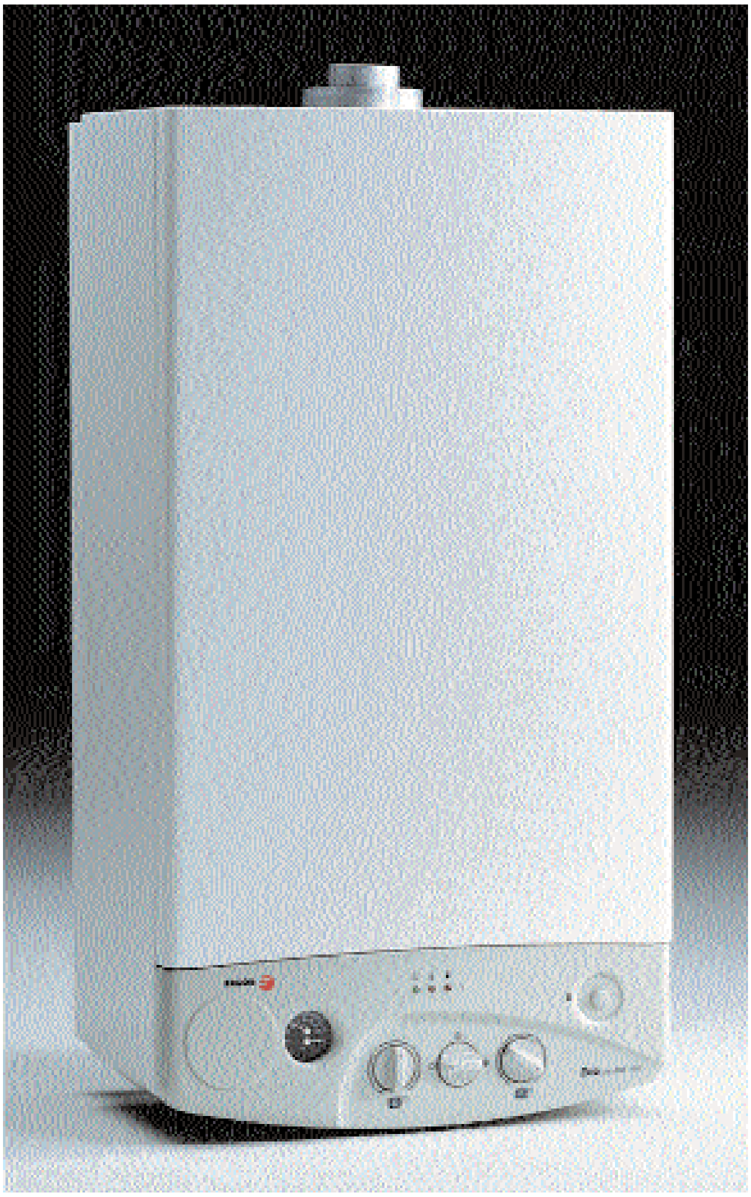
Technical Documentation



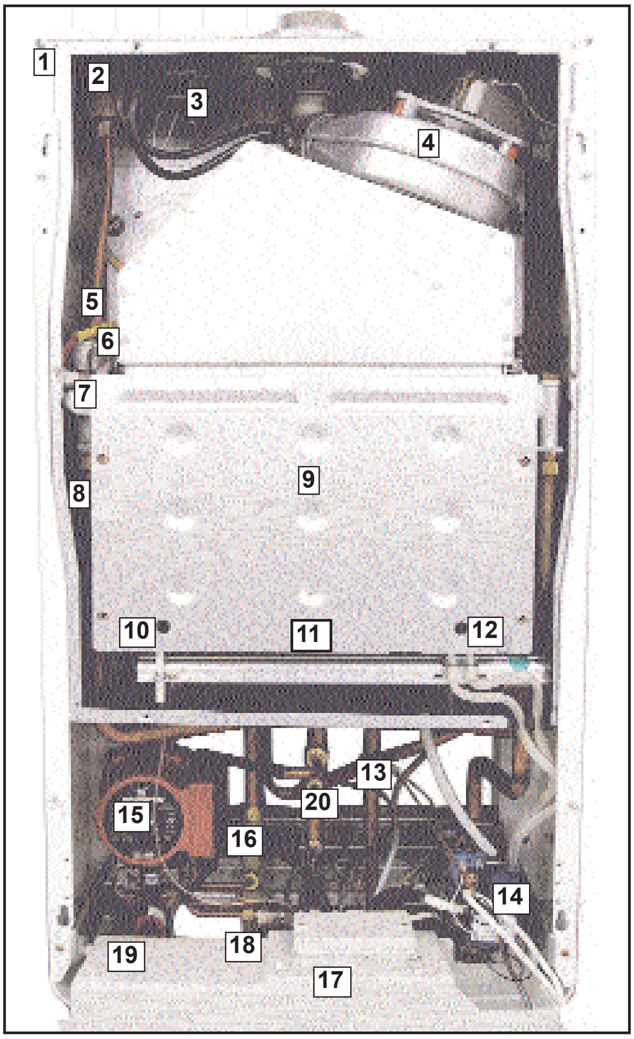
FEB-20E

Technical Documentation 01-2005

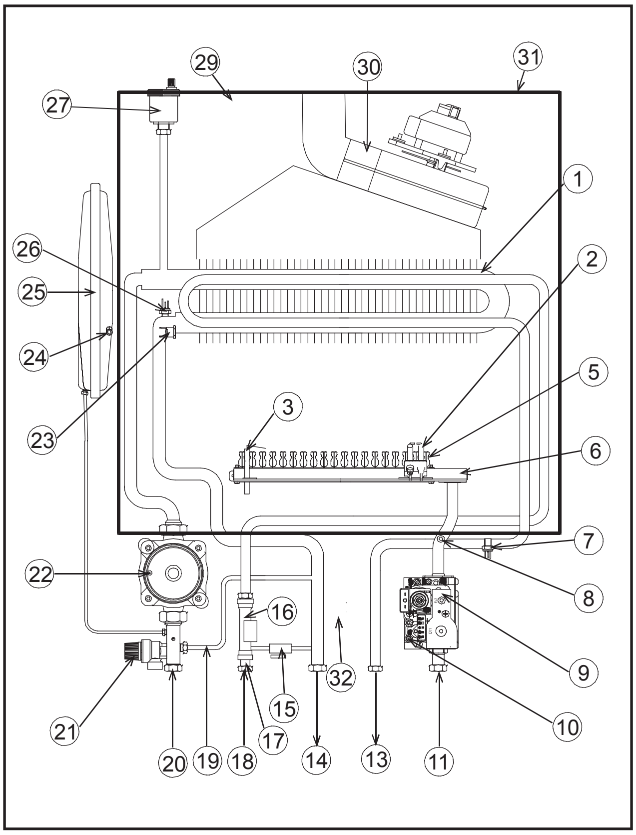
FAGOR Confort

TECHNICAL DATA

Model			**FEB-20E**
Category			II_{2H3P}
Type			$C_{12},C_{32},C_{42},C_{52}$
Central Heating (C.H) Output	Maximum Output	kW	23,8
		kcal/h	20.468
	Minimum Output	kW	9,3
		kcal/h	8.000
Domestic Hot Water (D.H.W.) Output	Maximum Output	kW	23,8
		kcal/h	20.468
	Minimum Output	kW	9,3
		kcal/h	8.000
Central Heating Nominal Heat Input (Hi) and D.H.W. Nominal Heat input (Hi)	Qn max.	kW	26
	Qn min.	kW	10,3
D.H.W. Flow Rate at 25º C Temp Rise (l/min)			13,6
D.H.W. Nominal Flow (l/min)			10
Minimum Flow Rate Required to Activate D.H .W. Mode (l/min)			2
Operating Pressure (bar)	Maximum	C.H.	3
	Maximum	D.H.W.	10
	Minimum	D.H.W.	0,25
Expansion Vessel Capacity (l)			7
Temperature Selection Range (ºC)	Central Heating		60-85
	D.H.W. Circuit		35-60
Gas Pressure (mbar)	Natural		13
	Propane		30
Gas Consumption	Natural (m^3/h)		2,75
	Propane (kg/h)		2,04
Electrical Supply (V/Hz)			220-230~50Hz
Power Consumption (W)			120
Dimensions (mm)	Height		807
	Width		440
	Depth		317
Connections	Gas Inlet		½”
	Cold Water Inlet		½”
	Hot Water Outlet		½”
	C.H. Flow		¾”
	C.H. Return		¾”
Flue Gas Exit Temp (ºC)			135
Net Weight (kg)			38



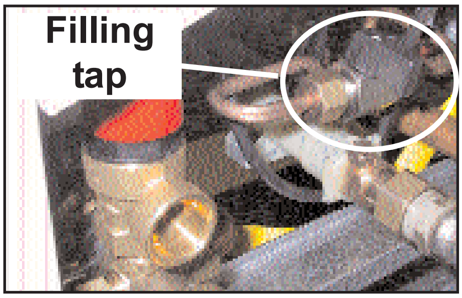
1. Back Plate
2. Automatic Air Vent
3. Air pressure switch
4. Fan
5. Heating Thermistor
6. Safety Thermostat
7. Heat Exchanger
8. Expansion Vessel
9. Combustion Chamber
10. Ionisation plug
11. Main Burner
12. Ignition plug
13. Domestic Hot Water Thermistor
14. Modulating Gas Valve
15. Circulation Pump
16. Flow switch
17. Electronic Swing Open Box
18. Heating circuit filling tap
19. Excess pressure relief valve
20. Water pressure switch



1.- Copper heat exchanger
2.- Ignition electrode
3.- Detection electrode
5.- Burner
6.- Injector Manifold
7.- D.H.W Thermistor
8.- Burner pressure nipple
9.- Modulating gas valve
10.- Inlet pressure nipple
11.- Gas inlet
13.- Hot Water outlet
14.- C.H. flow
15.- Heating circuit filling tap
16.- Flow
17.- Water filter
18.- Cold water inlet
19.- By-pass
20.- C.H. return
21.- Pressure relief valve
22.- Pump
23.- High limit stat
24.- Expansion vessel filling tap
25.- Expansion vessel
26.- Central heating thermistor
27.- Automatic air bleed
29.- Air pressure switch
30.- Fan
31.- Sealed air box
32.- Water Pressure switch

HIDRAULIC CHARACTERISTIC

FILLING THE HEATING CIRCUIT



The boiler works correctly when the pressure in the heating circuit (when the circuit is cold) is 1,2 bar.

To fill correctly the heating circuit with water is important to follow the steps:

◆ Fill the heating circuit **opening very slowly the filling tap**. The filling tap is placed in the bottom of the boiler (5)as it shows in the picture.

During the filling of the boiler is very important to make sure that the pump is ON.

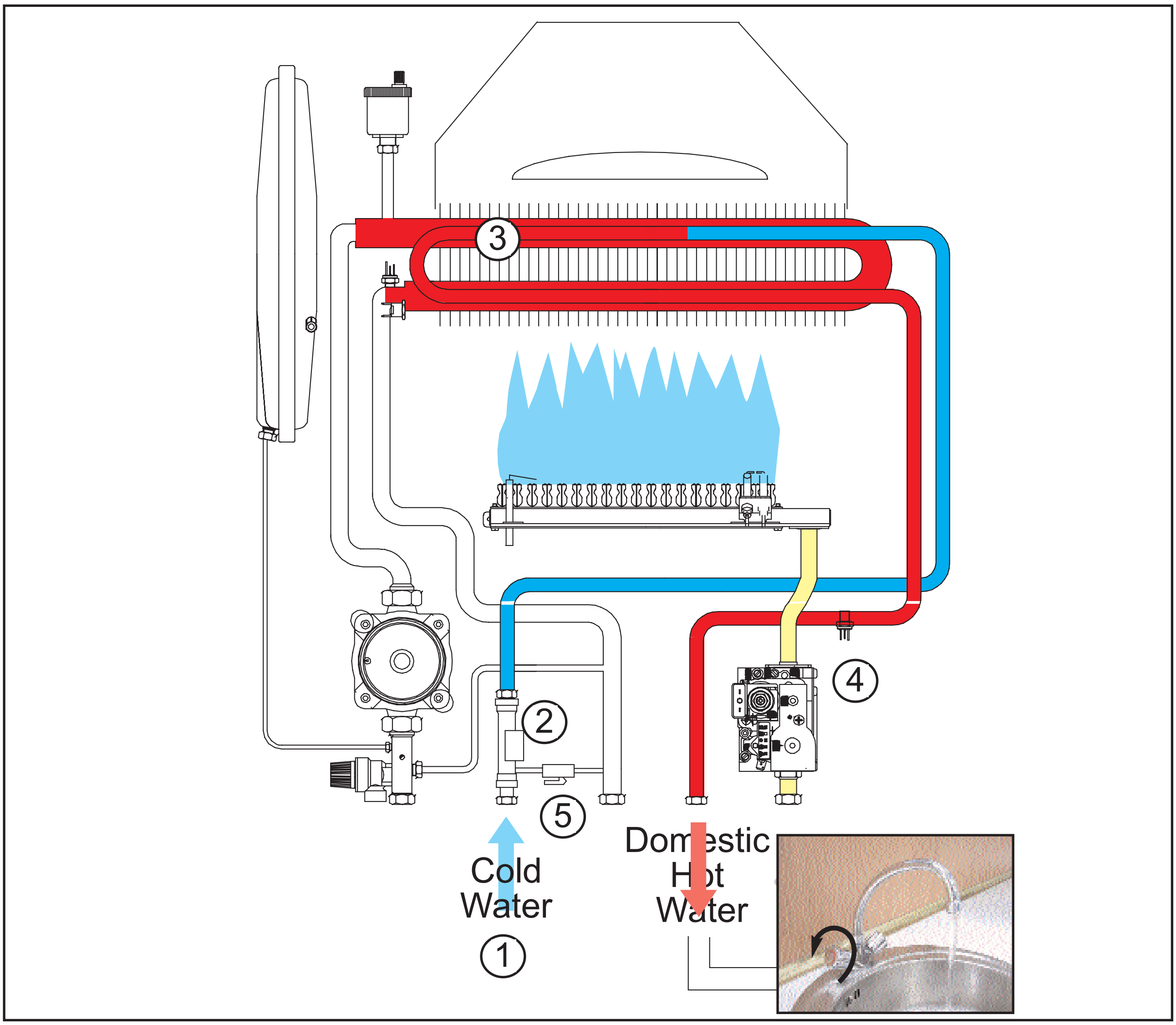
◆ Turn OFF the filling tap when the boiler gets to the pressure of 1,2 bar.

◆ Make sure that there is not water leak in the heating installation or even in the boiler. Check all the connections.

The installation and the boiler should be watertight, that means no air in the installation. It is very important to blowdown the boiler and the installation

D.H.W.

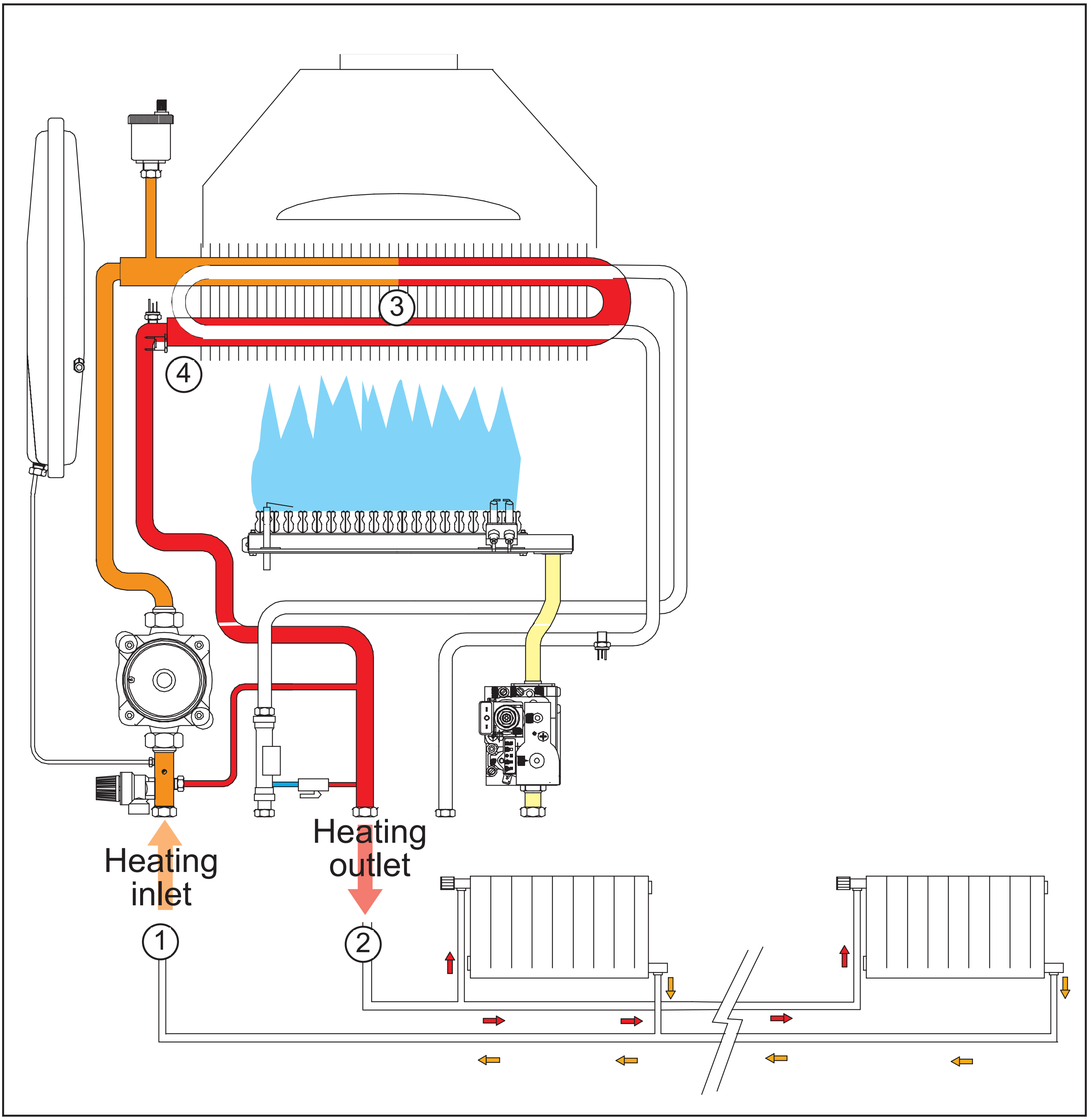
The cold water flows inside the circuit, The water gets inside the boiler (1). Then goes through the flowswitch (2) (this one tells to the electronic circuit that there is an D.H.W. demand). Then the water goes through the heat exchanger (3). While the water goes through gets hotter and hotter. The temperature value is checked by the D.H.W. thermistor(4).

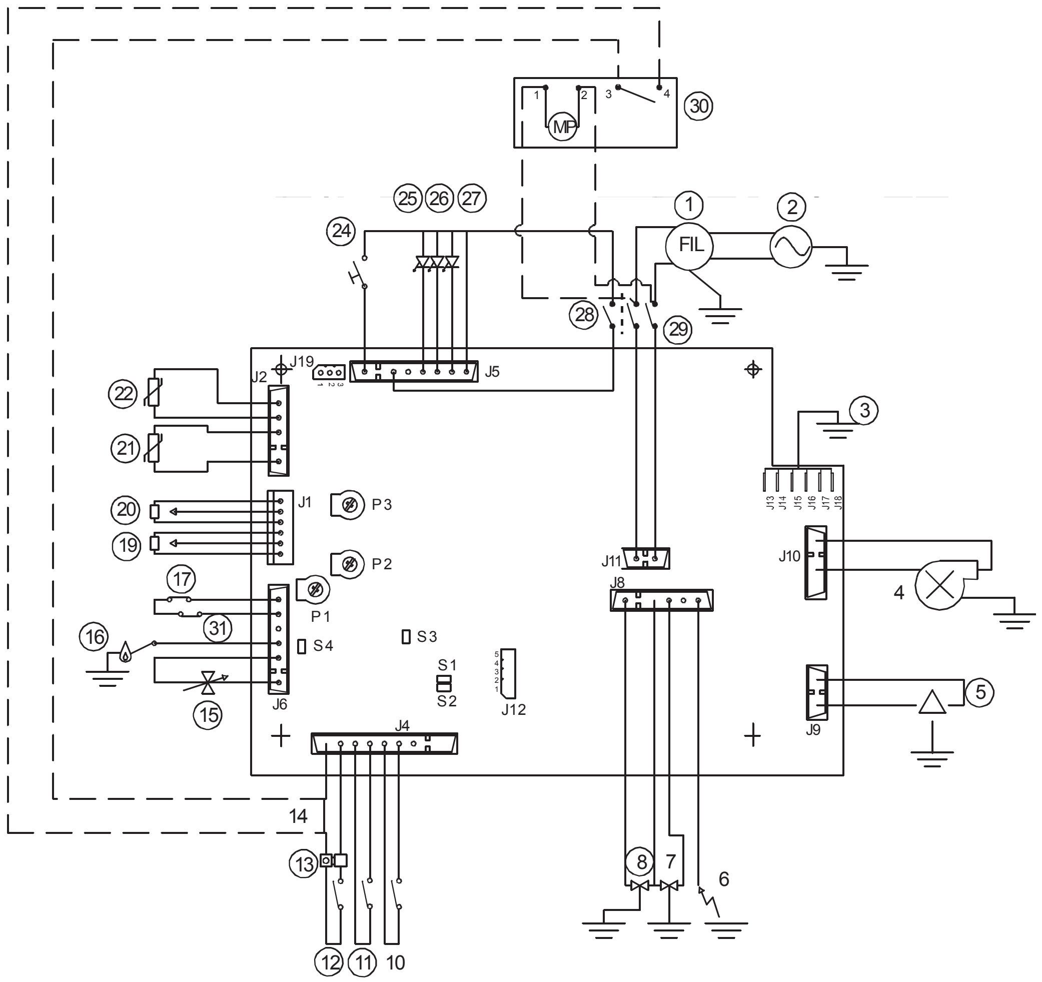


Heating demand

The electronic card turns ON the pump. The pump moves the water of the heating circuit. This water gets inside the boiler (1) and gets to the radiators (2). In the boiler the water gets hot in the water exchanger(3). The heating temperature is check by the heating thermistor (4)

During heating process when the burner stops because of temperature or because of the room thermostat the pump keeps moving 1 minute more.



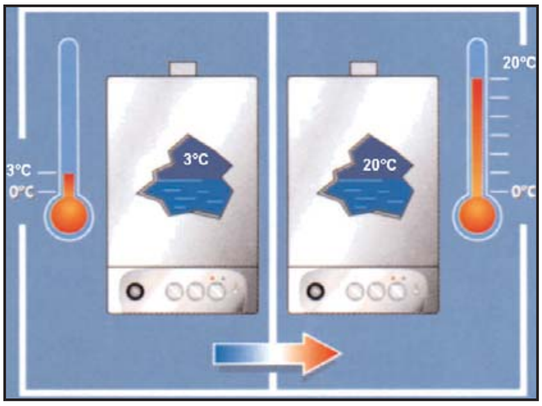


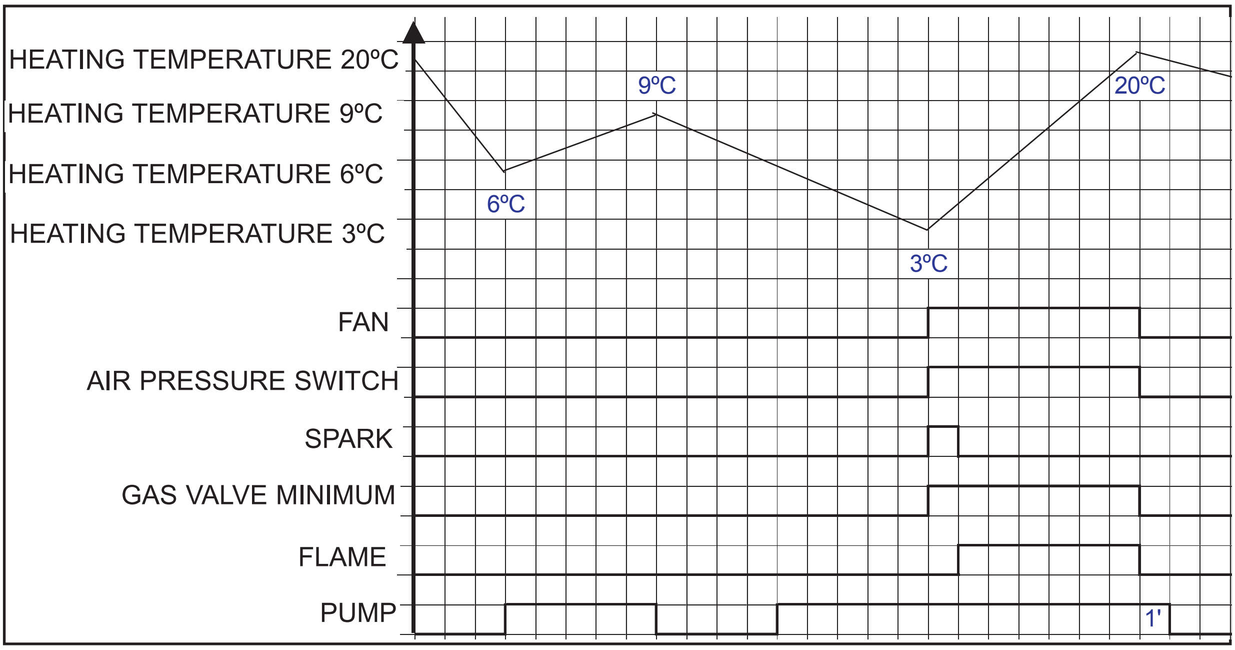
1. Filter
2. Supply
3. Earth
4. Fan
5. Pump
6. Ignition
7. Burner solenoid valve 1
8. Burner solenoid valve 2
10. Water flow switch
11. Air pressure switch
12. Room stat (optional)
13. Terminal block
14. Clock connection
15. Modulating solenoid valve
16. Detection plug
17. High limit stat
19. Hot water pot
20. Central heating pot
21. Hot water thermistor
22. Central heating thermistor
24. Reset button
25. Burner funcioning indicator
26. Lock out indicator light
27. Power On indicator light
28. Winter / summer switch
29. On/Off switch
30. Clock
31. Water pressure switch

S4 Gas change bridge. Made- Propane. Break- Nat. Gas

ANTI FREEZE SAFETY

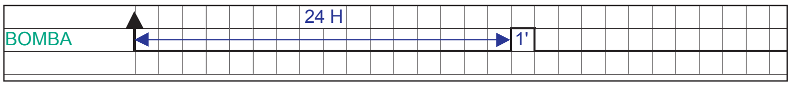
When the outlet heating circuit temperature (heating thermistor) decrease more than 6ºC the pump turns ON till the temperature reaches to 9ºC. If the temperature keeps going down and the heating thermistor reads less than 3 ºC the boiler turns On at minimum output till the temperature reaches to 20º C after that the pump keeps ON one more minute.

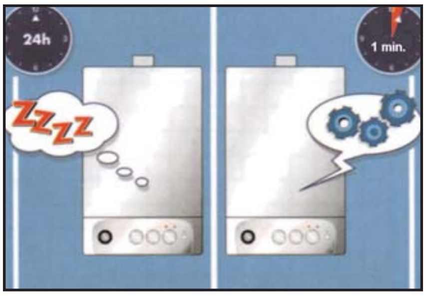




PUMP ANTIBLOCK SAFETY

When the pump doesn´t work during 24 hours the electronic circuit will turn ON the pump 1 minute.



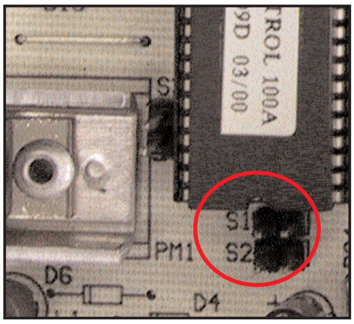


OVERHEATING

When the heating thermistor gets a lower temperature than 50ºC and there is a higher output than 95% after 5 minutes the boiler stops and makes a lighting up process again.

JUMPERS CONFIGURATION

We use the same electronic circuit in all the electronic ignition boilers. To identify the different type of boilers we use jumpers S1 and S2. See table



The white block represent the way the jumper is connected S1,S2

S1	S2	Type of boiler	Model
NO Jumper	**NO** Jumper	Bithermic with fan	**FEB-20E**

Effects produced by an incorrect jumper position depending of the type of boiler

Important: Is very Important to place the jumpers like in the picture above.

If the boiler is: FEB-20E , That means S1 and S2 No jumper.

What could happened if:

It has jumper S1: The boiler will try to work like a boiler with a flow switch in the heating circuit. So when the pump turns on this flow switch won´t close because there is no flow switch. The boiler will make 30 second lighting up cycles and 5 seconds turning off cycles . After 15 minutes the boiler will block showing failure number 3.

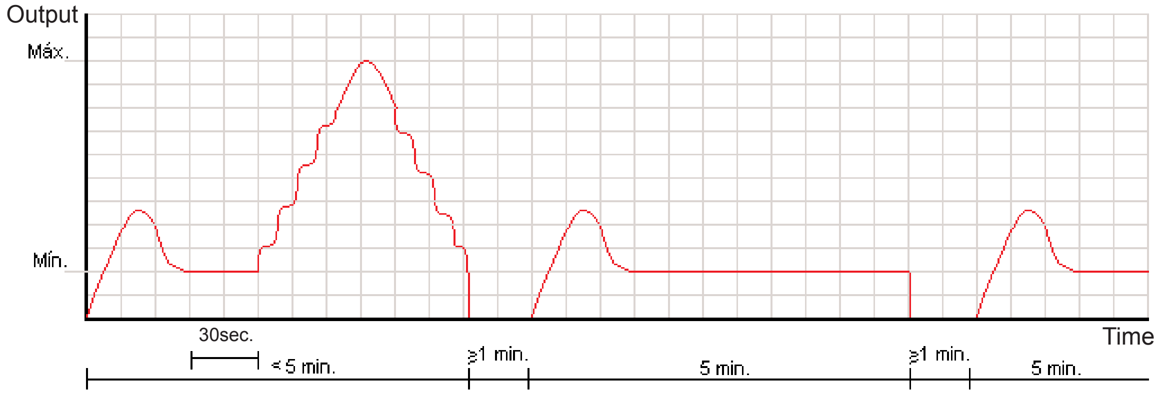
It has jumper S2: The circuit thinks that there is a bitermic without fan so in any lighting up sequence the fan won´t turn on and also the pressure air switch. The boiler will block showing failure 1

It has jumper S1 and S2: The boiler doesn´t detect the pressure sensor so it gets locked and shows failure 3.

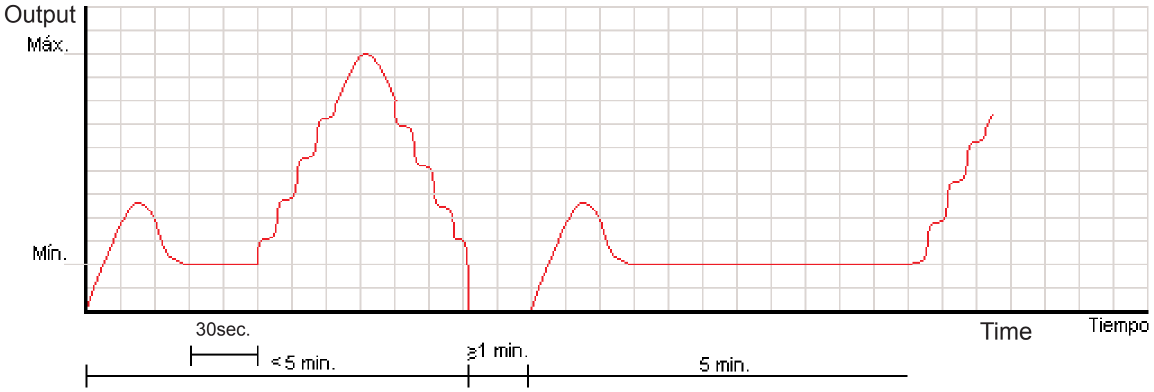
FUZZY LOGIC

This is a new program that the new electronic circuit has. It works only on heating position. It works as follows:

When there is any heating demand the boiler checks the room thermostat and then starts at lighting up pressure and then goes to the minimum pressure the first 30 seconds.Then the boiler begins modulating



If the heating thermistor cuts before than 5 minutes the next heating cycle the boiler will keep the first 5 minutes at minimum pressure, see figure above.
If after 5 minutes at minimum pressure the boiler doesn´t stop it will begin modulating again.



GAS VALVE PRESSURES REGULATION

For each type of gas the burner gas pressure are different. The following table shows all the pressures

Important: It is very important to know that when you are making the gas regulation you may use the values of this tables. The values should be equal or lower never could be higher. For example if you are making a maximum natural gas regulation the table says 80 mm.w.c. so you should get 80 or less than 80 in the water column.

Chart 1

	Natural gas	**LPG**
Burner Injector	112	73

Chart 2

Burner pressure in mm of a water column		
Output (kcal/h)	**Natural**	**LPG**
20.000	80	165
18.000	65	130
15.000	45	100
12.000	26	70
10.000	18	50
8.000	11	24

BURNER MAXIMUM AND MINIMUM GAS PRESSURE REGULATION

To make a burner gas pressure regulation you should have: **water column, wrench number 10 and a scwedriver.**

- Place the water column in the outlet measure pressure (4) taking of the screw, see figure 1
- Open the electronic Box
- Take off the gas valve protection (C) see detail number 1.

Make the regulation:

Maximum pressure setting.

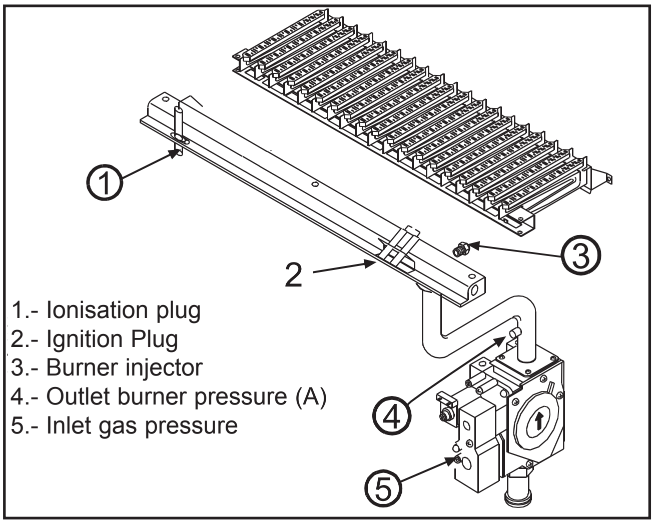


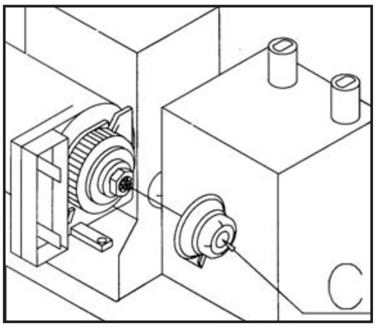
Figure 1. Spare parts of the gas group.

Move the variable resistance of the electronic circuit P1 to the maximum position (clockwise).

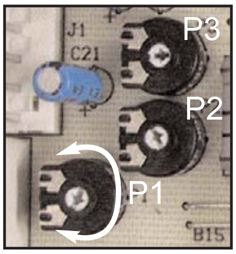
Open a hot tap to the maximum position.

Using a hexagonal spanner rotate the screw E of the gas valve till the value of the water column is the same as the value of the table see detail 2.

Move the variable resistance P1 (see photo) anti clockwise till the water column starts moving , that´s the point where the electrical maximum and the mechanical maximum get together in the same point.



Detail 1

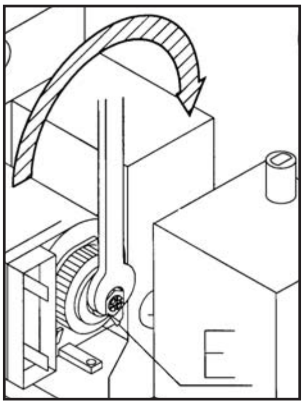


Minimum pressure setting.

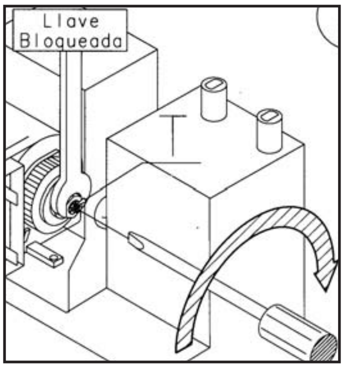
Open a hot tap.

Block the screw E with the hexagonal spanner and rotate the screw T till you get the same value in the water column thatn in the table of page 10 see detail 3.

Place again the gas valve protection (C) and place the screw in the same position as before, see figure 1

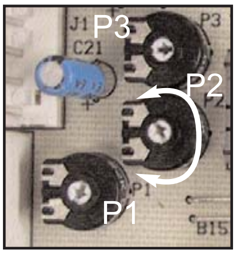


Detail 2



Detail 3

LIGHTING UP REGULATION



IMPORTANT: The lighting up regulation must be do it right after the maximum and minimum regulation

Use the values of the table Page 10

USe the following steps:

◆ Open the D.H.W. tap

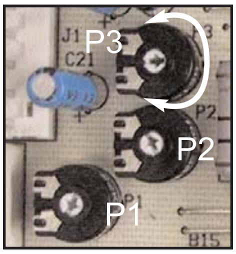
◆ Use the variable resistance P2 to make the lighting up regulation. Turning clockwise the pressure increases.Use the values of the table page 10.

◆ Ones you have set the lighting up regulation turn OFF the D.H.W. tap.

◆ Close the electronic box.

◆ Take of the water column put the screw see figure 1.

MAXIMUM HEATING PRESSURE REGULATION

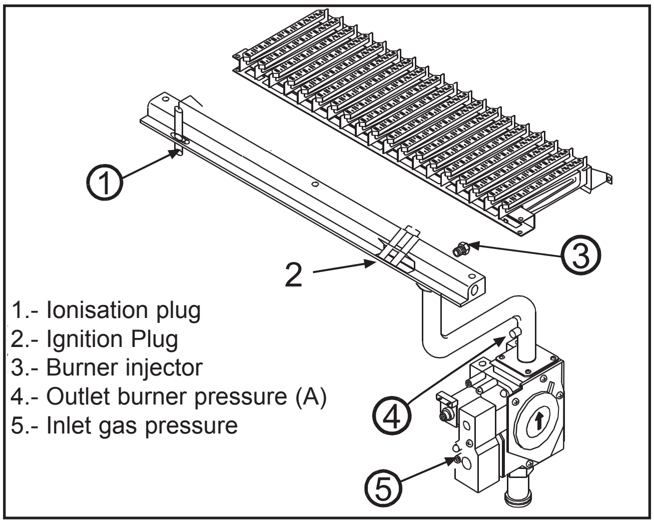


◆ Use the variable resistance P3 to make the maximum heating regulation .Use the values of the table page 10.

GAS CHANGE

This type of boiler are made to work with Natural gas and LPG

Natural gas to LPG



1.- Ionisation plug
2.- Ignition Plug
3.- Burner injector
4.- Outlet burner pressure (A)
5.- Inlet gas pressure

Repalce the injectors (3) (figure 2). Follow tthe following steps:

◆ Take off the control panel and the frontal panel.

◆ Take off the combustion frontal panel and the mainfold.

◆ Replace the injector with the rigth ones , see table page 10.

◆ Put the water column in point number (4) see figure 2.

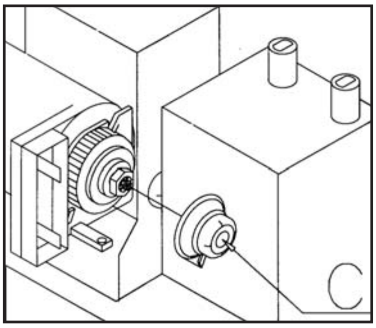
◆ Open the electronic box.

◆ Get into the electronic box so you can work with the jumper S4

- S4 - Put the jumper using LPG
- S4 - Tkae off the jumper using Natural gas

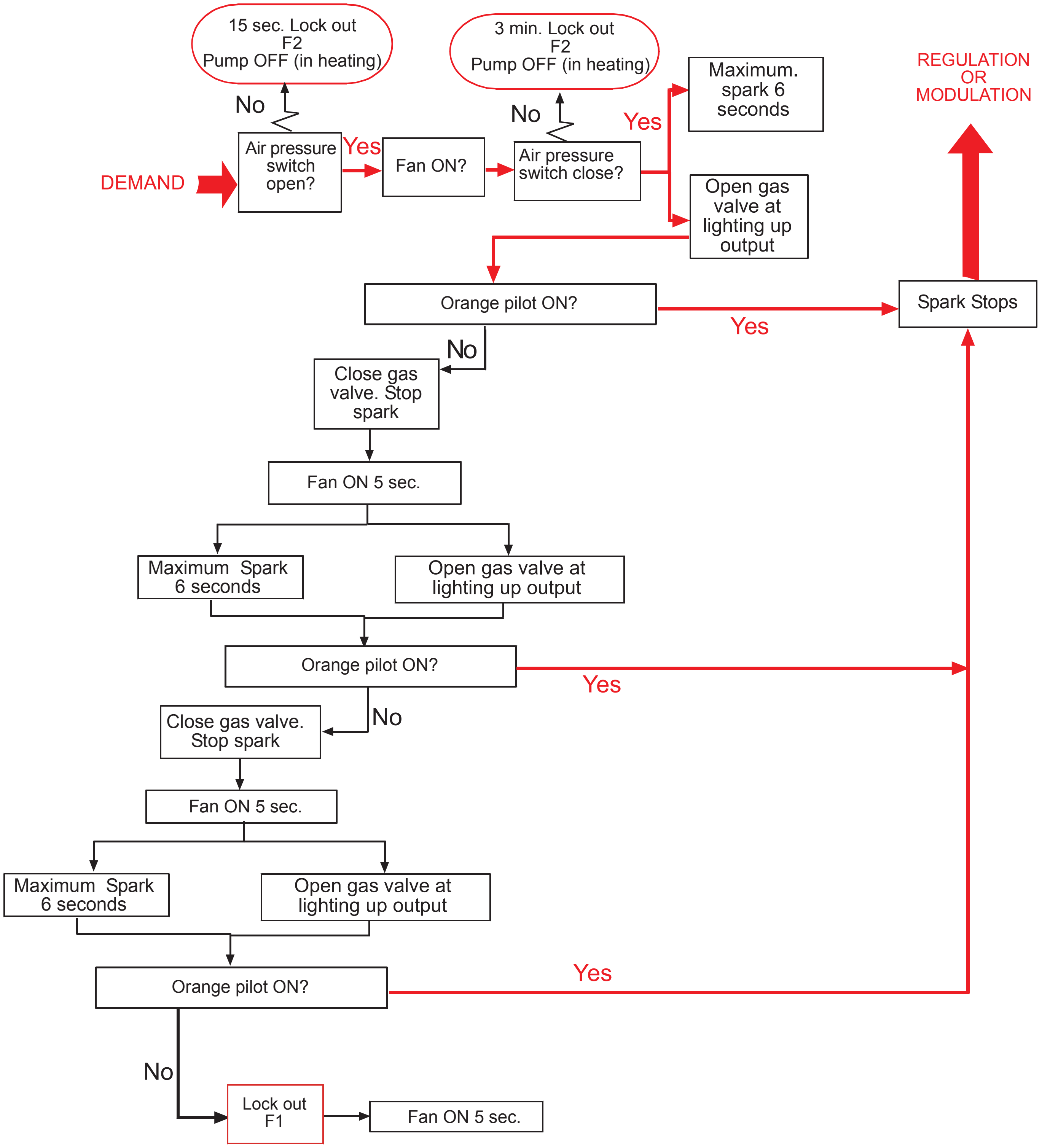
◆ Take off the gas valve protection see detail 1.

To make the gas regulation follow the steps of the previous points



Detail 1

LIGHTING UP SEQUENCE



D.H.W. SERVICE

When there is a D.H.W. demand (one tap is open)

- The flow switch detects that the water moving and gives the signal to the electronic card.

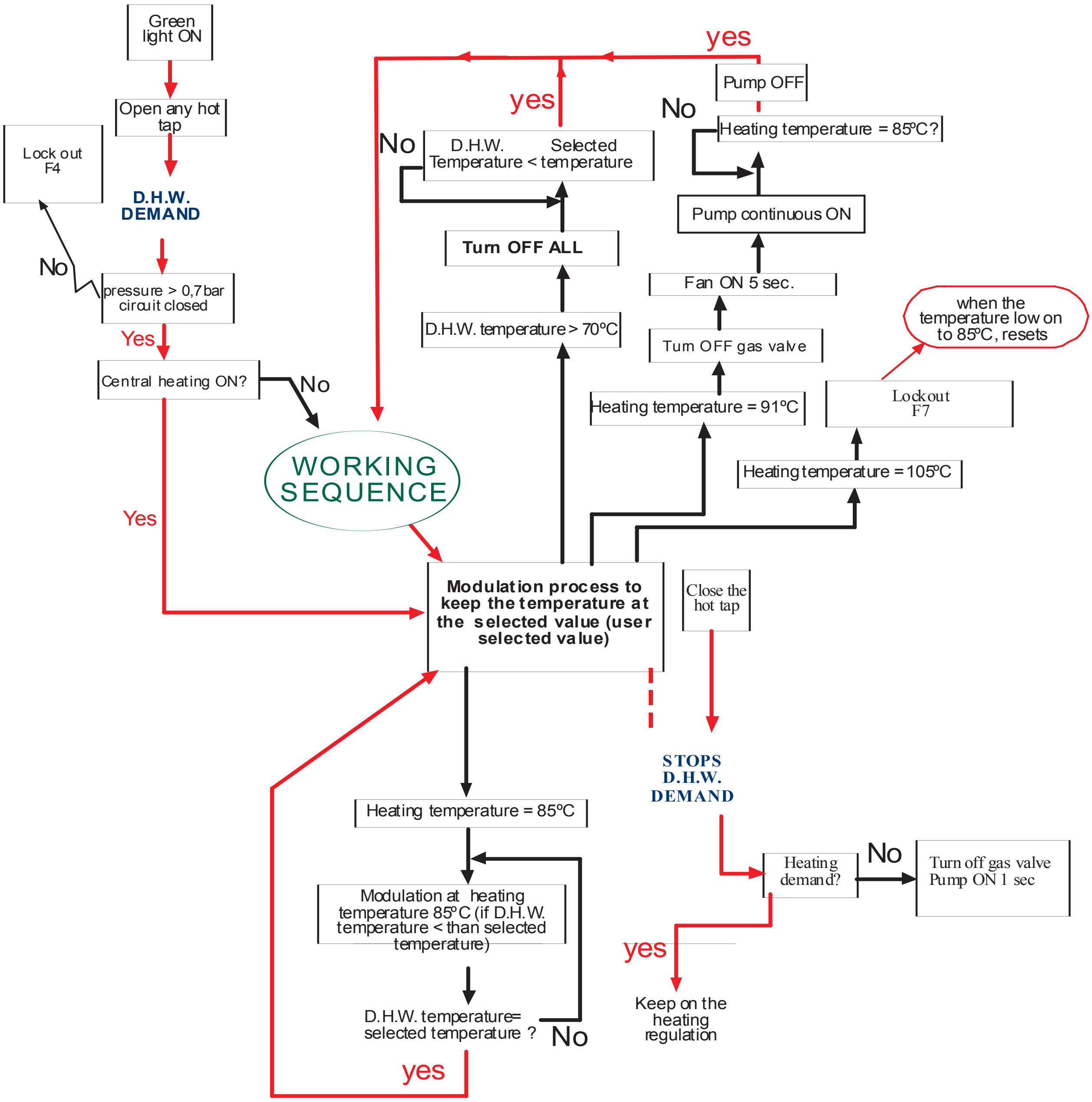
- The fan turns ON at the same time that the air pressure switch closes.

- The gas valve opens and the spark starts.

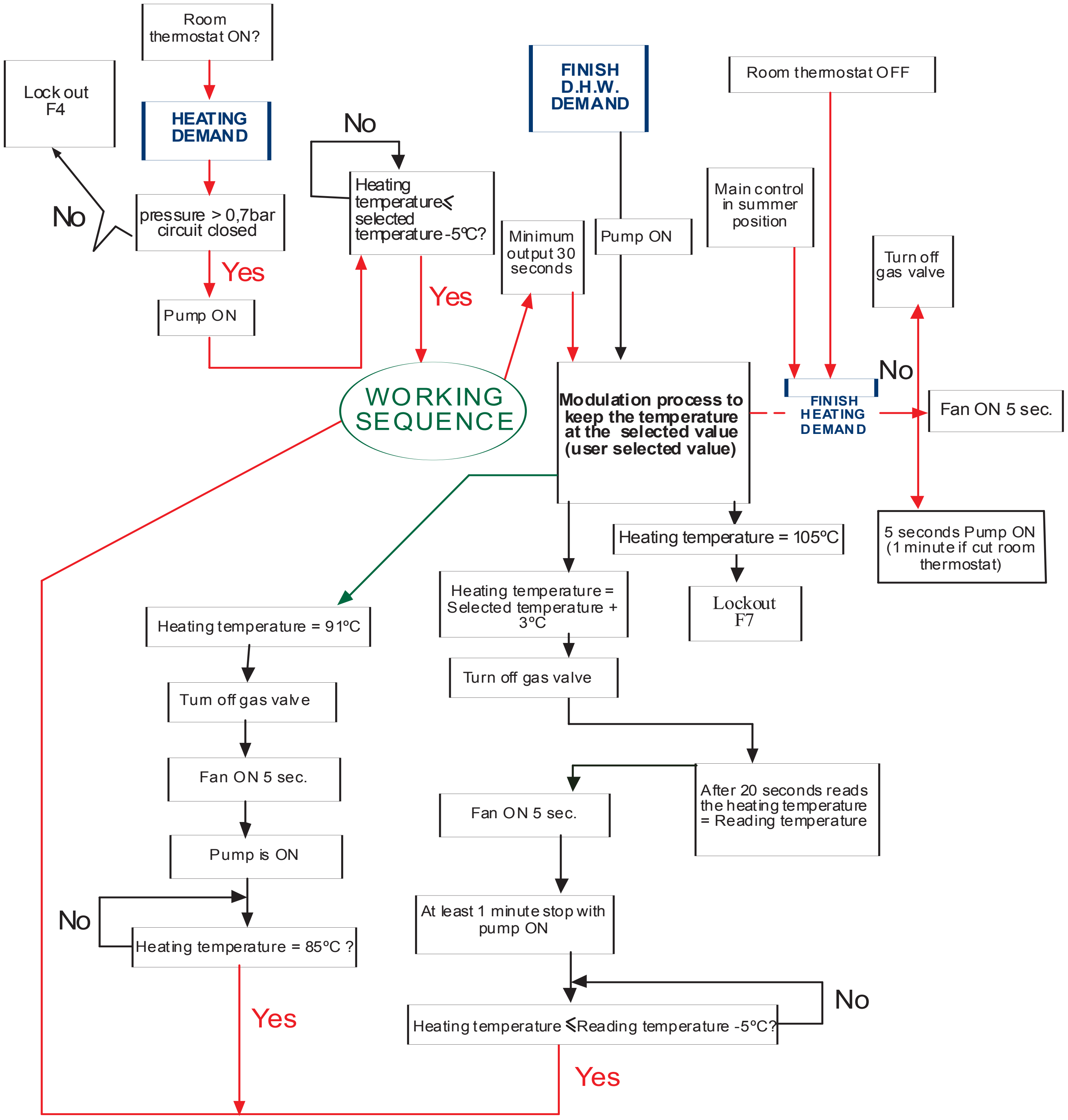
- There is flame and the water gets warmer (the spark stops).

- When the D.H.W. demand is over everything stops.

- When the D.H.W. demand is over everything stops but the fan and the air pressure switch that keeps on 5 more seconds.

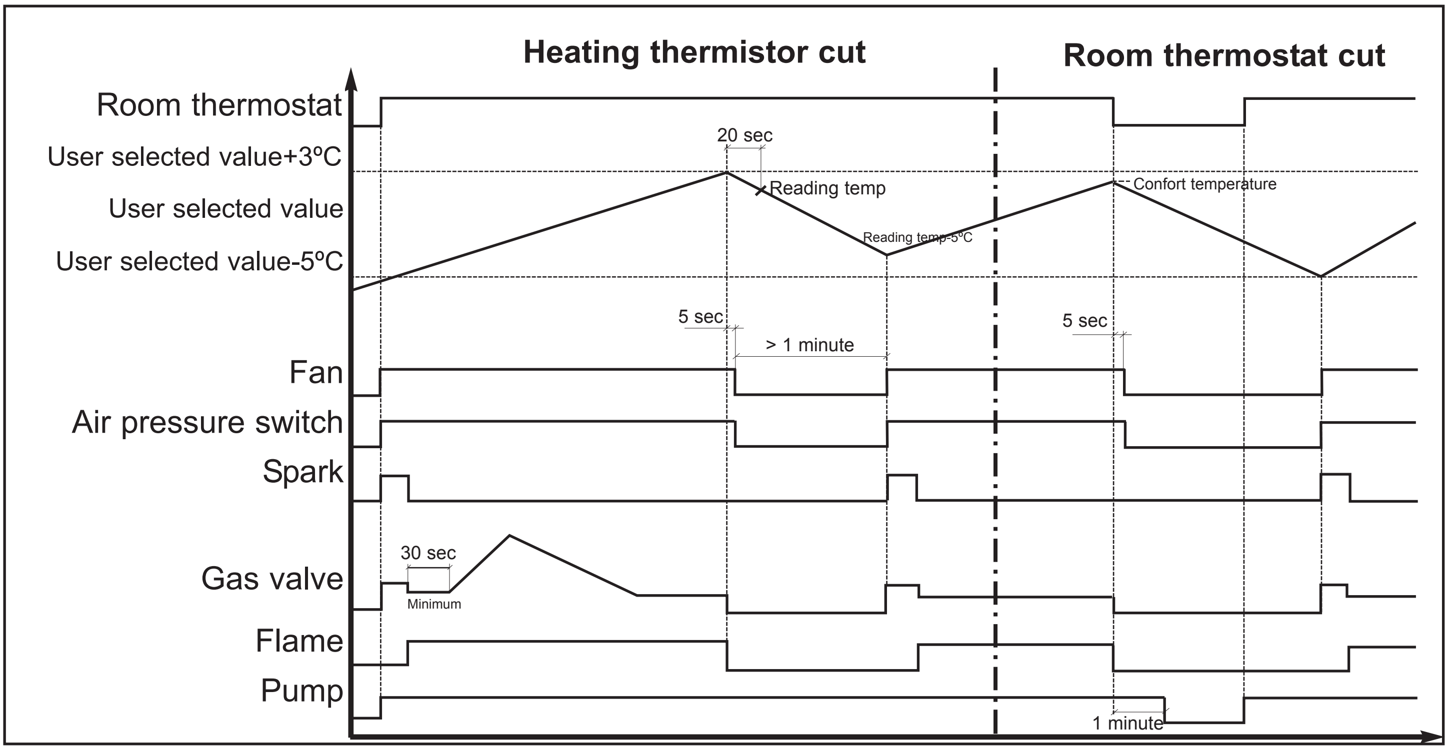


HEATING SEQUENCE



The following table shows to different type of heating cut: heating thermistor cut and room thermostat cut.

The values that this table shows are the more significative values of each process.

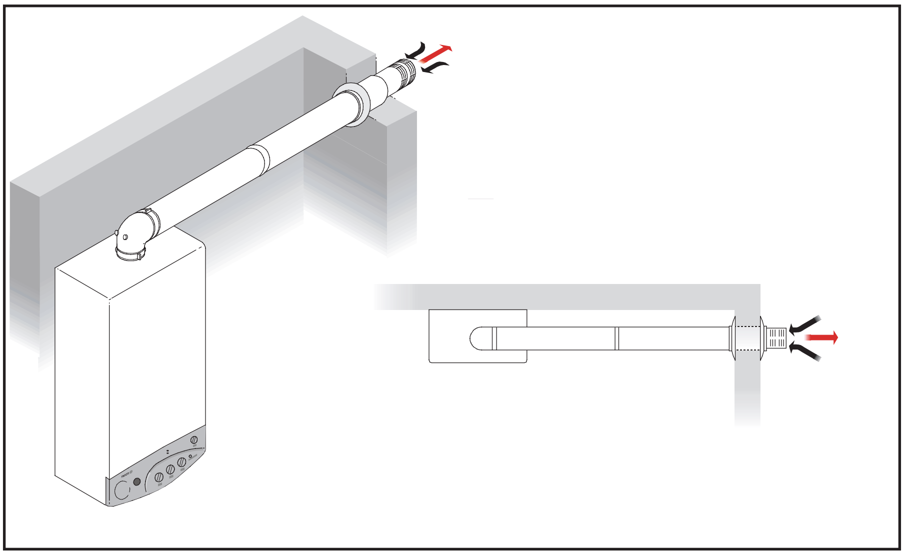


The room thermostat cutting could happened with the burner ON or with the burner OFF:

- With the burner ON there is one minute of pump recirculation.
- With the burner OFF the pump stops right after the room thermostat cut.

COMBUSTION PRODUCT EXTRACTION

Ø 60-100 HORIZONTAL CONCENTRIC COMBUSTION PRODUCT EXTRACTION AND AIR INTAKE

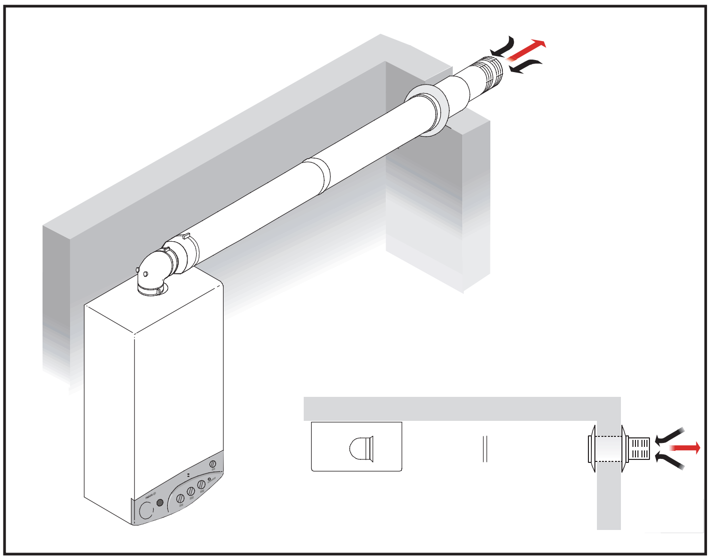


The maximum length of the combustion and intake pipes which may be used with the FEB-20E boiler is three meters, measured from the 90° bend. Each 90° bend, or two 45° bends, reduces the available length by 0.8m. (See installation examples).

It is recommendable to fit the pipe at a slight 2° or 3° downward incline to prevent any water or condensation from entering in the boiler.

Use the Restrictor Ring when the length of the pipes is equal or lower than 1 meter (this diaphragm is supplied with the boiler).

Ø 80-125 HORIZONTAL CONCENTRIC COMBUSTION PRODUCT EXTRACTION AND AIR INTAKE



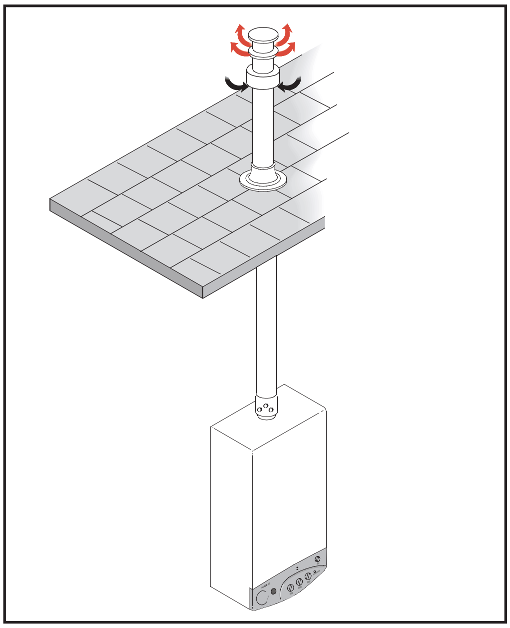
The extraction of the combustion products and the air intake is carried out by means of Ø 80 mm concentric pipes for the extraction of the combustion products and Ø 125 mm pipes for the intake of air do it with the Ø80-125mm concentric flue kit.

The maximum length of the combustion and intake pipes which may be used with the boiler is 8 metres, measured from the 90° bend. Each 90° bend, or two 45° bends, reduces the available length by 0.8m. (See installation examples).

It is recommendable to fit the pipe at a slight 2° or 3° downwards incline to prevent any water or condensation from entering in the boiler.

Use the Restrictor Ring when the length of the pipes is equal or lower than 2 meter (this diaphragm is supplied with the boiler).

Ø 60-100 VERTICAL CONCENTRIC COMBUSTION PRODUCT EXTRACTION AND AIR INTAKE



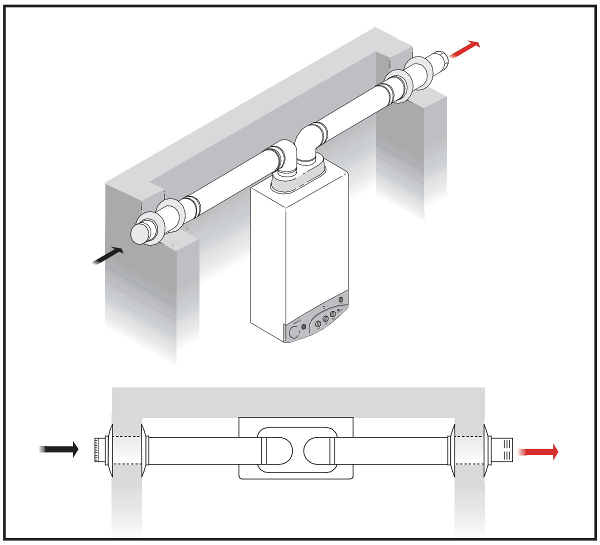
The extraction of the combustion products and the air intake is carried out by means of Ø 80 mm concentric pipes for the extraction of the combustion products and Ø 125 mm pipes for the intake of air do it with the Ø80-125mm vertical concentric flue kit.

The vertical maximum length of the combustion and intake pipes which may be used with the boiler is 8 metres. Each 90° bend, or two 45° bends, reduces the available length by 0.8m. (See installation examples).

It is recommendable to conect the condesing pipe to prevent any water or condensation from entering in the boiler.

Use the Restrictor Ring when the length of the pipes is equal or lower than 2 meter (this diaphragm is supplied with the boiler).

Ø 80 TWIN-PIPE COMBUSTION PRODUCT EXTRACTION AND AIR INTAKE



The extraction of the combustion products and the air intake is carried out by means of Ø 80 mm twin-pipes one for the extraction of the combustion products and the other onefor the intake of air do it with the Ø80mm twin-pipe flue kit.

The maximum length of the combustion and intake pipes which may be used with the boiler is 18 metres,this is the result from the add of the extraction pipe and the intake pipe and is measured from the 90° bend. Each 90° bend, or two 45° bends, reduces the available length by 0.8m. (See installation examples).

It is recommendable to fit the pipe at a slight 2° or 3° downwards incline to prevent any water or condensation from entering in the boiler.

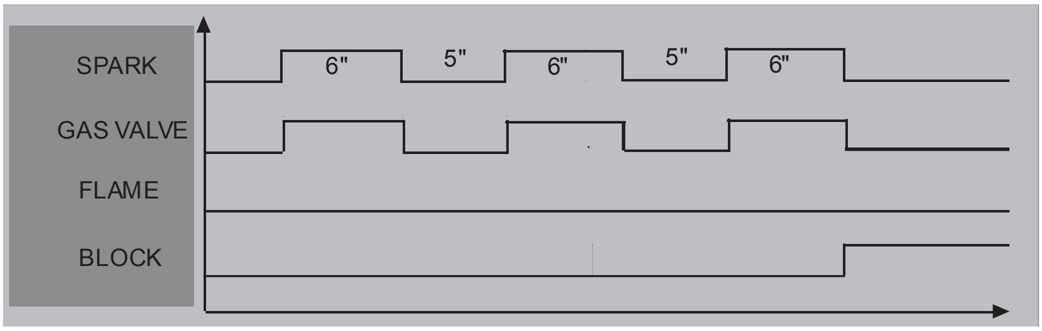
Use the Restrictor Ring when the add of the length of the pipes is equal or lower than 6 meter (this diaphragm is supplied with the boiler).

FAILURES AND FINDING

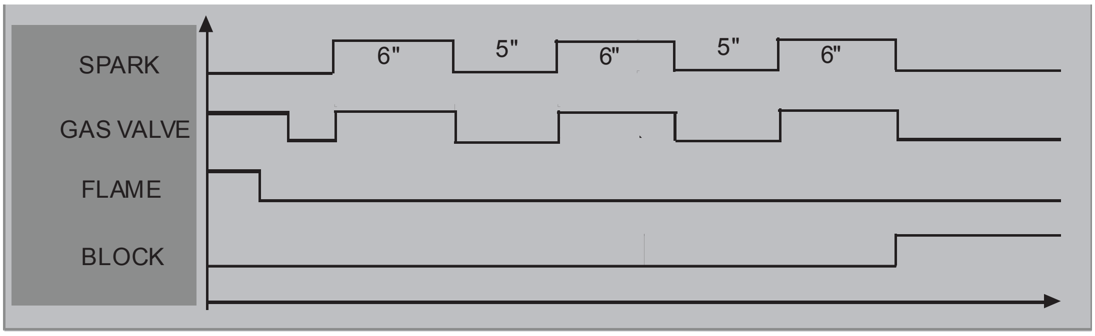
FAILURE

The different type of failures the boiler will show with a reset light flicker:

① The boiler try 3 times to get the flame: the 6 seconds between the three of them waits 5 seconds. If the ionisation plug doesn´t detect flame the boiler gets locked.



When the boiler is working if the flame disappears because something irrepressible is happening (gas valve failure, ionisation plug failure...) after 1 second without flame detecting the boiler stops (gas valves) then the boiler stars again if the ionisation plug doesn´t detect the flame the boiler gets locked

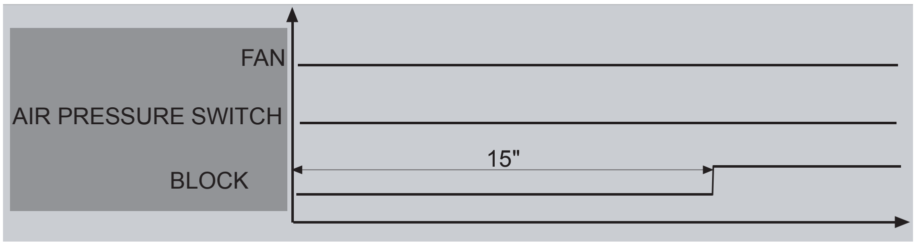


Possible causes

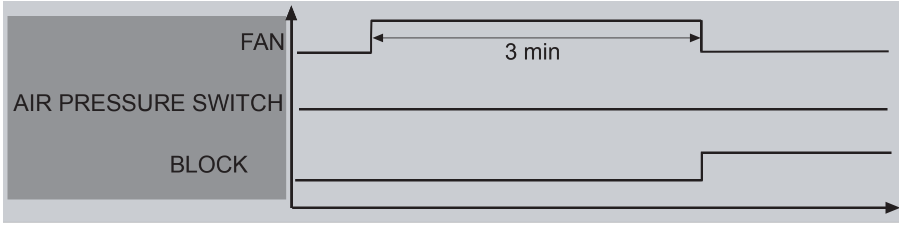
- No gas
- No spark
- TTB cuts
- Inlet gas pressure incorrect
- Air in the gas circuit
- Ionisation plug incorrect
- Dirty burner
- Faulty gas valve
- Incorrect injectors or faulty injectors

②

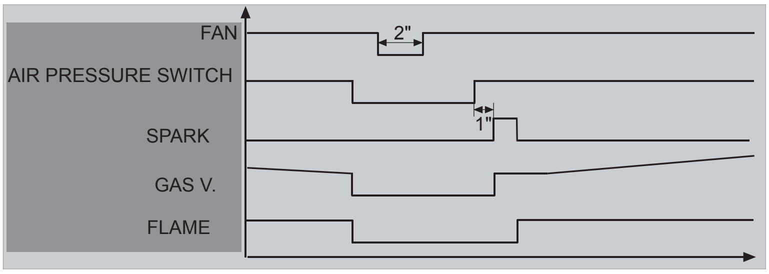
In the lighting up process the electronic circuit checks if the air pressure switch is close. After 15 seconds if the air pressure switch is no open the boiler gets locked.



In the lighting up process the electronic circuit checks if the air pressure switch is close turning On the fan if after 3 minutes the air pressure switch doesn´t open the boiler gets locked.



When the boiler is working if the air pressure switch gets open the boiler try another lighting up process after 2 seconds. If the air pressure switch doesn´t close after 3 minutes the boiler gets locked.



Possible causes:

- Fan broken
- Air pressure switch broken
- Obstruction in the combustion product extraction and air intake
- Air pressure switch connections (+and-) put them wrong
- Combustion pipes too long

④

If the heating circuit’s pressure goes down lower than 0,7 bares, or If there is any failure in the pressure switch (the contact open) the boiler gets locked.

If the Safety thermostat device is opened the boiler gets locked.

⑤ If there is any failure in the software protections of the boiler control program the boiler gets locked.

⑥ If the ionisation plug detects flame during 10seconds while the boiler is in a turning off process, that means rigth after the boiler turns off, the boiler gets locked. The pump and the fan keep ON (safety)

Possible causes:

- Ionisation plug break down
- Unknown ignition
- The flame doesn´t go out when the gas valve is closed

⑦ If the outlet temperature of the heating circuit gets higher than 105ºC the boiler gets locked. The pump keeps ON till the temperature gets to 85ºC. Only could get F7 with the burner ON or a few seconds after(6 seconds aprox.)

Possible causes:

- Heating thermistor failure
- No water in the heating circuit
- Expansion vessel incorrect
- Minimum very high

⑧

If during the starting time the boiler do not detect the control panel after 5 seconds the boiler gets locked.

⑩ During the turning off of the burner the electrovalves of the gas valve close one time each till the flame is gone. If during a turning off the flame keeps ON after 5 seconds the next turning off the gas valve will start with the same electrovalve that didn´t work the last time. If this time doesn´t close again the boiler gets locked.

Possible causes:

- Electronic circuit failure (one of the electrovalve relay is broken)
- Gas valve failure

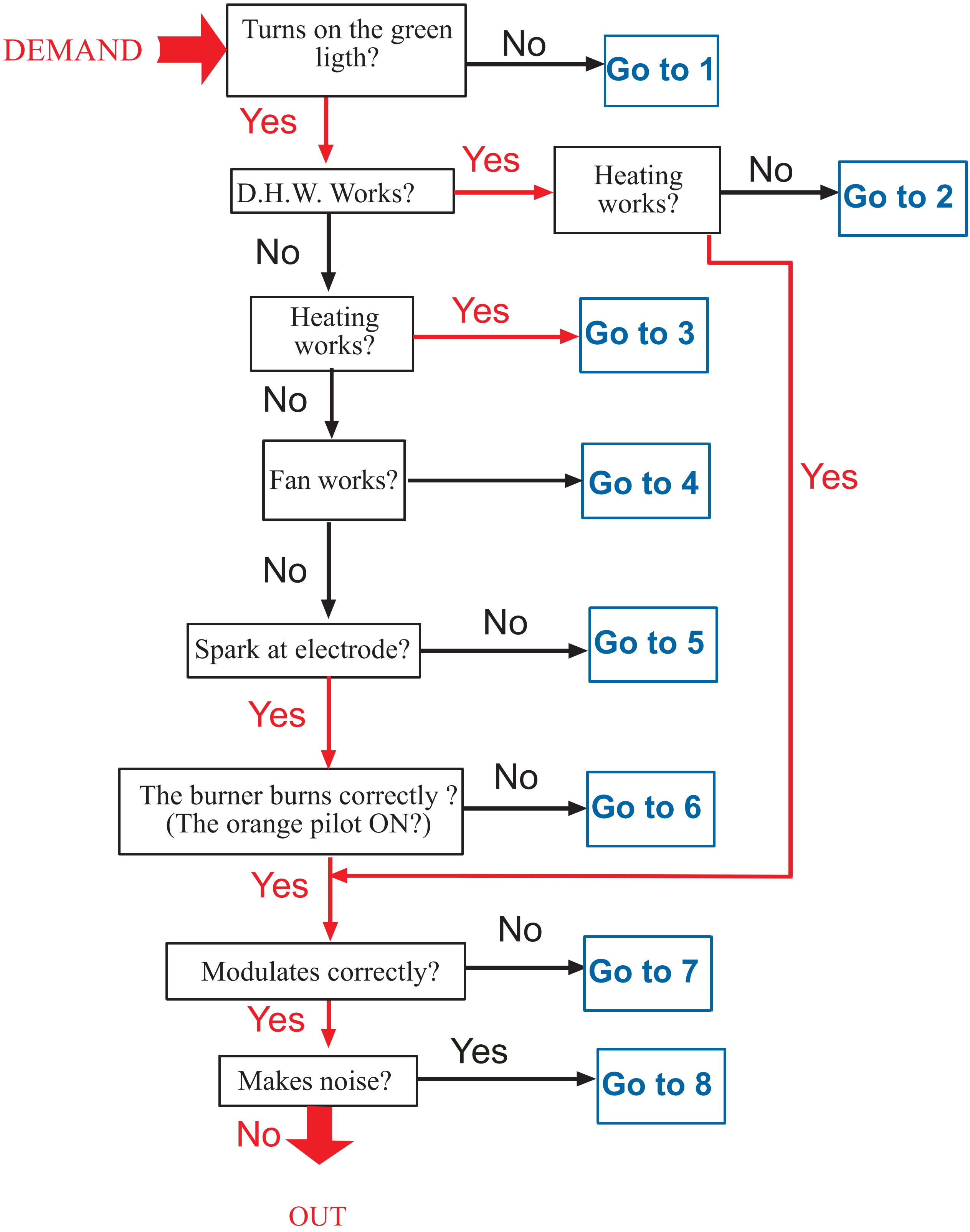
⑪ During a D.H.W. demand If the values that the D.H.W. thermistor reads during 10 seconds are out of range the boiler gets locked. The boiler turns ON automatly when the values get in to the range. It doesn´t affect to the heating procces.

⑬ If the heating thermistor is out of range the boiler will block. The boiler turns ON automatly when the values get in to the range.

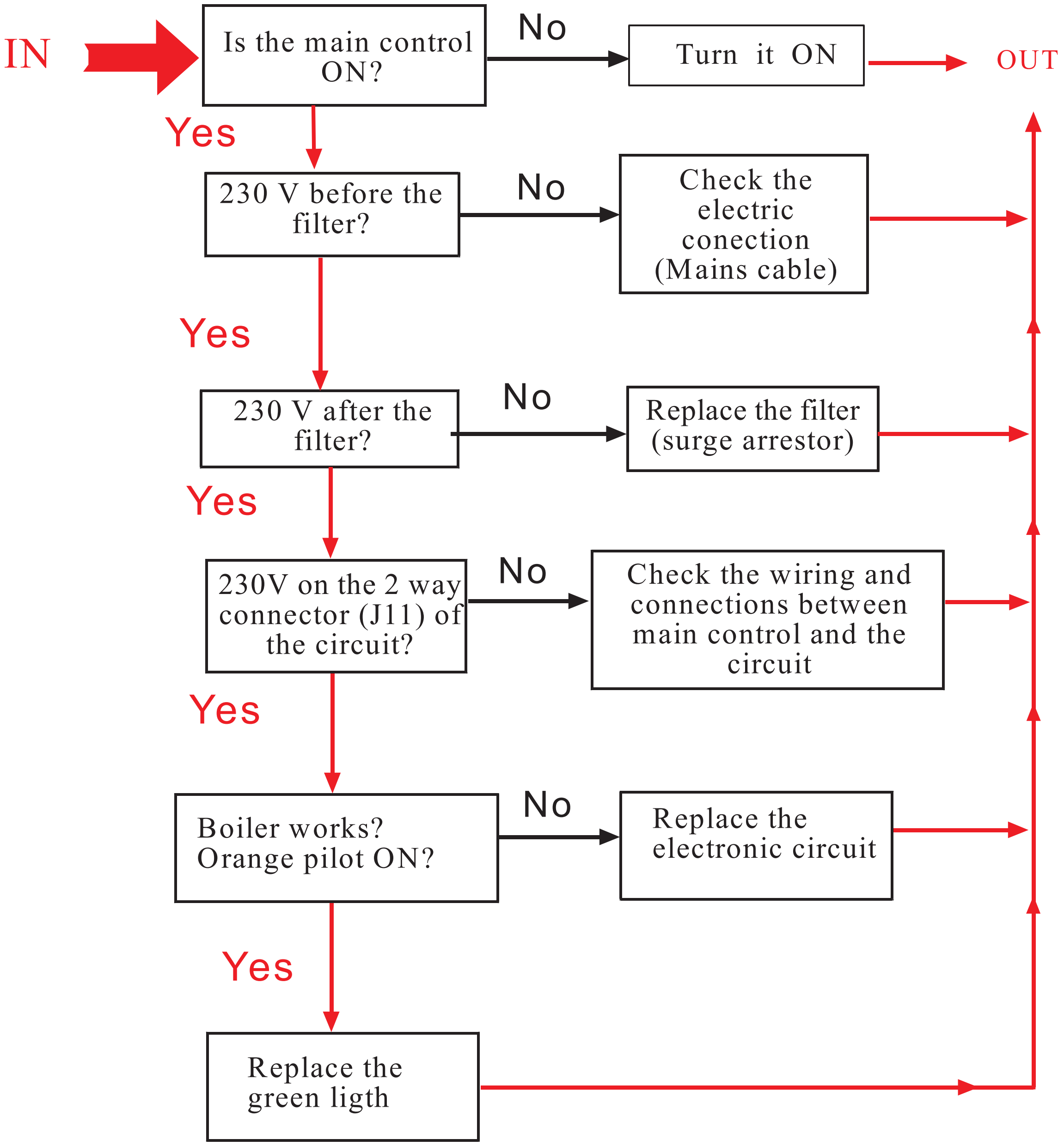
FAULT FINDING

With this sequence of fault finding we pretend to make really easy the fault finding.

Important: In this sequence there is no reference to the jumpers. To make everything easy and fast we suggest first of all to check the jumpers position.

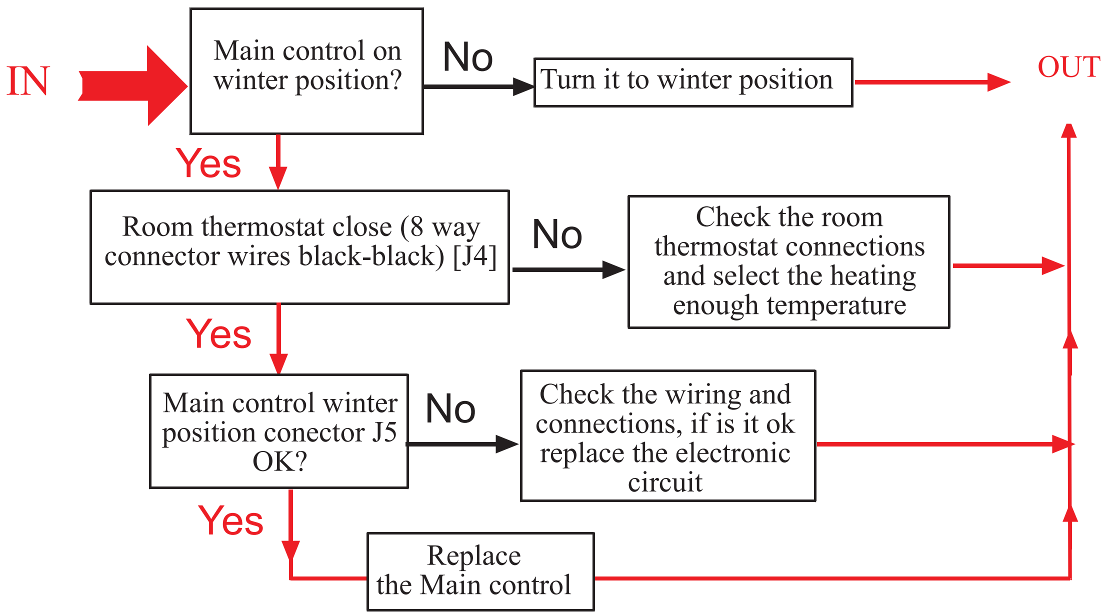


1 LIGHTING UP INCORRECT



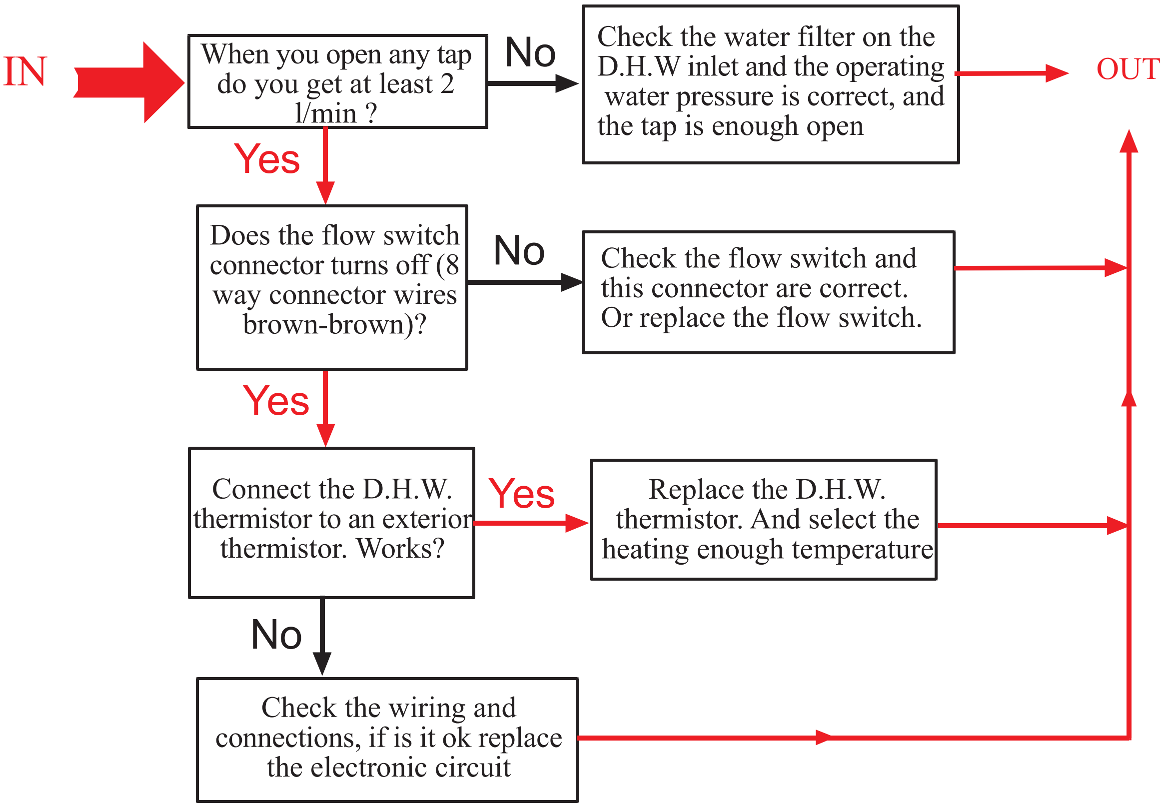
2

HEATING DOESN´T WORK BUT D.H.W. WORKS

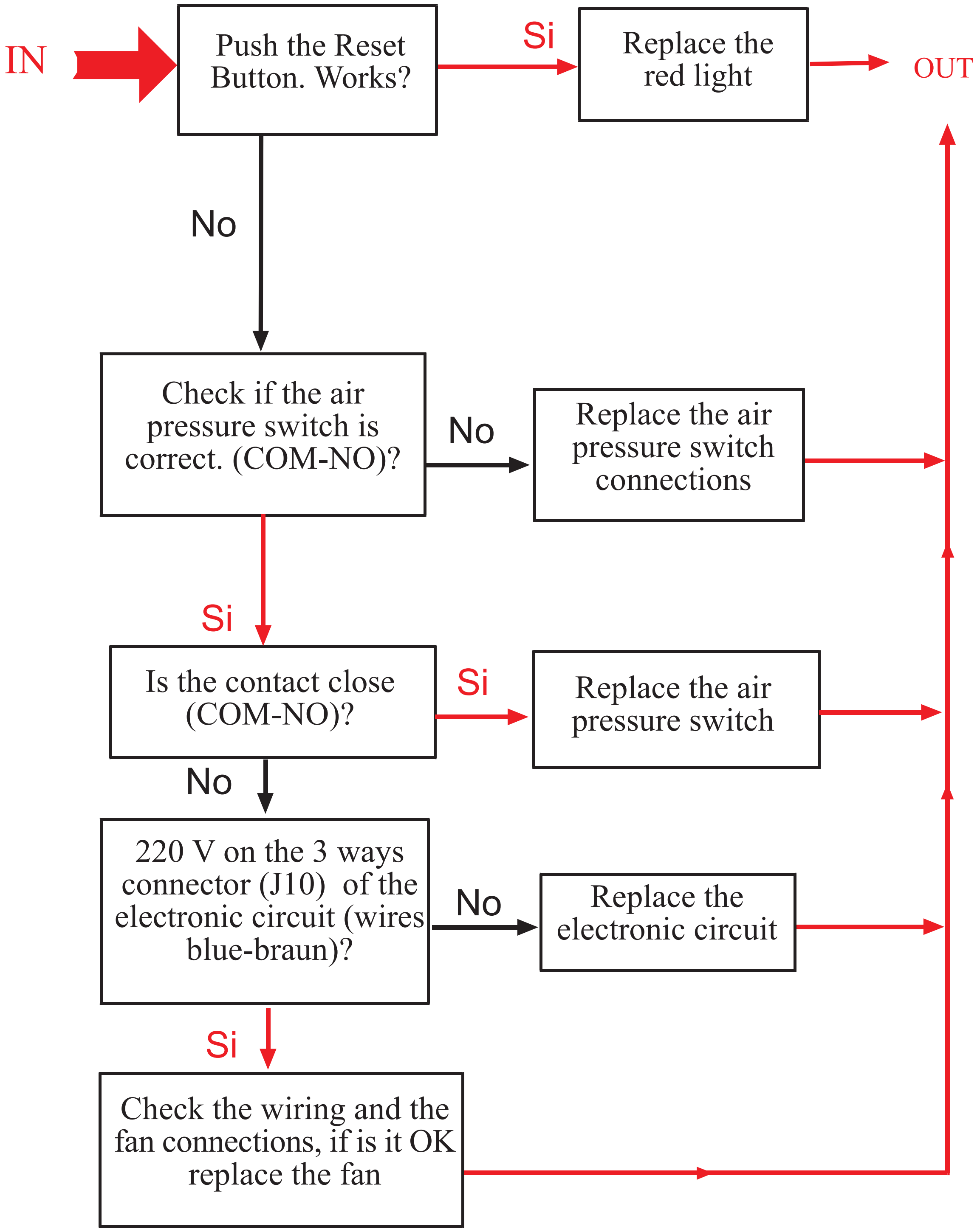


3

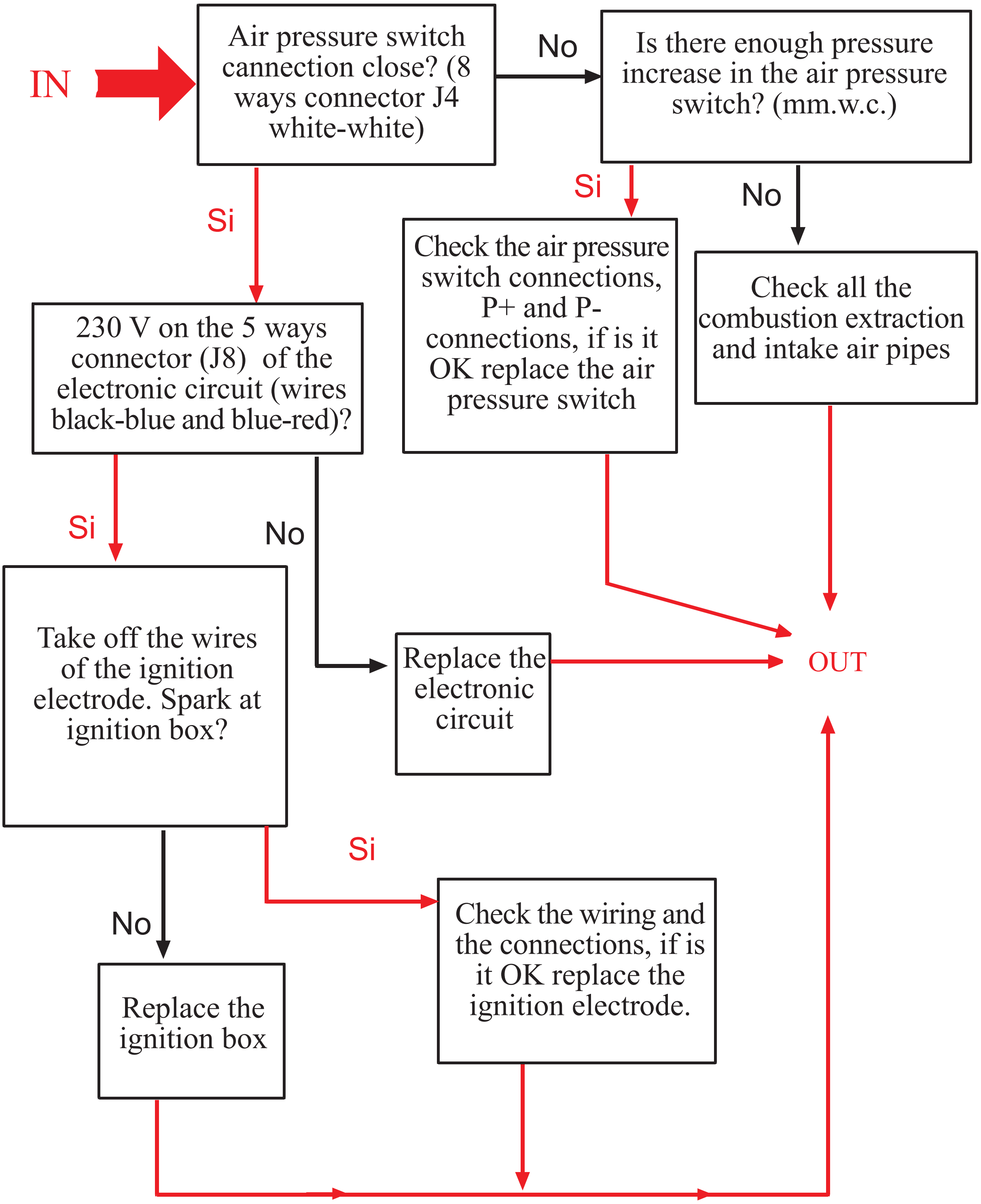
D.H.W. DOESN´T WORK BUT HEATING WORKS



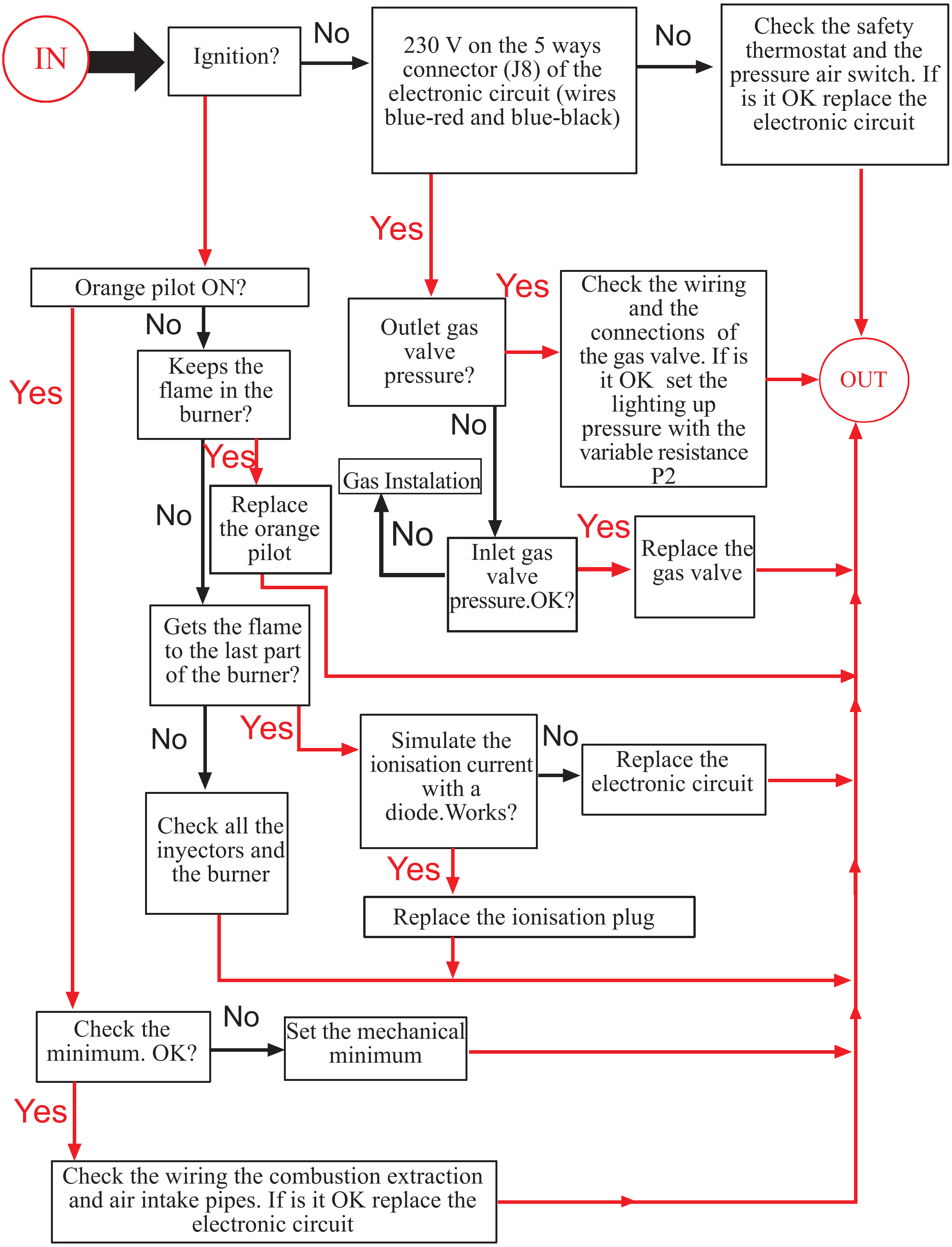
4 FAN DOESN´T WORK



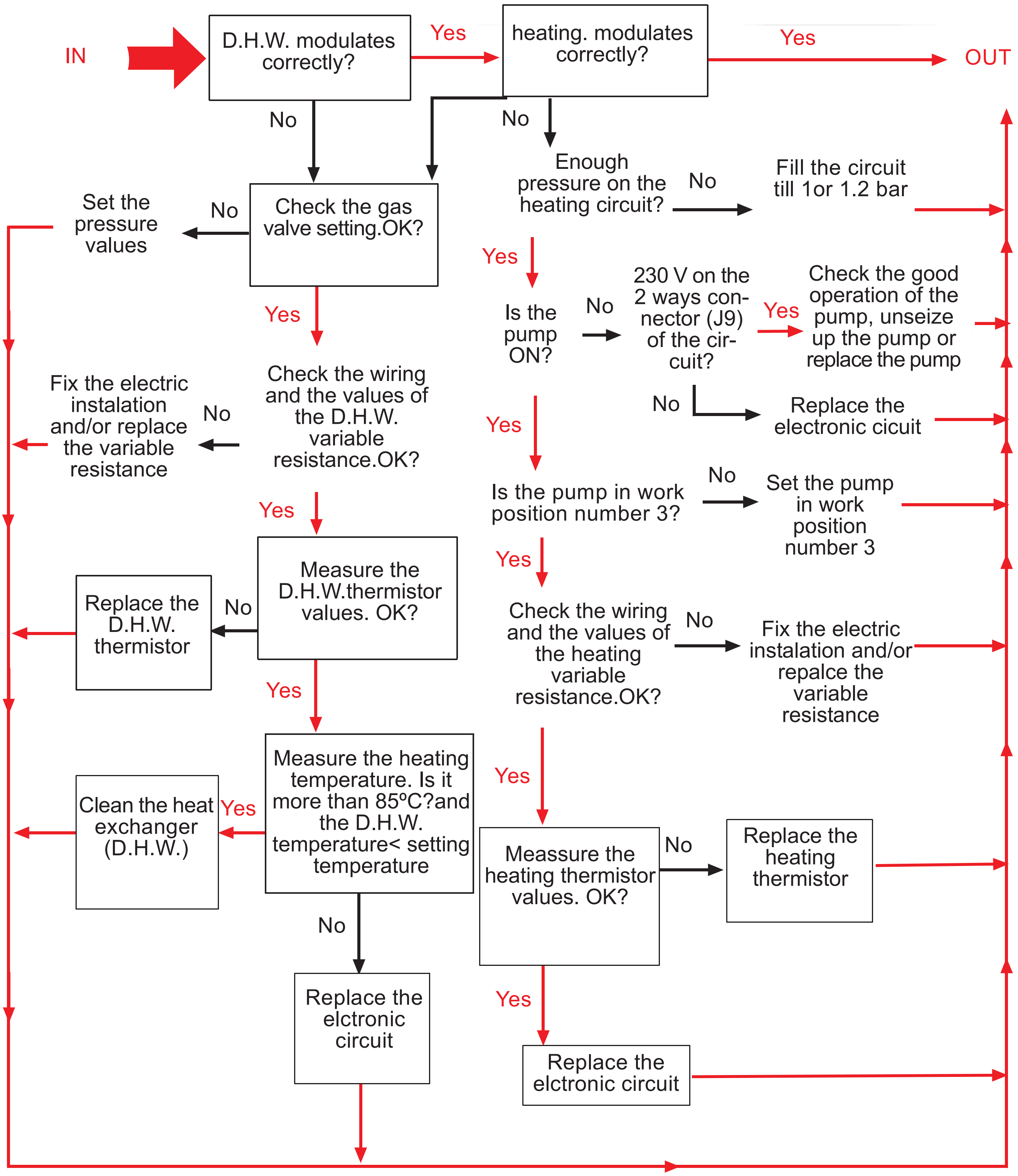
5 FAN WORKS BUT THERE IS NO SPARK



6 NO FLAME

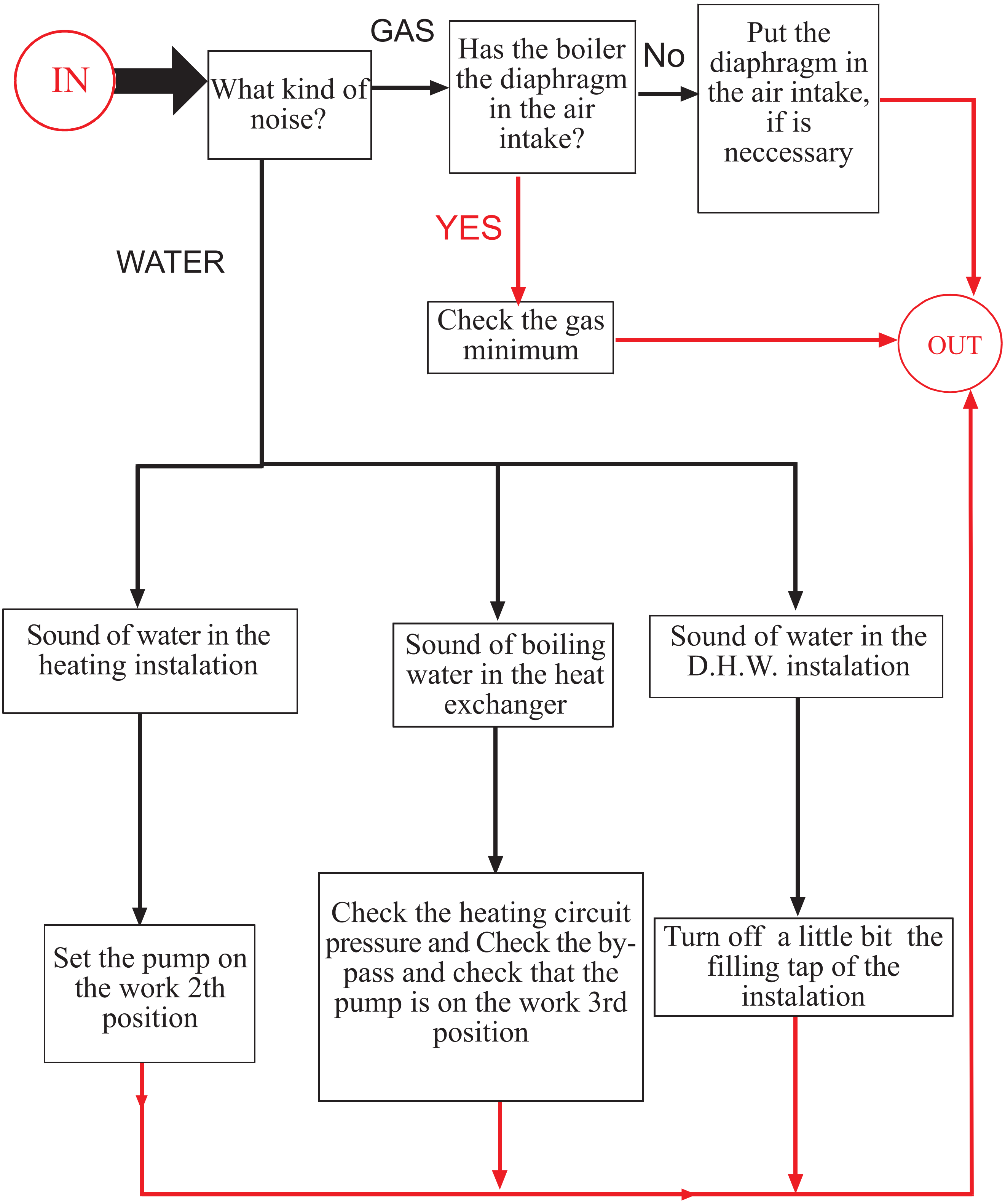

IN
Ignition?
No
230 V on the 5 ways connector (J8) of the electronic circuit (wires blue-red and blue-black)
No
Check the safety thermostat and the pressure air switch. If is it OK replace the electronic circuit
Yes
Orange pilot ON?
No
Yes
Outlet gas valve pressure?
Yes
Check the wiring and the connections of the gas valve. If is it OK set the lighting up pressure with the variable resistance P2
OUT
Yes
Keeps the flame in the burner?
No
Yes
Replace the orange pilot
Gas Instalation
No
No
Inlet gas valve pressure.OK?
Yes
Replace the gas valve
No
Gets the flame to the last part of the burner?
No
Yes
Simulate the ionisation current with a diode.Works?
No
Replace the electronic circuit
Yes
Check all the inyectors and the burner
Replace the ionisation plug
Check the minimum. OK?
No
Set the mechanical minimum
Yes
Check the wiring the combustion extraction and air intake pipes. If is it OK replace the electronic circuit

6 IT DOESN´T MODULATE CORRECTLY



8

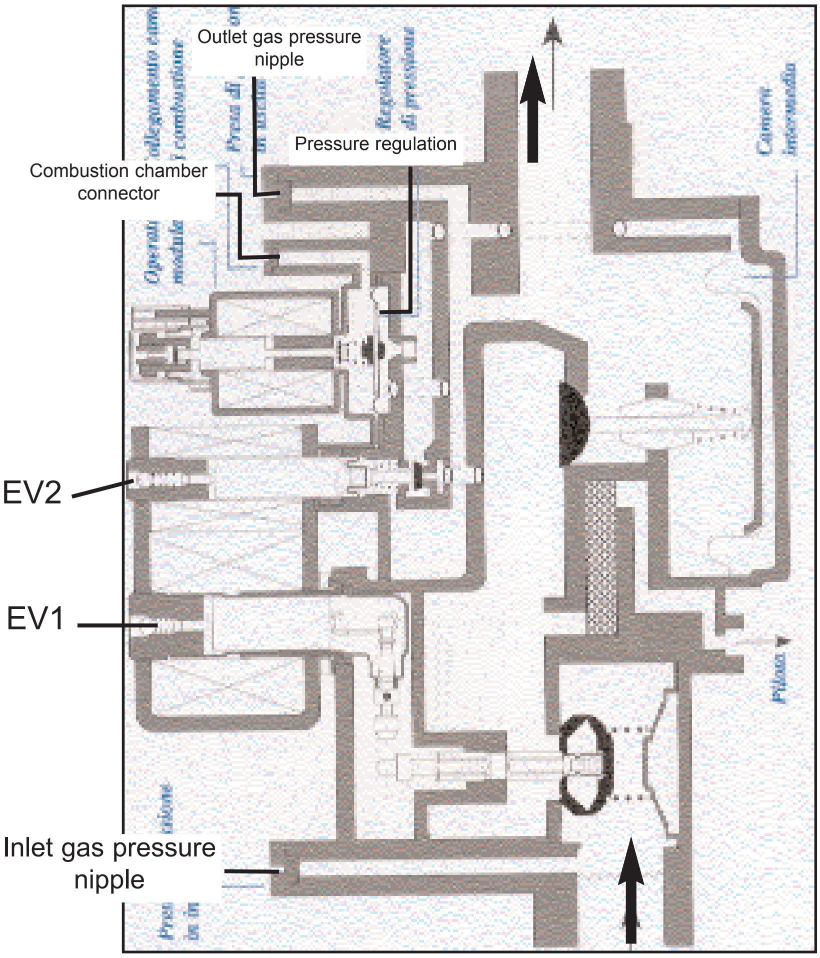
MAKES NOISE

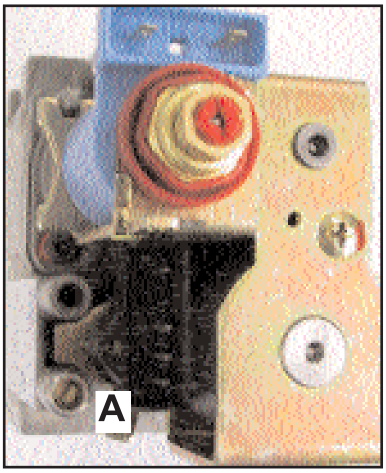


GAS VALVE

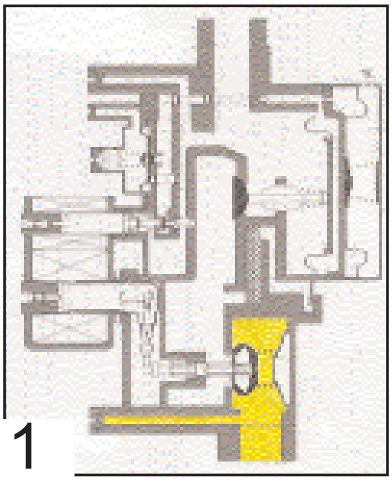
This is a very important component in the boiler.

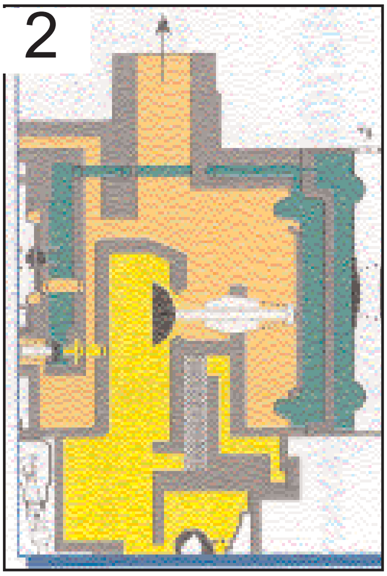
This type of gas valve has two safety electrovalves and one proportional electrovalve that makes the modulation endless. The valve has also a point (A) where you can measure the inlet gas pressure the outlet gas pressure is better to be done in the gas pipe between the gas valve and the manifold.

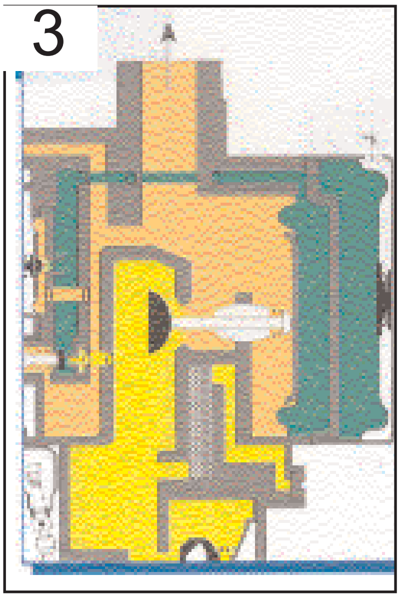




Gas valve process:

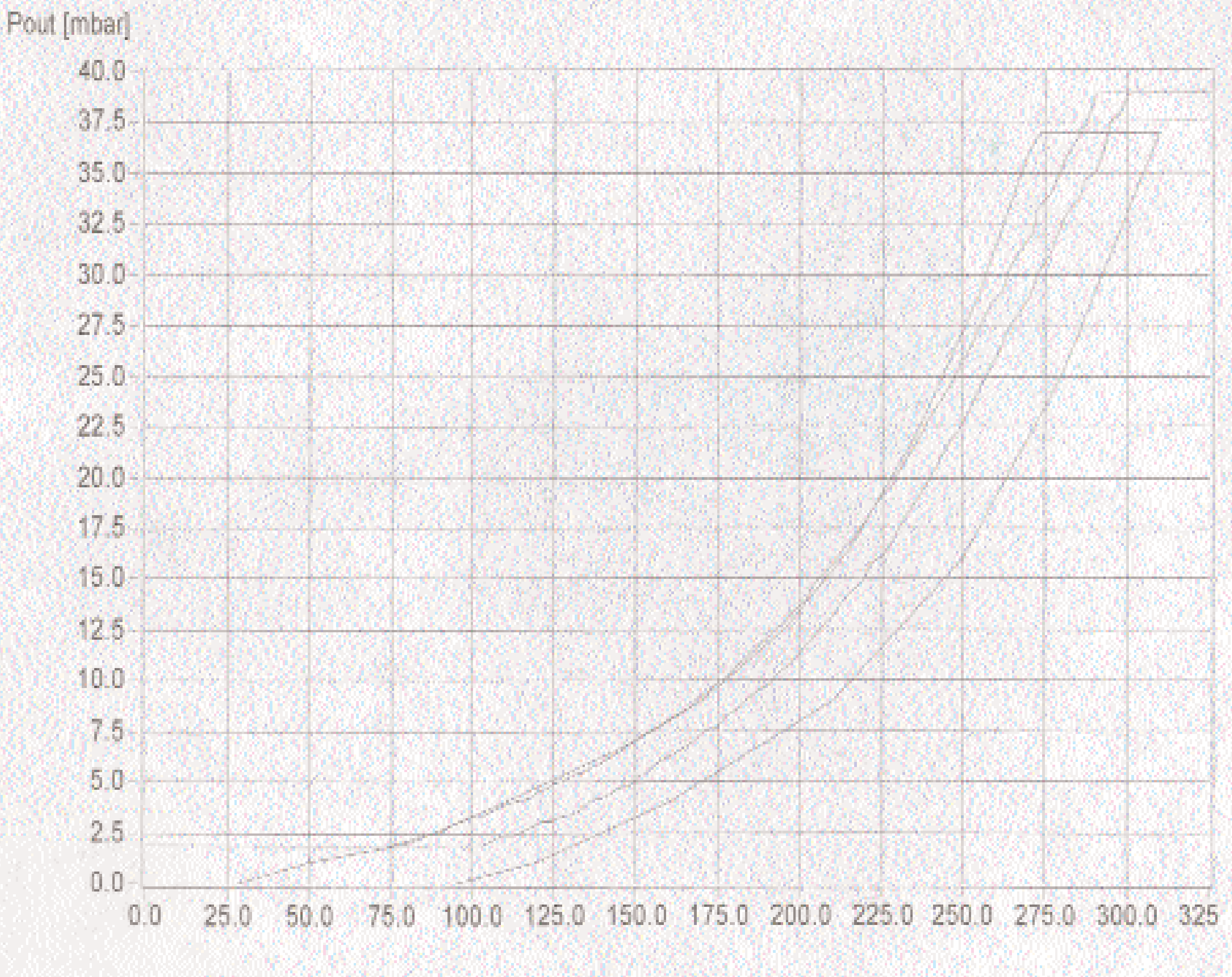




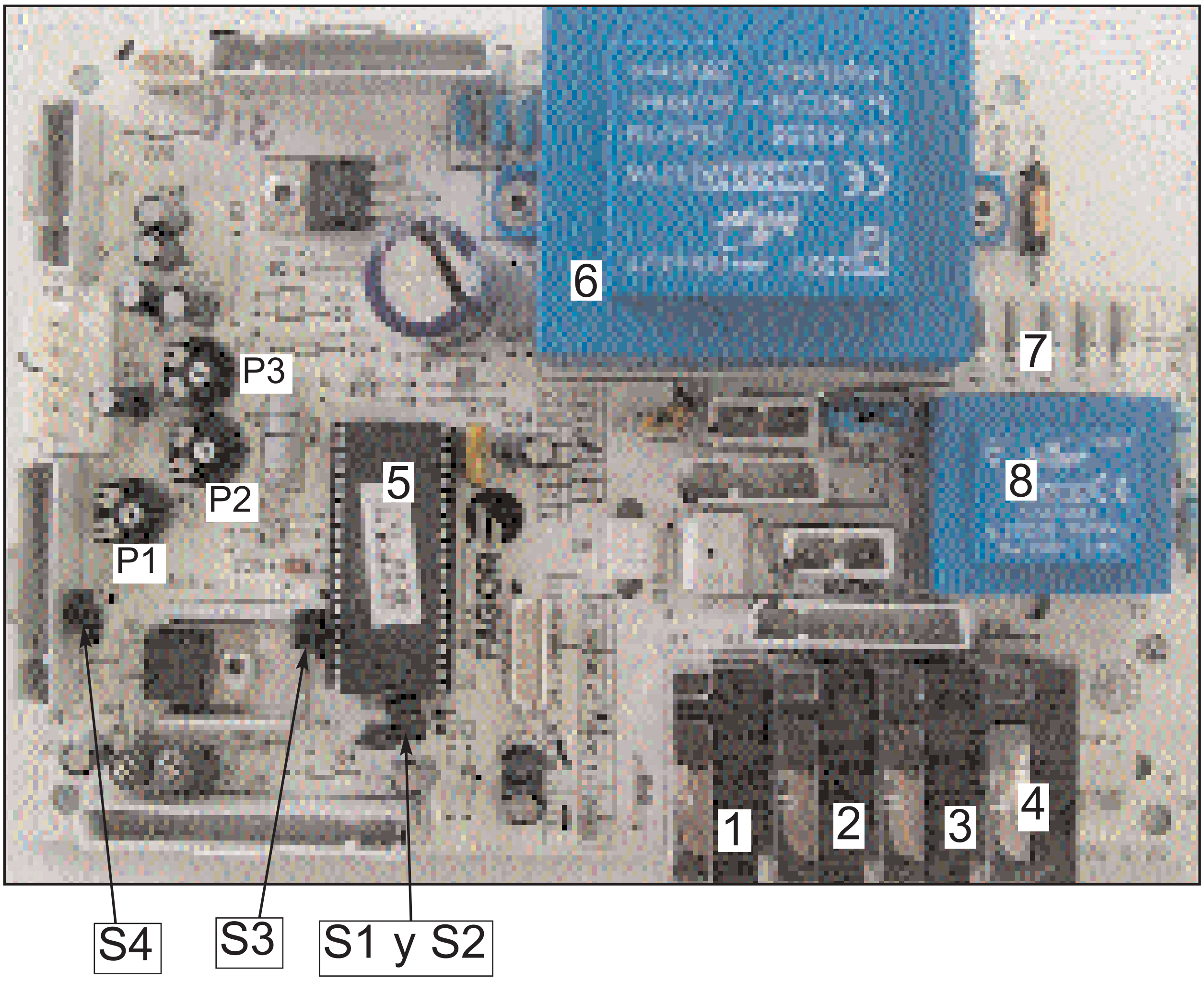


Gas valve curve

Pressure



ELECTRONIC CIRCUIT

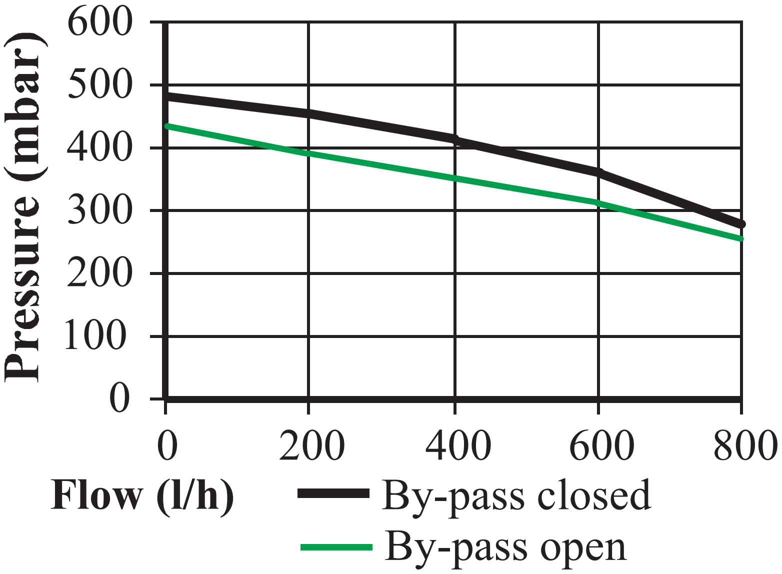


1	FAN RELAY	
2	ELECTROVALVE1 RELAY	
3	ELECTROVALVE 2 RELAY	
4	PUMP RELAY	
5	EPROM **103**	
6	CONVERTER	SECUNDARY 1: 14V AC
		SECUNDARY 2: 28V AC
7	GROUND	
8	CONVERTER	

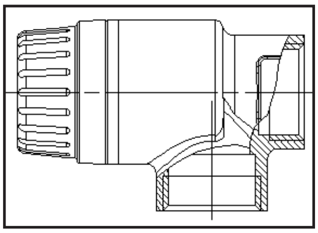
P1	MAXIMUM OUTPUT REGULATION	S1 Y S2	BOILER MODEL
P2	LIGHTING UP OUTPUT REGULATION	S3	PUMP POST-CIRCULACIÓN
P3	MAXIMUM HEATING OUTPUT REGULATION	S4	GAS TYPE

CIRCULATION PUMP

The pump moves the water all around the installation that means the boiler the pipes and the radiators. This element has an automatic and manual antiblock system. This pump has 3 speeds positions.



PRESSURE RELIEF VALVE



This is one of the boiler security elements.

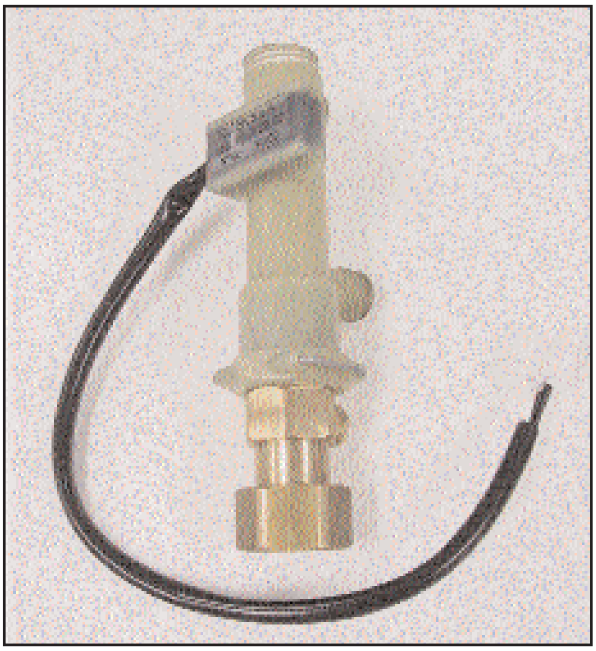
This valve opens when the heating circuit reaches to 3 bar.

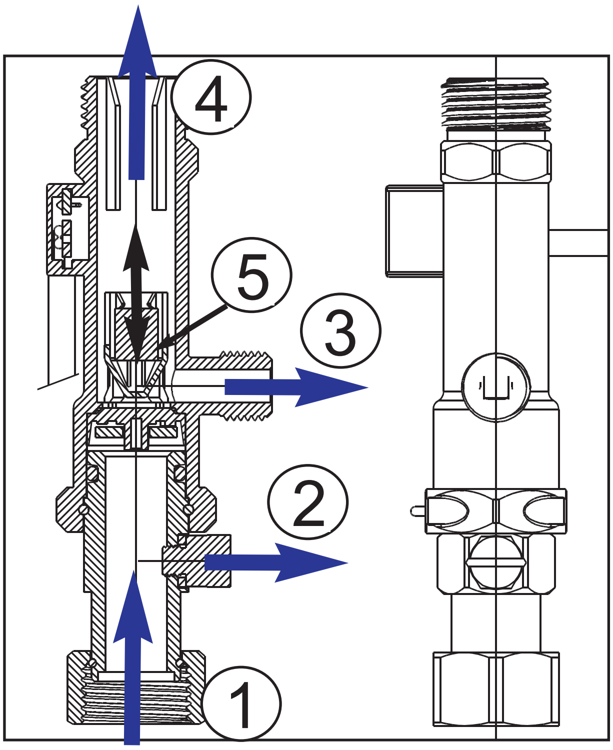
The heating circuit normal pressure is in between 1,2 (cold cicuit) and 2 (heating time) if the pressure increases and gets to 3 bar the valve opens and the water goes out till the values gets lower than 3 bar.

It is very important to connect the pressure relief valve to a water drainage

FLOW SWITCH

When a D.H.W. tap is opened the water flows inside the boiler and goes through the flow switch. the water moves the magnet (5) activating the electromagnet. This element gives the signal to the electronic card that one water heating tap is open.





1.- Boiler water inlet.
2.- Scooting plug.
3.- Heating circuit filling tap connection.
4.- Flow switch water outlet.
5.- Magnet.

SAFETY THERMOSTAT

The safety thermostat is place it in the heat exchanger. Checks the inlet temperature of the heating circuit. Protects the boiler against overheating. The safety thermostat cuts at 102ºC.

This type of thermostat is an automatic restart thermostat

THERMISTORS (HEATING AND D.H.W.)

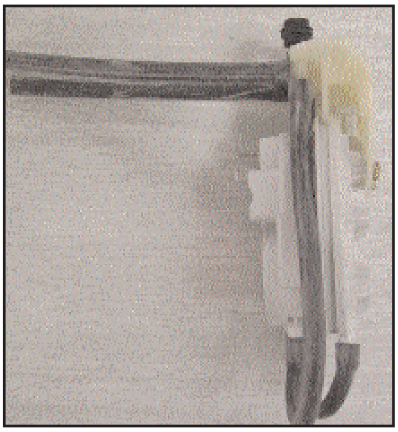
This boiler has to different types of thermistor one checks the D.H.W. inlet temperature and the other one checks the heating temperature and also the limit temperature.

In this type of thermistor when the temperature increases the resistance decreases.

Relation between Temperature-Voltage and Thermistor nominal Resistance

Temperature (ºC)	Voltage (Volts)	Resistance (k?)
85	0.92	1.44
80	1.01	1.65
75	1.15	1.91
70	1.28	2.21
65	1.41	2.57
60	1.54	2.99
55	1.71	3.51
50	1.93	4.13
45	2.13	4.87
40	2.34	5.78
35	2.55	6.89

Air pressure switch



This is another safety element of the boiler. The air pressure switch is connected with the air pressure connector.

This component makes sure that the fan is working in the right way and there is no obstruction inside the combustion extraction and air intake duckts