

Service manual

Models covered by these instructions

424 S
428 S
424 RS

Wall hung, fan flue, room sealed gas boiler

GAIA

Leave this manual adjacent to the gas meter

BIASI S.p.A.

37135 Verona (Italy)

Via Leopoldo Biasi, 1

Stabilimento:

33170 Pordenone (Italy)

Via Pravolton, 1/B



Table of contents

1	Overall information
1.1	Overall View
1.2	Hydraulic diagram
2	General access and emptying hydr. circuits
2.1	Nomenclature
2.2	Body panels
2.3	Access to the electric parts of the control panel
2.4	Access to the sealed chamber
2.5	Emptying the main circuit
2.6	Emptying the d.h.w. circuit
3	Diagrams
3.1	Wiring diagram
3.2	Functional flow diagrams
3.3	Control circuit voltages
4	Fault finding
5	Main heat exchanger
5.1	Characteristics
5.2	Removal
5.3	Cleaning
6	D.h.w. heat exchanger
6.1	Function
6.2	Removal
7	Pump
7.1	Function
7.2	Checks
7.3	Removal
8	Diverter valve and d.h.w. pressure switch
8.1	Function
8.2	Checks
8.3	Removal
9	Electronic control circuit
9.1	Function
9.2	Selection and adjustment devices
9.3	Checking the temperature
9.4	Function selectors
9.5	Ignition gas pressure regulator
9.6	Max. c/h power regulator
9.7	Checks
9.8	Removal of the control circuit
9.9	Thermal control in the mode
9.10	Thermal control in the mode
10	Display circuit
10.1	Function
10.2	Display circuit operation
10.3	Removal
11	Full sequence ignition device

11.1	Function
11.2	Checks
11.3	Removal
11.4	Ignition sequence
12	Gas valve
12.1	Function
12.2	Nomenclature of the parts
12.3	Adjustment
12.4	Checks
12.5	Removal
13	Main circuit flow switch
13.1	Function
13.2	Checks
13.3	Removal
14	D.h.w. filter and flow limiter
14.1	General notes
14.2	Removal of the filter
14.3	Flow limiter
15	Temperature probes
15.1	Function
15.2	Checks
15.3	Removal
16	By-pass valve
16.1	Function
16.2	Removal
17	Water pressure switch and pump relè
17.1	Function
17.2	Checks
17.3	Removal of the pressure switch
17.4	Removal of the pump relè
18	Flue fan, venturi, air pressure switch
18.1	Function
18.2	Checks
18.3	Removal of the fan
18.4	Removal of the air pressure switch
19	Ignition and detection electrodes
19.1	Function
19.2	Checks
19.3	Removal
20	Safety thermostat
20.1	Function
20.2	Checks
20.3	Removal
21	Short spare parts list

1 Overall information

1.1 Overall View

fig. 1

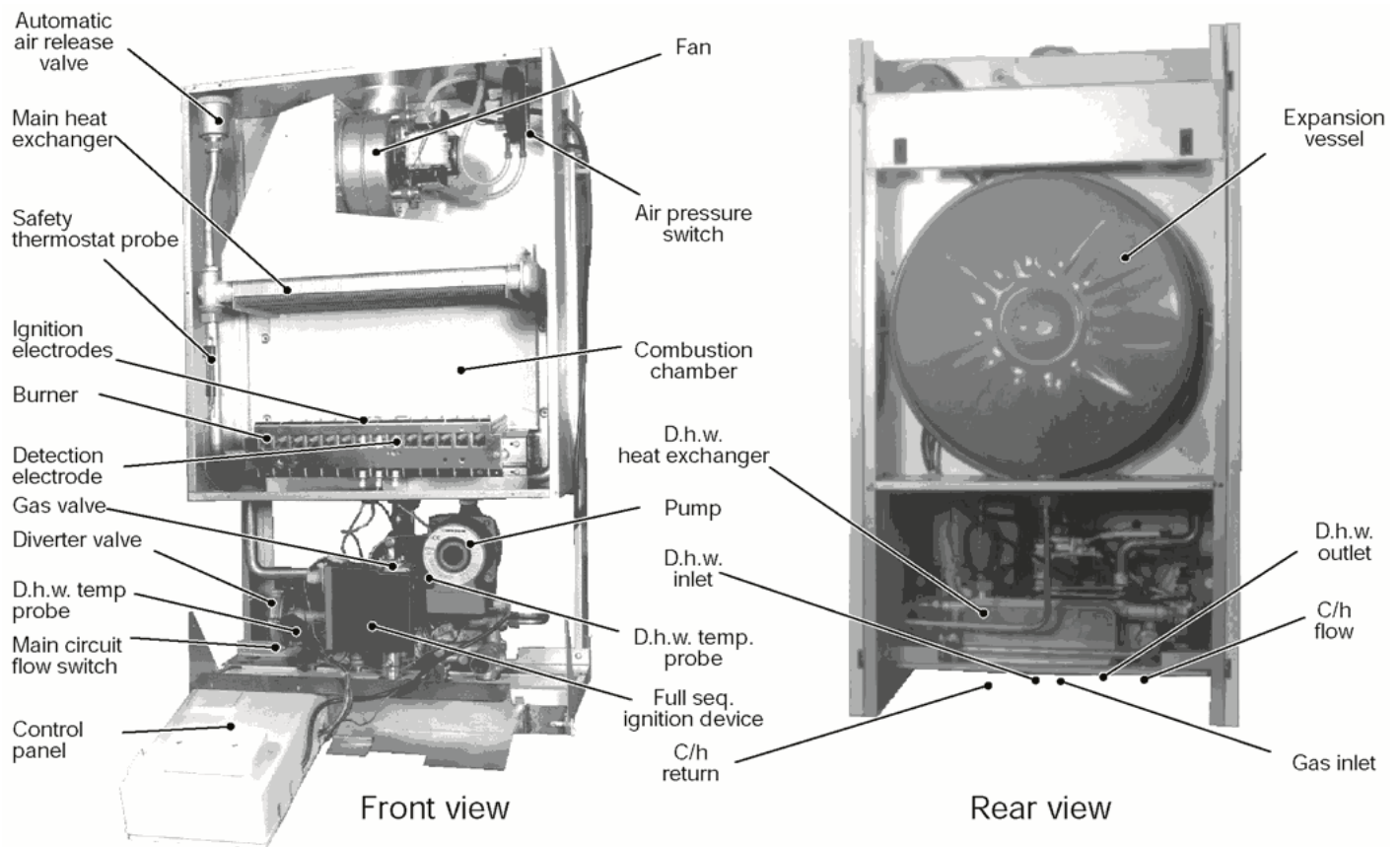


fig. 1

1.2 Hydraulic diagram

fig. 2

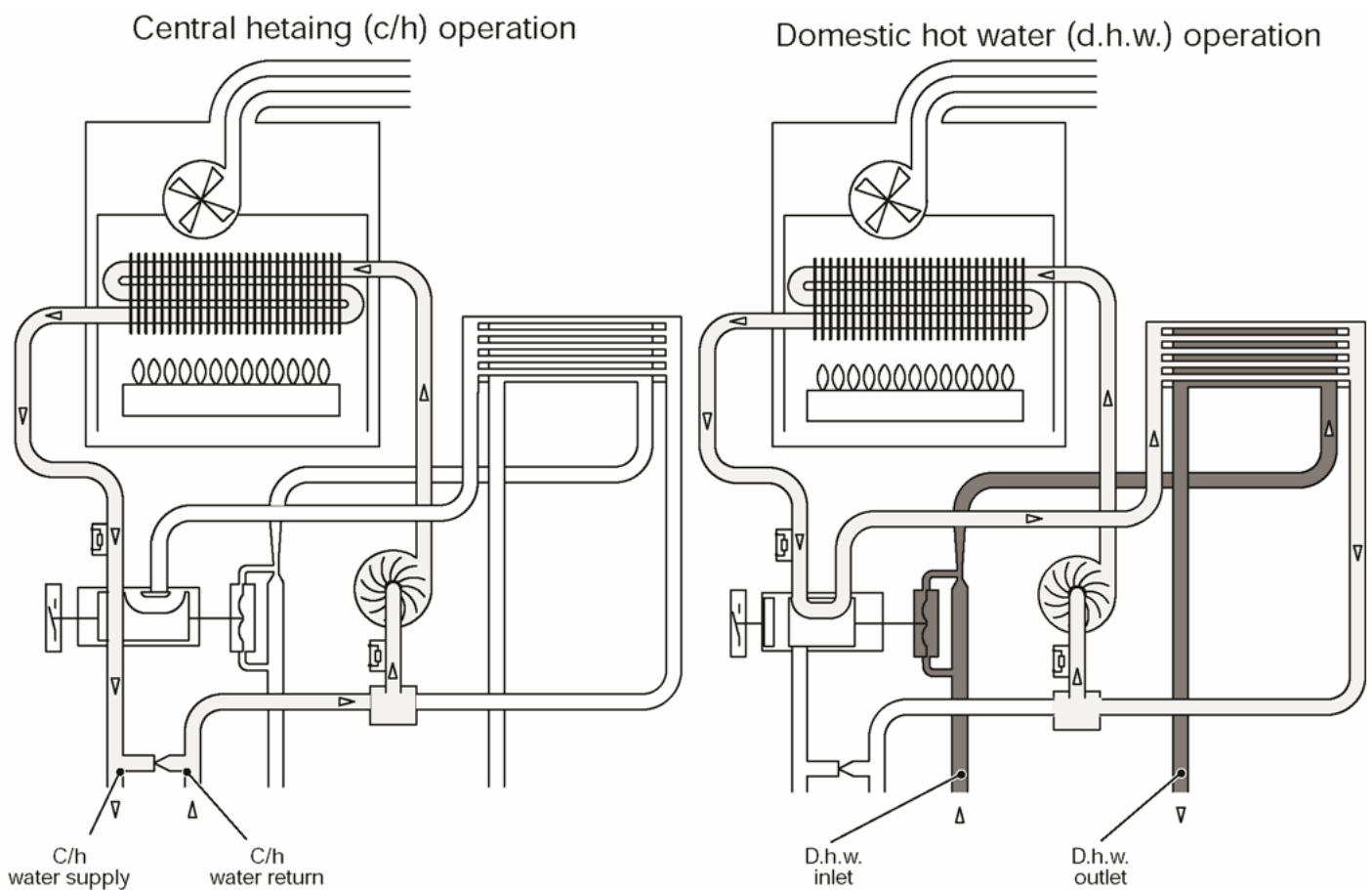


fig. 2

2 General access and emptying hydraulic circuits

2.1 Nomenclature

fig. 3

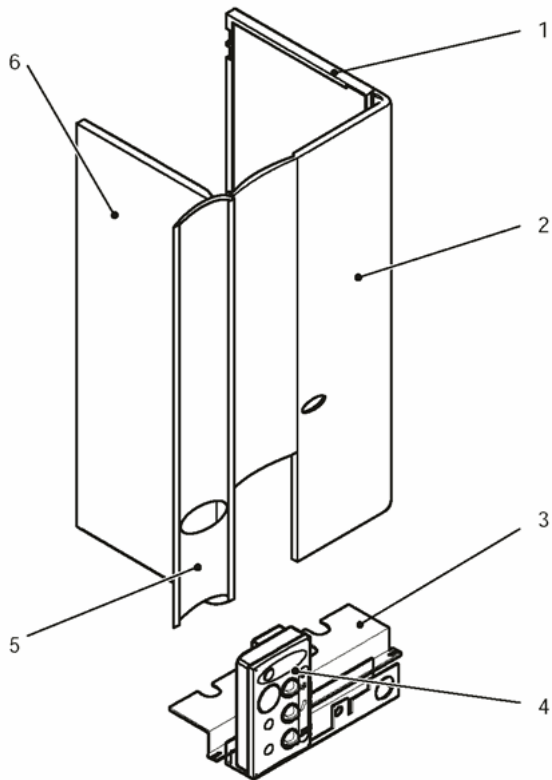


fig. 3

- 1 Right side panel
- 2 Front panel
- 3 Lower protection plate
- 4 Control panel
- 5 Case lid
- 6 Left side panel

2.2 Body panels

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

For the most part of the check and maintenance operations it is necessary to remove one or more panels of the case.

The side panels can be removed only after the removal of the front panel.

To remove the front panel remove the two screws A ([fig. 4](#)) and bring the base of the panel far from the boiler.

fig. 4

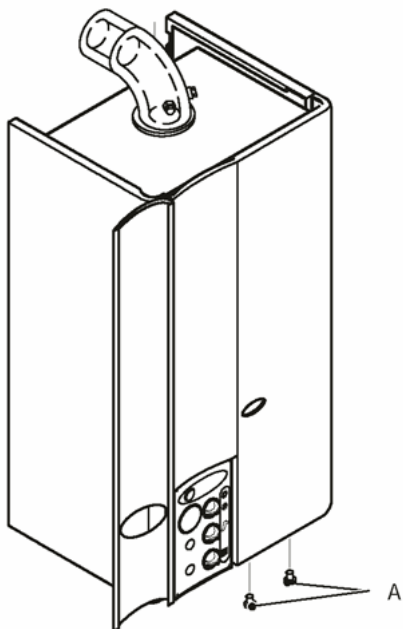


fig. 4

Lift the front panel freeing it from the hooks placed on its left and right side.

To remove the side panels loosen the screws *B* ([fig. 5](#)), bring the base of the panels far from the boiler and lift them, freeing them from the side hooks of the frame.

fig. 5

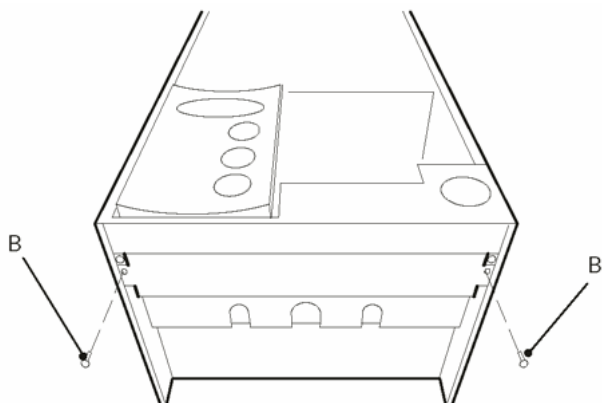


fig. 5

To remove the lower protection plate completely unscrew the screws *B* and remove the plate ([fig. 5](#)).

To gain access to the supply terminal block and to the parts located behind the control panel unscrew the screws *C* and lower the panel ([fig. 6](#)).

fig. 6

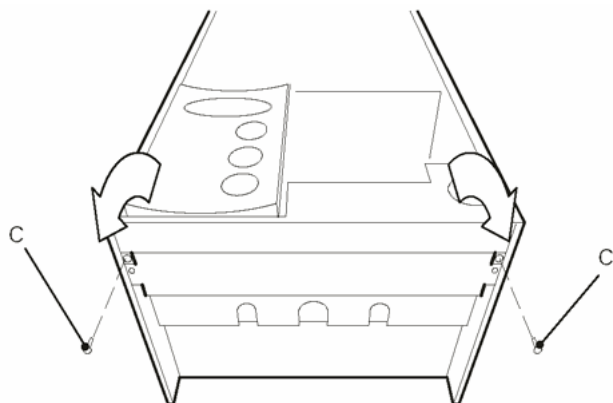


fig. 6

2.3 Access to the electric parts of the control panel

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

To gain access to the parts located inside the control panel remove the four screws *D* ([fig. 7](#)) and remove the cover pulling it towards the front.

fig. 7

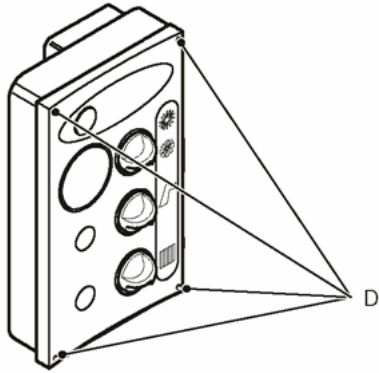


fig. 7

2.4 Access to the sealed chamber

To gain access to the parts contained in the sealed chamber it is necessary to remove the cover of the sealed chamber.

For this purpose, remove the front panel of the case and remove the screws *E* as indicated in [fig. 8](#).

fig. 8

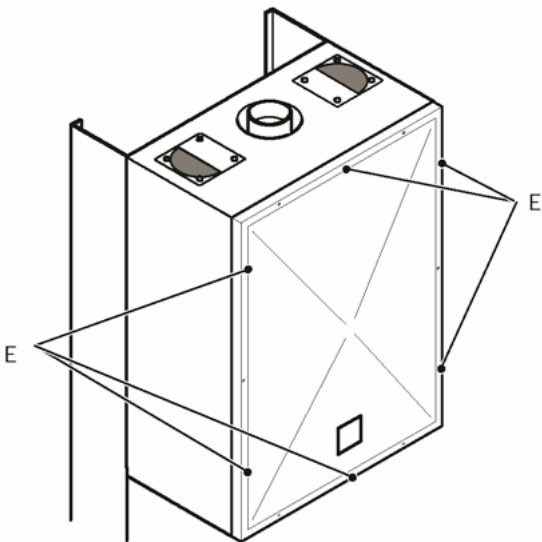


fig. 8

2.5 Emptying the main circuit

1. Close the c/h circuit isolation valves *F* ([fig. 9](#)).
2. Open the draining tap *G* ([fig. 10](#)) until the boiler is completely emptied.

fig. 9

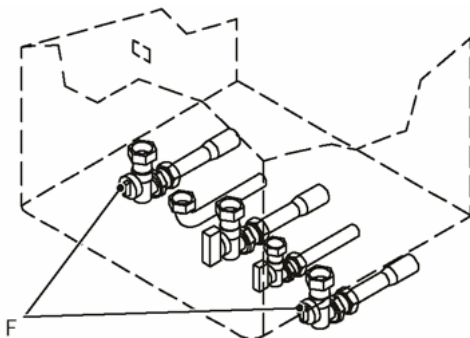


fig. 9

fig. 10

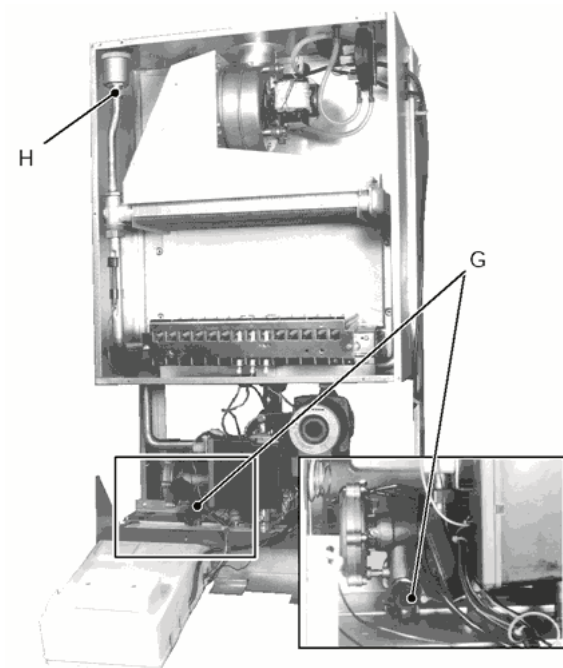


fig. 10

To facilitate the downflow of water, remove the front panel, also remove the sealed chamber cover and loosen the nut *H* ([fig. 10](#)) of the automatic air bleed valve.

Tight it again once the emptying has been completed.

2.6 Emptying the d.h.w. circuit

1. Close the d.h.w. circuit cut-off valve / ([fig. 11](#));
2. Open one or more hot water taps of the plant until the boiler has been completely emptied.

fig. 11

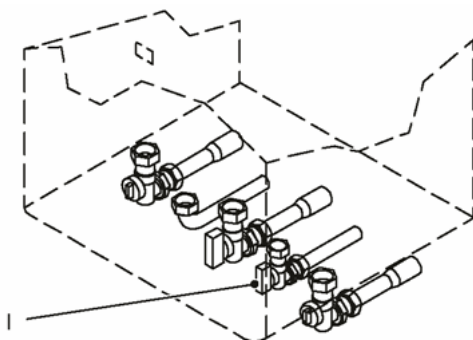
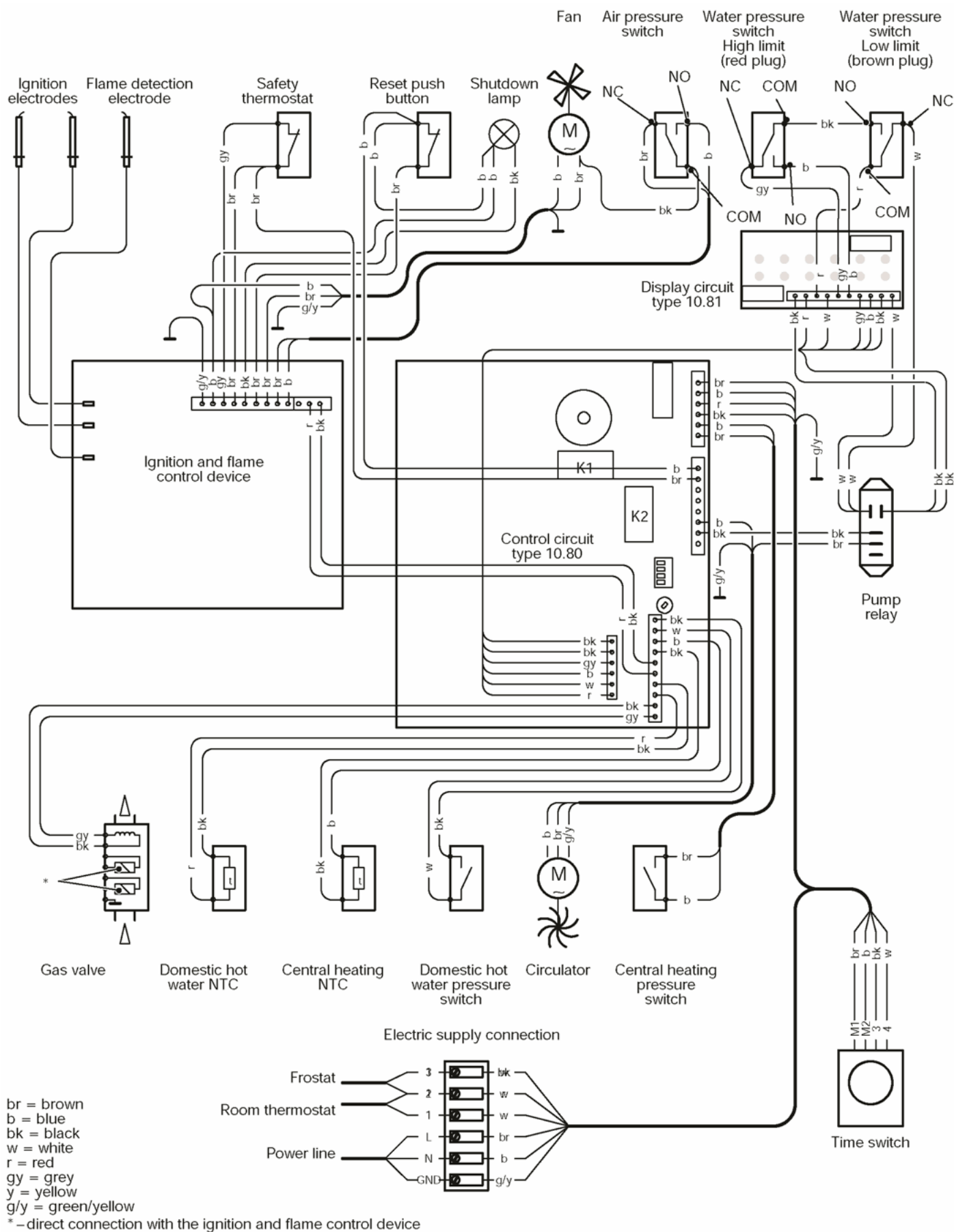


fig. 11

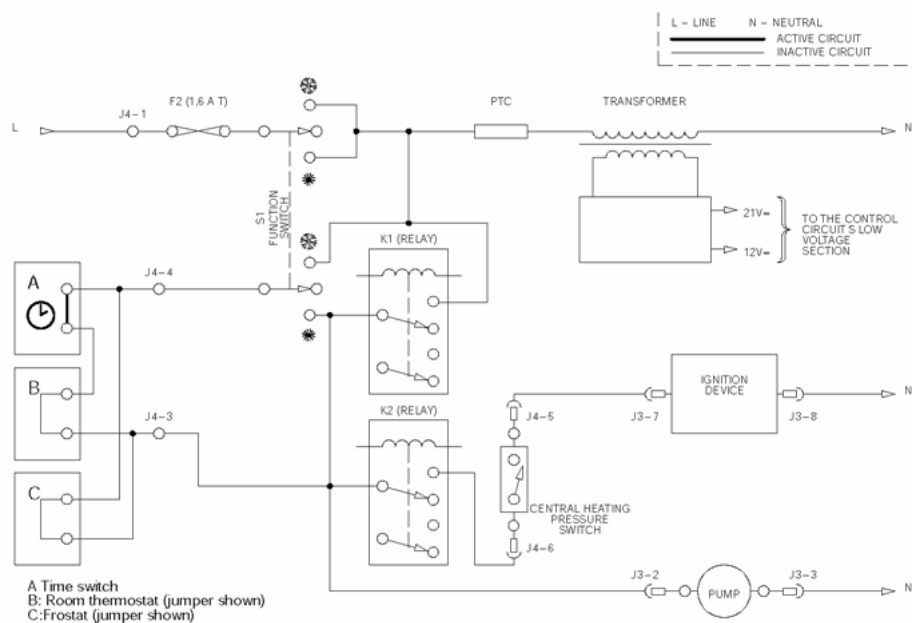
3 Diagrams

3.1 Wiring diagram

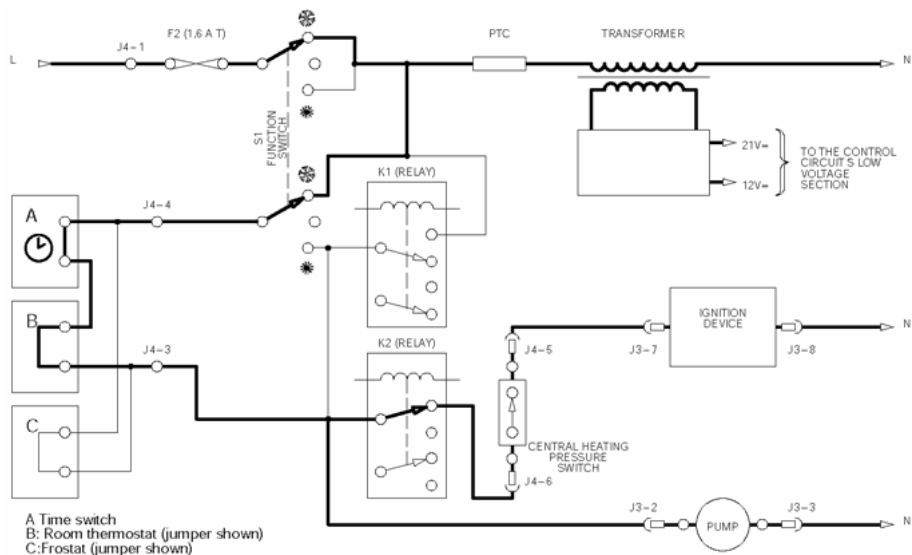


3.2 Functional flow diagrams

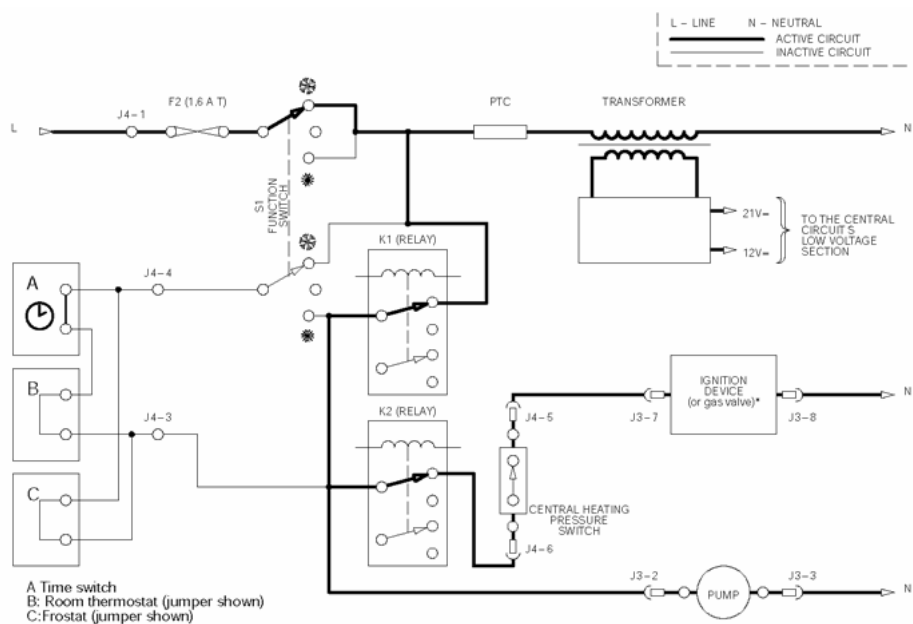
General layout function switch position off



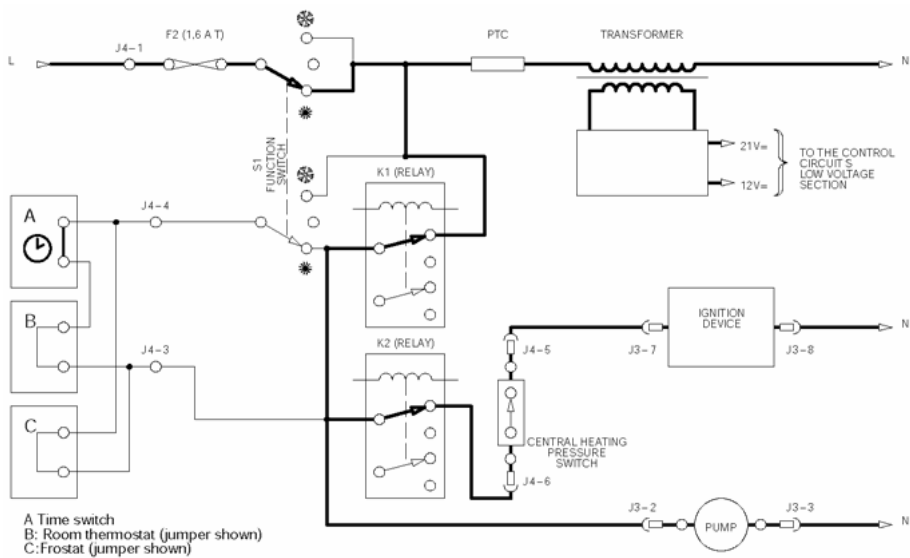
Function switch position Heat request on c/h



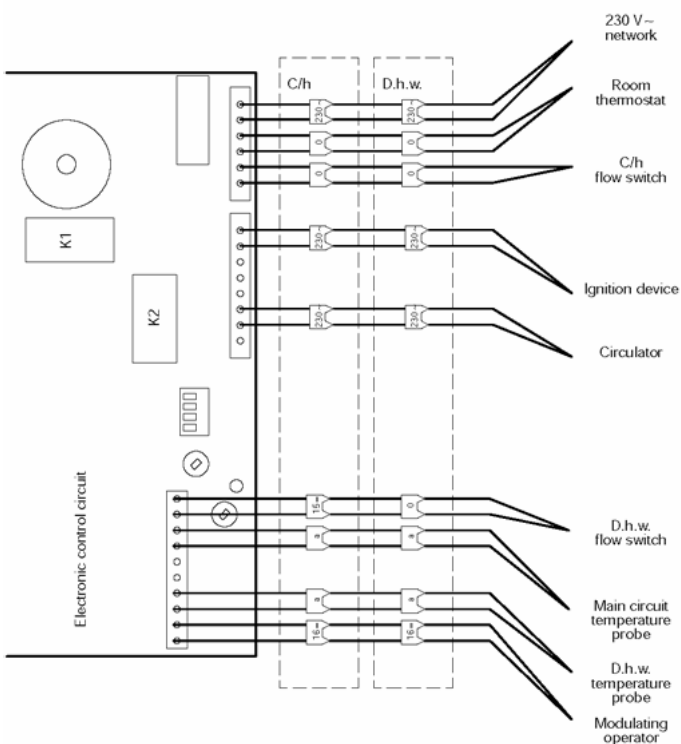
Function switch position Heat request on d.h.w.



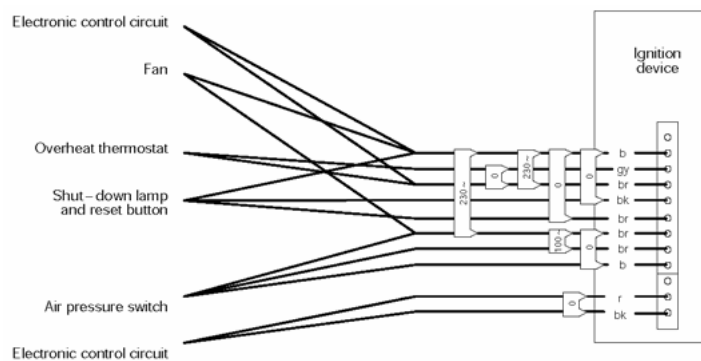
Function switch position Heat request on d.h.w.



3.3 Control circuit voltages



a: never zero (short circuit) never 12V= (open circuit)



Electrical voltages in Volts during normal operation with burner on at maximum power

4 Fault finding

	Components to check																			
Section of the manual → (note ref. in brackets)	– (1)	– (2)	– (3)	– (4)	6	7.2	8.2	9.7	11.2	12.4	13.2	14.2	15..							
Defect ↓	Power supply line	Gas supply line	Flue pipes	C.h. circuit	D.h.w. circuit	D.h.w. heat exchanger	Pump (windings)	Pump (rotor – impeller)	Diverter valve (membrane)	Diverter valve (deviation group)	D.h.w. pressure switch	Fuse (regulation p.c.b.)	Regulation p.c.b.	Function selectors (reg. p.c.b)	Full sequence device	Gas valve (on – off operators)	Gas valve (modulating operator)	Main circuit flow switch	D.h.w. filter	Main circuit temp. probe
The boiler operates correctly but the gas pressure to the burner remains at minimum.													■				■			
Poor d.h.w. temperature		■				■				■			■				■		■ (9)	
Low flow rate of d.h.w.					■	■													■	
Water leaks from the safety valve during operation on c/h				■																
Water leaks from the safety valve when the boiler is off.																				

- Note
- Check for 220–240V~ between line (L) and neutral (N)
Verify the integrity of supply cable, plug and external fuses.
Check the polarity of line and neutral connection
 - Verify the soundness of the gas supply pipe, the position of stop valves.
Check the gas pressure at the inlet test point of the gas valve (see sect. 12.3) with the boiler at rest and during operation
 - and compare it with the values given on the installation booklet.
 - Check for soundness and absence of obstructions. Verify that the flue terminal is correctly installed (see clearances) and ensure that exhaust gas is not sucked back by the boiler.
 - Check for soundness of the circuit and verify its correct filling (see also installation manual).
 - A jammed by-pass could cause the over-heating of the main circuit and the intervention of the safety thermostat.

5 Main heat exchanger

5.1 Characteristics

The main heat exchanger (A in [fig. 12](#)) has the function of transferring heat of the gas produced by combustion to the water circulating in it.

fig. 12

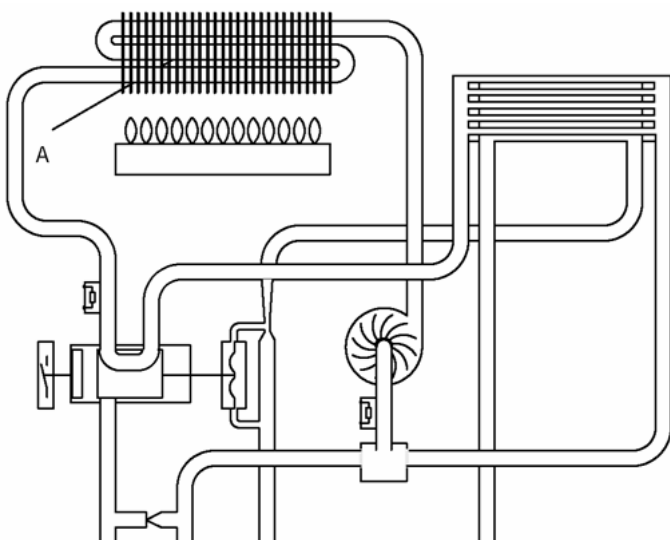


fig. 12

The hydraulic circuit consists of five elliptical pipes connected together in series ([fig. 13](#)).

fig. 13

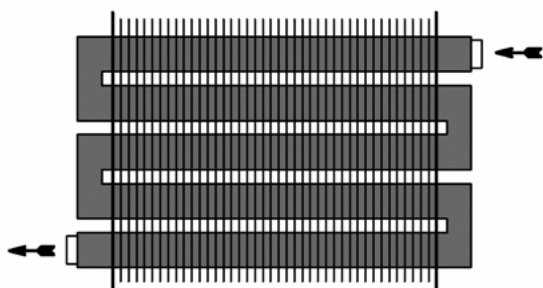


fig. 13

5.2 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

- 1 Empty the main circuit of the boiler
- 2 Remove the front panel of the case
- 3 Remove the sealed chamber cover.

For models 424 S, 424 RS...

- 4a Remove the cover of the combustion chamber;
- 5a Remove the front part of the flue gas hood by unscrewing the screw *B* ([fig. 14a](#))

fig. 14a

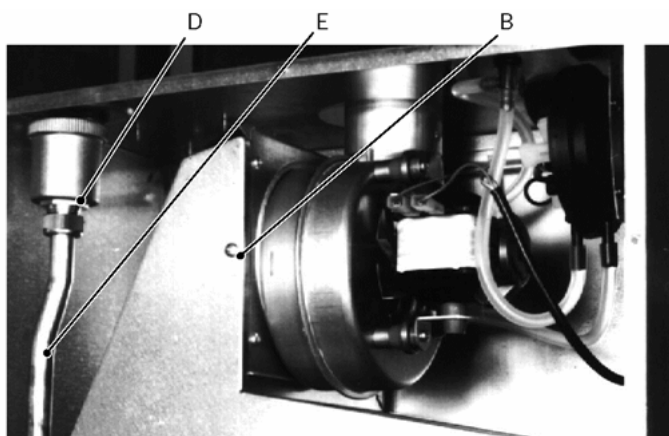


fig. 14a

For model 428 S...

- 4b Remove the front part of the flue gas hood by unscrewing the four screws *C* ([fig. 14b](#))
- 5b Remove the cover of the combustion chamber

fig. 14b

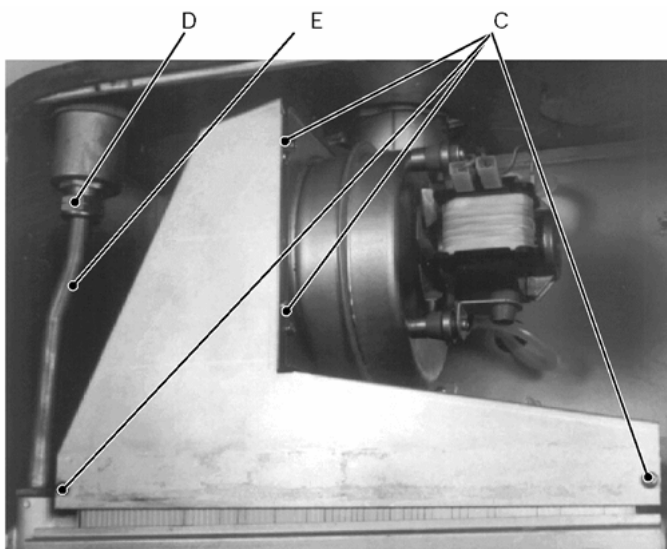


fig. 14b

6 Unscrew the automatic air valve connection nut *D* and remove the valve ([fig. 14a](#));

7 Separate the heat exchanger from the hydraulic circuit, loosening the inlet and outlet pipe fittings;

For models 424 S, 424 RS...

8a move the right pipe and free the right connection; lower the right side of the exchanger and extract it from the front;

For model 428 S...

8b Extract the heat exchanger, from the front;

9 Unscrew the pipe *E* ([fig. 14b](#)) from the heat exchanger;

10 Assemble the heat exchanger carrying out the removal operations in reverse sequence.

5.3 Cleaning

If there are deposits of soot or dirt between the blades of the heat exchanger, clean with a brush or non-metallic bristle brush.

In any case, avoid any actions that can damage the protective varnish with which the exchanger has been covered.

6 D.h.w. heat exchanger

6.1 Function

The d.h.w heat exchanger (A in [fig. 15](#)) allows the instantaneous transferral of heat from the primary hydraulic circuit to the water destined for d.h.w use.

fig. 15

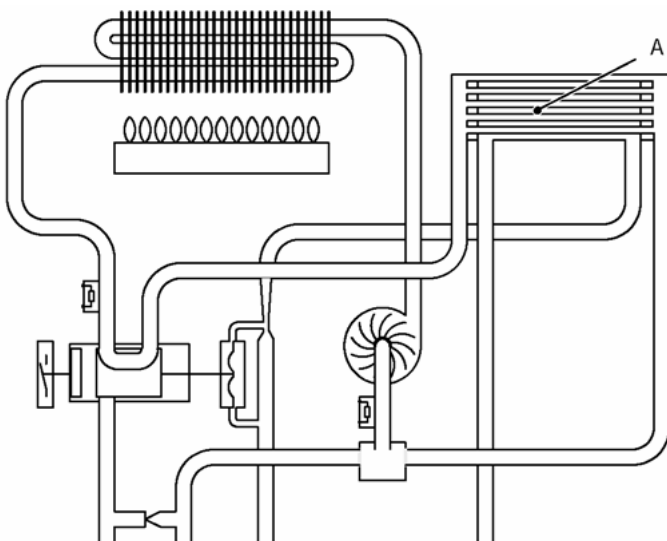


fig. 15

The schematic structure is shown in [fig. 16](#).

fig. 16



 Primary hydraulic circuit
 Domestic hot water circuit

fig. 16

6.2 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Empty the primary circuit and the d.h.w circuit of the boiler
2. Remove the front panel of the case and lower the instrument panel
3. Completely unscrew the two Allen key screws *B* (in [fig. 17](#) the right one is shown) which hold the exchanger to the brass deviator groups;
4. Move the exchanger towards the rear side of the boiler and extract it.

fig. 17

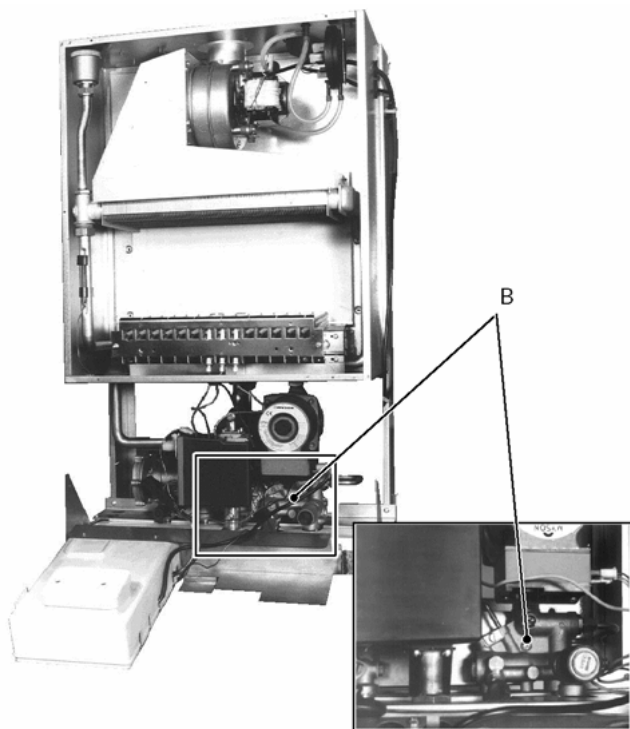


fig. 17

Reassemble the d.h.w. heat exchanger carrying out the removal operations in the reverse order.

Attention. Reassembling the exchanger be sure to put the off center location/securing pin indicated in [fig. 18](#) towards the left side of the boiler.

fig. 18

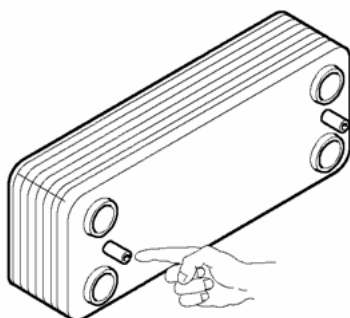


fig. 18

7 Pump

7.1 Function

The pump (A in [fig. 19](#)) has the function of making the water in the main circuit circulate through the main heat exchanger and therefore through the c/h system (during the c/h function) or through the secondary heat exchanger (during the d.h.w. function).

fig. 19

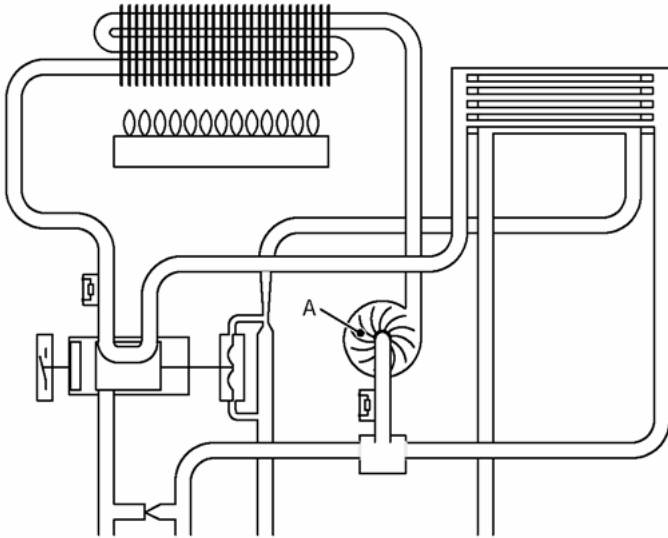


fig. 19

NOTE:

the pump can be stopped by the intervention of the low limit water pressure switch.

7.2 Checks

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Check that the pump is not seized and that the movement of the rotor is not subject to mechanical impediments.

With the boiler off, remove the front panel and lower the instrument panel. Remove the air release plug of the pump and turn the rotor with a screwdriver.

Check the electrical completeness.

Remove the service panel, disconnect the connector to the electronic control circuit (see electrical diagram) and measure the electrical resistance between the pump supply conductors. ([fig. 20](#)).

fig. 20

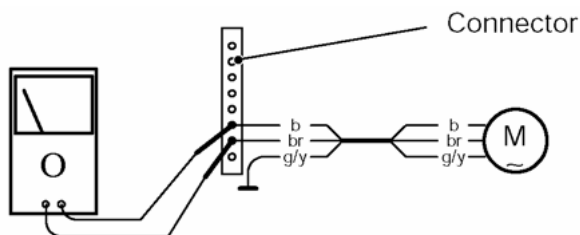


fig. 20

Electrical resistance of the windings (at ambient temperature) on switch position 3 must be about:

210 Ω - Myson CP53

180 Ω - Myson CP63 (high head alternative)

220 Ω - Salmson MYE30

120 Ω - Salmson MYL50 (high head alternative)

Check the absence of starting defects.

With the boiler off remove the front panel and lower the control panel;

for Myson pump: unscrew the plug of the pump by hand (the plug cannot be removed). Pull it and turn the rotor. Start the boiler and verify if the motor runs.

for Salmson pump (high head alternative): remove the air release screw of the pump. Start the boiler and with a screwdriver, have the rotor turn in the direction of the arrow. If there is a defect in starting, the rotor will begin to turn normally only starting it manually.

Check that the impeller is integral with the rotor.

Remove the pump head loosening the screws which hold it to the pump body and check that the impeller is firmly jointed with the rotor.

7.3 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

If the clearance to the right side of the boiler is restricted, the removal of the pump can be easily achieved by first removing the head by unscrewing the four Allen keys screws (B in [fig. 21](#), the two on the upper side indicated).

fig. 21

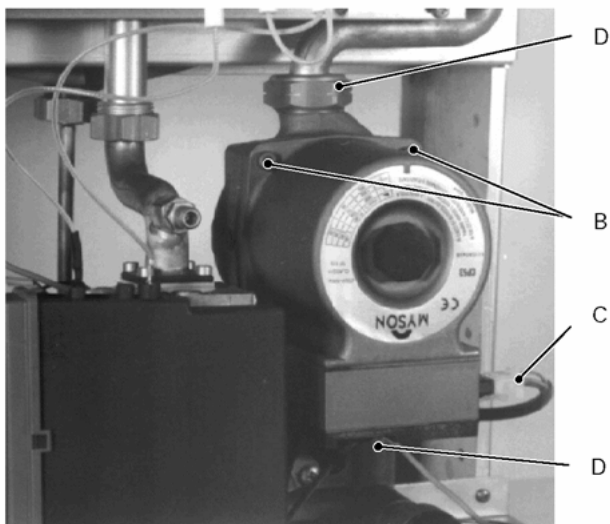


fig. 21

1. Empty the main circuit of the boiler.
2. Remove the front panel of the case, the right side panel and lower the control panel.
3. Disconnect the connector C ([fig. 21](#)).
4. Completely unscrew the connection nuts D and remove the pump.
5. Before the reassembling, carefully clean the support seat of the gasket.
6. Reassemble the pump carrying out the removal operations in the reverse order.

8 Diverter valve and d.h.w. pressure switch

8.1 Function

The diverter valve (A in [fig. 22](#)) has the function of modifying the hydraulic circuit of the boiler by means of an hydraulic command given by the opening of a d.h.w. tap in order to send the water that exits the main heat exchanger towards the c/h system or towards the d.h.w. heat exchanger.

fig. 22

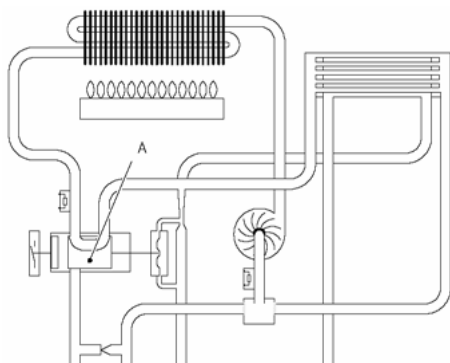


fig. 22

Moreover it operates the d.h.w. pressure switch which acts on the electronic control circuit.

8.2 Checks

General check

It is possible to verify the general operation of the valve by measuring the voltage between the leads of the d.h.w. pressure switch during the operation on c/h and d.h.w.

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Switch off the boiler and open the control panel.
2. Connect a meter, set for direct voltage measurement, to the points indicated in [fig. 23](#).
3. Switch the boiler on position and verify the voltages during c/h and d.h.w. by matching the readings with the values indicated in the [section 3.3](#).

fig. 23

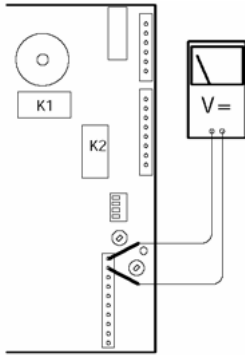


fig. 23

Check the mechanical function

1. Switch off the boiler; remove the front panel of the case, the lower protection plate and lower the control panel.
2. Remove the pressure switch as explained in the [section 8.3 "Removal of the switch"](#).
3. Open and close a d.h.w. tap and verify the position of the shaft *B* referring to [fig. 24](#).

fig. 24

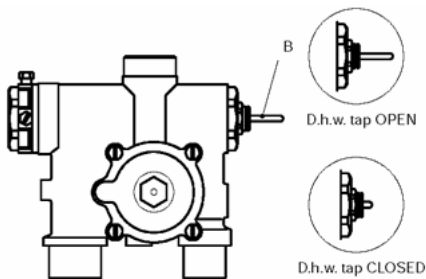


fig. 24

8.3 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Removal of the membrane

1. Remove the front panel of the case, lower the control panel and empty the d.h.w. circuit.
2. Remove the forks *C* and move away the pipes *D*. ([fig. 25](#) - rear view of the boiler).
3. Loose the screws *E* and remove the hydraulic actuator *F* ([fig. 26](#)).
4. Unscrew the six screws *G*, open the hydraulic actuator and remove the membrane *H*. ([fig. 27](#)).
5. Assemble the part proceeding in reverse order.

fig. 25

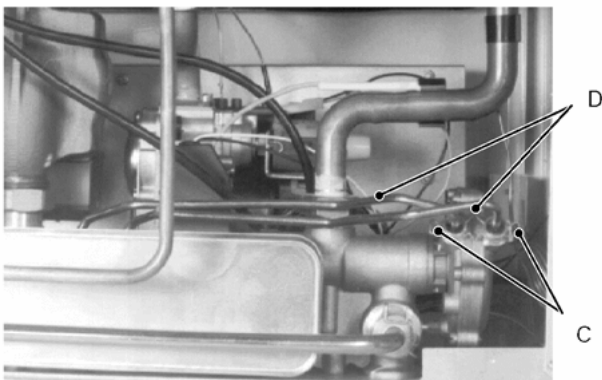


fig. 25

fig. 26

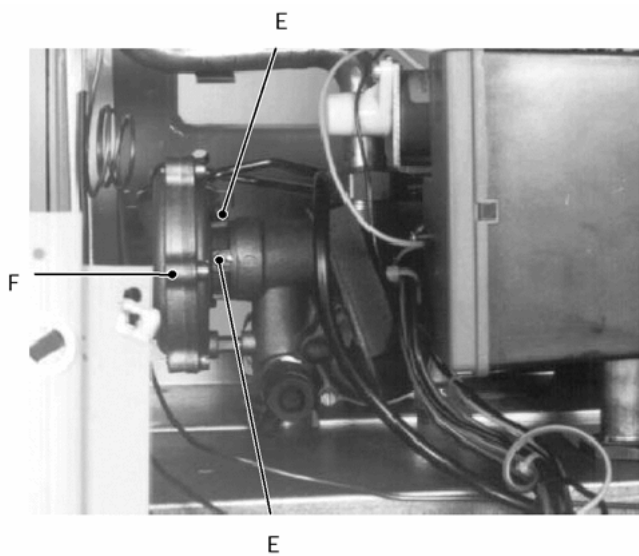


fig. 26

fig. 27

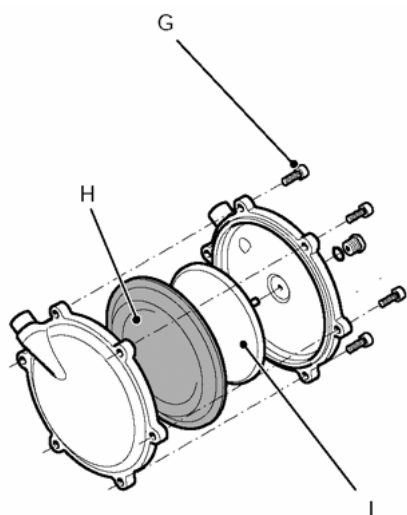


fig. 27

Assembling the part, ensure to place the concave side of the membrane towards the actuator plate I ([fig. 27](#)).

When fixing the actuator to the valve, fit the reference shaft J in the seat of the valve ([fig. 28](#)).

fig. 28

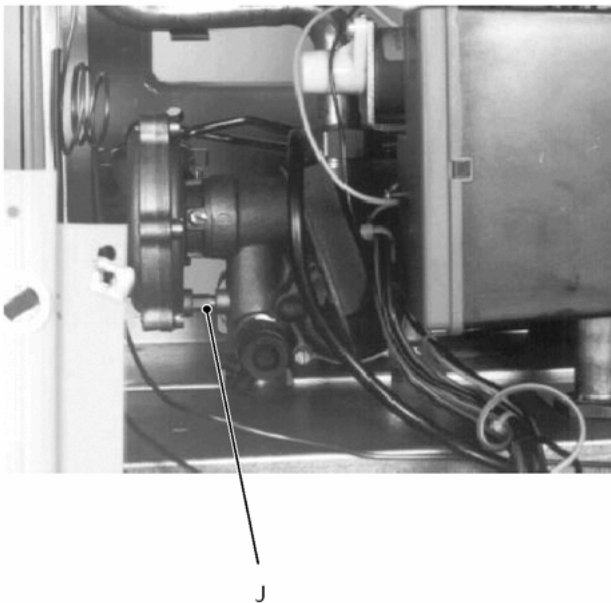


fig. 28

Removal of the switch

1. Switch off the boiler; remove the front panel of the case, the lower protection plate and lower the control panel.
2. Remove the fork *K* that holds the d.h.w. pressure switch *L* placed on the right side of the valve and remove the switch ([fig. 29](#)).
3. Open the box and disconnect the switch.
4. Reassemble the switch proceeding in the reverse order.

fig. 29

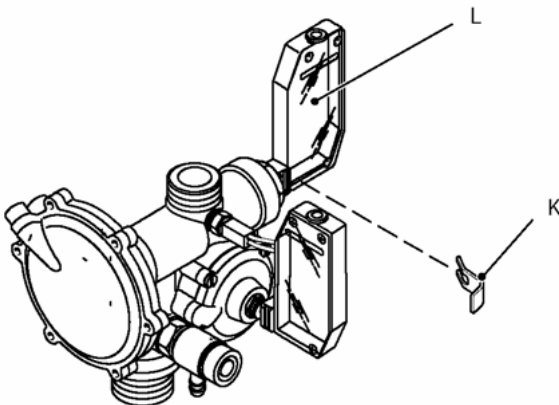


fig. 29

Removal of the valve and the diverter mechanism

1. Switch off the boiler; remove the front panel of the case, the lower protection plate and lower the control panel.
2. Drain the d.h.w. and the c/h circuits.
3. Completely loosen the connections to the hydraulic circuits indicated in [fig. 30](#).
4. Remove the forks *M* and move away the pipes *N* ([fig. 31](#)).
5. Remove the forks that hold the d.h.w. pressure switch *O* and the main circuit flow switch *P* and separate the switches from the valve ([fig. 32](#)).
6. Disconnect the temperature probe *Q*.
7. Unscrew the screw *R* that holds the d.h.w. heat exchanger, the bolt *S* that holds the valve to the frame ([fig. 33](#)) and remove the valve.

fig. 30

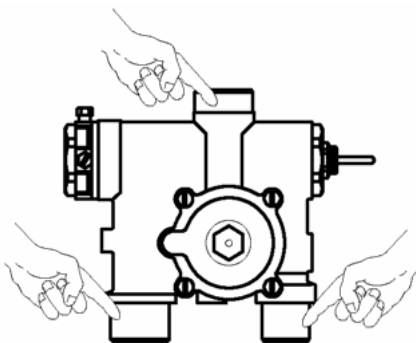


fig. 30

fig. 31

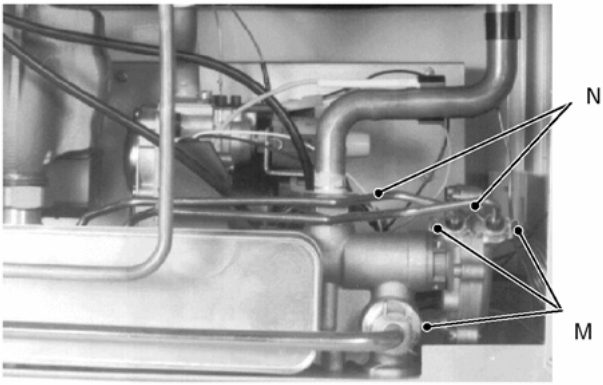


fig. 31

fig. 32

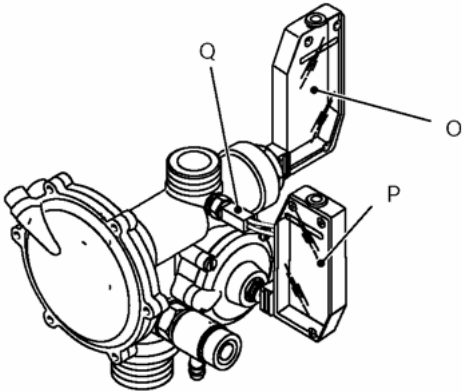


fig. 32

fig. 33

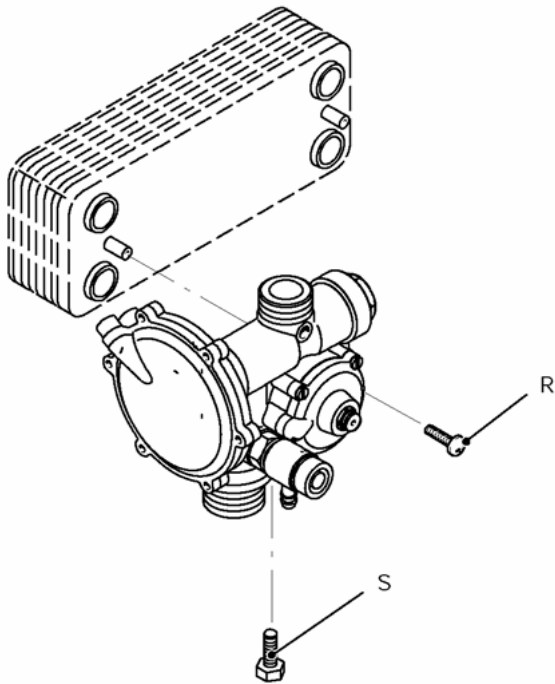


fig. 33

The diverter mechanism is composed by two parts. To reach them remove the hydraulic actuator as explained at the step 3 of the part *Removal of the membrane* of this chapter.

With a suitable spanner unscrew both plugs indicated in [fig. 34](#) and remove the parts of the diverter mechanism.

fig. 34

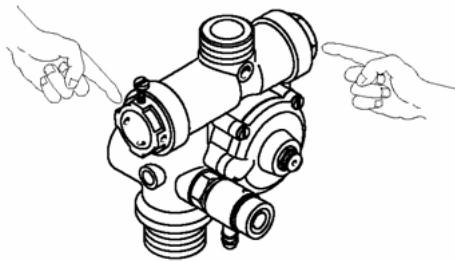


fig. 34

Reassemble the valve proceeding in the reverse order.

9 Electronic control circuit

9.1 Function

The fundamental function of the control circuit is that of controlling the boiler in relation to the external needs (heating the room, heating the water for d.h.w. use) operating in order to keep the temperature of the hydraulic circuits constant.

This is obviously possible within the useful power and maximum working temperature limits foreseen.

Generally, the control circuit receives inlet information coming from the boiler (the sensors) or from the outside (knobs, room thermostat, etc.), processes them and consequently acts with outlet commands on other components of the boiler ([fig. 35](#)).

fig. 35

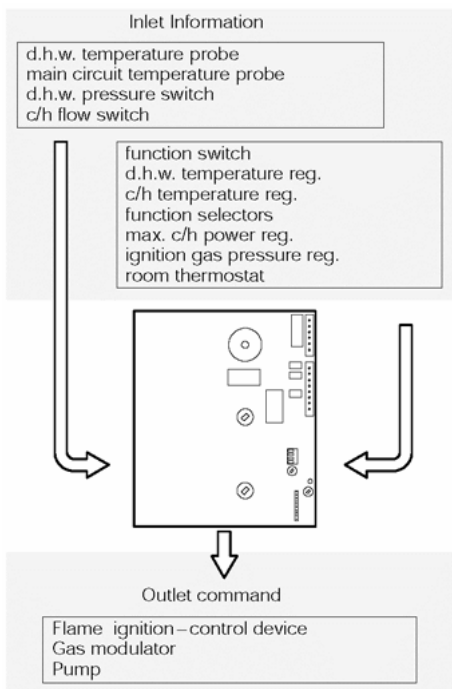


fig. 35

9.2 Selection and adjustment devices

On the control circuit several selection, adjustment and protection devices are located. ([fig. 36](#)).

fig. 36

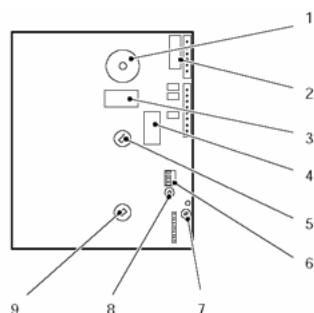


fig. 36

- 1 function switch
- 2 fuse F2 (1,6 A)
- 3 K1 relay
- 4 K2 relay (ignition device control)
- 5 d.h.w. temperature reg. potentiometer
- 6 function selectors
- 7 c/h maximum power adjustment (RISC.)
- 8 ignition gas pressure adjustment (ACC.)
- 9 c/h temperature reg. potentiometer

Several of these devices are directly accessible by the user (function switch, temperature adjustment potentiometers etc.) others are accessible by removing the cover.

9.3 Checking the temperature



The control circuit makes it possible to separately adjust the c/h water flow and d.h.w. outlet temperature.

The temperature of the water is converted into an electric signal by means of temperature probes. The user, setting the desired temperature with the knobs of the instrument panel operates the variable elements (5 and 9 in [fig. 36](#)) of the control circuit.

If the power requested is lower by about 40% of the maximum useful output, the control is done by igniting at the minimum power and turning off the burner (on- off function). If the power is higher the boiler will modulate down to 40% of its maximum power output.

When the boiler functions in c/h ([fig. 37](#)), the signal coming from the primary temperature probe is compared to the signal given by the instrument panel through the adjustment made by the user (knob ¹). The result of such a comparison operates the modulation of the gas valve, consequently changing the instantaneous useful output of the boiler.

fig. 37

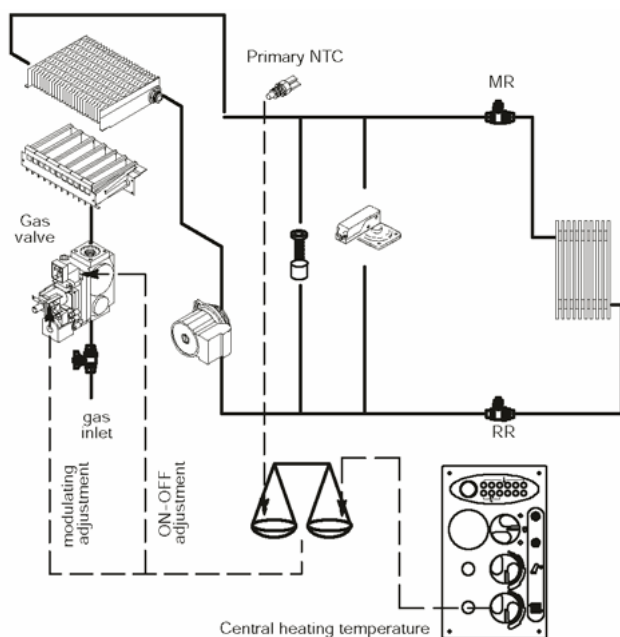


fig. 37

When the boiler functions in d.h.w. ([fig. 38](#)), the signal coming from the d.h.w. temperature probe is compared with the signal given by the instrument panel through the adjustment made by the user (knob ²).

fig. 38

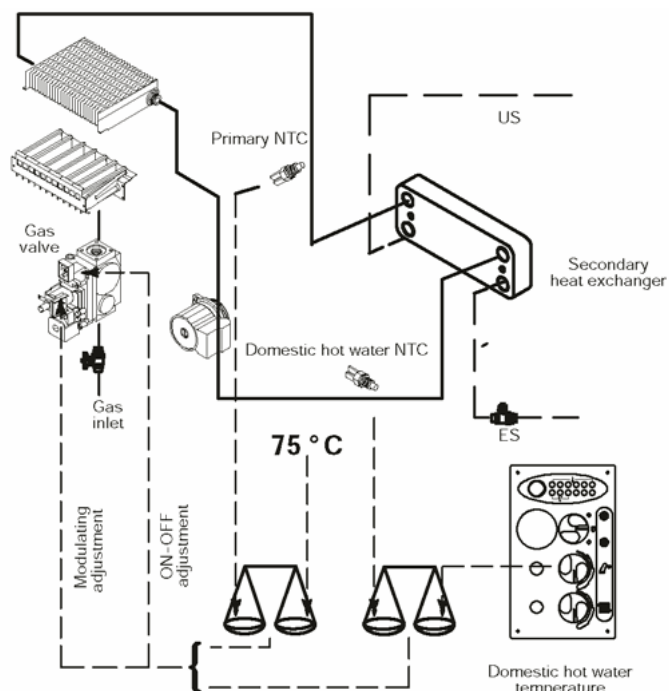


fig. 38

Normally, the result of the comparison between these two signals directly operates the adjustment elements of the gas valve, adjusting the useful output generated in order to stabilize the temperature of the exiting water.

If during the functioning in d.h.w. mode, the temperature of the primary circuit goes over 75°, the useful output is automatically reduced so that the primary circuit cannot reach excessive temperatures.

The control sequences in ³ function and in ⁴ function are illustrated in detail in [sections 9.9](#) and [9.10](#).

9.4 Function selectors

The function selectors "6" ([fig. 36](#) and [fig. 39](#)) are microswitches with which it is possible to select the various modes of functioning of the boiler.

fig. 39

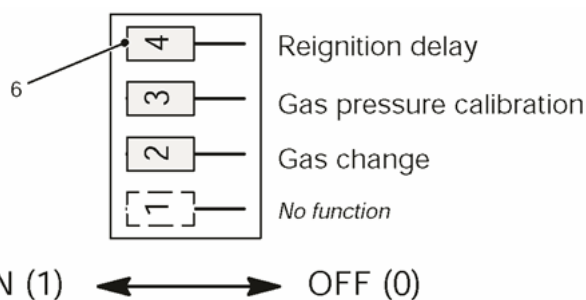


fig. 39

In [fig. 39](#) the selectors are illustrated in the configuration in which the p.c.b. is set in the factory (natural gas boiler).

Selector 2

It selects the functioning of the boiler on the basis of the type of gas used.

It allows the selection of the maximum supply current given to the modulator device.

To set correctly the selector follow the table of [fig. 40](#).

fig. 40

Gas supply	Position of selector	Approx. Max current trough the modulator device
Natural gas	On	120 mA
L.P.G.	Off	165 mA

fig. 40

Selector 3

It forces the functioning of the boiler in order to permit the optimal gas pressure at the burner to be adjusted during the ignition phase.

The adjustment (see [section 9.5](#)) is done by means of the potentiometer "8" marked "ACC." ([fig. 36](#)).

After the adjustment operations bring the selector back to the normal position (ON).

fig. 41

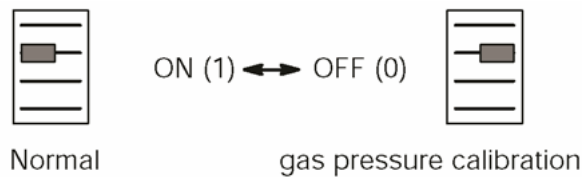


fig. 41

Selector 4

It makes it possible to select the minimum time that must pass between two ignitions of the burner in c/h function.

fig. 42

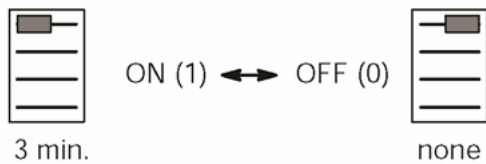


fig. 42

9.5 Ignition gas pressure regulator

By using the device "8" ([fig. 36](#)) marked "ACC." on the circuit board, it is possible to adjust the gas pressure at the injectors in the ignition phase.

This pressure is maintained at the injectors until ignition occurs (ionization signal).

To carry out the adjustment move the function selector n°3 downwards (adjustment) and use the adjustment device "8"(ACC).

Bring the gas pressure at the injectors to the value indicated in the tables "data for gas adjustment" stated for each model in the second part of the manual (ignition pressure).

By rotating the device clockwise the pressure increases.

Check the regular ignition of the burner by turning the boiler on and off repeatedly.

After the adjustment operation move the selector upwards (normal).

fig. 43

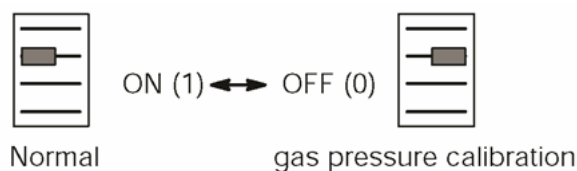


fig. 43

9.6 Max. c/h power regulator

By using device 7 ([fig. 36](#)) marked "RISC." on the circuit board, you can limit the maximum useful output delivered in the c/h function. This adjustment does not influence the maximum useful output delivered in d.h.w. function.

By rotating the device clockwise the pressure increases.

9.7 Checks

Check that the fuse is complete

If the control circuit does not supply any device (pump, gas valve, etc.) check that the fuse F2 is complete ([fig. 44](#)).

fig. 44

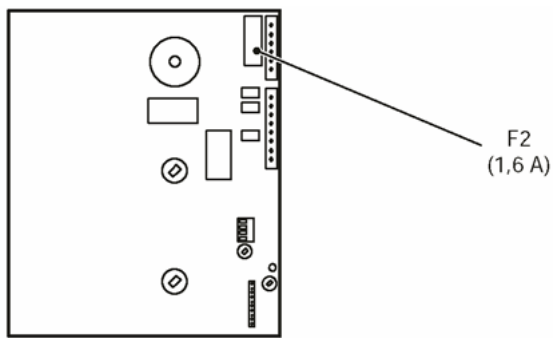


fig. 44

The F2 fuse can be reached by removing the panel cover.

If the fuse is blown replace it with one that has the same characteristics after having identified the cause of the interruption.

9.8 Removal of the control circuit

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the cover of the control panel as described in the [section 2.3](#) of this manual;
2. Delicately flex the hooks indicated in [fig. 45](#) and disconnect the four connectors A
3. unscrew the three screws B and move away the bracket C ([fig. 46](#));
4. unscrew the three screws D and remove the circuit ([fig. 45](#));
5. assemble the control circuit following the disassembly procedures in the reverse order.

fig. 45

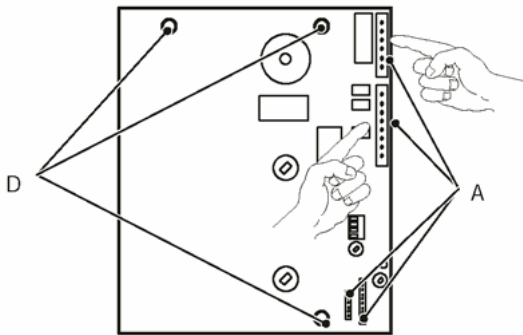


fig. 45

fig. 46

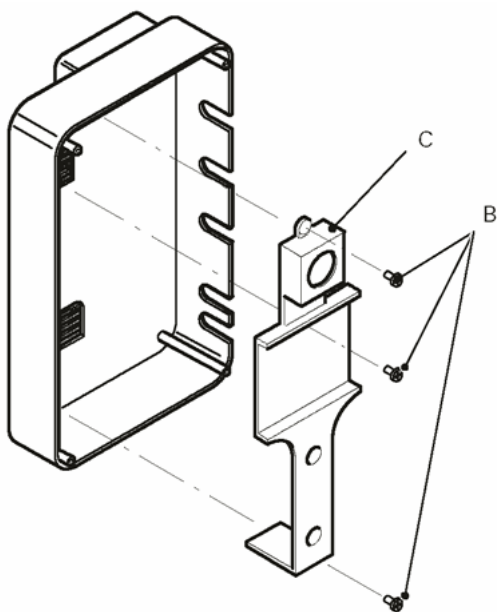


fig. 46

Attention: in order to facilitate the mounting of the cover:

1. position the knobs of the panel as illustrate in [fig. 47](#);
2. insert the spindles in the potentiometers E and F ([fig. 48](#)) and rotate them fully clockwise;

3. extract the spinldes and insert them with the flat side pointing in the direction shown in [fig. 48](#);
4. position the spindles as in [fig. 49](#) and mount the panel cover.

fig. 47

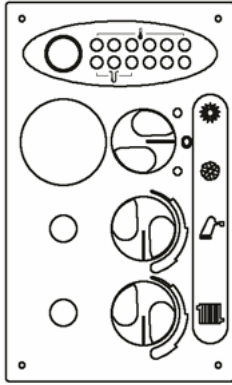


fig. 47

fig. 48

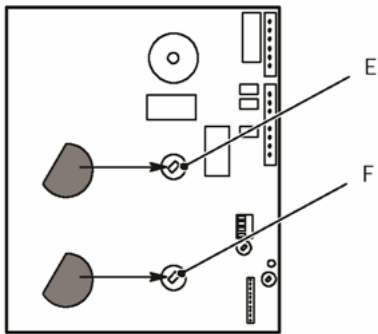


fig. 48

fig. 49

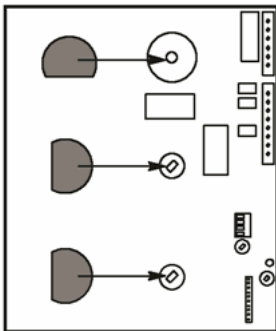


fig. 49

1 
2 

After having installed the control panel make sure the central heating ⁽¹⁾ and domestic hot water temperature ⁽²⁾ adjustment knobs can move freely (half a turn).

9.9 Thermal control in the “ ” mode

fig. 50

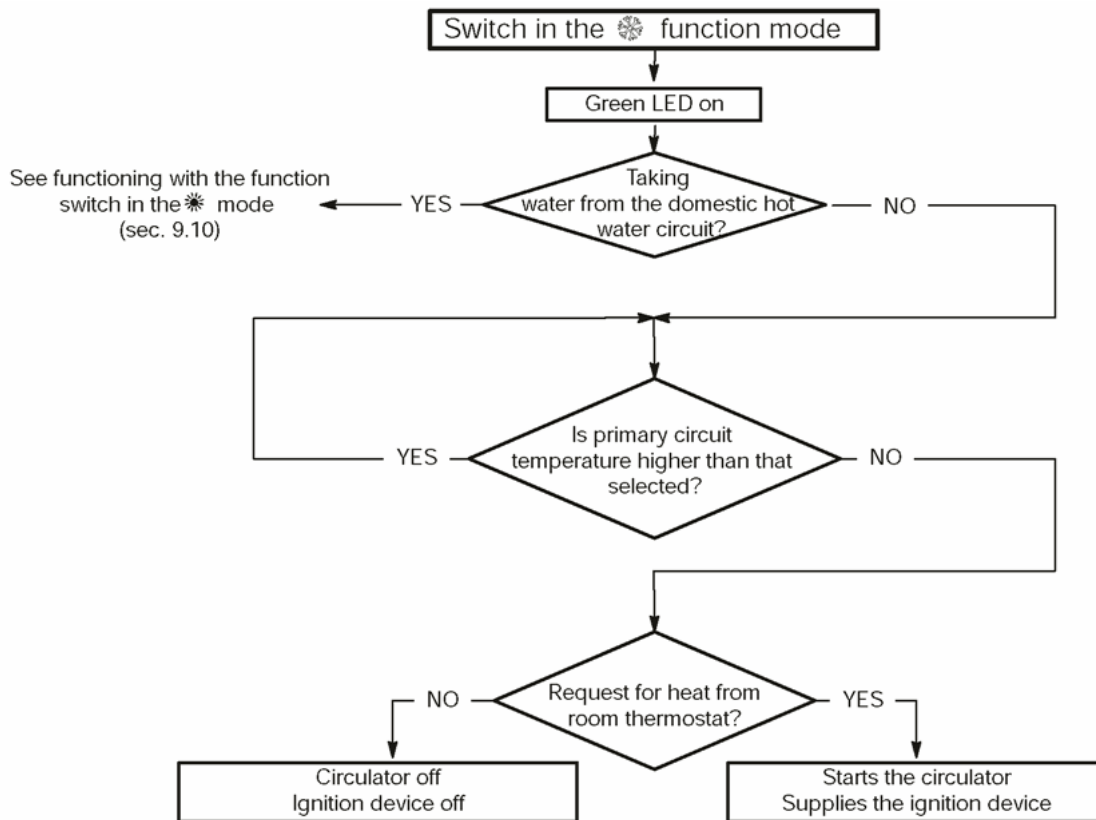


fig. 50

9.10 Thermal control in the " " mode

fig. 51

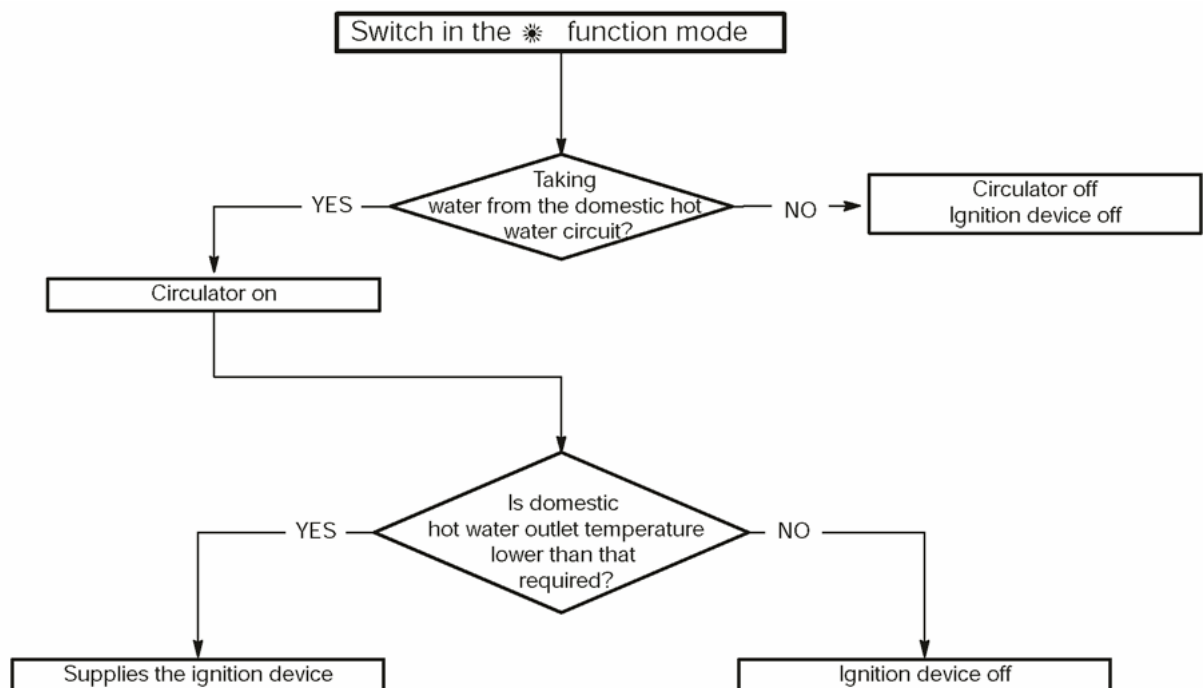


fig. 51

10 Display circuit

10.1 Function

The boiler is equipped with a pcb that displays some information about the operation of the appliance.

The electric signals that operate the display circuit are given directly by the electronic control circuit or by the water pressure switches.

fig. 52

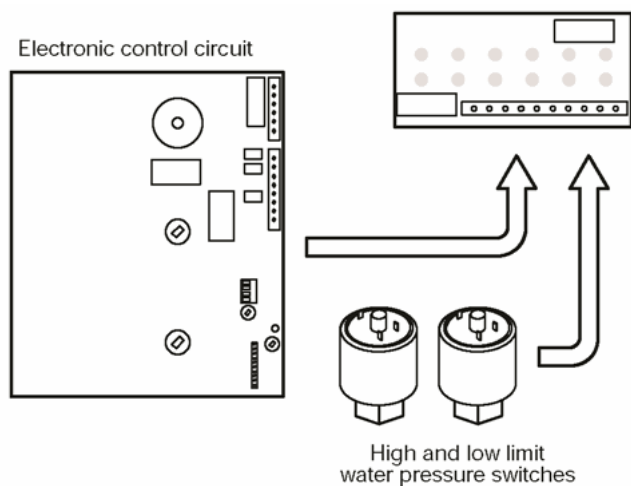


fig. 52

10.2 Display circuit operation

The following drawing ([fig. 53](#)) and list illustrate the position of each light and its function.

fig. 53

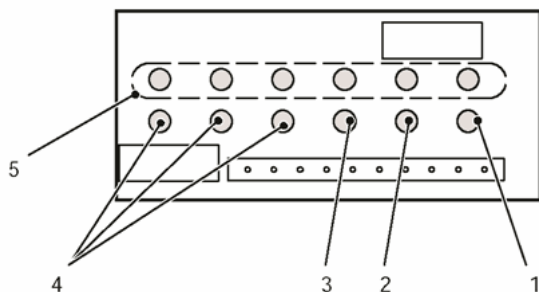


fig. 53

The colours are referred to the transparent windows of the control panel cover.

1 Boiler on - green

It indicates the operation of the boiler.

When the boiler is switched on, the indicator is continuously lit except after the extinction of the burner during the c.h. operation.

In this condition the light flashes for a period of 3 minutes indicating the reignition delay state of the boiler. This flashing indication is not affected by the position of the function selector on the control circuit (see [sect. 9.4](#)).

Switching the boiler on, the light could remain switched off for a period not longer than 20 seconds due to the reset time of the control system.

2 Heat request - green

This light indicates the heat request signal from the electronic control circuit and it comes on when the water temperature (d.h.w. or c.h. circuit) is lower than the requested on the control panel.

During d.h.w. operation it coincides with the ignition of the burner.

During c.h. operation the light could be on and the burner could remain off due to the room thermostat and/or time switch that don't call for heat.

3 D.h.w. request - green

This light comes on when the boiler operates on d.h.w.

4 Main circuit pressure - yellow / green / red

These lights indicate the pressure of the water in the main (c.h.) circuit.

If the left one (yellow) is on, this means that the pressure is too low (approx. below 1 bar). If the right one (red) comes on, the water pressure is too high (approx. over 2 bar).

The central light (green) indicates the right pressure and the correct filling of the circuit.

5 Main circuit temperature - green / yellow

These lights indicate the water temperature in the main (c.h.) circuit.

All the lights are green with the exception of the right one that is yellow and indicates the highest temperature.

Only one at a time of these light is turned on.

The lights are turned on referring to the signal that comes from the central heating temperature probe. Consequently, the reading of the temperature can be altered by a faulty temperature probe.

10.3 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the cover of the control panel as described in the [section 2.3](#) of this manual;
2. disconnect the connector A, remove the two screws B ([fig. 54](#)) and remove the circuit board;
3. assemble the circuit following the disassembly procedures in the reverse order.

fig. 54

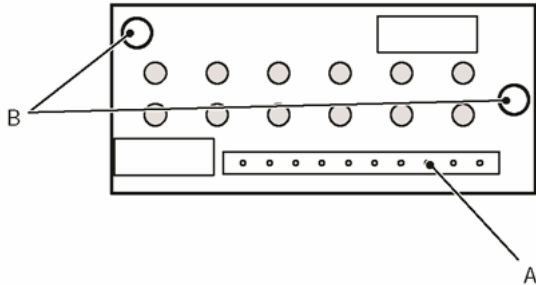


fig. 54

11 Full sequence ignition device

11.1 Function

The ignition and flame control device, type S4565DD, used on electronic ignition boilers with forced flue gas expulsion carries out the following fundamental functions:

- does a sequence of operations (ignition cycle) which lead to the ignition of the gas at the burner
- checks the presence of the flame during the entire period in which it is activated
- supplies the fan and checks its functioning by means of the signal coming from the flue gas pressure switch.

The ignition device is supplied by the electronic control circuit when the ignition of the burner is requested.

The ignition device has a **safety function** and any incorrect interventions or tampering can result in conditions of dangerous functioning of the boiler.

The ignition device can lock the functioning of the boiler (lock state) and stop its functioning up to the resetting intervention. The lock is signalled by the ignition of the lock lamp and the device can be reset only by using the reset push-button placed on the instrument panel.

Some components which are connected to the device that, can activate the lock state. The causes of a lock state could be:

- the intervention of the safety thermostat (primary hydraulic circuit)
- a fault on gas feeding
- faulty ignition (ignition electrode, its wiring and connection)
- faulty flame detection (detection electrode, its wiring and connection)
- gas injectors plugged
- faulty gas valve (on-off operators) or not electrically supplied
- faulty ignition device

other components like the flue gas pressure switch can temporarily stop the ignition of the burner but allow its ignition when the cause of the intervention has stopped.

[fig. 57](#) shows the sequence of the operations that are carried out at the starting of every ignition cycle and during normal functioning.

11.2 Checks

Shutdown sequence

Start the boiler until the burner is ignited.

While the burner is on, turn the gas supply off. The device should carry out a complete ignition cycle and then shutdown.

When turning the boiler on and off with the function switch, the device should not reset itself and the burner should not turn on.

11.3 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the front panel of the case and lower the control panel (see [sect. 2.2](#));
2. unscrew the screw A and remove the protection cover B; disconnect the flame detection cable C and the ignition cable D ([fig. 55](#));
3. remove the cable clamp and disconnect the two wires;
4. remove the ignition device by moving it from towards left ([fig. 56](#));

fig. 55 (view from the left side of the boiler)

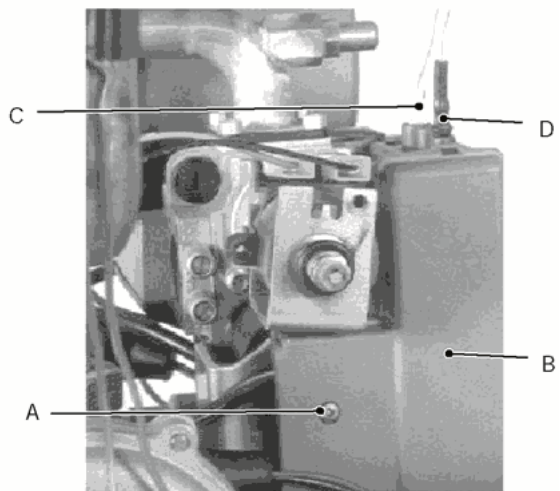


fig. 55 (view from the left side of the boiler)

fig. 56

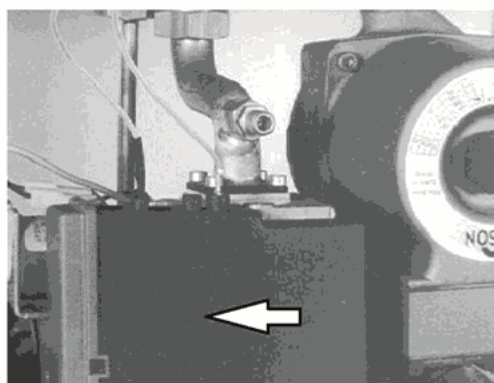


fig. 56

11.4 Ignition sequence

fig. 57

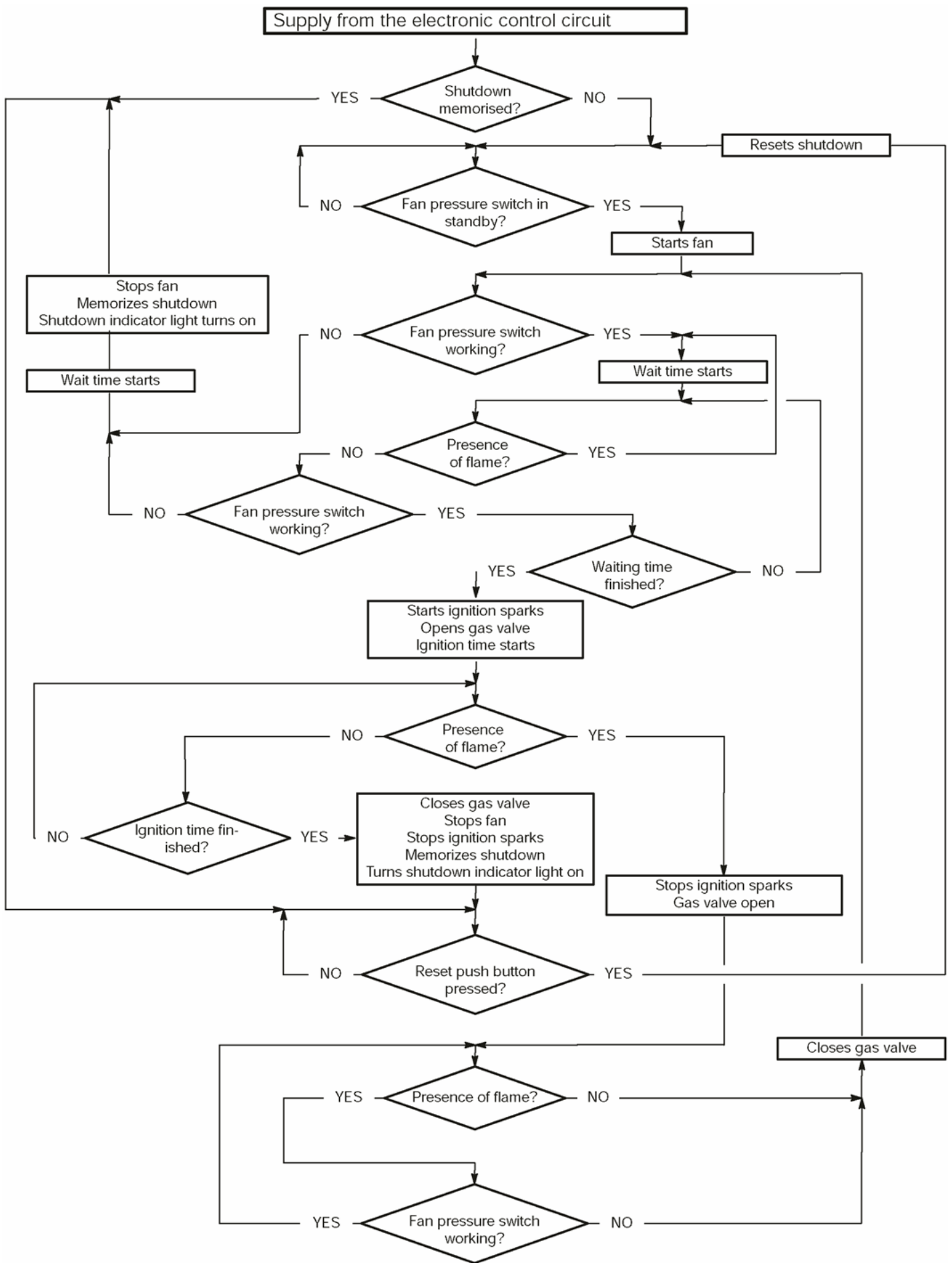


fig. 57

12 Gas valve

12.1 Function

The gas valve controls the gas inflow to the boiler burner.

By means of an electric command given to the on-off operators the passage of the gas through the valve can be opened or closed.

By means of an electric command given to the modulating operator the pressure can be varied and therefore the gas flow rate to the burner (modulation). The modulator device has mechanical organs which permit the adjustment of the minimum and maximum pressure exiting the valve.

12.2 Nomenclature of the parts

1. On-off operators
2. Modulating operator
3. Modulating operator's electric connectors
4. Valve inlet gas pressure test point
5. Valve outlet gas pressure test point
6. Gas pressure maximum adjuster
7. Gas pressure minimum adjuster

12.3 Adjustment

fig. 58 (view from the left side of the boiler)

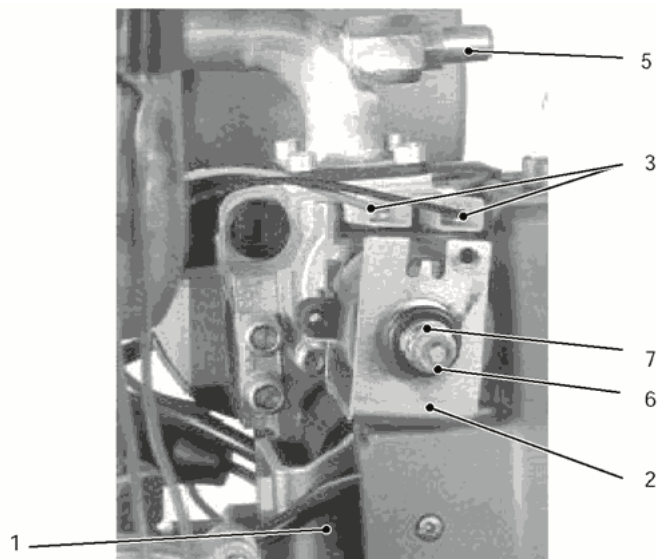


fig. 58 (view from the left side of the boiler)

fig. 59

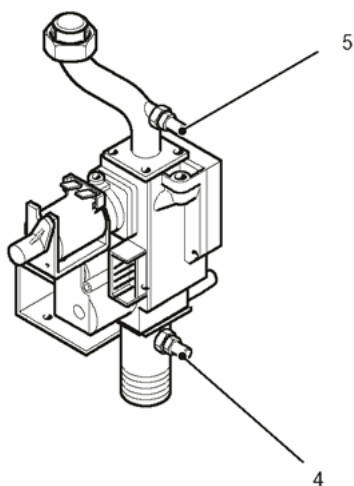


fig. 59

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the front panel of the case and lower the control panel as described in the [section 2.2](#);
2. open the gas pressure tap "4" at the valve input, connect a gauge and check the gas pressure of the supply network;
3. close the gas pressure tap "4";
4. open the gas pressure tap "5" at the valve output and connect a pressure gauge;
5. remove the protection cap from the mechanical pressure adjustment elements;
6. disconnect one of the two connectors "3" of the modulating operator;
7. start the boiler;
8. rotate the minimum pressure adjuster "7" until you obtain the expected pressure (by rotating clockwise the pressure increases);

9. turn the boiler off and connect the wire to the modulating operator;
10. start the boiler;
11. rotate the maximum pressure adjuster "6" until you obtain the expected pressure (by rotating clockwise the pressure increases);
12. turn the boiler off and disconnect the gauge;

At the end of the adjustment ensure to seal the gas test point.

12.4 Checks

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Check the modulating operator coil

1. Remove the front panel of the case and lower the control panel.
2. Disconnect one of the two connectors "3" ([fig. 58](#)) of the modulating operator and measure the electrical resistance of the coil.

Its electrical resistance value must be approx. 125 Ω.

Check the modulating operator coil

1. Remove the front panel of the case and lower the control panel.
2. Remove the full sequence ignition device (see the [section 11.3](#) of this manual).
3. Measure the electrical resistance between the leads of the on-off operators as illustrated in [fig. 60](#).

fig. 60

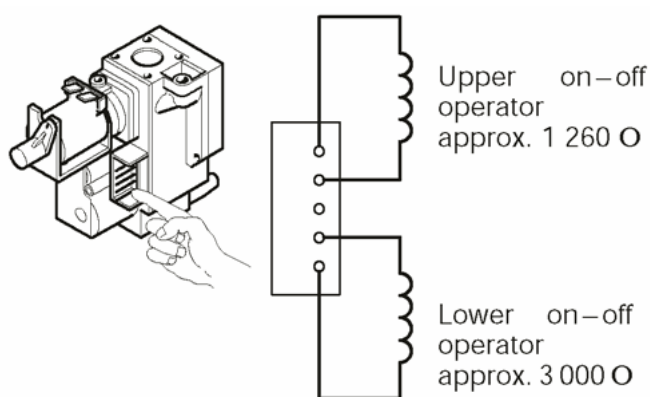


fig. 60

12.5 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the front panel of the case and lower the control panel.
2. Remove the full sequence ignition device (see the [section 11.3](#) of this manual).
3. Disconnect the modulating operator.
4. Unscrew the eight screws indicated in [fig. 61](#) and remove the valve.
5. Reassemble the valve carrying out the removal operations in reverse order.

fig. 61

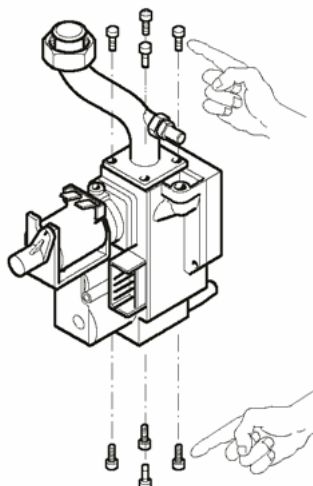


fig. 61

13 Main circuit flow switch

13.1 Function

The main circuit flow switch (A in [fig. 62](#)) is a device that controls the speed of water that crosses the main heat exchanger.

fig. 62

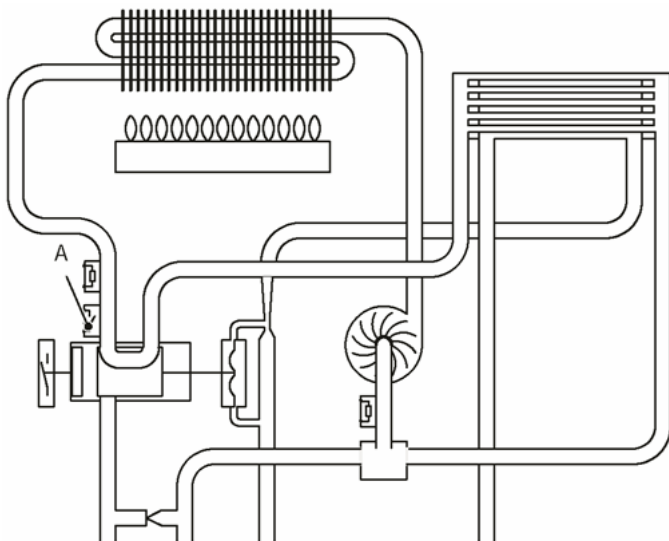


fig. 62

This device controls the regular functioning of the pump, the presence of water in the primary circuit of the boiler and the absence of obstructions of the main heat exchanger during the c/h function as well as during the d.h.w. function.

As a consequence of any one of these causes the main circuit flow switch cuts-off an electric circuit by means of a microswitch (B in [fig. 64](#)) installed on it.

The main circuit flow switch is connected to the electronic control circuit and its intervention prevents or stops the burner ignition cycle but does not send the boiler in the lock state.

13.2 Checks

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

General check

It is possible to verify the general operation of the switch by measuring the voltage between its leads during the operation on c/h or d.h.w.

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

- 1
1. Switch off the boiler and open the control panel.
 2. Connect a meter, set for alternating voltage (230V) measurement, to the points indicated in [fig. 63](#).
 3. Switch the boiler on ¹ position and verify the voltage by matching the readings with the values indicated in the [section 3.3](#).

fig. 63

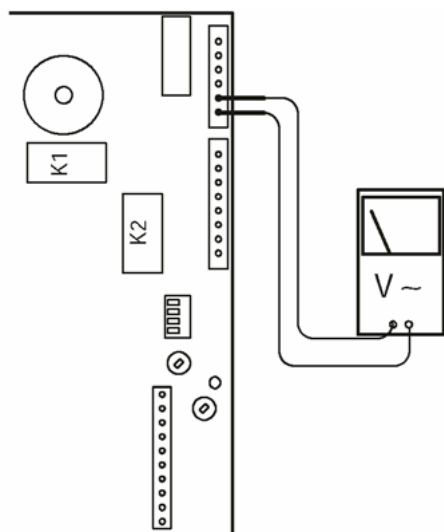


fig. 63

Mechanical function

1. Remove the front panel of the case and lower the control panel as described in the [section 2.2](#) of this manual.
2. Remove the fork *C* that holds the main circuit flow switch *B* ([fig. 64](#)).
3. Start and stop the boiler in c/h operation (time switch and external controls must call for heat) and verify the position of the shaft *D* referring to [fig. 65](#)

fig. 64

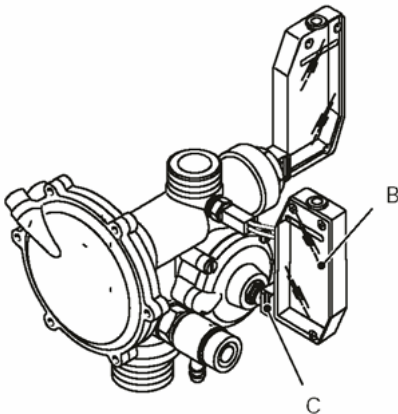


fig. 64

fig. 65

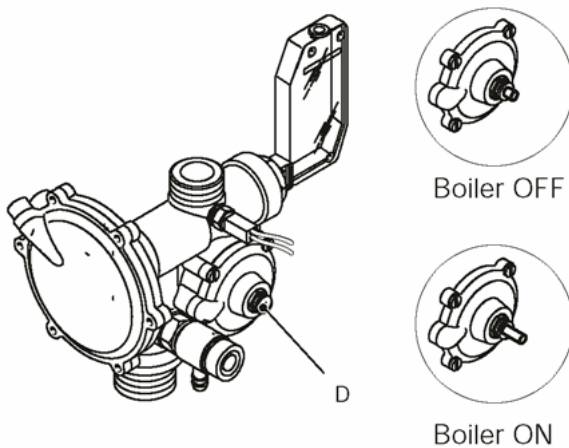


fig. 65

13.3 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Removal of the membrane

1. Remove the front panel of the case, lower the control panel and empty the main circuit.
2. Remove the fork *E* that holds the main circuit flow switch *B* ([fig. 64](#)).
3. Unscrew the four screws *F*, open the hydraulic operator and remove the membrane *G* ([fig. 66](#)).
4. Assemble the part proceeding in reverse order.

fig. 66

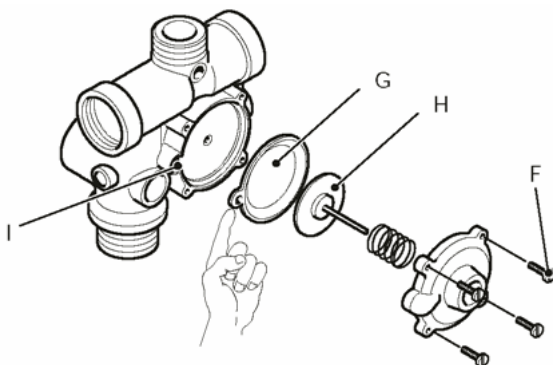


fig. 66

Assembling the part, ensure to place the concave side of the membrane towards the actuator plate *H* and the reference hole indicated in the seat *I* ([fig. 66](#)).

Removal of the switch

1. Switch off the boiler; remove the front panel of the case, lower the protection plate and lower the control panel.
2. Remove the fork *C* that holds the switch placed on the valve and remove the switch ([fig. 64](#)).
3. Open the box and disconnect the switch.
4. Reassemble the switch proceeding in the reverse order.

14 D.h.w. filter and flow limiter

14.1 General notes

The input port of the d.h.w. circuit is provided with a net filter and its function is to stop the passage of any impurities through the circuit.

The d.h.w. filter is located in the c.h. return group (indicated in [fig. 67](#)).

fig. 67

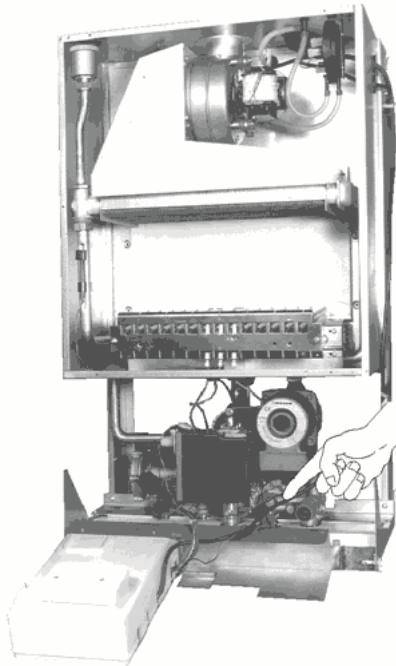


fig. 67

14.2 Removal of the filter

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the front panel of the case, the lower protection plate, lower the control panel and empty the d.h.w. circuit.
2. Unscrew the plug *A* ([fig. 68](#)) and extract the filter.

fig. 68

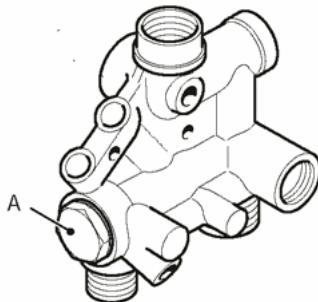


fig. 68

14.3 Flow limiter

424 S boilers are provided in the factory with a flow limiter rated at 10 litres/min.

If the flow rate of the d.h.w. circuit on the 428 S boiler is too high, it is also possible to limit it installing a flow limiter. The following sizes are available:

Nominal flow rate (litres/min)	Colour
10	Blue
12	Red

To install the flow limiter operate as in the following sequence:

- 1. Remove the d.h.w. filter as explained in the [section 14.2](#).
- 2. Unscrew the part *B* ([fig. 69](#)) and remove it from the body of the filter.
- 3. Install the flow limiter *C* putting its smaller diameter side towards the part *B*.
- 4. Install the filter following the removing sequence in reverse order.

fig. 69

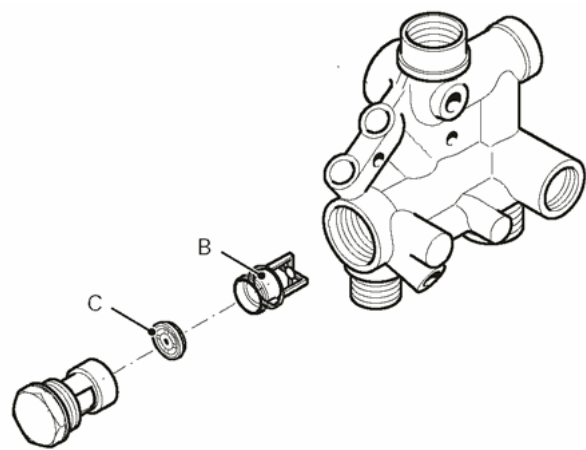


fig. 69

15 Temperature probes

15.1 Function

The temperature probe has the function of converting the temperature of the water of the hydraulic circuit where it is installed into an electric signal (resistance).

The relation between temperature and electrical resistance is stated in [fig. 70](#).

fig. 70

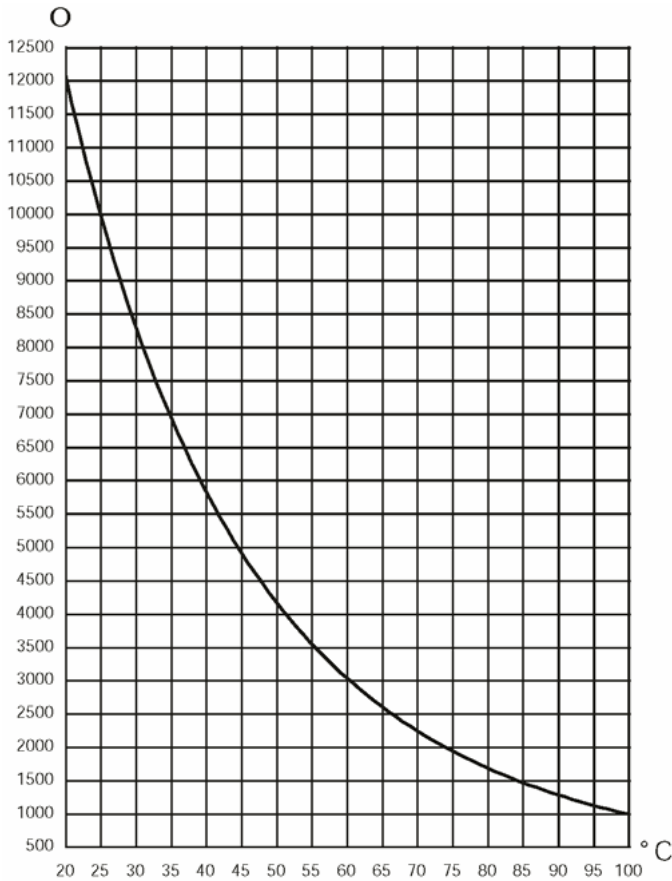


fig. 70

In the boilers with mixed function (c/h + d.h.w.) two temperature probes are assembled, one on the output of the main heat exchanger (main circuit temperature probe) A, ([fig. 71](#) and [fig. 72](#)) one on its input, before the pump (d.h.w. temperature probe) B ([fig. 71](#) and [fig. 73](#)).

fig. 71

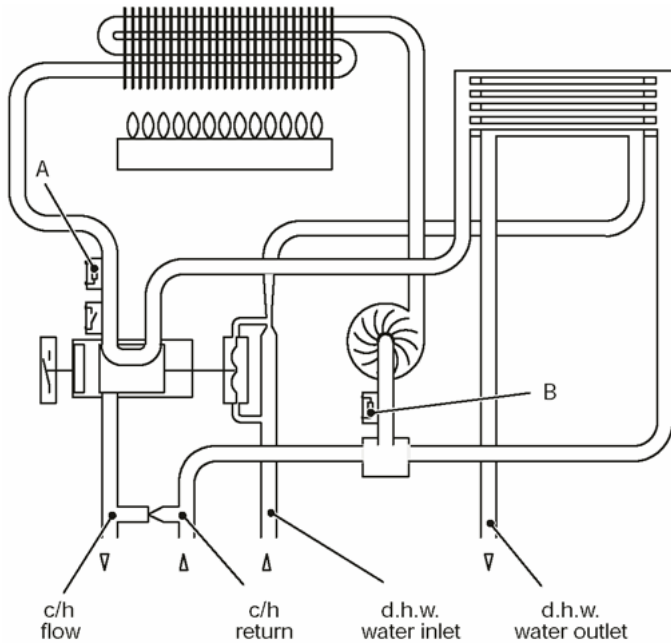


fig. 71

15.2 Checks

Temperature-resistance relationship

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Disconnect the cable from the temperature probe.

Measure the temperature of the pipe near the temperature probe and check the electrical resistance according to the graph in [fig. 70](#).

Remember that a temperature probe failed in short circuit sends a signal to the control circuit at a temperature equivalent to 100°C. A disconnected or interrupted temperature probe sends a signal at a temperature equivalent 0°C thus the burner will always be on maximum power.

15.3 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

To remove the main circuit or the d.h.w. temperature probes follow the same sequence.

Refer to [fig. 72](#) for the main circuit temperature probe, to [fig. 73](#) for the d.h.w. temperature probe.

fig. 72

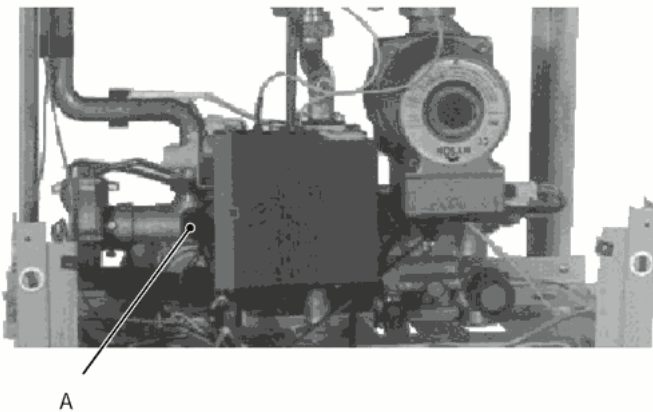


fig. 72

1. Remove the front panel of the case and lower the instrument panel;
2. empty the main circuit of the boiler;
3. remove the electric connector of the temperature probe and unscrew it;
4. assemble the temperature probe carrying out the removal operations in reverse order;

fig. 73

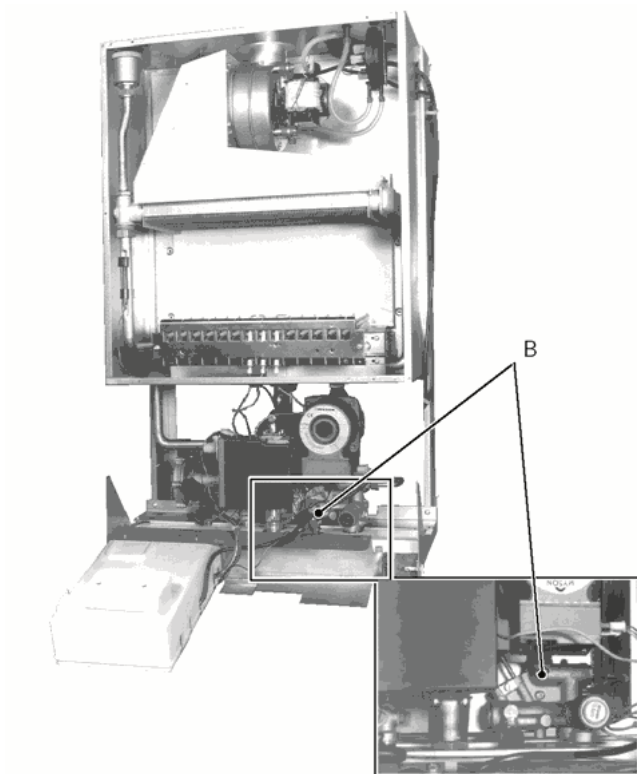


fig. 73

16 By-pass valve

16.1 Function

The by-pass valve is located between the c/h water flow and return (A in [fig. 74](#)) and its function is that of guaranteeing a minimum flow across the main heat exchanger also if the circulation across the c/h system is completely closed.

fig. 74

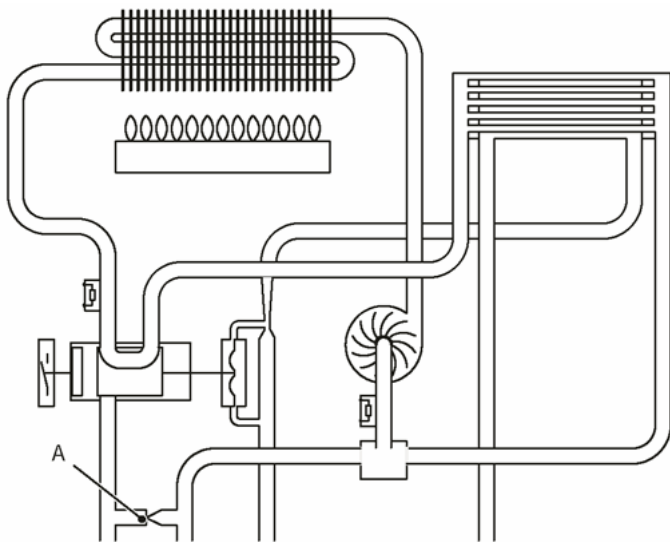


fig. 74

16.2 Removal

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the front panel of the case and lower the control panel;
2. empty the main circuit and the d.h.w. circuits of the boiler;
3. remove the hydraulic actuator *B* ([fig. 75](#)) as explained in the section *Diverter valve and d.h.w. pressure switch* of this manual;
4. remove the fork *C* and the pipe *D*.
5. Unscrew the connector *E* and remove the bypass valve *F* ([fig. 76](#));
6. reassemble the by-pass valve as illustrated in [fig. 76](#) and proceeding in reverse order.

fig. 75 (rear view of the boiler)

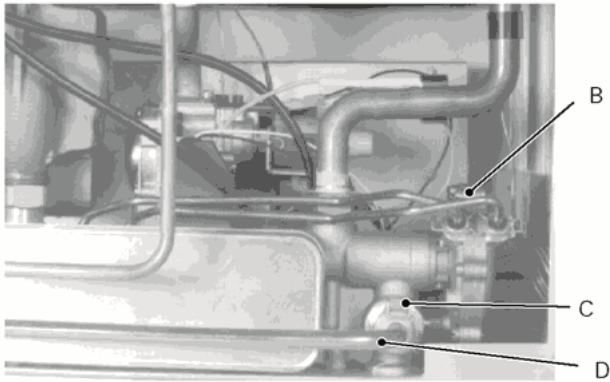


fig. 75 (rear view of the boiler)

fig. 76

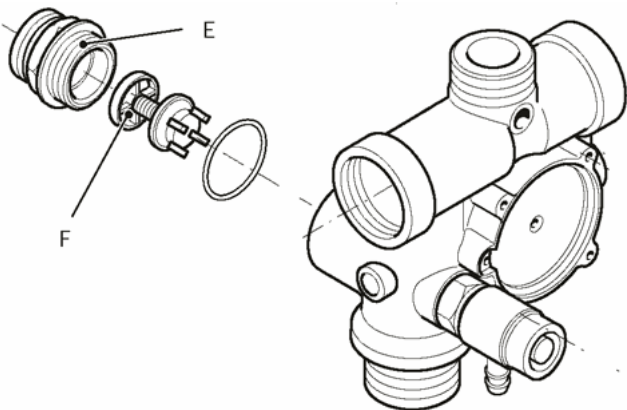


fig. 76

17 Water pressure switch and pump relay

17.1 Function

The boiler is equipped with two water pressure switches which are connected to the main (c.h.) water circuit. They have two different operating points and, by switching an electric circuit, they indicate the water pressure by means of the display circuit (fig. 77). The lower limit pressure switch interrupts the power to the pump via the pump relay, in the event that the system pressure drops below 0.5 bar.

fig. 77

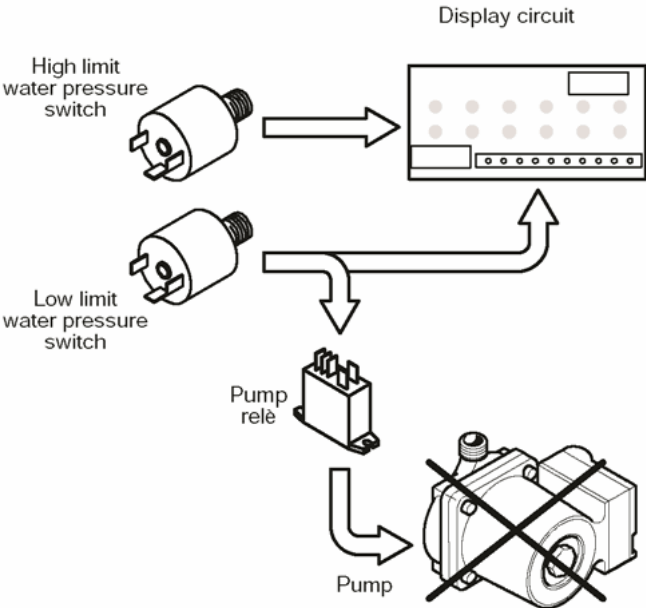


fig. 77

The high and low pressure switches can be identified by the color of the pastic plug situated on the end of each switch. The table below gives further details.

Pressure switching point (bar)	Colour
--------------------------------	--------

0.5	Black
2	Red

17.2 Checks

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1 Switch off the boiler. Remove the front panel of the case, lower the control panel and empty the main circuit.

If you need to verify the operating point of the switches, connect a suitable water pressure gauge to a test point of the circuit near the boiler;

2 disconnect the connectors to the pressure switches and measure the electrical resistance between the connections ([fig. 78](#)).

fig. 78

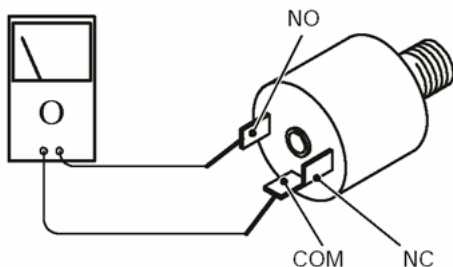


fig. 78

When the circuit is empty, the contact between the connection COM and the connection NC must be closed; the contact between COM and NO must be open.

3 Gradually fill the circuit. The lower limit pressure switch (brown plug) must switch at a pressure of about 0.5 bar.

Verify that the contact between COM and NC is open and between COM and NO is closed.

4 To check the high limit pressure switch (red plug) further increase the pressure of the circuit. It must switch at a pressure of about 2 bar. Verify the contacts as explained above.

After this test, remember to decrease the water pressure to an adequate value.

17.3 Removal of the pressure switch

1. Empty the main circuit of the boiler;
2. remove the front panel of the body, the right side panel and lower the control panel;
3. disconnect the wirings from the pressure switch and unscrew it.
4. Reassemble the switch carrying out the removal operations in the reverse order.

Reassembling the pressure switch, refer to the diagram of the [section 3.1](#) to connect correctly the wirings.

17.4 Removal of the pump relay

The pump relay is located under the display circuit. To remove it:

1. gain acces to the electric parts of the control panel (see [sect. 2.3](#));
2. remove the display circuit (see [sect. 10.3](#));
3. disconnect the wirings and remove the relay.

18 Flue fan, venturi, air pressure switch

18.1 Function

The boiler has a fan whose function is that of forcing the expulsion of the products of combustion.

The fan is supplied by the full sequence ignition device at the beginning of the ignition cycle.

Its correct functioning is controlled by means of a system of a built in venturi device and an air pressure switch.

18.2 Checks

Check of the fan

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Remove the front panel of the body and the lid of the sealed chamber.

Disconnect the connectors A ([fig. 79](#)) and measure the electrical resistance of the motor that has to be about 47 Ω.

fig. 79

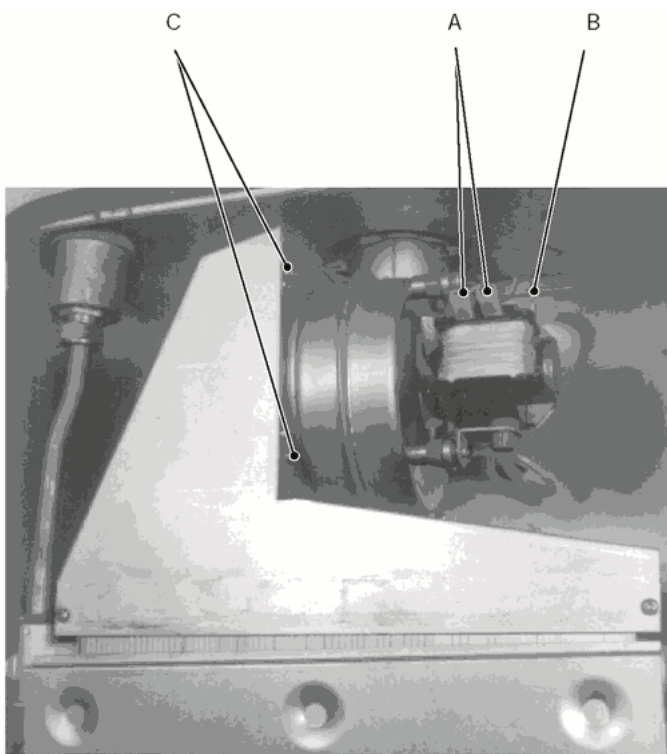


fig. 79

Check of the air pressure switch operation

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

- 1 Remove the front panel of the body and the lid of the sealed chamber
- 2 Disconnect the wires and check the electrical resistance between its connections

Between COM and NO the contact must be open.

Between COM and NC the contact must be closed (electrical resistance zero).

Refer to the [fig. 80a b](#) or [c](#) in accordance with the type of air pressure switch used.

fig. 80a

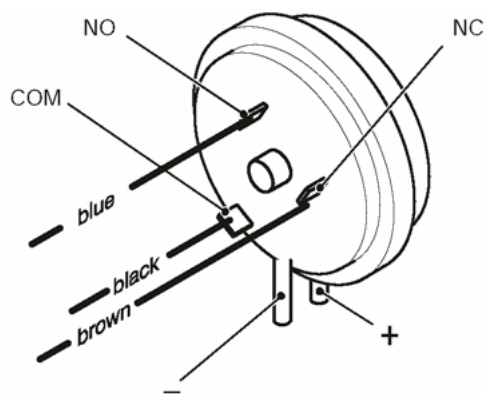


fig. 80a

These switches are interchangeable.

- 3 Connect the black wire (COM) and the brown wire (NC).

- 4 Run the boiler (the fan must run) and check the the electric resistance between COM and NO

Between COM and NO the contact must be closed (electrical resistance zero)

Remember that in this condition the boiler runs only for the ignition safety time and than it goes on safety lock-out. The above described test has

fig. 80b

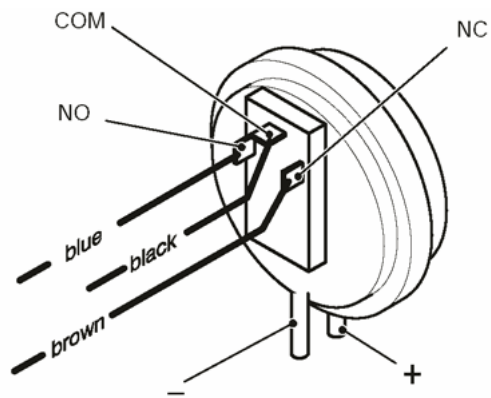


fig. 80b

fig. 80c

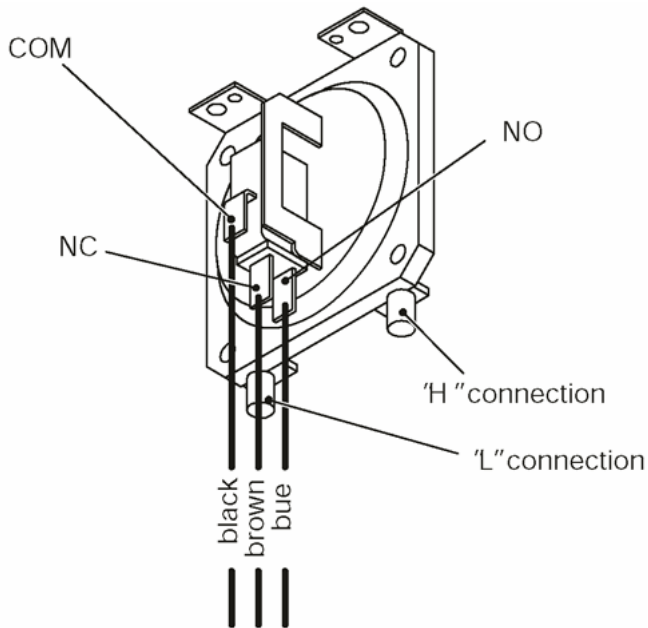


fig. 80c

18.3 Removal of the fan

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the front panel of the body and the lid of the sealed chamber;
2. disconnect the connectors A and the earth connection B ([fig. 79](#));
3. disconnect pipes which connect the venturi device to the air pressure switch;
4. unscrew the screws C and extract it from the exhaust flue duct than move it towards the front of the boiler;
5. remove the fan;
6. assemble the fan carrying out the removal operations in reverse sequence.

WARNING:

reassembling the fan, refer to [fig. 81](#) to connect correctly the venturi device to the air pressure switch.

fig. 81

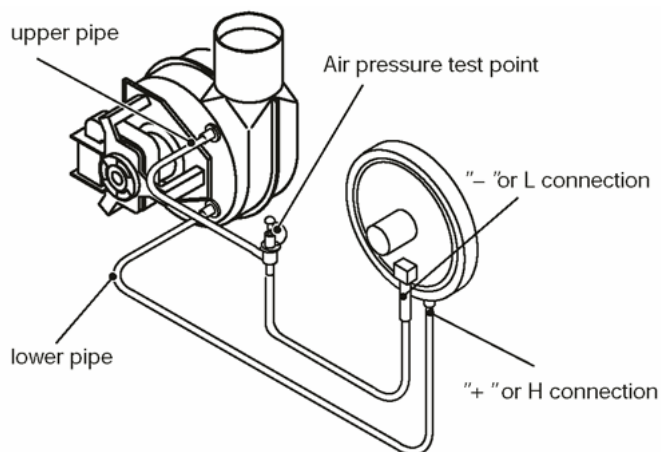


fig. 81

18.4 Removal of the air pressure switch

Note that there are two different air pressure switches with different operating values for the 424 S, 424 RS and 428 S boilers.

Refer to the short spare parts list for the correct selection of the switch.

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

1. Remove the front panel of the body and the lid of the sealed chamber;
2. Disconnect the wires of the air pressure switch;
3. Remove the two pipes from the air pressure switch;
4. Unscrew the screw *D* (two for the pressure switch of [fig. 80c](#)) which holds the air pressure switch to the frame ([fig. 82](#));

fig. 82

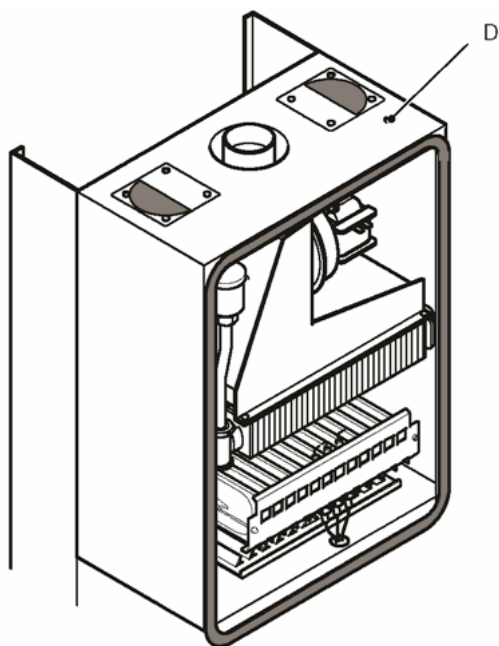


fig. 82

WARNING:

reassembling the air pressure switch, refer to [fig. 80a b](#) or [c](#) to connect correctly the wirings and to [fig. 81](#) to connect the venturi device to the air pressure switch.

19 Ignition and detection electrodes

19.1 Function

Three electrodes are fitted on the burner. Two of them are the ignition electrodes and are fitted near the front part of the burner. The ignition sparks take place between their metallic edges over the central ramp of the burner during the ignition sequence.

The third electrode is the detection electrode and it detects the presence of the flame.

fig. 83

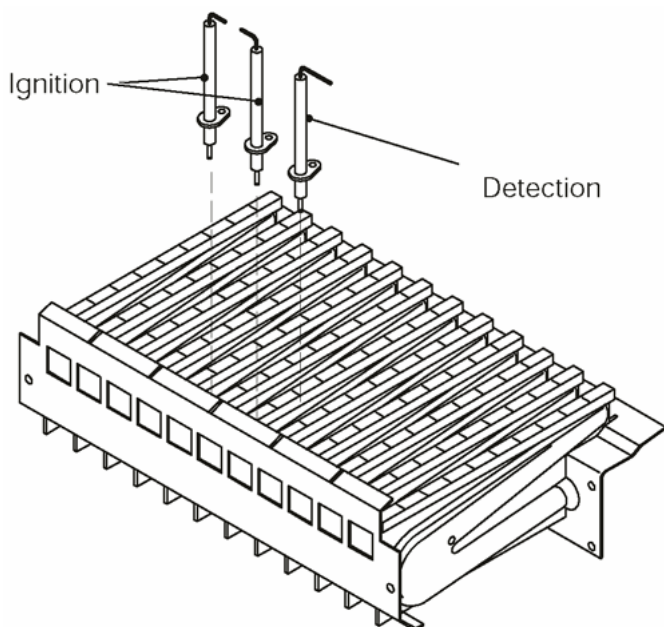


fig. 83

19.2 Checks

Check the position of the electrode edges

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Remove the front panel of the body, the sealed chamber cover and the combustion chamber panel.

Check for the correct distance between the metallic edges of the ignition electrodes and refer it to the [fig. 84](#).

fig. 84

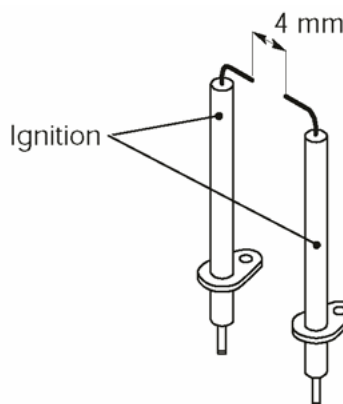


fig. 84

Check the integrity of the detection electrode and ensure that its metallic edge is correctly placed over the ramp of the burner.

Check the connection wires

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Remove the front panel of the body, the lid of the sealed chamber and the cover of the combustion chamber.

Check for the integrity of the insulation of wires which connect the electrodes to the ignition device.

19.3 Removal

1. Remove the front panel of the body, the sealed chamber lid and the combustion chamber panel.
2. Remove the burner unscrewing the four screws placed at the right and left sides of the burner.
3. Remove the grid unscrewing the two screws placed on the rear side of the burner.
4. Unscrew the screws A ([fig. 85](#)) which hold the electrodes to the burner.
5. Extract the electrodes from the burner.
6. disconnect the electrode wires from the full sequence ignition device.
7. Assemble the electrodes carrying out the removal operation in reverse order.

fig. 85

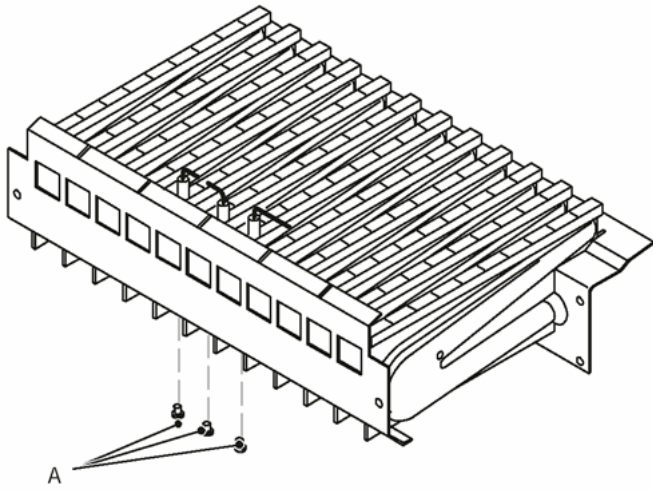


fig. 85

In order to recognize the electrodes refer to [fig. 83](#).

NOTE:

the metallic edge of the detection electrode is longer than the one of the ignition electrodes.

20 Safety thermostat

20.1 Function

The safety thermostat (A in [fig. 86](#)) is a device that senses the temperature of the main circuit water which flows in the outlet pipe of the main heat exchanger.

fig. 86

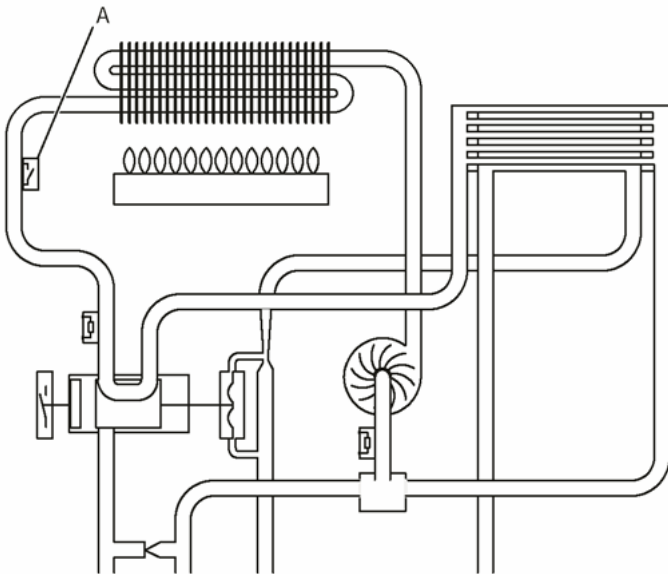


fig. 86

If the temperature control system of the boiler fails and the temperature of the main circuit reaches a dangerous temperature, the safety thermostat opens the electric circuit which supply the full sequence ignition device.

Consequently, the gas valve operators are no more activated and the gas flow to the burner is stopped.

The safety thermostat does not re--set automatically. To reset, it is necessary to remove the plug B and push the re -- set button with the help of a tool on the instrument panel ([fig. 87](#)).

fig. 87

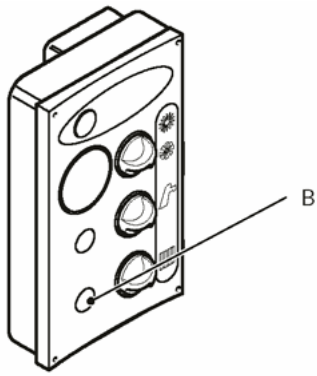


fig. 87

The safety thermostat has two parts:

the temperature probe *C* which is fitted on the outlet pipe of the main heat exchanger ([fig. 88](#)) and the electric switch *D* which is fitted in the control panel ([fig. 89](#))

fig. 88

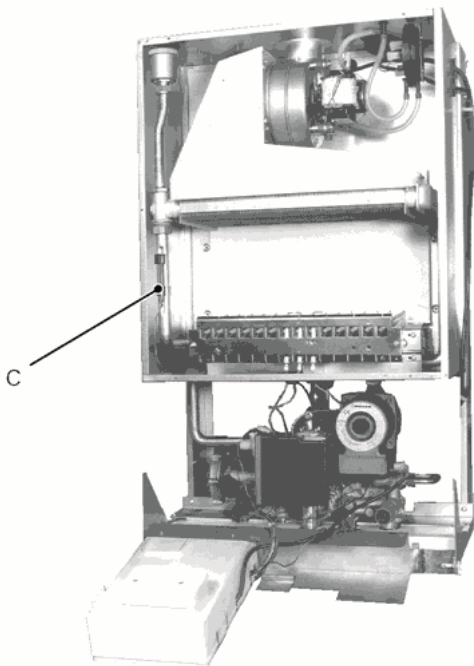


fig. 88

fig. 89

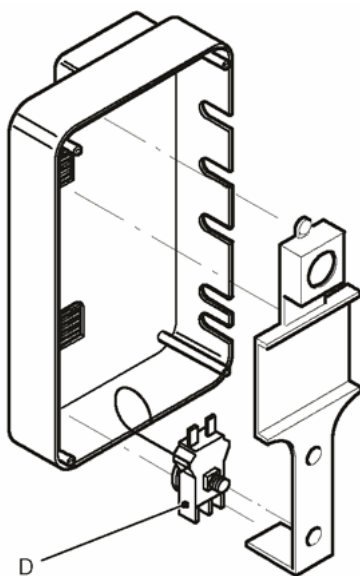


fig. 89

20.2 Checks

WARNING:

isolate the boiler from the mains electricity supply before removing any covering or component.

Position of probe and integrity

Remove the front panel of the case and the sealed chamber cover.

Verify the soundness of the fitting between the main circuit pipe and the temperature probe C ([fig. 88](#)). Verify the integrity of the capillary which connects the probe to the switch. If the capillary is broken the switch opens automatically.

Overheat temperature value

Set the temperature control knobs to their max. position and run the boiler in d.h.w. and c/h. Allow the boiler to reach its maximum operating temperature (monitor the temperature display on the control panel). The boiler should operate and maintain a temperature below that of the safety thermostat and no overheat intervention should occur.

It is not permissible to change the factory setting of the safety thermostat. The safety thermostat must be replaced if its operation temperature is too low and therefore constantly interrupts the correct functioning of the boiler and not allowing it to reach its maximum permissible operating temperatures.

Electrical function

Remove the cover of the control panel as described in the [section 2.3](#).

Disconnect the switch and check its electrical function. Normally (no intervention) the contact must be closed (electrical resistance zero Ω).

20.3 Removal

1. Remove the front panel of the case and the sealed chamber cover;
2. remove the springs which hold the temperature probe and extract the probe from the sealed chamber;
3. remove the cover of the control panel as described in the [section 2.3](#);
4. disconnect the switch;
5. unscrew the nut that holds the switch to the bracket *E* and remove the thermostat;
6. reassemble the switch carrying out the operations in reverse order.

fig. 90

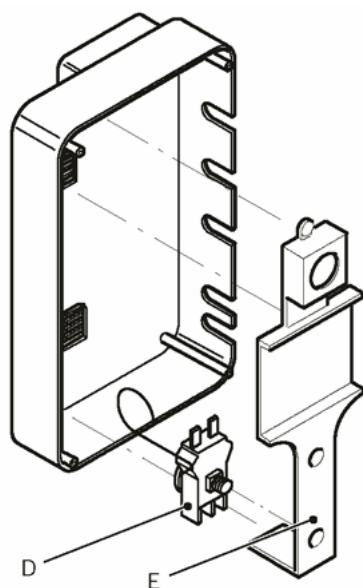


fig. 90

21 Short spare parts list

