ARCA caldaie

ASPIRO

Installation
Operation
Maintenance

www.arcacaldaie.com

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1. GENERAL WARNINGS

The instruction manual is an integral part of the product and is shipped along with it to the customer. Carefully read any warning reported in this manual because they provide important informations concerning safe operation, correct installation and use. Carefully store in a safe place this manual for any future needing.

The installation must be carried out only by qualified personnel or by an authorized ARCA technical center following the producer's recommendations and guidelines. A wrong installation may cause harm to people, animals and objects being ARCA not liable for them.

Control for product integrity In case of doubt don't use the product and address to your vendor. The packing components must not be thrown away in the surrounding environment or left to the reach of children.

Before performing any changing or maintenance or cleaning operation on the system, turn off the boiler using the main external switch.

In case of boiler fault, turn it off without performing any attempt to repair it by yourself. Address only to qualified personnel. Any repair must be performed by an authorized technical center only, using only original spare parts.

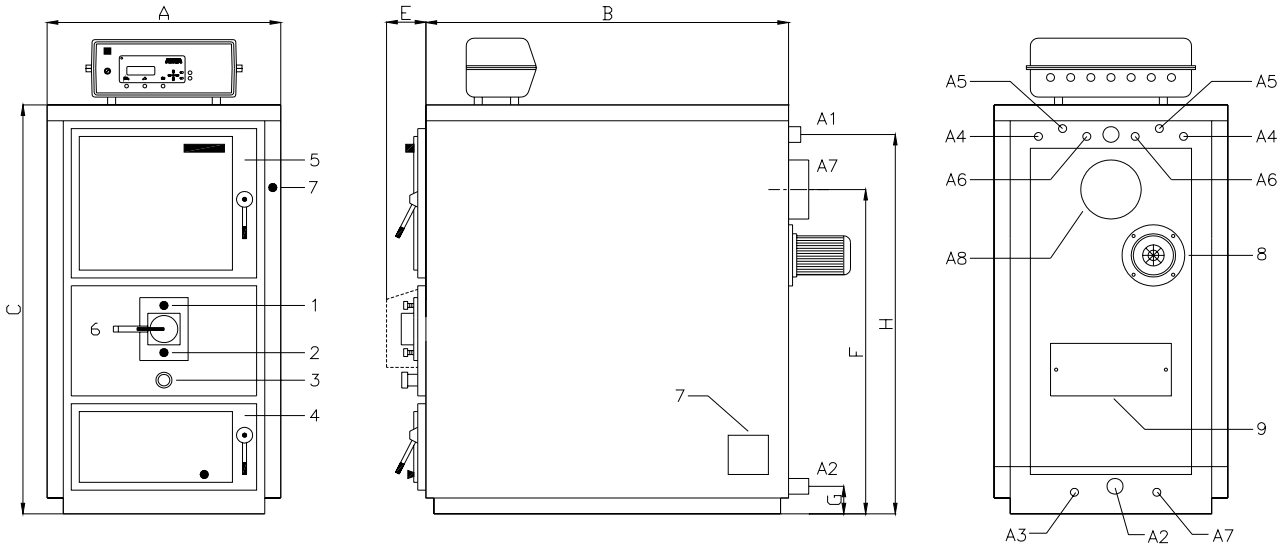
We take no responsibility for any damage which could result from wrong installation or use or from being not respected the instructions and recommendations given in this manual.

Not respecting the instructions and guidelines of this manual may compromit the security level of the whole system or of its components, causing danger for the customer, for which we take no responsibility.

WARNING !

The first firing and the final test of the boiler must be performed by an authorized technical center only.

2. TECHNICAL CHARACTERISTICS AND OVERALL DIMENSIONS



Key:

1	Primary air stream adjusting	**A1**	Heating circuit delivery
2	Secondary air stream adjusting	**A2**	Heating circuit return
3	Flame control bull's eye	**A3**	Boiler water descharging
4	Bottom door (combustion chamber)	**A4**	Sanitary hot water heat exchanger connections (only SA version)
5	Upper door (wood chamber)	**A5**	Security heat exchanger connections
6	Combustion air modulator	**A6**	Temperature probes receptacles (S4)
7	Anti deflagration door	**A7**	Temperature probe receptacle (S5)
8	Fan motor	**A8**	Smoke outlet
9	Smoke chamber inspection door		

Model	Minimum rated power kcal/h kW	Max. rated power kcal/h kW	Max. power to the burner kcal/h kW	Boiler weight kg	Boiler Water content liters	Insertion losses water side m water column	Insertion losses smoke side Mm water column	Max rated pressure bar	Comb. chamber volume liters	Wood chamber opening size mm	Maximum wood logs length cm
A 29 R/SA	14,000 16	26,000 30	29,500 34	380	95	0.10:	0,3	4	95	290 × 330	53
A 34 R/SA	20,000 23	25,000 29	29,600 34.5	470	115	0.08	0,4	4	135	340 × 430	53
A 43 R/SA	23,000 27	35,000 41	43,000 50	470	115	0,08	0,4	4	135	340 × 430	53
A 52 R/SA	28,000 33	42,000 49	52,000 60	555	135	0.10:	0,6	4	185	340 × 430	68
A 70 R/SA	38.000 44	59000 69	70.000 81	685	170	0,05	0,3	4	230	340X520	74
A 90 R/SA	52000 60	72000 84	90.000 105	920	215	0,10	0,5	4	320	340X520	105

Model	A mm	B mm	C mm	D mm	E mm	F mm	G mm	H mm	A1 A2 ø	A3 ø	A4 ø	A5 ø	A6 A7 ø	A8 ø
A 29 R/SA	550	850	1,200	190	150	980	80	1130	1"¼	½"	½"	½"	½"	180
A 34 R/SA	650	850	1,300	190	150	1,080	80	1220	1"½	½"	½"	½"	½"	180
A 43 R/SA	650	850	1.300	190	150	1.080	80	1220	1"½	½"	½"	½"	½"	180
A 52 R/SA	650	1.030.	1,300	190	150	1,080	80	1220	1"½	½"	½"	½"	½"	180
A 70 R/SA	760	1.120	1.425	190	150	1,070	100	1340	2"	½"	½"	½"	¾"	220
A90 R/SA	760	1.370	1.425	190	150	1,070	100	1340	2"	½"	½"	½"	¾"	220

3. GASIFICATION TECHNOLOGY

Boiler ASPIRO operation is based upon the gasification technology applied to wood. The solid fuel, stored in the upper collection chamber in contact with hot ashes in its bottom part, on the burner's grate, releases combustible gazes which may be fired when mixed with the main air stream. This flammable compound is sucked through the slot existing in the bottom part of the wood collection chamber, where it will light producing the characteristic *"reverse flame".*
The gasification principle, not allowing wood to burn directly as in any other classic arrangement but using instead the gazes released under high temperature conditions, allows a complete burning of the fuel which permits to get high thermal yield and a very low level of harmful emissions in the smoke released outside.
The boiler ASPIRO has been designed to limit to the maximum possible level the harmful action of the acid condensate. The burner chamber has a 8 mm thickness walls and has no welding in its upper part; furthermore, the rear and front walls are protected by a refractory cement layer and they are not in touch with water (dry walls).

4. MAIN BOILER COMPONENTS

4.1. WOOD COLLECTION CHAMBER

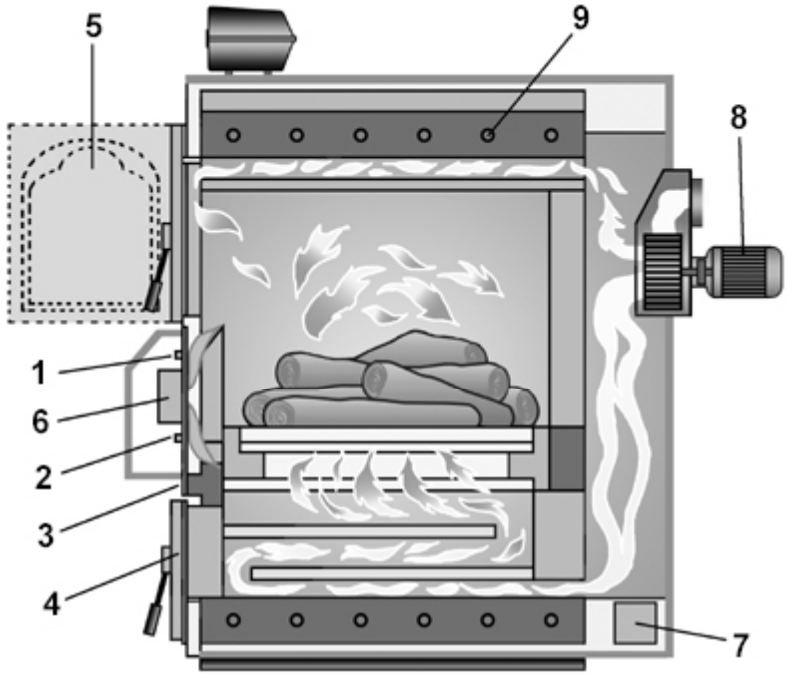
It is the *fuel "tank"* of the boiler. In this chamber, located in the boiler upper part, the wood logs are charged after being succesfully performed the ignition procedure, getting a first layer of hot ashes.

4.2. MAIN BURNER REFRACTORY CEMENT FRAME AND BARS

In the middle part of the boiler, between the fuel chamber and the bottom part where the heat exchange takes place, is located the burner, built with a special designed refractory cement frame with a slot in its central part and a grate. The grate is formed by single elements (the "bars"), realized in chrome cast iron, which support the ashes while letting the released gazes passing through downward.

4.3. HEAT EXCHANGE AREA AND CATALYST ELEMENTS

The gazes released by wood, after being passed through the cast iron bars, light producing a bluish vertical reverse flame which touches a special shaped chrome cast iron cylinder called "the catalyst".
The flame, passing through this cast iron element which reaches a very high temperature, will have completely burnt the main part of its residual carbon particles which were not burnt before. The combustion gazes, flowing through the heat exchanging zone, warm up the water.



Key:

1 Primary air stream adjusting
2 Secondary air stream adjusting
3 Flame control bull's eye
4 Bottom door (combustion chamber)
5 Upper door (wood chamber)
6 Combustion air modulator
7 Anti deflagration door
8 Fan motor
9 Hot sanitary water heat exchanger (SA versions only)

4.4. SMOKE DRAFTING PASS-THROUGH CHAMBER AND FAN

The gazes resulting from the combustion process, after being released their heat charge to the water, are collected in the smoke pass-through chamber located in the rear part of the boiler. In the smoke chamber has place the drafting fan with horizontal axle arrangement, realized with an electric motor and the impeller. The fan is easy to be maintained being fixed with wing nuts.

4.5. AIR DISTRIBUTION ASSEMBLY

In the front part of the boiler, in the middle between the upper and the bottom door, is located the combustion air suction port. The immission duct has an internal gravitational closing door which closes the air passage when the drafting fan stops, and another temperature commanded external closing.
The air entering in the air chamber is then divided in primary and secondary air stream. The main air stream enters the wood collecting chamber and creates the combustible mixture which is fired after passing through the cast iron grate. The secondary air stream flows through some internal ducts realized in the refractory cement layer thickness encountering the wood gazes in the burner central slot, where starts the flame, optimizing the combustion process.

4.6. HOT SANITARY WATER HEAT EXCHANGER

The ASPIRO boiler may be equipped with an internal real time heat exchanger for hot sanitary water production purposes (SA models only). The heat exchanger is realized with a copper pipe coil plunged in the heating circuit water gap, around the boiler main body, with the hidraulic connections in the rear part of the boiler.

4.7. EMERGENCY HEAT EXCHANGER

The boiler is equipped with a security heat exchanger. Its function is to let the boiler cooling down in the evenience of reaching excessive temperature by the mean of a heat relief valve connected to the security exchanger (refer to paragraph 5.5). This is realized by a steel pipe coil with its hidraulic connections in the rear part of the boiler (connections “A5”). The temperature sensor of the heat relief valve is to be positioned on the A6 connection.

4.8. PROBES RECEPTACLES

In the rear part of the boiler are two holes (A6) both with a ½” pipe coupling having the following function:

- to fit the copper receptacle for installing the thermostatic sensors used by the electronic control board;
- to fit another copper receptacle for other temperature sensing device.

4.9. BYPASS PUMP

With the aim to reduce any condensation in the boiler it is mandatory to install a bypass pump . The bypass pump must be connected between the delivery connection (A1) and the return connection (A2) with water flux direction upward. Our company may deliver the whole bypass kit, complete with bypass pump, pipes and fittings.

4.10. INSULATION

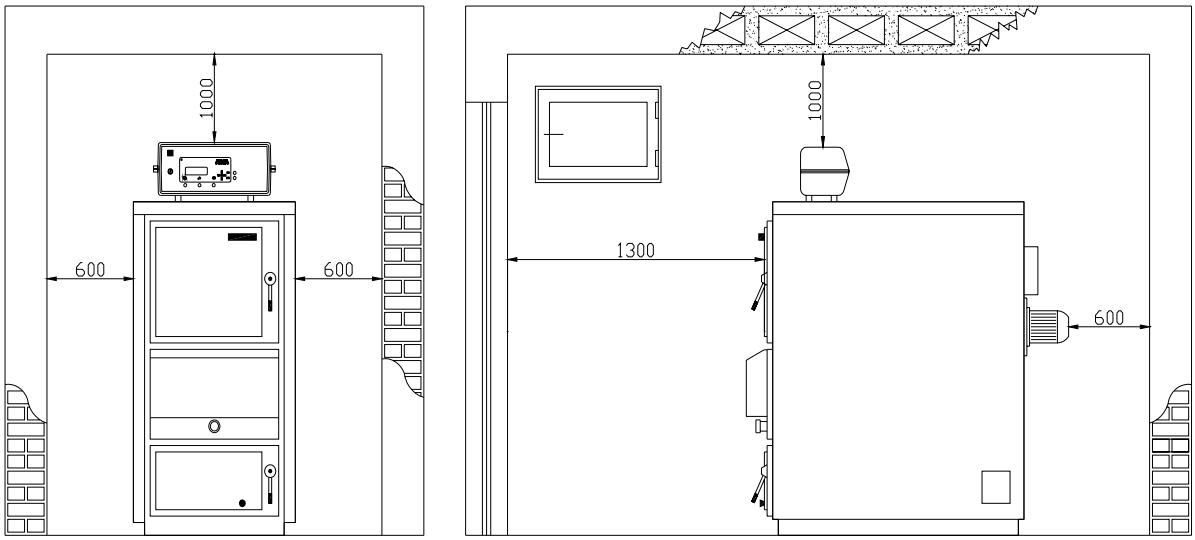
Insulation of ASPIRO boiler is obtained using a 60 mm thickness mineral fiber layer in touch with the boiler body which is covered by the external boiler housing, realized by sheet metal panels painted with epoxy powder paint.

5. INSTALLATION

The ASPIRO boiler does not feature any difference from an ordinary solid fuel boiler; therefore, no other installation prescriptions than what stated by the regulations in force is applicable. The installation room has to be equipped with venting openings having a total surface not less than 0,5 m^2. In order to make simpler smoke passages cleaning, a free space not less than boiler depth must be leaved in front of it and the boiler door must be free to open at least 90°.
The boiler can be put directly in touch with the floor, because is equipped with a self-bearing chassis. Anyway, if the floor is very wet, it is better to build a concrete platform where to position the boiler on. After positioning, the boiler must be in horizontal and stable position in order to reduce vibrations and noise.

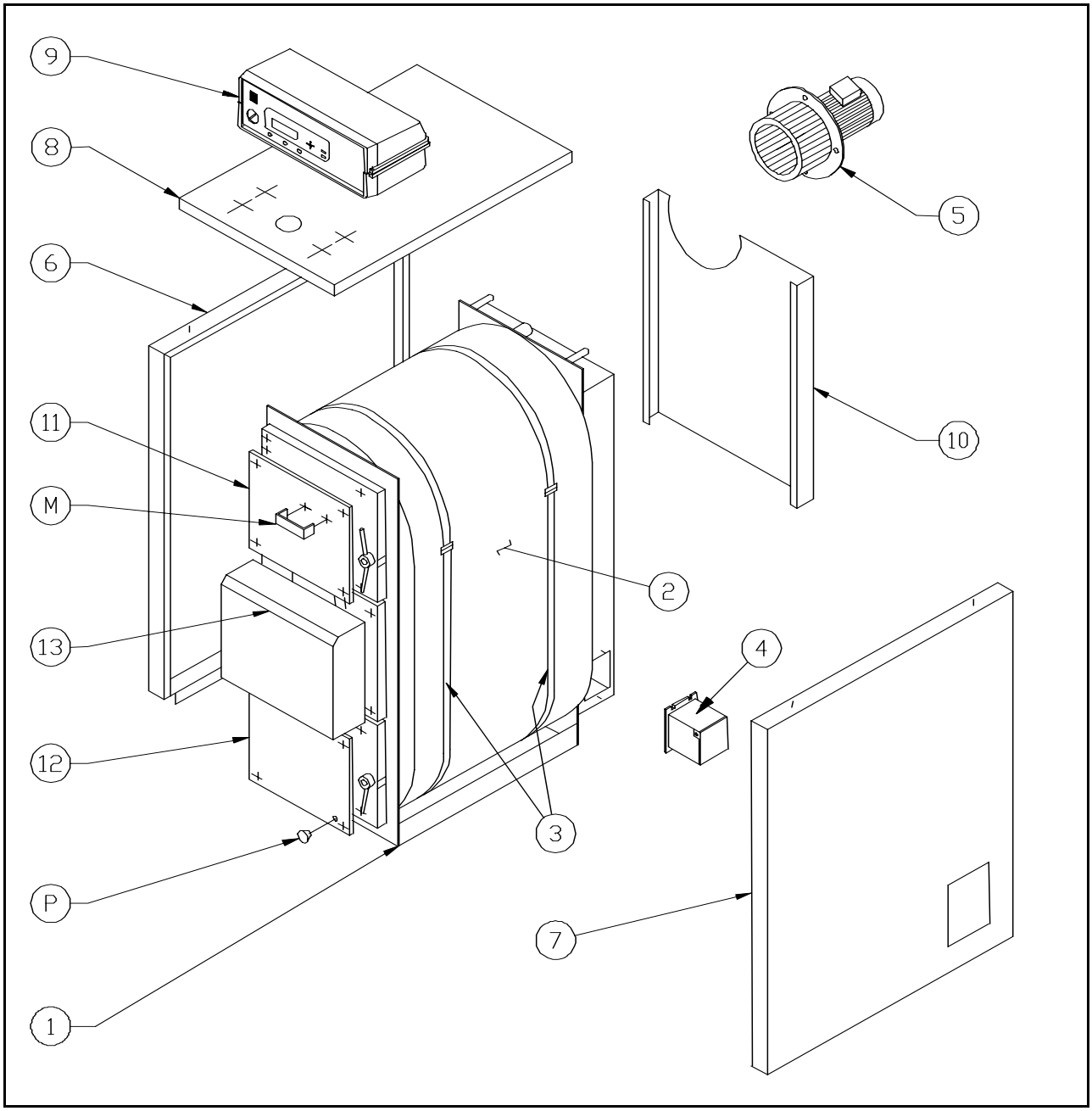
5.1. INSTALLATION IN A BOILER ROOM

The ASPIRO boilers must be installed only in rooms having the characteristics stated by the rules and regulations in force regarding boilers installation rooms (please contact the fire department to get more details).
The distances for the correct positioning of the boiler in the installation room are as follows:



5.2. EXTERNAL HOUSING MOUNTING

- Install the boiler **1** in its installation room and complete the hidraulic connections.
- Put the mineral fibre insulation layer all around the boiler body **2** fixing it with the metal bands **3**.
- Fix the antideflagration doors at the base of the smoke chamber tightening the screws **4**.
- Install the fan **5** in place in the smoke chamber fixing it with the wing nuts.
- Position in place the side parts **6** and **7**, being careful to correctly insert their upper bends in the slots on the upper part of the front and rear boiler body plates, while inserting the lower bends in the internal side of the L shaped base frame.
- Put the upper part of the housing **8** over the side parts **6** and **7**, carefully inserting the studs on the side parts in the holes on the cover, then gently press down to have the studs retained by the cover holes springs
- Fix the electronic control panel **9** to the housing cover **8** straightening the thermostats capillary tubes and letting them pass under the external housing to the rear part of the boiler where they will have their bulbs fitted in the receptacles on the back of the boiler.
- Fit the back panel **10**, fixing it to the side parts studs **6** and **7** with the back panel retaining springs.
- Fit to the wood collecting chamber the protection panel **11**, with its handle **M** fixed.
- Fix the hood **13** on the middle door using the bayonet joints.
- Fix the protection panel **12** to the bottom door with its knob **P** mounted.



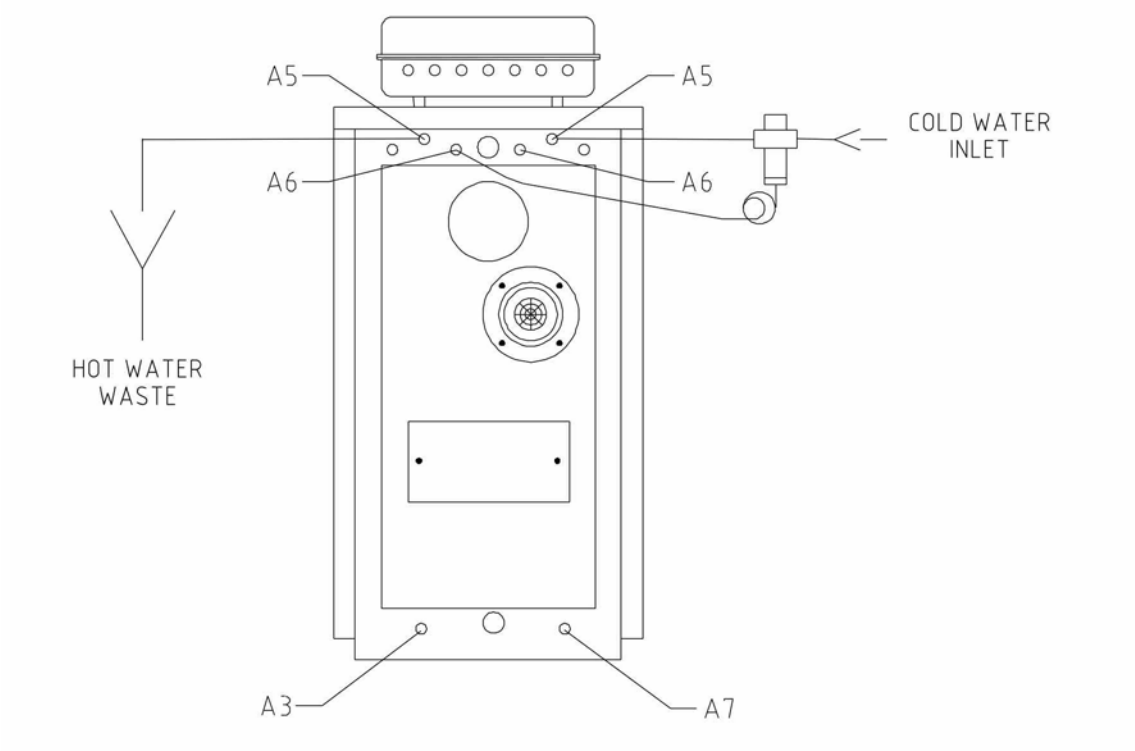
5.3. EXPANSION TANK

According to the regulations in force in Italy, any heating appliance with solid fuels must be equipped with open expansion tanks.

5.4. FLUE DUCT

The flue duct is very important for the proper operation of the boiler; it must be seal and thermal insulated. Old or new flue ducts, built without respecting the above prescriptions, can be reused introducing a metal duct in the interior. Another metal duct must be introduced in the interior of the existing flue duct filling the gap between the external surface of the inner duct and the internal surfaces of the old duct with insulating materials. Flue ducts realized with cement blocks must have any joint perfectly sealed to avoid the condensate sticking to the inner surfaces staining the external wall.
The construction of new flue ducts requires setting up a project satisfying any prescription required by the regulations in force.
In any case the flue duct must feature a good draft, at least 2 mm of water column depression at the base of the duct when cold. Lower draft values will cause the boiler cutting off completely during the stand by periods and tar and condensate will stick in the air inlet passages. On the other hand, too high draft values will cause high thermal inertia and poor fuel economy.
We recommend anyway the use of a draft adjusting device to keep a constant depression value in the duct, to avoid unwanted power raising.

5.5. THERMAL RELIEF VALVE CONNECTION



Key:

A3 Boiler water descharging

A5 EMERGENCY HEAT EXCHANGER

A6 Probes receptacles S4

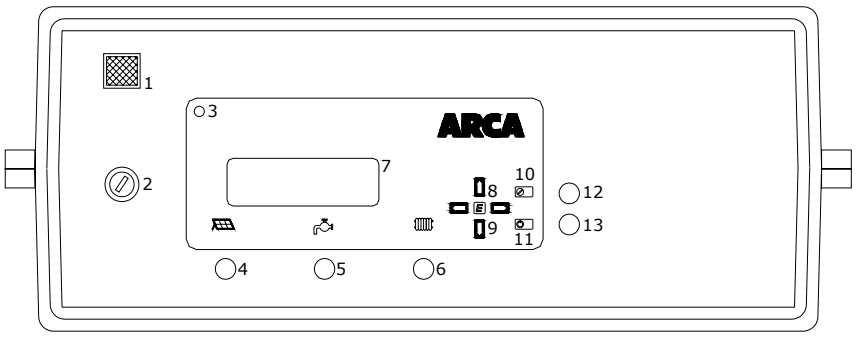
A7 Probe receptacles S5

- Connect the heatsink relief valve to one of the two A5 connections.
- Connect cold water supply to the heatsink relief valve.
- Connect the free A5 fitting (hot water waste) to an exhaust duct.
- Insert the heat relief valve temperature sensing bulb in the free A6 receptacle.

Note: the heatsink relief valve could be installed even on the waste hot water outlet, but this wouldn't add anything from the point of view of the overall operation security level of the boiler, and debris in the heat exchanger could plug or stick the relief valve.

6. ELECTRONIC PANEL, RELEASE 2007

The electronic panel equipped with the TERMODUE control board is designed to control all the wood fueled ARCA boilers.



Key:

1	Main switch (with green telltale)	8	Controls and functions keyboard
2	Security thermostat	9	“E” button for parameters and temperature settings
3	Reset button	10:	Automatic/Manual operation button
4	Green indicator; solar panels	11	Turn on/turn off boiler functions button
5	Yellow indicator: sanitary hot water production tank pump	12	Yellow indicator: bypass pump
6	Red indicator: system pump	13	Red indicator: fan
7	Control panel display	ACUSTIC WARNING: EXCESSIVE BOILER TEMPERATURE	

6.1. GENERAL CHARACTERISTICS

- Microprocessor controlled, equipped with EEPROM memory (in case of blackout, all settings return to the state they were before).
- Non volatile memory (the stored data will be retained for about 10 years without power).
- 4 rows liquid crystal display.
- Self diagnostic program to detect internal errors or wrong probes connections.

6.1.1. DEFAULT ENDOWMENT

- The electronic control board TERMODUE is equipped with a preprogrammed microprocessor for the whole range of wood fueled ARCA boilers.
- Basic endowment with 3 PTC insulated temperature probes.
- 230/12 V AC transformer (code TRA0002).
- Mechanical security thermostat with manual reset.

6.1.2. OPTIONAL ENDOWMENT

- Expansion board for multiple zones systems (SCH0005C), see paragraph 11 (page 30).

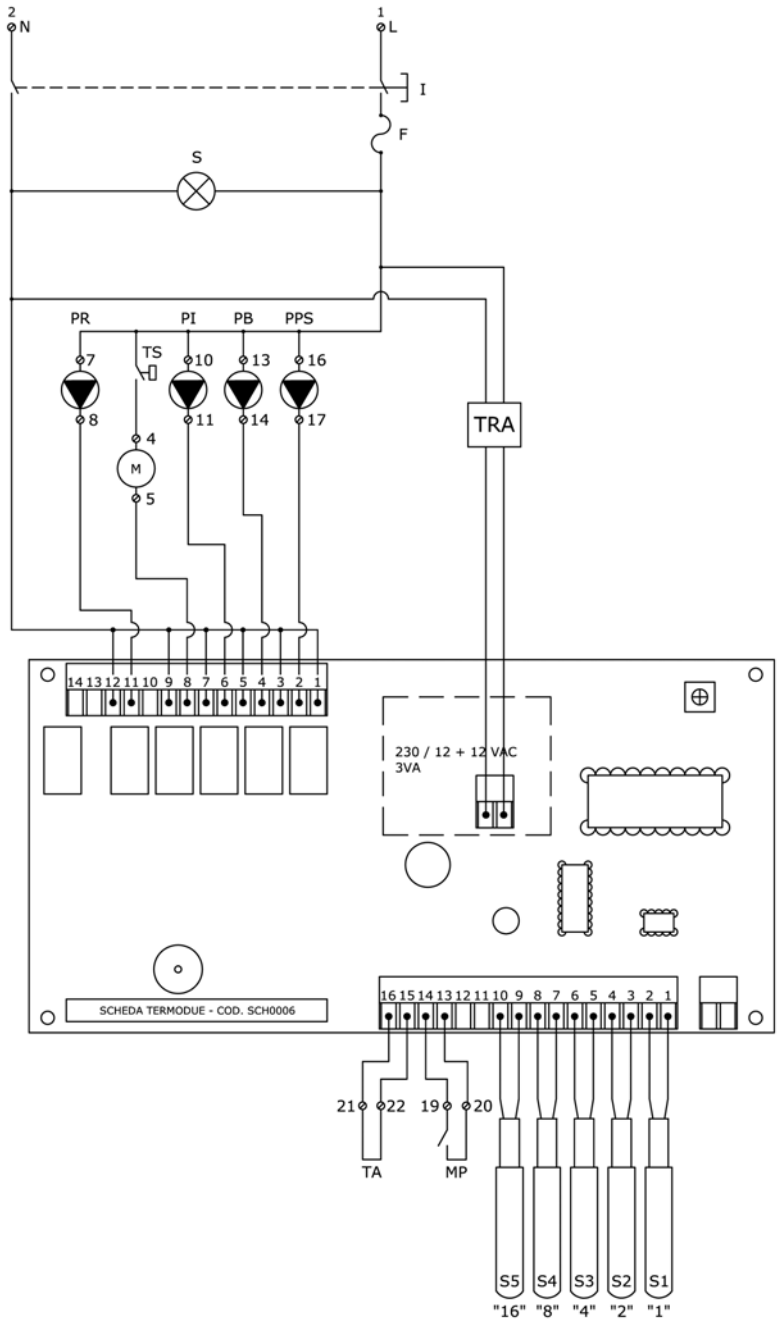
6.2. DISPLAY

(In the picture are shown the main boiler functions which can be displayed).
When the red button on the control panel is pressed (⏻) the boiler is turned ON and the drafting fan starts.

6.3. OPERATION MODES

The electronic board is designed to manage three different operation modes. Operation modes “HEATING ONLY”, “HEATING AND HOT SANITARY WATER PRODUCTION WITH SINGLE OR DOUBLE COIL HEAT EXCHANGER ARRANGEMENT”, “HEATING AND PUFFER TANK MANAGEMENT”. The parameters settings are specific to each operation mode of the boiler. PUFFER is a term which describes a heat accumulating device, as a relatively large tank.

6.4. SCHEMATIC DIAGRAM AND ELECTRONIC BOARD WIRING

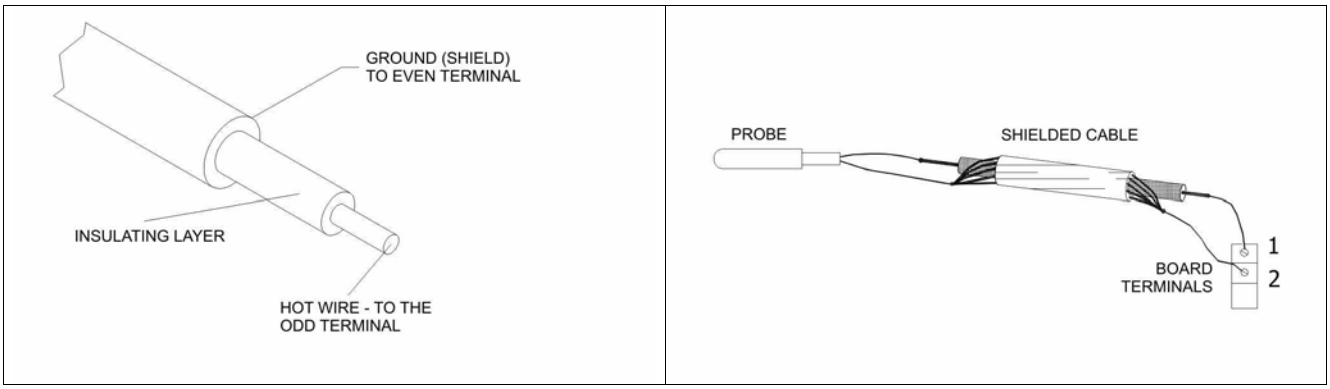


Key:

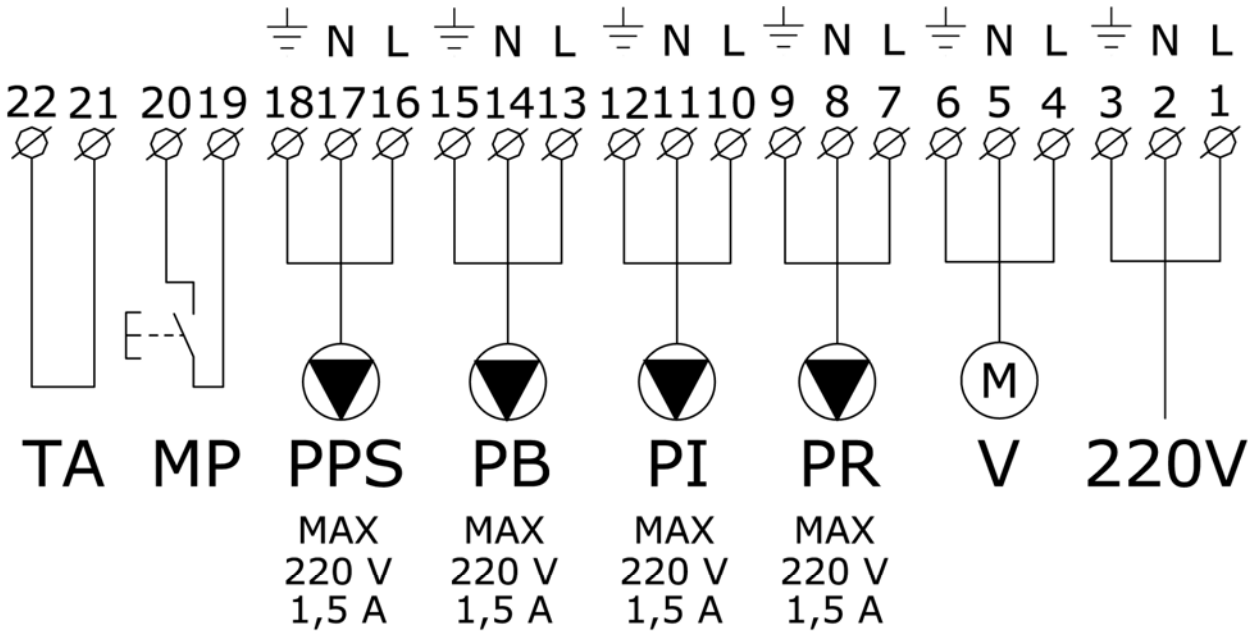
I	Main switch	**S1**	Solar panels temperature probe
S	Green telltale	**S2**	Puffer low temperature probe
TRA	220/12 V AC transformer	**S3**	Puffer high temperature probe
TA	Room thermostat	**S4**	Heating system delivery temperature probe
F	Fuse	**S5**	Heating system return temperature probe
MP	Door microswitch	**PR**	Bypass pump
PPS	Solar panels pump	**V**	Fan
PB	Puffer tank pump	**TS**	Security thermostat
PI	System pump		

6.5. PROBES CONNECTION

NOTE: to avoid erratic temperature displaying, if the probe connection cable is near to other power cables or longer than 3 mt, it is necessary to use shielded cable. The following drawings show how the hot terminal of each probe must be connected to the odd board terminal while the shield must be connected to the even board terminal. By this way a shielded connection is got, getting rid of any electrical noise.



6.6. BRACKET HARNESS WIRING



NOTE:
Terminals 21 and 22 are bridged to allow system pump operation if a room thermostat is not employed.

WARNING:
When a room thermostat is used, remove the wire bridge and control for a right connection to the room thermostat. If the system pump does not work, control for a faulty room thermostat.

7. TEMPERATURE DISPLAYING AND PARAMETERS CHANGING OR SETTING

Displaying procedure:

Step 1: You can browse the various options using the arrow buttons and on the panel.

Setting procedure:

Step 1: To enter the functional parameters setting procedure press and hold the button for about 15" until PROG> is displayed.

Step 2: When the next screen appears, the first parameter with its actual value will be shown.

Step 3: You can move through the various options using the arrow buttons and on the panel.

Step 4: With the parameter whose value is intended to be changed displayed, use the arrow button to change the value; the parameter starts blinking. Using the buttons and the parameter value is changed. As soon as the parameter will reach the requested value, it can be stored pressing the arrow.

Step 5: To have other parameters changed you can browse them using the directional arrows and on the panel.

Step 6: After being finished with parameters setting or modifying, in order to have them transferred on the board non volatile memory press button for about 10-15".

7.1. PROBES ENABLING AND DISABLING (FUNCTION PARAMETER #1)

To have each probe ON or OFF the parameter “Function parameter #1” must have a numeric value which is the result of the weighted sum of all the probes:

S1 (solar panels circuit delivery temperature)	1
S2 (heat exchanger low temperature)	2
S3 (heat exchanger temperature)	4
S4 (system delivery temperature)	8
S5 (system return temperature)	16

The number is obtained by adding the weights of the required probes for the operation mode choosen by the next parameter “Function parameter #2”.

Function parameter #1 setting example

For example, if the boiler is intended to work in **heating only mode,** refer to schematic diagrams 8.3.1, 8.3.2, 8.3.3., must be present the two probes S4 and S5. Therefore the values 8 and 16 are added = 24. Setting the value 24 the two required probes are abled.

Note:
In the evenience of problems during a probe installation, better you will have the two terminals on the board for that probe wire bridged to avoid the warning message of missing or faulty probe being displayed.

7.2. BOILER AND ACCESORIES SETTINGS (FUNCTION PARAMETER #2)

This parameter sets the electronic board for each of the three different operation modes ("HEATING ONLY", "HEATING AND HOT SANITARY WATER PRODUCTION WITH SINGLE OR DOUBLE COIL HEAT EXCHANGE ARRANGEMENT", "HEATING AND PUFFER TANK MANAGEMENT"). The functional settings follow the same logic of the "Function parameter #1". To calculate the required value you will add the weighted values assigned to each function in the following way:

Functional settings:

Without SOLAR PANELS ⟶ set "**0**
With SOLAR PANELS ⟶ set "**1**"

With BYPASS PUMP ⟶ set "**0**"
Without BYPASS PUMP ⟶ set "**2**"

Without external hot sanitary water tank ⟶ set "**0**"
With external hot sanitary water tank ⟶ set "**4**"

External tank, type with heat exchanger coil set "**0**" ⟶
External tank, type PUFFER or PUFFER COMBO ⟶ set "**8**"

WARNING:
to set a Puffer or Puffer combo type tank add 8, but must also be added the value 4 for the external tank setting up. In this example, you will have to introduce the value 12.

Function parameter #2 setting example

If setting up an external coil type hot water production tank is required, along with solar panels and the bypass feature, the following calculation will be performed:

Parameter value Function 2 = **1** (with solar panels) + **0** (bypass feature present) + **4** (external hot water tank) + **0** (coil type tank) Total = **5**.

7.3. DISPLAY LANGUAGE SELECTION.

Parameter #12 selects the display language.
4 languages are available:
Value 00: italian
Value 02 : romanian
Value 04 : french
Value 06 : spanish

8. "HEATING ONLY" OPERATION

To connect the boiler in heating only mode refer to connection diagrams 8.3.1 - 8.3.2 - 8.3.3. controls the system pump and the bypass pump The required probes are S4 (system delivery high point probe) and S5 (system return low point probe). These settings are valid even for models SA with real time hot sanitary water production heat exchanger.

To have the boiler turned ON and to start the "timed operation cycle" must be pressed the red button on the control panel (); the drafting fan is started and the display changes from OFF (standby) to ON. The fan remains ON until the water temperature reaches the value set by the parameter "Boiler working temperature".

NOTE: it is important to remember that any time the button () is pressed, the timing options and the options related to the operation mode AUT (Automatic) or MAN (Manual) are stored on a non volatile memory. In the case of black-out, the boiler will start from the point where it was at that moment.
The system pump is controlled by the room thermostat, but only if the boiler water temperature is more than the value set by the parameter "Minimum boiler temperature" and "Temperature difference in heating mode". If the boiler does not reach the temperature required during its ON timed cycle, will pass to the standby mode.

The bypass function avoid water temperature stratification between its highest and lowest points. The parameter "Maximum boiler body temperature differential" turns ON the bypass pump if the temperature difference between the high and the low point of the boiler is more than the preset value. The bypass circuit is always ON both in standby and in "Timed operation cycle" at any temperature.

8.1 BOILER PARAMETERS SETTING “HEATING ONLY MODE”

FUNCTIONAL PARAMETERS

Parameter description		Recommended values
0	Boiler operating temperature	80°C
1	Boiler minimum temperature	65°C
2	Maximum boiler temperature in thermal inertial phase	88°C
3	Minimum hot water tank temperature	45°C
4	Maximum hot water tank temperature	65°C
5	Temperature differential in heating mode	2.0°C
6	Temperature differential in hot water preparing mode	3.0°C
7	Temperature difference in solar panel heating mode	5.0°C
8	Maximum boiler body temperature difference	4.0°C
9	Boiler standby delay	50 min.
10:	Function parameter #1: Probes activation and deactivation.	**24** (heating only)
11	Function parameter #2: Boiler and accessories setting.	**0** (heating only)
12	Language selection	00 (italian)

Modifying these parameters or wrong values may cause boiler malfunctions and in consequence problems on the whole system. We recommend to have the boiler fired for the first time only by technical skilled personnel or by an authorized service center.

8.2. PARAMETERS SETTINGS “HEATING ONLY OPERATION”

0. **Working boiler temperature**: it means the temperature at which the boiler will enter the standby mode. When the set temperature is reached, the electronic control turns OFF the fan. The fan will be started again when the water temperature falls under the “temperature difference in heating mode” (usually 2 °C) plus another hysteresis degree.
   Example: “Working boiler temperature”= 80°C - (2+1)= 77°C; therefore, when the system pump or the hot water tank pump are stopped, if the boiler temperature falls down under 77 °C and the temperature of 80 °C won't be reached within the time set in the parameter “Standby delay time”, the boiler will enter back the standby mode.

1. **Minimum boiler temperature**: The minimum boiler temperature is that value under which the pumps are stopped to avoid condensation issues. In the same time, if the boiler remains under this temperature for the time “Standby delay time”, the boiler gets back in standby mode.

2. **Maximum allowed temperature in thermal inertial mode**: The maximum temperature allowed for the boiler; if the temperature is more than this, the boiler will stop producing an ALARM sound. In this case the electronic control board starts the system pump and the bypass pump to dissipate the exceeding heat. If the temperature reaches 104 °C the manual reset security thermostat opens the supply circuit to the fan stopping it until it won’t be rearmed.
   NOTE: if the boiler temperature reaches frequently its maximum allowed value, check for a good closing of the round air port door (not more than 2 mm air passage) when the boiler reaches its working temperature, or for poor doors seal or for damaged doors gaskets.

3. **Minimum hot water tank temperature**: not used in this operation mode.

4. **Maximum hot water tank temperature**: not used in this operation mode.

5. **Temperature differential in heating mode**: Sets the system pump on/off hysteresis. If the minimum boiler temperature is 60 °C and the differential is set to 2 °C, when the room thermostat calls for heat (contacts 21-22 closed), the system pump starts at 62°C and stops at 61°C (hysteresis on all parameters). Furthermore, the same parameter sets the drafting fan on/off temperature differential (see parameter “Working boiler temperature”).

6. **Hot water preparing temperature differential**: not used in this operation mode.

7. **Solar panels heating temperature differential**: not used in this operation mode.

8. **Boiler body maximum temperature differential**: If the system delivery temperature is more than that of return by a difference more than the value set by this parameter, the bypass pump will be started to balance the temperature difference between the boiler highest and lowest point.

9. **Standby delay time**: Sets the "timed operation cycle" when the boiler is operative. The cycle activation is performed pressing the button ( ); the drafting fan starts. If the boiler temperature falls down under the value “Minimum boiler temperature” (usually 60 °C), the boiler has the time set by this parameter (usually 50’) to rise its temperature back above the said value, otherwise it will enter the standby mode.

10. **Function parameter #1 (probes activation/deactivation)**: See probes activation procedure description (page16).

11. **Function parameter #2 (optional setting):** See optional settings description (page17).

12. **Display language selection:** See display language selection description (page17).

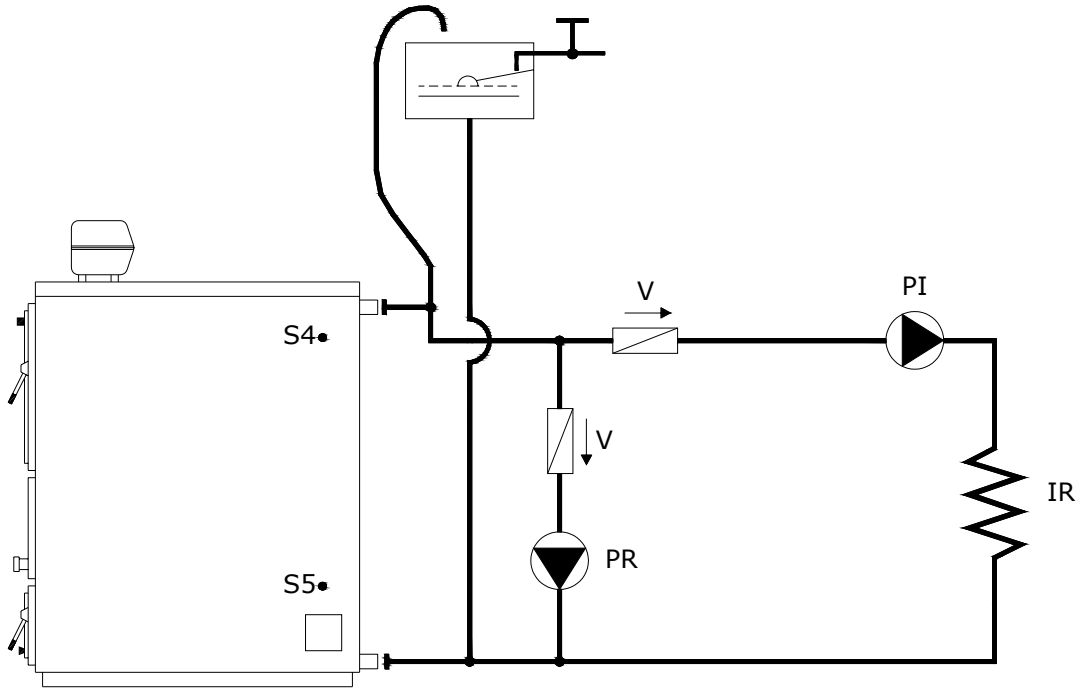
8.3. HYDRAULIC SCHEMATIC DIAGRAMS

All the schematic diagrams in this manual are given as reference only, and they must be validated by authorized engineers. The company ARCA s.r.l. takes no responsibility for any harm to objects, persons and animals caused by a wrong system project. For any other schematic diagram you may need, feel free to contact ARCA technical department. Putting in service heating systems realized differently from what recommended in this manual, or otherwise not authorized, will cause void of warranty.

Note:
The correct operation of the boiler requires the bypass pump to avoid harmful water temperature stratifications.

The absence of the bypass pump will void the warranty.

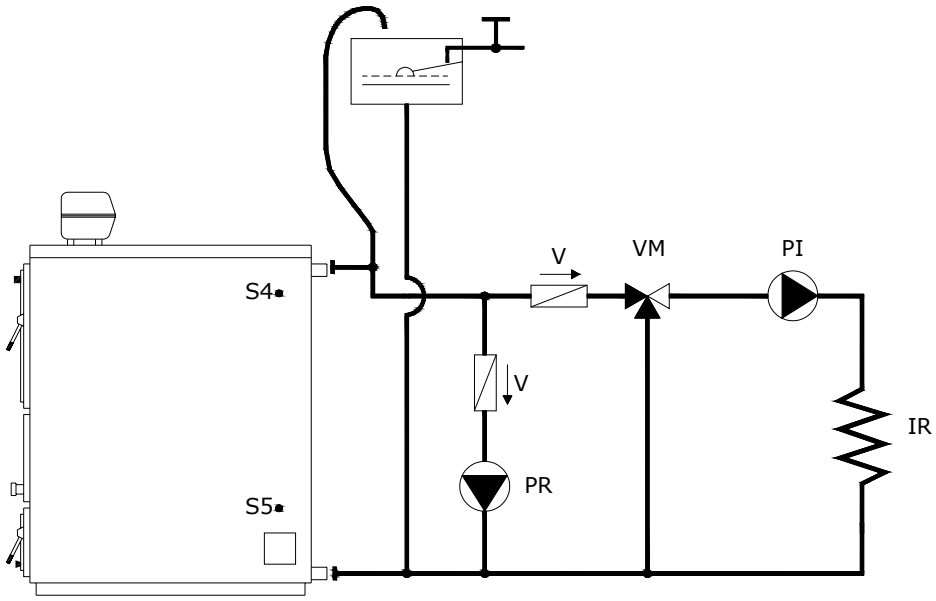
8.3.1. GENERAL CONNECTION DIAGRAM FOR HEATING ONLY OPERATION WITH OPEN EXPANSION TANK



Key:

PI	System pump	**V**	Non return valve
PR	Bypass pump	**S4**	Heating system delivery temperature probe
IR	Heating system	**S5**	Heating system return temperature probe

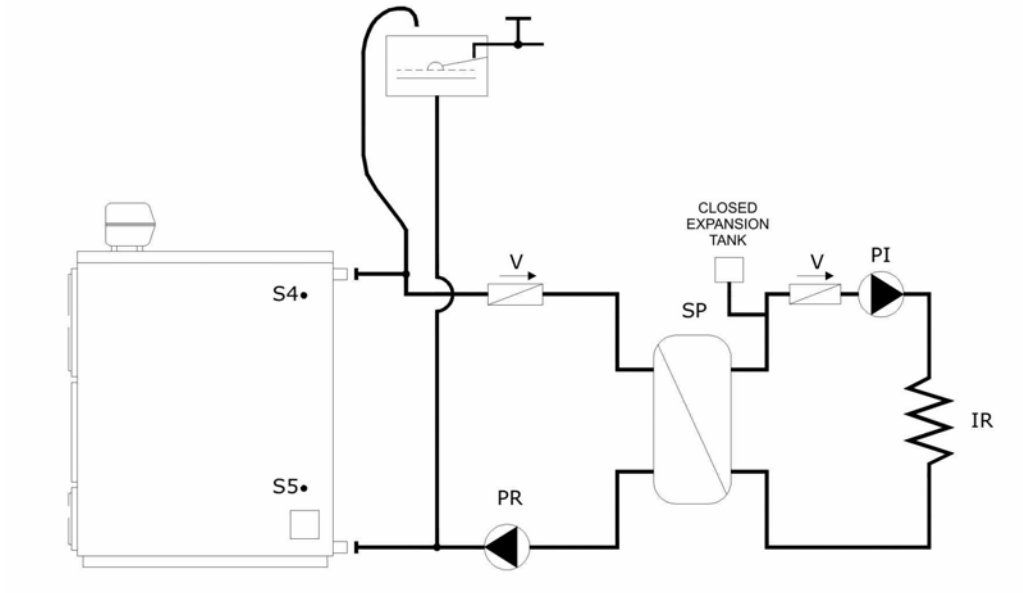
8.3.2. GENERAL CONNECTION DIAGRAM FOR HEATING ONLY OPERATION WITH MIXING VALVE



Key:

PI	System pump	**VM**	Mixing valve
PR	Bypass pump	**S4**	Heating system delivery temperature probe
IR	Heating system	**S5**	Heating system return temperature probe
V	Non return valve		

8.3.3. GENERAL CONNECTION DIAGRAM FOR HEATING ONLY OPERATION WITH OPEN EXPANSION TANK/CLOSED EXPANSION TANK



Key:

PI	System pump	**V**	Non return valve
PR	Bypass pump	**S4**	Heating system delivery temperature probe
IR	Heating system	**S5**	Heating system return temperature probe
SP	Plate heat exchanger		

9. HEATING AND HOT WATER PRODUCTION WITH INTERNAL HEAT EXCHANGER

The boiler, when used in combo mode (heating and hot sanitary water production) with an external coil type hot water tank, will follow the general schematic diagrams 9.3.1. – 9.3.2. and all the pumps (system pump, external tank pump, bypass pump and solar panels circuit pump) will be automatically controlled. The required temperature probes are: solar panels probe (S1), solar tank heat exchanger low point probe (S2), solar tank heat exchanger low point probe (S3), heating system boiler delivery probe (S4) and heating system boiler return probe (S5).

To have the boiler turned ON and to start the "timed operation cycle" the red button on the control panel () must be pressed; the drafting fan is started and the display changes from OFF (standby) to ON. The fan remains ON until the water temperature reaches the value set by the parameter “Boiler working temperature”.

NOTE: it is important to remember that every time the button () is pressed, the current settings are stored onto the electronic board non volatile memory. In case of black-out, the boiler will start from the point where it was at that moment.

The system pump is controlled by the room thermostat, but only if the boiler water temperature is more than what set by the parameter “Minimum boiler temperature” and “Temperature differential in heating mode”. If the boiler does not reach the required temperature during its ON timed cycle, will pass to the standby mode.

The external water tank pump is started on request and with priority over the heating system pump. In normal operation conditions the priority function is performed automatically while on the display is shown the message “AUT”. In this condition, when the S3 external hot water tank probe reaches the minimum allowed temperature (“Minimum tank temperature”), the electronic control starts the hot water tank preparation cycle which will end when the S3 temperature reaches its set value (“Maximum tank temperature”). To change the heat exchanging priority, the boiler operation must be changed to manual mode with the button A/M, on the display will appear “MAN”; after that, pushing the  arrow button the heat exchanging priority passes from hot sanitary water to heating system and viceversa. The external hot sanitary water tank heating is controlled monitorizing the temperature differential from high point boiler probe S4 and high point tank probe S3. If the boiler temperature gets over the value set by the “Minimum boiler temperature” parameter, then the pump is started but only if in the same time the difference of the temperatures detected by the S4 and S3 probes (S4 – S3) is greater than the value set by the “Temperature differential in hot water tank preparation mode” parameter; only in this condition the tank pump will be actually started. Anyway, if for some reasons the boiler does not reaches the required temperature in the timed operation cycle time, this will cause passing to standby mode.

The solar panel function, activated by the “Function parameter #2”, works in the same manner, using the temperature differential criteria; the probes involved are S1 and S2 (water tank low point). In this case, when the difference of the temperatures detected by the S1 and S2 probes (S1 – S2) is greater than the value set by the “Temperature differential in solar panels heating mode” parameter, then the pump will be started. The solar panel function is always ON both in standby and in “Timed operation cycle” mode.

The bypass function avoids water temperature stratification between its highest and lowest points. The parameter “Max boiler body temperature differential” turns ON the bypass pump if the temperature difference between the high and the low point of the boiler is more than the preset value. The bypass circuit is always ON both in standby and in “Timed operation cycle” at any temperature.

9.1. PARAMETERS SETTING “HEATING AND HOT WATER PRODUCTION BY MEANS OF AN EXTERNAL TANK”

FUNCTIONAL PARAMETERS TO BE SET

Parameter description		RECOMMENDED Setting	
0	Boiler operating temperature	80°C	
1	Boiler minimum temperature	65°C	
2	Maximum boiler temperature in thermal inertial phase	88°C	
3	Minimum hot water tank temperature	45°C	
4	Maximum hot water tank temperature	65°C	
5	Temperature difference in heating mode	2.0°C	
6	Temperature difference in hot water preparing mode	5.0°C	
7	Temperature difference in solar panel heating mode	6.0°C	
8	Maximum boiler body temperature difference	4.0°C	
9	Boiler delay time in Stand by	50 min.	
10:	Function parameter #1: Probes activation and deactivation.	**28** (ext. tank)	**30** (ext. tank and solar panels)
11	Function parameter #2: Boiler and accessories setting.	**4** (ext. tank)	**5** (ext. tank and solar panels)
12	DISPLAY LANGUAGE SELECTION.	00 (italian)	

Modifying these parameters or setting wrong values may cause boiler malfunctions and in consequence problems in the whole system. We recommend having the boiler fired for the first time only by technical skilled personnel or by an authorized service center.

9.2. PARAMETER SETTING “HEATING AND HOT WATER PRODUCTION WITH AN EXTERNAL TANK”

0. **Working boiler temperature**: the temperature at which the boiler will enter the standby mode. When the set temperature is reached, the electronic control turns OFF the fan. The fan will be started again when the water temperature falls under the “temperature difference in heating mode” (usually 2 °C) plus another hysteresis degree.
   Example: “Working boiler temperature”= 80°C - (2+1)= 77°C; therefore, when the system pump or the hot water tank pump are stopped, if the boiler temperature falls below 77 °C and the temperature of 80 °C is not reached within the time set by the parameter “Standby delay time”, the boiler will enter the standby mode.

1. **Minimum boiler temperature**: the value under which the pumps are stopped to avoid condensation problems. At the same time, if the boiler remains under this temperature for the time “Standby delay time”, the boiler returns to standby mode.

2. **Maximum allowed temperature in thermal inertial mode**: the maximum temperature allowed for the boiler; if the temperature is greater than this value, the boiler will start producing an ALARM sound. In this case the electronic control board starts the system pump, the tank pump and the bypass pump to dissipate excess heat. If the temperature reaches 104 °C the manual reset security thermostat opens the supply circuit to the fan stopping it until it will be rearmed.
   NOTE: if the boiler temperature often reaches the maximum allowed value, control that the air suction port gravitational closing disc is closed when the boiler reaches the "working boiler temperature", or check for bad door closing or damaged door gaskets.

3. **Minimum external tank temperature**: sets the minimum tank temperature under which, if the “AUT” (automatic) function is set, the external tank heating cycle is started, then if S3 probe detects a temperature value less than this parameter value the boiler enters the hot water preparation priority mode.

4. **Maximum working hot water tank temperature**: if in hot water preparation priority mode, when the S3 probe detects a temperature greater than this parameter value, the electronic control board cancels the hot water preparation priority mode restarting the heating circuit pump.

5. **Temperature differential in heating mode**: to avoid too much fan ON/OFF cycles in a short time as the boiler reaches working temperature, this parameter fixes a minimum fan OFF time.

6. **Temperature differential in external hot water tank heating mode**: sets the hot water temperature differential between the S4 boiler temperature probe and the S3 tank temperature probe. NOTE: the hot water tank pump is started when the “Minimum boiler temperature” is reached. Furthermore, the hot water preparation cycle starts when the temperature differential between the S4 high point boiler probe and the S3 tank temperature probe reaches the “Temperature differential in hot water preparation mode”. Example: Tank S3 temperature = 62 °C, temperature differential = 3 °C; the pump is started when the boiler S4 temperature reaches 65 °C (62+3).

7. **Temperature differential in solar panels heating mode**: setting ON the solar panel function, this parameter sets the solar panel system working temperature differential. The two involved probes are S1 (solar panel probe) and S2 (hot water tank heat exchanger). To have heat transferred from the solar panel system to the hot water tank heat exchanger the S1 temperature must be greater than the heat exchanger S2 probe temperature by this value.

8. **Boiler body maximum temperature differential**: If the system delivery temperature is greater than that of return by a difference greater than the value set by this parameter, the bypass pump will be started to balance the temperature difference between the boiler highest and lowest point.

9. **Standby delay time**: Sets the "timed operation cycle" when the boiler is operative. The cycle activation is performed by pressing the button (); the drafting fan starts. If the boiler temperature falls below the value “Minimum boiler temperature” (usually 60 °C), the boiler has the time set by this parameter (usually 50’) to raise its temperature back above the said value, otherwise it will be cut off.

10. **Function parameter #1 (probes activation/deactivation)**: See probes activation procedure description (page16).

11. **Function parameter #2 (optional setting):** See optional settings description (page17).

12. **Display language selection:** See display language selection description (page17).

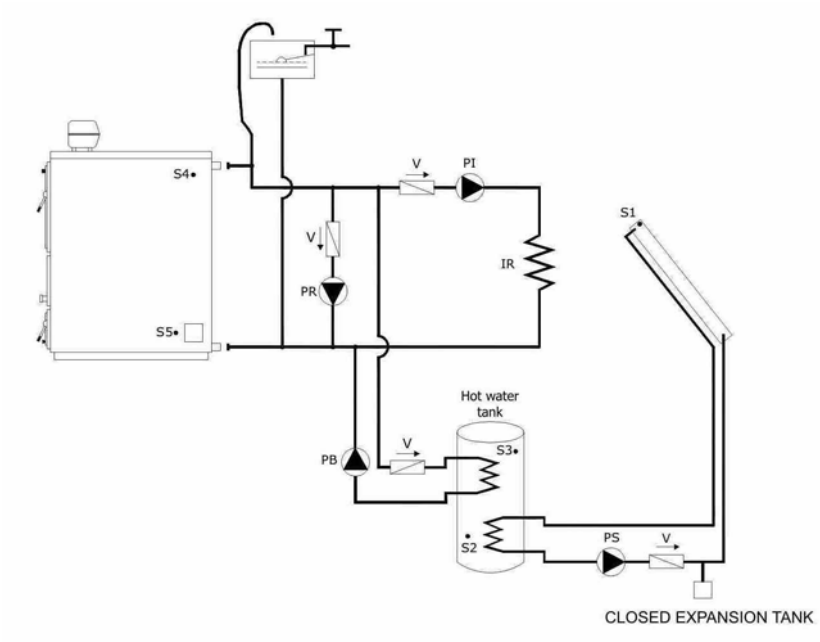
9.3. HYDRAULIC SCHEMATIC DIAGRAMS

All the schematic diagrams in this manual are given as reference only, and they must be validated by authorized engineers. The company ARCA s.r.l. assumes no responsibility for any harm to objects, persons and animals caused by a wrong system project. For any other schematic diagram you may need, feel free to contact ARCA technical department. Putting in service heating systems realized differently from those recommended in this manual, or otherwise not authorized, will cause void of warranty.

Note:
The correct operation of the boiler requires the bypass pump to avoid harmful water temperature stratifications.

The absence of the bypass pump will void the warranty.

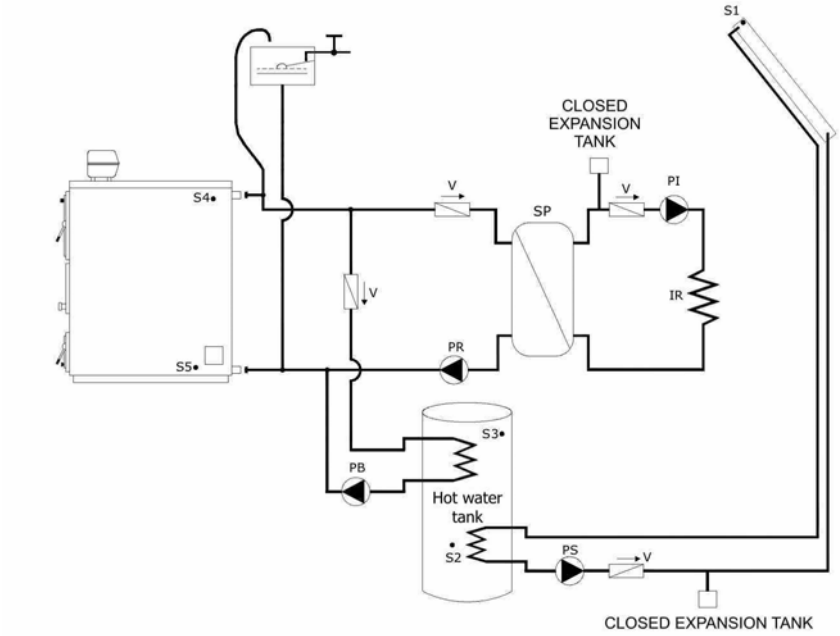
9.3.1. GENERAL CONNECTION DIAGRAM FOR A BOILER WITH EXTERNAL HOT WATER PRODUCTION TANK AND SOLAR PANELS



Key:

PI	System pump	**S1**	Solar panel system probe
PR	Bypass pump	**S2**	Hot water tank probe - low point
PB	Hot water tank circuit pump	**S3**	Hot water tank probe - high point
PS	Solar panel system pump	**S4**	Heating system delivery temperature probe
IR	Heating system	**S5**	Heating system return temperature probe
V	Non return valve		

9.3.2. GENERAL CONNECTION DIAGRAM FOR A BOILER WITH SOLAR PANELS AND CLOSED EXPANSION TANK



Key:

PI	System pump	**S1**	Solar panel system probe
PR	Bypass pump	**S2**	Hot water tank probe - low point
PB	Hot water tank circuit pump	**S3**	Hot water tank probe - high point
PS	Solar panel system pump	**S4**	Heating system delivery temperature probe
IR	Heating system	**S5**	Heating system return temperature probe
V	Non return valve	**SP**	Plate heat exchanger

10. BOILER OPERATION WITH "PUFFER" OR COMBO PUFFER

When the boiler is used with an external “puffer” (heat accumulator tank) or “combo puffer” configuration, one must follow the reference connection diagrams 10.3.1 – 10.3.2 and the heating system pump;, the operation of the bypass and solar panels circuit pump and the solar panels circuit pump will be automatically controlled. The required probes are: S1 (solar panel circuit probe), S2 (“puffer” or “combo puffer” low point probe), S3 (“puffer” or “combo puffer” high point probe), S4 (heating system boiler delivery high point probe) and S5 (heating system boiler delivery low point probe).

To have the boiler turned ON and to start the "timed operation cycle" one must press the red button on the control panel ( ); the drafting fan is started and the display changes from OFF (standby) to ON. The fan remains ON until the water temperature reaches the value set by the parameter “Boiler working temperature”.

NOTE: it is important to remember that every time the button ( ) is pressed, the current settings are stored onto the electronic board non volatile memory; this is important in order to get back to the point the boiler was before a black-out event.

The system pump is controlled by the room thermostat but only if the boiler water temperature is greater than that set by the parameter “Minimum boiler temperature” plus “Temperature differential in heating mode”. If the boiler does not reach the temperature required during its ON timed cycle, it will pass to standby mode.

The external tank circuit pump has the task of transferring the most possible heat from the boiler to the external “combo” tank or “puffer” tank. The heat transfer is realized with thermal differential mode; the boiler high point S4 probe and external tank S2 low point probe are involved. If the boiler temperature reaches the value set by the “Minimum boiler temperature” parameter, then the pump is started but only if in the same time the difference of the temperatures detected by the S4 and S2 probes (S4 – S2) is greater than the value set by the “Temperature differential in hot water tank preparation mode” parameter; only under this condition will the tank pump be started. Anyway, if for any reason the boiler does not reach the required temperature in the timed operation cycle time, this will cause it to pass to standby mode.

The solar panels function, activated by the “Function parameter #2” works in the same manner, using the temperature differential criteria; the probes involved are solar panel system S1 and solar circuit heat exchanger S2 (water tank low point). In this case, when the difference of the temperatures detected by the S1 and S2 probes (S1 – S2) is greater than the value set by the “Temperature differential in solar panels heating mode” then the pump will be started. The solar panels function is always ON both in standby and in “Timed operation cycle” mode.

The bypass function avoids water temperature stratification between its highest and lowest points. The parameter “Max boiler body temperature differential” turns On the bypass pump if the temperature difference between the high and the low point of the boiler is higher than the preset value. The bypass circuit is always ON both in standby and in “Timed operation cycle” at any temperature.
The timed operation is set by the parameter "Standby delay time" and maintains ON the drafting fan until reaching the working temperature.

10.1. PARAMETERS SETTING “OPERATION WITH "PUFFER" OR COMBO PUFFER”

PARAMETERS TO BE SET

Parameter description		RECOMMENDED Setting	
0	Boiler operating temperature	80°C	
1	Boiler minimum temperature	65°C	
2	Maximum boiler temperature in thermal inertial phase	88°C	
3	Minimum hot water tank temperature	55°C	
4	Maximum hot water tank temperature	65°C	
5	Temperature difference in heating mode	1.0°C	
6	Temperature difference in hot water preparing mode	2.0°C	
7	Temperature difference in solar panel heating mode	6.0°C	
8	Maximum boiler body temperature difference	2.0°C	
9	Boiler delay time in Stand by	50 min.	
10:	Function parameter #1: Probe activation and deactivation.	**30** (puffer)	**31** (ext. combo tank and solar panels)
11	Function parameter #2: Boiler and accessories setting.	**12** (puffer)	**13** (ext. combo tank and solar panels)
12	DISPLAY LANGUAGE SELECTION.	00 (italian)	

Modifying or incorrectly setting these parameters may cause boiler malfunction and in consequence problems on the whole system. We recommend having the boiler fired for the first time only by technical skilled personnel or by an authorized service center.

10.2. PARAMETERS SETTING “OPERATION WITH PUFFER OR COMBO PUFFER”

0. **Working boiler temperature**: it means the temperature at which the boiler will enter standby mode. When the set temperature is reached, the electronic control turns OFF the fan. The fan will start again when the water temperature falls below the “temperature difference in heating mode” (usually 2 °C) plus another hysteresis degree.
   Example: “Working boiler temperature”= 80°C - (2+1)= 77°C; therefore, when the system pump or the hot water tank pump are stopped, if the boiler temperature falls below 77 °C and the temperature of 80 °C is not reached within the time set in the parameter “Standby delay time”, the boiler will re-enter standby mode.

1. **Minimum boiler temperature**: The minimum boiler temperature is the value under which the external tank circuit pump is stopped to avoid condensate formation issues. At the same time, if the boiler remains under this temperature for the time “Standby delay time”, the boiler returns to standby mode.

2. **Maximum allowed temperature in thermal inertial mode**: The maximum temperature allowed for the boiler; if the temperature is greater than this value, the boiler will stop producing an ALARM sound. In this case the electronic control board starts the system pump and the bypass pump to dissipate the excess heat. If the temperature reaches 104 °C the manual reset security thermostat opens the supply circuit to the fan stopping it until it is will be manually rearmed.
   NOTE: if the boiler temperature reaches often the maximum allowed value, check that the air suction port gravitational closing disc is closed when the boiler reaches the "working boiler temperature", or for bad door closing or damaged door gaskets.

3. **Minimum external tank temperature**: sets the minimum tank temperature under which, if the “AUT” (automatic) function is set, the external tank heating cycle is started, then if S3 probe detects a temperature value less than this parameter value the boiler enter the hot water preparation priority mode, but this is to be considered only with a combo type external tank instead of a "puffer" (heat accumulator tank). NOTE: it is important to know that when the combo type external tank or the "puffer" has a temperature greater than the "Minimum external tank temperature" value, in the event of heat request by the room thermostat the heating system pump will be started.

4. **Maximum working hot water tank temperature**: if in hot water preparation priority mode, when the S2 probe detects a temperature greater than this parameter value, the electronic control board cancels the hot water preparation priority mode displaying back the heating message.

5. **Temperature differential in heating mode**: to avoid too many fan ON/OFF cycles in a short time as the boiler reaches working temperature, this parameter establishes a minimum fan OFF time.

6. **Temperature differential in external hot water tank heating mode**: sets the hot water temperature differential between the S4 boiler temperature probe and the S3 tank temperature probe. NOTE: the hot water tank pump is started when the “Minimum boiler temperature” is reached. Furthermore, the hot water preparation cycle starts when the temperature differential between the S4 high point boiler probe and the S3 combo type tank or "puffer" low point probe reaches the “Temperature differential in hot water preparation mode”. Example: Tank S2 temperature = 62 °C, temperature differential = 2 °C; the pump is started when the boiler S4 temperature reaches 64 °C (62+2).

7. **Temperature differential in solar panels heating mode**: setting ON the solar panels functions this parameter sets the solar panel system working temperature differential. The two involved probes are S1 (solar panels probe) and S2 (hot water tank heat exchanger). To have heat transferred from the solar panel system to the hot water tank heat exchanger the S1 temperature must be greater than the heat exchanger S2 probe temperature by this value.

8. **Boiler body maximum temperature differential**: If the system delivery temperature is greater than that of return by a difference greater than the value set by this parameter, the bypass pump will be started to balance the temperature difference between the boiler highest and lowest point.

9. **Standby delay time**: Sets the "timed operation cycle" when the boiler is operative. The cycle activation is performed by pressing the button (); the drafting fan starts. If the boiler temperature falls below the value “Minimum boiler temperature” (usually 60 °C), the boiler has the time set by this parameter (usually 50’) to rise its temperature back above the said value, otherwise it will be cut off.

10. **Function parameter #1 (probes activation/deactivation)**: see probes activation procedure description.

11. **Function parameter #2 (optional setting):** See optional settings description.

12. **Display language selection:** See display language selection description (page17).

10.3. HYDRAULIC SCHEMATICS

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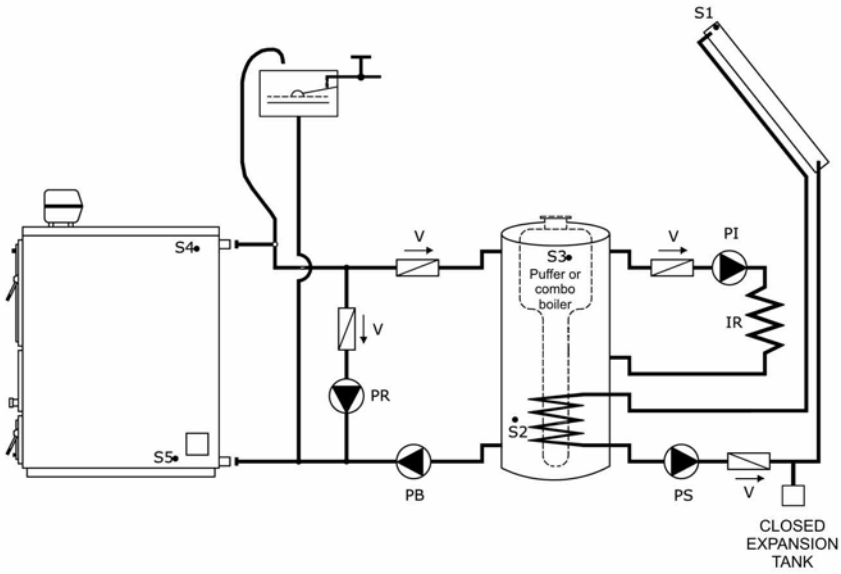
Note:
The correct operation of the boiler requires the bypass pump to avoid harmful water temperature stratifications.

The absence of the bypass pump will void the warranty.

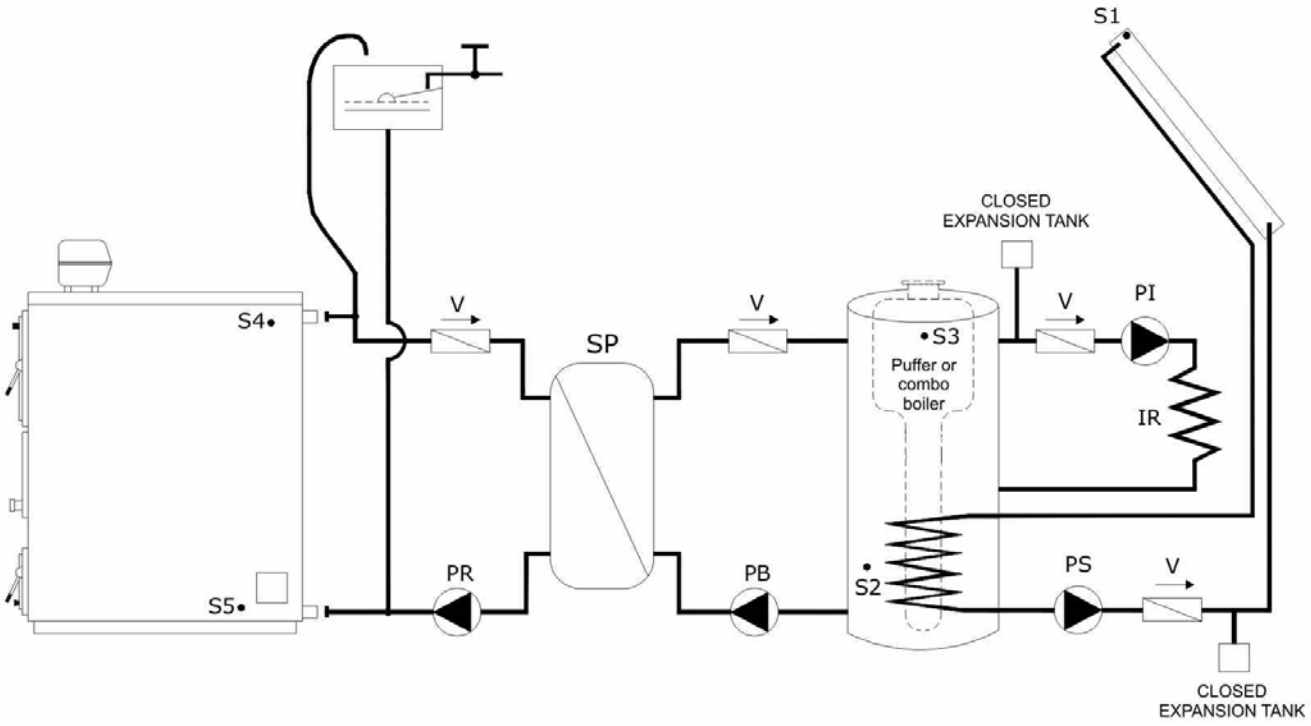
10.3.1. GENERAL CONNECTION DIAGRAM WITH "PUFFER" OR COMBO PUFFER AND SOLAR PANELS



Key:

PI	System pump
PR	Bypass pump
PB	External tank circuit pump ("Puffer" or combo Puffer)
PS	Solar panel system pump
IR	Heating system
V	Non return valve
S1	Solar panel system probe
S2	"Puffer" low point probe
S3	Hot water tank probe - high point
S4	Heating system delivery temperature probe
S5	Heating system return temperature probe

10.3.2. GENERAL CONNECTION DIAGRAM WITH "PUFFER" OR COMBO TANK AND SOLAR PANELS

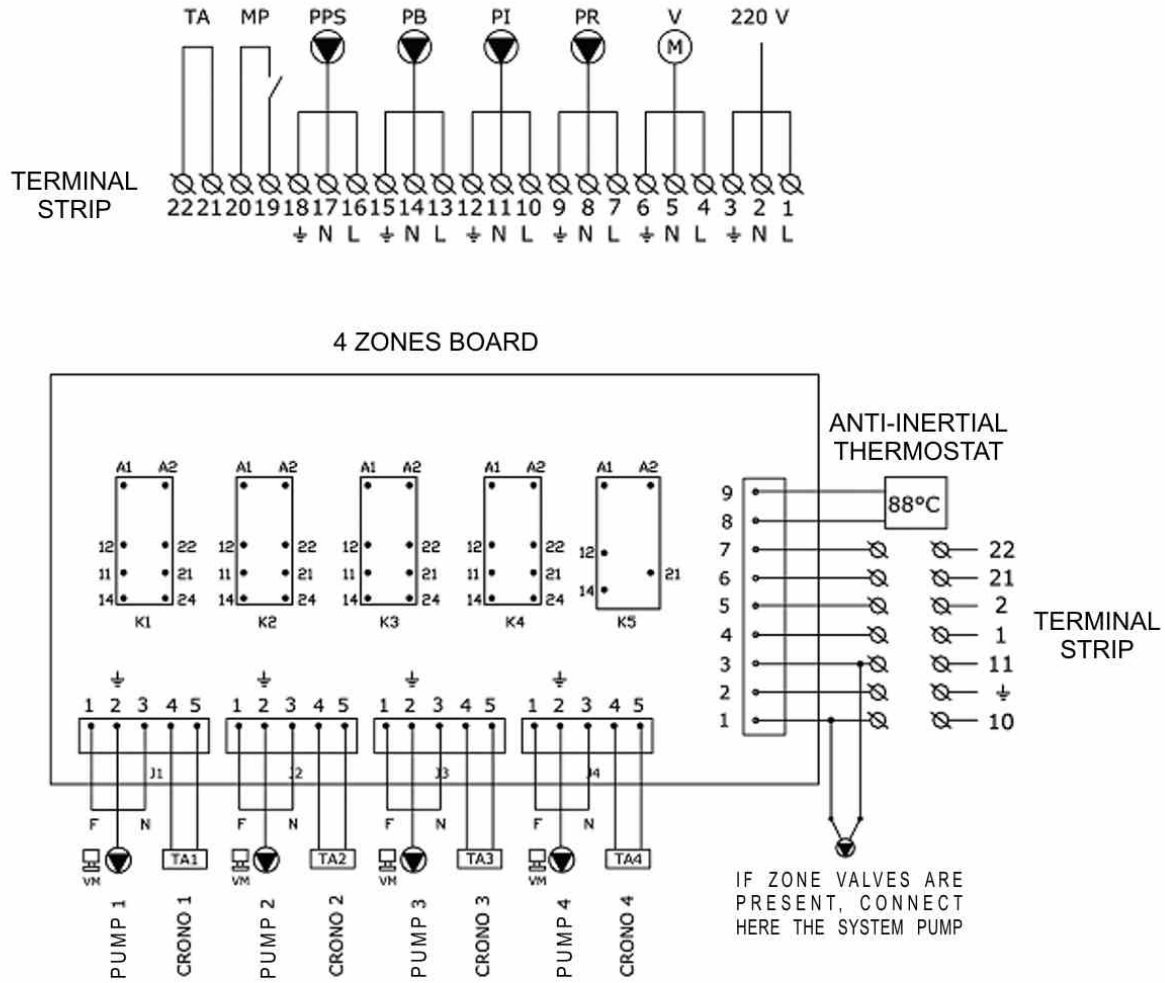


Key:

PI	System pump	**S1**	Solar panel system probe
PR	Bypass pump	**S2**	Hot water tank probe - low point
PB	External tank circuit pump ("Puffer" or combo tank)	**S3**	Hot water tank probe - high point
PS	Solar panel system pump	**S4**	Heating system delivery temperature probe
IR	Heating system	**S5**	Heating system return temperature probe
V	Non return valve	**SP**	Plate heat exchanger

11. “N” ZONES SYSTEM CONNECTIONS

Company ARCA S.r.l. may supply an extra control board as an accessory for heating systems with 4 different zones (cod.SCH0005C).



WARNING: THE MAXIMUM CURRENT MUST BE LESS THAN 4 AMPS

12. FIRING AND BURNING

Before proceeding to the boiler firing control the following:

a) The cast iron bars must be correctly inserted in their supporting hollow frame in the central part of the wood collecting chamber bottom cement plate.

b) The catalyst elements must be correctly in place; it is especially important that:
   - ❑ the lower catalyst element is in touch with the bottom plate
   - ❑ the upper catalyst element is in touch with the lower door

c) The heating circuit must be filled with water and adequately bled from air

d) The closing valves must be opened, if any, and the pumps must not be blocked

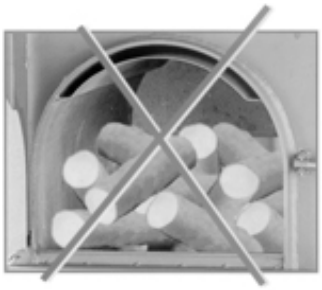
12.1. FIRING

Close the lower door, then turn on the main switch 1. Put on the central part of the wood collecting chamber bottom cement plate, on the cast iron grate, some dry and thin pieces of wood in a crossed pattern. Over the wood put some easily flammable materials, avoid large and square shaped pieces. Using some thin paper sheets (such as newspapers), light the wood. Immediately close the upper wood collecting chamber door.
When the upper wood collecting chamber door is open, the display shows “*BOILER DOOR OPEN*”; when closing the door, make sure that this message disappears.

12.2. FIRING CYCLE STARTING

The firing cycle will end when the boiler is succesfully fired and reaches the minimum admitted operating temperature.
To start the cycle the button 11 must be pressed. (paragraph 6, page 13 The drafting fan will start, allowing the boiler to fire. At this point, the boiler temperature must reach the value set by the parameter “Minimum boiler temperature” or "Boiler working temperature" to have one of the two pumps (PB) or (PI) started, depending upon the heat request in that moment.
The firing cycle is set by the parameter 10, "Standby delay time".

12.3. WOOD LOADING



When an adequate ash bed is available, the upper chamber may be filled with wood logs. Slowly open the upper wood chamber door, to have the smoke in the chamber sucked out by the drafting fan. Using the intended poker tool supplied, slowly open the door and evenly distribute the ashes on the bottom cement plate. Now, the wood may be loaded, using wood logs as long as the wood collecting chamber depth.

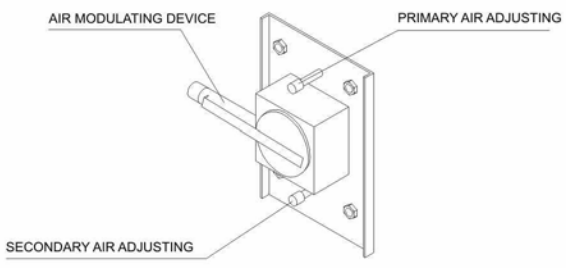
NOTE: This instructions must be strictly followed. Since it is necessary that the wood come down smoothly and evenly in the fuel chamber in order to have good combustion, make sure that the wood logs’ dimensions, shapes and the loading pattern don’t create obstacles to movement. The wood logs must be loaded longitudinally, no piece must be put in a raking way or transversely.

Before loading the boiler again, let the existing wood burn as long as possible. New wood will be loaded when the ash bed thickness in the wood chamber is reduced to about 5 cm. Perform the new wood loading in the same way as above.

Useful tips:

- Wood logs that are too long usually do not fall in an even way, they tend to prevent other wood logs over them from falling down.
- Open the wood chamber door slowly to avoid releasing smoke outside.
- During the operation of the boiler, the lower door must not be opened under any circumstance.
- **Avoid (especially in the middle seasons) excessive fuel loading** so as not to have the boiler in standby mode for a long time and the wood chamber full. Under these conditions, the wood in the loading chamber is dried due to the high temperature reached, but the corrosive vapours released can not be expelled through the boiler smoke outlet, and when they come in contact with the cooler chamber metal walls they condense performing their corrosive action. **For this reason we do not recommend completely filling the wood chamber during the middle seasons (or in summertime for hot water preparation purposes), and the wood should not stay more than a day in the wood chamber without being burnt.**

12.4. COMBUSTION AIR ADJUSTING



The combustion air flows through the suction port and duct located behind the combustion air modulating device. The air entering the boiler is then divided in two separate streams called “primary combustion air” and “secondary combustion air”.
The primary air determines the thermal power of the combustion process and the amount of burnt wood in time: the more the air quantity, the more the power, the more the fuel consumption. To adjust the primary air stream, turn the adjusting screw located on the air suction duct: tightening the screw the passage is reduced, loosing the screw the passage is increased. The required primary air amount is strictly related to the quality of the loaded wood: well dried wood in small pieces requires few primary air, while wet wood in large pieces will require more primary air. The secondary

air stream is aimed to complete the combustion oxidizing the flame; to have it adjusted, move the secondary air stream adjusting screw located under the suction air duct.
In the ashes that collect over the catalyst elements, in the bottom chamber of the boiler, only very few unburnt materials must be present. If the primary air stream is too high, in the ashes will be live coals, the flame will have an excessive speed, and will be very bluish and noisy. Diminish the primary air amount. If the primary air amount is low, the flame will be small, won't enter in contact with the catalyst elements and the power won't reach its rated value.
If the flame colour is dark orange, the secondary air amount is low, if it is bluish and small the secondary air amount is too much.
The thermal power of the boiler is controlled by changing the air amount sucked from outside. The combustion air modulator progressively closes the passage for the air sucked from outside along with increasing boiler temperature. The modulator is correctly adjusted when the closing disc is far from the suction port by 2 cm when the boiler is cold, while when the boiler temperature reaches its operative value the disc must as near to the suction port as 3-4 mm. In this way, the output boiler power is adjusted to fit the heating system needs.
It is important that smoke temperature be from 160 to 200°C, and this is achieved by correctly adjusting both the primary and secondary air amounts on the thermostatic modulator. A lower smoke temperature could cause condensation problems in the flue duct. Higher temperatures cause poor overall thermal yield, drafting fan motor overheating, vibrations, a noisy operation of the fan and a quick impeller axle bearing wear. To be adjusted by authorized technical service only.

12.5. WARNINGS

Using wet wood (greater than 25%) and/or a total amount of fuel not suited for the heating system current needs (with long stop periods with the wood chamber full) causes a relevant condensation formation in the wood chamber.
Inspect the wood chamber steel walls weekly. They should be covered with a thin layer of dry and matt tar, with blisters which tend to break and detach from the wall. If the tar layer is glossy and wet and pours downward, it is mandatory to use less wet wood and/or to reduce the overall quantity of fuel loaded. The condensation on the wood chamber walls internal surface causes quick corrosion. This is not covered by any warranty being caused by incorrect boiler use (wet wood, excessive loading), etc.).
The smoke circulating in the flue passages will be rich in steam content using wet wood. When the smoke comes in touch with relatively cold surfaces (about 60 °C), the steam condenses and, mixing with other combustion products, causes metal surfaces corrosion problems. Frequently check for smoke condensation signs (blackish liquid on the floor, in the back of the boiler). In this case it will be necessary to use less wet wood; check for the proper bypass pump operation, control the smoke temperature, raise the operation boiler temperature (in this case, you may install a mixing valve on the heating system delivery to lower the system water delivery temperature if necessary). The corrosion problems caused by smoke condensation are not covered by warranty because they are caused by the improper use of too wet wood.

13. MAINTENANCE AND CLEANING

- Before proceeding with any maintenance operation the boiler must be turned OFF and one must wait until it has reached the room temperature.
- Empty the heating circuit only if absolutely necessary.
- Periodically check the proper operation of the smoke exhausting devices and of the flue duct.
- Do not perform any cleaning operation on the boiler using flammable liquids (gasoline, alcohol, solvents, etc.)
- Do not leave flammable liquids or materials in the same room where the boiler is installed.

An accurate maintenance program will always mean fuel economy and safe operation.

13.1. DAILY CLEANING

- Remove the residual ash bed with the special fitted tool supplied letting it fall in the bottom chamber to have the upper part of the cast iron grate free from any ash. This operation will prevent grate slots from blocking up and]a consequent poor boiler operation; it will prevent the grate bar cast iron elements from overheating and their consequent quick wear.
- Remove any ash from the catalyst zone.

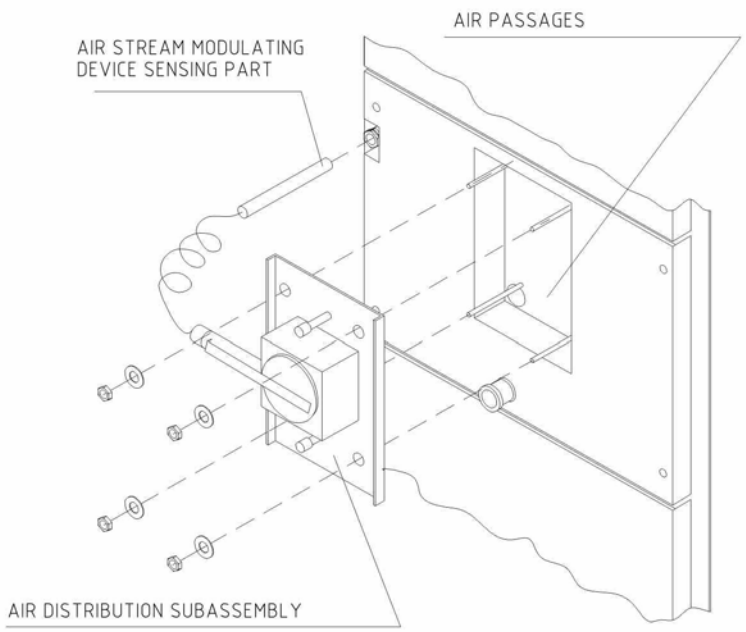
13.2. WEEKLY CLEANING

- Remove from any point of the wood chamber any residual combustion product.
- Using the special brush supplied clean the triangular smoke passages in the heat exchanging zone (lower door).
- Remove any ash from the smoke pass-through chamber working through the lateral doors.
- Check for plugged grate slots.

13.3. MONTHLY MAINTENANCE

- Remove any carbon deposit from the drafting fan impeller. Usually, with compressed air or a smooth brush a perfect cleaning is achieved. If the deposits are sticked, we recommend anyway to be careful with using more force to avoid unbalancing of the fan impeller which would become noisy and less efficient.
- Lubricate the front fan motor bearing.

13.4. EXTRA MAINTENANCE



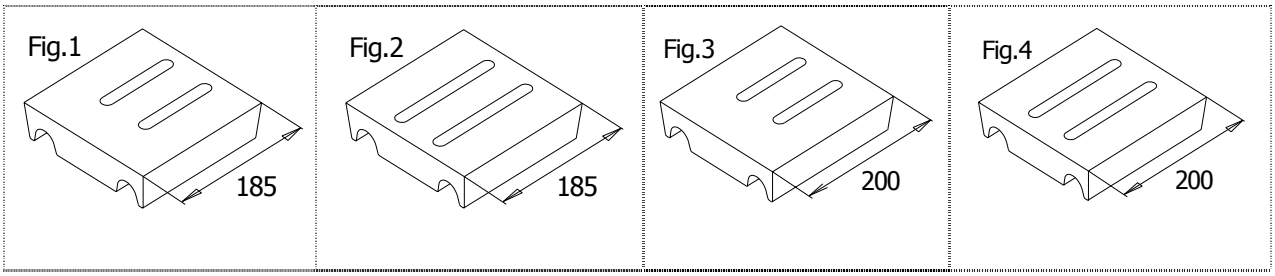
- At the end of each season a deep cleaning operation must be performed on the boiler, removing any residual ash from the wood chamber. If the boiler is not used in the summertime keep the doors closed.
- Thoroughly clean the air distribution subassembly, its mounting place and the secondary air passages removing pieces of wood, tar and dust which may have collected there during the winter season operation. Thoroughly clean all air passages with a soft brush.

13.5. EXPENDABLE MATERIALS

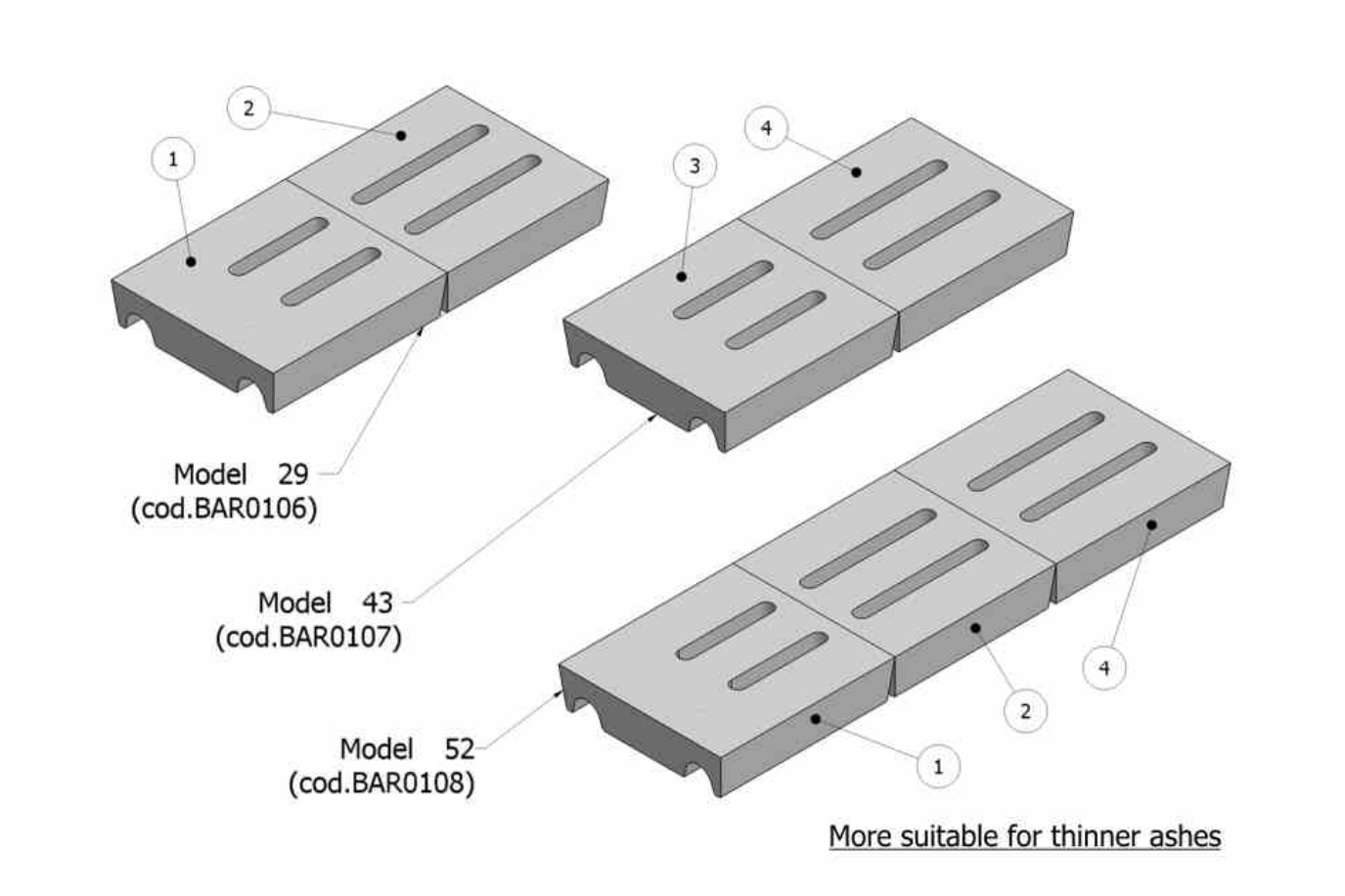
The grate bar elements are built with high temperature and smoke aggressive action resistant chrome cast iron. Therefore, they are well suited for many hours of operation, whose number will depend upon the average boiler working temperature which is determined by many other factors, such as the type of wood most frequently used, its degree of humidity, the number and duration of the standby periods, etc.; how long they will last depends as well upon the flame acidity degree, more or less accurate cleaning and maintenance of the whole grate zone, if the boiler operates correctly within the standard parameters or not.

They are excluded from the warranty covering and must be considered from any point of view **expendable materials.** The same considerations apply to the catalyst elements and the drafting fan.

CAST IRON BAR ELEMENTS WITH LONGITUDINAL SLOTS



Model	Number of bar elements	Code
29	2	BAR 0106
43	2	BAR 0107
52	3	BAR 0108



Mounting warnings: the piece with longer slots must first be firstly positioned on the boiler back plate side.
The grate with longitudinal slots (pic. 1,2,3,4) is better suited to types of wood producing thinner ashes. When the grate is changed, the authorized technical personnel must consider employing the best suitable new type.

Warning: depending on the type of wood used, its thermal power and especially the humidity degree and the average ash dimensions, employing a grate with different slot shape may be required in order to prevent slots from plugging.
Usually, the two longitudinally or transversely slotted grates do not feature visible differences in the output power. The transversely slotted grate (pic. 5 and pic. 6), is better suited when using very dry wood with high thermal power producing thicker ashes.

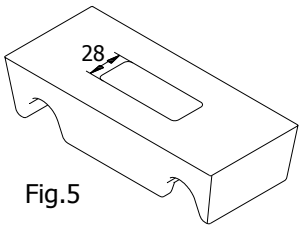


Fig.5

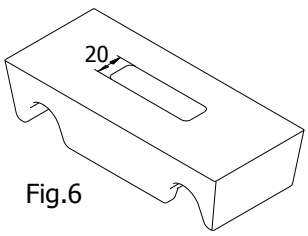
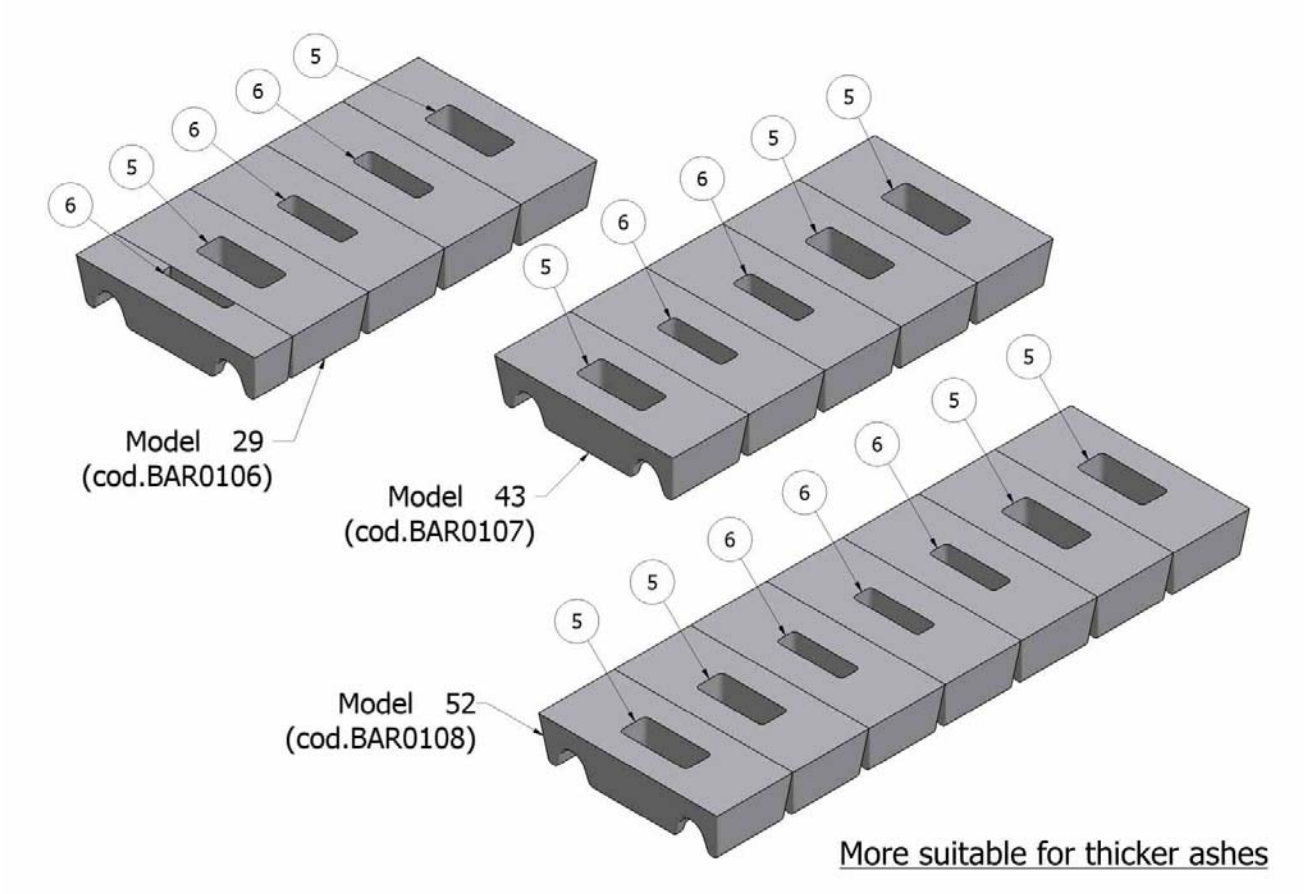


Fig.6

TRANSVERSELY SLOTTED BAR ELEMENTS

Models	Number of bar elements	Code
29	4.5.	BAR 0106T
43	5	BAR 0107T
52	7	BAR 0108T



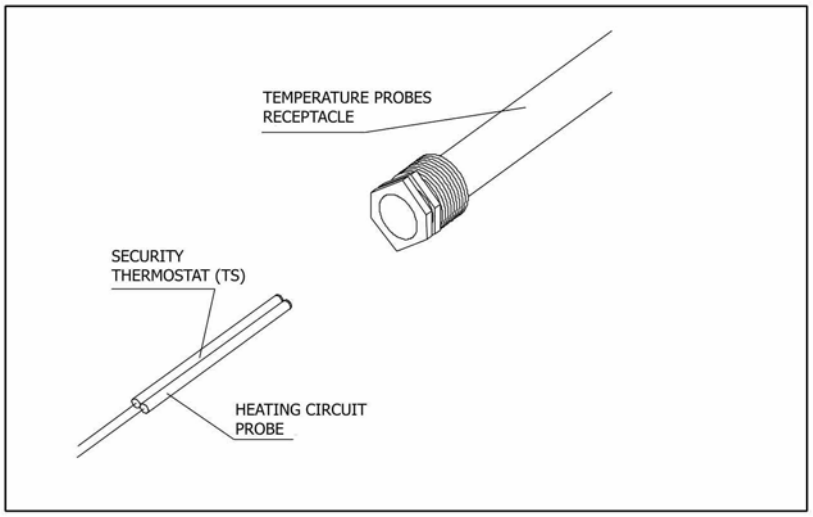
14. TROUBLESHOOTING

14.1. CONTROL PANEL "TERMODUE" – 2007 rel. TROUBLESHOOTING

Problem encountered	Solution
On the display appears the message: **"Disconnected or faulty probe, i.e. solar panels probe, call for assistance"**	The probe could be faulty or its circuit could be open (check for an open in the wiring or replace the probe) In some cases the value set by the parameter "Function parameter #1" could be wrong; check again for a correct parameter value.
The probe on the display shows (- - -) instead of the normal value.	This is not an error because a disabled probe always shows **- - -**.
The boiler temperature does not rise and the display shows **"door open"**	Check for a correct ajar switch connection as shown on the electrical schematic diagram. If the message is still shown, check for correct microswitch positioning with the door closed; if necessary adjust the microswitch position.
The reading of one or more probes is erratic.	Try to use a shielded cable for the probe connection to the board to avoid electrical noise being collected by the cables. Refer to paragraph 7.1.

For any kind of problem we recommend having the boiler inspected by technically skilled personnel or by an authorized assistance center.

NOTE: both the security thermostat sensing element and the system delivery probe (S4) sensing bulbs must be inserted together in the same receptacle near the heating system delivery connection.



Note:
In case problems occur during a probe installation, it is better to have the two terminals on the board for that probe wire bridged to prevent the warning message of missing or faulty probe from being displayed. Alternatively the problem may be fixed by pressing the button E for a long time until the programming mode is entered and the missing probes can be disabled.

14.2. FIXING BOILER PROBLEMS

Symptoms	Possible causes	Solutions
The boiler tends to cut off leaving an incurved wood mass unburnt in the wood chamber. The restart is abnormally long with a difficulty flame formation.	a) The grate is plugged. b) Not enough primary air	a) Unplug the grate slots b) Increase the primary air
The flame is noisy and a lot of white and black ash is produced. The boiler features high fuel consumption.	a) Too much primary air.	a) Decrease the primary air.
The flame is short, slow, the power is abnormally low and the lower door refractory plate is black.	a) Not enough primary air.	a) Increase the primary air.
The boiler produces a lot of liquid tar in the wood chamber.	a) Too wet wood b) Too low boiler temperature. c) Long standby times with wood chamber full of wood.	a) Load dryer wood b) Rise the operation temperature thermostat to 75 - 80°C c) Proportion the total wood quantity loaded to the real needs.

The fan does not stop and the boiler does not reach the operation temperature.	a) Plugged boiler. b) Pumps not connected or blocked. c) Wood loaded without respecting the outlined prescriptions. d) Boiler not correctly dimensioned to the real heat needings. e) See 16,1	a) Clean the boiler in all its parts. b) Connect the pumps to the control board. c) When loading the wood, be careful not to leave empty spaces. d) Progressively open one after another the existing system zones.

For any problem we recommend having the boiler inspected by an authorized assistance center.

15. OPERATING ABNORMALITIES

15.1. ACOUSTIC WARNING

If an excessive temperature is reached, the boiler will emit an acoustic warning.
This value is set by parameter #3 which is set by default at 88 °C (page 19, page 24, page 28)
In some real situations, the operating temperature may require being set higher than standard, i.e. if the heating system includes electroventilating unit heaters far from the boiler installation place, besides parameter #1 setting (working temperature 80 °C).
In this case the overheat acoustic warning could trip frequently.
In such a situation it is better to increase parameter #3 (Maximum temperature in thermal inertial mode), up to a maximum value of 95°C.
If the acoustic warning trips without boiler temperature increasing, it may be caused by other system abnormalities, such as too much flue draft, wood loading door open, heating system pump or bypass pump stuck or blocked, faulty electronic board.

Another tip: if a greater working temperature is required than the preset value of 80°C, increase the parameter #3 (Maximum temperature in thermal inertial mode).

16. GENERAL TECHNICAL TIPS

16.1. SETTINGS AND HIGHEST PERMITTED TEMPERATURES

High power boilers are often used to heat industrial plants in the wood processing sector.
In such situations, the process waste is used to fuel the boiler.
Often, waste materials are very dry and contain synthetic resins and paints which should not be used as fuel.
Thus their thermal power is very high, and consequently the boiler output power as well as the smoke exhaust temperature increase significantly.

WARNING!: if the smoke exhaust temperature goes beyond 200°C, drafting fan motor problems may occur (the bearings lubricating grease dries), the burner grate bar cast iron elements may quickly wear out, the same thing happens with the catalyst elements and so on.

Therefore is strongly advisable to monitor the smoke temperature, proportionally reducing the combustion air supply and to mix with the dry wood waste other less dry wood with a lower specific thermal power.
For a proper system operation the smoke exhaust temperature must be in the range 160°C - 200°C.
If it is lower, condensation and corrosion problems may appear.
If it is higher, fan problems may occur and the burner bar and the catalyst elements may wear out quickly.

Obviously, a proper boiler setting “on site” is required for the many specific thermal power differences among the various wood types which can be used.

16.2. FIRST FIRING

Any kind of boiler, especially the high power featured models, requires a gradual first firing to allow for the refractory parts to dry out completely.
We recommend loading only a small quantity of fuel the first time and letting the temperature rise slowly. If the boiler is fully loaded the very first time, cracks on the refractory blocks may appear or their surface layer, detaching and falling down. In some cases, if the residual water content in the refractory blocks thickness does not have the time to come out, small blasts may occur.

16.3. REFRACTORY CEMENT PARTS EXISTING IN THE BOILER

It is fairly normal that the refractory blocks show small imperfections.
For this reason, the refractory blocks thickness is overdimensioned; by this way, should happen what is outlined above, (paragraph 16.2.), the boiler overall insulation degree is anyway guaranteed.

16.4. BOILER AUTONOMY AND FUEL LOADING INTERVALS

Under normal operation conditions the boiler must be loaded on average two times a day. With “normal operating conditions” we intend a boiler average output power in the middle of the recommended power interval.
This is obtained if the house to be heated is well insulated from the thermal point of view.
In extreme conditions the fuel loading operations will be more frequent (3-4 a day), while in spring a single charge will be enough.

16.5. EXPLOSIONS

Under poor flue draft conditions and using very dry wood filling completely the wood loading chamber, gases released by the wood may accumulate in the chamber. When the fan is started again, the compound air-released gases may fire causing explosions in the wood chamber. Anyway, this will not harm the boiler because of the presence of antideflagration doors in the back part of the boiler.

17. MODEL CHOICE

17.1. BOILER POWER

For each model the minimum power, the rated power (corresponding to standard wood type featuring a specific thermal power of 3500 kcal/Kg with 15% humidity degree) and the maximum output power vary; the maximum output power value is only given for correct security devices dimensioning purposes: valves, relief pipe diameter and so on.
We recommend seeing a qualified technician to assist in choosing the right model, taking into account the foreseeable specific average thermal power and humidity degree of the intended wood.

NOTE:
The wood thermal power may vary from a minimum of about 1600 kcal/Kg and a maximum value of about 3500 kcal/Kg. Wood logs coming from dead trees or from trees grown in shade are more difficult to burn because the carbon content is reduced; in the first case the tree remained without natural feeding for some time and the wood was subjected to a natural combustion process. By “natural combustion process” (without flame) we refer to the carbon being released during the long drying time. In the second case, the tree had a reduced photosynthesis process, and the wood is poor in carbon while rich in cellulose content.

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