STREBEL
S-CB+ Boiler Range

Models +60 - +80 - +100 - +120 - +150 - +180

Wall hung high efficiency condensing boiler

Installation, Operating & Maintenance Manual

STREBEL HEATING TECHNOLOGY

2015-07-21 v1

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INTRODUCTION

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

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.

1 SAFETY GUIDELINES

Carefully read all the instructions before commencing installation.
Keep these instructions near the boiler for quick reference.

The appliance should be installed by a skilled installer such as GAS SAFE registered person, electrical work carried out by a qualified person, all according to national and regional standards.

Failure to comply with these regulations could deem the warranty invalid. This appliance must be installed in accordance with the rules that apply and only be used in an adequately ventilated space conforming to standards in place.

Without written approval of the manufacturer the internals of the boiler may not be changed. When changes are executed without approval, the boiler certification becomes invalid.

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

What should one do when there is the smell of gas: -
- Don't use any electrical equipment.
- Don't press any switches.
- Close the gas supply.
- Ventilate the room (open the windows and/or outdoor boiler room doors).
- Immediately warn the responsible person.

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

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.

These instructions are written for the installer of Strebel products and contain all necessary information on the installation and adjustment of S-CB$^+$ Ranges of boilers. Please read these instructions fully before installation to ensure that all work is carried out correctly.

We suggest that you keep a copy of these instructions near the boiler.

These instructions together with those in any supplemental instruction booklet cover the basic principles to ensure the satisfactory installation of the boiler, although detail may need slight modification to suit particular local site conditions.

It is the law that all gas appliances and fittings are installed by a competent person (such as a Gas Safe registered installer) and in accordance with The Gas Safety (installation and Use) Regulations.

The relevant British standards for installation, codes of practice or rules in force and in accordance with the Manufactures' instructions.

The installation must be carried out in accordance with the following regulations plus relevant codes & standards:

- Due consideration must be given to current Health & Safety Legislation while this product is being installed.
- Key Approved Documents to the Building Regulations, in the region of the United Kingdom that this product is being installed.
- The Local Building Regulations and Local water by-laws, the gas services area and the Local Authority recommendations.
- The appropriate British & European Standards for the type of installation and fuel used, including but not exclusively the following standards: -
    - BS 5440: Parts 2 (Flues and Ventilation).
    - BS 6644: Installation of gas-fired hot water boilers of rated inputs between 70kW & 1.8MW
- The clean air act as defined by the local authority.
- The appropriate documents as produced by the Institution of Gas Engineers and Managers Documents (IGEM) for the type of installation and fuel used, including but not exclusively the following documents: -
    - IGE/UP1
    - IGE/UP2
    - IGE/UP4
    - IGE/UP10
- If the product is being fuelled with LPG then the appropriate UKLPG Codes of Practice (CoP) should be referred to.
- Wiring to the appliance must be in accordance with the IEE (BS 7671) Wiring Regulations the Health and Safety Document No 635 "The Electricity at Work Regulations 1989" and any local regulations that apply.
- CP 342: Part 2, 1994. Code of practice for centralised hot water supply – buildings other than individual dwellings.
- CIBSE, Guides A, B and C.

Adhere to all regulations that are in force at the time of installation or service.

2 TECHNICAL DATA S-CB+ BOILERS

2.1Functional introduction

The S-CB+ boilers are central heating boilers 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-CB+ boiler is standard set for Natural gas G20

Gases used must meet the European standard EN 437.
Fuel used should have sulphur rates according to the European standard, a maximum annual peak over a short period of time of 150 mg/m^3 and an annual average of 30 mg/m^3.

Boiler control includes:
- Cascade control for up to twelve boilers
- Remote operation and heat demand indication from each boiler
- Weather compensation control
- Hot water cylinder control

Connections for:
- 0-10 VDC remote flow temperature (set point) control
- 0-10 VDC remote burner input control
- Outdoor temperature sensor
- External hot water cylinder pump or diverter valve

Cascade control
When using the integrated cascade control, a maximum of twelve boilers 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 boiler flow temperature or power input can be controlled by an external 0-10 VDC signal. When a number of boilers are cascaded, and controlled by the integrated cascade control, the signal should be directed to the master boiler only. If an alternative control is used, more than one boiler may be controlled by a 0-10 VDC signal. A signal of 1,48 Volt will switch on the boiler(s), less than 1,4 Volt will switch off the boiler(s).

Time program
For both central heating and hot water function of the boiler, time programs with three programmable periods per day are available. These time programs are set and activated by entering the desired settings directly at the boiler control panel.

2.2Technical specifications datasheet

GENERAL							
Product Identification Number	-	CE 0063 BP3254					
Classification	-	II2H3P (for NL II2L3P)					
Gas Appliance Type	-	B23, B23P; C13X, C23X, C33X, C43X, C53X, C63X, C83X					
Type boiler		**S-CB⁺60**	**S-CB⁺80**	**S-CB⁺100**	**S-CB⁺120**	**S-CB⁺150**	**S-CB⁺180**
Dimensions (h x w x d)	mm	**842 x 476 x 486**				**898 x 476 x 677**	
Water content estimated	litre	3,9	5,0	6,5	8,3	10,4	12,9
Weight (empty)	kg	46	73	78	83	92	101
Flow/return connection (boiler)	inch	R 1"	R 1"	R 1"	R 1"	R 1¼"	R 1¼"
Flow/return connection (T-piece)	inch	Rp 1¼"	Rp1¼"	Rp 1¼"	Rp 1¼"	Rp 1½"	Rp 1½"
Gas connection	inch	R ¾"	R ¾"	R ¾"	R ¾"	R 1"	R 1"
Flue duct flue/air inlet (* as supplied)	mm	80/125*	80/125*	100/150*	100/150*	100/150	100/150
Parallel connection (* as supplied)	mm	80-80	80-80	100-100	100-100	130-130*	130-130*

HEATING		**Values min-max:**					
Nominal input (Net)	kW	12,5 - 55,6	14,6 - 74,3	17,2 - 92,2	26,0 - 111	34,0 - 138	45,0 - 166
Nominal input (gross) (G20, G25)	kW	13,9 - 61,8	16,2 - 82,5	19,1 - 102	28,9 - 123	37,8 - 153	50,0 - 184
Nominal input (gross) (G31)	kW	13,6 - 60,4	15,9 - 80,8	18,7 - 100	28,3 - 121	37,0 - 150	48,9 - 180
Nominal input (gross) (G30)	kW	13,5 - 60,3	15,8 - 80,2	18,6 - 99,7	34,7 - 120	36,8 - 150	48,8 - 180
Nom. output 80/60°C	kW	12,0 - 53,5	14,0 - 71,2	16,5 - 88,4	24,7 - 106	32,6 - 132	43,3 - 160
Nom. output 50/30°C	kW	12,9 - 57,4	15,2 - 77,5	18,0 - 96,2	27,2 - 116	35,5 - 144	47,3 - 175
Nom. output 37/30°C	kW	13,5 - 59,8	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 S-CB⁺ range**					

GAS CONSUMPTION [EN437]			**Values min-max:**					
Natural gas	G25	m^3_{st}/h	1,54 - 6,84	1,80 - 9,14	2,12 - 11,4	3,20 - 13,7	4,18 - 17,0	5,54 - 20,4
Natural gas	G20	m^3_{st}/h	1,32 - 5,88	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	0,51 - 2,27	0,60 - 3,04	0,70 - 3,77	1,06 - 4,54	1,39 - 5,65	1,84 - 6,79
Butane gas	(B/P) G30 [1]	m^3_{st}/h	0,39 - 1,72	0,45 - 2,29	0,53 - 2,85	0,99 - 3,44	1,05 - 4,28	1,40 - 5,15
Gas supply pressure nom. [2]	G25	mbar	25					
	G20	mbar	20					
	G31 [1]	mbar	30/37					
	G30 [1]	mbar	50					

NOTES

[1] Using propane or butane/propane mixtures (B/P), maximum fan speed needs to be reduced (parameter P4BD)

[2] Min. and max. gas supply pressures according to EN437:

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

Type boiler			**S-CB$^+$60**	**S-CB$^+$80**	**S-CB$^+$100**	**S-CB$^+$120**	**S-CB$^+$150**	**S-CB$^+$180**
EMISSION [EN437]		**Values min-max:**						
CO_2 flue gas [3]	G25/G20	%	8,7 - 9,0	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 - 10,3	9,3 - 10,4	9.3 - 10.5
	G30 (B/P)	%	9,3 - 10,4	9,3 - 10,4	9,3 - 10,4	9,3 - 10,4	9,3 - 10,5	9.3 - 10.6
NOx at 0% O_2, year emission		ppm	21,0	31,5	24,6	27,4	25,3	16,5
		mg/kWh	37,7	56,6	44,2	49,2	45,4	29,7
NOx class [EN483 / EN15420]		-	5					
Flue gas temperature at combustion air temperature = 20°C		°C	~ 85-95					
Available pressure for the flue system [4]		Pa	200					
INSTALLATION								
Available pressure for the installation at	ΔT = 20 K	mWC	3,8	1,3	1,5	1,0	0,7	0,1
	ΔT = 25 K	mWC	5,1	3,7	3,7	3,0	3,2	2,5
Pressure boiler min-max.		bar	1,0 - 4,0 [5]					
Max. flow temperature		°C	90					
ELECTRIC								
Power consumption		W	355	355	355	370	600	
Power supply		V/Hz	230/50					
Protection class		-	IPX4D					

NOTES

[3] CO_2 of the unit measured/set without the boiler front panel in place

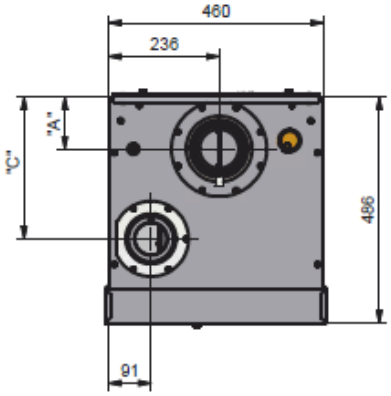
[4] Maximum allowed combined resistance of flue gas and air supply piping at high fire

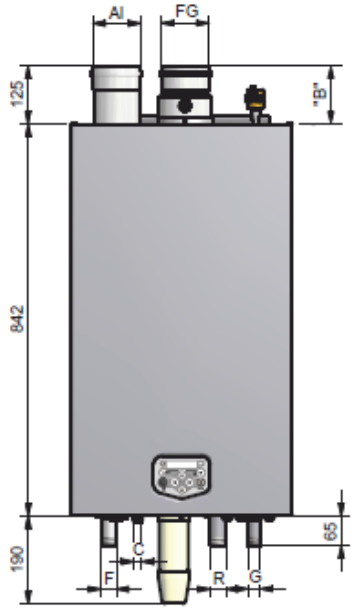
[5] When the built-in water pressure sensor is replaced by a water pressure switch, water pressure may go up to 6,0 bar

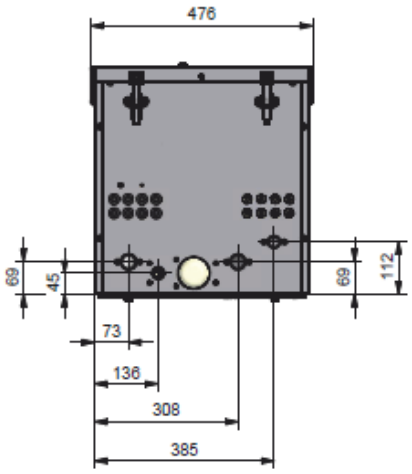
3 DIMENSIONS

3.1S-CB+ 60-120

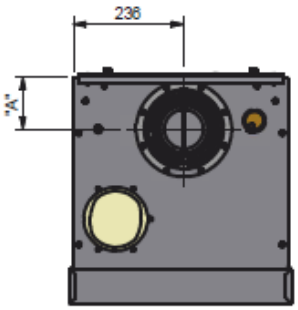
TWIN PIPE

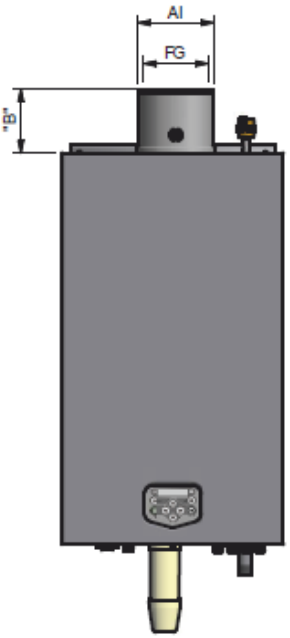






CONCENTRIC (Standard Delivery)

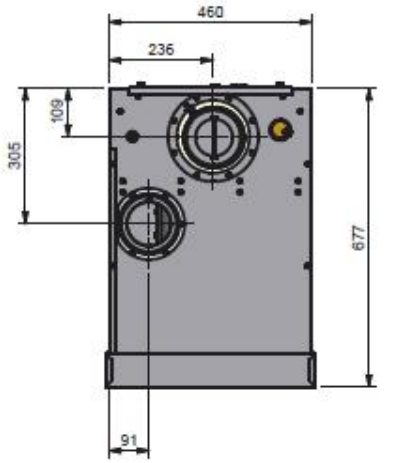


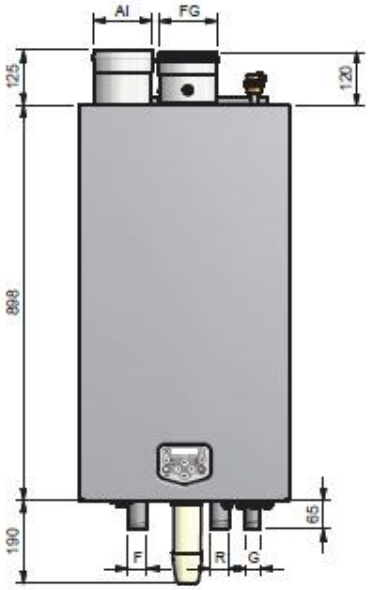


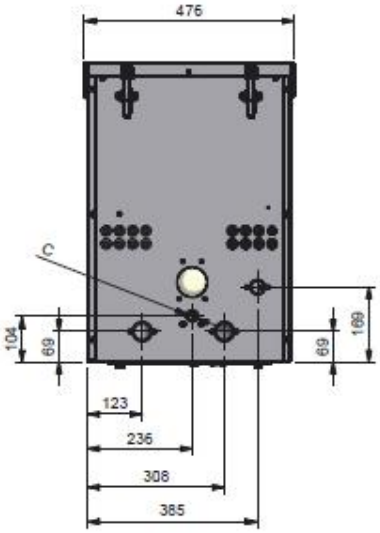
Connections		twin pipe				Concentric (Standard Delivery)			
		+60	+80	+100	+120	+60	+80	+100	+120
FG	flue gas	80-80		100-100		80/125		100/150	
AI	air inlet								
size **"A"**		112				155	112		
size **"B"**		135				150	135		
size **"C"**		308				N.A.			
F	flow	R 1¼" (male)							
C	condensate	flexible hose Ø25/21 x 750 mm							
R	return	R 1¼" (male)							
G	gas	R ¾" (male)							

3.2S-CB+ 150-180

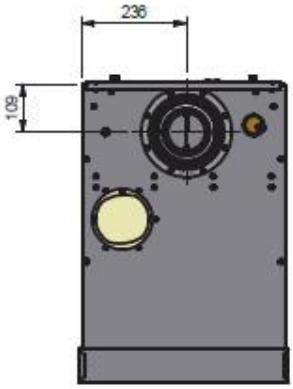
TWIN PIPE (Standard Delivery)

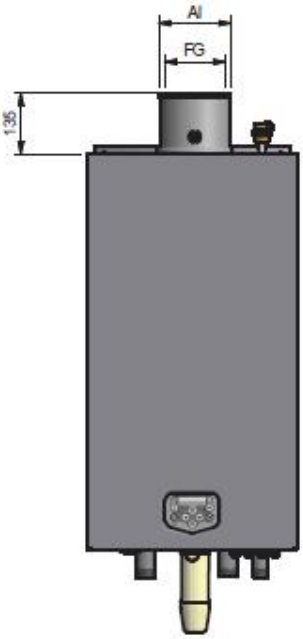






CONCENTRIC





Connections		**twin pipe** (Standard Delivery)	**concentric**
FG **AI**	flue gas air inlet	130-130	100/150
F **C** **R** **G**	flow condensate return gas	R 1½" (male) flexible hose Ø25/21 x 750 mm R 1½" (male) R 1” (male)	

4 ACCESSORIES AND UNPACKING

4.1Accessories

Depending on the selected controlling behaviour for the central heating system and/or the optional use of a calorifier, the following items can be supplied with the boiler. Ask your supplier for the specifications.

Item		Part Nº.
Outdoor (air) temperature sensor: 12kOhm@25°C (to be connected to the boiler connections)		E04.016.585
External flow temperature sensor for system side of the low loss header: 10kOhm@25°C (to be mounted to the boiler connections)		E04.016.304
Calorifier temperature sensor: 10kOhm@25°C (to be connected to the boiler connections)		S04.016.303
Conversion sets flue and air terminals	S-CB$^+$60: concentric to twin pipe 80/125→80-80	E61.001.162
	S-CB$^+$60: twin pipe to concentric 80-80→80/125	E61.001.187
	S-CB$^+$80: concentric to twin pipe 80/125→80-80	E61.001.163
	S-CB$^+$80: twin pipe to concentric 80-80→80/125	E61.001.170
	S-CB$^+$100-120: concentric to twin pipe 100/150→100-100	E61.001.164
	S-CB$^+$100-120: twin pipe to concentric 100-100→100/150	E61.001.171
	S-CB$^+$150-180: concentric to twin pipe 100/150→130-130	E61.001.165
	S-CB$^+$150-180: twin pipe to concentric 130-130→100/150	E61.001.172
Room Controller “OpenTherm” RC (Modulating) with room sensor		S04.016.355
Room Controller “OpenTherm” RC (Modulating) no room sensor/to be used with E04.016.359		S04.016.358
External room sensor for the RC and RCH controller: 5kOhm@25°C		E04.016.359
Room thermostat (modulating) RCH with e-bus interface, to control one heating zone (Thermostat includes room sensor).		S04.016.357
EBC heating zone controller to control 2 different heating zones. This EBC will include the wall housing unit, for an easy installation and connection.		S04.016.550
Interface **IF** to convert an OpenTherm signal to an E-bus signal (One interface for each boiler or one interface for cascaded boilers).		S04.016.552
External flow sensor for one heating zone: 5 kOhm@25°C		E04.016.363
Software + interface cable for programming the boiler with a computer/laptop		S04.016.586

4.2Unpacking

The S-CB$^+$ boiler will be supplied with the following documents and accessories:

- One “Mounting Instructions” manual for the installer
- One suspension bracket with locking plate and bolts
- Three spare nuts for mounting the burner plate, two spare fuses for the boiler control and a gas conversion sticker (all in a bag attached to the front of the gas valve)
- Bottom part of the siphon
- Two T-pieces for the flow and return connections of the boiler

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

5 INSTALLATION OF THE S-CB+

5.1General notes

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

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 boiler must be able to hold the weight of the boiler. If not, it is recommended to mount the boiler by means of a (cascade) frame.

Other considerations related to the boiler location.
- The ventilation of the boiler room must meet local and national standards and regulations, regardless of the selected supply of fresh air to the boiler.
- Both the air supply and the flue gas pipes must be connected to the outside wall and/or the outside roof.
- The installation area must be dry and frost-free.
- The boiler has a built-in fan that will generate noise, depending on the total heat demand. The boiler location should minimise any disturbance this might cause. Preferably mount the boiler on a brick wall.
- There must be sufficient lighting available in the boiler room to work safely on the boiler.
- When a boiler is positioned at the highest point of the installation, the supply and return pipes must first protrude 0.5 m above the top of the boiler, before these pipes go to the installation side. In other words, the water level must always be 0.5 meter above the top of the boiler and an automatic air vent must be installed in the supply or return pipe. A low-water level protection should also be installed at the installation side.
- 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 boiler.

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

5.2Mounting the boiler

Before mounting and installing the boiler the following connections should be considered:

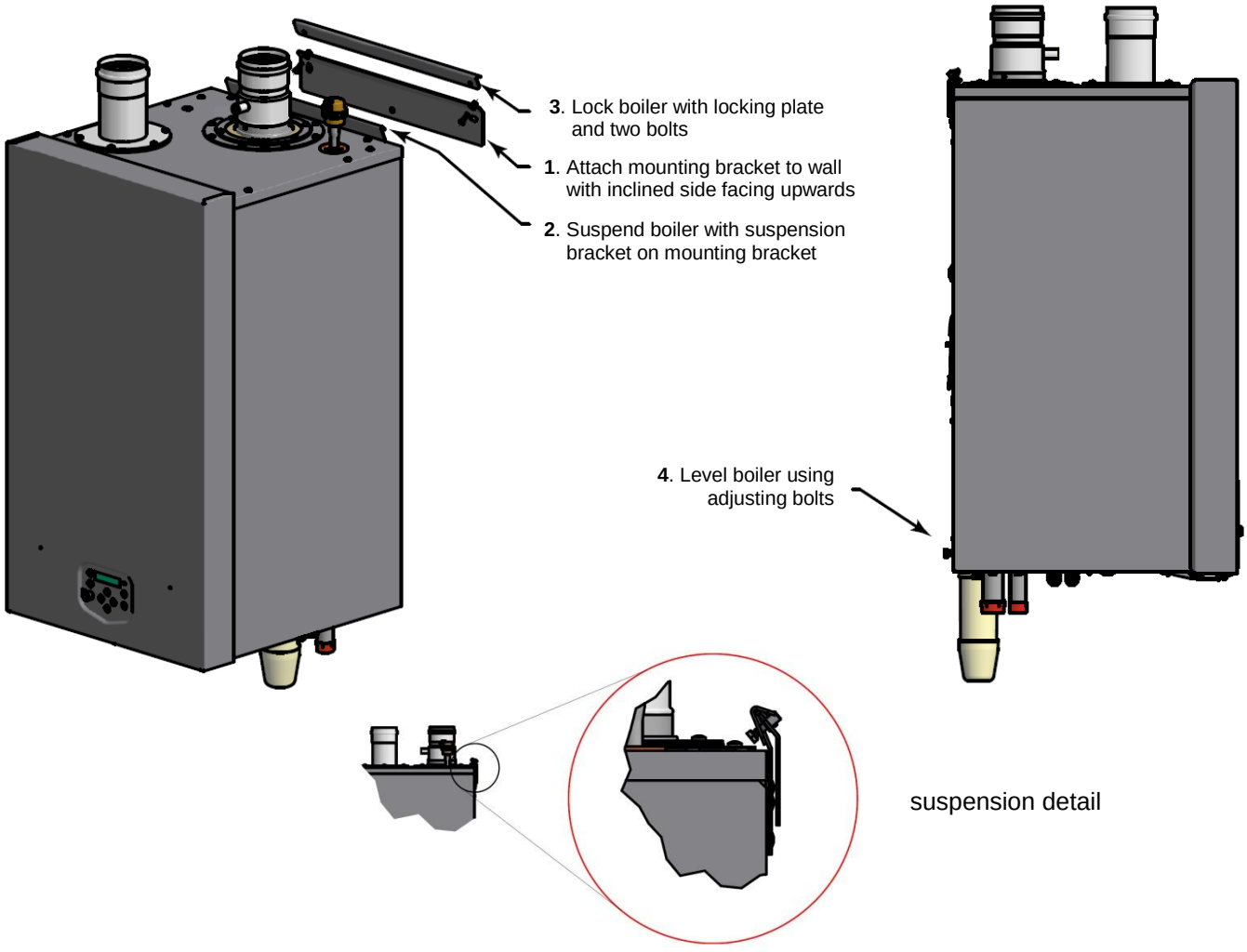
- Flue gas system and the flue gas pipe connections
- Air supply system and connections
- Flow and return pipe connection
- Condensate and pressure relief valve drainage
- Power supply (preferably the power connection positioned above the boiler)

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

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 boiler 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 boiler in position. The exact boiler position lies between the boiler hanging level and hanging slightly backwards.

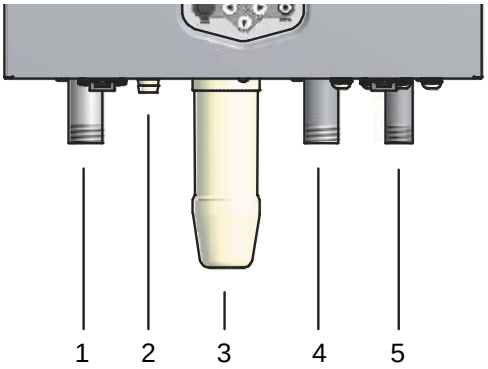
The boiler should not lean forward in the mounted position.

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



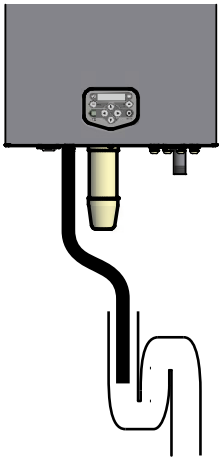
6 CONNECTIONS WATER SIDE

FRONT VIEW



6.1Boiler connections

1 – Flow CH
2 – Condensate drain
3 – Siphon cleaning point
4 – Return CH
5 – Gas



Open connection to the sewer.

6.2Condensate drain connection

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

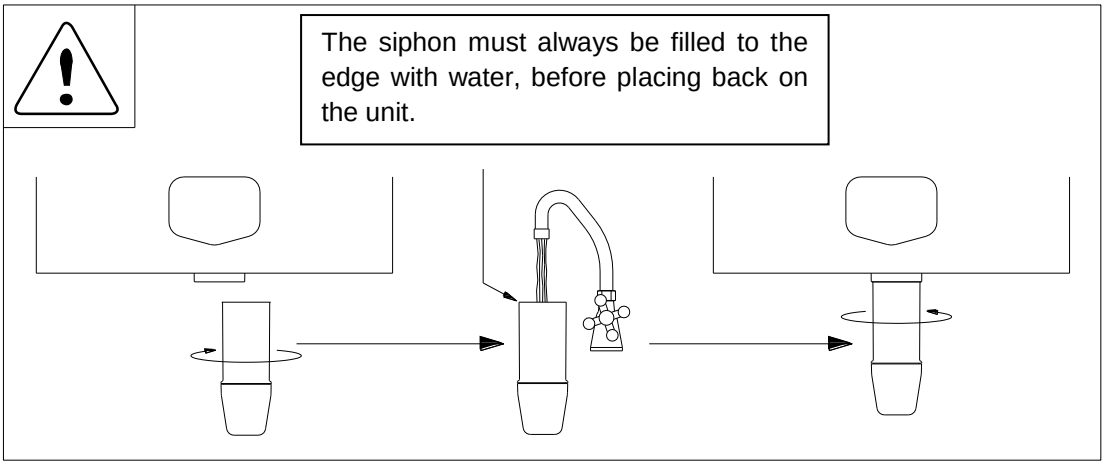
Use only plastic parts with the condensate drain. Metal lines are not allowed.

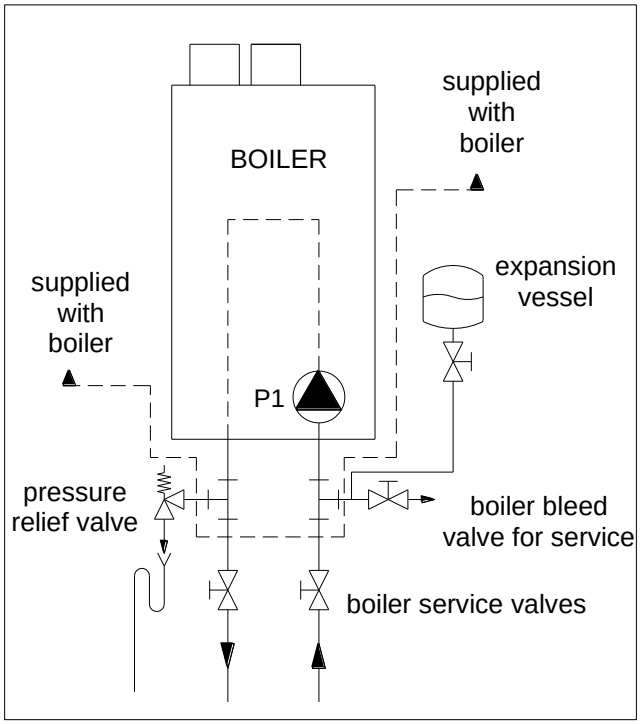
Blockage of this drain might damage the boiler. The drain connection is correct when the condensate can be seen flowing away, e.g. using a funnel. Any damage that might occur, when the drain is not installed correctly, is not covered by the warranty of the boiler.

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

When mounting the bottom part of the siphon, before commissioning the boiler 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.





6.3Flow and return connections

Two separate T-pieces are shipped with the boiler.
These are applied for externally mounting the pressure relief valve and the boiler bleed valve for servicing the boiler. We advise to install two service valves in the flow and return pipes underneath the boiler, so the boiler can be isolated from the heating system and eventually disconnected, when needed.

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

6.4The expansion vessel

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

6.5Pressure relief valve

The boiler has no internal pressure relief valve. This should be installed close to the boiler in the flow pipe of the heating system. When having cascaded boilers, each boiler should have its own pressure relief valve. It is advised to use the T-piece that is supplied with the boiler, for this.

Advice is always to install service valves, so the boiler can be isolated from the heating system, when needed. Make sure that the pressure relief valve is mounted between the boiler and the service valves.
The specifications and size of the relief valve should be determined by the installer and must comply with all applicable regulations and boiler capacity.

6.6Bypass

The boiler has no internal bypass. When many thermostatic valves are being used, the system should have a bypass to allow an adequate flow when all thermostatic valves are closed. Instead of a bypass also a low-loss header can be used for this function.

The boiler flow will also be influenced when a pipe of the heating system is frozen / blocked. Make sure all heating pipes are free from the risk of frost. If there is the risk of freezing of the heating system, all the pipe section must be insulated and/or protected with the help of a tracing.

6.7Pump functionality

Controlling the pump:
The pump speed is controlled by a PWM signal provided by the burner controller at a value causing a Delta T across the heat exchanger of 20°C at the whole burner modulation range.
When the boiler modulates down or up, also the pump speed decreases or increases, keeping delta T at 20°C until it reaches the end of its modulation range.

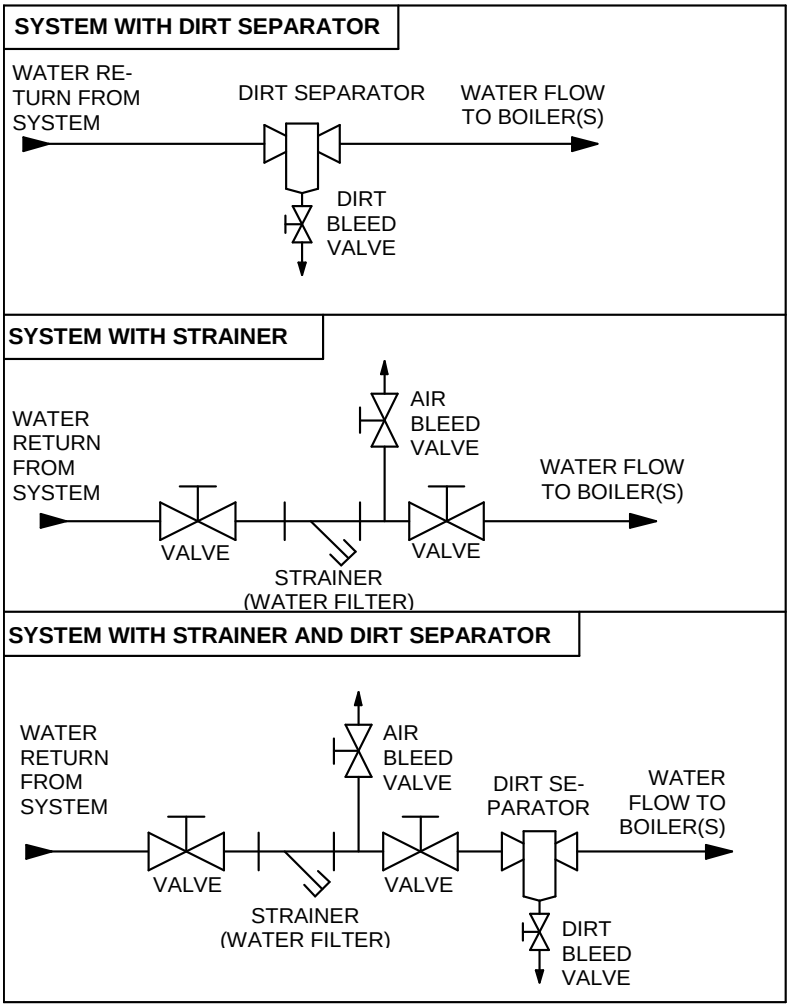
Delta T monitoring:
The delta T monitoring parameters are active. A malfunctioning of the pump, burner controller or a high resistance in the hydraulic system will cause a high Delta T and will therefore be detected by the burner controller. The display shows “dT Block” or “FlowReturn dTfault”.

6.8Frost protection

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

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

6.9Installing a strainer and/or dirt separator



Always install a strainer (water filter) and/or a dirt separator in the return pipe of the boiler; in such a way that the water going to the boiler is free of any debris/particles. When using a water filter always check a week after installation to determine the strainer cleaning interval. Advice is to mount valves before and after the strainer, including an air bleed valve, so the strainer can be isolated from the heating circuit for service operations. Clean water is very important, blocked and/or polluted heat exchangers, including failures and/or damages caused by this blockage are not covered by the warranty.

6.10 Water quality

The pH value of the water must be within the following limits: 7,5 < pH < 9,5. This pH value is reached with the steady conditions. These steady conditions will occur, when after filling the heating system (pH around 7) with fresh water, the water will lose its air because of the air bleeding operation and heating up (dead water conditions).

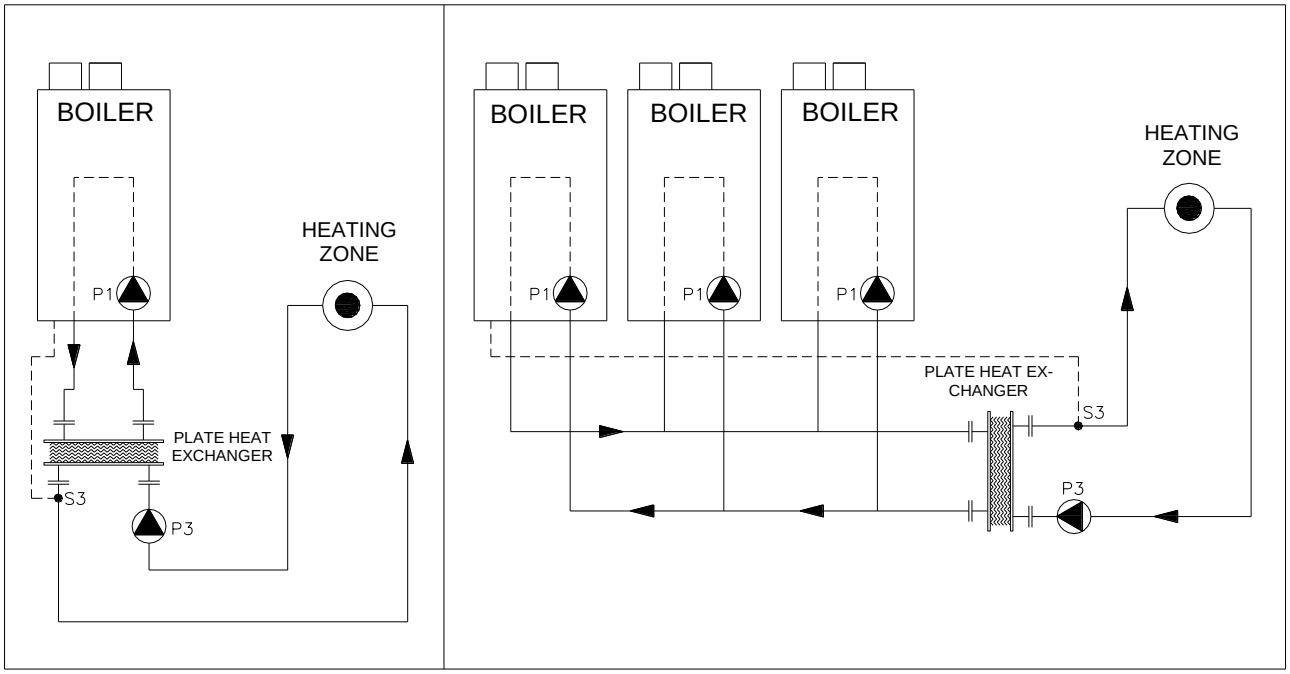
Water hardness must be within the following limits:
3,5° Clark (50 ppm $CaCO_3$) < total hardness < 10,5° Clark (150 ppm $CaCO_3$)

When the water might contain aluminium particles, this should be of a maximum of 0.2 mg/litre. If there is the risk of contamination of the water by any kind of debris/chemicals in the period after installing, a plate heat exchanger should be used to separate the boiler circuit from the heating circuit (see drawing below).

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

6.11 Plastic piping in the heating system

When plastic pipes are used in the central heating system, these should be separated from the boiler system by using a plate heat exchanger. Diffusion (through the plastic) can cause air to enter the heating system. This could damage the boiler, pumps and other components in the system. Be aware that plastic piping is often used in under floor heating systems. When no measures have been taken to prevent the entrance of air into the boiler system, the warranty of the boiler and any boiler part may be deemed invalid.



6.12 Automatic air vent

An automatic air vent is mounted on the boiler to remove the air from the water circuit.
NOTICE: This automatic air vent is only used for bleeding the air in the heat exchanger of the boiler. One or more external automatic air vent(s) and/or air separators must always be mounted in the heating system to take out the air trapped in the heating circuit.
DE-AERATION PROGRAM. When the unit is fired for the first time the unit starts a de-aeration program. One cycle means 5 seconds pump running and 5 seconds pump off. A complete de-aeration program consists out of three cycles. The de-aeration program can be interrupted/stopped by briefly pressing the service button.

6.13 Automatic water filling systems

When using an automatic water refill system some precautions should be taken (fresh water is bringing fresh oxygen into the system), like installing a water meter to measure and evaluate the total water volume that is added to the system. This to detect and eliminate any water leakage as soon as possible.
When an automatic water refill system is used, some form of logging should take place to prevent continuously filling of the system with large amounts of oxygenated fresh water. This can happen when a leak in the system is not detected and the total added water amount is not being logged.

6.14 Water pressure

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

Sensor
A water pressure sensor has been built into the boiler. With this sensor, the minimum water pressure in the boiler is 0,8 bar and the maximum pressure is 4,0 bar (sensor values). The normal water pressure is supposed to be between 1,5 and 2,0 bar.
The pressure sensor will stop the boiler from firing when the water pressure drops below 0,8 bar, and start the boiler firing again when the water pressure reaches above the 1,0 bar. These values can be changed in the boiler control settings.

Higher pressure systems (e.g. in high buildings)
If pressures higher than 4,0 bar occur in the heating system, the best solution is to separate the system from the boiler by means of a plate heat exchanger. Now the boiler pressure can still be under 4,0 bar and the boiler control remains as described above.
Without plate heat exchanger, above 4,0 bar, a water pressure switch has to be built into the boiler instead of the water pressure sensor - the maximum allowed value in the boiler now is 6,0 bar and the boiler control needs to be adjusted.

6.15 Chemical water treatment

The chemical compatibility of several products for treatment of the central heating equipment has been tested on the heat exchangers and the boilers. A list with the corrosion inhibitors in preventative and curative treatment for gas fired central heating boilers can be supplied by Strebel Ltd.

6.16 Under floor heating

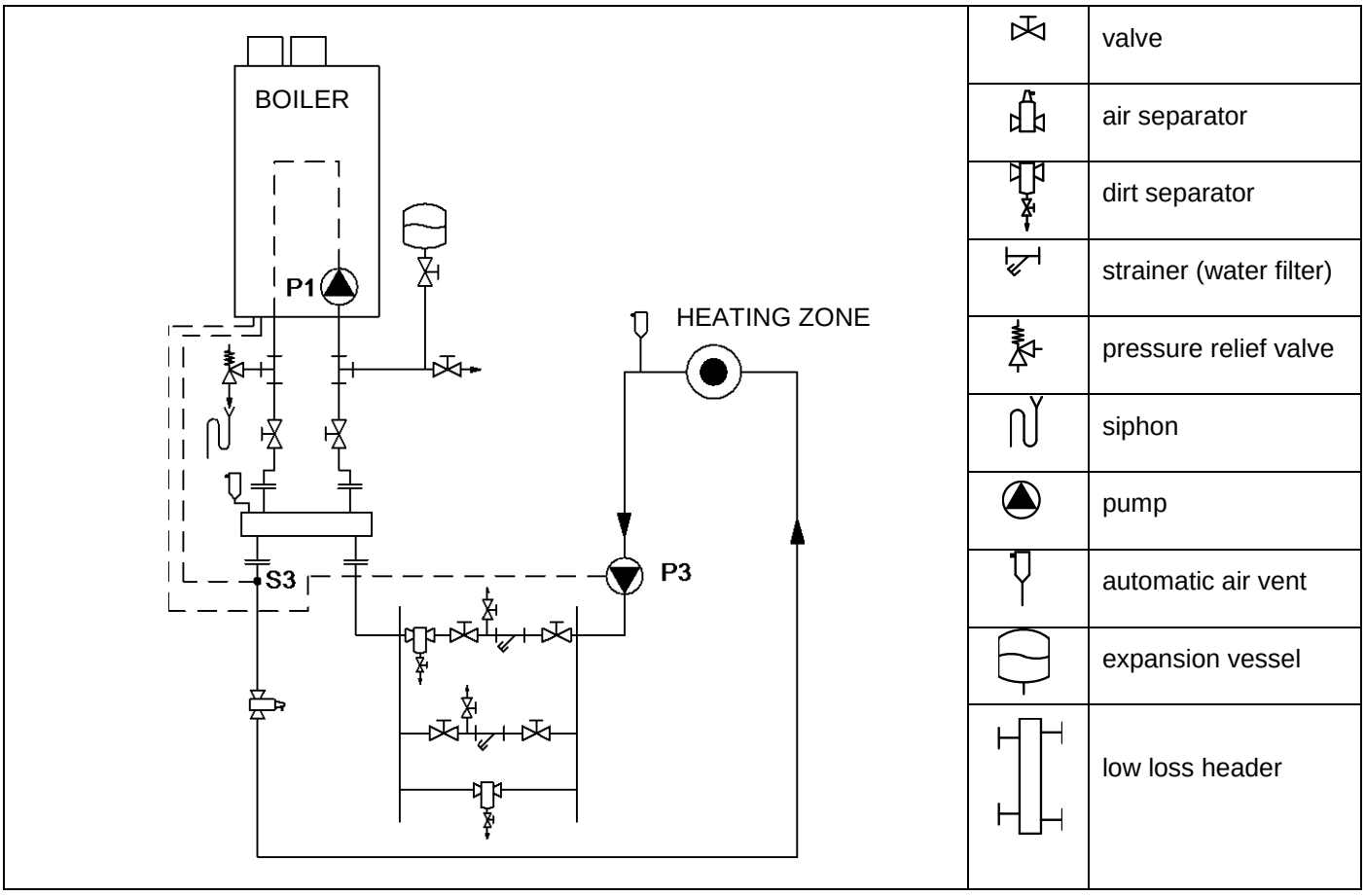
When using an under floor heating system, the boiler circuit must be separated from the heating circuit with a plate heat exchanger.

6.17 Flush the system with fresh water

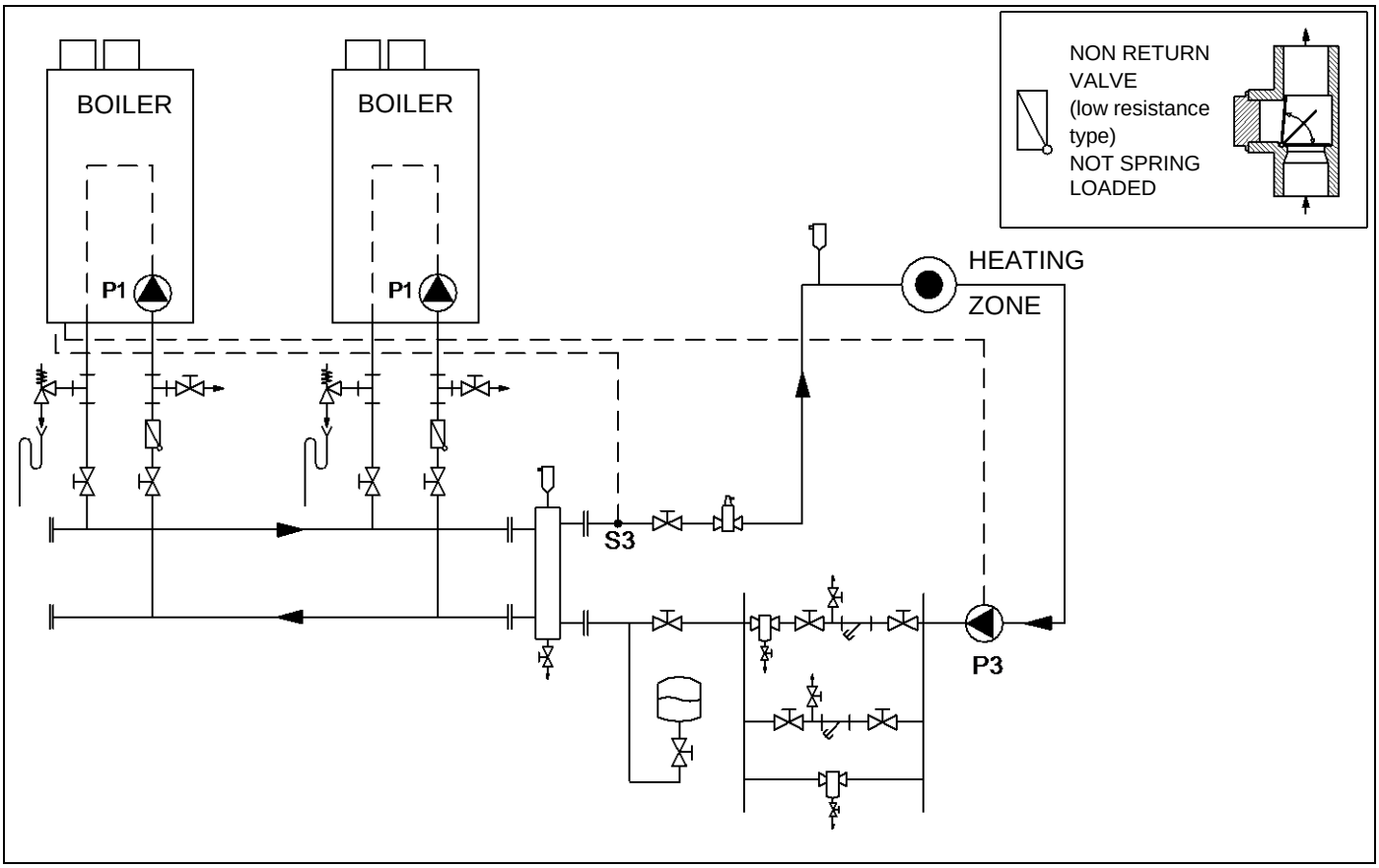
The water of the boiler and heating circuit should be free of any particles, debris and pollution. Therefore the complete installation must always be thoroughly flushed with clean water before installing and using the boiler(s).

6.18 Installation examples

6.18.1 EXAMPLE OF A STANDARD SINGLE BOILER HEATING CIRCUIT WITH LOW LOSS HEADER



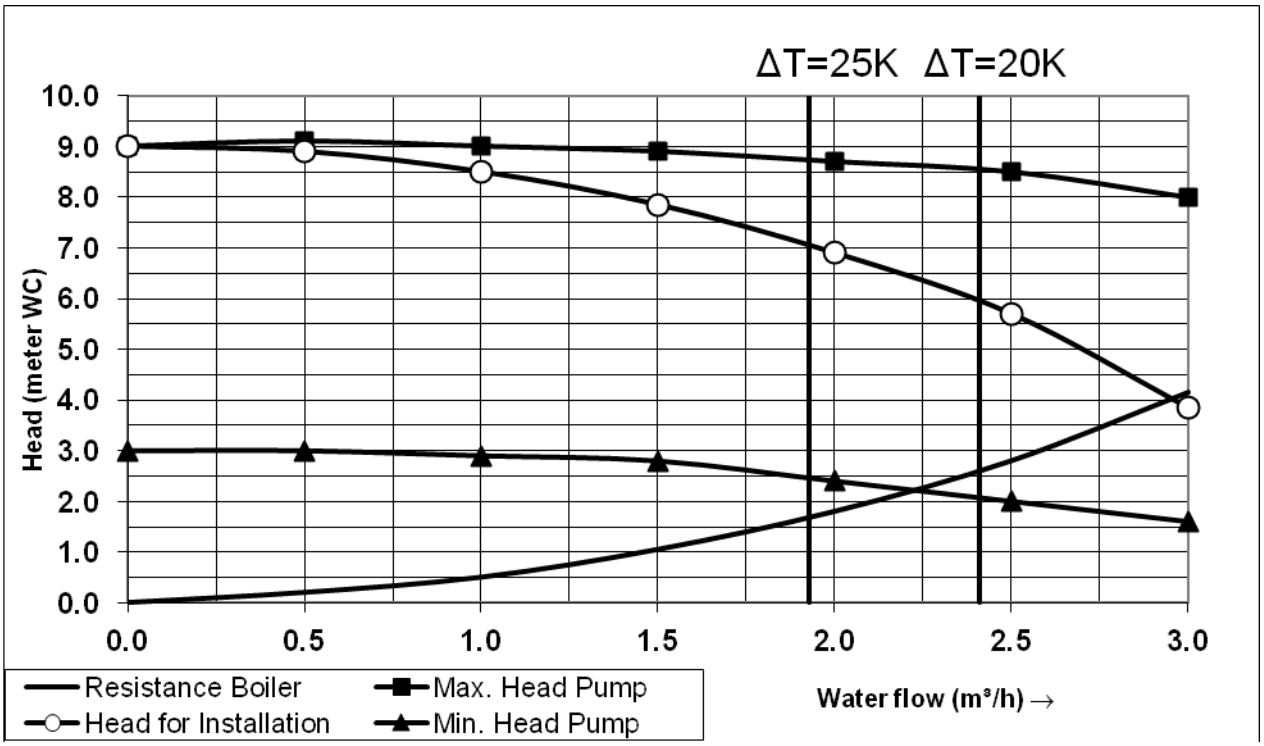
6.18.2 EXAMPLE OF A MULTIPLE BOILER HEATING CIRCUIT WITH LOW LOSS HEADER



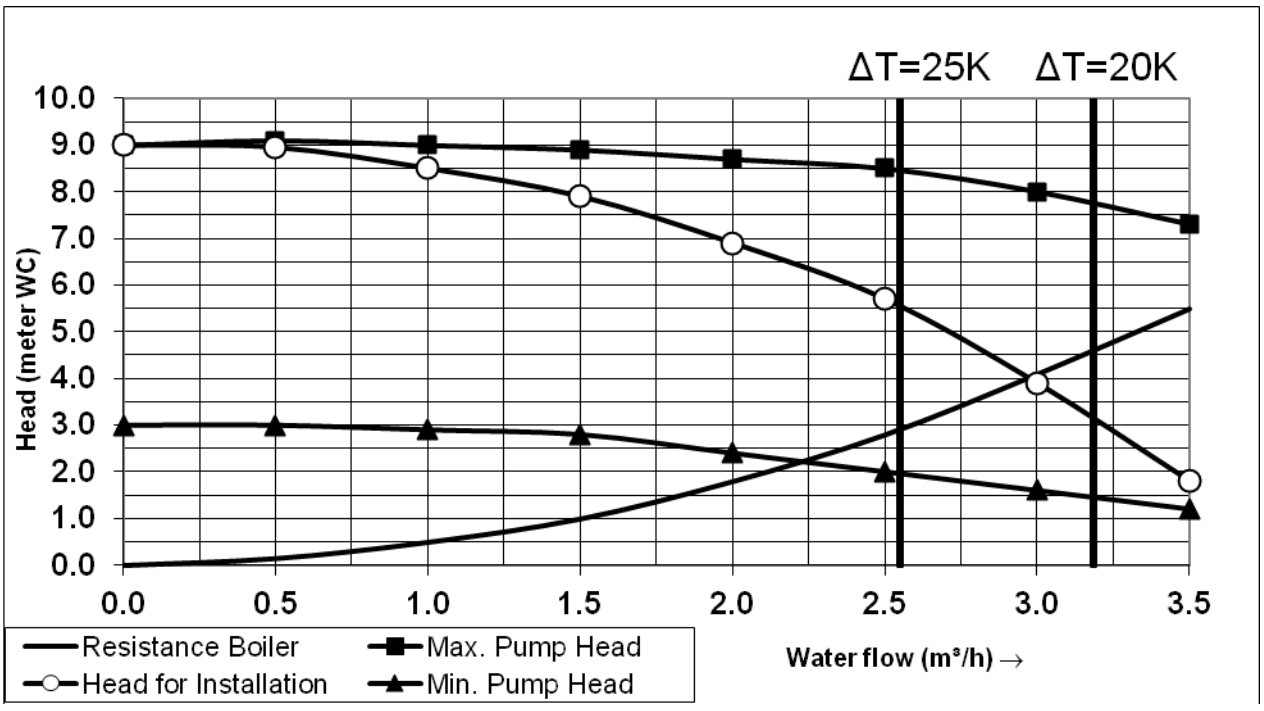
7 PUMP CHARACTERISTICS

7.1Hydraulic graphs

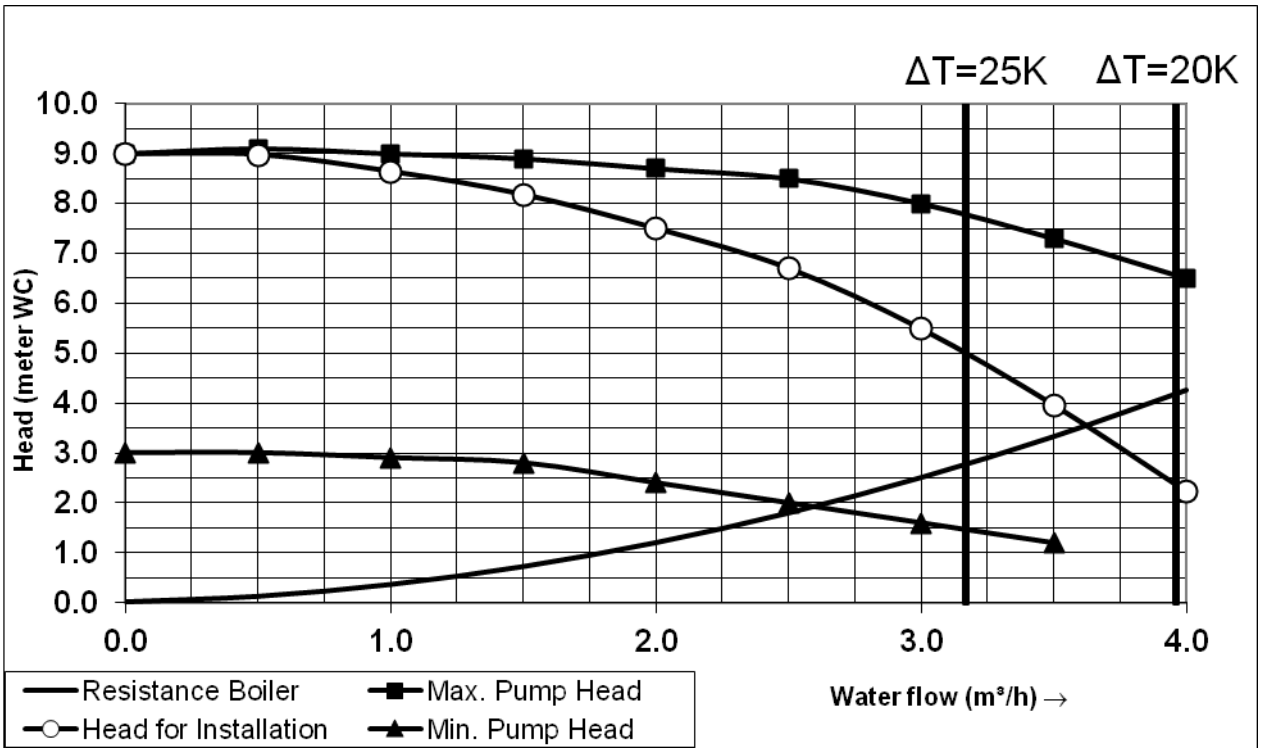
Boiler and pump graph S-CB+ 60. UPML 25-105PWM:



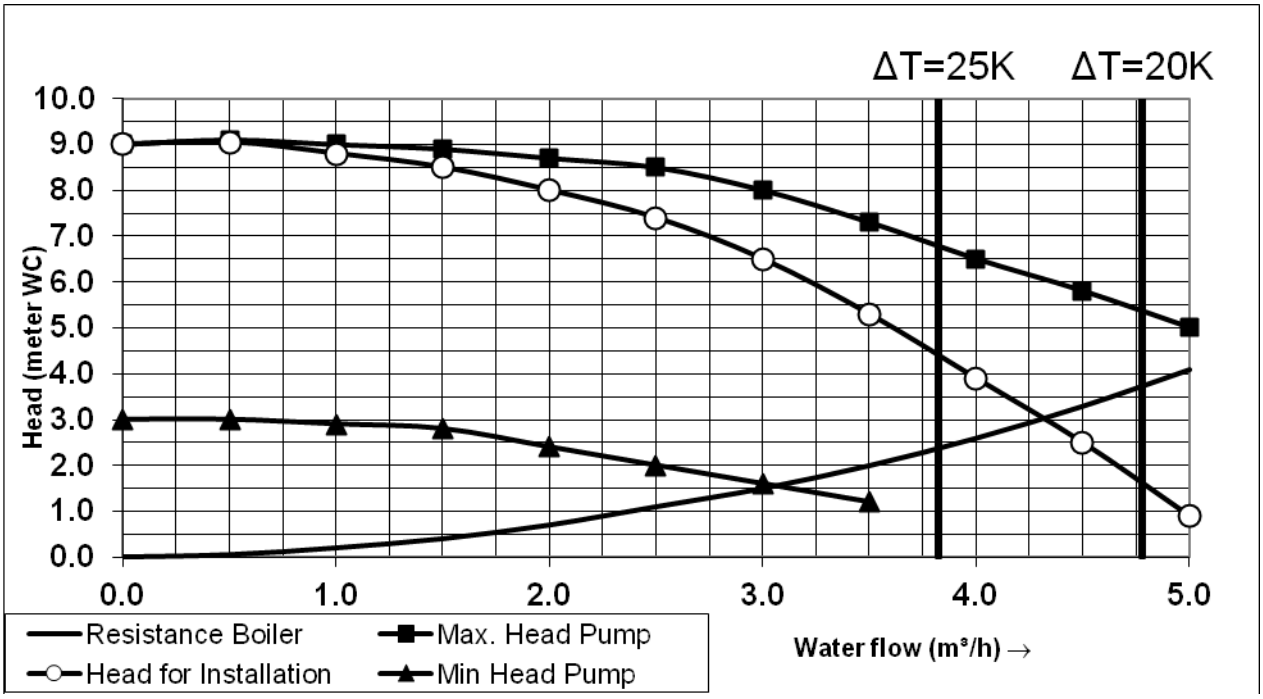
Boiler and pump graph S-CB+ 80. UPML 25-105PWM:



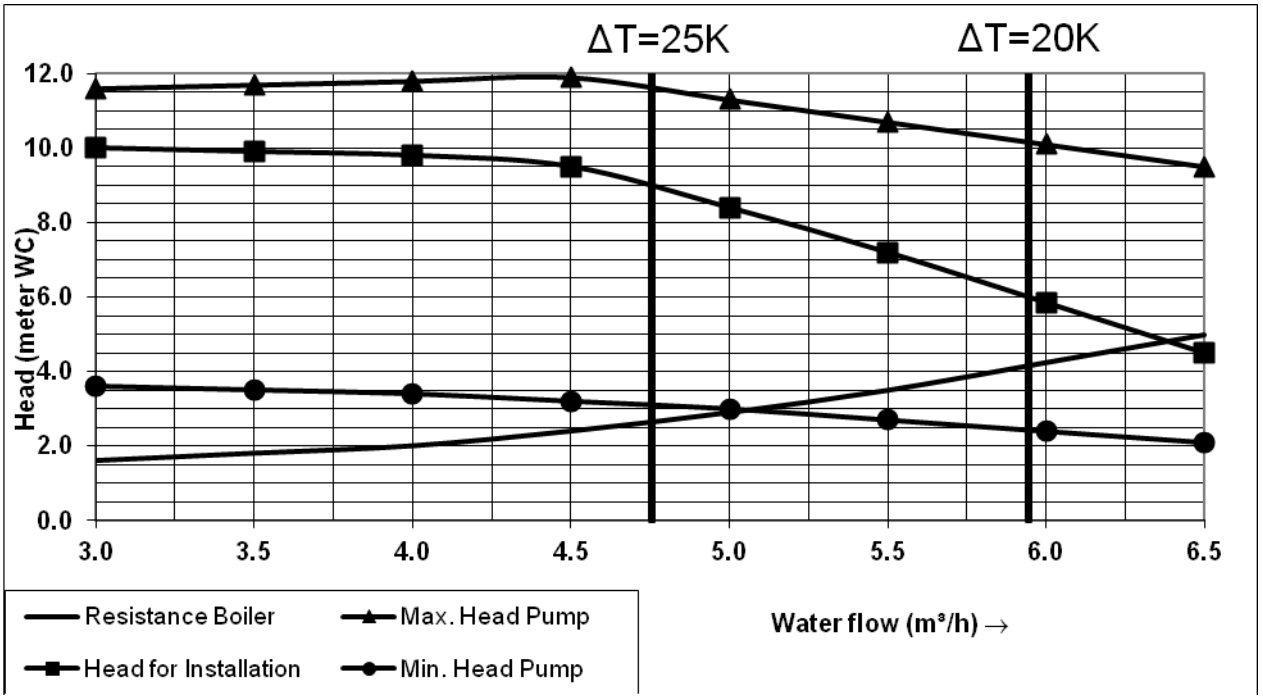
Boiler and pump graph S-CB+ 100. UPML 25-105PWM:



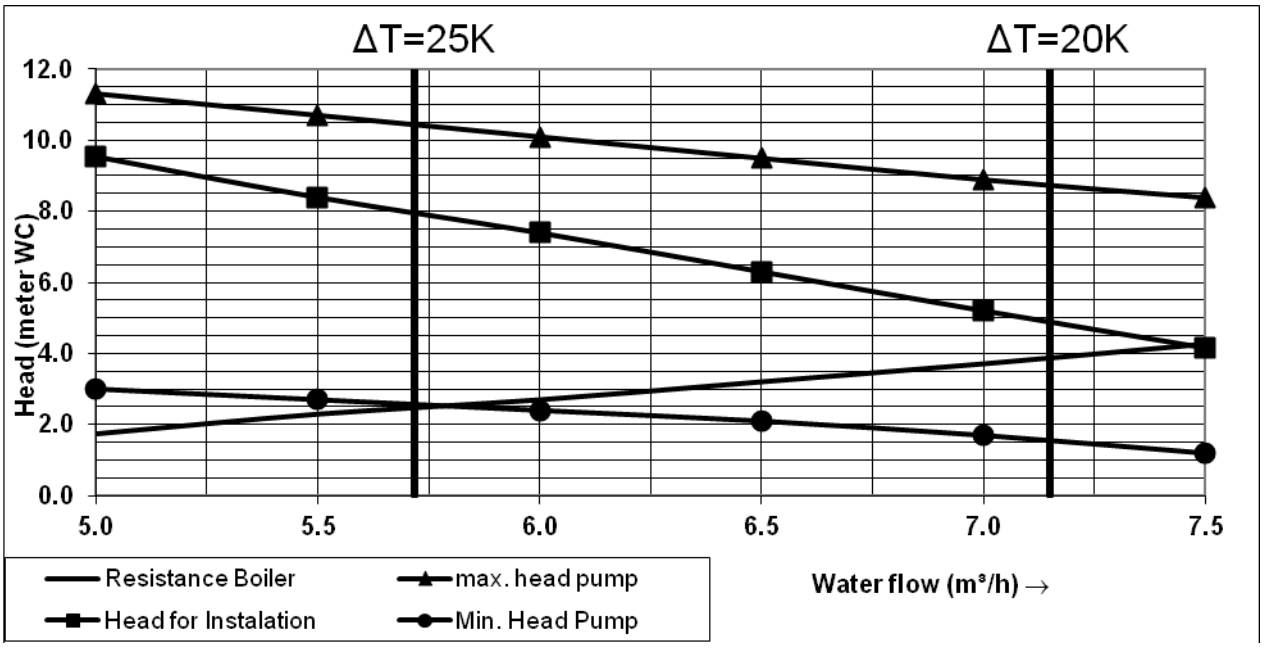
Boiler and pump graph S-CB+ 120. UPML25-105 PWM:



Boiler and pump graph S-CB+ 150. Wilo Stratos Para 30/1-12 PWM:



Boiler and pump graph S-CB+ 180. Wilo Stratos Para 30/1-12 PWM:



Explanation pump graph:

The S-CB+ range is equipped with high efficiency pumps, in the hydraulic graph there is a minimum and maximum head for the pump. This is the range in which the pump will modulate.
The pump speed is controlled by a PWM signal provided by the burner controller at a value causing a Delta T across the heat exchanger of 20°C at the whole burner modulation range.

7.2Pumps: maximum electrical power

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

When the two statements are combined, the conclusion is that nominal currents of pumps, controlled by the PCB, may not exceed 2 A.

Pump P1 - boiler pump.
This modulating pump is part of the appliance. The speed and power consumption depends on the Delta T across the heat exchanger and is controlled by the burner controller.

Pump P2 - calorifier pump.
Pump P2 is a DHWi pump and is used when P4AA = 1, meaning the appliance is an indirect calorifier.
Pumps P1 and P2 are connected to one fuse of 5 A, so their total nominal current may not exceed 5 A. To limit the inrush current, the switching sequence has been modified so pump P2 always switches 100 ms later than pump P1.
The maximum nominal current of pump P2 must also be 2 A, again due to the inrush current.

3 way valve.
The combined nominal current of pump P1 and the 3 way valve must be smaller than 5 A.
So, the inrush current of the 3 way valve must be lower than 3 A.

Pump P3 - system pump.
The nominal current of pump P3 must be equal to or lower than 2 A.

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 § 11.1.7 on page 79.

8 FLUE GAS AND AIR SUPPLY SYSTEM

8.1General

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

Notice:
- Install the horizontal flue components with an angle of 3° downwards in the direction of the boiler (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 60-80 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 heating installation.

Note
Because the flue gases can have a low temperature, the boiler needs to have a high efficiency approved stainless steel or plastic flue system. These materials, including the gaskets, should be usable for positive pressure flue gas systems and have a temperature class of **T120**.

8.2Air supply

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

The air supply duct can be made of:
- PVC / PP
- Thin-walled aluminium
- Stainless steel

8.2.1 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 boiler near a swimming pool, a washing machine, laundry or chemical plants does expose combustion air to these contaminants.

8.2.2 AIR SUPPLY THROUGH HUMID AREAS

When the supply duct will be placed in a boiler 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 boiler and therefore condensation at the internal air canals must be prevented.

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

8.3Flue terminal

Never use aluminium (containing) flue gas materials for this boiler.

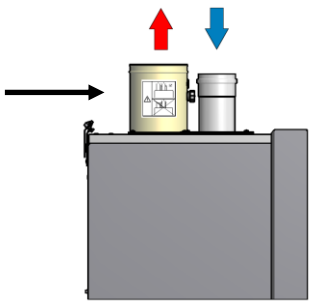
The flue terminal duct can be made of:
- Stainless steel in combination with **T120** gaskets
- PP temperature class **T120**

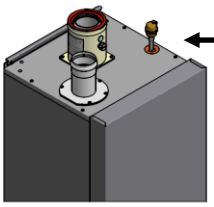
Multiple boilers can be connected to a common duct. These flue gas systems for multiple boiler installations must always be engineered as zero or negative pressure systems; this to prevent the risk of recirculation of the flue gases. Consult the flue gas supplier for detailed information and engineering. See also the cascade manual for these multiple boiler installations.

8.4S-CB$^+$ 60 Twin pipe version

The S-CB$^+$ 60 boiler as shown in the picture below, is a twin pipe boiler with separate air inlet and flue outlet pipes. Do NOT connect a concentric pipe to this boiler.

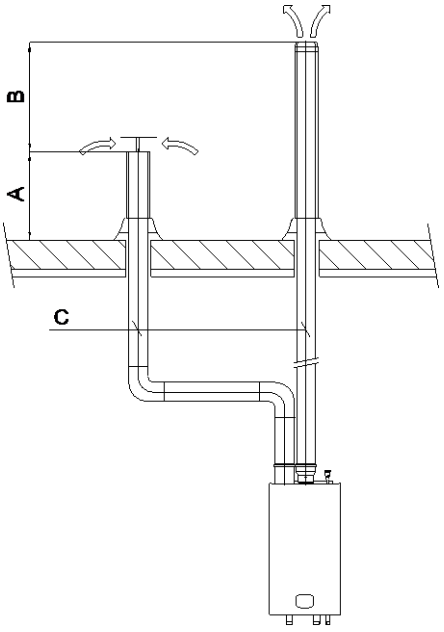
Note the sticker on the flue pipe, indicating that this is a twin pipe boiler.





The twin pipe version is recognized by the two pipes, one of which has a **RED** ring cap.

8.5Pipe heights and mutual distances on a flat roof



Height A

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

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

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

Height difference B

This is the distance between the flue outlet and the air inlet.
The flue gas outlet should be at least 70 cm above the air inlet. It is advised to be equipped with a conical outlet.
When no air inlet connection is applied on the roof, the flue outlet should be situated at least 100 cm above the roof surface.

Distance C

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

8.6B23P certified

Overpressure flue gas systems
For boiler classification B23P and for overpressure flue gas systems the minimum requirements of the flue gas material for Eco Boilers can be determined in a designation string according to the EN1443 (see table):

CE string flue gas material (B23P)	European standard	Temperature class	Pressure class	Resistance to condensate	Corrosion resistance class	→
min. requirement PP	EN 14471	T120	P1	W	1	
min. requirement StS	EN 1856-1	T120	P1	W	1	

→	Metal: liner specifications	Soot fire resistance class	Distance to combustible material	Plastics: location	Plastics: fire behaviour	Plastics: enclosure
		O	30	I or E	C/E	L
	L20040	O	40			

A few examples of flue gas material suitable for ECO boilers:
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.

8.7C63 certified

In general, boilers are certified with their own flue gas material. If a boiler is C63 certified, no specific type flue gas material has been certified in combination with the boiler. In this case the flue gas material does not need to be certified in combination with the boiler but should be fit for purpose, and comply with the applicable European standards. It must be able to handle the condensate forming and transport, overpressure and must have a minimum temperature class of **T120**.

8.8Flue gas and air supply resistance table

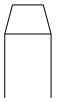
In the next section, for five typical flue gas outlet & air inlet configurations the maximum lengths of the straight pipes will be calculated. First all component resistance values are given in the next table:

		+60	+80	+100	+120	+150	+180
FLUE GAS PIPING	**Ø [mm] ***	**RESISTANCE [Pa]**					
straight tube/m	80	5,0	8,0	-	-	-	-
	100	2,0	3,5	4,0	6,5	-	-
	130	0,45	0,8	1,2	1,8	3,8	6,0
	150	-	-	0,5	0,8	1,7	3,0
45° bend	80	2,5	4,0	-	-	-	-
	100	1,0	1,7	2,0	3,2	-	-
	130	0,2	0,4	0,6	0,8	1,9	3,0
	150	-	-	0,2	0,4	0,8	1,5
90° bend	80	5,0	8,0	-	-	-	-
	100	2,0	3,5	4	6,5	-	-
	130	0,4	0,8	1,2	1,8	3,8	6,0
	150	-	-	0,5	0,7	1,7	3,0
Flue outlet zeta=0,05	80	0,7	1,2	-	-	-	-
	100	0,3	0,5	0,8	1,1	-	-
	130	0,1	0,18	0,3	0,4	0,6	0,9
	150	-	-	0,15	0,2	0,35	0,5
Flue outlet zeta=1	80	13,8	24,0	-	-	-	-
	100	5,6	9,8	15,2	22,1	-	-
	130	2,0	3,5	5,3	7,8	12,0	17,3
	150	-	-	3,0	4,4	6,8	9,8
Flue outlet zeta=1,5	80	20,6	36,0	-	-	-	-
	100	8,5	14,8	22,8	33,2	-	-
	130	3,0	5,2	8,0	11,6	18,0	26,0
	150	-	-	4,5	6,6	10,2	14,7
AIR SUPPLY PIPING	**Ø [mm] ***	**RESISTANCE [Pa]**					
straight tube/m	80	4,0	7,5	-	-	-	-
	100	1,2	3,0	3,5	4,0	-	-
	130	0,35	0,75	0,8	1,1	1,2	2,0
	150	-	-	0,3	0,4	0,6	1,2
45° bend	80	2,0	3,5	-	-	-	-
	100	0,6	1,5	1,7	2	-	-
	130	0,2	0,4	0,4	0,5	0,6	1,0
	150	-	-	0,15	0,2	0,3	0,6
90° bend	80	4,0	7,0	-	-	-	-
	100	1,2	3,0	3,5	4,0	-	-
	130	0,3	0,7	0,8	1,1	1,2	2,0
	150	-	-	0,3	0,4	0,6	1,2
Air inlet zeta =1	80	10,4	18,1	-	-	-	-
	100	4,2	7,4	11,4	16,7	-	-
	130	1,5	2,6	4,0	5,8	9,1	13,1
	150	-	-	2,3	3,3	5,1	7,4
CONCENTRIC PARTS	**Ø [mm] ***	**RESISTANCE [Pa]**					
roof terminal	80/125	34	61	-	-	-	-
	100/150	-	-	39	45	69	86
	130/200	-	-	-	-	15	23
outside wall terminal	80/125	13	22	-	-	-	-
	100/150	-	-	19	24	40	48
straight tube/m	80/125	9	12	-	-	-	-
	100/150	-	-	8	10	14	16
45° bend concentric	80/125	5	7	-	-	-	-
	100/150	-	-	8	9	14	16
90° bend concentric	80/125	8	13	-	-	-	-
	100/150	-	-	11	13	22	28
conc./par. adaptor	80/125	10	14	-	-	-	-
	100/150	-	-	16	22	40	56

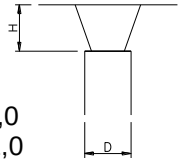
FLUE GAS OUTLET

zeta=0
open outlet

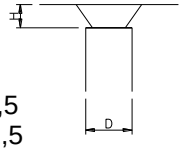
zeta=0,05
conical outlet



H/D=1,0
zeta=1,0

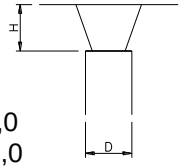


H/D=0,5
zeta=1,5



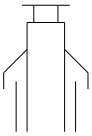
AIR INLET

H/D=1,0
zeta=1,0

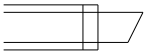


CONCENTRIC
FLUE GAS OUTLET
AIR INLET

ROOF



WALL



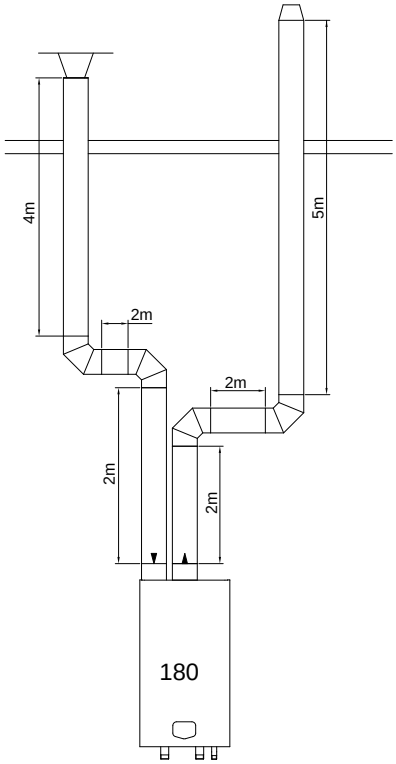
*** Never reduce pipe diameters relative to boiler connections**
Values printed in grey applicable for larger pipe diameters than boiler connection

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

8.9Five typical examples

A:	Twin pipe system with separate pipes for flue gas and air supply	**C13, C33, C43, C63, C93**
B:	Twin pipe system with separate pipes and concentric roof terminal	**C13, C33, C43, C63, C93**
C:	Single pipe for flue gas outlet only (air supply from boiler room)	**B23, B23P, B33**
D:	Concentric pipe for flue gas/air supply (roof-mounted)	**C13, C33, C43, C63, C93**
E:	Concentric pipe for flue gas/air supply (wall-mounted)	**C13, C33, C43, C63, C93**

8.9.1 EXAMPLE A: TWIN PIPE SYSTEM

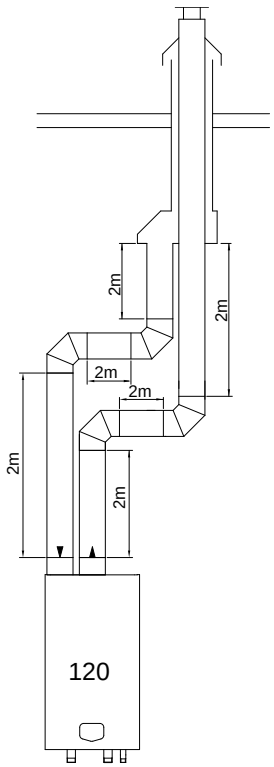


Calculation example with given lengths: checking resistance

Boiler type:		**S-CB+ 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.

8.9.2 EXAMPLE B: TWIN PIPE SYSTEM WITH CONCENTRIC ROOF TERMINAL

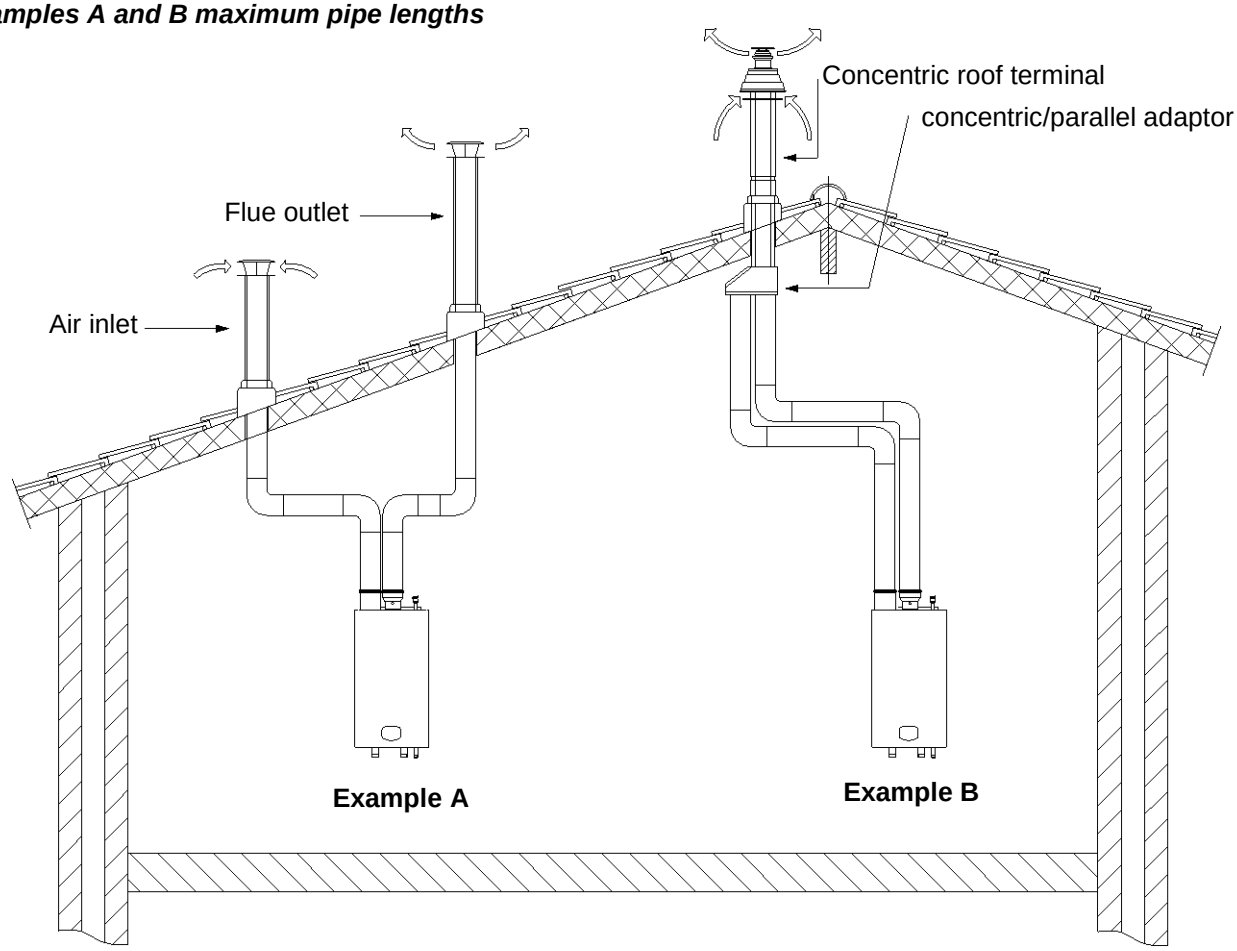


Calculation example with given lengths: checking resistance

Boiler type:		**S-CB+ 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 sup-ply	**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.

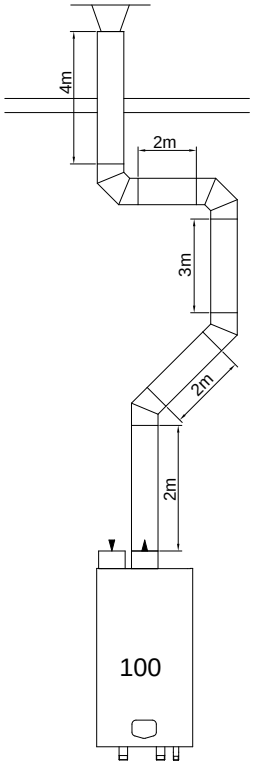
Examples A and B maximum pipe lengths



Example A							
boiler type →		**S-CB + 60**	**S-CB + 80**	**S-CB + 100**	**S-CB + 120**	**S-CB + 150**	**S-CB + 180**
Diameter air inlet	[mm]	80	80	100	100	130	130
Diameter flue outlet	[mm]	80	80	100	100	130	130
Diam. roof terminals	[mm]	80	80	100	100	130	130
Maximum pipe length (inlet + outlet together)	**[m]**	**27,5**	**18,0**	**31,5**	**24,0**	**44,5**	**30,0**

Example B							
boiler type →		**S-CB + 60**	**S-CB + 80**	**S-CB + 100**	**S-CB + 120**	**S-CB + 150**	**S-CB + 180**
Diameter air inlet	[mm]	80	80	100	100	130	130
Diameter flue outlet	[mm]	80	80	100	100	130	130
Concentric roof terminal	[mm]	80/125	80/125	100/150	100/150	130/200	130/200
Maximum pipe length (inlet + outlet together)	**[m]**	**21,0**	**12,0**	**23,0**	**16,5**	**40,5**	**25,5**

8.9.3 EXAMPLE C: SINGLE FLUE GAS OUTLET. AIR SUPPLY FROM BOILER ROOM

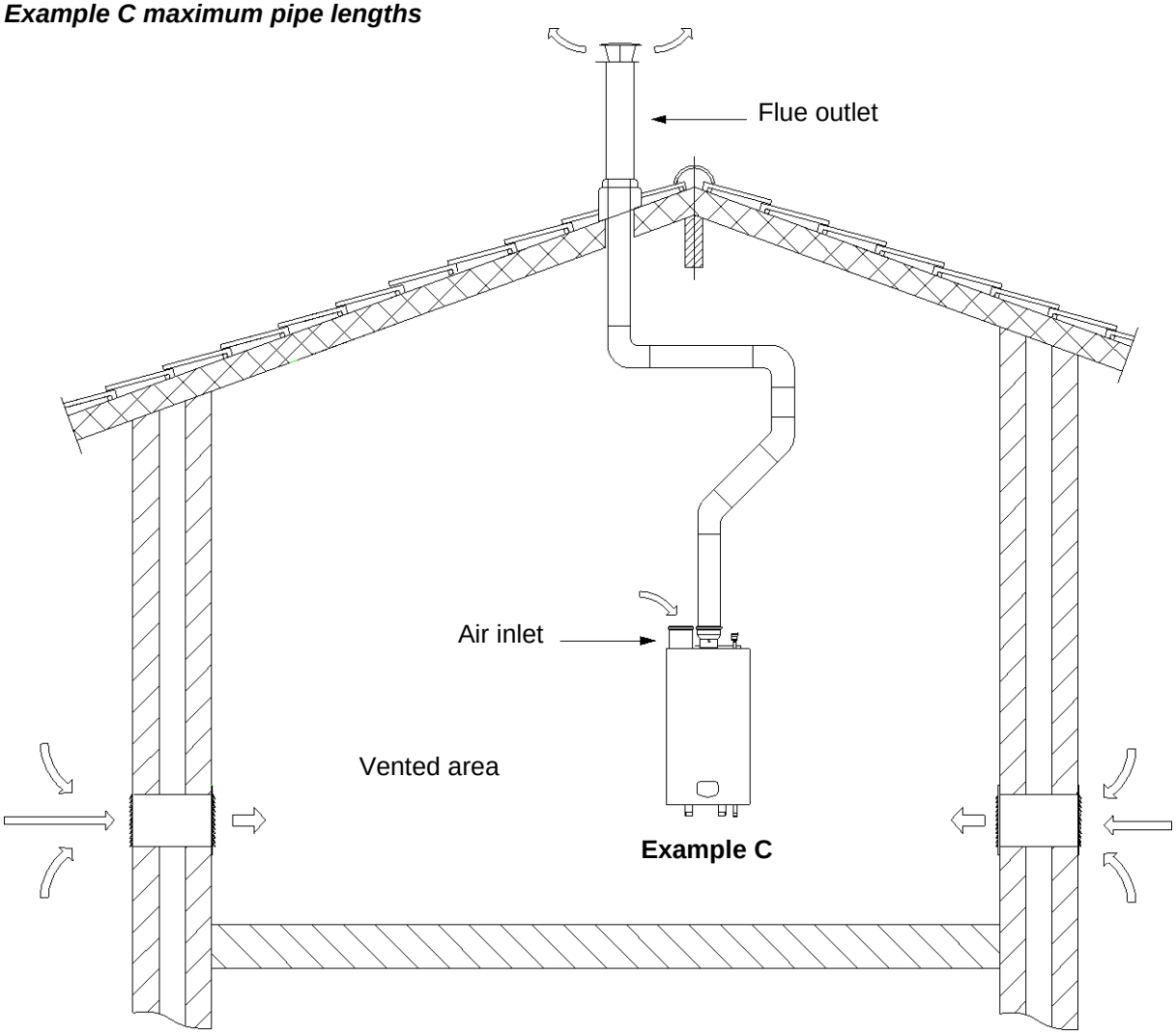


Boiler type:		S-CB+ 100		
Flue gas	**Diameter: 100 mm**	**Number**	**Pa**	**Pa total**
	Straight tube m¹ total	13	4	52
	Bend 90°	2	4	8
	Bend 45°	2	2	4
	Flue outlet H/D = 1,0	1	15,2	15,2
	Total resistance flue gas outlet:			**79,2**

Calculation example with given lengths: checking resistance

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

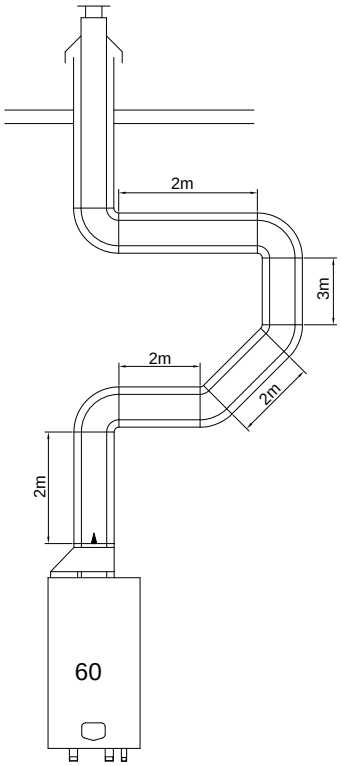
Example C maximum pipe lengths



Example C

Example C							
boiler type →		**S-CB⁺ 60**	**S-CB⁺ 80**	**S-CB⁺ 100**	**S-CB⁺ 120**	**S-CB⁺ 150**	**S-CB⁺ 180**
Diameter air inlet	[mm]	80	80	100	100	130	130
Diameter flue outlet	[mm]	80	80	100	100	130	130
Diam. roof terminal	[mm]	80	80	100	100	130	130
Maximum pipe length (total outlet length)	**[m]**	**36,5**	**21,5**	**46,5**	**27,5**	**49,5**	**30,0**

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

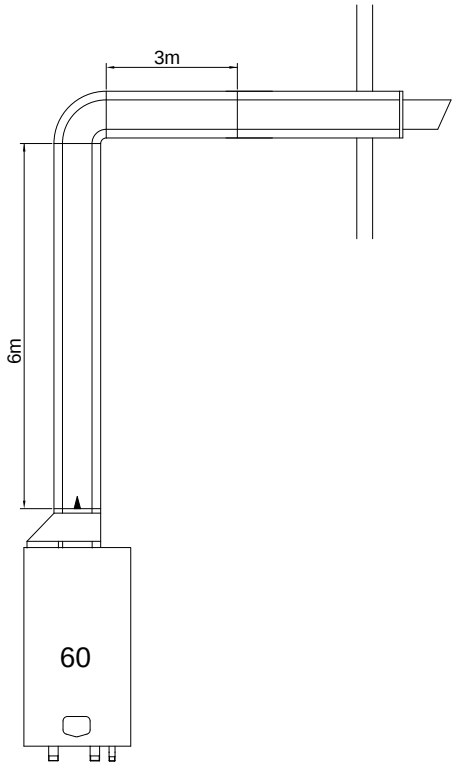


Calculation example with given lengths: checking resistance

Boiler type:		S-CB+ 60			
Concentric	Diameter: 80/125 mm.		Number	Pa	Pa total
	Adaptor conc./par.	80/125	1	10	10
	Straight tube m¹	total	11	9	99
	Bend	90°	3	8	24
	Bend	45°	2	5	10
	Concentric terminal	roof	1	34	34
	Total resistance flue gas outlet and air supply (concentric):				**177**

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

8.9.5 EXAMPLE E: CONCENTRIC FLUE GAS/AIR SUPPLY PIPE (WALL-MOUNTED)

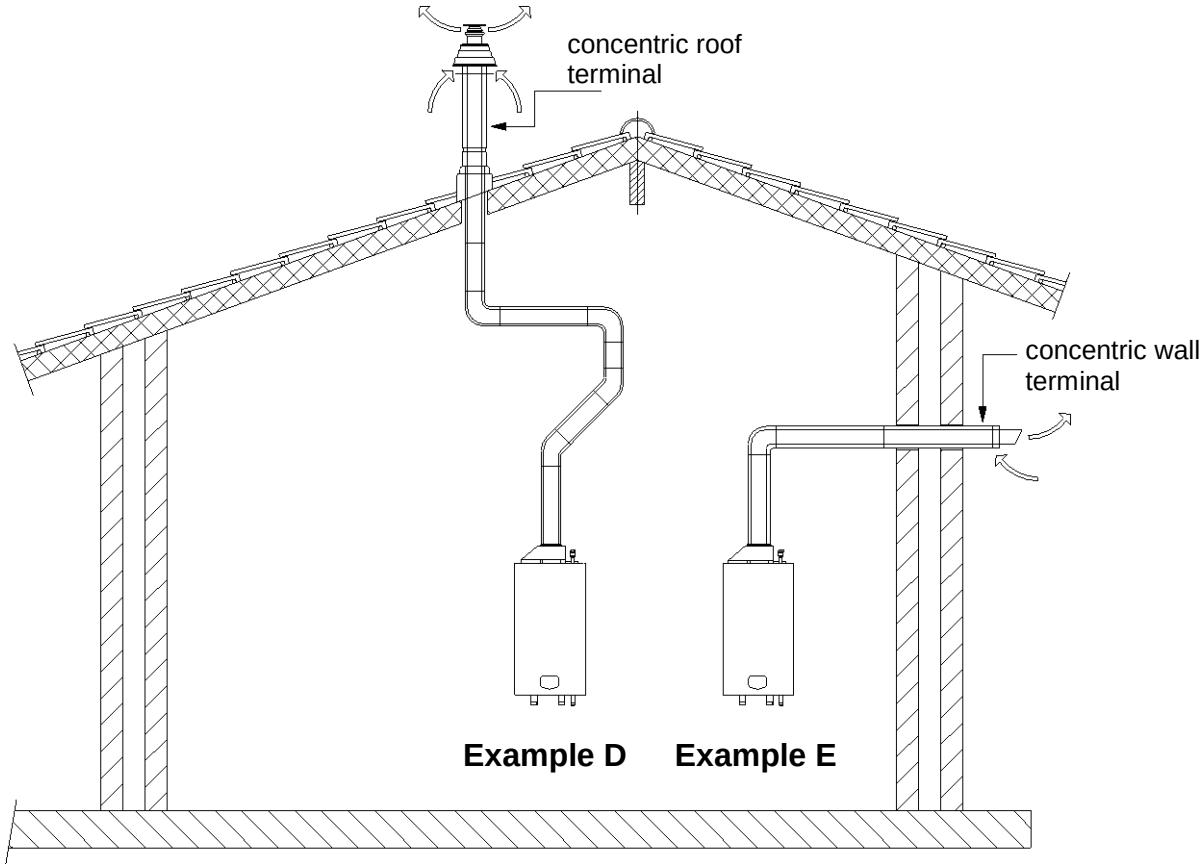


Calculation example with given lengths: checking resistance

Boiler type:		S-CB+ 60			
Concentric	Diameter: 80/125 mm		Number	Pa	Pa total
	Adaptor conc./par.	80/125	1	10	10
	Straight tube m¹	total	9	9	81
	Bend	90°	1	8	8
	Concentric terminal	wall	1	13	13
	Total resistance flue gas outlet and air supply (concentric):				**112**

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							
boiler type →		**S-CB⁺ 60**	**S-CB⁺ 80**	**S-CB⁺ 100**	**S-CB⁺ 120**	**S-CB⁺ 150**	**S-CB⁺ 180**
Diameter concentric pipe	[mm]	80/125	80/125	100/150	100/150	**NOT RECOMMENDED** (choose B,C or E)	
Concentric roof terminal	[mm]	80/125	80/125	100/150	100/150		
Maximum pipe length	**[m]**	**13,5**	**6,0**	**12,0**	**7,5**		

Example E							
boiler type →		**S-CB⁺ 60**	**S-CB⁺ 80**	**S-CB⁺ 100**	**S-CB⁺ 120**	**S-CB⁺ 150**	**S-CB⁺ 180**
Diameter concentric pipe	[mm]	80/125	80/125	100/150	100/150	100/150	100/150
Concentric wall terminal	[mm]	80/125	80/125	100/150	100/150	100/150	100/150
Maximum pipe length	**[m]**	**18,5**	**12,5**	**19,0**	**14,0**	**7,0**	**4,0**

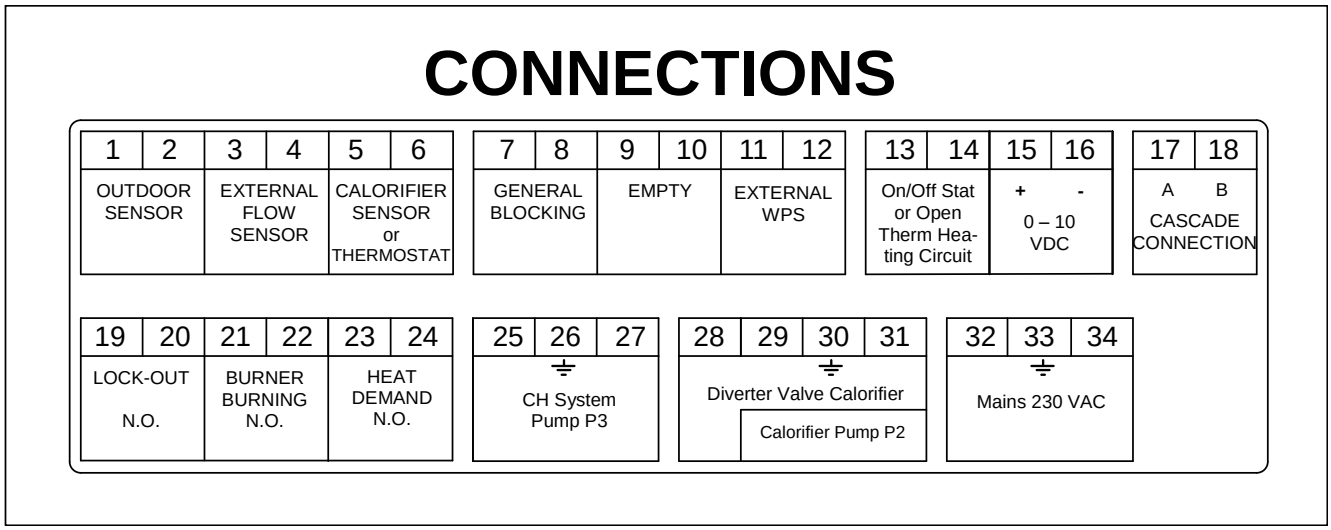
9 ELECTRICAL INSTALLATION

9.1General

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 boiler front door and the connector protection cover.

- For operation the boiler needs a power supply of 230 Vac 50Hz.
- The boiler connections are not life/neutral sensitive (the boiler is not phase-sensitive).
- The wiring for the connections can be entered at the bottom of the boiler through the cable glands.
- NOTICE: Before starting to work on the boiler, it must be switched off and the power supply to the boiler must be disconnected.
- Electrical wiring should be installed according to all applicable standards and regulations.
- Working on the boiler should only be done by a qualified service engineer that is skilled in working on electrical installations and according to all applicable standards.

9.2Electrical connections

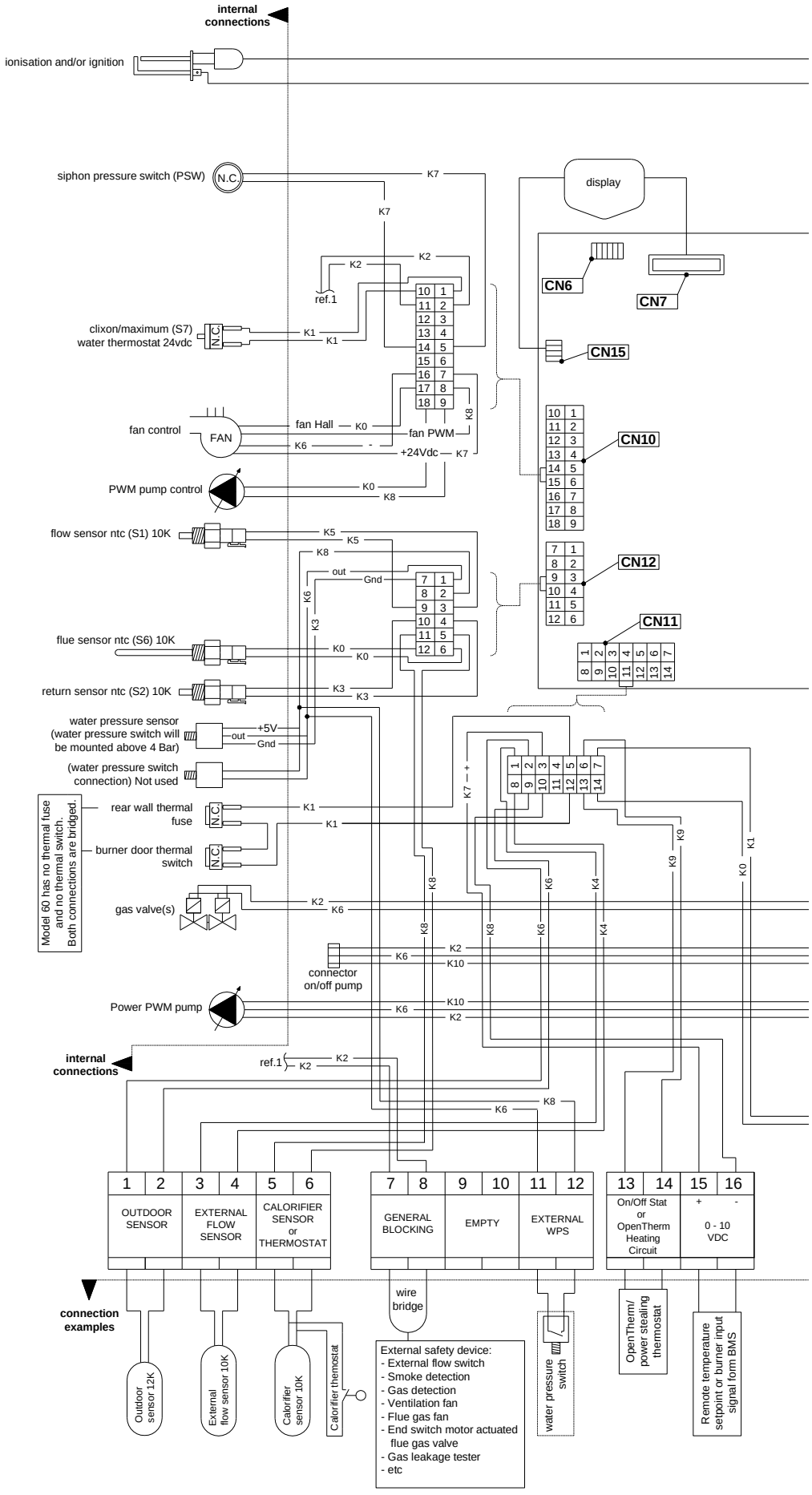


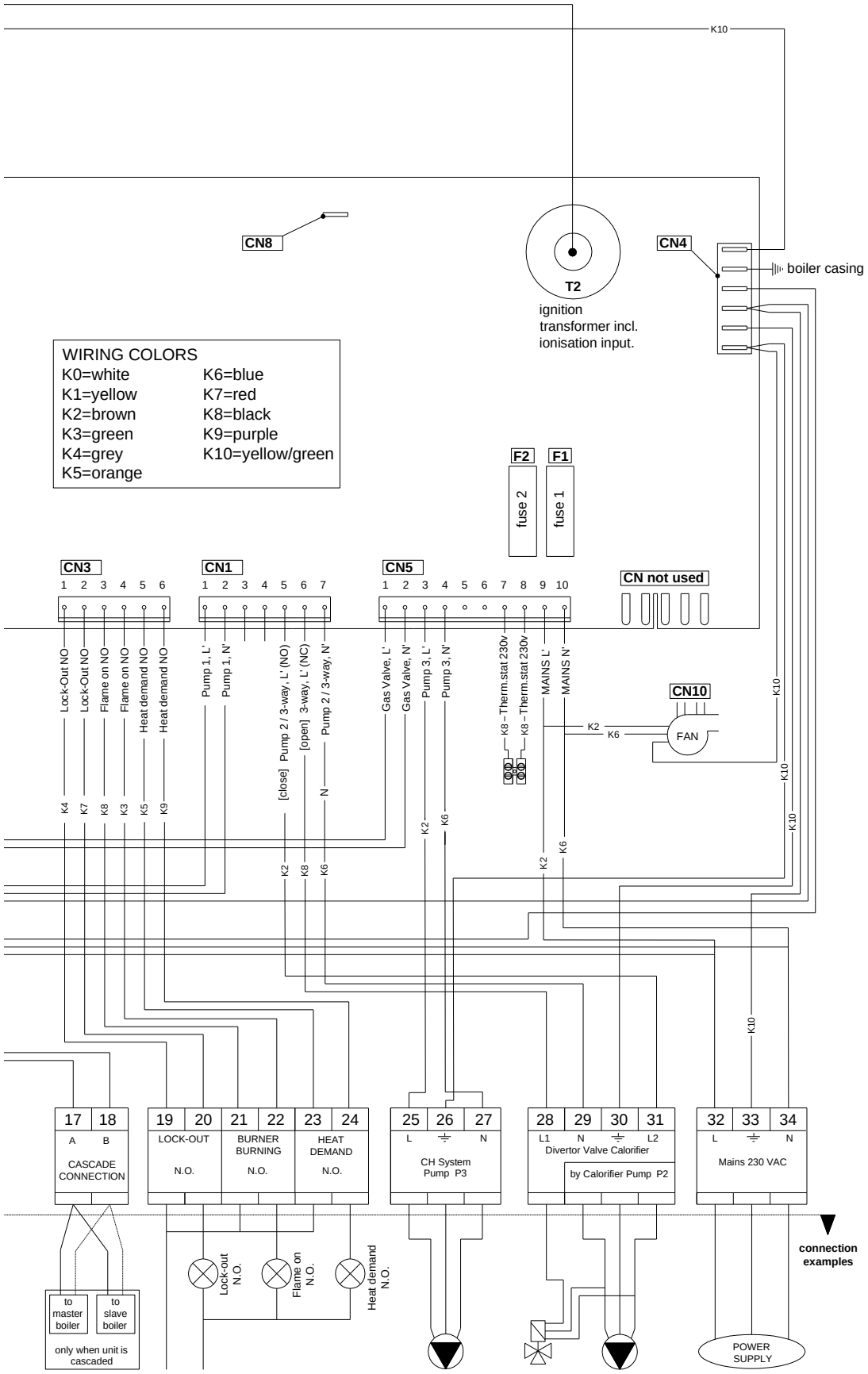
9.3Explanation of the connections

1-2	**OUTDOOR SENSOR**
When an outdoor temperature sensor is connected, the boiler will control the flow water temperature by using a calculated setting, which is relative to the outdoor temperature. PARAMETER: No parameter settings needed.	
3-4	**EXTERNAL FLOW SENSOR**
When a low loss header is used, this sensor measures the flow temperature at the system side. The sensor must be mounted on the supply pipe at the system side, just behind the low loss header. NOTICE: The sensor must be used when boilers are cascaded with the internal cascade manager. PARAMETER: No parameter settings needed.	
5-6	**CALORIFIER SENSOR or THERMOSTAT**
When an indirect hot water tank / calorifier is installed, a hot water sensor must be connected to these terminals. In case of a DHW heat demand, the set point will be shown in the display. An external on/off thermostat can also be connected to these terminals. When there is heat demand (terminals 5 and 6 are bridged) the flow temperature going to the heating coil(s) will be shown in the display.	

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 sensor is mounted in the boiler. As an option a water pressure switch can be installed. The sensor can be replaced by the water pressure switch, which can be wired to the terminals. When terminals 11-12 are not bridged, the boiler will lock-out. PARAMETER: A parameter change is needed.	
13-14	**ON/OFF STAT OR OPENTHERM HEATING CIRCUIT**
OPTION 1: An ON/OFF thermostat can be connected. The boiler will use the set/programmed flow temperature for the heating system when these terminals 13 and 14 are bridged. OPTION 2: An OpenTherm (OT) controller can be connected to the terminals 13 and 14. The boiler 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 boilers are cascaded with the internal cascade manager for controlling the total cascade. NOTICE: Connect all terminals 17 and all terminals 18 together, do not switch between these terminals.	
19-20	**LOCK-OUT OR PUMP ON/OFF**
This contact is N.O. (normally open). When the unit is in lock-out this contact will close. This contact can also be used for the switching of a pump with a separate control input connection; then a parameter change is needed.	
21-22	**BURNER BURNING OR EXTRA BOILER 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 boiler or for the switching of a pump with a separate control input connection; in both latter cases a parameter change is needed.	
23-24	**HEAT 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; then a parameter change is needed.	
25-26-27	**CH SYSTEM PUMP P3**
Connections for a central heating system pump (P3). Nominal pump current of P3 may not exceed 2 A, therefore its power may not exceed 460 W, see also § 0.	
28-29-30-31	**DIVERTER VALVE CALORIFIER**
When using a calorifier/hot water tank, a 3-way valve or a pump (P2) can be used to divert hot water to the heating coil of the calorifier/tank. This 3-way valve will open, when the hot water storage tank/calorifier has a heat demand. PARAMETER: A parameter change is needed. 28 = L2 wire (heating position); 29 = Neutral wire; 30 = Ground wire; 31 = L1 wire (hot water position). The inrush current of the 3-way valve may not exceed 3 A, see also § 0.	
29-30-31	**CALORIFIER PUMP P2**
When using a calorifier/hot water tank, a 3-way valve or a pump (P2) can be used to divert hot water to the heating coil of the calorifier/tank. This pump will start when the hot water storage tank/calorifier creates a hot water demand. PARAMETER: A parameter change is needed. Nominal pump current of P2 may not exceed 2 A, therefore its power may not exceed 460 W, see also § 0.	
32-33-34	**POWER SUPPLY**
The power supply connection of the unit. 32 = Phase wire; 33 = Ground wire; 34 = Neutral wire.	

9.4Electrical schematics


internal connections
ionisation and/or ignition
siphon pressure switch (PSW)
N.C.
K7
display
CN6
CN7
CN15
CN10
CN12
CN11
ref.1
K2
clixon/maximum (S7) water thermostat 24vdc
K1
fan control
FAN
fan Hall
fan PWM
+24Vdc
K0
K6
K8
PWM pump control
flow sensor ntc (S1) 10K
K5
out
Gnd
flue sensor ntc (S6) 10K
return sensor ntc (S2) 10K
K3
water pressure sensor (water pressure switch will be mounted above 4 Bar)
+5V
(water pressure switch connection) Not used
Model 60 has no thermal fuse and no thermal switch. Both connections are bridged.
rear wall thermal fuse
burner door thermal switch
gas valve(s)
connector on/off pump
Power PWM pump
K10
K9
K4
internal connections
OUTDOOR SENSOR
EXTERNAL FLOW SENSOR
CALORIFIER SENSOR or THERMOSTAT
GENERAL BLOCKING
EMPTY
EXTERNAL WPS
On/Off Stat or OpenTherm Heating Circuit
0 - 10 VDC
connection examples
wire bridge
Outdoor sensor 12K
External flow sensor 10K
Calorifier sensor 10K
Calorifier thermostat
External safety device:
- External flow switch
- Smoke detection
- Gas detection
- Ventilation fan
- Flue gas fan
- End switch motor actuated flue gas valve
- Gas leakage tester
- etc
water pressure switch
OpenTherm/ power stealing thermostat
Remote temperature setpoint or burner input signal form BMS


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
CN10
FAN
Lock-Out NO
Lock-Out NO
Flame on NO
Flame on NO
Heat demand NO
Heat demand NO
Pump 1, L'
Pump 1, N'
Pump 2 / 3-way, L' (NO)
[close]
3-way, L' (NC)
[open]
Pump 2 / 3-way, N'
Gas Valve, L'
Gas Valve, N'
Pump 3, L'
Pump 3, N'
K8 – Therm.stat 230v
K8 – Therm.stat 230v
MAINS L'
MAINS N'
17 18
A B
CASCADE CONNECTION
19 20 21 22 23 24
LOCK-OUT
N.O.
BURNER BURNING
N.O.
HEAT DEMAND
N.O.
25 26 27
L N
CH System Pump P3
28 29 30 31
L1 N L2
Divertor Valve Calorifier
by Calorifier Pump P2
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.
Flame on N.O.
Heat demand N.O.
POWER SUPPLY

9.5Sensor values

SENSOR	SENSOR TYPE	SENSOR VALUE
S1	internal flow sensor	NTC-10K-B3977
S2	internal return sensor	NTC-10K-B3977
S3	external flow sensor	NTC-10K-B3977
S4	calorifier/tank sensor	NTC-10K-B3977
S5	outdoor sensor	**NTC-12K-B3740**
S6	flue gas sensor	NTC-10K-B3977

Conversion table temperature vs. resistance outdoor sensor NTC-12k B3740

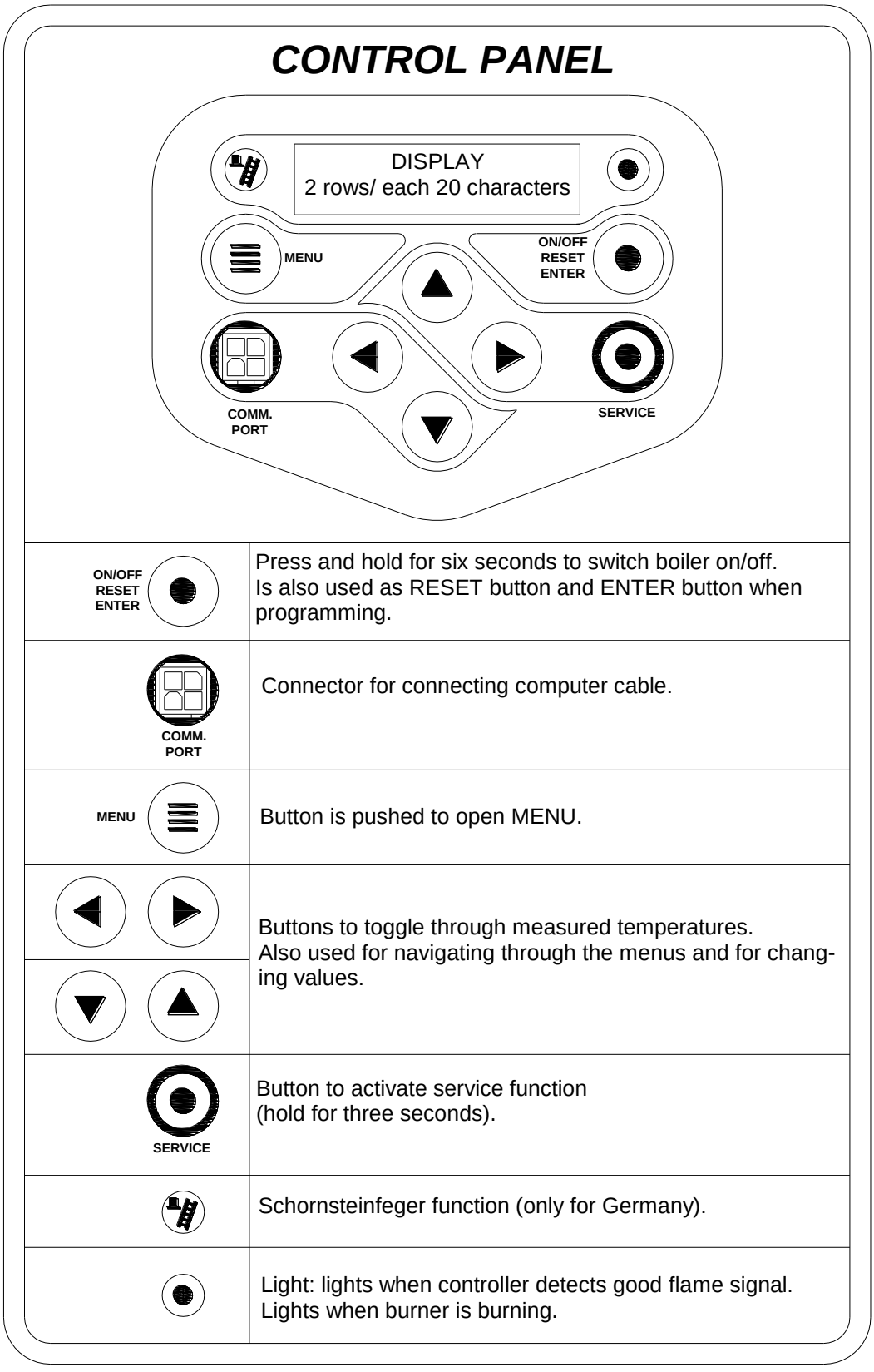
Temperature (°C)	Resistance (Ω)	Temperature (°C)	Resistance (Ω)
-50		0	36130
-45		5	28600
-40		10	22800
-35		15	18300
-30	171800	20	14770
-25	129800	25	12000
-20	98930	30	9804
-15	76020	35	8054
-10	58880	40	6652
- 5	45950	45	5522

Conversion table temperature vs. resistance all sensors except outdoor sensor. NTC-10k B3977

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

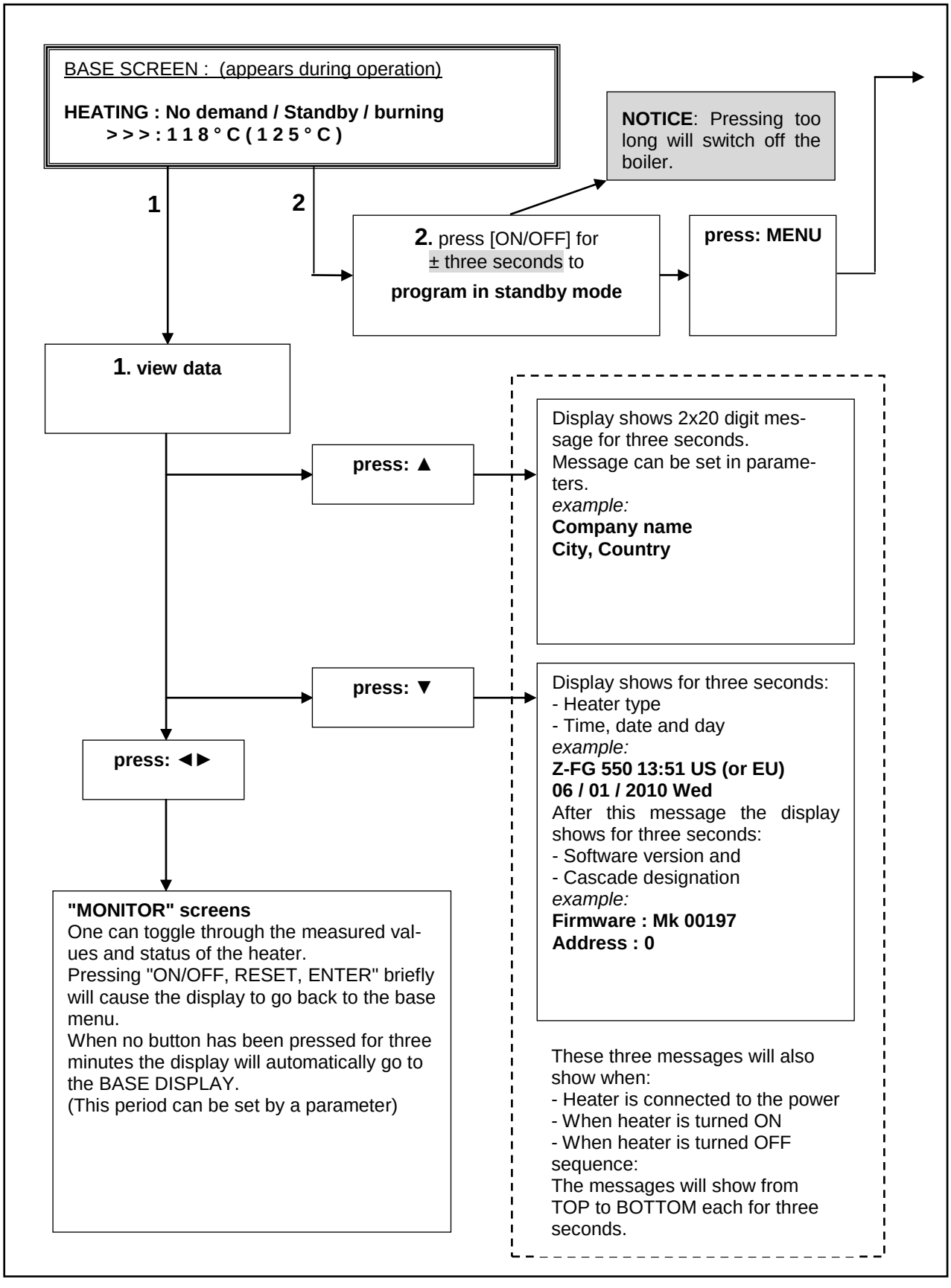
10 USER INTERFACE

10.1 Control panel / display unit



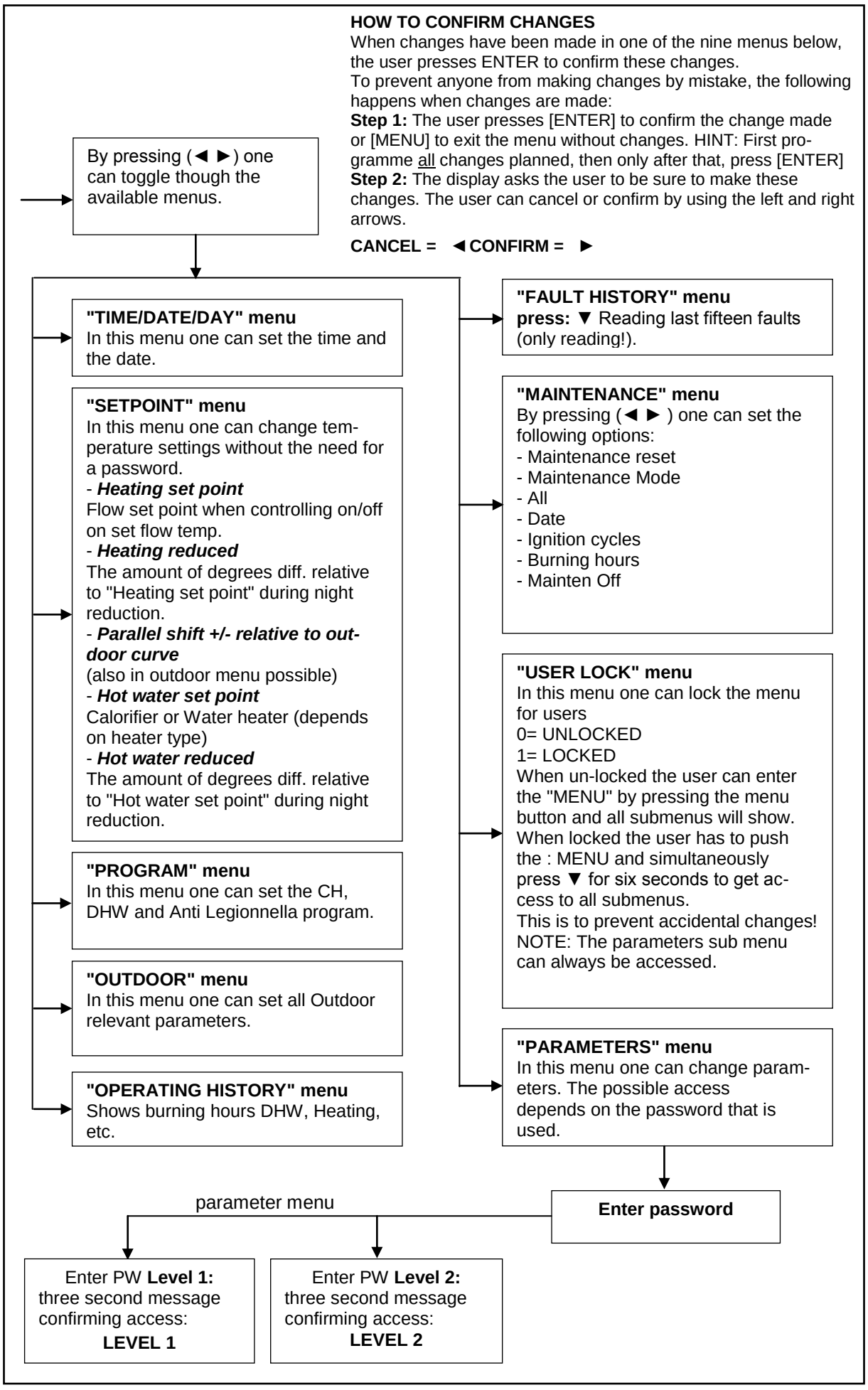
ON/OFF RESET ENTER	Press and hold for six seconds to switch boiler on/off. Is also used as RESET button and ENTER button when programming.
COMM. PORT	Connector for connecting computer cable.
MENU	Button is pushed to open MENU.
	Buttons to toggle through measured temperatures. Also used for navigating through the menus and for changing values.
SERVICE	Button to activate service function (hold for three seconds).
	Schornsteinfeger function (only for Germany).
	Light: lights when controller detects good flame signal. Lights when burner is burning.

10.2 Control panel menu structure



HOW TO CONFIRM CHANGES
When changes have been made in one of the nine menus below, the user presses ENTER to confirm these changes.
To prevent anyone from making changes by mistake, the following happens when changes are made:
Step 1: The user presses [ENTER] to confirm the change made or [MENU] to exit the menu without changes. HINT: First programme all changes planned, then only after that, press [ENTER]
Step 2: The display asks the user to be sure to make these changes. The user can cancel or confirm by using the left and right arrows.

CANCEL = ◄ CONFIRM = ►



10.3 Display during operation

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

Display at HEATING DEMAND

Heat demand type:								Actual status:										
H	E	A	T	I	N	G	:	N	o		d	e	m	a	n	d		
>	>	>	:	1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)
cascade communication indicator				temp. set point							control sensor showing the measured temperature. Can be turned off by P5 BJ								

When heat is needed for the calorifier the text "HEATING" changes into "HOTWATR".
When there is no heat demand it always shows heating.

Display at HOT WATER DEMAND

Heat demand type:								Actual status:										
H	O	T	W	A	T	R	:	N	o		d	e	m	a	n	d		
>	>	>	:	1	2	3	.	4	°	C	(	1	2	3	.	4	°	C	)
cascade communication indicator				temp. set point Thermostat > coil flow temp. Sensor > water temp.							control sensor showing the measured temperature Can be turned off by P5 BJ								

Explanation "Actual status" screen

Actual status:
B o i l e r o f f
When boiler 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 calorifier sensor (open).
S t a n d - b y
Room thermostat & calorifier 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 ignitor 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 stand-by, the [◄] and [►] buttons can be used to show some boiler 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 2 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 calorifier 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 the sensor wires or the sensor itself is shorted.

SCREEN: 4	
dTFlowReturn	123,9 °C — Temp. difference between internal flow & return sensor.
dTFlueReturn	123,9 °C — Temp. difference between flue gas & internal return sensor.

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	9999 rpm — Actual fan speed in rpm.
Fan speed	100 % — Actual fan speed % of maximum allowable fan speed.

SCREEN: 7	
Flamesignal	100 µA — Flame signal given in µA.
WaterPressur	1,0 bar — Shows water pressure when sensor is connected.

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

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

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 o/t week

SCREEN: 11	
Casc Design 0	0 = MASTER, 1 ..... 11 = SLAVES
Casinf 0123456789AB	Displays number, priority and state of cascade boilers.

DESCRIPTION "CASCINFO" Screen 11

Shows the number of boilers connected with the cascade. The Master/Lead boiler is designated as 0. Slave/Lag boilers will be designated 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B. When a "-" is used instead of a number, then that boiler 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 boiler is connected, but in lockout mode.
When a "d" is displayed instead of a number, then that boiler is handling a DHW demand.
When the number is flashing, then that boiler is providing heat to the cascade. When the leading boiler is changed according to the set priority change time, then that boiler's address will be shown first in the row of numbers.

Example 1: "3 4 5 - - - - - - 0 1 2"
Six are boilers present and nr. 3 has priority.

Example 2: "3 4 x - - - - - - d 1 2"
Six boilers are present and nr. 3 has priority. Boiler 0 is heating up an indirect DHW tank. Boiler 5 is present, but in a lock-out.

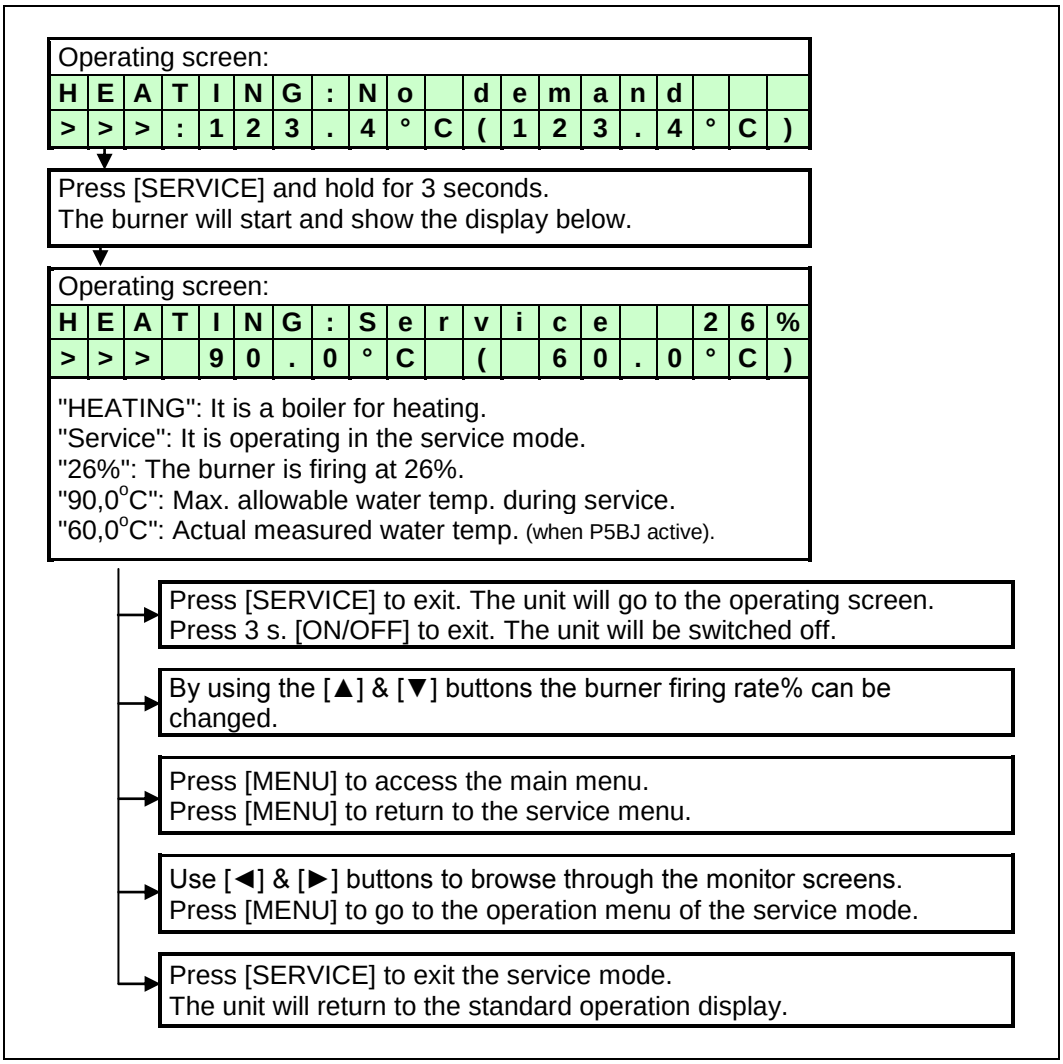
SCREEN: 12	
Casc Power 999% 999%	% heat demand of total (cascade) power available (%).
Dual Burner: No	Heat exchanger equipped with two burners: "Yes" or "No".

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".

10.5 Service function

The following graphs describe how to use the service function.



Maximum RPM table:

	Model: →	S-CB+ 60	S-CB+ 80	S-CB+ 100	S-CB+ 120	S-CB+ 150	S-CB+ 180
RPM	Max. set point *	6500	6500	6500	6500	5700	5700
	Max. actual**	6500	6500	6230	6095	5700	5700
	Margin on actual	± 50	± 50	± 175	± 175	± 50	± 50

* The maximum rpm that the controller is to use as a set point.
** The maximum rpm that the fan is actual able to run.

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. The relation between the maximum rpm set point and the maximum actual rpm is given in this table. This table applies also to the service and "Schornsteinfeger" function of the boiler.

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 boiler. This is a simplified function similar to the normal service function of the boiler.

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 boiler 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 boiler/water heater pump and the system pump are running.

10.7 Programming in standby mode

Standby
Use the standby mode for modifying boiler settings without interaction with the boiler 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 active: pumps, fans and cascade are operational, recirculation and frost protection are working.

How to programme the boiler:

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

Display message	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)

- Program the boiler at the control panel (see the following sections).
- Terminate programming mode by pressing [MENU], or [ENTER] and NO ◄ or YES ►.
- Reactivate the boiler by pressing [ON/OFF] for three seconds again.

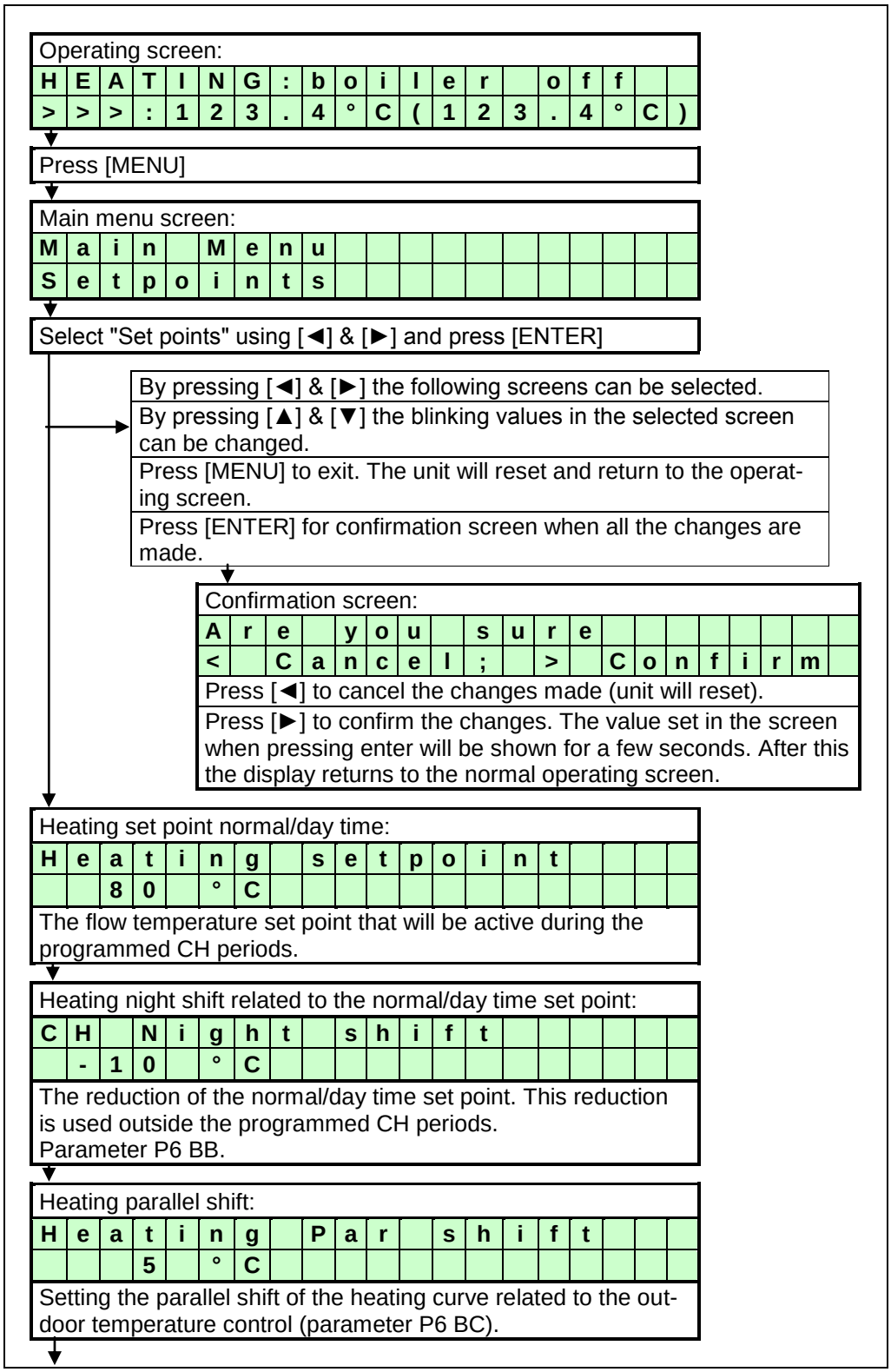
10.8 Setting the time & date

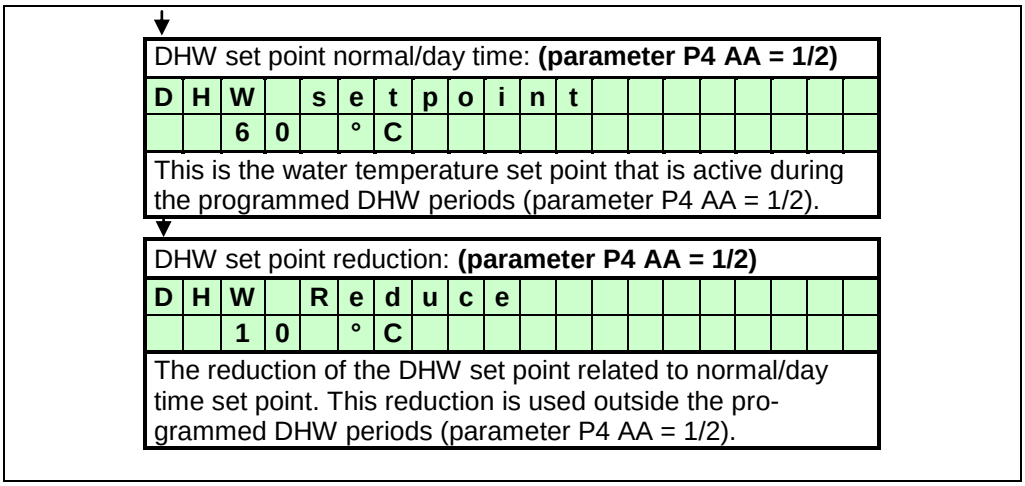
The following graphs describe how to programme the time and date of the unit.

Operating screen: 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]
↓
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 heating and hot water set points.
NOTICE: The hot water set points are only displayed, when the boiler is programmed as an indirect hot water boiler or direct hot water boiler. See parameter P4 AA for the exact boiler configuration.





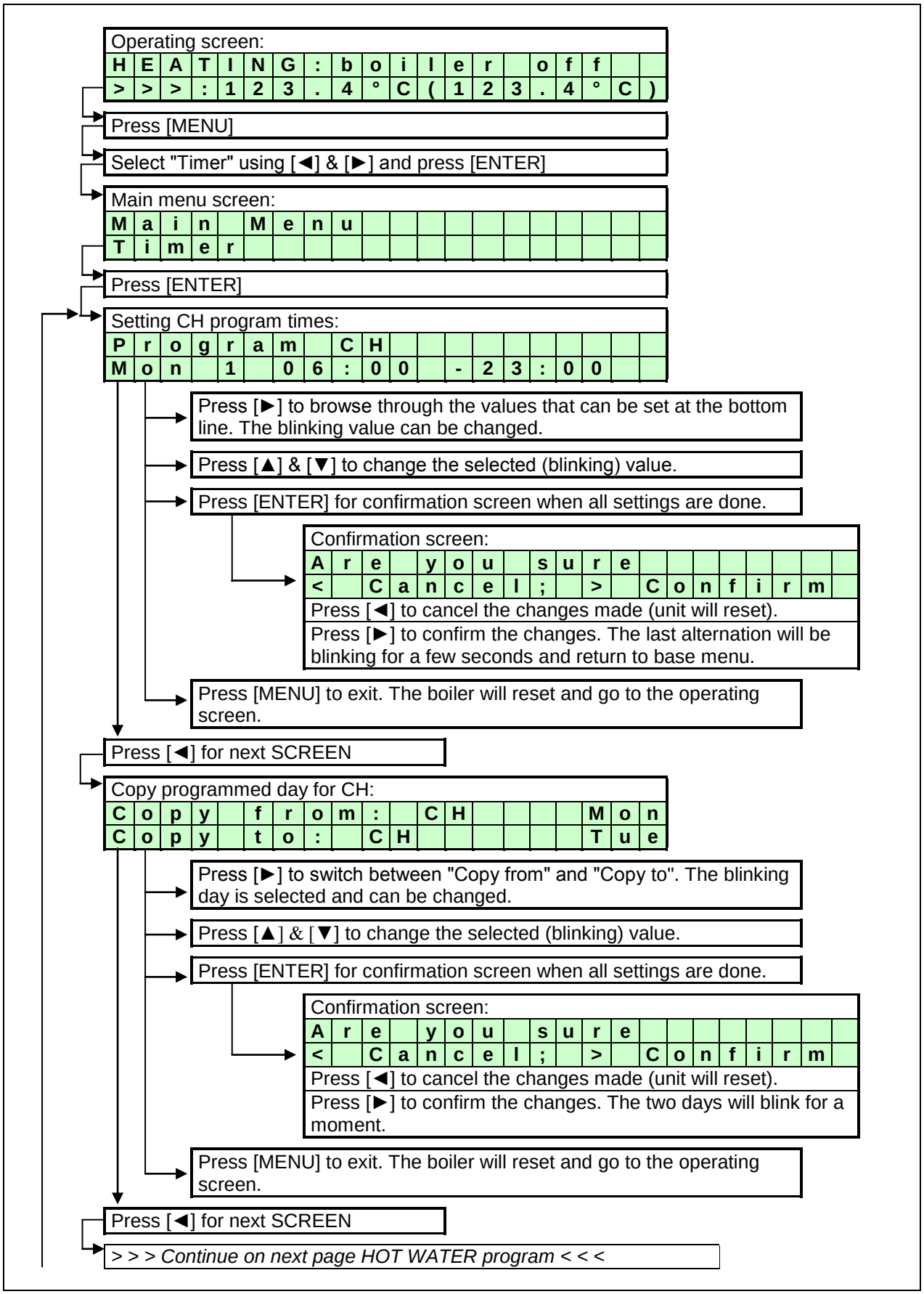
10.10 Setting the timer programs

Three different programs can be set with the boiler, these are:

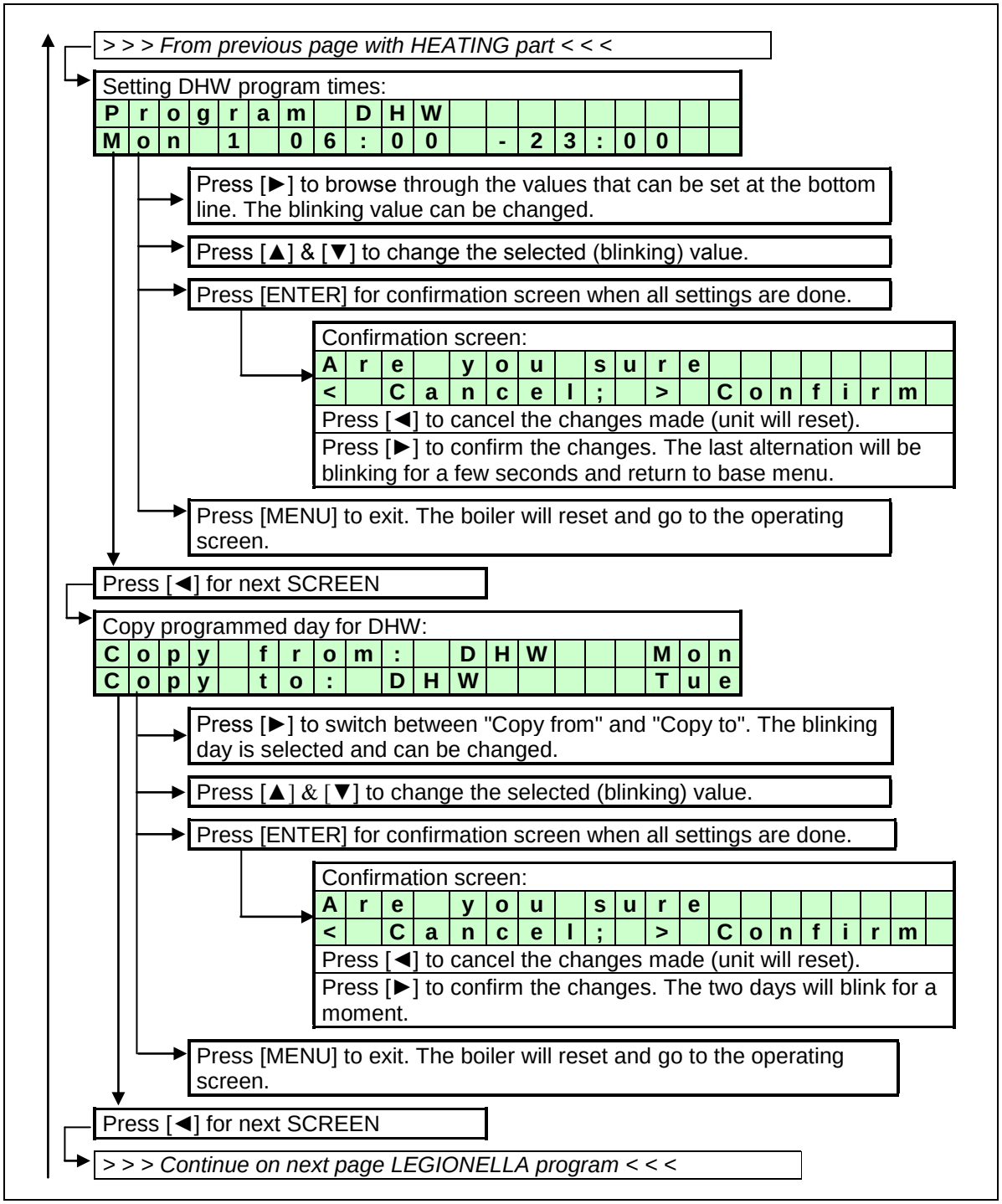
- CH program
- DHW program
- Anti-Legionnaires' disease (pasteurisation) program

HEATING PROGRAM

Three programmed periods each day can be set (period 1, period 2 and period 3). During these periods the unit will use the normal CH and DHW set points. 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 --:-- ---:--"**).

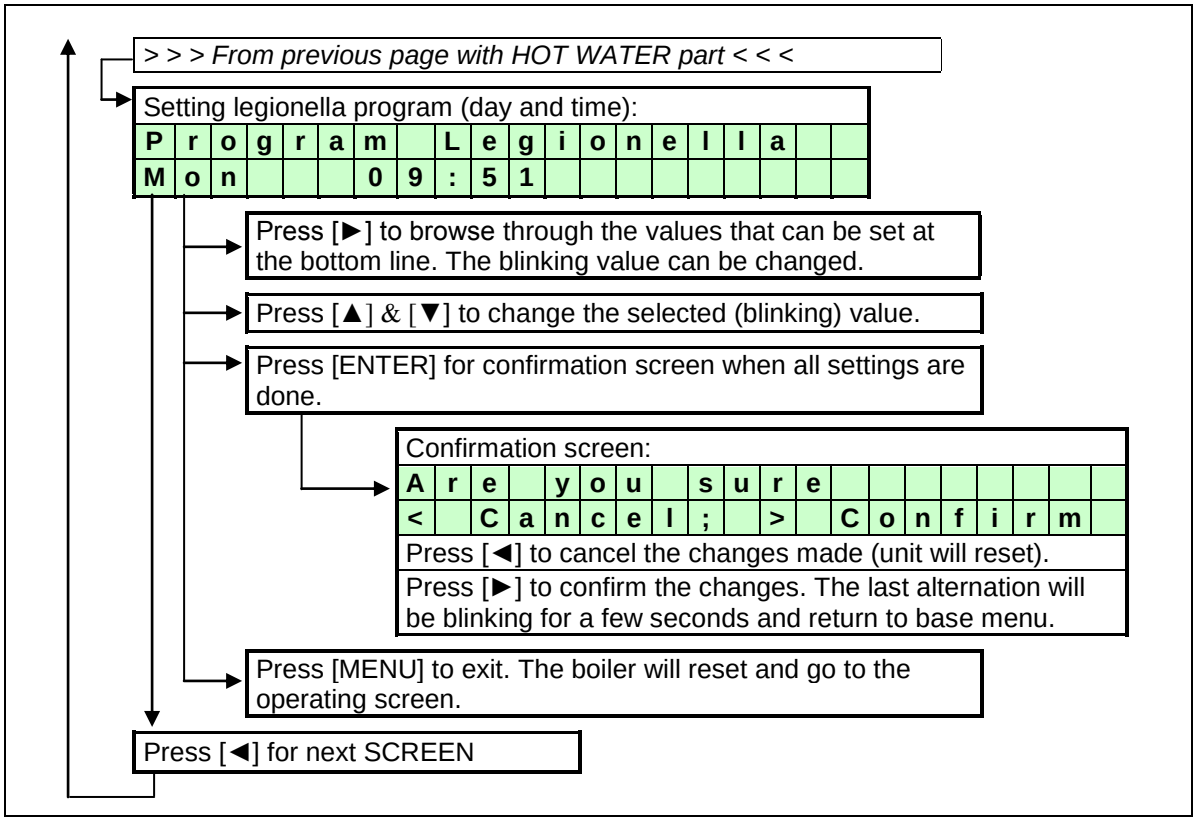


HOT WATER PROGRAM



ANTI LEGIONNAIRES' DISEASE PROGRAM

The anti-Legionnaires' disease (pasteurisation) program of the boiler can only be used when the boiler is set as an "indirect" boiler configuration or a "direct" hot water boiler configuration. Only these configurations can activate the day and time program of the anti-Legionnaires' disease function. See the following graphs. The standard factory setting for this function is "OFF".

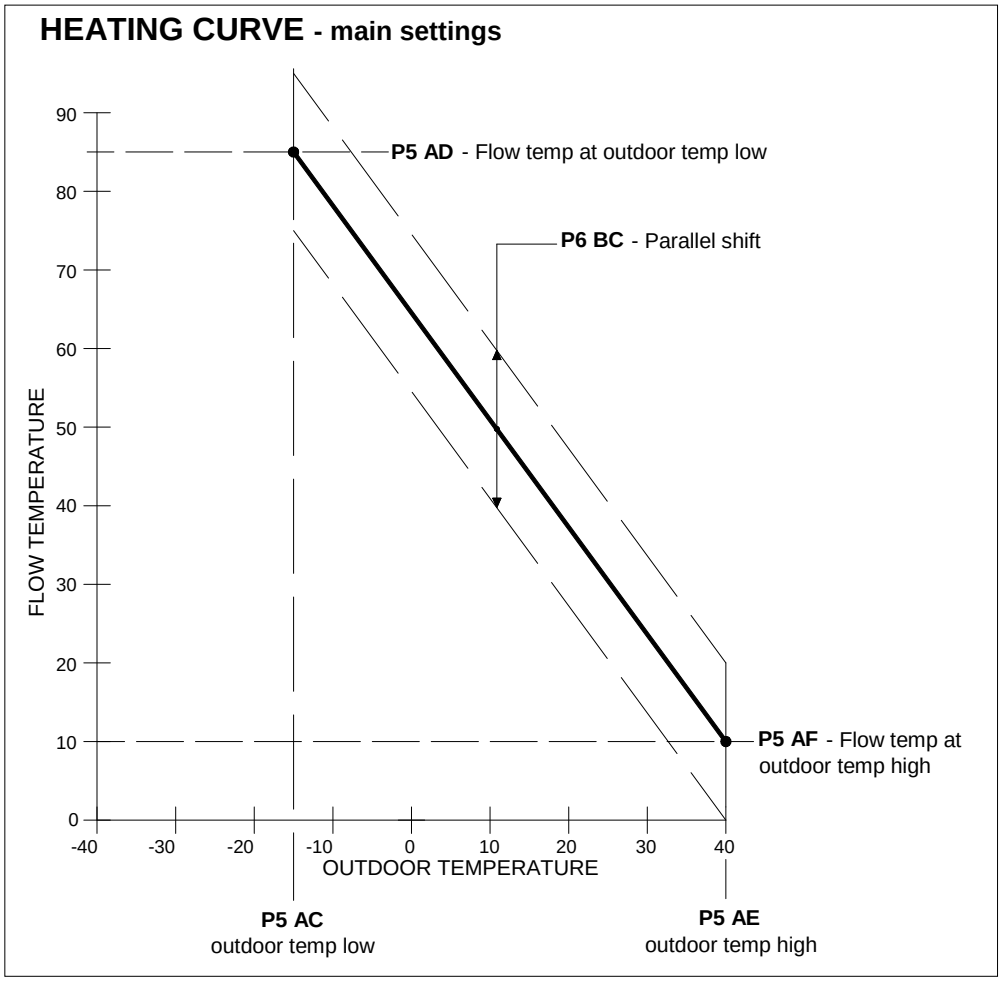


10.11 Setting the outdoor specifications

PARAMETERS FOR SETTING THE OUTDOOR GRAPH
When using this function the flow temperature is calculated based on the measured outdoor temperature. The relation between the outdoor temperature and the flow temperature can be programmed with the following parameters. This setting creates the so called "heating curve".

The boiler will recognise an outdoor sensor when it is connected. When the sensor is detected the boiler controller will control the flow temperature based on the heating curve that is programmed.

OUTDOOR GRAPH (see also next page)



P5 AC Heat curve minimum outdoor temperature (°C)
This sets the minimum outdoor temperature at which one wants the maximum flow temperature that is set.

P5 AD Heat curve flow temperature at minimum (°C)
This sets the desired maximum flow temperature at the set minimum outdoor temperature.

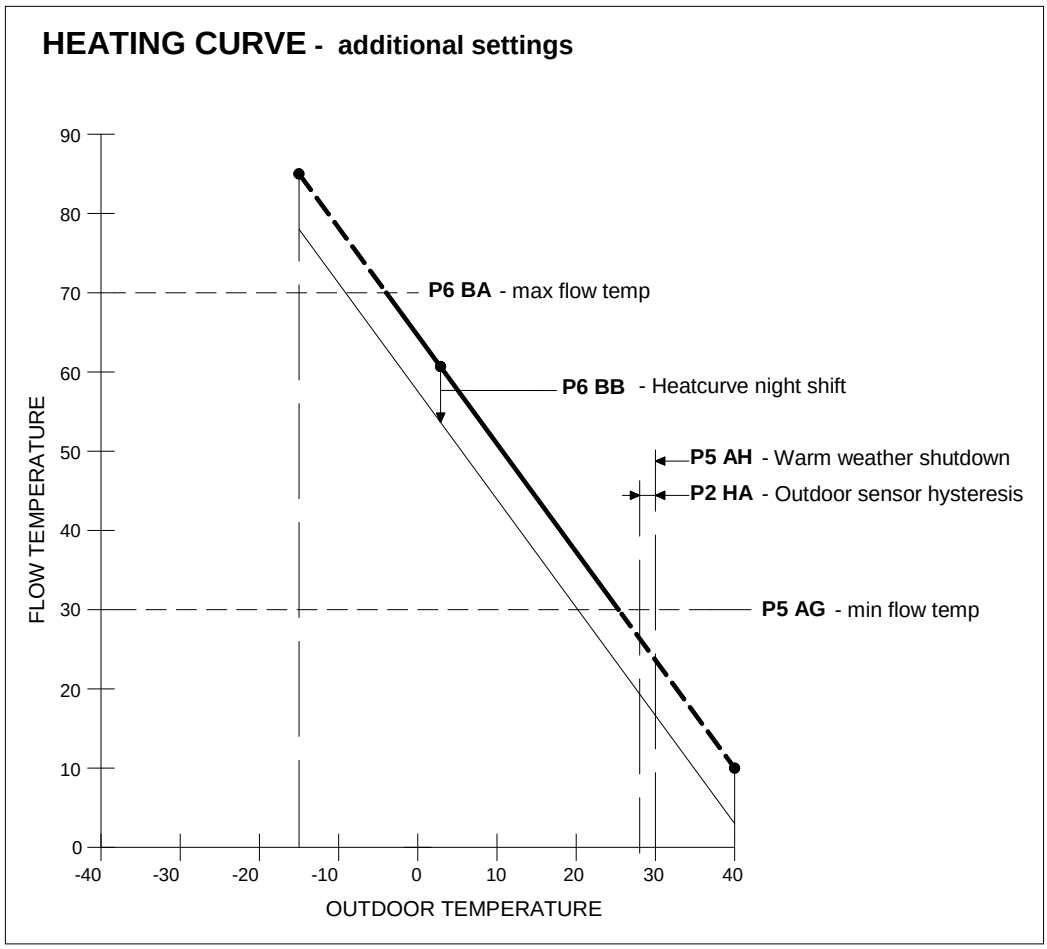
P5 AE Heat curve maximum outdoor temperature (°C)
This sets the maximum outdoor temperature at which one wants the minimum flow temperature that is set.

P5 AF Heat curve flow temperature at maximum (°C)
This sets the desired minimum flow temperature at the set maximum outdoor temperature.

P6 BC Heat curve parallel shift (°C)
The heating curve is set by the parameters. Next to these setting done by the installer, the end user has the freedom to influence the flow temperature by doing a parallel shift setting. In this parameter the margins are set within which the user can increase and decrease the calculated flow temperature relative to the calculated flow temperature by the heating curve that is set.

The actual parallel shift that is set by the user within the bandwidth allowed according to “P5 AQ Max heat curve parallel shift”.

Additional settings of the heating curve p.t.o. →



P5 AG Heat curve minimum flow temperature (°C)
The set point will never be lower than the flow temperature set in parameter P5AG. The minimum temperature is limited, even if the calculated set temperature, according to the heating curve, would be lower.

P5 AH Summer outdoor temperature central heating (°C)
If the outdoor temperature is higher than set in P5AH the heat demand for heating will be blocked.

P5AR Outdoor sensor 10K or 12K resistance (1 or 0)
Depending to the used type of sensor this parameter can be set. Set to '0' when using a so called 12k NTC sensor (sensor resistance is 12 k ohm at 25°C) Set to '1' when using a so called 10k NTC sensor (sensor resistance is 10 k ohm at 25°C) Default the parameter = 0, so the used sensor is assumed to be 12 kΩ.

P2 HA Outdoor sensor hysteresis (°C)
If the outdoor temperature reaches the temperature set in P5 AH (warm weather shutdown) the unit won't start for heating. If the measured outdoor temperature drops P5 AH minus P2 HA the boiler can start up for heating again.

P6 BA CH user setting (°C)
The set point will never be higher than the flow temperature set in parameter P6BA. The maximum temperature is limited, even if the calculated set temperature, according to the heating curve, would be higher.

P6 BB Heat curve night shift (°C)
The temperature reduction during the night, relative to the setting determined by the heat curve

DISPLAY

The following graphs describe how to program the outdoor graph settings.

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

Press [MENU]

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

Main menu screen:
Main Menu
Outdoor

Press [◄] & [►] to browse through the screens that are shown below.
Press [▲] [▼] to change the blinking value in the selected screen.
Press [MENU] to exit. The unit will reset and go to the operating screen.
Press [ENTER] for confirmation screen after all changes are made.

Confirmation screen:
Are you sure
<Cancel; >Confirm
Press [◄] to cancel the changes made (unit will reset).
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.

01 OutsidPres 0	P5 AA
02 HCminOuTmp -15 °C	P5 AC
03 HCminFlTmp 85 °C	P5 AD
04 HCmaxOuTmp 20 °C	P5 AE
05 HCmaxFlTmp 20 °C	P5 AF
06 HCminFlLim 20 °C	P5 AG
07 SumShDwnOu 30 °C	P5 AH
08 HCmaxFlLim 85 °C	P6 BA
09 HCnghtshft -10 °C	P6 BB
0A HCparashft 5 °C	P6 BC
0B OutS12k10k 0	P5 AR

10.12 Checking the operating history

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

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

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

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

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

SCREEN: 1

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

Top line: Shows the operating history menu is activated.

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

SCREEN: 2

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

Top line: Total burning hours for heating.

Bottom line: Total burning hours for domestic hot water.

SCREEN: 3

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

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

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

SCREEN: 4

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

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

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

SCREEN: 5

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

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

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

10.13 Checking the fault history

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

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 "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 alternately ▼

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 ten faults.

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

The fault menu shows the last ten 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 boiler (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.

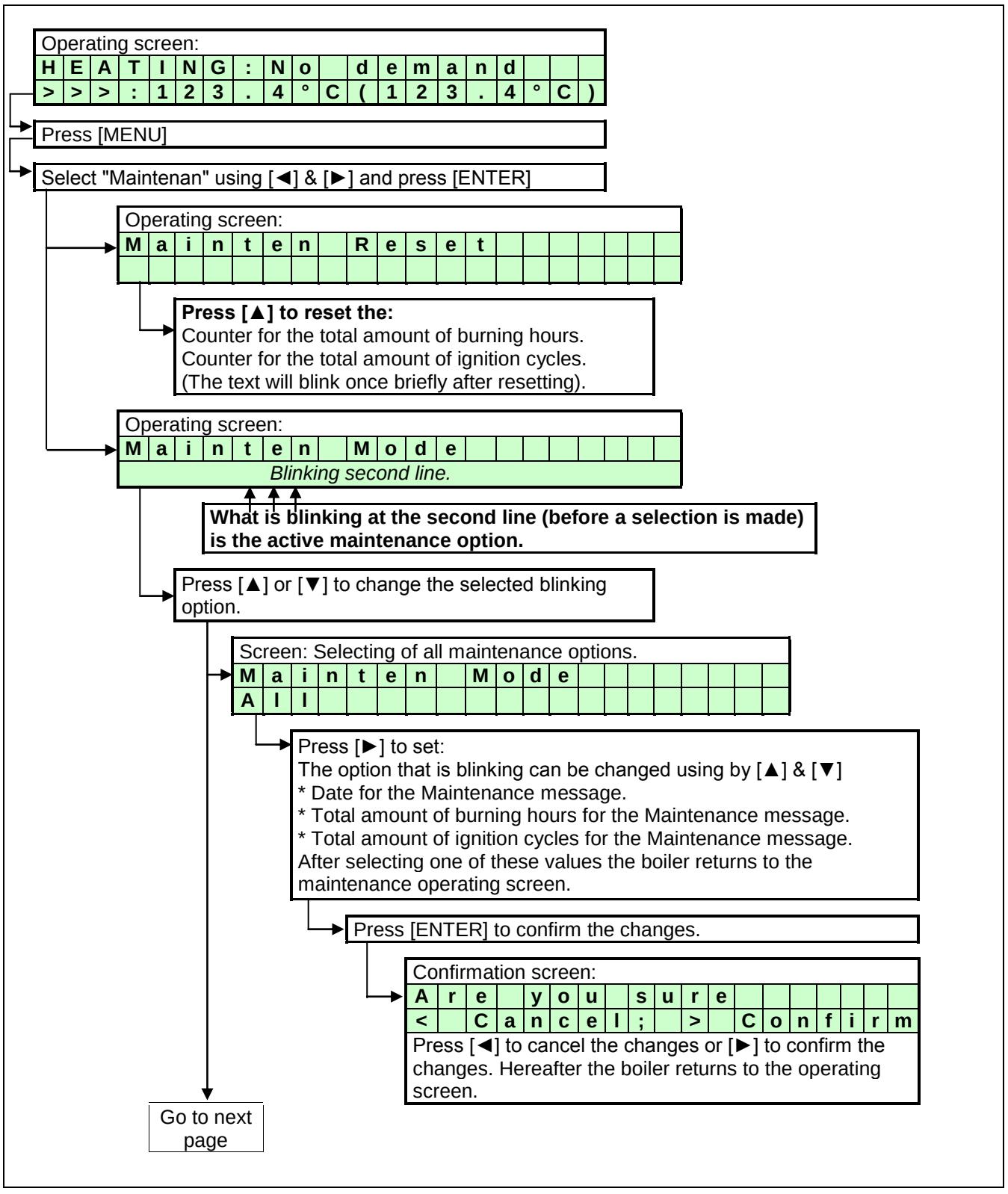
10.14 Setting the maintenance specifications

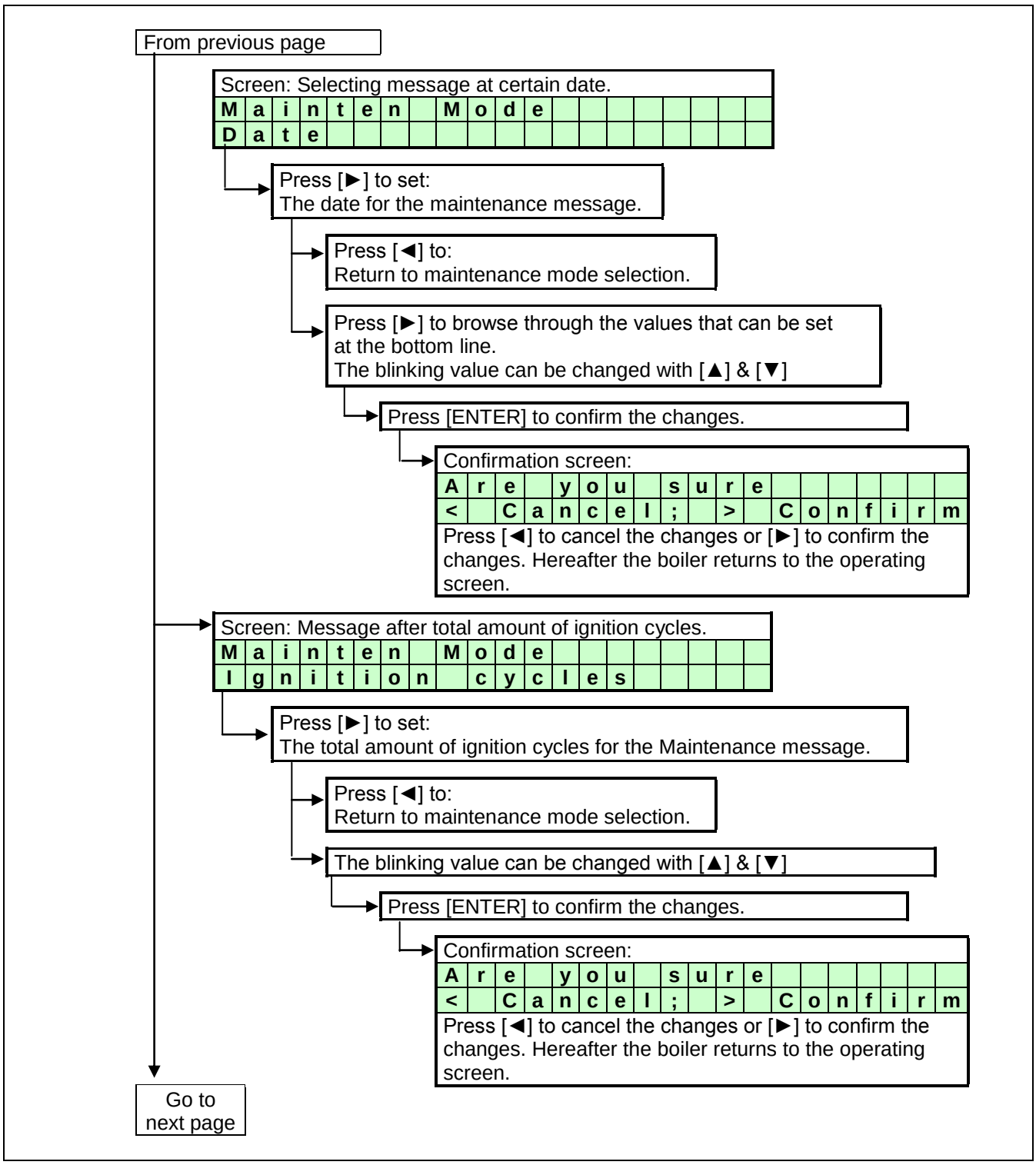
The following graphs describe how to check and program the maintenance settings. The standard factory setting for this function is “OFF”.

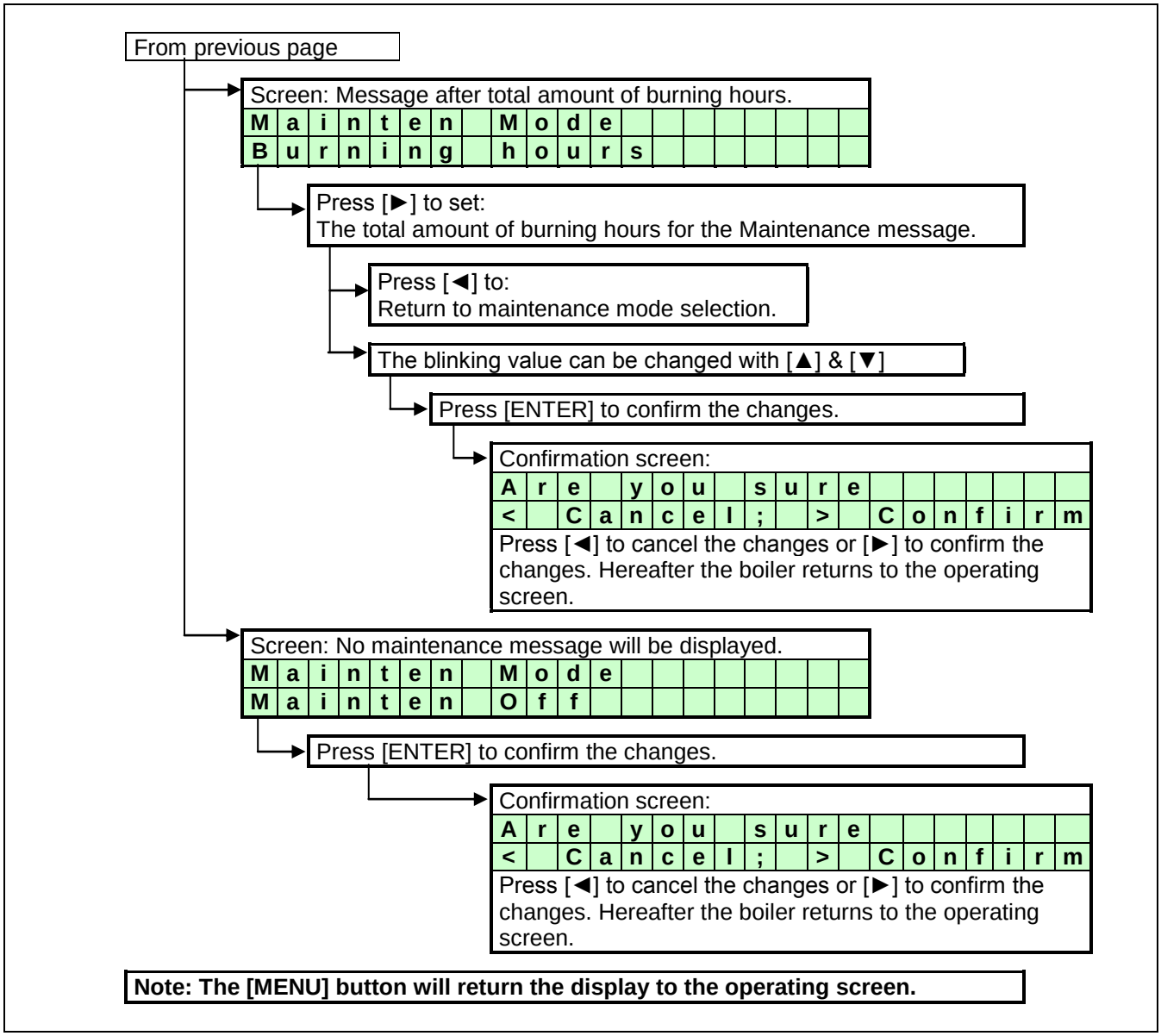
MAINTENANCE SETTINGS

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.

One single option can be activated or all three options.


Operating screen:
HEATING: No demand
>>>:123.4°C (123.4°C)
Press [MENU]
Select "Maintenan" using [◄] & [►] and press [ENTER]
Operating screen:
Mainten Reset
Press [▲] to reset the:
Counter for the total amount of burning hours.
Counter for the total amount of ignition cycles.
(The text will blink once briefly after resetting).
Operating screen:
Mainten Mode
Blinking second line.
What is blinking at the second line (before a selection is made) is the active maintenance option.
Press [▲] or [▼] to change the selected blinking option.
Screen: Selecting of all maintenance options.
Mainten Mode
All
Press [►] to set:
The option that is blinking can be changed using by [▲] & [▼]
* Date for the Maintenance message.
* Total amount of burning hours for the Maintenance message.
* Total amount of ignition cycles for the Maintenance message.
After selecting one of these values the boiler returns to the maintenance operating screen.
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 boiler returns to the operating screen.
Go to next page


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 boiler 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 boiler 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 application 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 responsibility of the end user to have the unit maintained every twelve months.

10.15 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 boiler can be locked for (end-)users. 0 = UNLOCKED 1 = LOCKED
When the boiler is unlocked, the user can enter the MENU by pressing the menu button and all screens will show up.
When the boiler 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**	**:**	**N**	**o**		**d**	**e**	**m**	**a**	**n**	**d**		
>	**>**	**>**	**:**	**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 boiler and the boiler will return to the operating screen. Changes will be neglected in this case.

10.16 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

MENU			PARA-METER	DESCRIPTION	UNITS	TEXT DISPLAY	PASSWORD: 1342 LEVEL 1 Modify
HEATING	A	1	P5BE	Step modulation (1=on 0=off)	-	Stepmodul	no
		2	P5AO	Blocking offset flow temperature control	°C	HE s Offset	yes
		3	P5AP	Proportional range temperature control	°C	HE s Prop	no
		4	P5AL	Hysteresis CH Flow temperature control	°C	HE s CDif	yes
		5	P2IC	Integration time temperature control	s	HE s Intt	no
		6	P2MI	Blocking offset System CH temperature control	°C	HE c Offs	yes
		7	P2MJ	Proportional range System CH temperature control	°C	HE c Prop	no
		8	P2MK	Integration time CH temperature control	s	HE c Intt	no
		9	P5AB	Timer Contact (1=on)	-	Timercon	yes
DHW	B	1	P4AB	DHW Pump Config 0=Pump 1=TWV	-	DHipmp/tw v	yes
		2	P5CB	Flow temperature DHW tank low	°C	DHiflow LO	yes
		3	P5CK	Flow temperature DHW tank hi	°C	DHiflow HI	yes
		4	P5CL	Low Flow temperature time DHW	min	DHi LOti me	yes
		5	P5CD	Legionella temperature	°C	Legi o te mp	no
		6	P5CI	Legionella hyst DHW tank temperature	°C	Legi o hys t	no
		7	P5CJ	Legionella hold time (0=off)	min	Legi o hold	no
		8	P2KI	CH interrupt by Legionella (0=yes)(1=no)	-	Legi o int r	no
		9	P2LC	Regulation temperature offset DHWd	°C	DHdsc Of f 2	yes
		A	P2MN	Proportional range DHWd modulation	°C	DHdsc Prop	no
		B	P2LD	Regulation temperature hysteresis DHWd	°C	DHdsc Dif 2	yes
		C	P2MO	integration time DHWd modulation	s	DHdsc Intt 2 3	no
		D	P2ML	Sys temp blocking offset DHW tank	°C	DHdsc Of f 3	yes
		E	P2MM	Sys temp blocking hysteresis DHW tank	°C	DHdsc Dif 3	yes
		F	P5CA	Hysteresis DHW tank temperature	°C	DHisc Dif 4	yes
		G	P2KH	Gradient heat demand detect DHW tank temperature	°C	DHidegr ad	yes
CASCADE	C	1	P2MA	Max number extra boilers	-	Maxcascun t	no
		2	P5DA	Bus address boiler	-	Bus add res s	no
		3	P5DC	Dhw on entire cascade(0) only master(1)	-	DHicas/mas	no
		4	P5DE	Extra Boiler output enable(1)	-	Extr a un i t	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 boilers with common flue 0=None	-	Comm FlNu m	no
GENERAL	D	1	P5BB	Analogue input Config (0=off 1=temp 2=power)	-	An In pu C on	yes
		2	P5AI	Minimum Temperature 0-10V input	°C	0-10M in Tm p	yes
		3	P5BI	Altitude (in amounts of 100 ft.)	100 ft	Al t * 1 00 ft	yes
		4	P2LK	Max cooling time	min	Max Co ol Ti m	yes
		5	P5BJ	Temperature display 1=on	-	Tem p On Di sp	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	-	con f i g	no
		8	P4BD	Gas type values 0-2	-	gas t y pe	no
		9	P4BE	Soft start type values 0-2	-	con f i g	no
		A	P5BN	Pump modes 0-3	-	con f i g	no

For extensive explanation see Ch. 11: ‘Controlling options and settings’, page 78 ff.

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

Parameter screens + concise explanation see next pages →

Operating screen:

H	E	A	T	I	N	G	:	N	o		d	e	m	a	n	d			
>	>	>	:	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.

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 time 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.

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 HW 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. 12 boilers).

Menu C: Cascade

	C	**2**				**B**	**u**	**s**		**a**	**d**	**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 = Single / Slave unit
1 = Master unit

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

Function for the cascading of the 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

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.

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)

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*

0 = G20, G25 and for Poland G27, G2.350
1 = G31
2 = B/P

*According to EN437

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)

10.17 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 boiler always check the boiler, central heating system and all components corresponding to the related lock out description. Never just reset the boiler, before analysing the possible cause of failure.

10.17.1 LOCK-OUT CODES

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

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

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

Display message	F	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 boiler caused by faulty connection/sensor.

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

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

Display message	L	a	c	k		o	f		w	a	t	e	r							
F2	p	u	m	p		o	n					9	9	9	,	5		h	r	s

Reason The general required gradient water lack has failed.

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

Reason Return sensor not detected by the boiler 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 by the boiler 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 which has been set in the parameters.

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 Boiler is not starting after the programmed starting attempts.

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

Reason Software parameters have been programmed.

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

Reason Fault during programming of the boiler software parameters.

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 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 T1-T2 has exceeded the blocking value more than three times.

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

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

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

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

10.17.2 BLOCKING CODES

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

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

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

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

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, as set in the parameters.

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

Reason Flow temperature has exceeded the blocking temperature, as set in the parameters

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

Reason Flow temperature has exceeded the blocking temperature, which is set in the

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, which is set in the parameters, 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 as set in the parameters.

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

Reason The boiler starts its de-aeration function and after will return to normal operation. This function can be activated by parameter P4AJ.

Display message	**G a s p r e s s u r e l o w**
	9 9 9 , 5 h r s

Reason Gas supply pressure is (too) low.

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	O u t d o o r s e n s o r f a i l
	9 9 9 , 5 h r s

Reason Outdoor temperature has exceeded the blocking temperature which is set in the parameters.

Display message	d T B l o c k
	9 9 9 , 5 h r s

Reason Temperature difference between flow and return exceeds the blocking value but not the lock out value.

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

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

Display message	A P S f a u l t
	9 9 9 , 5 h r s

Reason Activation of the air pressure switch.

Display message	N R V o r F a n f a u l t
	9 9 9 , 5 h r s

Reason Non return valve contact signal activated, > 15 seconds will cause a lock-out.

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	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

10.17.3 MESSAGES

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

MAINTENANCE ATTENTION FUNCTION
The display shows alternating the base screen and this message, while the backlight is blinking.
The boiler 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 paragraphs describe some general functions of the boiler and their possible use.

11.1.1 EXTRA BOILER CONTROL

When all units (cascaded) are firing at their maximum it is possible to start an extra “external” heating source. This unit can be connected to the “Burner Burning” contacts (connection 21-22).

P5DE Extra Boiler output enable (1) (display C4)
When this parameter is set 1, the contact “Burner Burning” will close, but only when all units are firing at a certain (programmable) input percentage. The standard factory setting for this function is “OFF”.

11.1.2 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)
This function is not used for central heating boilers.

11.1.3 TEMPERATURE DISPLAY ON/OFF

Selection for showing the measured temperatures at the operation display of the boiler.

P5BJ Temperature display 1=on (display D5)
The measured temperature at the operation display.
0 = not visible
1 = visible

11.1.4 WATER PRESSURE

P4AD pressure 0=off, 1=sensor, 2=switch.
When the water pressure exceeds 4 bar a pressure switch must be used instead of the sensor (suitable till 4 bar). With the switch, pressure can go up to 6 bar.
In this case, remove the pressure sensor and replace it by the pressure switch. Now set the parameter at the control panel by changing “D7 config” from 1 into 2.

11.1.5 GAS TYPE SELECTION

Settings for gas types: natural gas, propane or butane-propane mixture (B/P).

P4 BD Gas type (0=standard, 1=propane, 2=B/P) (display D8)
This parameter is set 0 for the common used gas types such as natural gas G20 or G25.
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), Lw, Ls (Lw and Ls only for Poland)
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 § 11.1.6.

In case of gas conversion, paste the corresponding sticker at the appropriate position in the boiler 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).

G31 P	PROPANE PROPAN PROPANO PROPAAN		P4BD = 1
G30/G31 B/P	BUTANE/PROPANE BUTAN/PROPAN BUTANO/PROPANO BUTAAN/PROPAAN		P4BD = 2

11.1.6 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).

P4 BE **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)

11.1.7 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.

P5 BN **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**, connectors 9 and 18
1 = Start-stop through relay **1**, connectors 19 and 20 (lock-out)
2 = Start-stop through relay **2**, connectors 21 and 22 (burner burning)
3 = Start-stop through relay **3**, connectors 23 and 24 (heat demand)

11.2 Heating

The following paragraphs describe the different functions of the boiler and their related “controlling behaviour settings” as a central heating boiler.

11.2.1 CONTROLLING BEHAVIOUR SETTINGS

The factory settings for all heating applications are working fine and it is therefore advised not to change these settings. Always consult the manufacturer for advice if changes to parameter settings are needed.

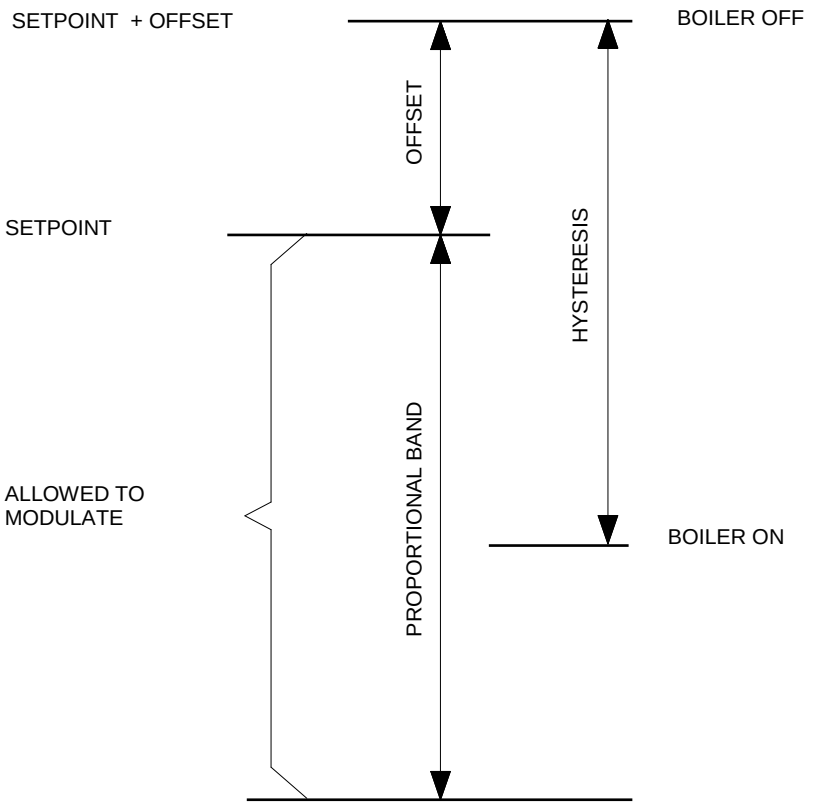
P5 AO Blocking offset flow temperature control (display A2)
The amount of degrees the measured temperature exceeds the active flow temperature set point before the heat demand stops. Only active when the unit is controlled by the internal flow sensor (S1) and used for single unit control.

P5 AL Hysteresis CH flow temperature control (display A4)
The amount of degrees that the measured temperature must drop, relative to the active flow temperature set point + Offset (Parameter **P5 AO**), before the heat demand starts. This function is active when the unit is controlled by the internal flow sensor (S1) and used for single units. When controlling cascaded units with an external flow sensor (S3), this sensor will be used.

P5 AP Proportional range single heating boiler (display A3)
The proportional range for controlling the flow temperature of the boiler. This function is active when the unit is controlled by the internal flow sensor (S1) and used for single units. When controlling cascaded units with an external flow sensor (S3), this sensor will be used.

P2 MI Blocking offset system CH temperature control (display A6)
The amount of degrees the measured temperature exceeds the active flow temperature set point before heat demand stops. Only active when the unit is controlled by an external flow sensor (S3).

The following graph shows the relation between the several parameters.



WHEN CONTROLLING ON INTERNAL FLOW SENSOR

Settings:

P5 AO	Offset	= 5°C
P5 AP	Proportional band	= 15°C
P5 AL	Hysteresis	= 10°C
	Temp. set point	= 50°C

Burner starts at 45°C
Set point + Offset - Hysteresis = 50+5-10= 45°C

Burner stops at 55°C
Set point + Offset = 50 + 5 = 55°C

WHEN CONTROLLING ON EXTERNAL FLOW SENSOR

Settings:

P2 MI	Offset	= 5°C
P5 AP	Proportional band	= 15°C
P5 AL	Hysteresis	= 10°C
	Temp. set point	= 70°C

Burner starts at 65°C
Set point + Offset - Hysteresis = 70+5-10= 65°C

Burner stops at 75°C
Set point + Offset = 70 + 5 = 75°C

11.2.2 ROOM THERMOSTAT ON/OFF

A room thermostat with a fixed set point and using an ON/OFF control can be connected to the boiler (Connections 13-14). Changing the flow temperature set point and activation of a timer program can be done by this room thermostat or by programming the boiler settings. See chapter 10.10

11.2.3 ROOM THERMOSTAT OPEN-THERM

An RC Open Therm controller can be connected to the boiler for temperature reading(s) and remote programming (connections 13-14).

11.2.4 OUTDOOR TEMPERATURE RELATED FLOW CONTROL

The flow temperature can be calculated by using the measured outdoor temperature for controlling the boiler. See for detailed information § 10.11.

11.2.5 0-10 VDC REMOTE FLOW TEMPERATURE SET POINT

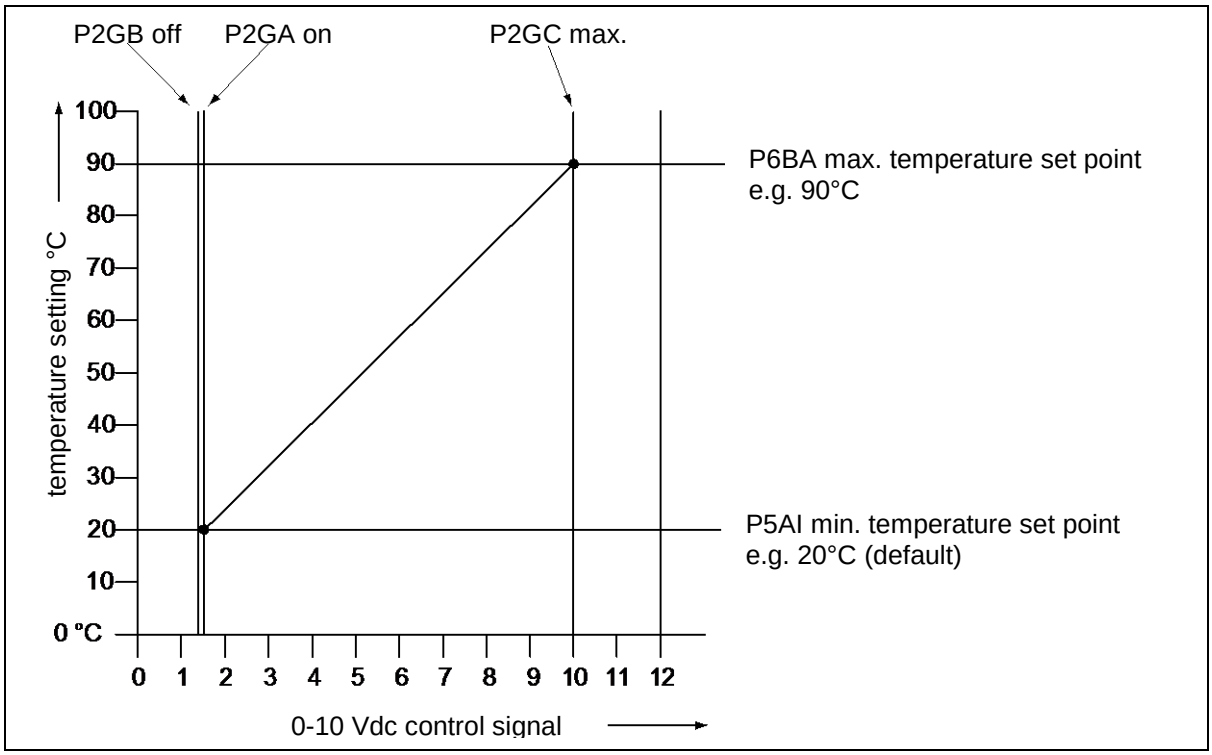
The flow temperature is controlled by connecting an external 0-10 Vdc signal to the boiler (connections 15-16).

P5 BB Analogue input config (0=off 1=temperature 2=power) (display D1)
This parameter must be set at "1" so the supplied 0-10 Vdc signal will control the temperature set point.
Possible settings are:

0 = 0-10 V control off
1 = 0-10 V temperature set point control active
2 = 0-10 V burner input control active

P5 AI Minimum temperature 0-10V input (display D2)
The standard starting temperature of the heat demand, when the minimum voltage signal is sent to the boiler.
The factory settings for all heating applications are working fine and it is therefore advised not to change these settings. Always consult the manufacturer for advice if parameter changes are needed.

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



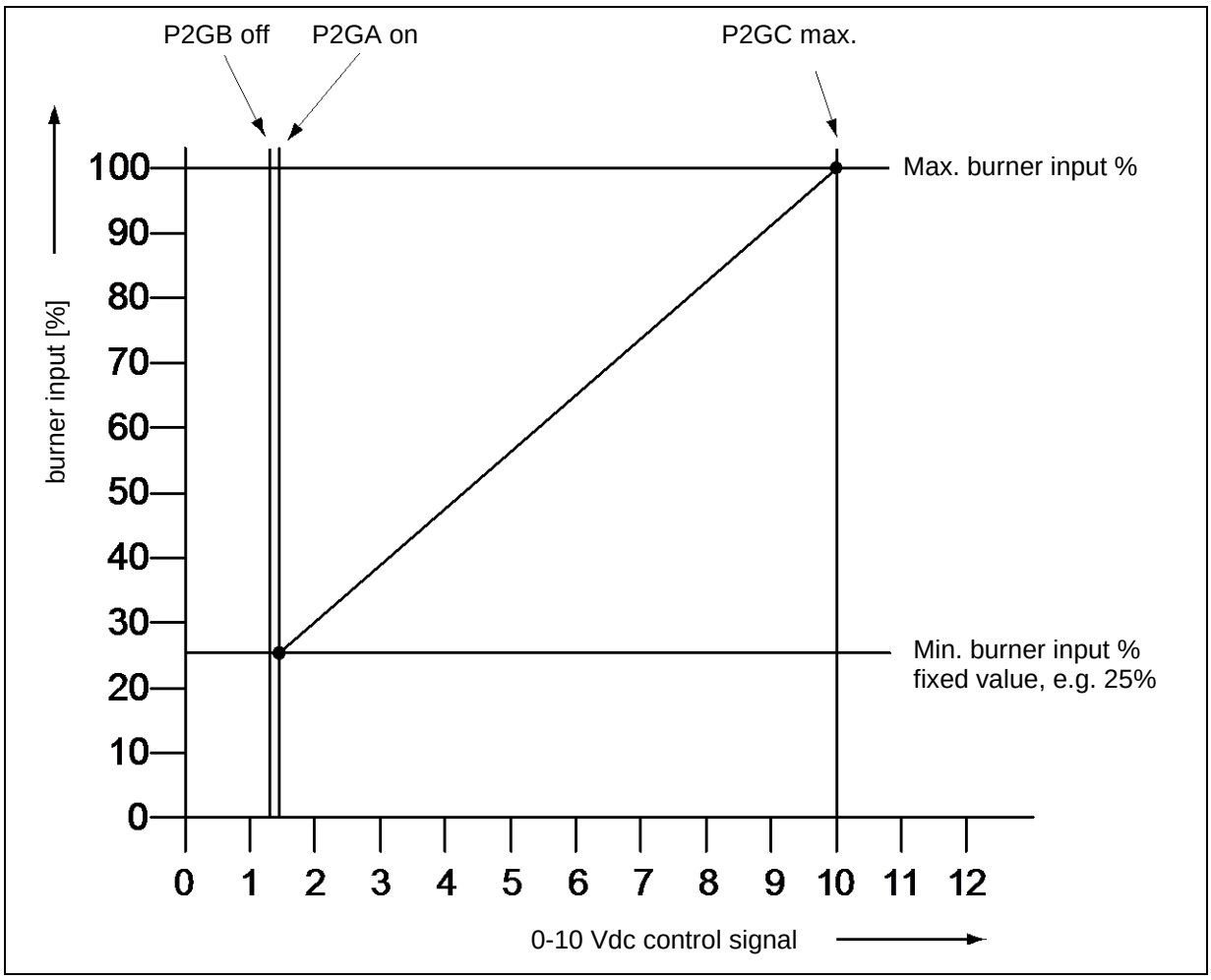
11.2.6 0-10 VDC REMOTE BURNER INPUT CONTROL

The burner input is controlled by connecting an external 0-10 Vdc signal to the boiler (connections 15-16).

P5 BB Analogue input config (0=off 1=temperature 2=power) (display D1)
This parameter must be set at "2" so the supplied 0-10V dc signal will control the burner input. The standard factory setting is “1”, temperature set point control. Possible settings are:

0 = 0-10V control off
1 = 0-10V temperature set point control active
2 = 0-10V burner input control active

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



11.2.7 TIMER CONTACT FUNCTION

This function can be activated when using an external night reduction timer for heating. This timer contact can be connected to the thermostat terminals (connections 13-14).

P5 AB Timer contact (1=on) (display A9)
When this parameter is activated and…

- …the thermostat terminals are bridged (timer contact closed), the normal daytime temperature is used as set point.
- …the thermostat terminals are not bridged (timer contact open), the night reduced temperature is used as set point.

11.3 Indirect hot water/calorifier

The following paragraphs describe the different functions of the boiler and their related “controlling behaviour settings” as a central heating boiler with an indirect hot water function.

11.3.1 PUMP AND 3-WAY VALVE CONTROL

See chapter 19 for several installation examples of the boiler and the preferred functions. When the boiler is used as an indirect boiler for both central heating and hot water function, this hot water function can be activated by using a DHW pump (calorifier pump (pump 2)) or a 3-way valve.

P4 AB DHW Pump config 0=Pump 1=TWV (display B1)
With this parameter it is programmed if the flow to the indirect water tank (calorifier) is controlled by a pump (0 = pump) or a 3-way valve (1 = TWV).

11.3.2 TANK THERMOSTAT

An external thermostat can be connected to the boiler (connections 5-6). When there is a hot water demand and the tank thermostat closes, the boiler will start for the hot water demand. The calorifier/tank pump will be activated or in case of a 3-way valve, this valve will turn to the position to supply heat to the tank coil(s). In case of a heat demand and hot water demand, the (central) heating pump will switch off until the hot water demand ends.

P4 AB DHW pump Config 0=Pump 1=TWV (display B1)
With this parameter it is programmed if the flow to the indirect water tank (calorifier) is controlled by a pump (0 = pump) or a 3-way valve (1 = TWV).

11.3.3 TANK SENSOR

A tank sensor can be connected to the boiler. The tank (hot water) set point and related controlling parameters are set in the boiler controller. A hot water demand is detected by the boiler, when the sensor (water) temperature drops below the set point. The calorifier/tank pump will be activated or in case of a 3-way valve, this valve will turn to the position to supply heat to the tank coil(s). In case of a heat and hot water demand at the same time, the heating pump will switch off until the hot water demand is stopped (water temperature is reached).

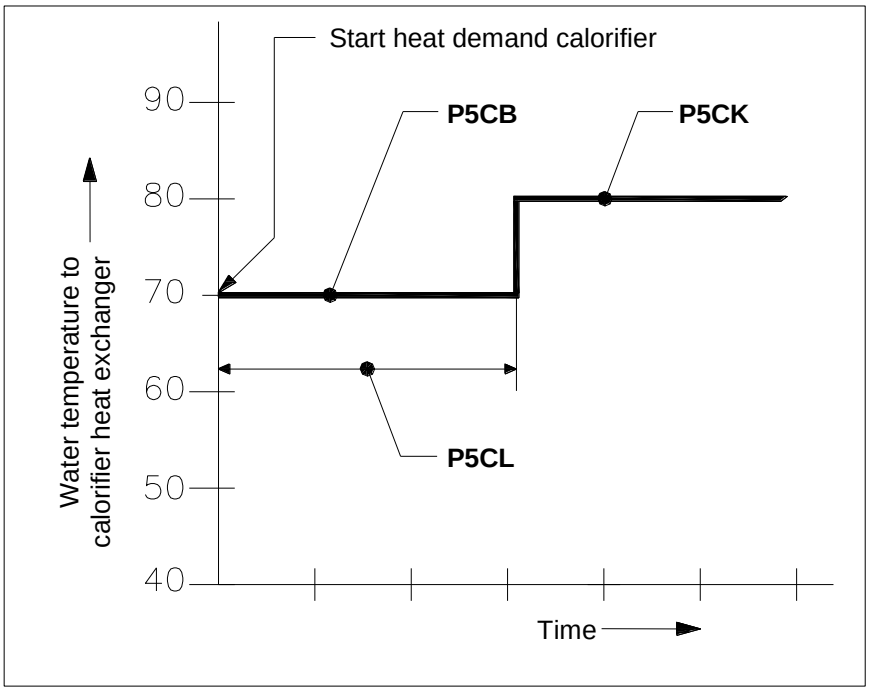
P5 CA Hysteresis DHW tank temperature (display BF)
The amount of degrees that the hot water temperature in the indirect water tank/calorifier needs to drop relative to the hot water set point, before the heat demand is send to the boiler.

11.3.4 LOW/HIGH FLOW TEMPERATURE TO TANK COIL

This function can only be used for an “indirect” programmed boiler (parameter **P4 AA** = 1).
Normally for a regular calorifier a fixed flow temperature of 85°C is supplied to the calorifier heat exchanger in case of a heat demand. This hot water flow will indirectly heat up the water in the calorifier tank.

The parameters for this function can be configured for both low and high calorifier operation.

This function operates as follows:
When there is a heat demand, the boiler supplies water to the heat exchanger of the calorifier, according to the flow temperature set in parameter **P5 CB**. When the heat demand remains for the period set in parameter **P5 CL**, the flow temperature set point will change to a higher temperature, which is set in parameter **P5 CK**. This situation continues until the heat demand ends.



The reason for this function is that the boiler by supplying a lower flow temperature to the heat exchanger of the calorifier, can stay in its condensing mode (if the temperature is low enough) and thus operate at a higher efficiency level. When it takes too long (> **P5 CL**) to heat up the tank with this low temperature mode, the flow temperature set point will change to a higher setting to make sure that the hot water set point is reached.

P5 CB Flow temperature DHW tank low (display B2)
The low level flow temperature to the tank coil(s) in case of a calorifier/indirect hot water demand. This “two staged” function is added to keep the boiler in the condensing mode as long as possible.

P5 CK Flow temperature DHW tank high (display B3)
The high level flow temperature to the tank coil(s) in case of a calorifier/indirect hot water demand.

P5 CL Low flow temperature time DHW (display B4)
The programmed period for changing the set point of the water flow temperature from low to high.
The standard factory setting for this function is “OFF”.

11.3.5 HEATING AND HOT WATER SWITCHING TIME

This function can only be used for an “indirect” programmed boiler (parameter **P4 AA** = 1).
In case there is a heating demand and the unit is operating for this heating demand, also a hot water demand can be activated. A hot water demand always has priority, this means that the unit will switch to hot water operation. When the hot water demand remains for a longer period, there will be no heat supply for/to the central heating system during this period. Not supplying any heat for/to the central heating system might cause undesirable temperature fluctuations. The following parameters can be used to program the preferred settings.

P5 CL Low flow temperature time DHW (display B4)
The period during which the set point of the water flow temperature (to the heating coil(s) of the calorifier) will switch from “low” to “high”.

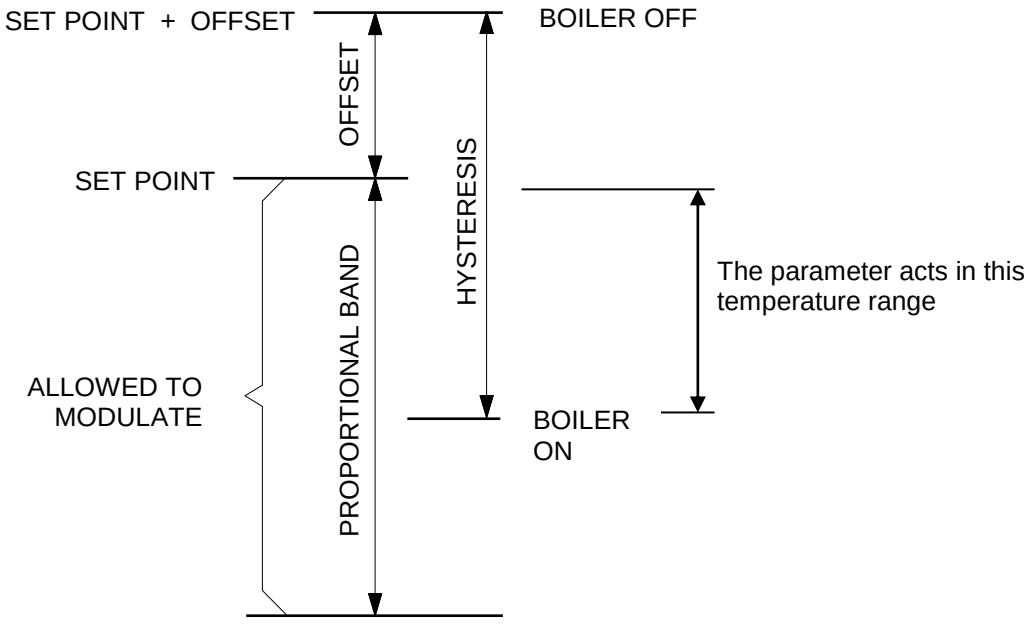
P5 CF Max runtime DHW during CH demand
The programmed period for the boiler to operate for DHW demand in case of a CH demand. After this period the boiler will switch to operate for CH demand, even when there is still a DHW demand.

P5 CM Max runtime CH during DHW demand
The programmed period for the boiler to operate for CH demand in case of a DHW demand. After this period the boiler will switch to operate for DHW demand, even when there is still a CH demand.

The standard factory setting for this function is that the hot water demand always has priority and that no switching between the heat and hot water demand happens, when both are active.

11.3.6 HEATING AND HOT WATER SWITCHING AT SUDDEN TEMPERATURE DROP

This function can be used to detect indirect water tank/calorifier heat demand in case of a sudden temperature drop within the range between the set point and the (minimum) value at which the boiler is normally switched on. For this parameter is chosen the value of the temperature drop detected within one second, at which an immediate indirect hot water demand is activated.



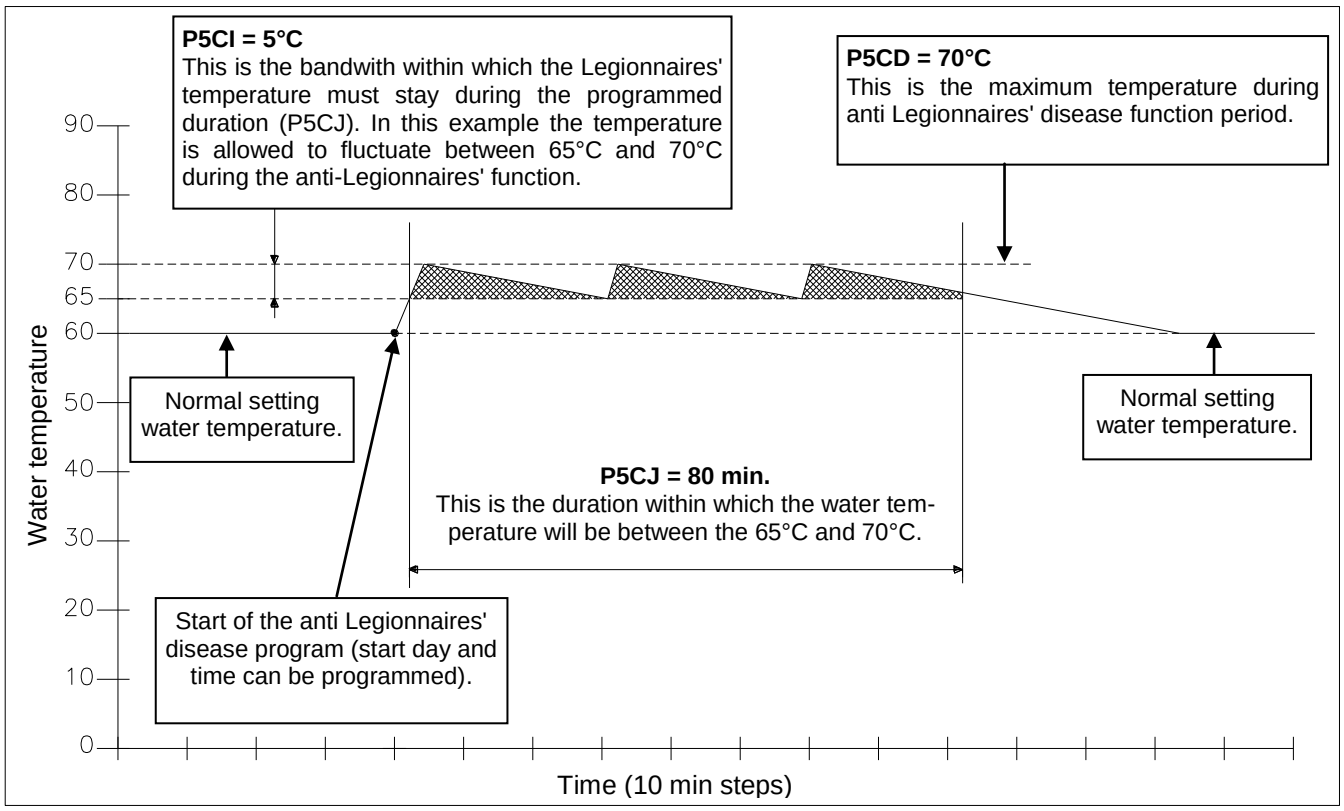
P2KH Gradient heat demand detect Dhw tank temperature (display BG)
See the given explanation. The standard factory setting for this function is “OFF”.

11.3.7 ANTI-LEGIONNAIRES' DISEASE FUNCTION (PASTEURISATION)

This function can only be used for an "indirect" programmed boiler (parameter **P4 AA** = 1), on which a DHW program is active.
To prevent Legionnaires' disease the boiler (software) provides a function for heating up the hot water storage tank (once a week) to a higher water temperature then the normal active hot water set point. Also the period, that this "higher" water temperature function must be active, can be programmed.
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 time of this Legionnaires' disease function can be programmed at the control panel of the boiler.

There are several parameters being used for this function. Three of these parameters are shown in the following graph.

With parameter P2 KI the heating (CH) demand can be interrupted to provide heat for the anti-Legionnaires' disease demand. When no interruption is activated the boiler will wait for the end of the heat demand before the anti-Legionnaires' disease function starts. The standard factory setting for this function is "OFF".



The settings of these parameters **P5 CI**, **P5 CJ** and **P5 CD** must be programmed according to the national and/or local anti-Legionnaires' disease preventing regulations.

The setting of these parameters can only be done by the manufacturer/supplier of the boiler 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.

11.4 Cascade control

→ *The following information is also found in the specific cascade manual, supplied standardly with Strebel cascade accessories or on request.*

Before commissioning a cascade installation, a number of parameters have to be changed.
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 Ambassador+ range boilers. He will be able to check whether the installation functions correctly after the parameter change has been done.

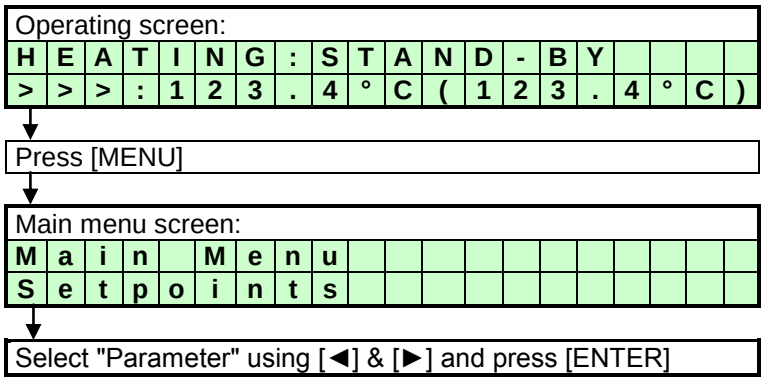
For programming **all parameters** of the boilers one needs to have a laptop with the appropriate EHS software and an interface cable for connecting the laptop to the boiler control (one order no.: S04.016.586). This software is used for programming but also shows all measured temperatures and cascade behaviour during operation and service/fault history.

11.4.1 PARAMETER SETTINGS FOR CASCADED BOILERS

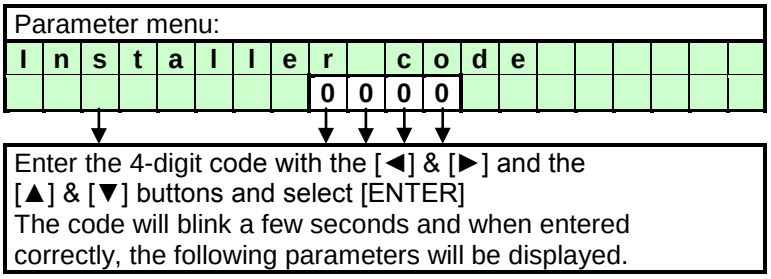
Before programming the cascaded boilers, make sure that all boilers are connected (wire) with each other. Use connection 17 and 18 of each boiler.

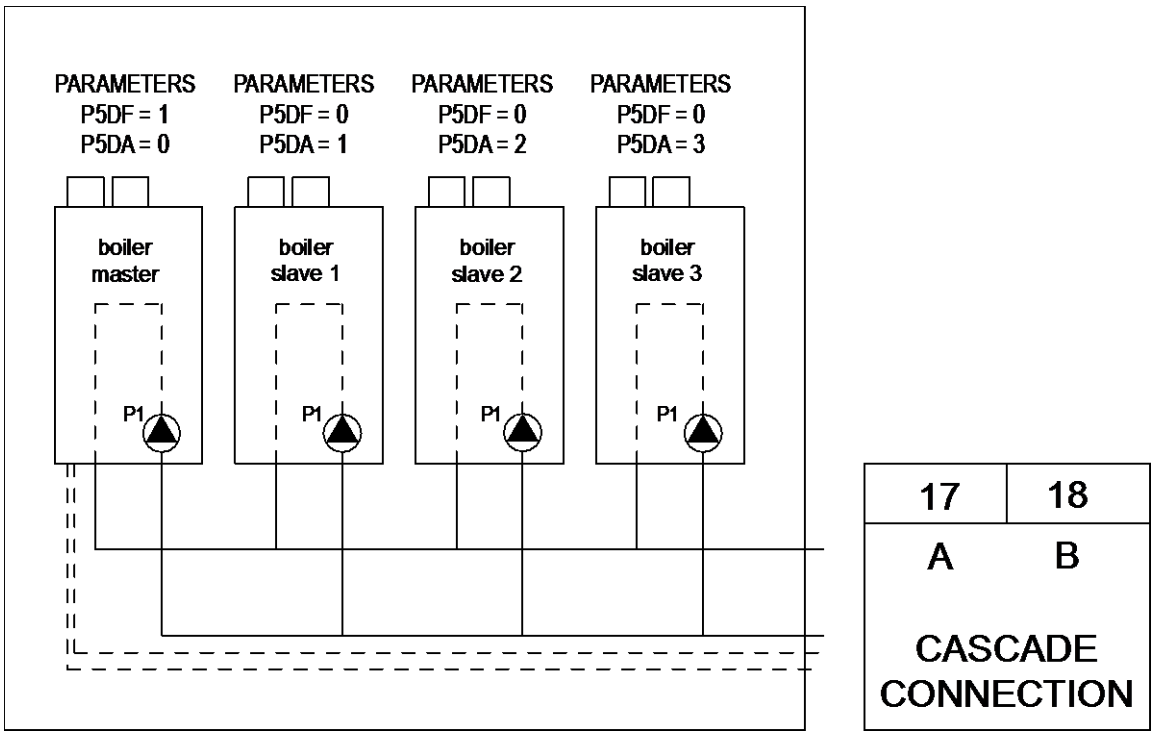
Remind: do not alternate these connections, so always connect 17 to 17 and 18 to 18.

After connection every boiler 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 boiler 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 boiler(s). This parameter sets the function of the boiler at a cascade alignment 0 = Single / Slave unit 1 = Master unit

Menu C: Cascade
C 2 B u s a d 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, 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 boiler.

When cascade connection is programmed correctly the boiler 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.

11.4.2 MONITOR SCREENS

To obtain cascade information, see § 10.4 on page 47.

11.4.3 OUTPUT CONTROL AND BOILER SEQUENCE

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

To distribute operating hours equally over all boilers, the working sequence of the boilers 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: boiler sequence example of an eight boiler cascade.

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

12 COMMISSIONING THE BOILER

12.1 First: flushing the boiler with water

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

12.2 Second: filling & venting the boiler and the system

After flushing the boiler and the installation the system can be filled with fresh water. Fill the boiler and the heating system by using the appropriate filling valve. The water pressure of the system normally lies between 1,5 and 2,0 bar – see § 6.14 'Water pressure' on page 20.

NOTICE: Use the following aspects to prevent corrosion of the central heating system:

- Filling water: Do not use any additives for the water of the central heating system. The pH value of the water should be more than 5 (If this pH value is less, please contact the supplier).
- Ensure that any used "plastic" pipes are oxygen diffusion-proof in accordance with DIN 4726/4729. If not, make sure that the boiler circuit is separated from the heating circuit by a plate heat exchanger. This way no oxygen that entered the heating system through these pipes can reach the boiler.
- Check the total heating system for any leaks. This to prevent oxygen entering the system through these leaks.

The boiler has an automatic air vent situated on top. This vent must be opened during the filling of the boiler and the heating system to make sure that no air/oxygen is trapped in the heat exchanger of the boiler. NOTICE: Check that the screw cap has been loosened at least one twist. Shortly after putting the boiler into operation, check the water pressure and add or lose some water to obtain the required pressure.

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

12.3 Third: check the water flow

Before the boiler will be started it must be sure that the boiler pump is functioning and that there is a water flow over the heat exchanger. Check the electrical power supply of the boiler; if this is connected correctly, the display will show:

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

Reason Boiler is not active. To activate the boiler press [ON/OFF] button for six seconds.

Display message	**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)

Reason Boiler is standby. To activate the boiler press [ON/OFF] button for three seconds.

Activate the boiler by pressing the [ON/OFF] button for six resp. three seconds. After this the following display will appear:

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

Reason Boiler is active, but there is no heat demand.

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

By pressing the [SERVICE] button of the boiler, the boiler can be started without a heating demand. The boiler will start to fire and also the pump will start to run. Firing of the boiler without 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 boiler by pressing the [◄] button once. The temperature difference of the flow and return must be between 13°C and 25°C at high fire. This temperature difference indicates that there is a sufficient water flow over the boiler; this water flow protects the heat exchanger against possible damage caused by a thermal overload.

Another safety feature of the boiler, to make sure that there is enough water flow over the boiler, is the monitoring of the flow and return temperatures (T1 and T2). When the temperature difference (delta T) between the flow and return exceeds a certain (set) value, 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 B l o c k**
	9 9 9 , 5 h r s

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

When the T1-T2 value exceeds the lock-out setting, the boiler will switch off and the following lock out code will be shown at the display.

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 T1-T2 has exceeded the blocking value more than three times.

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

The boiler has no built in water-flow switch. If there is the possible risk of a water-flow blockage of the (external) heating system, the following pre-cautions can be taken to ensure a water flow over the boiler:

- Separate the boiler circuit from the (external) heating circuit by using a low loss header or plate heat exchanger.

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

NOTICE: Always check the running of the pump before firing the boiler.

13 STARTING THE BOILER

13.1 General

Check the gas pressure available at the gas connection pipe of the boiler. Use the pressure nipple (3) of the gas safety valve for this measurement.

The graphs on page 95 show the position of the pressure nipple (3) for the complete boiler range.

The gas input pressure for the boiler to operate properly under the correct load must be **more than 20 mbar at high fire**.

For Ls gas G2.350, used in parts of Poland, a B+J gas valve must be installed in the A+80, A+100, A+150 and A+180 boilers. See also page 93 ff. and page 96.

13.2 Firing for the first time

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

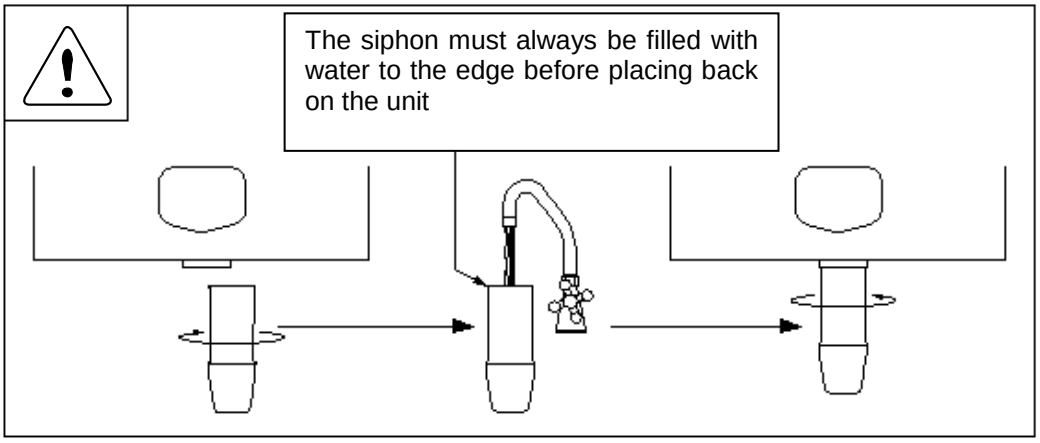
Display message	**H**	**E**	**A**	**T**	**I**	**N**	**G**	**:**	**N**	**o**		**d**	**e**	**m**	**a**	**n**	**d**			
	>	**>**	**>**	**:**	**1**	**2**	**3**	**.**	**4**	**°**	**C**	**(**	**1**	**2**	**3**	**.**	**4**	**°**	**C**	**)**
Reason	Boiler is active, but there is no heat demand.																			

The display describes:

- The actual operation for heating or hot water
- If there is a heat demand activated
- The temperature setting
- The temperature measured

When mounting the bottom part of the siphon, before commissioning the boiler 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 leaking out of the heat exchanger via the condensate drain.



When the boiler receives a heat demand the electronics will start the operation of the boiler. Before the boiler is used, the boiler 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 boiler is installed
- As part of a service/maintenance check, in case the CO_2 values turn out to be incorrect

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

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

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

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

Gas types and valves
The right type of valve must be selected, depending on the gas type. Gas types G20, G25 and G31 are commonly used; the boilers are standard equipped with the A+C-class valves required for these types of gas.

Poland
Gas types G27 and G2.350 are Lw and Ls gases, used in some parts of Poland. For Ls gas G2.350, the boilers S-CB $^{+}$80, S-CB $^{+}$100, S-CB $^{+}$150 and S-CB $^{+}$180 must be equipped with B+J-class valves, see table 3 and see the pictures on page 96.

Set-up of this chapter:
First, all necessary values are given in three tables in § 14.1.1. A drawing of the gas valve(s) and setting screws is given in § 14.1.2 on the next page. In § 14.1.4 a general scheme, conform which the adjustments must be carried out, is presented in table form. After that, in §§ 14.2 and 14.3, a thorough description is given of how to proceed in cases **A** and **B** respectively. In § 14.4, finally, two main procedures used in the previous sections are described in detail.

14.1.1 ADJUSTMENT TABLES

Table 1

			gas type:		
boiler type	**load**	**output**	**G20** [1]**, G25** [1]**, G27** [1]**, G2.350** [1]	**propane** [3] **G31** [1]	**butane (B/P)** [3] **G30** [1]**/G31** [1]
S-CB^{+} 60-120 [2]	**max. load**	**CO_2 (%)**	**9,0**	**10,3**	**10,4**
		O_2 (%)	4,8	5,2	5,3
	min. load	**CO_2 (%)**	**8,7**	**9,3**	**9,3**
		O_2 (%)	5,3	6,7	6,9
S-CB^{+} 150 [2]	**max. load**	**CO_2 (%)**	**9,0**	**10,4**	**10,5**
		O_2 (%)	4,8	5,0	5,2
	min. load	**CO_2 (%)**	**8,7**	**9,3**	**9,3**
		O_2 (%)	5,3	6,7	6,9
S-CB^{+} 180 [2]	**max. load**	**CO_2 (%)**	**9,0**	**10,5**	**10,6**
		O_2 (%)	4,8	4,7	4,9
	min. load	**CO_2 (%)**	**8,7**	**9,3**	**9,3**
		O_2 (%)	5,3	6,7	6,9

[1] Cf. EN437. *(G27 and G2.350 for Poland)*
[2] All values are measured without boiler door
[3] Fan settings must be changed by altering parameter P4BD (display D8) (only by a skilled mechanic)

For adjustment use CO_2 tolerance of ± 0,1% (for O_2 this is ± 0,2%).

For Ls gas G2.350, used in parts of Poland, a B+J valve must be installed in the S-CB $^{+}$ 80, S-CB $^{+}$ 100, S-CB $^{+}$ 150 and S-CB $^{+}$ 180 boiler. See also page 96.

Table 2

pre adjustment settings gas valves *(G27 for Poland)*

boiler type	number of turns open (counter clockwise)		
	nat. gas G20 / G25 / G27	propane G31	butane G30 (B/P)
S-CB+ 60	1	0,5	0,25
S-CB + 80	1,5	0,75	0,5
S-CB + 100	3,5	1,5	1,25
S-CB + 120	2,25 *	1 *	0,75 *
S-CB + 150	2,25 *	1 *	0,75 *
S-CB + 180	4,25 *	2,25 *	2 *

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

Table 3

Gas valve settings for Ls gas G2.350 *(for Poland)*

boiler type	number of turns open (counter clockwise)		
	natural gas Ls G2.350	gas valve class	gas valve part n°:
S-CB + 60	1,25	A + C	*No replacement*
S-CB + 80	1,75	B + J	S04.000.393
S-CB + 100	4	B + J	S04.000.393
S-CB + 120	*2,5	A + C	*No replacement*
S-CB + 150	*2,5	B + J	S04.000.393
S-CB + 180	*4,5	B + J	S04.000.393

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

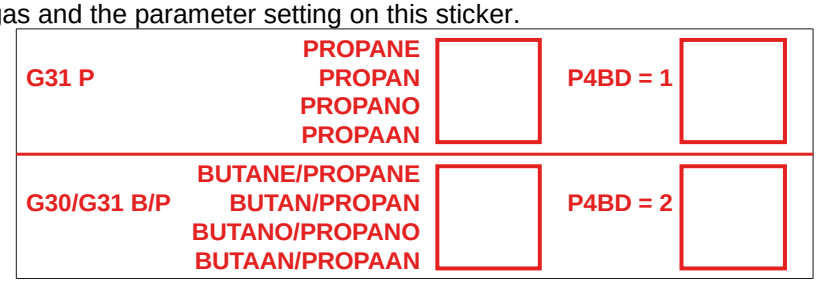
Table 4

Contact you boiler supplier for the right settings when converting to a not mentioned type of gas

Pressure adjustment settings LEFT valve

boiler type	"p-out" pressure at gas valve		
	nat. gas G20 / G25	propane G31	butane G30 (B/P)
S-CB + 120	-2 to 0 Pa	-4 to -2 Pa	-5 to -3 Pa
S-CB + 150	-2 to 0 Pa	-7 to -5 Pa	-8 to -6 Pa
S-CB + 180	-2 to 0 Pa	-7 to -5 Pa	-8 to -6 Pa

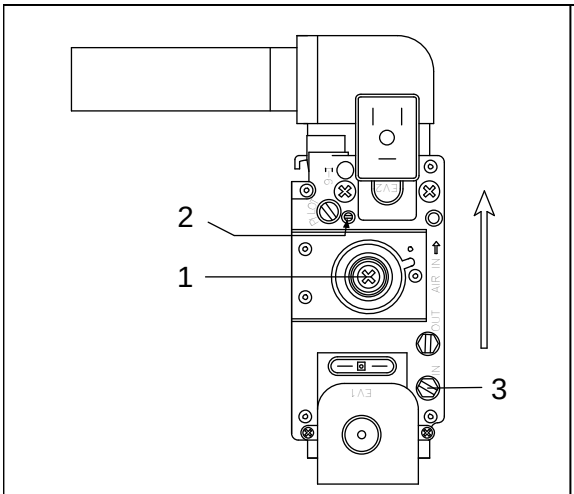
Maximum fan speed has to be reduced to convert the boiler into a propane or B/P appliance.
Setting of parameter P4BD.
A sticker has to be pasted after converting the boiler into a propane or B/P appliance.
Mark the used gas and the parameter setting on this sticker.



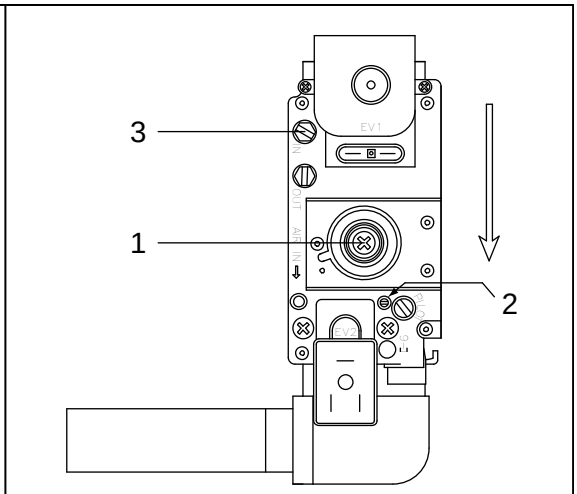
See § 14.3 on page 98.

14.1.2 SETTING SCREWS GAS VALVE(S): DRAWINGS

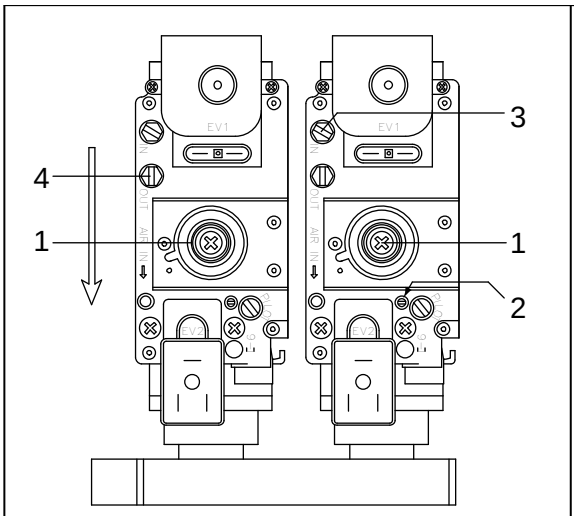
NOTICE: Do NOT mistake the screw marked ‘PILOT’ for screw 2.
→ Screw 2 is the SMALL screw immediately next to the pilot screw.



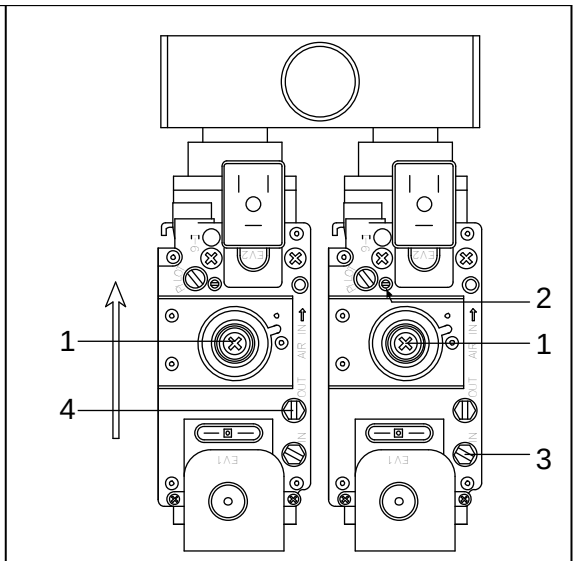
60



80 & 100

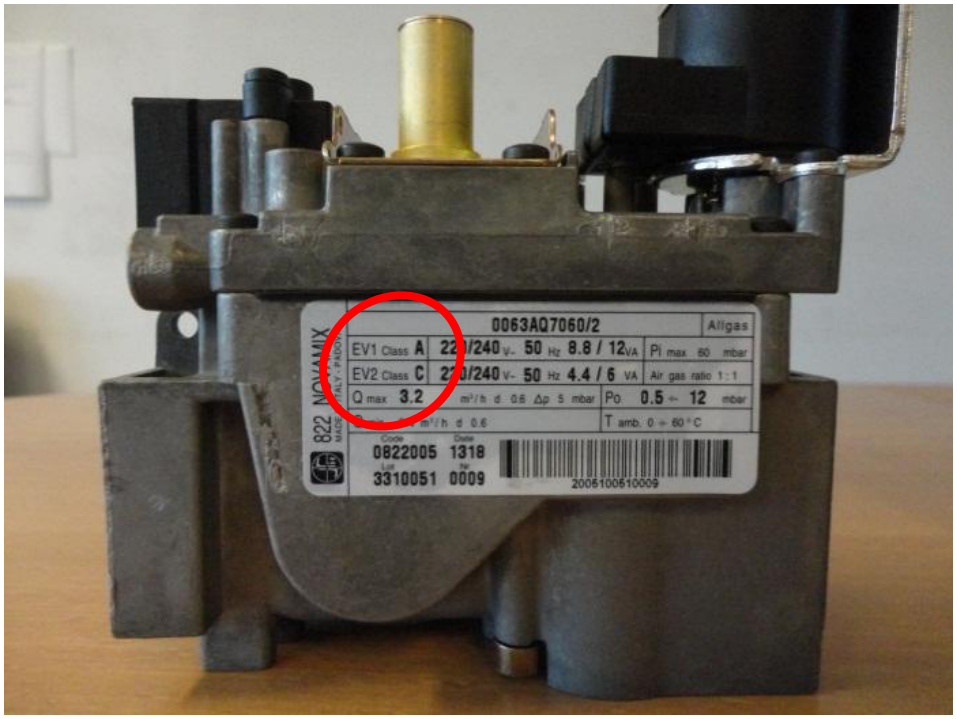


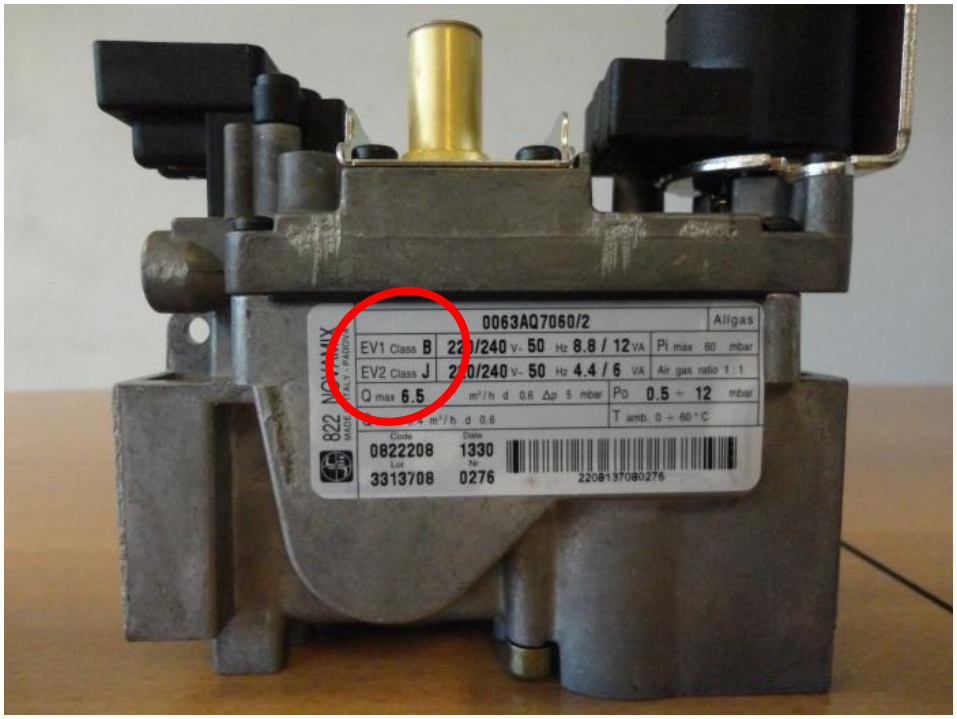
120



150 & 180

14.1.3 GAS VALVE CLASSES A+C AND B+J (B+J ONLY FOR POLAND)

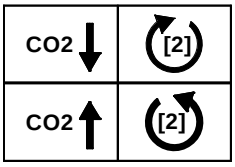
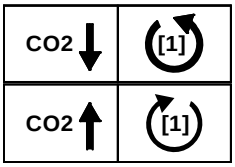




These pictures show the difference between an A+C and a B+J valve.
Notice the class being denoted on the ID plate of the valve.

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 boiler 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
match value with table 1
 
</td></tr>
<tr><td></td><td colspan="3">setting at minimum load</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">continue ↓</td><td rowspan="2">only → S-CB+120, +150, +180</td><td>[▼] set burner at minimum load</td></tr>
<tr><td>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
match value with table 1
 
</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">Boiler returns to NORMAL MODE after 40 min. OR by pressing [SERVICE] button</td></tr>
</table>

* in case of a double valve (S-CB+120, S-CB+150 and S-CB+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 boiler, or after maintenance (case A)

14.2.1 GENERAL REMARK

For all adjusting steps under **A** the following must be applied: as long as measured CO_2 values differ less than 0,3% from the table values, no adjustment is necessary, because this deviation is typical for the process (O_2 values: ± 0,5%). If, however, larger deviations are measured, adjustment now must be made until the table value is reached within max. 0,1% deviation (O_2: ± 0,2%).

14.2.2 CHECKING AND ADJUSTING AT MAXIMUM LOAD

Adjust at maximum load by carrying out procedure 1 on p.100.

14.2.3 CHECKING AND ADJUSTING AT MINIMUM LOAD

Adjust at minimum load by carrying out procedure 2 on p.100.

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

Maximum fan speed has to be reduced to convert the boiler 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 boilers containing a single valve (S-CB$^+$60 to S-CB$^+$100) and boilers with a double valve (S-CB$^+$120 to S-CB$^+$180).
All adjustments must result in CO_2 percentages within a bandwidth of max. ± 0,1% deviation from the table values (O_2: ± 0,2%).

14.3.2 CHECKING AND ADJUSTING AT MAXIMUM LOAD S-CB$^+$60 / S-CB$^+$80 / S-CB$^+$100

The boilers S-CB$^+$60, S-CB$^+$80 and S-CB$^+$100 all have single gas valves, see the drawings on page 94.

- 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 boiler and gas type.

After this, adjust at maximum load by carrying out procedure 1 on page 100.
If the burner doesn't start up in service mode, turn screw [2] a quarter turn counter clockwise further open, and try again.

14.3.3 CHECKING AND ADJUSTING AT MINIMUM LOAD S-CB$^+$60 / S-CB$^+$80 / S-CB$^+$100

Adjust at minimum load by carrying out procedure 2 on page 100.

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 boiler 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-CB$^+$120 / S-CB$^+$150 / S-CB$^+$180 see next page →

14.3.4 CHECKING AND ADJUSTING AT MAXIMUM LOAD S-CB$^+$120 / S-CB$^+$150 / S-CB$^+$180

The boilers S-CB$^+$120, S-CB$^+$150 and S-CB$^+$180 all have double gas valves, see the drawings on page 94.

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 boiler 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 on page 100.
If the burner doesn't start up in service mode, turn screw [2] a quarter turn counter clockwise further open, and try again.

14.3.5 CHECKING AND ADJUSTING AT MINIMUM LOAD S-CB$^+$120 / S-CB$^+$150 / S-CB$^+$180

Adjusting these boilers 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**	**)**

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

See table 4 for pressure settings "p-out" gas valve for the used boiler 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 cf. table 4, use only the **right hand** screw [1] for setting the CO_2 at low fire.

Adjust the **right hand** valve at minimum load by carrying out procedure 2 on page 100.
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 on page 95).
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 and 14.3, are described here:

Procedure 1: adjust at maximum load
*In case **B** (replacement of gas valve or gas conversion): consult § 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**	**)**

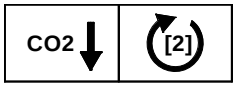
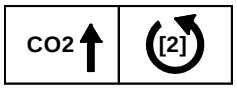
Boiler is activated and operates at service mode at 26% (minimum). (example)

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**	**)**

Boiler 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.
   NOTICE: For the A$^+$120, 150 and 180 boilers 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 boiler will be active for 40 minutes.
After this period the boiler will return to normal operation.

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

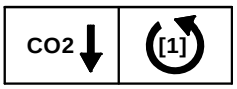
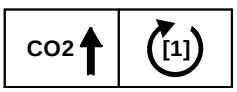
Carry out the next three steps:

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**	**)**

Boiler 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-CB$^+$120, 150 and 180 boilers 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 boiler will be active for 40 minutes.
After this period the boiler will return to normal operation.

15 PUTTING THE BOILER OUT OF OPERATION

It is recommended to have the boiler 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 boiler 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 room thermostat and/or other external controllers from the boiler. The CH pump and fan will stop after a short time.
- Switch off the boiler by pressing the [ON/OFF] button for six seconds.
- Make sure that 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 boiler CAN, however, be switched on again by pressing the [ON/OFF] button.
- Pumps, fans and cascade (if applicable) are operational, and so are both recirculation protection (if applicable) and frost protection.
- NOTICE: Pump 3 (CH pump) is switched OFF, but this is NOT the case when the boiler is in a cascade.
- To reactivate the boiler, switch on the burner by pressing [ON/OFF] for six seconds again.

The frost protection module can still activate the burner.
To prevent this, switch off this protection or put the boiler in 'power off' mode.

15.2 Out of operation: power off

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

Act as follows:

- Disconnect or switch off the room thermostat and/or other external controllers from the boiler. The CH pump and fan will stop after a short time.
- Switch off the boiler by pressing the [ON/OFF] button for six seconds.
- Make sure that 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 boiler (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 boiler and the heating system.

NOTICE: Before starting to drain the boiler, first start draining the heating system and subsequently open also the two drains of the boiler.

16 FAULT CODES. BLOCKING CODES

16.1 Fault 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.

LOCK-OUT CODES:

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

Explanation > **999,5:hrs** = time elapsed after fault/message.

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

Display message **F0**	**Flow sensor error** **pump on 999,5 hrs**
Reason:	Flow sensor is not detected.

Cause:
Bad wiring/connection in the flow sensor circuit.
Corrective action:
Check for loose wiring/connections in the flow sensor circuit.

Cause:
Bad temperature sensor causing a fault signal.
Corrective action:
Replace flow sensor.

Display message **F1**	**Flow high Temp** **pump on 999,5 hrs**
Reason:	Max. flow temperature exceeds limitation (lock-out) value.

Cause:
The water flow is restricted.
Corrective action:
Check functioning of the pump. Check/open all valves that might restrict the water flow through the unit. Check for an external system pump that influences flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump.

Display message F1	Return high Temp pump on 999,5 hrs
Reason:	Maximum return temperature exceeds limit value.

Cause:
Systems that pre-heats the boiler 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 boiler.
Corrective action:
Dampen external heating system control to prevent sudden boiler temperature rise.

Display message F2	Lack of water pump on 999,5 hrs
Reason	No temperature rise measured during firing.

Cause:
When the unit starts firing it expects to measure a temperature rise. If this temperature rise is not detected, there is suspicion that there is no medium (water) present, to transfer heat from combustion to the sensor. The lack of water can cause this fault when the unit is firing.
Corrective action:
Make sure there is water present in the unit before firing.

Display message F3	Return sensor error pump on 999,5 hrs
Reason	Return sensor is not detected by the boiler 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 F6	Flue sensor error pump on 999,5 hrs
Reason	Flue sensor is not detected by the boiler 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 F8	F a i l e d b u r n e r s t a r t p u m p o n 9 9 9 , 5 h r s
Reason	Boiler 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.

F8 →

F8 →

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	**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 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 boiler room pressure is equal to the pressure at the position of the flue gas outlet (when combustion air is drawn from the boiler room).

Display message **F10**	**F a l s e f l a m e s i g n a l** **p u m p o n 9 9 9 , 5 h r s**
Reason	Flame signal detected, while boiler 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 **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	Param/Hardw fault pump on 999,5 hrs
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 F15	Clixon Fault pump on 999,5 hrs
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 boiler.	

Display message F16	FlowReturn dt fault pump on 999,5 hrs
Reason:	Temperature difference between flow and return exceeds limitation value, or 'Heatexchang at Risk' has occurred 3 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 F17	Water high limit pump on 999,5 hrs
Reason	Maximum thermostat exceeds limitation value.
Cause:	
The water flow is restricted.	
Corrective action:	
Check functioning of the pump. Check/open all valves that might restrict the water flow through the unit. Check for an external system pump that influences the flow through the unit. Check if the system resistance exceeds the spare capacity of the unit pump.	

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 boiler.
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 boiler.

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.

16.2 Blocking codes:

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

Display message	**F l o w t e m p h i g h**
	9 9 9 , 5 h r s
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	**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 boiler 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 boiler.
Corrective action:
Dampen external heating system control to prevent sudden boiler temperature rise.

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 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 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	**A n t i c y c l e t i m e** **9 9 9 , 5 h r s**
Reason	The controller received a new heat demand too fast after the last ended 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	**W a t e r p r e s s u r e f a u l t** **9 9 9 , 5 h r s**
Reason	Water pressure is too low or high.

Cause:
The water pressure in the system is too high.
Corrective action:
Check if the system pressure is too high after (re)filling. Make sure that there is a pressure relief valve and expansion vessel installed in the system, according to the applicable standards. Check if there is an open connection between the unit and the relief valve plus expansion vessel. Be aware that if the unit is installed in the basement of a tall building, only the static pressure of the water column above the units can raise above the maximum allowable limits. Make sure that this is not the case.

Cause:
The water pressure in the system is too low.
Corrective action:
Check if there is no leakage in the system that causes the pressure to drop. Fix any leakage and fill the system. Check if there is an external system pump that sucks water through the boiler, causing an under pressure (bad installation design).

Display message	Line fault pump on 999,5 hrs
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	Outdoor sensor fail 999,5 hrs
Reason	No outdoor sensor detected.

Cause:
The unit is programmed to check if an outdoor sensor is present and does not detect an outdoor sensor.
Corrective action:
Check for loose wiring/connections in the outdoor sensor circuit. Check the state of the outdoor sensor and replace if necessary.

Display message	dT block 999,5 hrs
Reason	Temperature difference between flow and return has exceeded the blocking value, but not the lock out 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	Gen Block 999,5 hrs
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 in combination 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	**Cascade Block** **999,5 hrs**
Reason	One of the boilers of the cascade is in a lock-out.

Cause:
The unit is programmed in such a way that none of the boilers 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.

16.3 Maintenance attention function

The display shows alternately the base screen and this message, while backlight is blinking.
The boiler 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 boiler it is advised to carry out maintenance and service on the boiler at least once a year.

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

MAINTENANCE REMINDER FUNCTION.
← *See previous 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 10.14, ‘Setting the maintenance specifications’, page 62.

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

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

17.2 Inspection & maintenance

Inspection, maintenance and the replacement of boiler 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 boiler 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 boiler should be checked and inspected.
NOTICE: Before starting to work on the boiler:
- Switch off the electrical power to the boiler (service switch and/or unplug boiler)
- Close the gas valve to block gas supply to the boiler

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 boiler 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 boiler (parts).

Water leakage
The water pressure of the heating installation should be more than 1.0 bar and at a maximum of 2.0 bar in normal operation. When the water pressure drops below the minimum occasionally, there might be a water leak. Check the boiler and the complete heating installation for any water leakages and have these repaired.

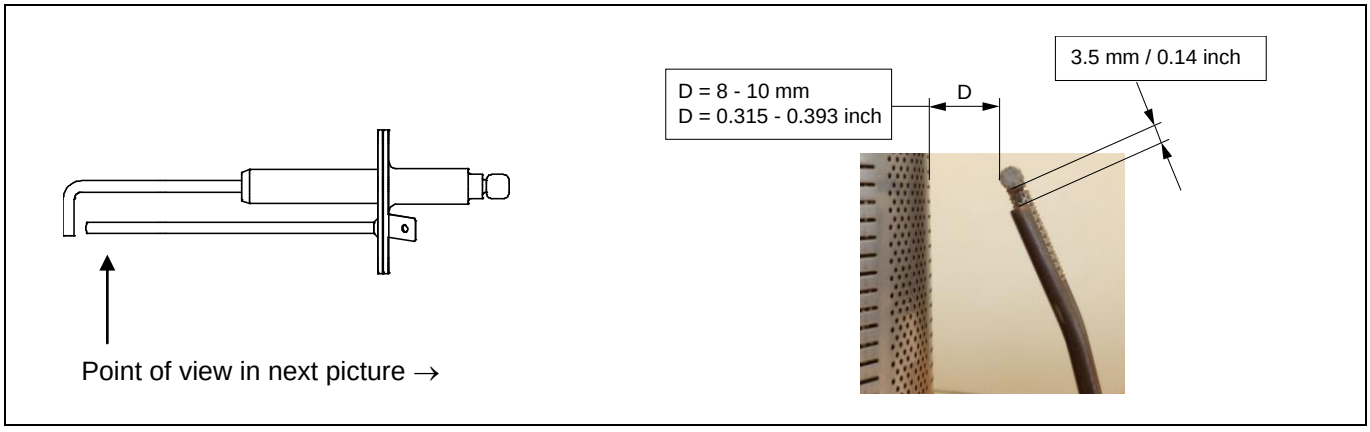
Flue gas & air supply
The flue gas pipes and the air supply pipes must be checked for gas tightness. Also check if the mounting of these pipes is correct, safe and not damaged. Check the rooftop of the boiler housing for signs of water leakage and traces of water coming from the air supply pipe, the 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 six M6 nuts, the ignition cable and the thermal fuse cables. After this, take out the complete burner unit by moving it forward out of the boiler housing. NOTICE: Watch out not to damage the burner plate insulation during this operation. While removing the complete burner unplug both of the electrical and controlling cables of the fan. After all this dismantle the 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 rust and/or cracks. When the burner surface is damaged the burner must be replaced. The burner can be cleaned by using a soft (non-metallic) brush. The dust can be removed with a vacuum cleaner or pressurized air.

Ignition / ionisation electrode
When the complete burner is removed, it is very easy to check the ignition electrode. First check if the distances between the electrodes and between the electrode and the burner are according to the 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 bending used electrodes they might break or burst. Check the electrode, after bending, for any tear/crack and signs of rust. When they are burst/cracked or rusty, replace the electrode. Also replace the electrode when there is a crack in the ceramic insulation of the electrode. When the electrode is replaced, also the gasket 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 boiler manufacturer.

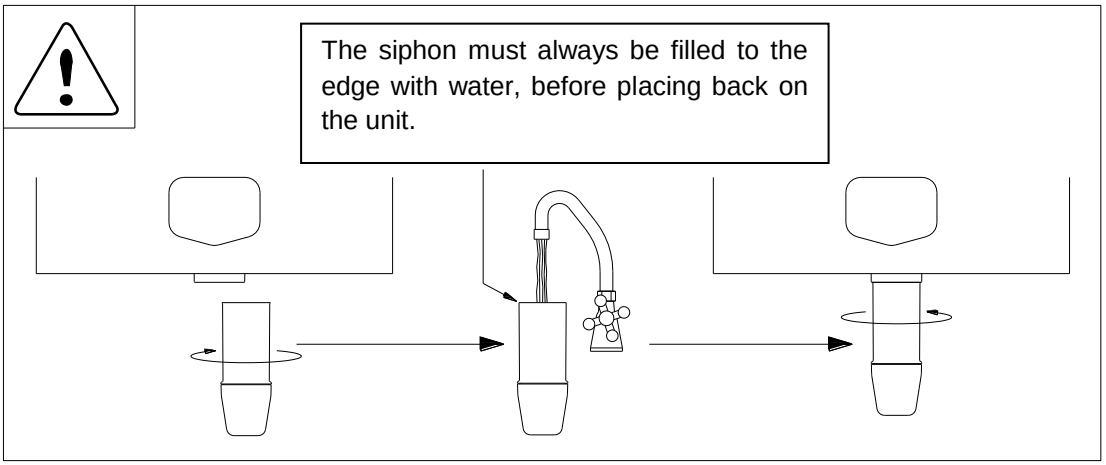
Fan
When the fan blades are polluted and dirty, carefully clean the blades with a soft brush. Notice: do not use too much force on the blades or else the fan might be out of balance and run irregularly, causing noises and fan failures. Check the fan also for any water damages. In doubt always replace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

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 in the burner room of a high condensate level (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 boiler 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.

When mounting the bottom part of the siphon, before commissioning the boiler 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.



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.

Gas/air ratio
With every service check and/or maintenance of the boiler always check the gas/air ratio by measuring the CO_2 percentage (flue gas) at the maximum and minimum load of the boiler. 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 boiler. 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 boiler.

During service and maintenance the gas, supply air, flue gas and condensate connections are disconnected, checked and replaced. Make sure that all these components are mounted correctly before commissioning the boiler again.

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

Mounting the burner door correctly back onto the heat exchanger:

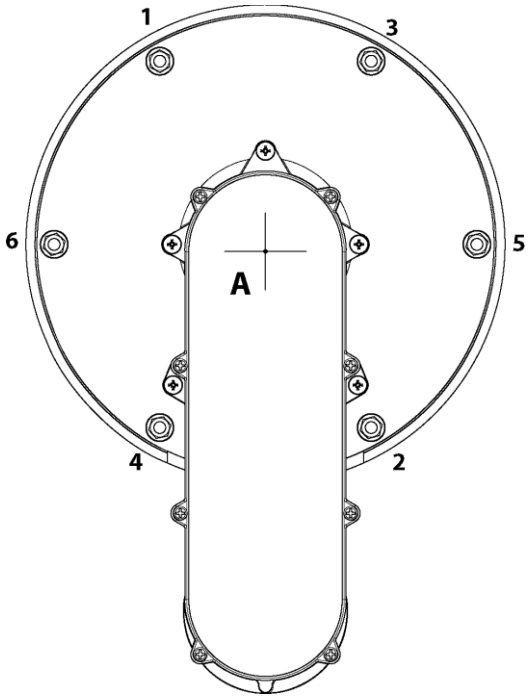
IMPORTANT:
Before mounting the burner door, make sure that its gaskets and insulation are in excellent shape.
If any signs of damage or ageing are present, these parts must be replaced.

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
- 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

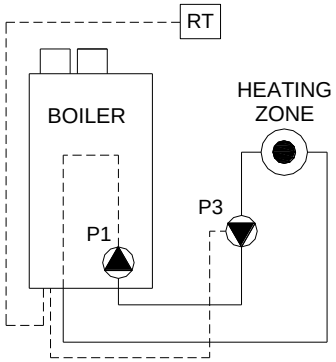
After installing and commissioning of the boiler, demonstrate the operation of the entire central heating system to the end-user. The user should be made familiar with all safety precautions of the boiler and the installation. The user should be instructed that service and maintenance of the boiler is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

19 INSTALLATION EXAMPLES

The following schematics present several ways of mounting the heating installation:

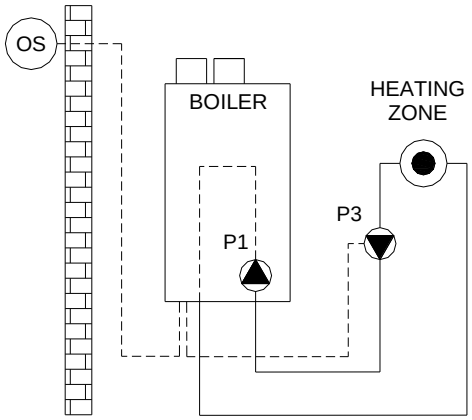
All schematics are purely functional. Safety components must be added conform all applicable standards and regulations.

System Type 1



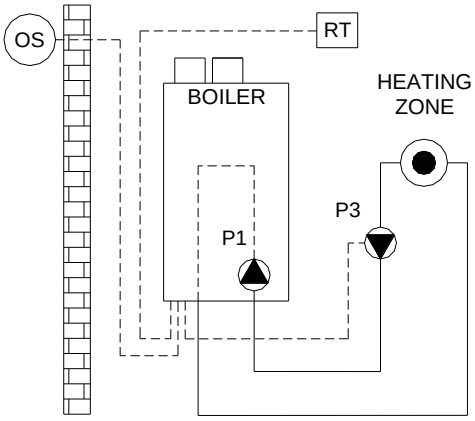
Code 1	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
No parameter change needed			

System Type 2



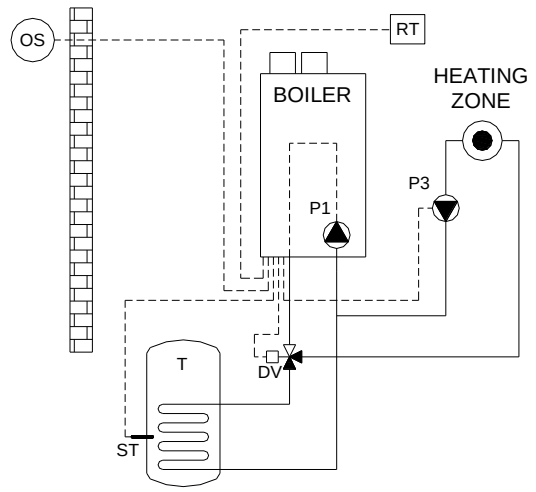
Code 2	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
	place bridge	13-14	
OS	outdoor temperature sensor	1-2	E04.016.585
No parameter change required			

System Type 3



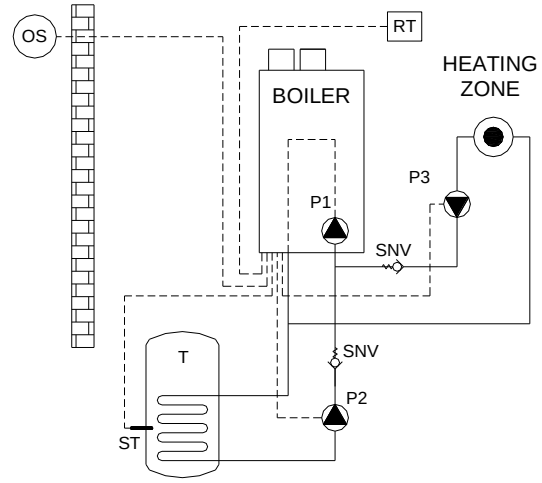
Code 3	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
OS	outdoor temperature sensor	1-2	E04.016.585
No parameter change required			

System Type 4



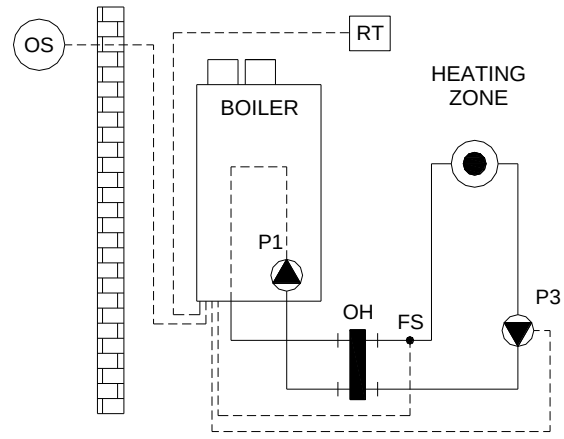
Code 4	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
T	calorifier		
ST	calorifier thermostat or tank sensor	5-6	S04.016.303
OS	outdoor temperature sensor	1-2	E04.016.585
DV	diverter valve (3-way-valve)	28-29-30-31	
Parameter change required			

System Type 5



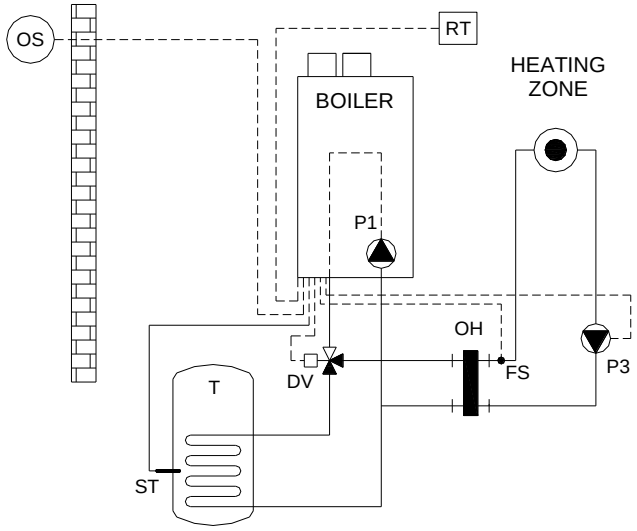
Code 5	Name	Wire terminal	Order nr.
P1	Built-in Boiler Pump		
P3	Optional Heating Pump	25-26-27	
RT	Modulating Room unit with timer	13-14	S04.016.355
T	Calorifier		
ST	Calorifier thermostat or tank sensor	5-6	S04.016.303
P2	HWS Primary Pump	29-30-31	
OS	Outdoor temperature sensor	1-2	E04.016.585
SNV	Non Return Valve		
Parameter change required			

System Type 6



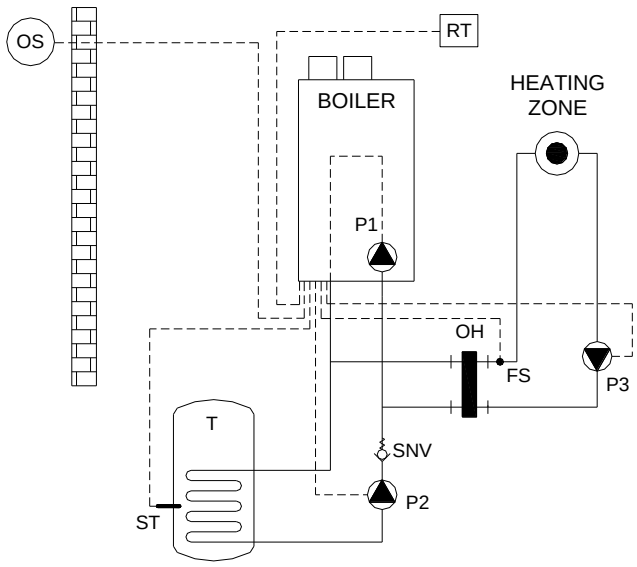
Code 6	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
FS	flow temperature sensor	3-4	E04.016.304
OH	low loss header		
OS	outdoor temperature sensor	1-2	E04.016.585
No parameter change required			

System Type 7



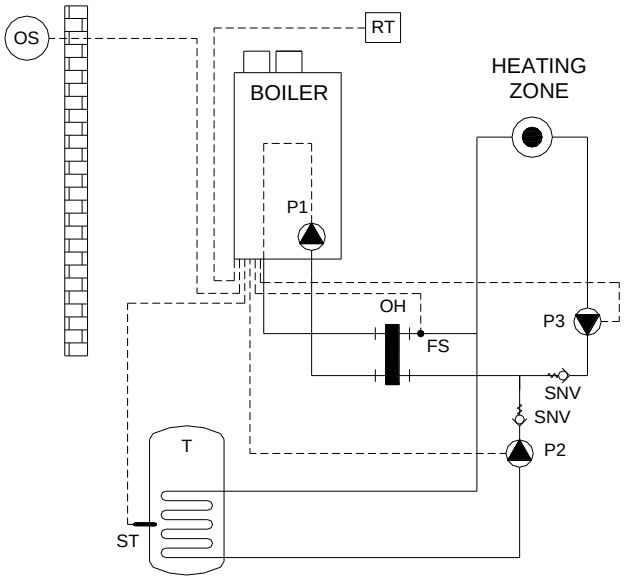
Code 7	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
T	calorifier		
ST	calorifier thermostat or tank sensor	5-6	S04.016.303
OH	low loss header		
FS	flow temperature sensor	3-4	E04.016.304
DV	diverter valve (3-way-valve)	28-29-30-31	
OS	outdoor temperature sensor	1-2	E04.016.585
Parameter change required			

System Type 8



Code 8	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
T	calorifier		
P2	HWS primary pump	29-30-31	
ST	calorifier thermostat or tank sensor	5-6	S04.016.303
OH	low loss header		
FS	flow temperature sensor	3-4	E04.016.304
SNV	non return valve (low resistance type)		
OS	outdoor temperature sen-sor	1-2	E04.016.585
Parameter change required			

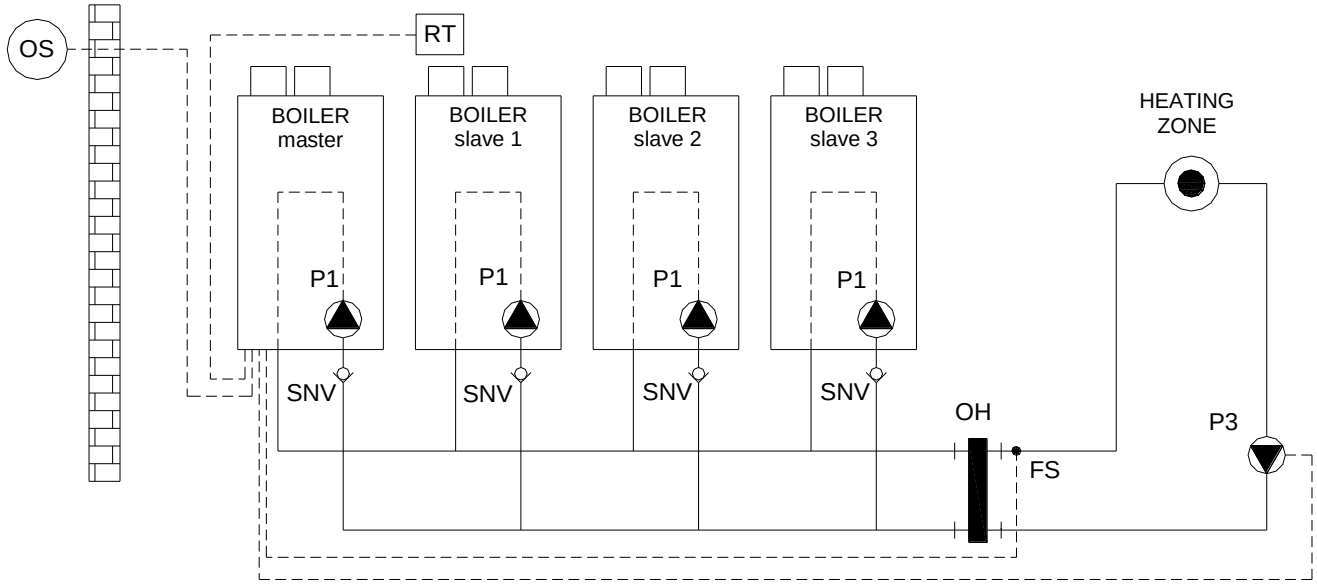
System Type 9



Code 9	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
P2	HWS primary pump	29-30-31	
T	calorifier		
ST	calorifier thermostat or tank sensor	5-6	S04.016.303
OH	low loss header		
FS	flow temperature sensor	3-4	E04.016.304
SNV	non return valve (low resistance type)		
OS	outdoor temperature sensor	1-2	E04.016.585
Parameter change required.			

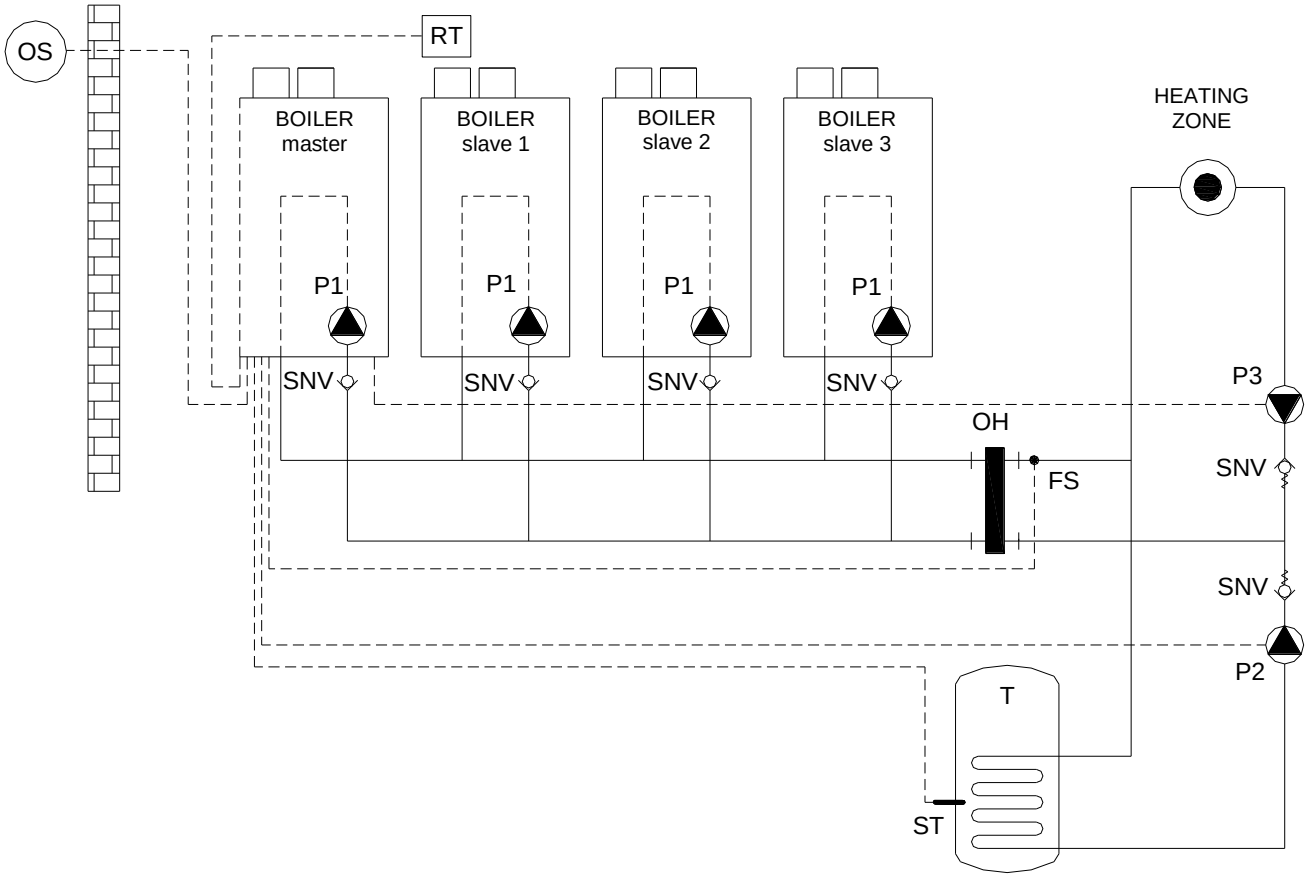
For the cascade installations see the special Cascade Manual.

System Type 10



Code 10	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
SNV	non return valve (low resistance type)		
OH	low loss header		
FS	flow temperature sensor	3-4	E04.016.304
OS	outdoor temperature sensor	1-2	E04.016.585
Parameter change required			

System Type 11



Code 11	Name	Wire terminal	Order nr.
P1	built-in boiler pump		
P3	optional heating pump	25-26-27	
RT	modulating room unit with timer	13-14	S04.016.355
SNV	non return valve (low resistance type)		
P2	HWS primary pump	29-30-31	
T	calorifier		
ST	calorifier thermostat or sensor	5-6	S04.016.303
OH	low loss header		
FS	flow temperature sensor	3-4	E04.016.304
OS	outdoor temperature sensor	1-2	E04.016.585
Parameter change required.			

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