Use connection 17 and 18 of each water heater.

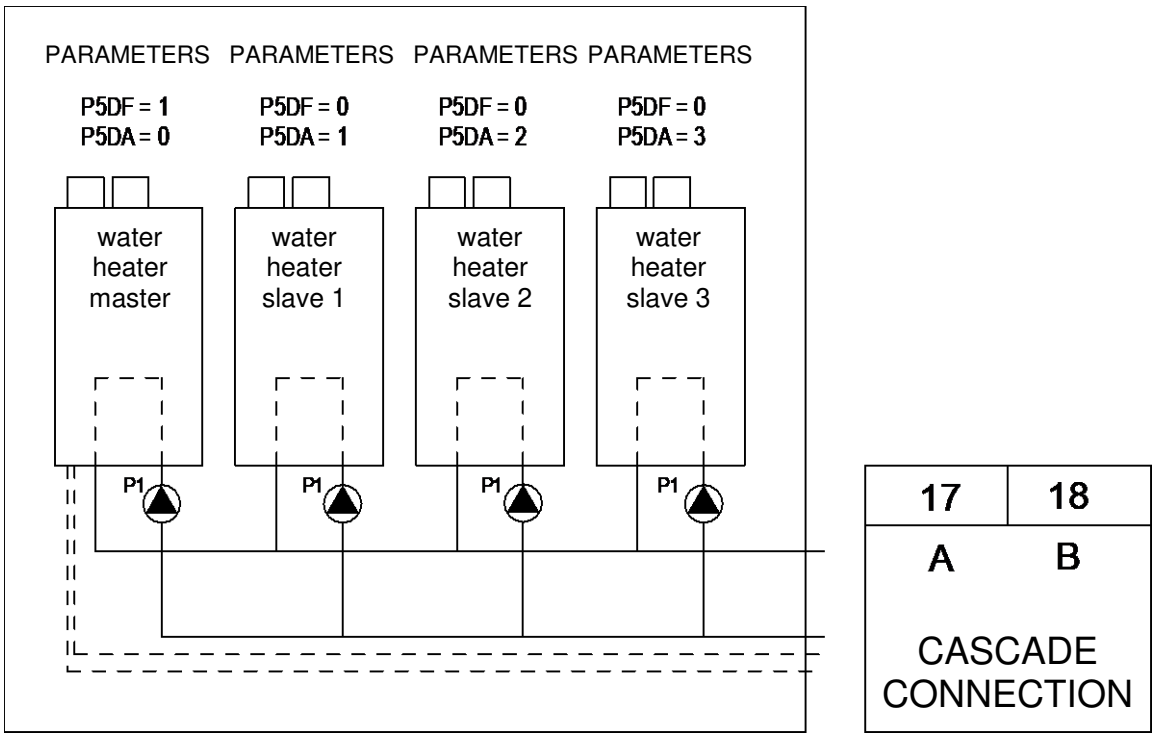
Remind: do not alternate these connections, so always connect 17 to 17 and 18 to 18.

After connection every water heater must be programmed. This can be done at the control panel. Press the [MENU] button and select the [PARAMETER] menu. See graphics below.



After this, use the password for installer's level 2.





Now for every single water heater of the cascade the following two parameters must be selected and programmed according to the above drawing.

Master:
C5 P5 DF **1**
C2 P5 DA **0**

Slave 1:
C5 P5 DF **0**
C2 P5 DA **1**

Slave 2:
C5 P5 DF **0**
C2 P5 DA **2**
And so on.

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 = Slave unit 1 = Single / Master unit

Menu C: Cascade
C 2 B u s a d 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, Slave1 = 1, etc.

When the correct parameter is set, this must be confirmed at the confirmation screen. After activation, the value will blink for a few seconds while the parameter is programmed into the water heater.

is continued p.t.o. →

When cascade connection is programmed correctly the water heater display will show the following.

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 1 second interval.

11.3.2 MONITOR SCREENS

To obtain cascade information, see § 10.4 on page 58.

11.3.3 OUTPUT CONTROL AND WATER HEATER SEQUENCE

The total cascade set-up will act as one single big water heater, switching on- and off water heaters, depending on the total load necessary to adjust and keep the flow temperature at the calculated value.
When the heat demand rises, more water heaters are switched on, and when heat demand falls, one or more water heaters will be switched off. The water heater that was switched on last, will be switched off first, see table below.

To distribute operating hours equally over all water heaters, the working sequence of the water heaters will change every two hours.

Hour	**Switching ON sequence**	**Switching OFF sequence**
X	Master – Slave 1 – Slave 2 – Slave 3 – Slave 4 – Slave 5 – Slave 6 – Slave 7	Slave 7 – Slave 6 – Slave 5 – Slave 4 – Slave 3 – Slave 2 – Slave 1 – Master
X+2	Slave 7 – Master – Slave 1 – Slave 2 – Slave 3 – Slave 4 – Slave 5 – Slave 6	Slave 6 – Slave 5 – Slave 4 – Slave 3 – Slave 2 – Slave 1 – Master – Slave 7
X+4	Slave 6 – Slave 7 – Master – Slave 1 – Slave 2 – Slave 3 – Slave 4 – Slave 5	Slave 5 – Slave 4 – Slave 3 – Slave 2 – Slave 1 – Master – Slave 7 – Slave 6
X+6	Slave 5 – Slave 6 – Slave 7 – Master – Slave 1 – Slave 2 – Slave 3 – Slave 4	Slave 4 – Slave 3 – Slave 2 – Slave 1 – Master – Slave 7 – Slave 6 – Slave 5
……..	……	……

Table: water heater sequence example of an eight-water heater cascade.

In this table a total of eight water heaters (one master, seven slaves) is mentioned as an example, in practice the maximum number in a cascade, without extra (external) control, is twelve water heaters.

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 whole DHW installation with fresh water to remove pollution, debris and other materials that might cause a blocking **with the S-WG+ heater isolated from the system.** 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.

The water heater has an automatic 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: Check that the screw cap has been loosened at least one twist.

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 will be started, 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 [ON/OFF] button for <u>six</u> 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 Water heater is standby. To activate the water heater press [ON/OFF] button for <u>three</u> seconds.

Activate the water heater by pressing the ON/OFF button for six resp. three seconds. After this the following display 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 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 to fire and also 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	**T 2 - T 1 h i g h**
	9 9 9 , 5 h r s

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

Display message	**d T D i r e c t b l o c k**
	9 9 9 , 5 h r s

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**	**F l o w R e t u r n d T f a u l t** **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 Direct block' has occurred three 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.

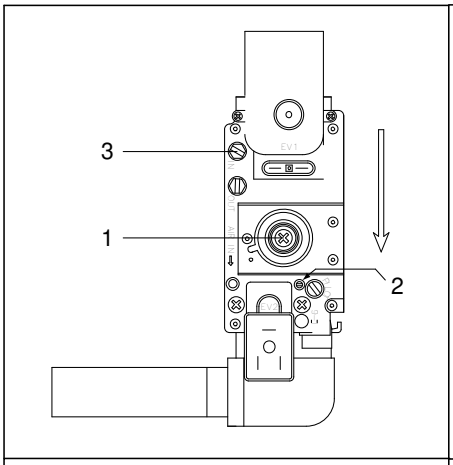
NOTICE: Always check the running of the pump before firing the water heater.

13 STARTING THE WATER HEATER

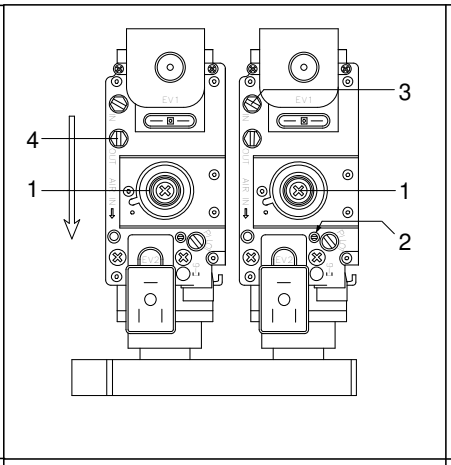
13.1 General

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 20 mbar.

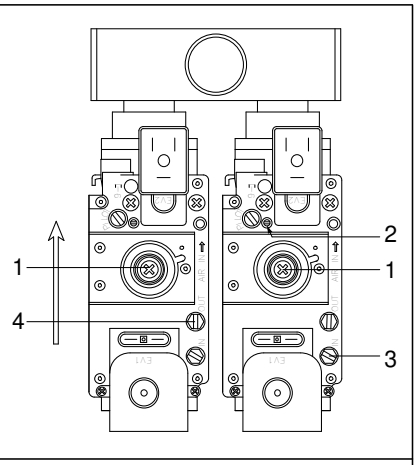
The graphs below show the position of the pressure nipple (3) for the complete water heater range.



80 & 100



120



150 & 180

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**	**)**

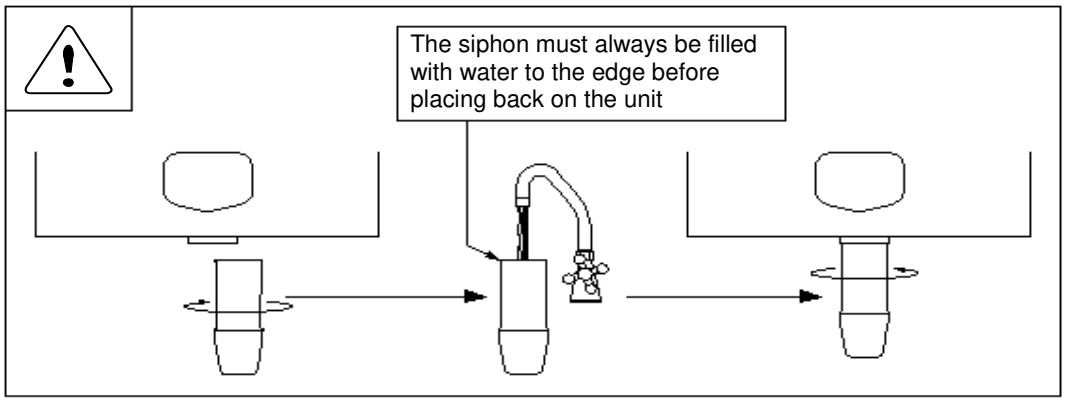
Reason Water heater is active, but there is no heat demand.

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 CO_2 values turn out to be incorrect.

B. - The gas control safety valve has been replaced.
- Another type of gas is applied: gas conversion.

Adjustment procedures for situation **A** *are described in* **chapter 14.2 and** *for situation* **B chapter 14.3**.

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

Set-up of this chapter:
First, all necessary values are given in three tables in chapter 14.1.1**Error! Reference source not found.**. A d rawing of the gas valve(s) and setting screws is given in chapter 14.1.3. In chapter 14.1.5. a general scheme, conform which the adjustments must be carried out, is presented in table form. A description is given of how to proceed in cases **A** and **B** respectively. In chapter 14.4, finally, two main procedures used in the previous sections are described in detail.

14.1.1 ADJUSTMENT TABLES

Table 1: CO_2 values for maximum and minimum load. [2)]

gas type [1)]		CO_2 [%]			O_2 [%]	
G20, G25.3	**Water heater type**	max load	min load		max load	min load
	S-WG⁺ 80-180	9,0 - 9,2	8,5 - 8,7		4,5 - 4,8	5,4 - 5,7

		CO_2 [%]			O_2 [%]	
Propane G31[3)]	**Water heater type**	max load	min load		max load	min load
	S-WG⁺ 80-120	10,3 - 10,5	9,1 – 9,3		4,9 - 5,2	6,7 – 7,0
	S-WG⁺ 150	10,4 - 10,6			4,7 - 5,0	
	S-WG⁺ 180	10,5 - 10,7			4,6 - 4,9	

		CO_2 [%]			O_2 [%]	
B/P [3) 4)] G30/ G31	**Water heater type**	max load	min load		max load	min load
	S-WG⁺ 80-120	10,4 - 10,6	9,1 – 9,3		5,1 - 5,4	7,0 – 7,3
	S-WG⁺ 150	10,5 - 10,7			4,9 - 5,2	
	S-WG⁺ 180	10,6 - 10,8			4,8 - 5,1	

1 Cf. EN437.
2 All values measured without front door. The CO_2 / O_2 values should always be between the values set in this table. Nominal values can be found in Technical specifications datasheet page.
3 Fan settings must be changed by altering parameter P4BD (display D8). (only by a skilled mechanic).
4 B/P: Propane/butane mixture.

Using propane or butane/propane mixtures (B/P), maximum fan speed needs to be reduced by changing parameter P4BD.

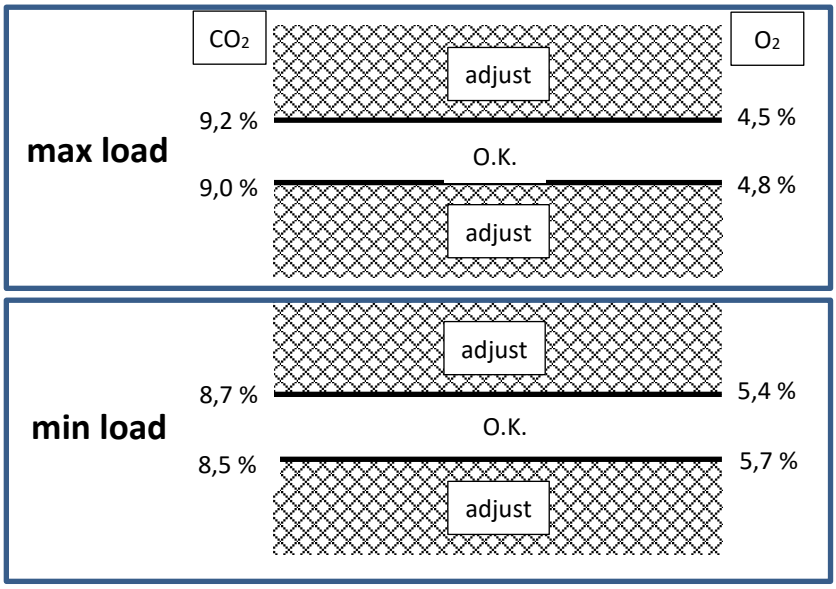
14.1.2 ADJUSTMENT VALUES

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

Gas type G20, G25.3

The CO_2 level may never be in the hatched area.

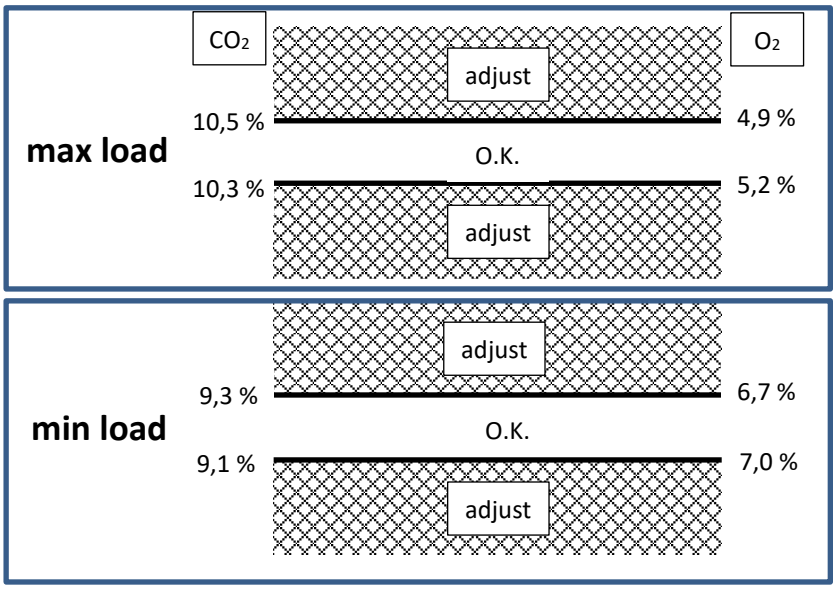
S-WG+ 80 - 180



Propane G31:

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

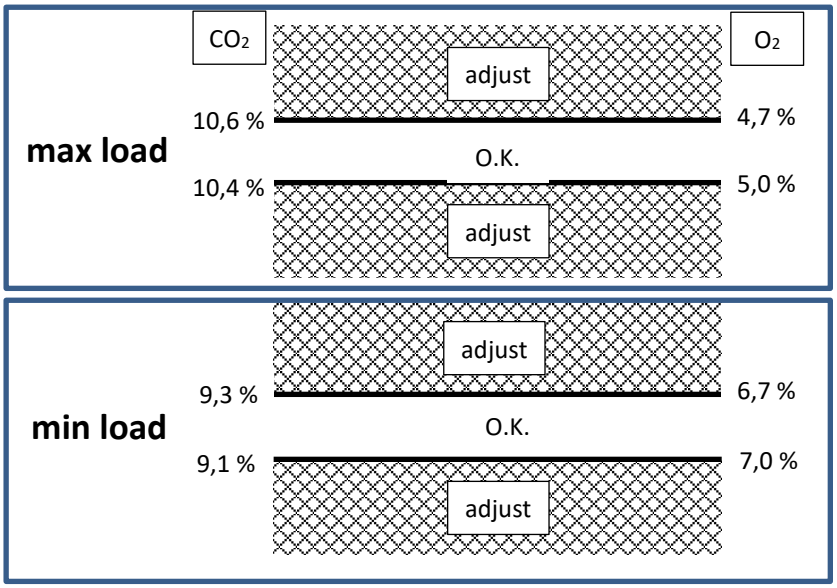
S-WG+ 80 - 120



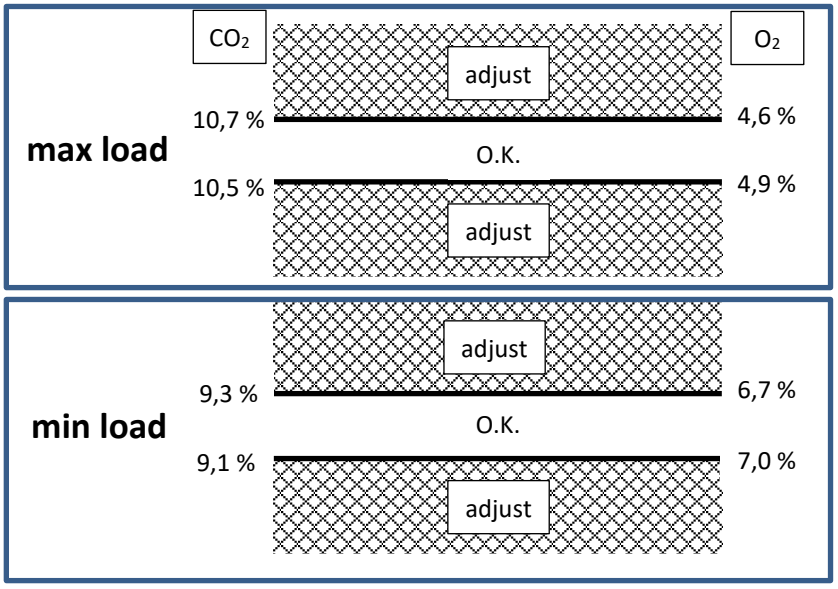
>>> cont. Propane G31:

The CO_2 level may never be in the hatched area.

S-WG+ 150



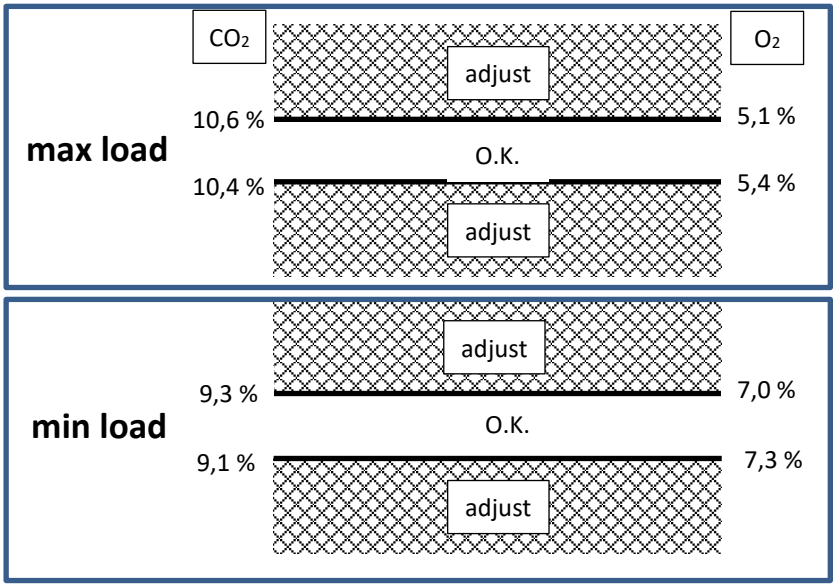
S-WG+ 180



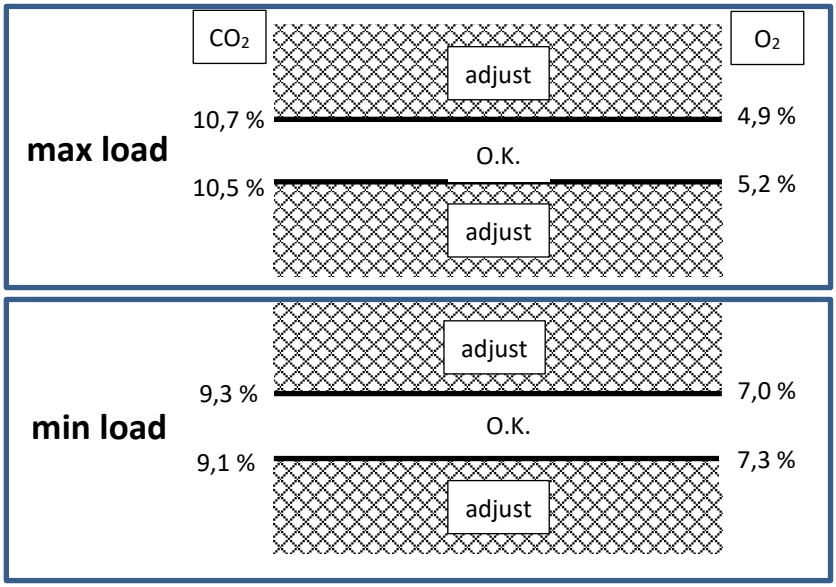
B/P: propane/ butane mixture G30/ G31:

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

S-WG+ 80-120



S-WG+ 150



S-WG 180

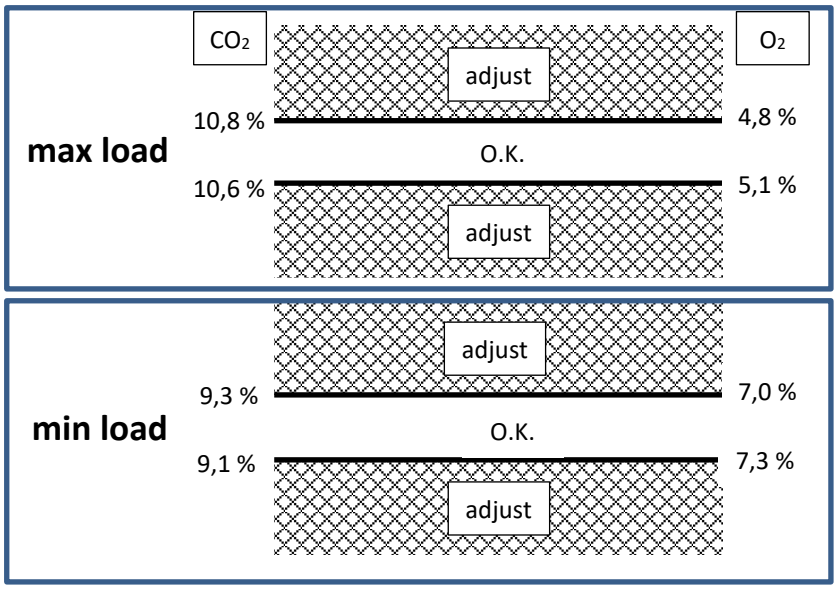


Table 2
pre adjustment settings gas valves

water heater type	number of turns open (counter clockwise)		
	Nat. gas G20 / G25.3	Propane G31	Butane/Propane B/P G30/G31
WG+ 80	1,5	0,75	0,5
WG+ 100	3,5	1,5	1,25
WG+ 120	2,25 *	1 *	0,75 *
WG+ 150	2,25 *	1 *	0,75 *
WG+ 180	4,25 *	2,25 *	2 *

** Both gas valves must be opened this number of turns.*

Table 4
Contact your water heater supplier for the right settings when converting to a not mentioned type of gas

Pressure adjustment settings LEFT valve

water heater type	"p-out" pressure at gas valve		
	Nat. gas G20 / G25.3	propane G31	Butane/Propane B/P G30/G31
WG+ 120	-2 to 0 Pa	-4 to -2 Pa	-5 to -3 Pa
WG+ 150	-2 to 0 Pa	-7 to -5 Pa	-8 to -6 Pa
WG+ 180	-2 to 0 Pa	-7 to -5 Pa	-8 to -6 Pa

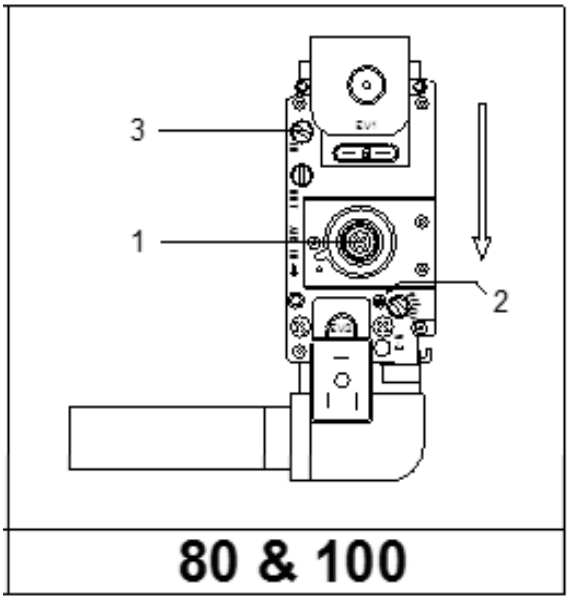
Maximum fan speed has to be reduced to convert the water heater into a propane or B/P appliance.
Setting of parameter P4BD.
A sticker has to be pasted after converting the water heater into a propane or B/P appliance.
Mark the used gas and the parameter setting on this sticker.

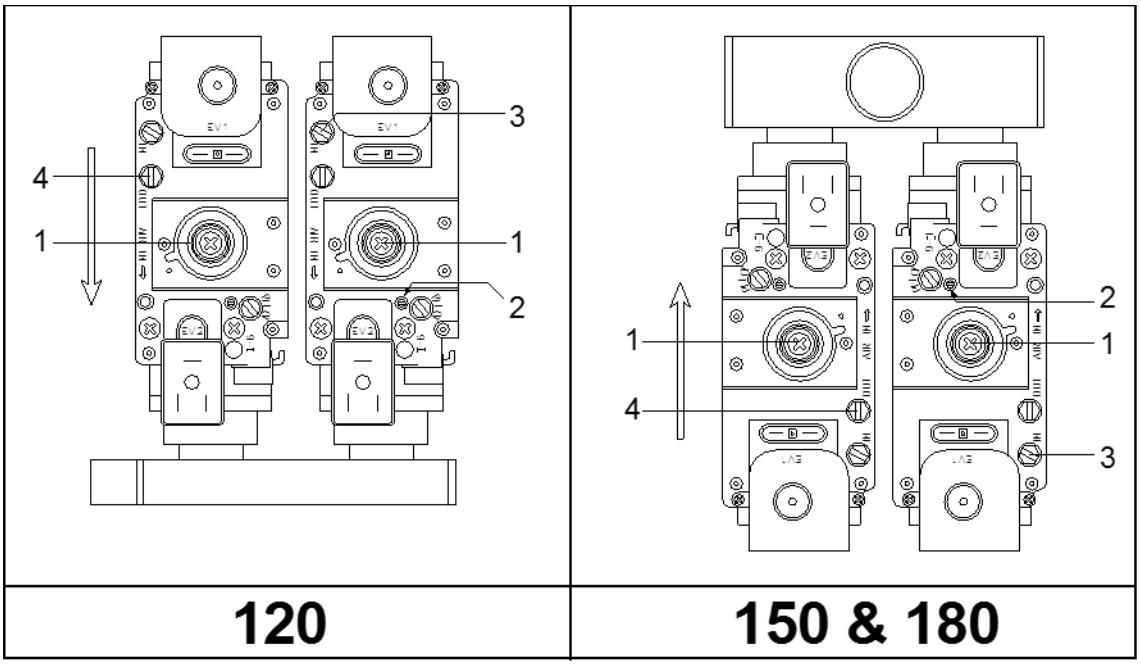


See chapter 14.3.

14.1.3 SETTING SCREWS GAS VALVE(S): DRAWINGS

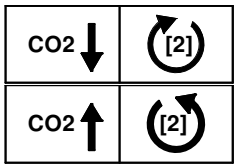
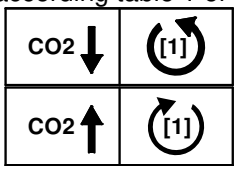
NOTICE: Do NOT mistake the screw marked 'PILOT' for screw 2.
→ Screw 2 is the SMALL screw immediately next to the pilot screw.





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 text blocks)):

<table>
<tr><td></td><td colspan="3">GENERAL SCHEME SETTING STEPS</td></tr>
<tr><td></td><td>Case A
New water heater or
service check</td><td colspan="2">Case B
Valve replacement or
gas conversion</td></tr>
<tr><td colspan="2">Continue ↓</td><td colspan="2">First close (both*) screw(s) [2], then set them in accordance with table 2</td></tr>
<tr><td></td><td colspan="3">SWITCH TO SERVICE MODE</td></tr>
<tr><td colspan="2">Continue ↓</td><td colspan="2">If burner doesn’t start, open (RIGHT*) screw [2] ¼ turn extra</td></tr>
<tr><td></td><td colspan="3">Setting at maximum load</td></tr>
<tr><td rowspan="2">Procedure 1</td><td colspan="3">[▲] Set burner at maximum load</td></tr>
<tr><td colspan="3">Measure CO_2 at flue gas outlet;
use (RIGHT*) screw [2] to
adjust according table 1 or figures.
</td></tr>
<tr><td></td><td colspan="3">Setting at minimum load</td></tr>
<tr><td></td><td>Continue ↓</td><td>only → WG+120, 150, 180</td><td>[▼] set burner at minimum load
use LEFT screw [1] to match "p-out" with table 4</td></tr>
<tr><td rowspan="2">Procedure 2</td><td>[▼] Set burner at minimum load</td><td colspan="2"></td></tr>
<tr><td colspan="3">Measure CO_2 at flue gas outlet;
use (RIGHT*) screw [1] to
adjust according table 1 or figures.
</td></tr>
<tr><td colspan="4">Repeat procedure 1</td></tr>
<tr><td colspan="4">Repeat procedure 2</td></tr>
<tr><td colspan="4">Keep repeating until values match table values best</td></tr>
<tr><td colspan="4">Water heater returns to NORMAL MODE after 40 min. OR by pressing [SERVICE] button</td></tr>
</table>

* in case of a double valve (S-WG+120, +150 and +180)

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 maintenance (case A)

14.2.1 GENERAL REMARK

For all adjusting steps under **A** the measured CO_2 values shall be according table 1 or figures.

14.2.2 CHECKING AND ADJUSTING AT MAXIMUM LOAD

Adjust at maximum load by carrying out procedure 1.

14.2.3 CHECKING AND ADJUSTING AT MINIMUM LOAD

Adjust at minimum load by carrying out procedure 2.

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

⚠ Maximum fan speed has to be reduced to convert the water heater into a propane or B/P appliance. Setting parameter P4BD.

14.3.1 GENERAL REMARKS

In case **B**, a distinction is made between the setting of water heaters containing a single valve (CD+80-CD+100) and water heaters with a double valve (WG+120-WG+180).
All adjustments must result in CO_2 according table 1 or figures.

Checking and adjusting at maximum load WG+80 / WG+100
The water heaters WG80 and WG100 all have single gas valves.

- 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 or 3 for the used water heater and gas type.

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

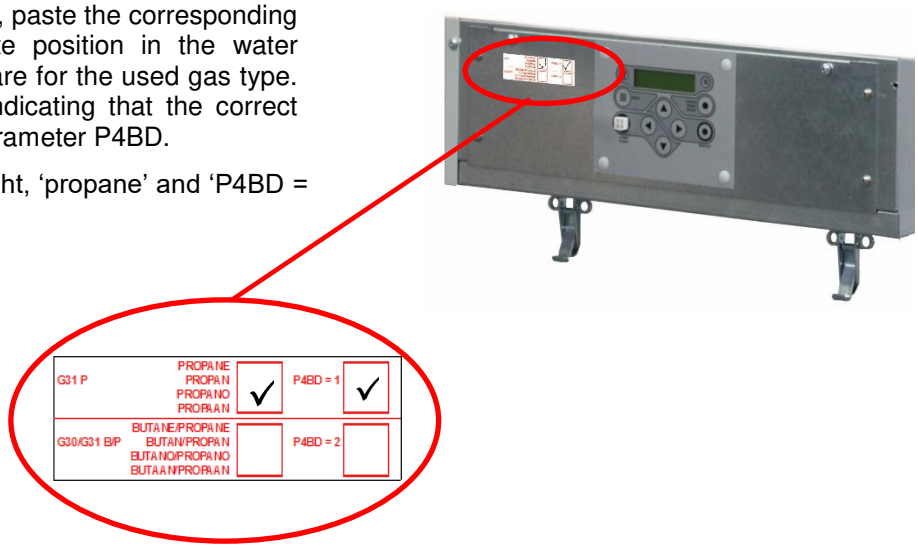
14.3.2 CHECKING AND ADJUSTING AT MINIMUM LOAD WG+80 / WG+100

Adjust at minimum load by carrying out procedure 2.

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

⚠ 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. Also mark the square, indicating that the correct value has been set for parameter P4BD.

(In the example on the right, 'propane' and 'P4BD = 1' have been marked).



For adjusting double gas valves S-WG⁺120 / ⁺150 / ⁺180 see next page →

14.3.3 CHECKING AND ADJUSTING AT MAXIMUM LOAD S-WG+120 / +150 / +180

The water heaters S-WG+120, +150 and +180 all have double gas valves.

First connect a manometer to "p-out" = measuring point [4] of the **left** gas valve (see drawing).

- Now, turn setting screws [2] of both gas valves clockwise until you feel resistance. This means that the valves are closed, do not try to tighten the screws any further in the closed position.
- After this, turn screws [2] of both left and right hand gas valve counter clockwise (open), according to the number of turns in table 2 or 3 for the used water heater and gas type.

From now on **only** use the **right hand** gas valve for adjustments on high fire.

Adjust the right valve at maximum load by carrying out procedure 1.
If the burner doesn't start up in service mode, turn screw [2] a quarter turn counter clockwise further open, and try again.

14.3.4 CHECKING AND ADJUSTING AT MINIMUM LOAD S-WG+120 / +150 / +180

Adjusting these water heaters at minimum load in case B involves extra measurements, to get both valves balanced:

Use the [▼] button to decrease the actual load of the service (percentage) to the minimum. The following screen will appear:

Display message	**H**	**E**	**A**	**T**	**I**	**N**	**G**	**:**	**S**	**e**	**r**	**v**	**i**	**c**	**e**			**2**	**6**	**%**
	>	**>**	**>**		**1**	**2**	**3**	**.**	**4**	**°**	**C**	**(**	**1**	**2**	**3**	**.**	**4**	**°**	**C**	**)**

Water heater is activated and operates at service mode at 26% (minimum).

See table 4 for pressure settings "p-out" gas valve for the used water heater and gas type.
Use screw [1] on the **left hand** gas valve to adjust the measured pressure at "p-out" to the right value according to table 4. Be sure the manometer has been zeroed out prior to making this setting.
Below, the influence of turning screw [1] is described.

Turning counter clockwise	→	less gas	→	a drop in CO_2	→	a drop in measured pressure at "p-out"
Turning clockwise	→	more gas	→	a rise in CO_2	→	a rise in measured pressure at "p-out"

After "p-out" has been set according table 4, the CO_2 level at low fire has to be set again. Use values of table 1 and/or figures.

Adjust screw [1] of the **RIGHT hand** valve to set the CO_2 at minimum load by carrying out procedure 2.
Again, toggle between high fire and low fire to make fine-tuning adjustments (adjusting the minimum setting affects the maximum setting and contrariwise).

If the valves have been set correctly, "p-out" left should equal "p-out" right. As an additional test, one could check this by measuring "p-out" at the RIGHT valve, i.e. at measuring point 4 on the right valve (not denoted in the drawings).
This pressure should be in the same range of pressure as the left valve, so in accordance with table 4 again.

If, after all setting steps have been carried out properly, the values of left and right "p-out" are still very different, contact your supplier.

14.4 Adjusting procedures

Procedures 1 and 2, referred to in the previous sections 14.2 and14.3 are described here:

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

Carry out the next 4 steps:

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

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

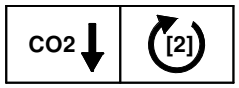
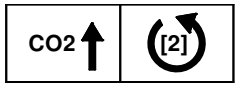
Water heater is activated and operates at service mode at 26% (minimum). (example)

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

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

Water heater is activated and operates at service mode at 100% (maximum). (example)

3. Measure the CO_2 percentage at the flue gas outlet.
4. By setting screw [2], adjust the gas valve to obtain the CO_2 value of table 1 or the figures.
   NOTICE: For the S-WG+120, 150 and 180 water heaters use only the RIGHT side gas valve for adjusting.

Decrease CO_2 percentage		**Turn screw [2] right (clockwise)**
Increase CO_2 percentage		**Turn screw [2] left (counter 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.

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

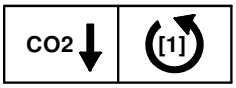
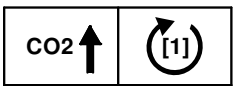
Carry out the next three steps:

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

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

Water heater is activated and operates at service mode at 26% (minimum).

2. Measure the CO_2 percentage at the flue gas outlet.
3. By setting screw [1], adjust the gas valve to obtain the CO_2 value of table 1.
   NOTICE: For the S-WG+120, 150 and 180 water heaters use only the RIGHT side gas valve for adjusting.

Decrease CO_2 percentage		**Turn screw [1] left (counter clockwise)**
Increase CO_2 percentage		**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 (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 starting to drain 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

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 F15	**C l i x o n F a u l t** **p u m p o n 9 9 9 , 5 h r s**
Reason	Heat exchanger fuse or burner door clixon exceeded maximum allowed value.
Cause:	
The thermal fuse of the heat exchanger has opened permanently.	
Corrective action:	
Switch off the electrical power and gas supply and contact supplier.	
Cause:	
The burner door clixon has opened.	
Corrective action:	
Remove the burner door of the heat exchanger and check the burner door gasket for leakage. Check the burner door for deformation; when it deforms it must be replaced. Check the heat exchanger for dirt and check that the flue is not blocked. If heat exchanger is clean, reset manually the clixon itself and reset the water heater.	

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	False flame signal pump on 999,5 hrs
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 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	F l o w h i g h T e m p p u m p o n 9 9 9 , 5 h r s
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	F l o w R e t u r n d t f a u l t 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.
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	F l o w s e n s o r e r r o r p u m p o n 9 9 9 , 5 h r s
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	F l u e s e n s o r e r r o r p u m p o n 9 9 9 , 5 h r s
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 actually 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**	**R e t u r n s e n s o r e r r o r** **p u m p o n 9 9 9 , 5 h r s**
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**	**S i p h o n s w i t c h** **p u m p o n 9 9 9 , 5 h r s**
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**	**W a t e r h i g h l i m i t** **p u m p o n 9 9 9 , 5 h r s**
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	**A n t i c y c l e t i m e** **9 9 9 , 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	**C a s c a d e B l o c k** **9 9 9 , 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	**D e l t a D i r e c t b l o c k** **9 9 9 , 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	**F l o w h i g h D H W** **9 9 9 , 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	**F l o w t e m p h i g h** **9 9 9 , 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 actually 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	T2-T1 high 999,5 hrs
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	Waterpressure fault 999,5 hrs
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	WATRHTR:T3 External >>>: 60.0°C (-30.7°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. Both safety and life time 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 a number of similar error codes and/or lock-outs appear.**
- **At least every twelve months 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.**

For more information about this maintenance mode see section 10.15 - Setting the maintenance specifications.

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

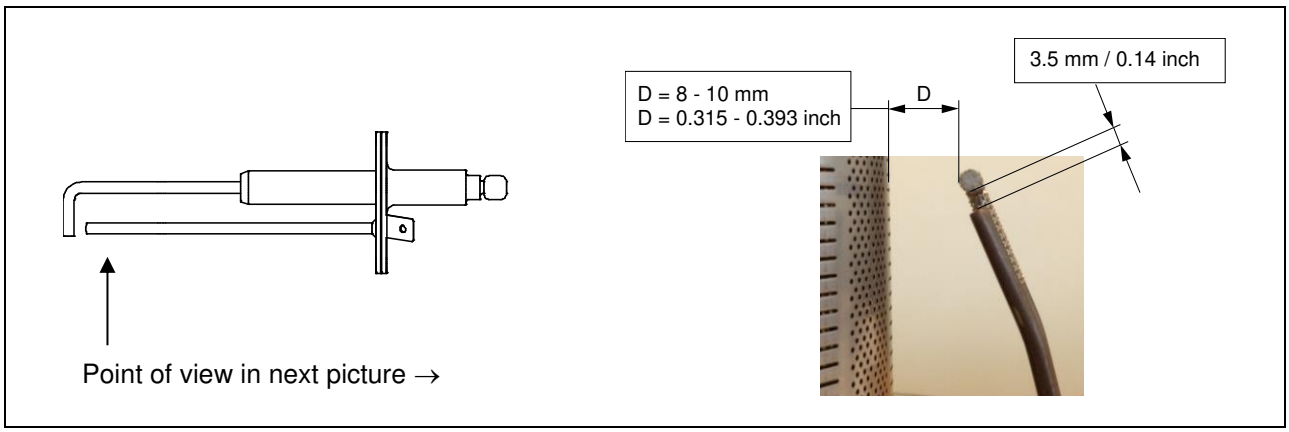
Flue gas & air supply
The flue gas pipes and the air supply pipes must be checked for gas tightness. Also check if the mounting of these pipes is correct, safe and not damaged. Check the rooftop of the water heater housing for signs of water leakage and traces of water coming from the air supply pipe, 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 of the 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 / ionisation 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 oxidised, 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.

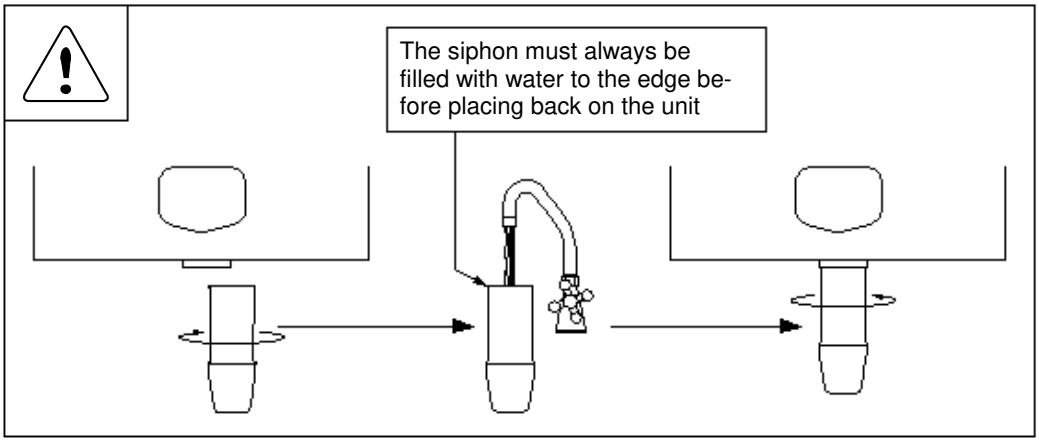


Burner door gaskets
When these gaskets have changed colours at some parts, the rubber has cured and/or has damages, these gaskets must be replaced. Notice: only use the gaskets that are supplied by the water heater manufacturer.

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 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:

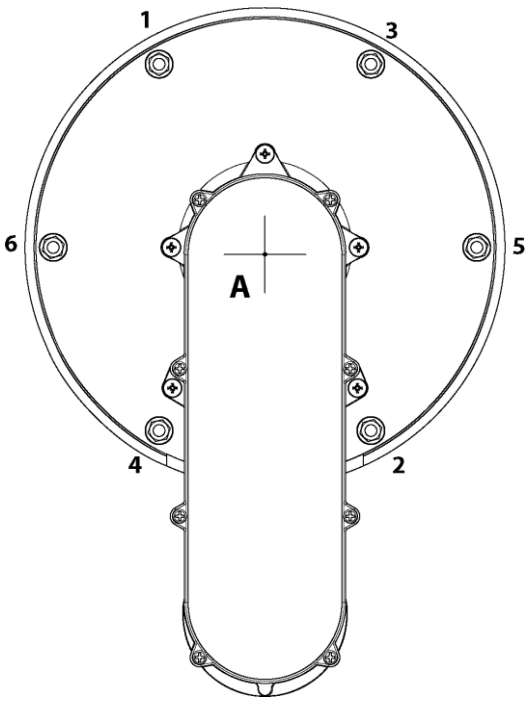
IMPORTANT:
Before mounting the burner door, make sure that its gaskets and insulation are in excellent shape.
If any signs of damage or ageing are present, these parts must be replaced.

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 **8 Nm.**

tighten in given order

torque value = 8 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. Regular service and maintenance is essential for a safe and proper operation of the water heater. Hand over the documents that are supplied with the water heater.

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