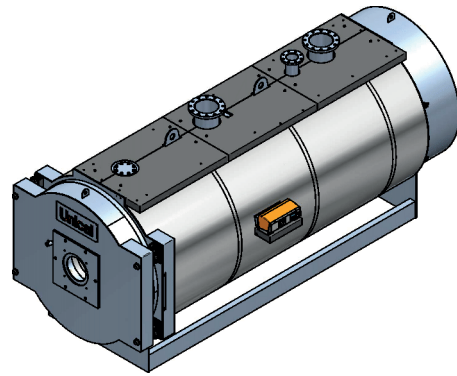


Unical®



TERNOx 2S

INSTRUCTIONS ON INSTALLATION, USE AND MAINTENANCE

Attention: this manual contains instructions for the exclusive use of the professionally qualified installer and/or maintenance technician in compliance with current legislation.

The system manager is NOT authorised to service the boiler.

The manufacturer will not be held liable in case of damage to persons, animals or objects resulting from failure to comply with the instructions contained in the manuals supplied with the boiler.

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ATTENTION

Wherever the boiler operates with a pressure jet gas burner, the appliance, not belonging to any category among those considered in Annex II of the Legislative Decree 93 of 25/02/2000 (Implementation of the Directive 97/23/EC regarding pressurised equipment), and moreover being considered by the Directive 90/396/EEC (Gas-fired appliances - transposed in Italy with Italian Presidential Decree 661 of 15/11/1996) to which art. 1 comma 3 paragraph "f.5" refers, is excluded from the range of application of the decree itself.

1

GENERAL INFORMATION

1.1 - GENERAL WARNINGS

The instruction booklet is an integral and essential part of the product and must be kept by the system manager.

Read the warnings contained in this instruction booklet carefully as they provide important guidelines regarding installation, use and maintenance safety.

Keep the booklet with care for further consultation.

Your appliance must be installed and serviced in compliance with the standards in force according to the manufacturer instructions, up to standard and by legally qualified and certified personnel.

Systems for the production of domestic hot water MUST be constructed entirely with materials that comply with M.D. 174/2004 (taps, pipes, fittings, etc.).

By professionally qualified personnel we mean: personnel with specific technical skill in the field of heating system components for civil use, domestic hot water production and maintenance. Personnel must have the qualifications provided for by current legislation.

Incorrect installation or improper maintenance can cause damage to persons, animals or objects for which the manufacturer is not responsible.

Before performing any cleaning or maintenance, disconnect the appliance from the energy mains by acting on the switch of the system and/or through the specific cut-off devices.

Do not obstruct the terminals of the intake/exhaust ducts. In case of failure and/or malfunctioning of the appliance, switch it off and do not try to repair it or intervene on it directly. Contact only personnel qualified in compliance with law.

Any product repairs must be performed solely by personnel authorised by Unical, using original spare parts only. Failure to comply with the above can compromise the safety of the appliance and void the warranty.

To guarantee appliance efficiency and its correct operation, yearly maintenance must be performed by qualified personnel.

Should you decide not to use the appliance, parts entailing potential sources of hazard must be made safe.

Before commissioning an appliance that has not been used, wash the domestic hot water production system, making the water flow until it has been fully replaced.

Should the appliance be sold or transferred to a new owner or if you move and leave the appliance, always make sure that the instruction manual accompanies it in order to be consulted by the new owner and/or installer.

Only original accessories must be used for all appliances with optionals or kits (including electric).

This appliance is intended solely for the use for which it was expressly designed. Any other use is to be considered improper and therefore dangerous.

1.2 - SYMBOLS USED IN THE MANUAL

Pay special attention when reading this manual to the parts marked by the symbols:



DANGER!
Serious danger for
personal safety and life



ATTENTION!
Possible dangerous
situation for the product
and the environment



NOTE!
Tips
for the user

1.3 - APPROPRIATE USE OF THE APPLIANCE



The TERNOX 2S appliance has been built according to the current level of engineering and acknowledged technical safety rules.

Nonetheless, if improperly used, dangers could arise for the safety and life of the user and other persons or damage to the equipment or other objects.

The appliance is intended to operate in hot water circulation heating systems.

Any other use must be considered improper.

UNICAL will not be held liable for any damage resulting from improper use.

Use according to the intended purposes also includes strict compliance with the instructions in this manual.

1.4 - INFORMATION FOR SYSTEM MANAGER



The user must be instructed concerning the use and operation of his heating system, in particular:

- Deliver these instructions to the user, as well as other documents concerning the appliance inserted in the envelope inside the packaging. **The user must keep this documentation safe for future consultation.**
- Inform the user about the importance of the air vents and the flue gas exhaust system, highlighting their essential features and the absolute prohibition of modifying them.
- Inform the user concerning controlling the system's water pressure as well as operations to restore it.
- Inform the user concerning correct temperature control, control units/thermostats and radiators for saving energy.
- Remember that the system must receive regular maintenance at least once a year and combustion analysis must be performed every two years (as per national law).
- Should the appliance be sold or transferred to a new owner or if you move and leave the appliance, always make sure that the instruction manual accompanies it in order to be consulted by the new owner and/or installer.

The manufacturer will not be held liable in the event of damage to persons, animals or objects resulting from failure to comply with the instructions contained in this manual.

1.5 - SAFETY WARNINGS



ATTENTION!

The appliance must not be used by people with reduced physical, sensory and mental abilities, without experience and knowledge. These people must be previously trained and supervised during manoeuvre operations. Children must be supervised so that they do not play with the appliance.



ATTENTION!

The appliance must be installed, adjusted and maintained by professionally qualified personnel, in compliance with the standards and provisions in force. Incorrect installation can cause damage to persons, animals and objects for which the manufacturer cannot be held responsible.



DANGER!

The boiler must be serviced or repaired by professionally qualified personnel, authorised by Unical. We recommend stipulating a maintenance contract.

Insufficient or irregular maintenance can jeopardise the operating safety of the appliance and cause damage to persons, animals and objects for which the manufacturer cannot be held responsible.



Modifying parts connected to appliance

Do not modify the following parts:

- the boiler
- the gas, air, water and electricity supply lines
- the flue gas pipe, the safety valve and the exhaust pipe
- the construction parts which affect the operating safety of the appliance.



Attention!

To tighten or loosen the screwed fittings, use only appropriate fixed spanners. Incompliant use and/or inappropriate tools can cause damage (e.g. water or gas leakage).



ATTENTION!

Indications for propane gas-fired appliances

Make sure that the gas tank has been deaerated before installing the appliance.

For state-of-the-art tank venting, contact the LPG supplier or person qualified in compliance with the law requirement.

If the tank has not been professionally deaerated, ignition problems could arise.

In that case, contact the supplier of the LPG tank.



Smell of gas

Should a smell of gas be perceived, follow these safety guidelines:

- do not turn electric switches on or off
- do not smoke
- do not use the telephone
- close the gas shut-off valve
- air out the area where the gas leakage has occurred
- inform the gas supplier or a company specialised in installation and maintenance of heating systems.



Explosive and easily flammable substances

Do not use or store explosive or easily flammable materials (e.g. petrol, paints, paper) in the room where the appliance is installed.

1.6 - TECHNICAL DATA PLATE

The technical data plate is inserted in the document envelope. When installation is finished, it is **MANDATORY** that the appliance installer apply it at the front top part.

If lost, ask the Unical Technical Assistance Service for a duplicate.


The serial number of the boiler is on the riveted plaque on the front plate of the body (front right top side).

If the identification plate is tampered with, removed or missing, the product cannot be safely identified, making any installation and maintenance operation difficult.

CE marking

The CE marking certifies that the boilers meet:

- The essential requirements of the gas appliance directive (90/396/EEC)
- The essential requirements of the efficiency directive (92/42/EEC)
- The essential requirements of the electromagnetic compatibility directive (89/336/EEC)
- CE marking compliant to directives governing the use of gas-fired appliances - Ts < 110°C.

Boiler type			Boiler water capacity	l	
Serial number	*		Max. operating pressure	bar	
Year of manufacture			Max. operating temp.	°C	
Mains: 230V~ 50Hz	Capacity	Max. press.	Max. temp.		
W: <input type="text"/>	Storage tank: <input type="text"/> l	<input type="text"/> bar	<input type="text"/> °C		
Fuels (only those with X)	Gas	Category	Wood	Charcoal	Diesel oil Naphtha
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
OUTPUTS	min.	kW	max.	kW	min. kW max.
Useful					
Furnace					
P.I.N. code			Sup. m ²		
Approval					

* See serial no. on boiler body

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1.7 - WATER TREATMENT



The treatment of the supply water allows to prevent inconveniences and maintain the functionality and efficiency of the generator over time.

The values displayed in the table can be used as a reference.

TOTAL HARDNESS	ppm	10
ALKALINITY	mg/l CaCO ₃	750
PH		8÷9
SILICA	ppm	100
CHLORIDES	ppm	3500



ATTENTION!

ANY DAMAGE TO THE BOILER CAUSED BY THE FORMATION OF FOULING OR BY CORROSIVE WATER WILL NOT BE COVERED BY THE WARRANTY.



ATTENTION: These appliances are NOT suitable for the production of water for human consumption according to Ministerial Decree D.M. 174/2007.



To minimise corrosion, it is crucial to use a corrosion inhibitor; in order for it to work properly, the metal surfaces must be clean.

TECHNICAL FEATURES AND DIMENSIONS

2.1 - TECHNICAL FEATURES

One of the significant aspects taken into account when designing the TERNOx 2S series boilers is the reduction of the formation of pollutants in exhaust gases.

One of these consists of nitrogen oxides (Nox). In Europe, their emission is governed by several legislative standards and provisions. Welding procedures and devices are approved and certified according to EN Standards.

The main technical elements of the design are:

- An accurate study of geometries, to achieve an ideal ratio between combustion volumes and exchange surfaces.
- The selection of the materials used to guarantee the long life of the boiler.

Welding procedures and devices are approved and certified according to EN Standards.

The boilers have pressurised combustion, with 3 flue gas passes with passing flame and wet inversion chamber.

The combustion gases produced by the burner, having passed the combustion chamber of the furnace, enter the pipes in the second flue gas pass.

After the exhaust gases return to the front of the boiler, they again change direction and pass through the pipes of the third flue gas pass towards the flue duct.

This type of boilers achieves a high average yearly performance and low content of harmful substances in the flue gas. Another advantage of the three flue gas pass structure consists of the fact that combustion products remain less time in high temperature areas, thus limiting harmful emissions of nitrogen oxides. The boiler body is thermally insulated by the application of a mineral wool mattress with a high insulation level to reduce heat dispersion to extremely low levels. It is finished by aluminium sheets.

2.2 - OPERATION PRINCIPLE

TERNOX 2S boilers have pressurised combustion, with 3 flue gas passes with passing flame and wet inversion chamber.

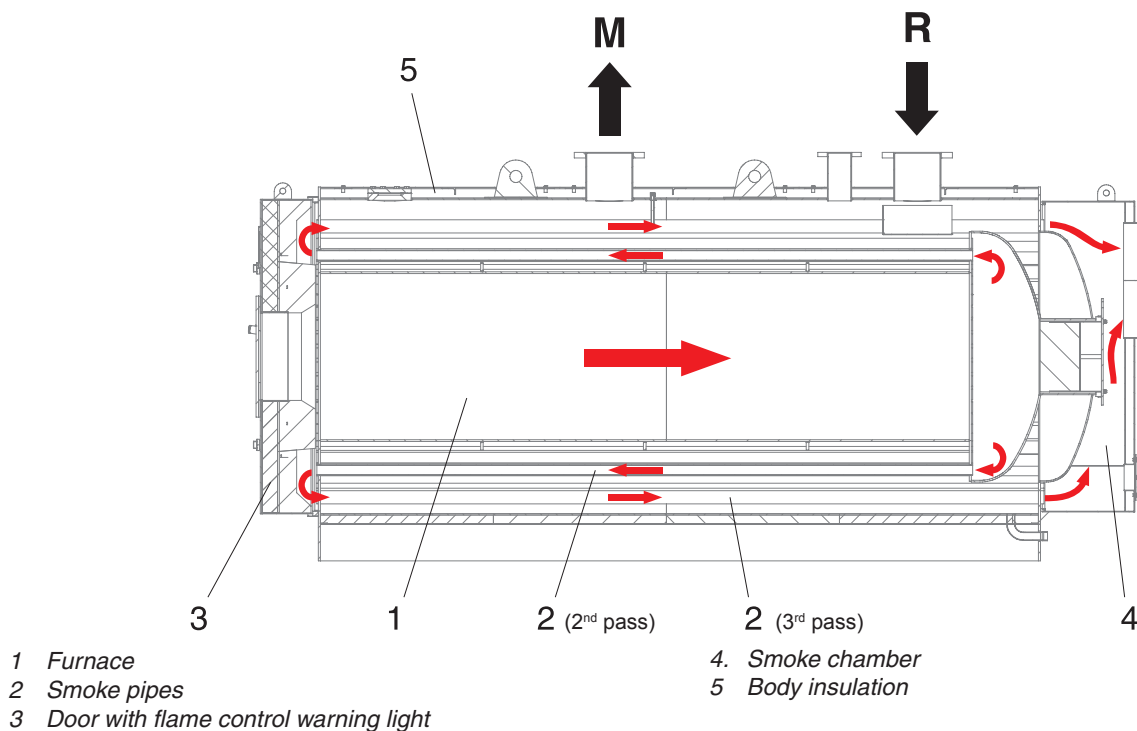
The combustion gases produced by the burner, having passed the inversion chamber of the furnace, enter the pipes in the second flue gas pass.

After the exhaust gases return to the front of the boiler, they again change direction and pass through the pipes of the third flue gas pass towards the flue duct.

The combustion chamber is always pressurised while the burner is operating.

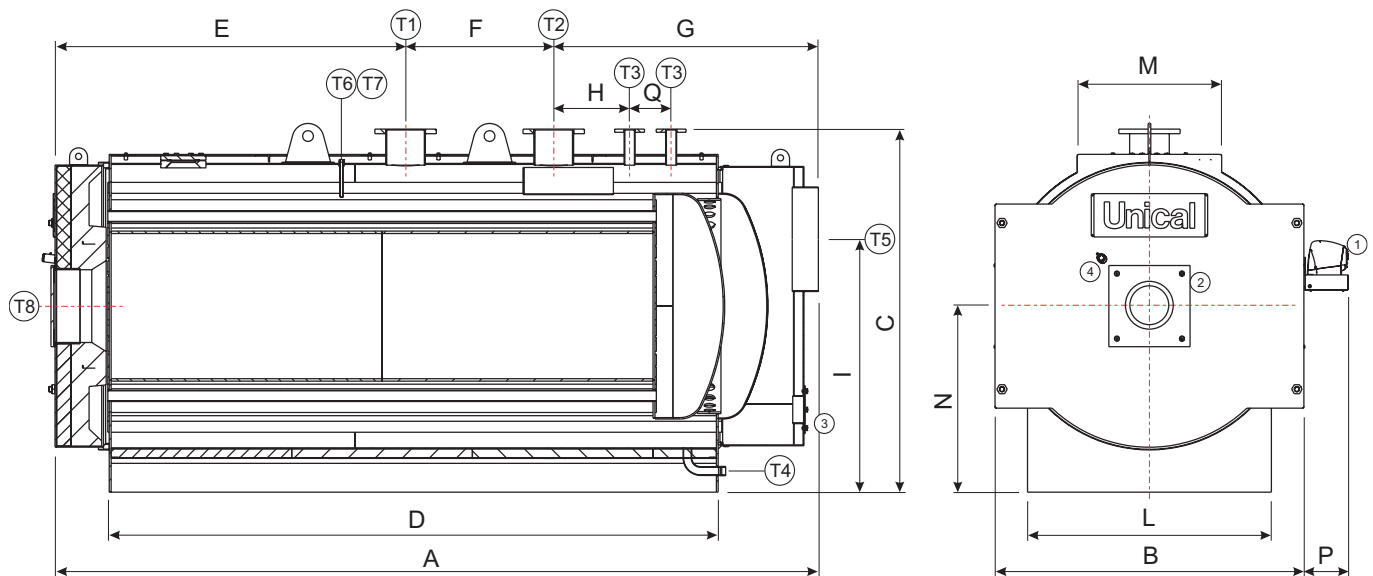
For the value of this pressure, see the TECHNICAL DATA table, in the column Flue gas pressure drop.

The flue gas duct and the fitting to the flue must be implemented in compliance with Standards and Legislation in force, with rigid ducts resistant to heat, condensation, mechanical stress and airtight.



2.3 - DIMENSIONS

TERNOX 2500 2S STD - 2200 2S Low NOx - 1800 2S Low NOx E
TERNOX 3500 2S STD - 3050 2S Low NOx - 2350 2S Low NOx E



- 1 Panel board
- 2 Burner connection flange
- 3 Smoke chamber cleaning door
- 4 Flame control warning light

- T1 Heating flow
- T2 Heating return
- T3 Expansion vessel connection
- T4 Boiler drain

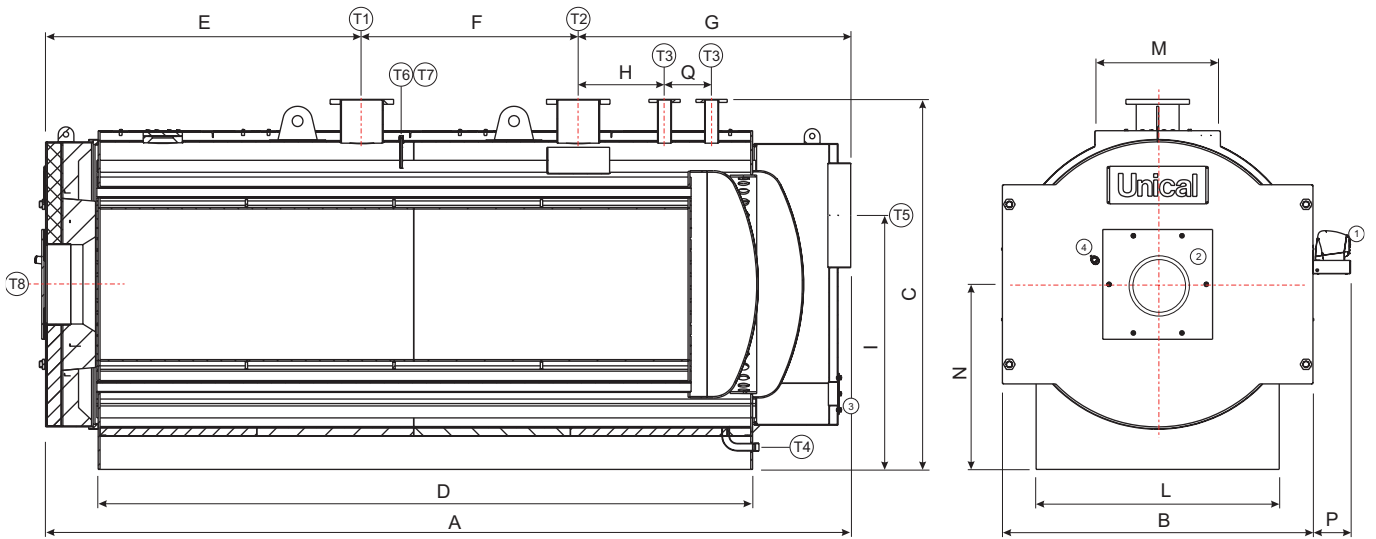
- T5 Chimney connection
- T6 Probe holder conduit connection
- T7 Probe holder conduit connection
- T8 Burner connection

TERNOx 2S	Useful output	Furnace furnace	Boiler capacity	Water side pressure drop(**)	Flue gas pressure drop	Maximum operating pressure boiler	Weight	CONNECTIONS							
								T1 T2	T3	T4	T5	T6	T7	T8	
Model	kW	kW	l	m.w.c.	mbar	bar	kg	UNI 2278 PN16	UNI 2278 PN16	ISO 7/1	Øi mm	Ø mm	Ø mm	Ø mm	
2500 2S STD	1800 - 2500	1951 - 2753		0.26 - 0.50	3.77 - 7.50										
2200 2S Low NOx	1800 - 2200	1951 - 2406	3790	0.26 - 0.39	3.77 - 5.73	6	5500	DN 200	DN 50	Rp 1½	570	Rp 1/2	Rp 1/2	400	
1800 2S Low NOx E	1800	1951		0.26	3.77										
3500 2S STD	2350 - 3500	2537 - 3848		0.43 - 0.95	3.48 - 8.00										
3050 2S Low NOx	2350 - 3050	2537 - 3329	4750	0.43 - 0.72	3.48 - 5.99	6	7000	DN 200	DN 65	Rp 1½	620	Rp 1/2	Rp 1/2	400	
2350 2S Low NOx E	2350	2537		0.43	3.48										

(**) Pressure drops corresponding to a thermal variation of 15K.

TERNOx 2S	DIMENSIONS														
	Model	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	I mm	L mm	M mm	N mm	P mm	Q mm
2500 2S STD															
2200 2S Low NOx	4225	1710	2010	3370	1940	820	1465	420	1400	1350	800	1030	245	230	
1800 2S Low NOx E															
3500 2S STD															
3050 2S Low NOx	4711	1830	2120	3824	1954	1140	1617	570	1480	1450	800	1080	245	250	
2350 2S Low NOx E															

TERNOX 4500 2S STD - 3800 2S Low NOx - 3000 2S Low NOx E
TERNOX 5800 2S STD - 5000 2S Low NOx - 4000 2S Low NOx E
TERNOX 7000 2S STD - 6300 2S Low NOx - 5100 2S Low NOx E
TERNOX 8500 2S STD - 7500 2S Low NOx - 5700 2S Low NOx E
TERNOX 10200 2S STD - 9500 2S Low NOx - 8400 2S Low NOx E



- 1 Panel board
- 2 Burner connection flange
- 3 Smoke chamber cleaning door
- 4 Flame control warning light

- T1 Heating flow
- T2 Heating return
- T3 Expansion vessel connection
- T4 Boiler drain

- T5 Chimney connection
- T6 Probe holder conduit connection
- T7 Probe holder conduit connection
- T8 Burner connection

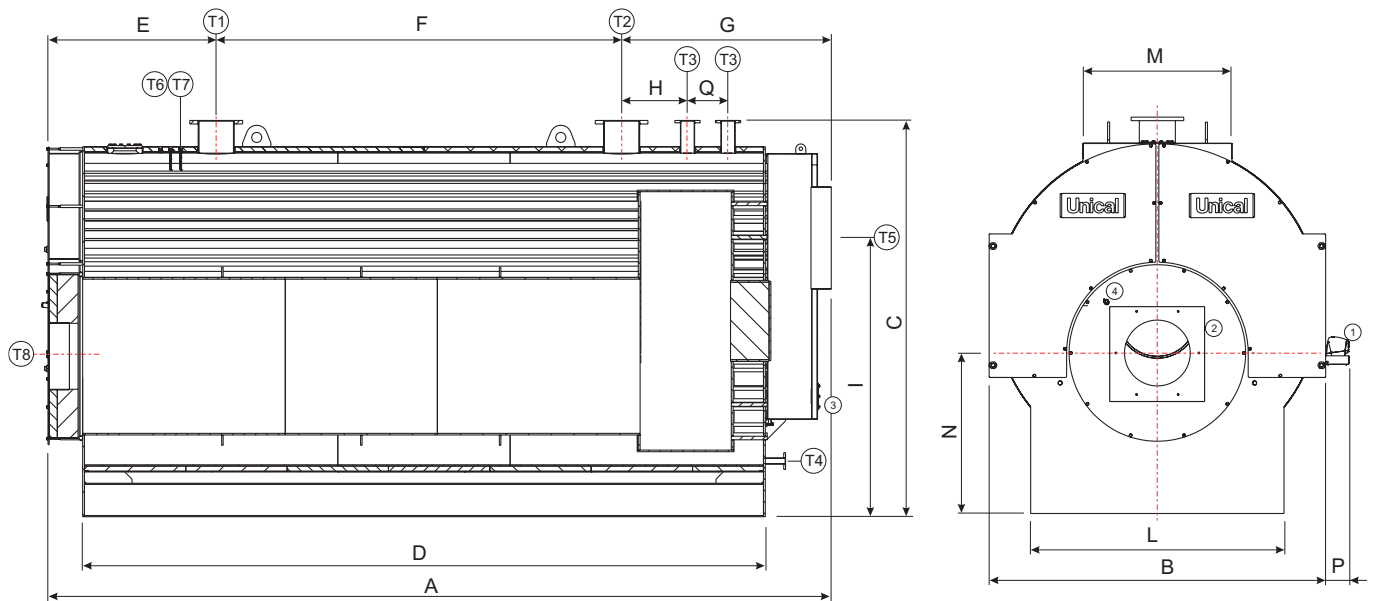
TERNOx 2S Model	Useful output kW	Furnace kW	Boiler capacity l	Water side pressure drop(**) m.w.c.	Flue gas pressure drop mbar	Maximum operating pressure boiler bar	Weight kg	CONNECTIONS						
								T1 T2 UNI 2278 PN16	T3 UNI 2278 PN16	T4 ISO 7/1	T5 Øi mm	T6 Ø mm	T7 Ø mm	T8 Ø mm
4500 2S STD 3800 2S Low NOx 3000 2S Low NOx E	3000 - 4500 3000 - 3800 3000	3239 - 4951 3239 - 4144 3239	6400	0.27 - 0.60 0.27 0.43 0.27	3.64 - 8.50 3.64 - 5.96 3.64	6	8200	DN 250	DN 80	Rp 1½	660	Rp 1/2	Rp 1/2	500
5800 2S STD 5000 2S Low NOx 4000 2S Low NOx E	4000 - 5800 4000 - 5000 4000	4325 - 6381 4325 - 5457 4325	8060	0.44 - 0.93 0.44 - 0.69 0.44	4.36 - 9.50 4.36 - 6.95 4.36	6	10000	DN 250	DN 80	Rp 1½	660	Rp 1/2	Rp 1/2	500
7000 2S STD 6300 2S Low NOx 5100 2S Low NOx E	5100 - 7000 5100 - 6300 5100	5529 - 7705 5529 - 6892 5529	9760	0.72 - 1.36 0.72 - 1.10 0.72	4.89 - 9.50 4.89 - 7.60 4.89	6	11500	DN 250	DN 100	Rp 1½	720	Rp 1/2	Rp 1/2	500
8500 2S STD 7500 2S Low NOx 5700 2S Low NOx E	5700 - 8500 5700 - 7500 5700	6169 - 9377 6169 - 8215 6169	11480	0.90 - 2.00 0.90 - 1.56 0.90	4.76 - 11.0 4.76 - 8.44 4.76	6	13500	DN 250	DN 100	Rp 1½	820	Rp 1/2	Rp 1/2	500
10200 2S STD 9500 2S Low NOx 8400 2S Low NOx E	8400 - 10200 8400 - 9500 8400	9128 - 11191 9128 - 10377 9128	14960	0.96 - 1.41 0.96 - 1.22 0.96	8.32 - 12.50 8.32 - 10.75 8.32	6	17300	DN 300	DN 100	Rp 1½	820	Rp 1/2	Rp 1/2	500

(**) Pressure drops corresponding to a thermal variation of 15K.

TERNOx 2S Model	DIMENSIONS													
	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	I mm	L mm	M mm	N mm	P mm	Q mm
4500 2S STD 3800 2S Low NOx 3000 2S Low NOx E	5134	1980	2360	4174	2017	1380	1737	550	1620	1550	800	1180	250	300
5800 2S STD 5000 2S Low NOx 4000 2S Low NOx E	5639	2180	2580	4626	2451	1400	1788	600	1780	1710	800	1300	250	300
7000 2S STD 6300 2S Low NOx 5100 2S Low NOx E	5875	2320	2700	4840	2505	1510	1860	550	1870	1850	880	1350	250	350
8500 2S STD 7500 2S Low NOx 5700 2S Low NOx E	6420	2400	2870	5330	2035	2590	1795	480	1980	1900	880	1460	250	350
10200 2S STD 9500 2S Low NOx 8400 2S Low NOx E	6772	2650	3080	5632	1406	3450	1916	550	2080	2080	1000	1560	250	350

Technical features

TERNOX 12500 2S STD
TERNOX 15000 2S STD



- 1 Panel board
- 2 Burner connection flange
- 3 Smoke chamber cleaning door
- 4 Flame control warning light

- T1 Heating flow
- T2 Heating return
- T3 Expansion vessel connection
- T4 Boiler drain

- T5 Chimney connection
- T6 Probe holder conduit connection
- T7 Probe holder conduit connection
- T8 Burner connection

TERNOX	Useful output	Furnace furnace	Boiler capacity	Water side pressure drop(**)	Flue gas pressure drop	Maximum operating pressure boiler	Weight	CONNECTIONS							
								T1 T2	T3	T4	T5 Øi	T6 Ø	T7 Ø	T8 Ø	
Model	kW	kW	l	m.w.c.	mbar	bar	kg	UNI 2278 PN16	UNI 2278 PN16	ISO 7/1	mm	mm	mm	mm	
12500 2S STD	12500	13789	24100	1.31 - 2.00	8.93 - 14.0	6	25500	DN 300	DN 125	DN 60	820	Rp 1/2	Rp 1/2	650	
15000 2S STD	15000	16458	27300	1.46 - 2.20	9.72 - 15.0	6	30000	DN 350	DN 125	DN 60	1000	Rp 1/2	Rp 1/2	650	

(**) Pressure drops corresponding to a thermal variation of 15K.

TERNOx	DIMENSIONS													
	A	B	C	D	E	F	G	H	I	L	M	N	P	Q
Model	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
12500 2S STD	7211	3210	3715	6236	1643	3500	2068	650	2700	2400	1470	1480	230	400
15000 2S STD	7761	3320	3910	6736	1693	4000	2068	650	2750	2500	1470	1583	230	400

2.4 - OPERATING DATA ACCORDING TO UNI 10348

GAS-FIRED		TERNOX 2500 2S STD	TERNOX 2200 2S LOW NO _x	TERNOX 1800 2S LOW NO _x E
Nominal heat output	kW	1800 - 2500	1800 - 2200	1800
Thermal output of furnace	kW	1951 - 2753	1951 - 2406	1951
Heat efficiency at nominal load (100%)	%	92.25 - 90.80	92.25 - 91.45	92.25
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.9 - 91.5	92.9 - 92.1	92.9
Heat loss at casing (min.-max.)	%	0.60 - 0.71	0.60 - 0.65	0.60
Heat loss at chimney with burner on (min.-max.)	%	7.15 - 8.49	7.15 - 7.90	7.15
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	146.46 - 174	146.46 - 161.92	146.46
CO ₂ content	%	9.80	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	2932.8 - 4138.6	2932.8 - 3616.1	2932.8

DIESEL OIL-FIRED		TERNOX 2500 2S STD	TERNOX 2200 2S LOW NO _x	TERNOX 1800 2S LOW NO _x E
Nominal heat output	kW	1800 - 2500	1800 - 2200	1800
Thermal output of furnace	kW	1951 - 2753	1951 - 2406	1951
Heat efficiency at nominal load (100%)	%	92.25 - 90.80	92.25 - 91.45	92.25
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.9 - 91.5	92.9 - 92.1	92.9
Heat loss at casing (min.-max.)	%	0.60 - 0.71	0.60 - 0.65	0.60
Heat loss at chimney with burner on (min.-max.)	%	7.15 - 8.49	7.15 - 7.90	7.15
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	156.73 - 186.20	156.73 - 173.27	156.73
CO ₂ content	%	12.80	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	2987.9 - 4216.3	2987.9 - 3684.0	2987.9

GAS-FIRED		TERNOX 3500 2S STD	TERNOX 3050 2S LOW NO _x	TERNOX 2350 2S LOW NO _x E
Nominal heat output	kW	2350 - 3500	2350 - 3050	2350
Thermal output of furnace	kW	2537 - 3848	2537 - 3329	2537
Heat efficiency at nominal load (100%)	%	92.64 - 90.95	92.64 - 91.62	92.64
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.2 - 91.7	93.2 - 92.3	93.2
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.58 - 0.65	0.58
Heat loss at chimney with burner on (min.-max.)	%	6.78 - 8.34	6.78 - 7.73	6.78
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	139.00 - 171.00	139.0 - 158.35	139
CO ₂ content	%	9.80	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	3813.1 - 5784.7	3913.1 - 5003.7	3813.1

DIESEL OIL-FIRED		TERNOX 3500 2S STD	TERNOX 3050 2S LOW NO _x	TERNOX 2350 2S LOW NO _x E
Nominal heat output	kW	2350 - 3500	2350 - 3050	2350
Thermal output of furnace	kW	2537 - 3848	2537 - 3329	2537
Heat efficiency at nominal load (100%)	%	92.64 - 90.95	92.64 - 91.62	92.64
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.2 - 91.7	93.2 - 92.3	93.2
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.58 - 0.65	0.58
Heat loss at chimney with burner on (min.-max.)	%	6.78 - 8.34	6.78 - 7.73	6.78
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	148.67 - 182.90	148.67 - 169.37	148.67
CO ₂ content	%	12.80	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	3884.6 - 5893.1	3884.6 - 5097.5	3884.6

GAS-FIRED		TERNOX 4500 2S STD	TERNOX 3800 2S LOW NOx	TERNOX 3000 2S LOW NOx E
Nominal heat output	kW	3000 - 4500	3000 - 3800	3000
Thermal output of furnace	kW	3239 - 4951	3239 - 4144	3239
Heat efficiency at nominal load (100%)	%	92.62 - 90.90	92.62 - 91.70	92.62
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.2 - 91.6	93.2 - 92.4	93.2
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.58 - 0.65	0.58
Heat loss at chimney with burner on (min.-max.)	%	6.80 - 8.39	6.80 - 7.65	6.80
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	139.31 - 172.00	139.31 - 156.79	139.31
CO ₂ content	%	9.80	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	4868.5 - 7441.4	4868.5 - 6228.9	4868.5

DIESEL OIL-FIRED		TERNOX 4500 2S STD	TERNOX 3800 2S LOW NOx	TERNOX 3000 2S LOW NOx E
Nominal heat output	kW	3000 - 4500	3000 - 3800	3000
Thermal output of furnace	kW	3239 - 4951	3239 - 4144	3239
Heat efficiency at nominal load (100%)	%	92.62 - 90.90	92.62 - 91.70	92.62
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.2 - 91.6	93.2 - 92.3 0.58 -	93.2
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.65	0.58
Heat loss at chimney with burner on (min.-max.)	%	6.80 - 8.39	6.80 - 7.65	6.80
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	149.03 - 184.00	149.03 - 167.73	149.03
CO ₂ content	%	12.80	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	4959.9 - 7581.0	4959.9 - 6345.8	4959.9

GAS-FIRED		TERNOX 5800 2S STD	TERNOX 5000 2S LOW NOx	TERNOX 4000 2S LOW NOx E
Nominal heat output	kW	4000 - 5800	4000 - 5000	4000
Thermal output of furnace	kW	4324 - 6381	4324 - 5457	4324
Heat efficiency at nominal load (100%)	%	92.50 - 90.90	92.50 - 91.62	92.50
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.1 - 91.6	93.1 - 92.3	93.1
Heat loss at casing (min.-max.)	%	0.59 - 0.71	0.59 - 0.65	0.59
Heat loss at chimney with burner on (min.-max.)	%	6.91 - 8.39	6.91 - 7.73	6.91
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	141.70 - 172.00	141.70 - 158.42	141.70
CO ₂ content	%	9.80	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	6500.2 - 9591.1	6500.2 - 8203.0	6500.2

DIESEL OIL-FIRED		TERNOX 5800 2S STD	TERNOX 5000 2S LOW NOx	TERNOX 4000 2S LOW NOx E
Nominal heat output	kW	4000 - 5800	4000 - 5000	4000
Thermal output of furnace	kW	4324 - 6381	4325 - 5457	4324
Heat efficiency at nominal load (100%)	%	92.50 - 90.90	92.50 - 91.62	92.50
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.1 - 91.6	93.1 - 92.3	93.1
Heat loss at casing (min.-max.)	%	0.59 - 0.71	0.59 - 0.65	0.59
Heat loss at chimney with burner on (min.-max.)	%	6.91 - 8.39	6.91 - 7.73	6.91
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	151.58 - 184.00	151.58 - 169.47	151.58
CO ₂ content	%	12.80	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	6622.2 - 9771.1	6622.2 - 8356.9	6622.2

GAS-FIRED		TERNOX 7000 2S STD	TERNOX 6300 2S LOW NOx	TERNOX 5100 2S LOW NOx E
Nominal heat output	kW	5100 - 7000	5100 - 6300	5100
Thermal output of furnace	kW	5529 - 7705	5529 - 6892	5529
Heat efficiency at nominal load (100%)	%	92.25 - 90.85	92.25 - 91.41	92.25
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.9 - 91.6	92.9 - 92.1	92.9
Heat loss at casing (min.-max.)	%	0.61 - 0.71	0.61 - 0.65	0.61
Heat loss at chimney with burner on (min.-max.)	%	7.15 - 8.44	7.15 - 7.94	7.15
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	146.49 - 173.00	146.49 - 162.81	146.48
CO ₂ content	%	9.80	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	8310.3 - 11581.7	8310.3 - 10360.0	8310.3

DIESEL OIL-FIRED		TERNOX 7000 2S STD	TERNOX 6300 2S LOW NOx	TERNOX 5100 2S LOW NOx E
Nominal heat output	kW	5100 - 7000	5100 - 6300	5100
Thermal output of furnace	kW	5529 - 7705	5529 - 6892	5529
Heat efficiency at nominal load (100%)	%	92.25 - 90.85	92.25 - 91.41	92.25
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.9 - 91.6	92.9 - 92.1	92.9
Heat loss at casing (min.-max.)	%	0.61 - 0.71	0.61 - 0.65	0.61
Heat loss at chimney with burner on (min.-max.)	%	7.15 - 8.44	7.15 - 7.94	7.15
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	156.65 - 185.00	156.65 - 174.10	156.65
CO ₂ content	%	12.80	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	8465.9 - 11798.7	8465.9 - 10554.1	8465.9

GAS-FIRED		TERNOX 8500 2S STD	TERNOX 7500 2S LOW NOx	TERNOX 5700 2S LOW NOx E
Nominal heat output	kW	5700 - 8500	5700 - 7500	5700
Thermal output of furnace	kW	6169 - 9376	6169 - 8214	6169
Heat efficiency at nominal load (100%)	%	92.40 - 90.65	92,40 - 91,30	92.40
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.0 - 91.4	93.0 - 92.0	93.0
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.58 - 0.65	0.58
Heat loss at chimney with burner on (min.-max.)	%	7.01 - 8.64	7.01 - 8.04	7.01
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	143.78 - 177.00	143.78 - 164.93	143.78
CO ₂ content	%	9.80	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	9272.2 - 14093.8	9272.2 - 12347.4	9272.2

DIESEL OIL-FIRED		TERNOX 8500 2S STD	TERNOX 7500 2S LOW NOx	TERNOX 5700 2S LOW NOx E
Nominal heat output	kW	5700 - 8500	5700 - 7500	5700
Thermal output of furnace	kW	6169 - 9377	6169 - 8215	6169
Heat efficiency at nominal load (100%)	%	92.40 - 90.65	92.40 - 91.29	92.40
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	93.0 - 91.4	93.0 - 91.9	93.0
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.58 - 0.65	0.58
Heat loss at chimney with burner on (min.-max.)	%	7.02 - 8.64	7.02 - 8.06	7.02
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	153.94 - 189.50	153.94 - 176.58	153.94
CO ₂ content	%	12.80	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	9446.8 - 14359.4	9446.8 - 12579.9	9446.8

GAS-FIRED		TERNOX 10200 2S STD	TERNOX 9500 2S LOW NOx	TERNOX 8400 2S LOW NOx E
Nominal heat output	kW	8400 - 10200	8400 - 9500	8400
Thermal output of furnace	kW	9128 - 11191	9128 - 10377	9128
Heat efficiency at nominal load (100%)	%	92.02 - 91.14	92.02 - 91.55	92.03
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.7 - 91.9	92.7 - 92.2	92.7
Heat loss at casing (min.-max.)	%	0.64 - 0.71	0.64 - 0.65	0.64
Heat loss at chimney with burner on (min.-max.)	%	7.33 - 8.15	7.33 - 7.80	7.33
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	150.34 - 167.00	150.34 - 159.88	150.34
CO ₂ content	%	9.80	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	13721.2 - 16822.0	13721.2 - 15579.9	13720.5

DIESEL OIL-FIRED		TERNOX 10200 2S STD	TERNOX 9500 2S LOW NOx	TERNOX 8400 2S LOW NOx E
Nominal heat output	kW	8400 - 10200	8400 - 9500	8400
Thermal output of furnace	kW	9128 - 11191	9128 - 10377	9128
Heat efficiency at nominal load (100%)	%	92.02 - 91.14	92.02 - 91.55	92.03
Heat efficiency at 30% load	%	91.40	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.7 - 91.9	92.7 - 92.2	92.7
Heat loss at casing (min.-max.)	%	0.64 - 0.71	0.64 - 0.65	0.64
Heat loss at chimney with burner on (min.-max.)	%	7.33 - 8.15	7.33 - 7.80	7.33
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	160.78 - 178.60	160.78 - 170.98	160.78
CO ₂ content	%	12.80	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	13978.3 - 17137.3	13978.3 - 15890.1	13977.6

GAS-FIRED		TERNOX 12500 2S STD	TERNOX 15000 2S STD
Nominal heat output	kW	10100 - 12500	12200 - 15000
Thermal output of furnace	kW	11012 - 13789	13251 - 16458
Heat efficiency at nominal load (100%)	%	91.72 - 90.65	92.07 - 91.14
Heat efficiency at 30% load	%	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.3 - 91.4	92.7 - 91.9
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.64 - 0.71
Heat loss at chimney with burner on (min.-max.)	%	7.70 - 8.64	7.29 - 8.15
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	157.83 - 177.00	149.40 - 167.00
CO ₂ content	%	9.80	9.80
Flue gas mass flow rate (min.-max)	kg/h	16552,5 - 20726,2	19918.5 - 24738.3

DIESEL OIL-FIRED		TERNOX 12500 2S STD	TERNOX 15000 2S STD
Nominal heat output	kW	10100 - 12500	12200 - 15000
Thermal output of furnace	kW	11012 - 13789	13251 - 16458
Heat efficiency at nominal load (100%)	%	91.71 - 90.65	92.07 - 91.14
Heat efficiency at 30% load	%	91.40	91.40
Combustion efficiency at nominal load (100%)	%	92.3 - 91.4	92.7 - 91.9
Heat loss at casing (min.-max.)	%	0.58 - 0.71	0.64 - 0.71
Heat loss at chimney with burner on (min.-max.)	%	7.70 - 8.64	7.29 - 8.15
Heat loss at chimney with burner off (min.-max.)	%	0.10	0.10
Flue gas temperature tf-ta (min.-max.)	°C	168.89 - 189.40	159.78 - 178.60
CO ₂ content	%	12.80	12.80
Flue gas mass flow rate (min.-max)	kg/h	16863.5 - 21115.7	20291.8 - 25201.8

3

INSTRUCTIONS FOR INSTALLATION

3.1 - GENERAL WARNINGS



ATTENTION!
This boiler is intended solely for the use for which it was expressly designed. Any other use is to be considered improper and therefore dangerous.
This boiler heats water at a temperature lower than the atmospheric pressure boiling temperature.



Before connecting the boiler, have professionally qualified personnel:

- Thoroughly wash all the piping of the system to remove any residues or impurities which could jeopardise proper operation of the boiler, even from a hygienic point of view.**
- Check that boiler is set up to operate with the available type of fuel.
The type of fuel can be seen written on the package and on the technical feature plate.
- Check that the chimney/flue has an appropriate draught, without any bottlenecks, and that no exhausts from other appliances are inserted, unless the flue has been implemented to accommodate several utilities according to specific standards and prescriptions in force. Only after this check can the fitting between the boiler and chimney/flue be mounted.



ATTENTION!
In rooms with the presence of aggressive vapours or dust, the appliance must operate independently from the air inside the installation room!



ATTENTION!
The appliance must be installed by a qualified technician with the technical-professional requirements according to law 46/90 which, under his own responsibility, guarantees compliance with standards according to good practice rules.



ATTENTION!
Mount the appliance respecting the minimum distances required for installation and maintenance.



The boiler must be connected to a heating system compatible with its performance and output.

3.2 - INSTALLATION STANDARDS

It must be installed by a professionally qualified technician, **who shall take the responsibility of observing all local and/or national laws published in the official journal, as well as applicable technical standards.**

3.3 - INSTALLATION ON OLD OR RETROFITTABLE SYSTEMS

Before installing this appliance on old systems, check that:

- The flue is able to withstand the temperature generated by the combustion products, has been measured and designed according to the regulations in force, is airtight and insulated, and does not feature obstructions or constrictions.
- The flue has a device for releasing condensation.
- The electrical system has been set up by a qualified technician in compliance with the rules in force.
- The rate, head and direction of the flow of the circulation pumps are appropriate.
- The expansion vessel(s) can fully absorb dilation of the fluid in the system.
- The fuel adduction line and the tank, if any, are made according to relevant standards in force.
- The expansion vessels can fully absorb dilation of the fluid in the system.
- The system has been cleaned and cleared of all sludge and scale, has been vented, and all its seals have been checked.
- There is a treatment system for feed/recirculation water (see reference values).

3.4 - PACKAGING

TERNOX 2S boilers are supplied with casing and with the door and smoke chamber assembled.

The panel and accessories are inside the combustion chamber.

Upon reception, make sure that the supply is complete and undamaged.

The document envelope, besides the appliance, contains:

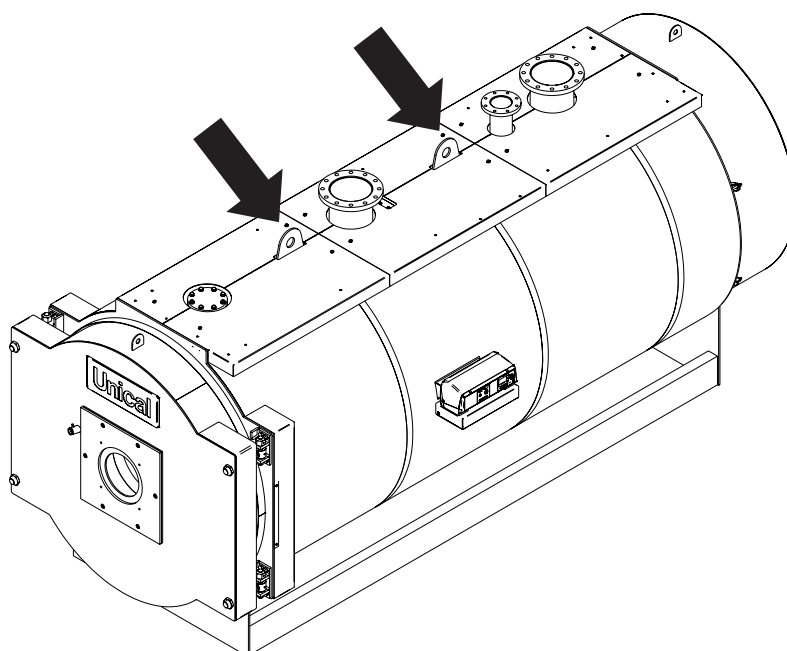


- Hydraulic test certificate
- Heating system booklet
- System manager operating instructions
- Installation and maintenance instruction booklet
- Warranty
- Local ventilation requirements label.

3.5 - HANDLING

TERNOX 2S boilers are equipped with lifting eyebolts.

Pay attention when handling the boiler and use equipment suitable for its weight.



3.6 - POSITIONING IN BOILER ROOM

TERNOX 2S boilers must be installed in rooms for exclusive use complying with Technical Standards and Legislation in force and with sufficiently sized air vents.

The ventilation openings must be permanent, communicating directly with the outside and must be positioned high or low according to standards in force.

The location of the ventilation openings, the fuel supply trains, electric energy supply and lighting must comply with current legal provisions in relation to the type of fuel used.

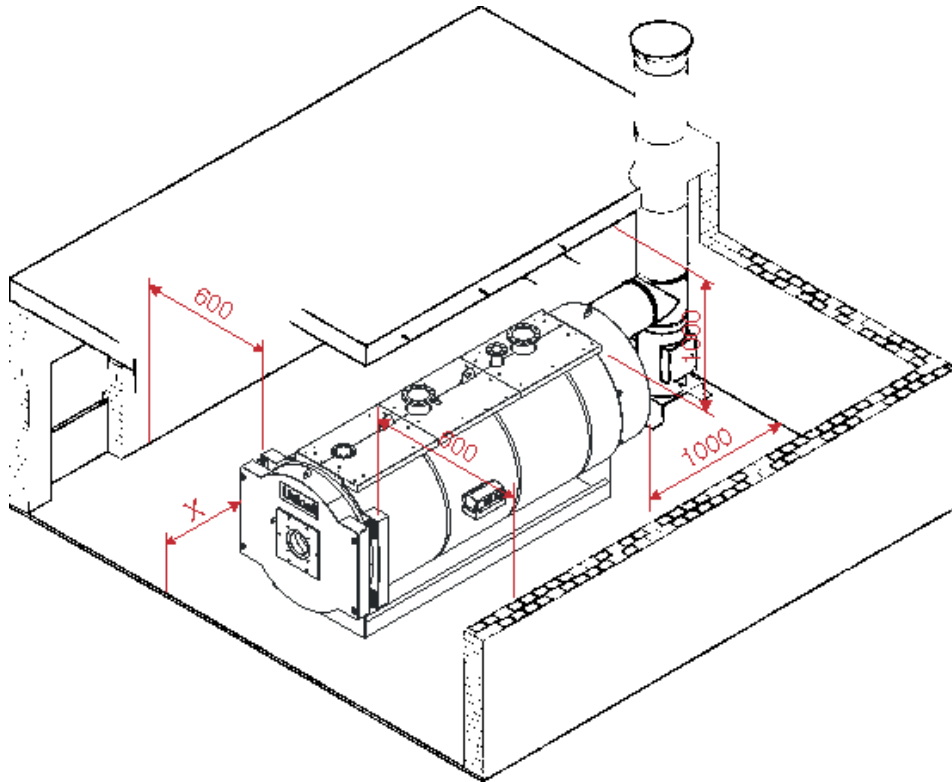
To make it easier to clean the smoke circuit, a free space must be left in front of the boiler no less than the length of the boiler body and, in any case, never less than 1300 mm. It must be checked that with the door/s open 90°, the distance between the door and the adjacent wall X is at least equal to the length of the burner.

The boiler must rest on a perfectly level surface.

It is advisable to provide a flat, level cement basement capable of bearing the weight of the boiler full of water. For the dimensions of the basement, see the dimensions R x B (dimensions table).

If the burner is fed with fuel gas weighing more than air, the electrical parts must be placed higher than 500 mm above the ground.

The appliance cannot be installed outdoors as it was not so designed and does not have automatic antifreeze systems.



Technical features and dimensions

3.7 - HYDRAULIC CONNECTIONS



ATTENTION!
Before connecting the boiler to the heating system, thoroughly clean the piping with an appropriate product compliant with UNI-CTI 8065, in order to eliminate metallic residue from processing and welding, oil and grease which could be present and which, reaching the boiler, could alter its functioning.



Attention!
The fittings of the boiler must not take the weight of the connecting pipes of the system; suitable supporting devices should be installed to do this.

The dimensions of the supply and return pipes for each boiler model are given in the DIMENSIONS table.

Check that the system is fitted with a sufficient number of air release valves.

Connection of expansion vessel

TERNOX 2S boilers are suitable for operating with forced water circulation both with the expansion vessel opened or closed.

An expansion vessel is always necessary to compensate the increase in water volume due to heating.



In the first case, the hydrostatic column must be at least 3 m above the casing of the boiler and sufficient to contain the volume increase of all the water of the system between the exposed surface of the water in the tank and the overflow pipe.

The connection pipes of the expansion vessel will start from the T3 attachment (see DIMENSIONS TABLES) and must have no shut-off valve.

Safety valve drain

Install a safety pressure valve on the flow pipe within 0.5 m of the starting flange, sized according to the capacity of the boiler and in compliance with local standards in force.

It is prohibited to place any type of shut-off valve between the boiler and expansion vessel or between the boiler and safety pressure valves. The valves used must be adjusted to trigger not beyond the maximum allowed operating pressure.

3.9.1 - RECIRCULATION PUMP

TERNOX 2S boilers must always operate with forced water circulation and a minimum return temperature of 55°C. It is therefore recommended to use a recirculation pump, which also has an anti-condensation function, installed between the flow and return connections upstream the mixing valve. This pump is dimensioned according to the formula:

$$Q = P \times 22$$

where **Q** = Flow rate in l/hr
P = Nominal output of boiler in kW
and **head** 1÷2 m H₂O

3.8 - FILLING AND EMPTYING THE SYSTEM



Attention!
Do not mix the heating water with incorrect concentrations of antifreeze or anti-corrosion substances! This could damage the gaskets and cause noise during operation. Unical will not be held liable for damage to persons, animals or objects due to failure to comply with the above instruction.

When all system connections have been completed, the circuit can be filled.



A specific tap can be connected to the T4 attachment at the rear of the boiler for filling and draining.



The values displayed in the table can be used as a reference.

TOTAL HARDNESS	ppm	10
ALKALINITY	mg/l CaCO ₃	750
PH		8÷9
SILICA	ppm	100
CHLORIDES	ppm	3500



ATTENTION!
ANY DAMAGE TO THE BOILER CAUSED BY THE FORMATION OF FOULING OR BY CORROSIVE WATER WILL NOT BE COVERED BY THE WARRANTY.

3.9 - GAS CONNECTION

Connecting Gas



Danger!

The gas connection must be carried out only by a qualified installer who must respect and apply that foreseen by relevant laws in force in the local prescriptions of the supply company. Incorrect installation can cause damage to persons, animals and objects for which the manufacturer cannot be held responsible.



Before installation, we recommend a thorough inner cleaning of all fuel adduction piping to remove any residue which could jeopardise proper operation of the boiler.

If you smell gas:

- Do not turn electric switches on or off, use a telephone or any other object which can create sparks;
- Immediately open doors and windows to create an air current to air out the room;
- Shut the gas cocks;
- Request the intervention of professionally qualified personnel.

3.10 - CONNECTION TO THE FLUE

The TERNOX 2S boiler can be attached to the chimney in different ways; straight pipes or elbows can be used to exit from the rear, on the left, on the right, or else vertically to enter the flue at a higher level.

It is recommended to insulate the pipe connecting to the chimney to reduce heat loss and noise.

Along the section connecting the boiler to the flue there must be suitable points for measuring flue gas temperature and analysing combustion products.

The flue gas duct and the fitting to the flue must be implemented in compliance with Standards and Legislation in force, with rigid ducts resistant to heat, condensation, mechanical stress and airtight.

The flue must guarantee the minimum negative pressure foreseen by Standards in force, considering "zero" pressure at the flue duct fitting.

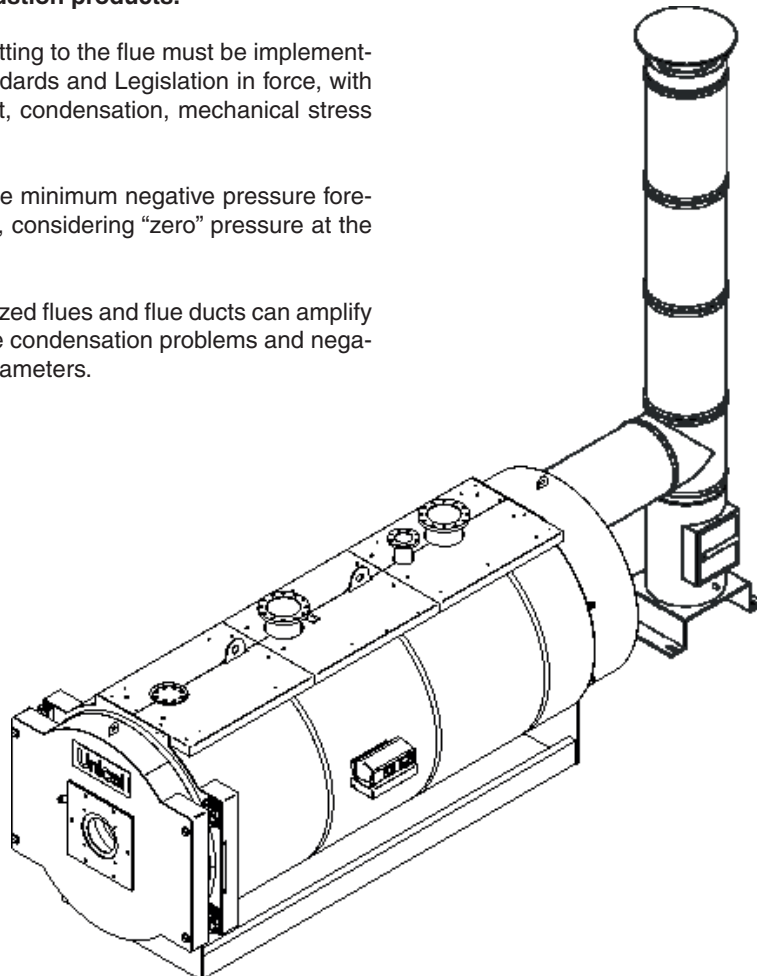
Inadequate or improperly sized flues and flue ducts can amplify combustion noise, generate condensation problems and negatively affect combustion parameters.

Non-insulated exhaust pipes are a potential source of risk.

The seals of the junctions must be made with materials resistant to temperatures of at least 250°C.

Along the section connecting the boiler to the flue there must be suitable points for measuring flue gas temperature and analysing combustion products.

Refer to national and local regulations in force for that which regards the cross-section and height of the chimney.



3.11 - FURNACE DOOR: ADJUSTMENT, OPENING AND CLOSING

IMPORTANT

- The door of the boiler must be opened when it is cooled off to avoid thermal shocks.
- The rear factory material of the door can show cracks after a short time of operation; this however does not reduce its insulation capacity nor jeopardise its lifespan.

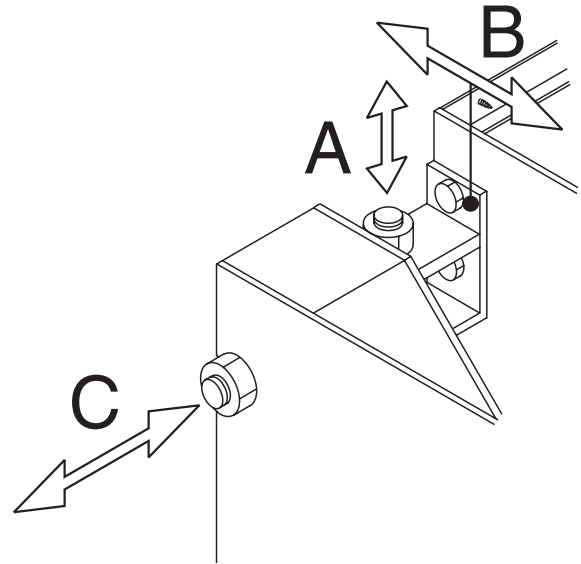
The door is hinged and fixed according to the indicated diagram: In these cases, the two hinges on the left are normally used as rotation hinges (from right to left), while the two on the right are used as closing hinges.

It will be exactly the opposite when the door is opened from left to right.

To invert rotation, just move the door support lock nut.

The following adjustments can be made on the door:

- A) Adjustment in the vertical direction:** by acting on the nut of the upper hinge pin on which the door turns.
- B) Adjustment in the transverse direction:** loosen the hinges fixed on the front plate of the boiler and move them sideways.
- C) Adjustment in the axial direction:** by adjusting the tightening nuts.



3.12 - BURNERS

The burners operating with the TERNOX 2S boilers must have the EC certification and comply with:

- Gas appliance directive (90/396/EEC);
- EMC Directive - Electromagnetic Compatibility (89/336/EEC).

They must also be approved according to the specifications:

- UNI EN 267 - test methods for atomizing oil burners of the monobloc type.
- UNI EN 676 - air-blown burners for gaseous fuel.
- Efficiency Directive (92/42 EEC).

3.12.1 - SELECTING THE BURNER

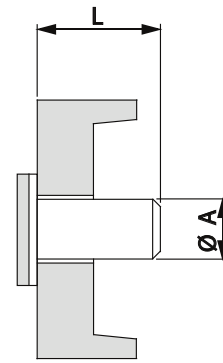
The correct choice and adjustment of the burner are fundamental for optimal operation of the boiler and therefore must be done carefully and not underestimated.

The burner must be chosen verifying that its firing rate (fuel capacity - combustion chamber pressure) is compatible with the same features declared for the boiler.

Remember that pressure drops on the flue side of the boiler, namely combustion chamber counter pressure, refer to zero pressure at the base of the chimney.

It is also recommended that the burner blast tube be no shorter than the minimum dimension shown in the following table and that the flame which must be implemented be suitable for the characteristics of the combustion chamber.

The manufacturing companies of the burners can supply the dimensions of the flames which their appliances develop, especially those approved based on the standards indicated above.



DIMENSIONS OF BURNER BLAST TUBE

TERNOx	ØA mm	L mm (min)	L mm (max)
2500	400	370	520
3500	400	370	520
4500	500	410	560
5800	500	410	560
7000	500	410	560
8500	500	450	650
10200	500	450	650
12500	650	450	650
15000	650	450	650

3.12.2 - INSTALLATION OF THE BURNER

The burner must be mounted to the door of the boiler guaranteeing perfect sealing of the combustion products.

The burner is supplied with a piece of ceramic fibre cord which must be placed on the blast tube of the burner to fully seal the space between the blast tube and the slot in the door.

Make sure that no gaps remain between the blast tube and the slot on the refractory material inside the door.

Should a cone larger than the diameter of the blast tube be mounted, it must be removed before mounting the burner on the support plate and put back afterwards.

With the burner mounted, check that the flexible hoses of the liquid fuel and the electric cables are long enough to allow the door to open 90°.

For gas-fired burners, flexible hoses cannot be used for connections. Therefore it must be equipped with a threaded or flanged joint for disconnecting the final section of the gas adduction tube.

3.12.3 - CONNECTING FLAME CONTROL WARNING LIGHT TO BURNER

The flame control warning light is supplied with a threaded 1/8" connection with a 9mm pressure test nipple mounted on it, to be used with a silicone tube to measure back pressure in the combustion chamber.

In place of this test nipple, which must be kept, an appropriate fitting will be mounted to connect the flame control warning light directly to the pressure chamber downstream the burner fan by means of a copper tube.

The air blown by the fan will conveniently cool the warning light glass and keep it from blackening.

If the cooling tube is not connected to the warning light, it could break.

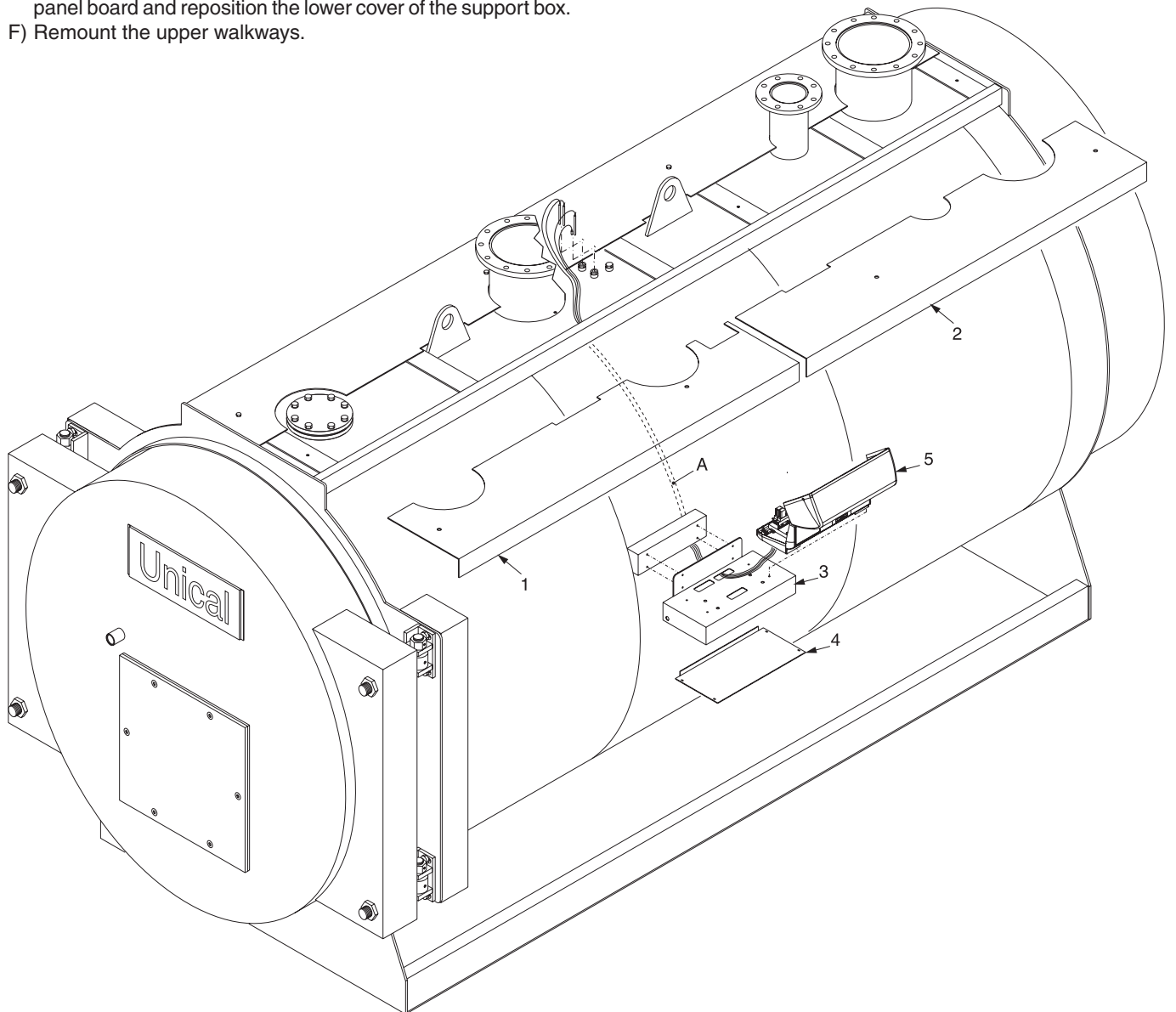


ATTENTION: the flame control warning light can be very hot; therefore pay the utmost attention.

3.13 - MOUNTING ELECTRIC PANEL

TERNOX 2S boilers are supplied with casing. Therefore to mount the panel board, proceed as follows:

- A) Dismount the right upper walkways (pos. 1 and 2).
- B) Fix the support box of the panel board to the bracket on the right side of the boiler.
- C) Remove the lower cover pos. 4 from the support box of the panel board.
Fasten the panel board (pos. 5) to the support box pos. 3.
- D) Rotate the cover of the panel board frontwards after having removed the two screws on the side and insert the electric inlet cables and the outlet probe capillaries through the slots at the base.
Insert the thermostat probe capillaries in the tube designed for their passage, that is placed under the casing (see detail "A").
Pay special attention when unrolling the capillaries and insert the bulbs in the two holders, inserting the contact springs and blocking the capillaries with the fixing springs.
- E) After having carried out the electric connections, close the panel board and reposition the lower cover of the support box.
- F) Remount the upper walkways.



3.14 - ELECTRICAL CONNECTIONS

General warnings



The electrical safety of the appliance is guaranteed only when it has been properly connected to an efficient earthing system carried out as intended by safety standards in force: pipes of the gas, water and heating systems are absolutely unsuitable as earthing electrodes.

It is necessary to verify this fundamental safety requirement. If in doubt, have the electric system carefully checked by professionally qualified personnel as the manufacturer is not liable for damage caused by failure to provide an earthing system.



Have professionally qualified personnel check that the electric system is adequate for the maximum power absorbed by the appliance, indicated on the data plate. Make sure in particular that the cross-section of the cables is suitable for the power absorbed by the appliance.

Use of any type of component using electric energy requires the observance of some fundamental rules, such as:

- do not touch the appliance with wet and/or moist parts of the body and/or in bare feet;
- do not pull the electric cables;
- do not leave the appliance exposed to atmospheric agents (rain, sun, etc.) unless expressly designed;
- do not allow children or unskilled persons to use the appliance.

230V electric power supply connection

The electrical connections are illustrated in chap. 3.15 3.19.

The boiler installation requires a connection to a 230 V - 50 Hz electric mains: this connection must be properly carried out as provided for by current IEC regulations.



Danger!

Only a qualified technician may perform the electrical installation.

Before performing connections or any type of operation on electrical parts, always disconnect electrical power and make sure that it cannot be reconnected accidentally.

Remember that a bipolar switch must be installed on the boiler power line with over 3 mm between contacts, easy to access, making maintenance quick and safe.

3.15 - STANDARD PANEL BOARD

The main switch [11] powers the board and the equipment connected to it.

Switches [12] and [13] in turn cut power to the burner and to the C.H. pump.

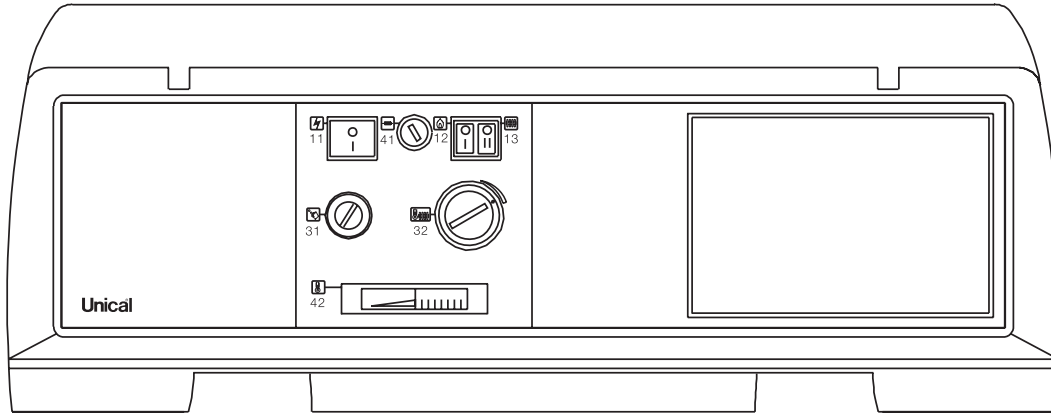
Thermostat [32] adjusts the working temperature of the boiler.

The working thermostat is provided with two switching contacts to control the two-stage burners.

The differential between the two contacts is 6°C (not adjustable).

The minimum thermostat, which can only be accessed after having lifted the cover of the electric control board, stops the C.H. pump until the boiler reaches the temperature of 50°C.

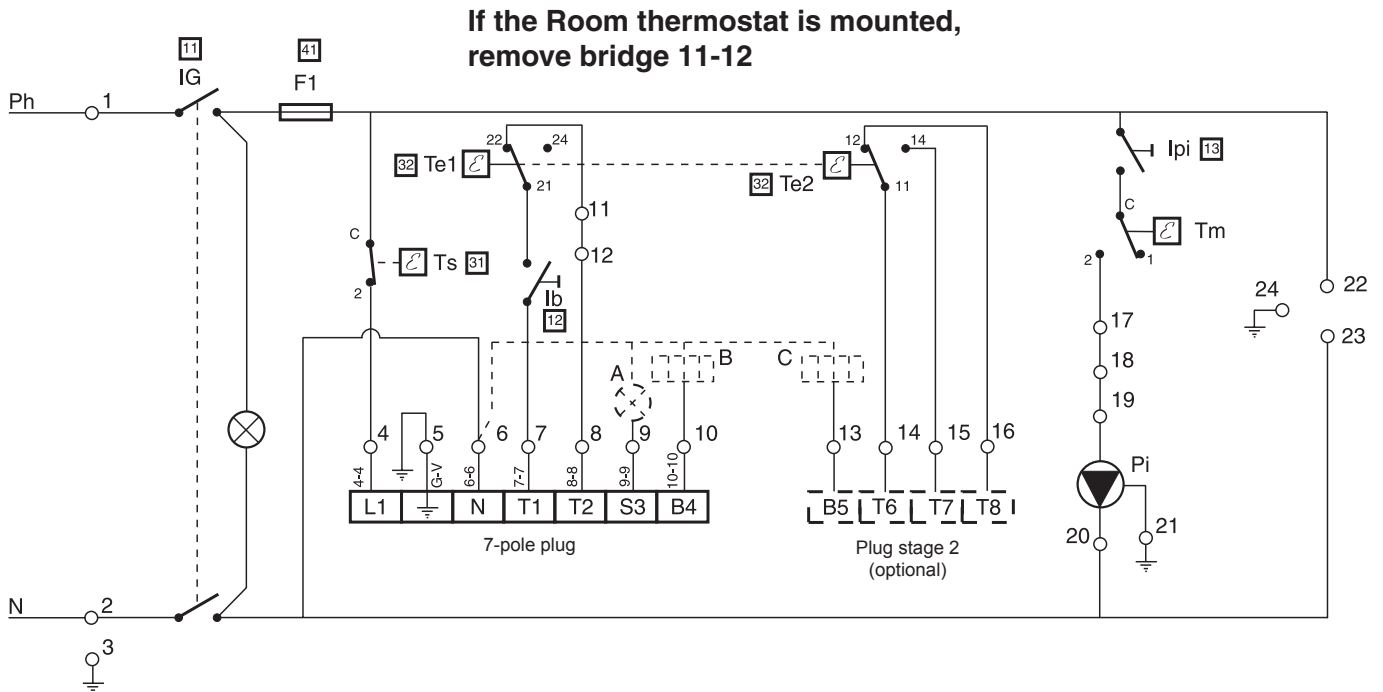
The electric power line of the boiler's control board must have a switch with protective fuses.



- 11 Main switch with indicator light
- 12 Burner switch
- 13 System pump switch
- 31 Safety thermostat

- 32 Working thermostat
- 41 General fuse
- 42 Boiler thermometer

For use of the panel board, see the system manager instruction manual

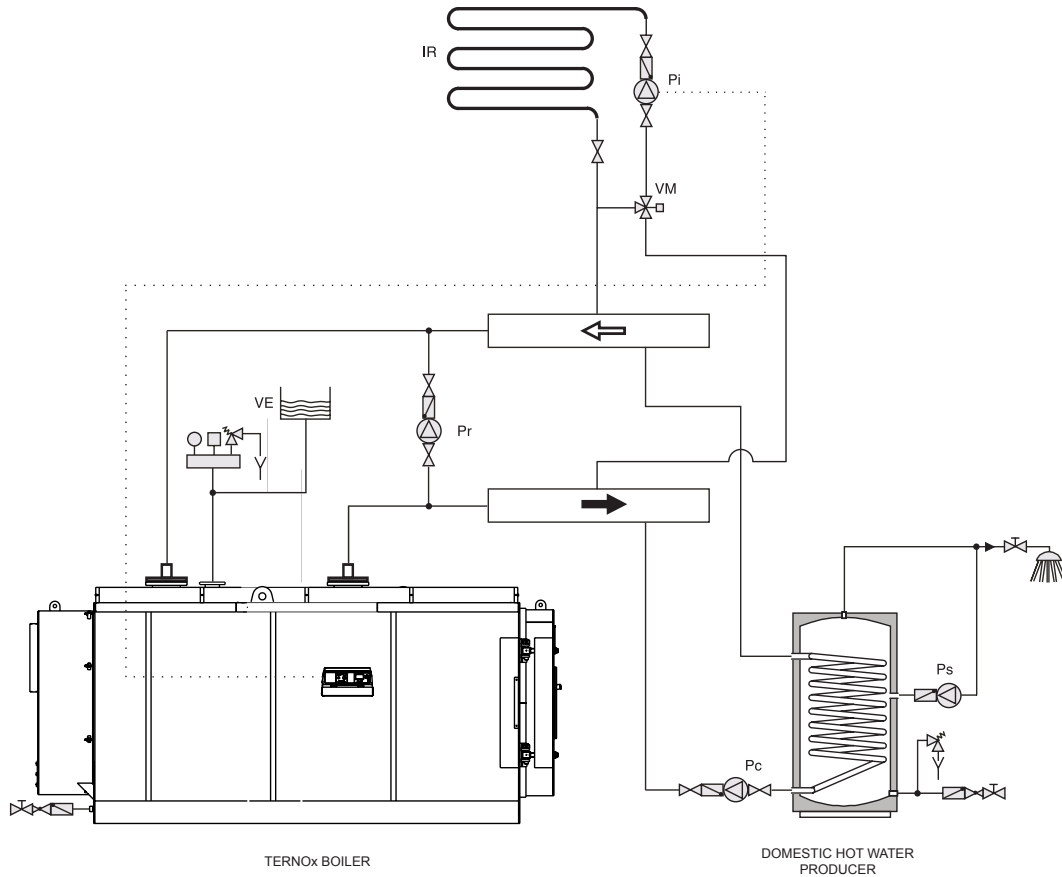


Ph	Phase (230V ~50Hz)	Te1	Working thermostat stage 1 (60°C±90°C)	Pi	System pump
N	Neutral	Te2	Working thermostat stage 2 (54°C±84°C)	A	Possible repetition of burner block
F1	General fuse (max 4A)	Tm	Minimum thermostat (50°C)	B	Possible working hour counter stage 1
lb	Burner switch	Ts	Safety thermostat (100°C)	C	Possible working hour counter stage 2
IG	Main switch with indicator light				
lpi	System pump switch				
Ta	Room thermostat				

3.16 - HYDRAULIC AND ELECTRICAL SYSTEM CONNECTION

The following figures show the typical layout of the connection of the boiler to the heating system with production of domestic hot water.

Remember that TERNOX boilers operate with forced circulation.

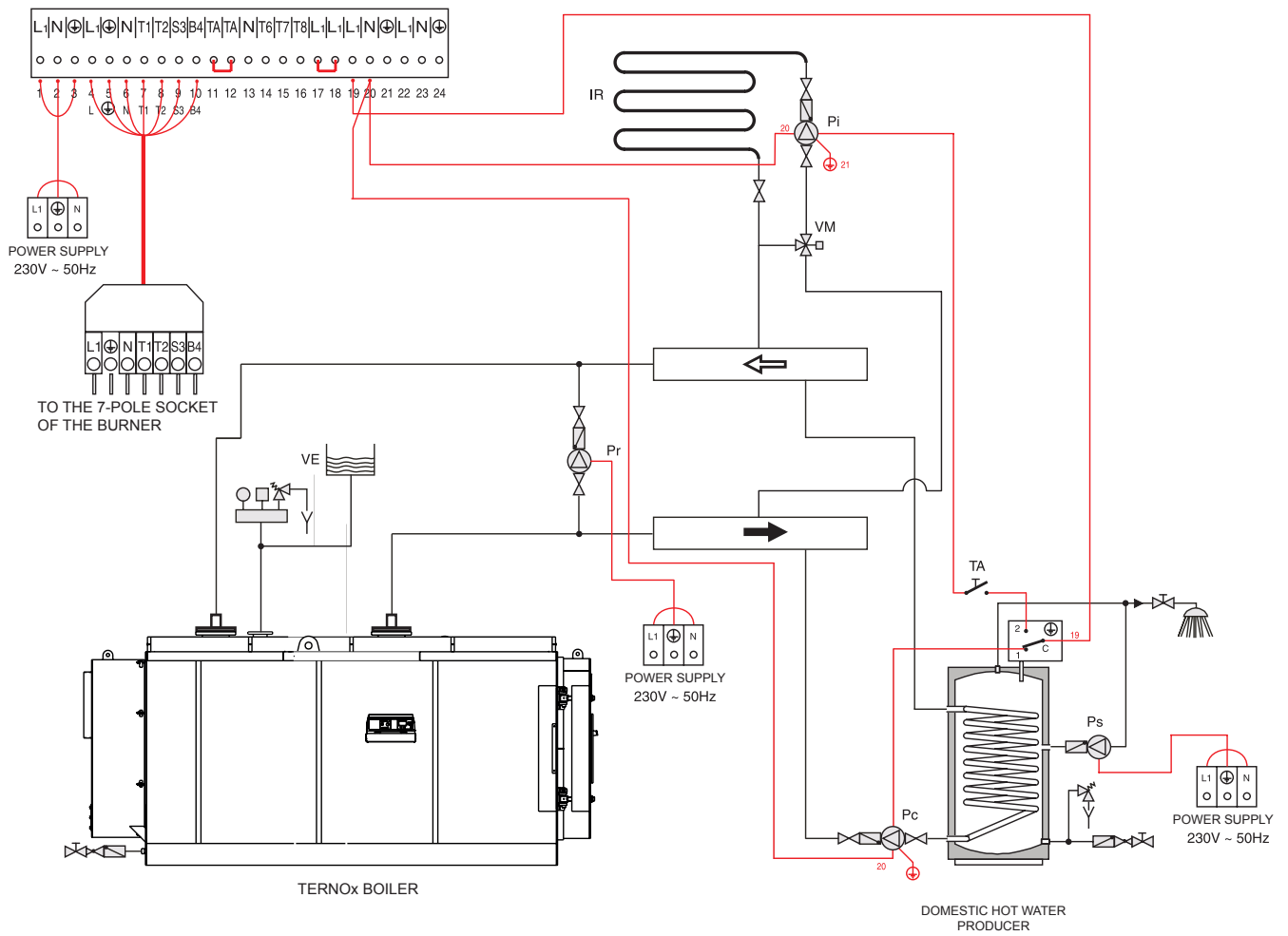


Key:

- Pr* = recirculation pump
- VM* = zone mixing valve
- Pi* = heating system pump
- VE* = expansion vessel
- IR* = heating system distribution
- Ps* = domestic water recirculation pump
- Pc* = domestic hot water production charge pump
- TA* = room thermostat

The standard panel board of the TERNOX boiler automatically switches the burner off when the temperature in the boiler reaches the value set on the control thermostat. It also manages the C.H. pump, which will only be activated when the minimum boiler temperature of 50°C has been reached (anti-condensation protection temperature). The pump will switch off when the lower threshold of 50°C (decreasing) is reached.

The panel is set up to manage dual-stage or modulating burners. With this layout configuration, the DHW storage tank loading pump will have the priority over the heating C.H. pump.



NOTE: With absorption beyond 4A, place adequate contactors between the panel board and the loads

3.17 - OPTIONAL MASTER PANEL BOARD

The main switch [14] powers the board and the equipment connected to it.

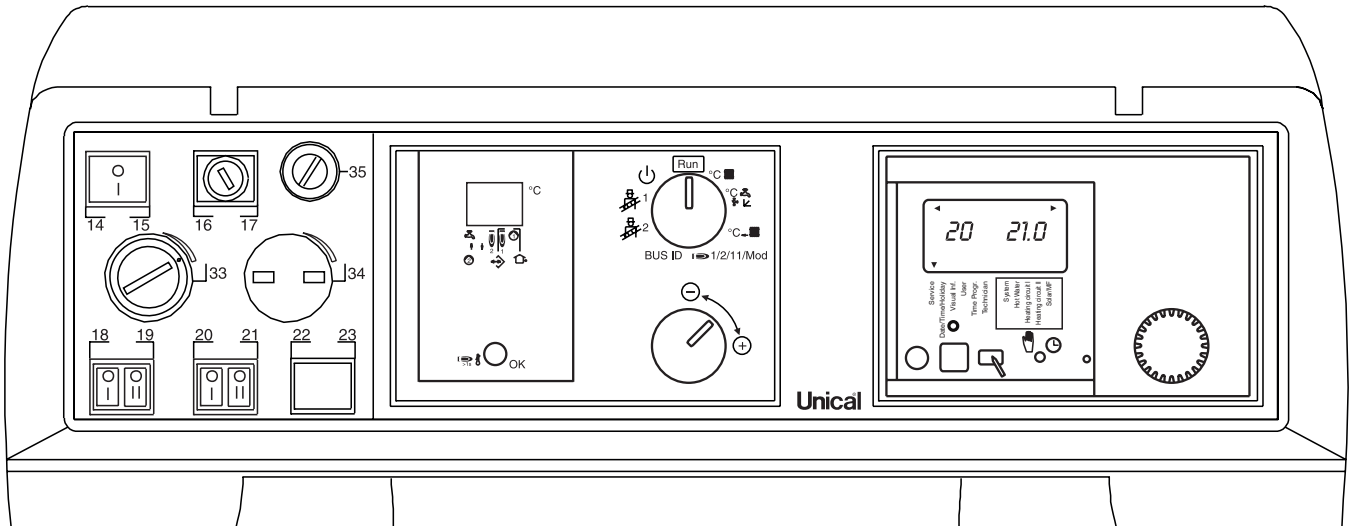
The switches [18] and [19] control the burner and P1 pump if the boiler operates in cascade.

The switches [20] and [21] control the Z1 pump (direct) and Z2 pump (mixed).

The thermostat adjusts the working temperature of the boiler: to achieve this, the thermostat must be placed at maximum full-scale pos. [33].

Modulation of the burner will be managed by heat control.

The electric power line of the boiler's control board must have a switch with protective fuses.



14 Main switch with indicator light

16 General fuse

18 Burner switch

19 P1 C.H. pump switch (cascade)

20 Pz1 direct zone C.H. pump switch

21 Pz2 mixed zone C.H. pump switch

33 Working thermostat

35 Safety thermostat

For use of the panel board, see the system manager instruction manual

The heating controller probes (boiler, storage tank, external, flow) are included in the supply; the ambient probes 1 and 2 are optional; the mixing valve and relative control motor are not included in the supply.

Should ambient probes be mounted (optional), the room temperature will only be determined with the boiler curve set by the program.

The optional panel board of the TERNOX 2S boiler automatically switches the burner off when the temperature in the boiler reaches the value set on the heating controller.

It also manages the pump to fill a storage tank for DHW production.

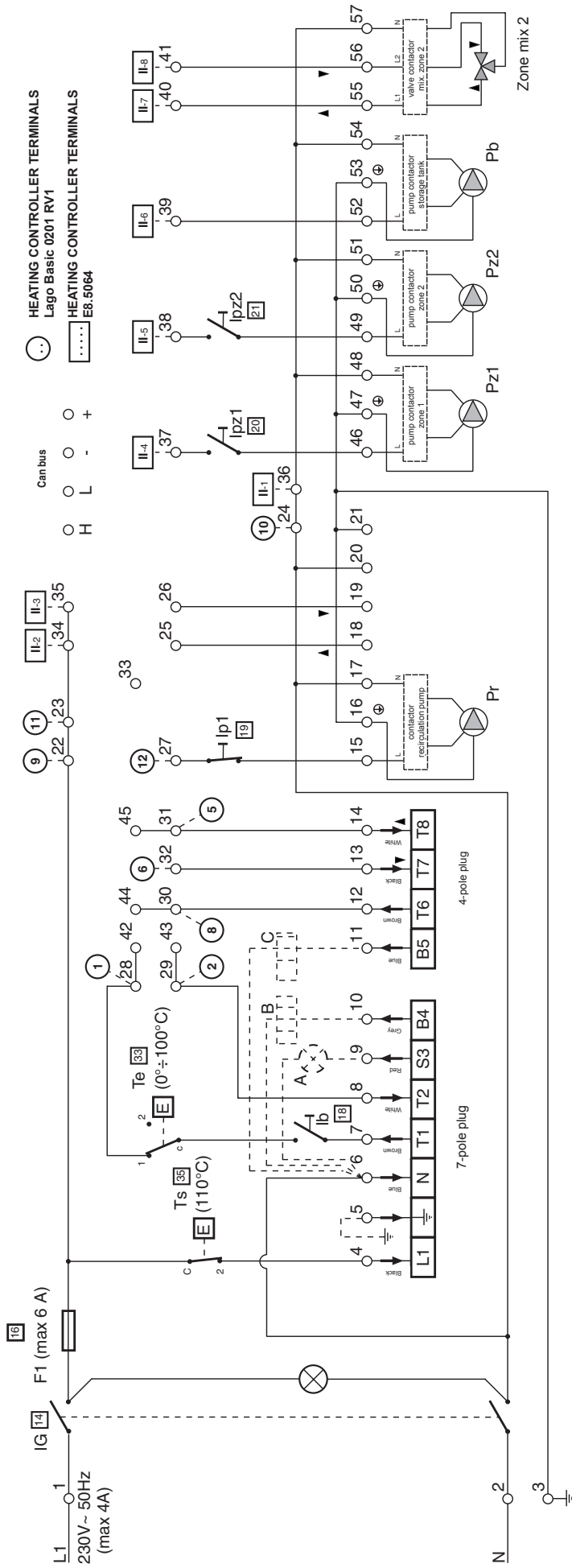
The heating systems are managed automatically based on the data detected by the boiler, external, ambient and flow probes. The high temperature zone C.H. pump is made ready for operation by the control switch pos. 20, and will only switch off when the temperature set on the heating controller has been reached. The low temperature zone C.H. pump is made ready for operation by the control switch pos. 21, and will only switch off when the temperature set on the heating controller has been reached.

The storage tank charge pump for DHW production switches on automatically and will only switch off when the temperature set on the heating controller has been reached.

The panel is set up to manage the modulating burners.

With this system configuration, the heating controller is capable of checking:

- direct zone system; the control unit commands the C.H. pump. The room temperature is controlled by the programming curves set in the heating controller;
- one zone system with motorised mixing valve: the flow probe (downstream the mixing valve) must be fitted; the control unit commands the C.H. pump and the mixing valve. The room temperature is controlled by the programming curves set in the heating controller;
- DHW production through storage tank;
- anti-legionella function with increase of water temperature in storage tank (function not enabled in factory, but can be enabled by customer).



HEATING CONTROLLER TERMINALS
Lago Basic 0201 RV1

HEATING CONTROLLER TERMINALS
ES.5064

Can bus
H O L O +

II-2 II-3
34 35

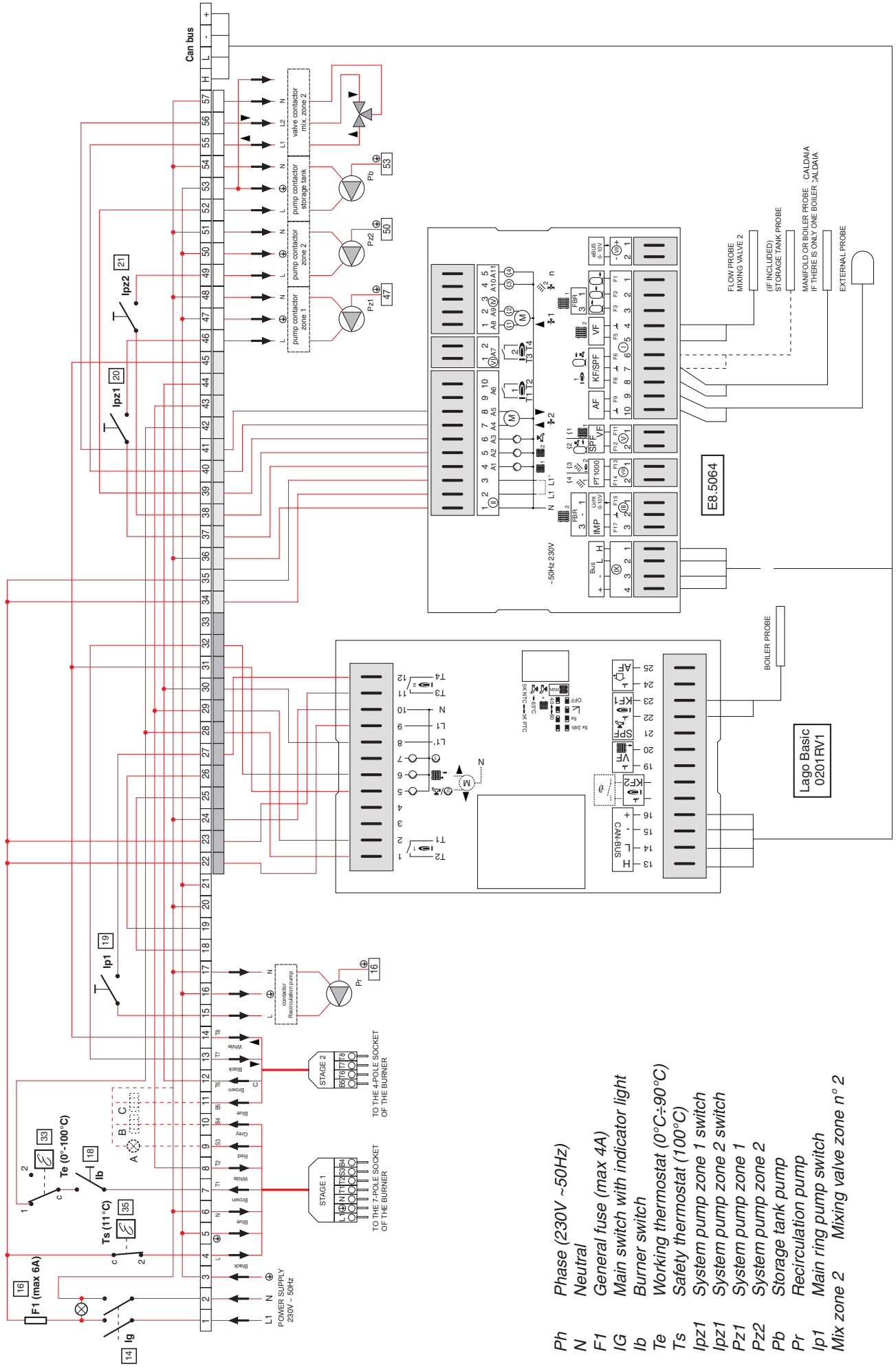
II-4 II-5 II-6 II-7 II-8
37 38 39 40 41

II-1 II-10 II-11 II-12 II-13 II-14 II-15 II-16 II-17 II-18 II-19 II-20 II-21 II-22 II-23 II-24 II-25 II-26 II-27 II-28 II-29 II-30 II-31 II-32 II-33 II-34 II-35 II-36 II-37 II-38 II-39 II-40 II-41

16 F1 (max 6 A)

IG 14 230V ~ 50Hz (max 4A)

- | | |
|------------|----------------------------------|
| Ph | Phase (230V ~50Hz) |
| N | Neutral |
| F1 | General fuse (max 4A) |
| IG | Main switch with indicator light |
| Ib | Burner switch |
| Te | Working thermostat (0°C÷90°C) |
| Ts | Safety thermostat (100°C) |
| Ipz1 | System pump zone 1 switch |
| Ipz2 | System pump zone 2 switch |
| Pz1 | System pump zone 1 |
| Pz2 | System pump zone 2 |
| Pb | Storage tank pump |
| Pr | Recirculation pump |
| Ip1 | Main ring pump switch |
| Mix zone 2 | Mixing valve zone n° 2 |



- Ph Phase (230V ~50Hz)
- N Neutral
- F1 General fuse (max 4A)
- IG Main switch with indicator light
- lb Burner switch
- Te Working thermostat (0°C÷90°C)
- Ts Safety thermostat (100°C)
- Ipz1 System pump zone 1 switch
- Ipz2 System pump zone 2 switch
- Pz1 System pump zone 1
- Pz2 System pump zone 2
- Pb Storage tank pump
- Pr Recirculation pump
- Ip1 Main ring pump switch
- Mix zone 2 Mixing valve zone n° 2

Technical features and dimensions

3.18 - PROGRAMMING THE HEATING CONTROLLERS

For that which concerns adjustment or programming of the heating controllers, see the instruction manual attached to the individual heating controller.

The following are the default parameters which cannot be modified.

As far as parameters which can be programmed by the user according to his requirements, see the system manager instruction book.


PARAMETERS PROGRAMMABLE BY TECHNICIAN AND PROTECTED BY ACCESS CODE FOR HEATING CONTROLLER type E8.5064


INSTALLATION			
Description	Value range	Default	Individual values
CODE NUMBER	0000 - 9999	ENTRY	
CODE NUMBER (variation)	0000 - 9999	0000	
BOILER BUS ID, 01 - 08	----	
BUS ID ₁	(00), 01 - 015	01	
BUS ID ₂	(00), 01 - 016	02	
AF SUPPLY	00,01 (off/on)	01 (ON)	
BUS CONNECTION	0.01	01	
BUS SUPPLY	00,01 (off/on)	01 (ON)	
TEMPERATURE MASTER	00, 01 (OFF / ON)	01 (ON)	
MAX-T HS1 MAX T-HEADER	30 °C - 110 °C	95 °C	
MIN-T HS1 MIN T-HEADER	10 °C - 80 °C	10 °C	
MAX-T HS2	30 °C - 110 °C	95 °C	
MIN-T HS2	10 °C - 80 °C	10 °C	
VOLTAGE CURVE	0 - 11	11	
CURVE 11-U2	0.00-10.00V	0V	
CURVE 11-U2	0.00-10.00V	10V	
CURVE 11-T1	00 - 120 °C	0	
CURVE 11-T2	00 - 120 °C	100 °C	
CURVE 11-UA	0.00-10.00V	0V	
T-WARM-UP	10 °C - 85 °C	10	
MINIMUM LIMIT	00, 01, 02	00	
HYSTERESIS	2K - 20K<P>	5	
HYSTERESIS TIME	00 - 30 min	00 min	
BOILER DETECTED	VIEW ONLY		
OUTPUT LEVEL	00 - 1000kW	* see note	
NEW CONFIGURATION	00,01 (off/on)		
MINIMUM MODULATION CASCADE	00 - 100	00	
DHW LEVELS	00 - 08	00	
CONTROL VARIANCE	(K)	VIEW	
NOMINAL OUTPUT INDEX	0 - 100%	VIEW	
SWITCH VALUE	(-99) - 0 - (99)	VIEW	
BLOCK TIME	REMAINING (min)	VIEW	
MAXIMUM BOILER TEMPERATURE	50 - 110°C	85	
BOILER DYNAMICS UPWARD	20 - 500K	30K	
BOILER DYNAMICS DOWNWARD	20 - 500K	20K	
RESET TIME	5 - 500	50	
MODULATION MAX	0% - 100%	80%	
MODULATION MIN	0% - 100%	50%	
MIN MODULATION HS	0% - 100%	0%	
IGNITION MODULATION INDEX	40% - 100%	80%	
BOILER SEQUENCE 1	----	12345678	
BOILER SEQUENCE 2	----	87654321	


Description	Value range	Default	Individual values
SEQUENCE MODE	01 - 06	01	
SEQUENCE CHANGE	10 - 800 HOURS	200 HOURS	
CYCLE BLOCK	00 min - 30 min	00 min	
HYSTERESIS BURNER 2	2K - 20K<P>	2K	
BOILER COOLING FUNCTION	00 - 01	00	
BOILER COOLING TEMPERATURE	30°C - 120°C	95	
HS 1 TYPE	00 - 06	06	
HS 1 BUS	00 - 04	04	
HS 2 TYPE	00 - 05	00	
HS 2 STORAGE TANK	01 - 03	00	
PUFFER	01 - 01 - 02	00	
SCREED	00, 01 (OFF - ON)	00 OFF	
SCREED PROGRAM	** see note		


* For only one modulating boiler, set the first stage value of the boiler at 1, in the second leave the dashes.
For two modulating boilers in cascade, set the first stage value at 1 for both boilers and in the second leave the dashes.
All other boiler stages must be disabled.

** See E8.5064 heating controller instruction manual

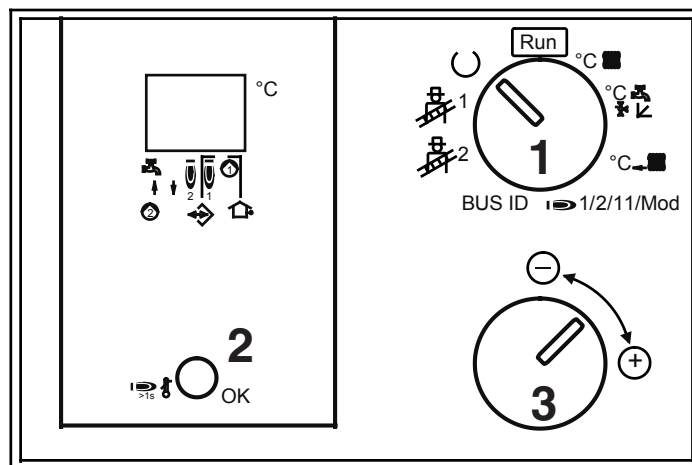
DOMESTIC HOT WATER PRODUCTION			
Description	Value range	Default	Individual values
CHARGE PUMP	00 - 01 (OFF / ON)	01 (ON)	
PARALLEL PUMP RUNNING	00 , 01, 02, 03	01	
T DHW	00K - 50K	20K	
DHW HYSTERESIS	5K - 30K	5 degrees	
DHW FOLLOWUP	00 min - 30 min	00 min	
THERMOSTAT INPUT	00, 01 (OFF / ON)	00 OFF	
THERMOSTAT FUNCTION	00, 01 (OFF / ON)	00 OFF	
LOADING	00, 01 (OFF / ON)	00 OFF	
RETURN	Exit level using 		

HEATING CIRCUIT 1			
Description	Value range	Default	Individual values
HEATING CIRCUIT FUNCTION	00 - 04	0	
PUMP FUNCTION	00 - 03	0	
MIXER OPEN	5 - 25	----	
MIXER CLOSED	5 - 25	----	
MAX FLOW TEMPERATURE	20 °C - 110 °C	95 °C	
MIN FLOW TEMPERATURE	10 °C - 110 °C	30 °C	
FROST PROTECTION TEMP	(-15)°C - (5)°C	0	
OUTSIDE TEMP DELAY	0:00 - 24:00	0.00	
HEATING SLOPE DISTANCE	00K - 50K	5 °C	
MANDATORY REDUCTION	00 - 01 (OFF / ON)	01	
RETURN	Exit level using 		

HEATING CIRCUIT 2			
Description	Value range	Default	Individual values
HEATING CIRCUIT FUNCTION	00 - 04	0	
PUMP FUNCTION	00 - 03	0	
MIXER OPEN	5 - 25	----	
MIXER CLOSED	5 - 25	----	
MAX FLOW TEMPERATURE	20 °C - 110 °C	45 °C	
MIN FLOW TEMPERATURE	10 °C - 110 °C	10 °C	
FROST PROTECTION TEMP	(-15)°C - (5)°C	0	
OUTSIDE TEMP DELAY	0:00 - 24:00	0.00	
HEATING SLOPE DISTANCE	00K - 50K	5 °C	
MANDATORY REDUCTION	00 - 01 (OFF / ON)	01	
RETURN	Exit level using 		

SOLAR M/F			
Description	Value range	Default	Individual values
MF (1-4) FUNCTION	00 - 26	00,00,01,02	
MF (1-4) T- NOM	00 - 03	30°C	
MF (1 - 4) HYSTERESIS	5 - 25	5°C	
F 15 FUNCTION	5 - 25	0	
RETURN	Exit level using 		

PARAMETERS PROGRAMMABLE BY TECHNICIAN FOR HEATING CONTROLLER
Lago Basic 0201 RV 1

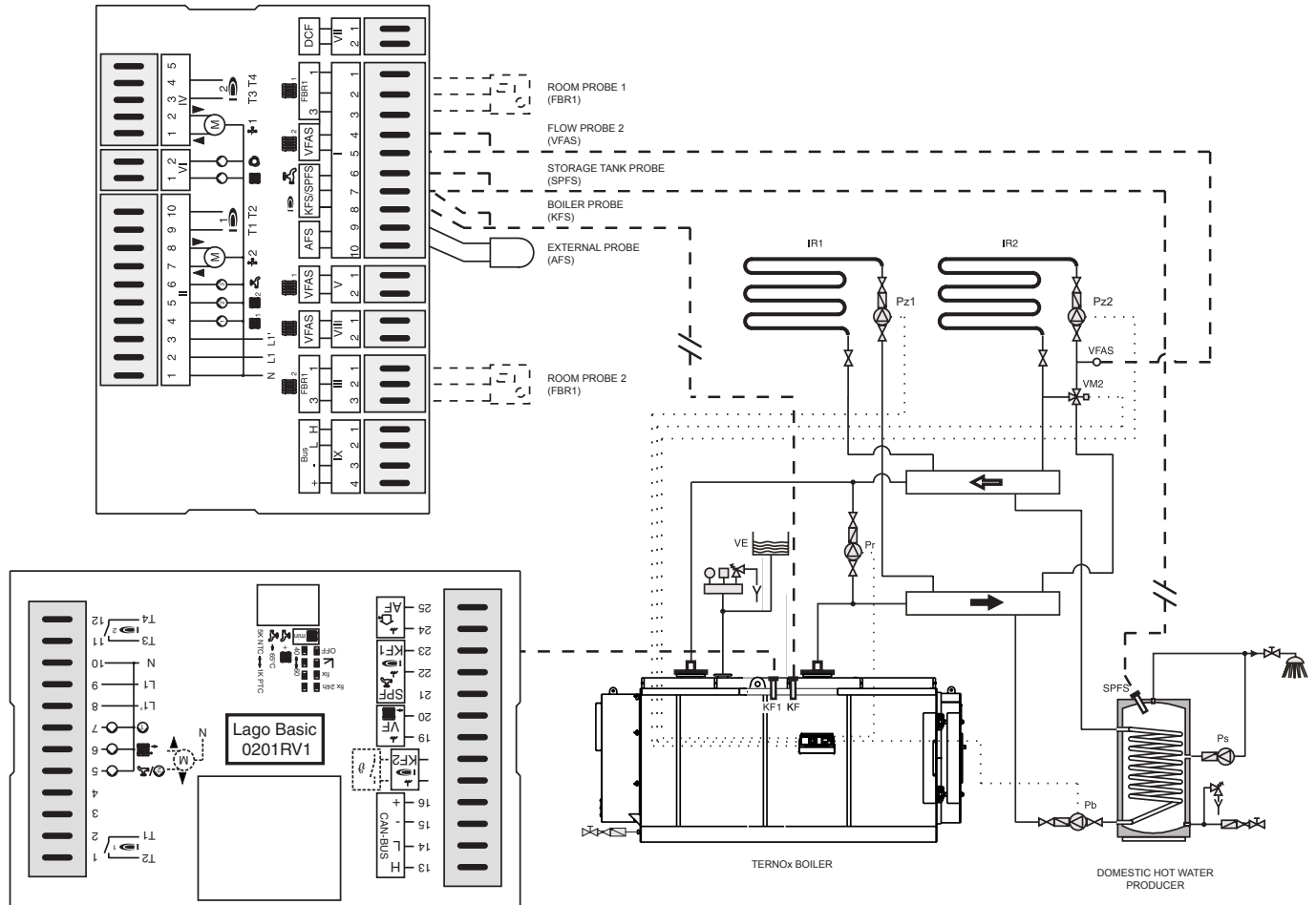


- 1**
 - 1) Switch selector to burner (1)
 - 2) Press ok (2)
 - 3) Turn the knob (3) until mm appears on the display (modulating burner)
 - 4) Press ok (2)
- 2**
 - 1) Switch selector (1) to mixer valve symbol
 - 2) Press ok (2)
 - 3) Turn the knob (3) and set the burner damper time (time necessary to switch from minimum output to maximum output)
 - 4) Press ok (2)
- 3**
 - 1) Switch the selector (1) to BUS ID
 - 2) Press ok (2)
 - 3) Turn the knob (3) until the number 1 appears on the display (boiler ID)
 - 4) Press ok (2). Turn the knob 1 back to pos. RUN.

3.19 - HYDRAULIC AND ELECTRICAL SYSTEM CONNECTION

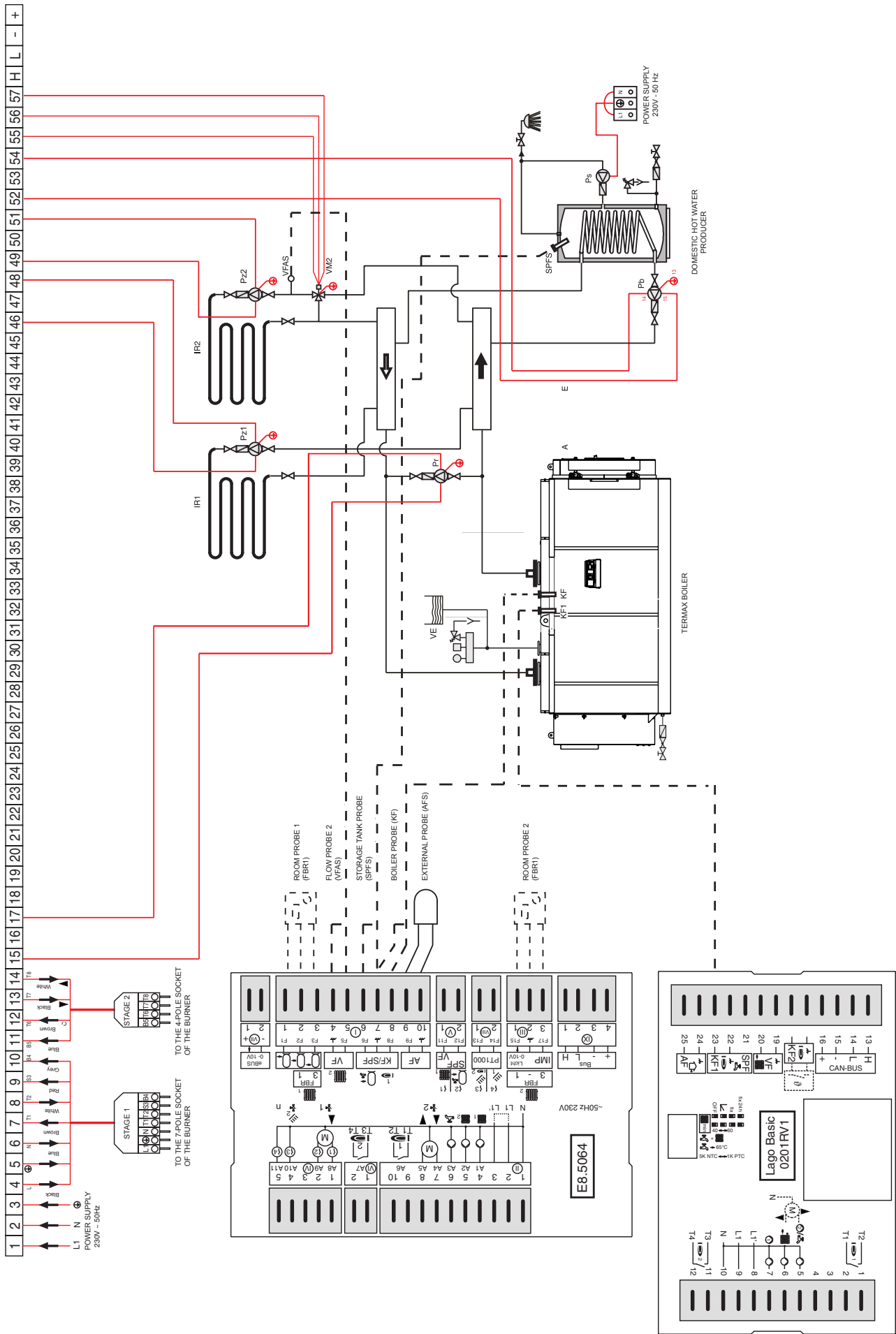
The following figures show the typical layout of the connection of the boiler to the heating system consisting of 2 zones one of which controlled by a motorised mixing valve. DHW production can also be managed.

Remember that TERNOX 2S boilers operate with forced circulation.



Key:

- Pr* = recirculation pump
- VM2* = zone mixing valve
- Pz1* = direct zone heating system pump
- Pz2* = mixed zone heating system pump
- VE* = expansion vessel
- IR1* = direct zone heating system distribution
- IR2* = mixed zone heating system distribution
- Ps* = domestic water recirculation pump
- Pb* = DHW production charge pump
- SPFS* = storage tank probe
- KF* = boiler probe (E8 heating control)
- KF1* = boiler probe (Lago Basic heating control)
- VFAS* = flow probe 2



NOTE: With absorption beyond 4A, place adequate contactors between the panel board and the loads

3.20 - CASCADE PANEL BOARD

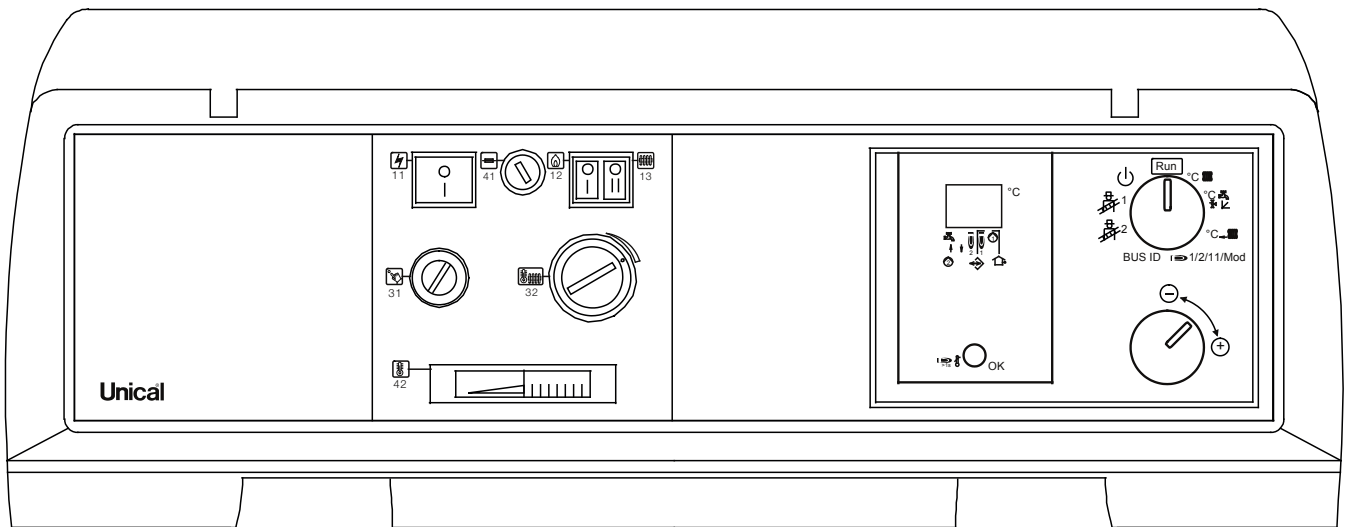
The main switch [11] powers the board and the equipment connected to it.

The switches [12] and [13] control the burner and P1 pump if the boiler operates in cascade.

The thermostat adjusts the working temperature of the boiler 2: to achieve this, the thermostat must be placed at maximum full-scale pos. [32].

Modulation of the burner will be managed by heat control.

The electric power line of the boiler's control board must have a switch with protective fuses.



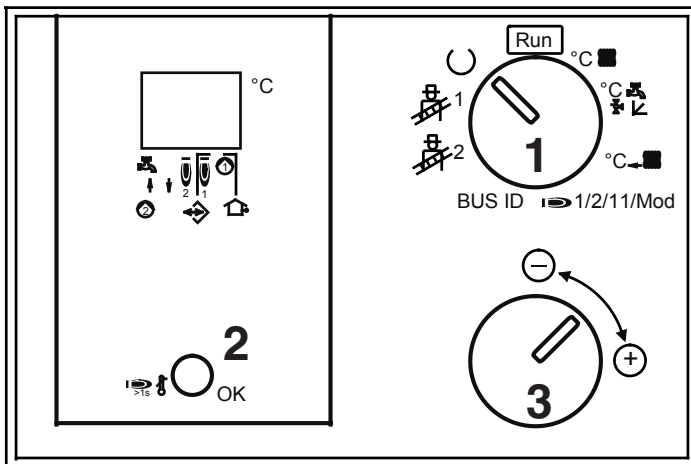
- 11 Main switch with indicator light
- 12 Burner switch
- 13 P1 C.H. pump switch (cascade)
- 31 Safety thermostat

- 32 Working thermostat
- 41 General fuse
- 42 Thermometer

**For use of the panel board, see the system manager instruction manual.
As far as the practical connection and operating diagrams are concerned,
see the documentation supplied inside the panel board.**

The boiler probe is included in the supply.

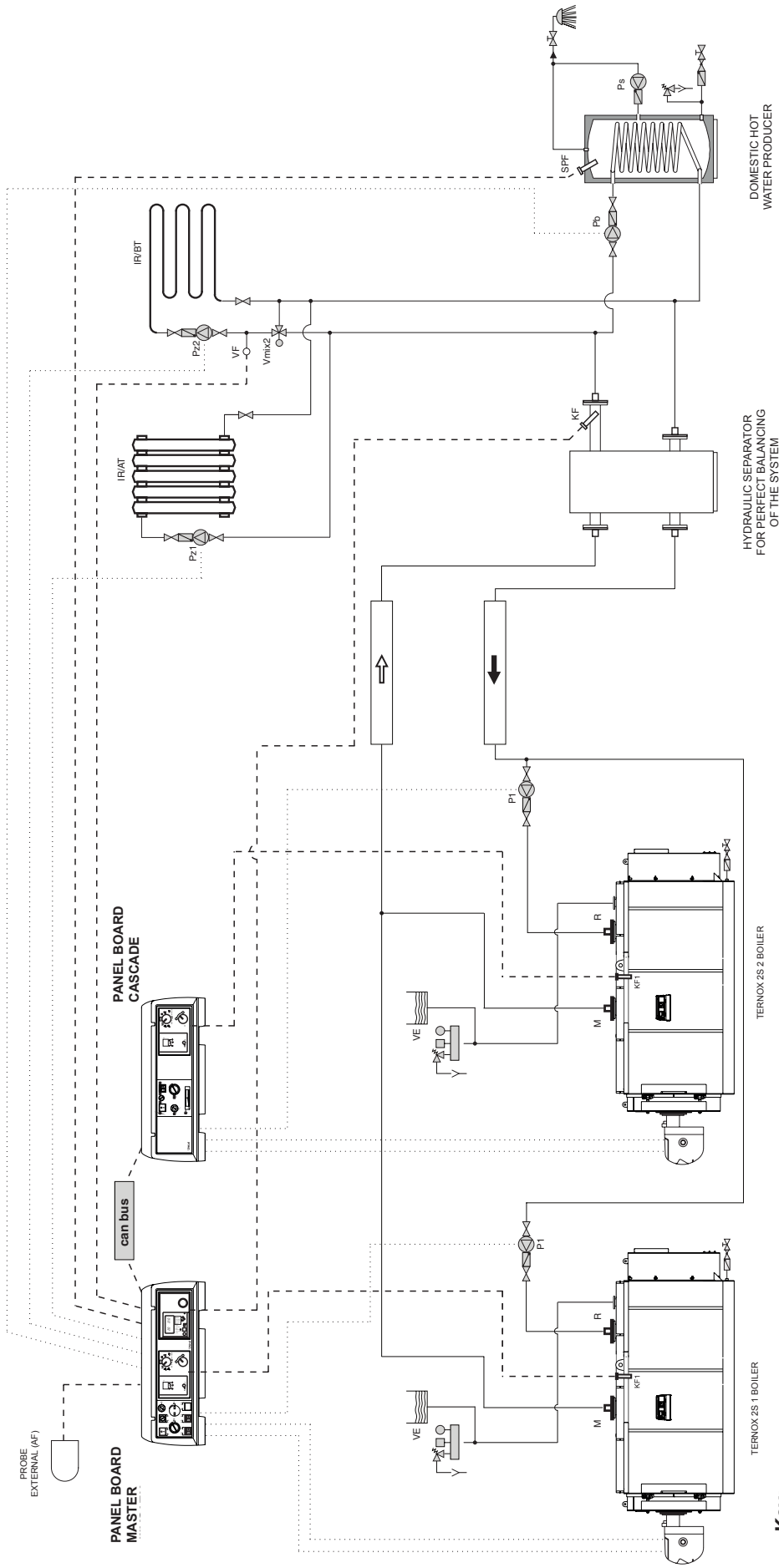
PARAMETERS PROGRAMMABLE BY TECHNICIAN FOR HEATING CONTROLLER
Lago Basic 0201 RV 1 ON BOILER N°2



- 1**
 - 1) Switch selector to burner (1)
 - 2) Press ok (2)
 - 3) Turn the knob (3) until mm appears on the display
 - 4) Press ok (2)
- 2**
 - 1) Switch selector (1) to mixer valve symbol
 - 2) Press ok (2)
 - 3) Turn the knob (3) until the number 15 appears on the display (burner servomotor time)
 - 4) Press ok (2)
- 3**
 - 1) Switch the selector (1) to BUS ID
 - 2) Press ok (2)
 - 3) Turn the knob (3) until the number 2 appears on the display (boiler ID)
 - 4) Press ok (2). Turn the knob 1 back to RUN.

3.21 - HYDRAULIC AND ELECTRIC SYSTEM CONNECTION WITH BOILERS IN CASCADE

The figure shows the typical layout of the connection of the boiler to the heating system consisting in 2 boilers in cascade serving 1 high temperature zone + 1 low temperature zone controlled by a motorised mixing valve + domestic hot water production.
 Boiler n°1 is equipped with a MASTER panel board, boiler n°2 with a CASCADE panel board.



Key:

- M = flow
- Rat = HIGH temperature return (NOT USED)
- Rbt = LOW temperature return
- Vmix2 = zone mixing valve (motorised)
- Pz1 = HIGH TEMPERATURE zone heating system pump
- Pz2 = LOW TEMPERATURE zone heating system pump
- VE = expansion vessel
- IR/AT = HIGH TEMPERATURE heating system distribution
- IR/BT = LOW TEMPERATURE heating system distribution

- Ps = domestic water recirculation pump
- P1 = circulation pump
- Pb = DHW production tank pump
- SPF = storage tank probe
- KF = E8.5064 heat control boiler probe
- KF1 = Lago Basic 0201 RV 1 heat control boiler probe
- VF = flow probe
- AF = external probe

The panel boards of the XC-K boilers (in cascade) automatically switch the burners off when the temperature in the boiler reaches the value set on the heating controller.

They also manage the pump to fill a storage tank for DHW production.

The heating systems are managed automatically based on the data detected by the boiler, external, ambient and flow probes. The high temperature zone C.H. pump is made ready for operation by the control switch pos. 20 of the MASTER board, and will only switch off when the temperature set on the heating controller has been reached.

The low temperature zone C.H. pump is made ready for operation by the control switch pos. 21 of the MASTER board, and will only switch off when the temperature set on the heating controller has been reached.

The storage tank charge pump for DHW production switches on automatically and will only switch off when the temperature set on the heating controller has been reached.

The panel is set up to manage the modulating burners.

With this system configuration, the heating controller is capable of checking:

- direct zone system; the control unit commands the C.H. pump. The room temperature is controlled by the programming curves set in the heating controller;

- one zone system with motorised mixing valve: the flow probe (downstream the mixing valve) must be fitted; the control unit commands the C.H. pump and the mixing valve. The room temperature is controlled by the programming curves set in the heating controller;
- DHW production through storage tank;
- anti-legionella function with increase of water temperature in storage tank (function not enabled in factory, but can be enabled by customer).

For practical connections, both electrical and of the probes, see the diagrams supplied with the MASTER and CASCADE panel boards.

3.22 - COMMISSIONING

3.22.1 - Preliminary checks



Commissioning must be done by professionally qualified personnel. Unical will not be held liable for damage to persons, animals or objects due to failure to comply with the above instruction.

After connecting the hydraulic and electrical system and the fuel line to the boiler, and before starting up the boiler, it is advisable to check the following:

Have all the hydraulic and electrical systems and the safety devices and fuel been connected in compliance with the domestic and local laws in force?	<input type="checkbox"/>
Are the expansion vessel and the safety valve (when applicable) connected correctly and cannot be shut off?	<input type="checkbox"/>
Are the bulbs of the operating, safety, minimum thermostats and that of the thermometer inserted in their conduits?	<input type="checkbox"/>
Are the control and safety devices working and configured correctly?	<input type="checkbox"/>
Are the refractory coverings intact?	<input type="checkbox"/>
Are the combustion air intake line and the flue gas evacuation line compliant with the applicable standards in force?	<input type="checkbox"/>
does the gas used (models with gas burner) correspond to boiler calibration?	<input type="checkbox"/>
is the fuel supply system sized according to the capacity required by the boiler? is it equipped with all safety and control devices required by the standards in force?	<input type="checkbox"/>
are the mains voltage and frequency compatible with the burner and the electrical equipment of the boiler?	<input type="checkbox"/>
is the burner assembled according to the instructions in the manufacturer's manual?	<input type="checkbox"/>
has the burner blast tube infill been performed correctly?	<input type="checkbox"/>
Is the system full of water and does not contain any air?	<input type="checkbox"/>
Are the drain valves closed and the system cut-off devices fully open?	<input type="checkbox"/>
is the gas supply cock open (models with gas burner)?	<input type="checkbox"/>
has gas leakage been checked (models with gas burner)?	<input type="checkbox"/>
Is the outside main switch ON? Is the pump/are the pumps working correctly?	<input type="checkbox"/>
has the system been checked for water leaks?	<input type="checkbox"/>
Are the ventilation conditions and minimum distances to perform any maintenance guaranteed?	<input type="checkbox"/>
Has the operator been trained and has the documentation been supplied?	<input type="checkbox"/>

Please tick the operations performed

3.22.2 - Ignition and extinction

Ignition

When the checks indicated in the previous paragraph are successful, the burner can be commissioned by a technician qualified and acknowledged by the Manufacturer of the burner.

The technician takes on all responsibility regarding calibration within the declared and approved output range of the boiler.

After having opened the fuel shut-off valves and made sure there are no leaks in the adduction circuit, set all switches at ON.

The burner is now ready for commissioning and adjustment, performed solely by the above-mentioned technician.

During commissioning, you must check that the door, the burner flange and connections with the chimney are airtight and that there is a slight negative pressure at the base of the flue.

The fuel flow rate must correspond to the plate data of the boiler. It must by no means exceed the maximum declared nominal output value.

The flue gas temperature must never drop below 160°C.

Extinction

- Set the operating thermostat at minimum.
- Disconnect power to the burner and close the fuel supply.
- Leave the pumps running until they are stopped by the minimum thermostat.
- Disconnect power to the electric panel.

3.23 - ADJUSTING THE BURNER



The following instructions are intended exclusively for service personnel **authorised by the manufacturer of the burner**.

Burner calibration and preliminary operations are described in the burner's instruction booklet.

Gas-fired burners are equipped with a gas valve with which the flow rate can be determined: upon commissioning the actual thermal flow rate **must always** be controlled by means of the counter on the main piping, making sure it is not below the minimum value on the data plate of the boiler.

When the burner is adjusted properly, the following values should be obtained, measured at the chimney by a specific analyser:

1) for diesel oil with max visc. 1.5°E at 20°C:

- CO₂ ~ 12÷13%
- Bacharach flue gas index <1
- Flue gas temperature ~ 190÷210 °C

2) with natural gas:

- CO₂ ~ 9÷10%
- Flue gas temperature ~ 180÷200°C

(values for boiler cleaned with water at ~ 70°C).

The flow rate of the fuel should be adjusted to the actual requirement of the system without, on the one hand, exceeding the indicated flue gas temperature and on the other, without dropping below 160°C.

3.24 - CHECKS DURING AND AFTER COMMISSIONING

When the appliance has been commissioned, check that it performs a shutdown and subsequent ignition:

- by modifying the boiler thermostat calibration;
- by intervening on the main switch of the panel board.

Check tightness of all the gaskets on the water and flue gas side. They must be further tightened when hot to guarantee perfect sealing.



This operation is crucial for the gasket of the doors, of the burner plate and of the flue gas casing so that toxic and dangerous combustion fumes do not escape from the boiler room.

Then tighten them when hot to guarantee perfect sealing.

It is also very important to check sealing of the boiler/chimney fitting for the reasons expressed above.

It is also extremely important to progressively tighten the gasket of the railing and manhole of the generator as the temperature increases for perfect sealing: otherwise the first time it leaks, the gasket would need to be replaced.

Check that the appliance fully stops when acting on the main switch of the system.

After all these conditions have been met, the burner must be properly calibrated at the maximum output allowed by the boiler, analysing the flue gas to achieve correct combustion and as few polluting emissions as possible.

As the pressure of the water in the system increases during operation, make sure that its maximum value does not exceed the design pressure of the boiler.

3.25 - ALKALINE OR "BOILING" WASH

This is a treatment carried out by specialised companies on the new boiler.

It removes deposits consisting of residual oil, grease and metal oxides caused by processing and assembly of the boiler.

If these substances are not eliminated, corrosion is caused due to the obstruction of the formation of a passivation coating on surfaces exposed to water.

Execution of alkaline wash:

- Fill the boiler with water.

- Instruments (pressure switch, pressure gauge etc.) must be excluded before starting the wash.
- Introduce 0.3 to 1% of caustic soda, sodium carbonate or trisodium triphosphate into the total content of the water.
- Specific surfactants must be added to these substances ranging from 0.05 to 0.15% of the total content of the water.
- Switching on the burner, bring the water to a temperature of 80-90°C and have it circulate in the boiler for 12-14 hours.
- Slowly empty the content and simultaneously introduce cold water to rinse it properly.

3.26 - BOILER SHUTDOWN

To shut down the boiler for a long period, proceed as follows:

- perform the preservation procedure of the water side, which can be wet or dry;
- turn off the main switch of the electric panel and disconnect the power supply;
- close the fuel shut-off valve;
- perform the flue gas side preservation procedure;
- protect all control, adjustment and safety devices from dust and humidity.

"Wet preservation" entails completely filling the boiler and adding preserving or neutralising products to the water.

Then the system must be sealed by closing all the shut-off valves.

This type of preservation is not recommended if there is a risk of freezing.

"Dry preservation" requires emptying the boiler.

Open the railing, completely dry the inside of the boiler by blowing air and insert highly hygroscopic substances (e.g. quick lime).

Close all the shut-off valves and the railing, thus sealing the generator.

Preservation of the flue gas side is performed as follows: open the inspection doors, remove the burner and disassemble the cap, clean all surfaces from soot (which could contain sulphur which becomes sulphuric acid when it becomes moist) and insert highly hygroscopic substances (e.g. quick lime) into the furnace and flue gas casing.

Hermetically close all the inspection doors, put the burner cap and burner back in place.

4

INSPECTIONS AND MAINTENANCE



Routine maintenance is essential in the interest of the safety, efficiency and durability of the appliance.

All maintenance must be carried out by qualified personnel.

Yearly maintenance of the appliance is mandatory in compliance with Laws in force.



Failure to perform Inspections and Maintenance can entail material and personal damage.



All cleaning and maintenance operations must be preceded by closing the fuel supply, after having disconnected electricity.

In order to make the most of the boiler, you should properly clean the combustion chamber, smoke pipes and smoke chamber.



IMPORTANT NOTE

Before opening the furnace door, it is necessary to take the following safety measures:

- Close the fuel supply (diesel oil or gas) to the burner.
- Cool the boiler off by having water circulate and then disconnect electrical power.
- Place a sign on the boiler with the following text: **DO NOT USE, BOILER MAINTENANCE UNDERWAY, OUT OF SERVICE.**



Inspections help to determine the actual status of the appliance and to compare it with the nominal status. This is done through measuring, controls and observation.



Maintenance is required to eliminate any differences between the actual status and the nominal status. This is normally done by cleaning, setting and replacing individual components subject to wear.



Maintenance intervals and their extent are determined by a specialist based on the status of the appliance ascertained through inspection.

Routine maintenance

Maintenance must be established based on the fuel used, the number of ignitions, the features of the system, etc. Therefore it is not possible to establish beforehand the frequency of maintenance.

The following cleaning intervals are recommended depending on the type of fuel:

- Gas-fired boilers: once a year.
- Diesel oil-fired boilers: twice a year.
- Fuel oil boilers: every 300 hours of operation.

In any case, local standards regarding maintenance must be respected.

During routine maintenance operations, the tube bundle and furnace must be brushed.

Remove deposits built up in the flue gas casing by opening the inspection doors.

For more energetic actions, remove the rear smoke chamber and replace the flue gas gasket if worn. Check that the condensation discharge is not obstructed.

Check that the control and measurement devices serving the generator work properly. On this occasion, the amount of recirculation water used must be detected. After having analysed the water, perform preventive descaling.

Calcium and magnesium salts dissolved in the water with repeated top ups give rise to deposits in the boiler and cause the sheet-metal to overheat, with possible damage which cannot be attributed to the materials or manufacturing, and therefore is not covered by warranty.

After having performed maintenance and cleaning operations and subsequent ignition, check the seals of the door and of the smoke chamber. If any combustion products leak, replace the relative gaskets.

The operations carried out must be written in the boiler room booklet.

Extraordinary maintenance

Extraordinary maintenance at end of season or for long idle periods.

All the operations described in the previous chapter must be carried out, plus:

- After cleaning the flue gas circuit, pass a rag soaked with a solution diluted with caustic soda. After leaving it to dry, re-pass all the surfaces with a rag soaked in oil.
- It is recommended to place hygroscopic substances inside the furnace (quick lime, silicon gel in small containers) and to close it hermetically so that no air enters.
- Do not empty the system and the boiler.
- Protect screws, nuts and pins of the door with graphite grease.

The operations carried out must be written in the boiler room booklet.

Inspection and maintenance instructions



To assure long-term functioning of your appliance and to avoid altering its approved status, only original Unical spare parts must be used.

Before proceeding with maintenance, always perform the following operations:

- Disconnect the electric mains switch.
- Isolate the appliance from the electric mains by means of an isolated device with a contact opening of at least 3 mm (e.g. safety devices or power switches) and make sure that it cannot be re-connected accidentally.
- Close the gas shut-off valve upstream the boiler (where present).
- Close any shut-off valves on the heating flow and return pipes.

After having completed all maintenance work, always perform the following operations:

- Open the heating flow and return pipes.
- If necessary, restore the heating system pressure until it reaches the static pressure relative to the highest point of the system.
- Open the gas shut-off valve (where present).
- Reconnect the appliance to the electric mains and engage the switch.
- Check tightness of the appliance on the gas side (where present) and on the water side.
- Vent the heating system and restore pressure if necessary.

Should you decide to temporarily deactivate the boiler, you must:

- a) intercept the supplies: electric, water and fuel;
- b) empty the water system if antifreeze is not used.

Boiler body maintenance



Danger!
Before performing any maintenance, make sure the boiler and its components have cooled down.

Disconnect the boiler from the electric mains and shut the gas supply (if any) to the appliance.



Attention!
Before cleaning the boiler body, protect the panel board against any water sprays.

Once a year, at the end of the heating season, the boiler must receive a general cleaning.

Before performing any maintenance, make sure that all the precautions referred to in the previous point have been taken.

To proceed with maintenance you must:

- disconnect power by acting on the main switch;
- remove the burner, which could be overhauled at the same time;
- open the furnace door to access the combustion chamber;
- remove the smoke chamber access door;
- brush the smoke ducts energetically to remove any trace of filth.

Check condition of gaskets and insulation fibres



The insulation fibre of the door can show cracks after a short time of operation; this however does not reduce its insulation capacity nor jeopardise its lifespan. Check the condition of the seal gasket which must not show signs of deterioration; if so, it must be replaced, using only original spare parts.

Check the condition of the smoke chamber inspection cover gasket.

Replace it if worn, using only original spare parts.

Maintenance of burner

Burner maintenance must be carried out by personnel authorised by its manufacturer (or else the warranty shall be terminated).

Checking ignition electrode

Burner maintenance must be carried out by personnel authorised by its manufacturer (or else the warranty shall be terminated).

TROUBLESHOOTING

The following are the most common causes of faults and their solutions.

FAULT: The burner does not switch on.	SOLUTIONS: <ul style="list-style-type: none">- check the electrical connections;- check the regular flow of fuel;- check that the fuel feeding system is intact and clean, and that it is deaerated;- check that ignition sparks are performed regularly and operation of the burner appliance;- check triggering of the boiler safety thermostat with manual rearming;- check calibration of the adjustment thermostat.
FAULT: The burner switches on regularly but shuts down immediately.	SOLUTIONS: <ul style="list-style-type: none">- check flame detection, air calibration and operation of the burner appliance.
FAULT: Difficulty in adjusting the burner and/or lack of efficiency.	SOLUTIONS: <ul style="list-style-type: none">- check that the burner, boiler, boiler/chimney duct and chimney are clean;- check sealing of the flue gas circuit (inspection doors, burner plate, flue gas casing, boiler/chimney fitting);- check the regular flow of fuel and the real output supplied by the burner;- check for any scales and perform a chemical wash.
FAULT: The burner is easily soiled with soot.	SOLUTIONS: <ul style="list-style-type: none">- check burner adjustment (flue gas analysis);- check the amount of fuel;- check clogging of the chimney and cleanliness of the burner air path (dust).
FAULT: Smell of gas and/or unburnt products.	SOLUTIONS: <ul style="list-style-type: none">- check sealing of the fuel supply system (if gas);- check sealing of the flue gas circuit (inspection doors, burner plate, flue gas casing, boiler/chimney fitting);- check that the rubber holder on the flame warning light is connected to the air socket of the burner or if it is plugged.
FAULT: The boiler does not reach operating temperature.	SOLUTIONS: <ul style="list-style-type: none">- check that the flue gas side and water side of the boiler are clean;- check coupling, adjustment and efficiency of the burner;- check the temperature set on the thermostats and their correct operation;- check positioning of the thermostat probes;- make sure that the boiler has sufficient output for the system.
FAULT: The boiler is at operating temperature but the heating system is cool.	SOLUTIONS: <ul style="list-style-type: none">- check that the system is deaerated;- check that the circulation pumps work properly.
FAULT: The safety thermostat triggers.	SOLUTIONS: <ul style="list-style-type: none">- check that electric wiring is correct;- check positioning of the thermostat probes;- check the calibration of the thermostats and their correct operation.
FAULT: The boiler safety valve triggers.	SOLUTIONS: <ul style="list-style-type: none">- check the pre-load pressure of the system;- check that the expansion vessel is sized correctly;- check that the safety pressure valves are calibrated correctly.
FAULT: Overheating of members due to lack of water in boiler.	SOLUTIONS: <ul style="list-style-type: none">- switch off the burner, do not introduce water or open the inspection doors and wait for return to room temperature before performing any operation.
FAULT: Water on floor near flue gas casing (condensation).	SOLUTIONS: <ul style="list-style-type: none">- check the correct positioning of the probes, correct operation and calibration of the boiler adjustment thermostat (minimum 60°C);- check that the exhaust in the flue gas casing is connected to a collection recipient;- check that the anti-condensation pump (if present) works correctly and is properly adjusted;- check that the water temperature returning from the system is no less than 50 °C.

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