FEB-24E UK SUPERCOMPACT

COMBINATION BOILER

TECHNICAL & FAULTFINDING GUIDE

BOILER OUTPUT

To Domestic Hot Water:
Minimum 7.6 kW (25,932.26 Btu/h)
Maximum 23.7 kW (80,867.71 Btu/h)
To Central Heating:
Minimum 7.6 kW (25,932.26 Btu/h)
Maximum 23.7 kW (80,867.71 Btu/h)

EC-TYPE EXAMINATION CERTIFICATE
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Contents

1. Quick Guide to Trouble shooting

This section outlines the most common problems and helps to guide you through the rest of the workshop manual. **(Read this section first, before you make any adjustments. It will save you time.)**

CHECK HOT WATER SYSTEM FIRST, BEFORE THE CENTRAL HEATING CIRCUIT

HOT WATER SYSTEM

Here are some common problems:

GAS REGULATORS

Single appliance low capacity gas regulators plus 3/8" flexible low pressure pipe, will reduce the efficiency dramatically. Ensure gas regulators and pipes are capable of delivering 37mbar at the inlet under full load. A 2.5mbar drop is acceptable.

WATER FILTER

Check for contamination with foreign objects such as sawdust, plastic pipe swarf, etc. The water filter is located inside the cold water inlet fitting under the boiler. Any blockage will reduce flow and may prevent the boiler firing up.

HOT AND COLD WATER CONNECTIONS

Connections may be reversed at the boiler inlet/outlet fittings, resulting in the boiler failing to commence ignition sequence. This is because the hydraulic valve operates in one direction only.

THERMOSTATIC SHOWER MIXER VALVE

Faulty non return valves within the mixer tap may allow mains cold water to enter the domestic hot water pipe work. The boiler will react to the situation according to the amount of mains water entering the system. In severe cases a high percentage of mains cold water will exit the hot water tap in place of hot water, as water will always take the path of least resistance. This will result in no hot water flow, or a very restricted flow through the boiler. This will result in no ignition occurring or the boiler will modulate at very low gas pressure, followed by the boiler eventually shutting down as insufficient flow passes through the boiler.

QUICK PLUMBING CHECK

A simple solution if cross contamination of hot and cold water is suspected, is to disconnect the hot water outlet pipe from the boiler (under the van), this procedure eliminates faulty mixer valves and crossed pipes from the system and will allow the boiler to operate without any water starvation or back pressure. If it works, you now know the plumbing system is at fault and not the boiler.

WATER SUPPLY

The FEB24E Combination Boiler delivers up to 10 litres/minute of hot water. Many sites depending on occupancy levels and season do not have a mains system capable of supplying a constant pressure/flow rate to the boiler. Should the pressure/flow rate of the incoming mains cold water fall below the minimum specified values, the boiler will shut down due to the domestic hot water (DHW) thermistor detecting a temperature greater than 70 deg C or the micro-switch deactivating under low flow. Pressure at the cold water inlet can be checked using a gauge attached to the filling loop valve on the installation pipe work. The pressures should be checked when the domestic hot water flow is at maximum (10 litres/min). This can be adjusted at the faucet. If max flow cannot be achieved through the faucet, there is either a blockage or the water supply is inadequate.

CENTRAL HEATING SYSTEM

Check the following first:-

ROOM THERMOSTAT – (if fitted)

Faulty connections or incorrectly wired room thermostats result in the central heating not working. The fault is usually at the room thermostat, but can also occur at the connector block on the boiler, due to the insulation not being removed from the conductor wire or a loose feed wire (2 black) at the base of the connector.

LOW PRESSURE ON GAUGE

Incorrect or too low a pressure in the heating circuit will disable the boiler in both central heating and hot water modes. FEB24E boilers are fitted with a pressure switch, should the pressure within the heating circuit fall below 0.8 bar the switch will become open circuit and the boiler will lock out. Fault code 2 will be displayed via the LED. This will prevent damage to the boiler in the event of the heating system leaking, or in some cases due to accidental drain down of the heating circuit.

Important- The accuracy of pressure gauges may vary and can provide a general indication of pressure within the boiler only. Pressure will also vary according to temperature. The normal operating pressure when cold should be 1.6bar.

Important - Leaks on the heating circuit can occur anywhere on the system. It is important to locate and rectify any leak however small it may be. One way of detecting minute leaks is to pressurise the boiler to 2.0bar. Using toilet or tissue paper, wipe around any joints on the system. If any moisture is present then the tissue will change colour becoming darker.

Check the following if low pressure is shown:

- Radiator air vent screws and blanking plugs
- Radiator valves all joints and unions
- Filling loop double check valve
  (This may not be visible without removing inspection panels)
- Boiler connections including safety valve (check discharge pipe)
- Automatic air vent bleed screw (located on top of pump)
- Drain plugs and connections under the van. Any leaks are usually indicated by dark patches on the concrete or gravel, or look for patches of dead grass.
- Loss of pressure from expansion vessel (see section under expansion vessel)

If the leak is impossible to detect then the last resort is to introduce a proprietary leak sealing chemical into the system such as Fernox LS 3.

TIME CLOCK

Check that the time clock is calling for heat, the white tappets should be in the outer position at the arrow head.

IMPORTANT. The specification of time clocks on boilers after serial number 050512656 incorporates a three position selector switch located at the base of the clock. There are three positions as follows:

1. Switch to the left overrides timed positions and heating is on constant.
2. Switch in the centre position heating is on or off according to tappet timed positions on the clock
3. Switch to the right heating is off.

HEATING SLOW TO REACH TEMPERATURE

The main burner may ignite for short periods only and the radiators may be slow to heat. This can be caused by a blocked filter on the central heating return pipe. (Right hand pipe). Access to the filter requires draining down the boiler, and removing the pipe fitting from the boiler. The filter can then be removed for cleaning and MUST be replaced to the boiler.

Another associated problem with sluggish radiator performance can be attributed to un-circulated undiluted anti freeze in the boiler and pipe work. This problem is usually worse in cold conditions. In order to cure the problem, try the following method.

1. Turn off one radiator valve on the largest radiator. Increase the pressure in the system to 2.0bar. Now release 0.5 litre of fluid from the air vent cap on the radiator into a container.

2. Close the vent and re-pressurise the heating circuit to 2.0bar and open the radiator valve which was closed on the initial purge. Close the valve previously open (you will need a screw driver and adjustable spanner to open and close the lock shield valve). Release another 0.5 litre of fluid from the air vent cap. This procedure should have cleared any concentrated anti freeze from the pipe work.

3. Re-pressure the boiler to 1.6bar and open both the radiator valves fully and run the heating. Once the boiler has established full heat at the radiator, close one of the valves on the working radiator. Other radiators should now slowly start to heat up. Radiators which fail to heat up may require purging as above.

4. If time is not a problem, simply leave the heating on. After an hour or two the problem will clear itself.

COLD RADIATORS

These usually appear in pairs, due to crossed pipe work, i.e. one radiator is fed with two flow pipes with a second radiator fed with two returns, and consequently neither radiator is capable of circulation and remains cold.

Always check that the valves are open. Some systems are not heat tested before despatch, and it is possible that the valves may be closed very tightly. If in doubt check by removing the plastic head and use a spanner to open the valve.

THINGS TO CHECK BEFORE MAKING ANY ADJUSTMENTS

1. Mains cold water supply valve fully open.
2. Gas installation correct. Regulator/pipe size correct/UPSO/OPSO working correctly.
3. Gas supply valves open/isolation valve on boiler fully open.
4. Power supply to boiler socket present.
5. Air pressure switch test point cap fully located. (Black rubber cap on the right hand side on the top of boiler)
6. Correct water pressure is in the heating circuit (1.6Bar when cold)

AT THE BOILER, REMOVE THE FRONT COVER AND CHECK THE FOLLOWING:

- The 2 white modulation solenoid wires are connected
- The spark generator is attached to the gas valve correctly
- Both the H.T leads from the spark generator are attached correctly
- Look for wires and components not connected or plugged incorrectly, especially the clip on central heating thermistor which should be attached to the heating flow pipe and not the gas pipe!

IMPORTANT: Boilers with serial numbers 050410747 onwards will have the central heating thermistor located on the left hand side of the main heat exchanger.

Important Things You Will Find in the Technical and Faultfinding Manual

Domestic Hot Water Ignition Sequence (Page 28)

This flow diagram represents the general operating system in the domestic hot water mode and the sequence of events if temperatures exceed the specified limits which are pre-determined by the PCB.

Central Heating Ignition Sequence (Page 29)

This flow diagram represents the general operating system in the central heating mode and the sequence of events if temperatures exceed the specified limits.

Please note that following the initial 30 seconds of minimum output, modulation may not occur for a further 5 minutes if the central heating logic programme is operating. This is because the boiler will not fire on full power if it has detected it is serving a system with a low load. This is the case in most caravan holiday homes. For more detailed information please see the note on central heating logic programme. **(Page 25)**

Lighting Up Sequence Flow Diagram (page 27)

The lighting up sequence is common for both the central heating and domestic hot water modes. Once the flame is established the relevant regulation on modulation takes place.

Explanation of Self-Diagnostics (Page 30)

Whenever a fault develops in the boiler that is likely to affect its safe operation it will lock out and show a fault code via a flashing sequence on the red LED on the control panel. Lock out faults will require a component to be replaced or service work to be carried out. Identify the fault by reading the flashing LED sequence (**self diagnostic fault code**). Each

fault code has a description as to the cause of the problem in the workshop manual – read this carefully.

N.B. there will be a time delay of between a few seconds and 3 minutes between the boiler locking out and showing the self diagnostic fault code. The workshop manual shows each component of the boiler, a functional description and the operating voltages where applicable. By reading this information and testing before replacing components the correct diagnosis can be reached ensuring that the wrong part is not replaced unnecessarily.

Fault Finding Flow Diagrams (Pages 39 – 46)

These diagrams help diagnose problems that are not related to the safe operation of the boiler and hence are not subject to the “lock –out” mechanism and the corresponding self diagnostic fault code. The diagrams are to be used as a guide only and in conjunction with the more detailed information on each component found elsewhere in the workshop manual.

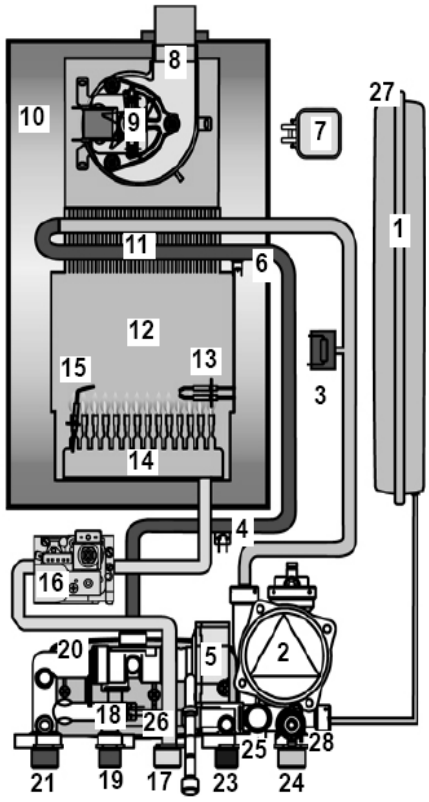
TECHNICAL DATA

Model			FEB-24EUK
Category			II2H3P
Type			$C_{12},C_{32},C_{42},C_{52},C_{82},B_{22}$
Central heating and domestic hot water performances.	Maximum output	kW	23.7
		Btu/h	80,840
	Minimum output	kW	7.6
		Btu/h	26,151
Nominal central heating and domestic hot input (Gross)	Maximum	kW	28.9
	Minimum	kW	9.2
Nominal central heating and domestic hot water input (Nett)	Maximum	kW	26
	Minimum	kW	8.3
Domestic hot water flow rate at 25ºC (l/min)			13.6
Domestic hot water flow rate at 35ºC (l/min)			9.7
Nominal D.H.W. flow rate at 34ºC (l/min)			10
Minimum flow rate for activating D.H.W. (l/min)			2
Operating pressure (bar)	Maximum	Central heating	2.5
	Maximum	D.H.W	10
	Minimum D.H.W. activation		0.3
Expansion vessel capacity (1)			7
Temperature selection range (ºC)	Central heating circu it		60-85
	D.H.W.circuit		35-60
Gas inlet pressure (mbar)	Natural G-20		20
	Propane G-31		37
Gas consumption (Hi)	Natural G-20 (m3/h)		2.75
	Propane G-31 (kg/h)		2.04
Electrical supply (V/Hz)			230V~50Hz
Max.power consumption (W)			120
Dimensions (mm)	Height		680
	Width		390
	Depth		254
Minimum clearance (mm)	Top		200
	Bottom		150
	Sides		5
	Front		5
	Gas inlet		18
	Domestic cold water inlet		15
	D.H.W.outlet		15
	Central heating flow		22
	Central heating return		29
Net weight (kg)			29
Type of gas	Propane G-31 (FEB-24E UK GLP)		X
92/42/EEC Directive			**

SCHEMATIC DIAGRAM - HYDRAULIC CIRCUIT

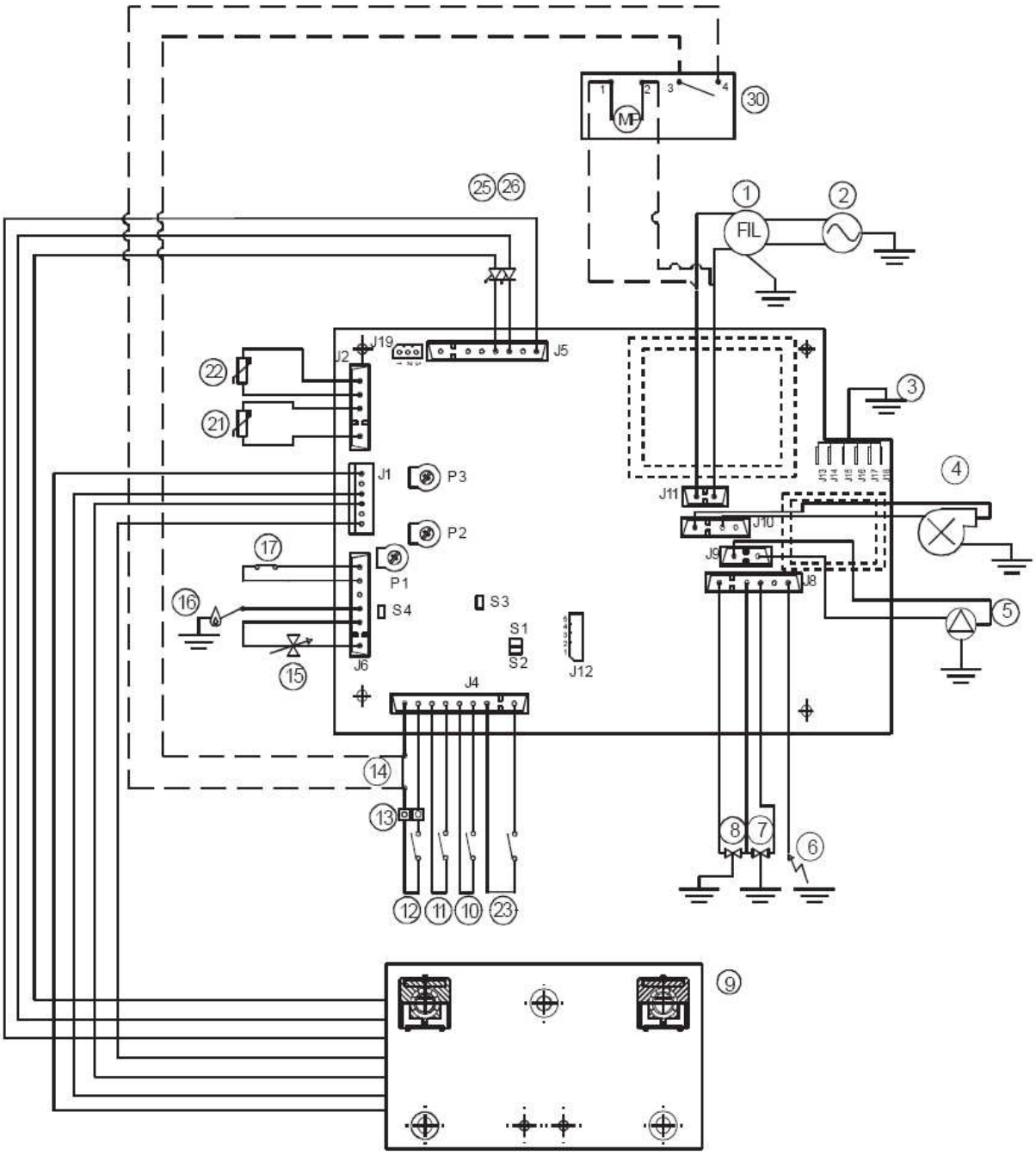
Schematic diagram- Hydraulic circuit

1.- Expansion vessel
2.- Pump with Automatic air bleed
3.- Water pressure switch
4.- Central heating thermistor
5.- Three way valve
6.- Overheat thermostat
7.- Air pressure switch
8.- Venturi
9.- Fan
10.- Sealed air box
11.- Copper heat exchanger
12.- Combustion chamber
13.- Ignition electrode
14.- Burner
15.- Flame sensing electrode
16.- Modulating gas valve
17.- Gas inlet
18.- D.H.W Thermistor
19.- Hot Water outlet
20.- Plate heat exchanger
21.- C.H flow
23.- Cold water inlet
24.- C.H return
25.- Pressure relief valve
26.- Automatic By-pass
27.- Expansion vessel valve
28.- Draining valve

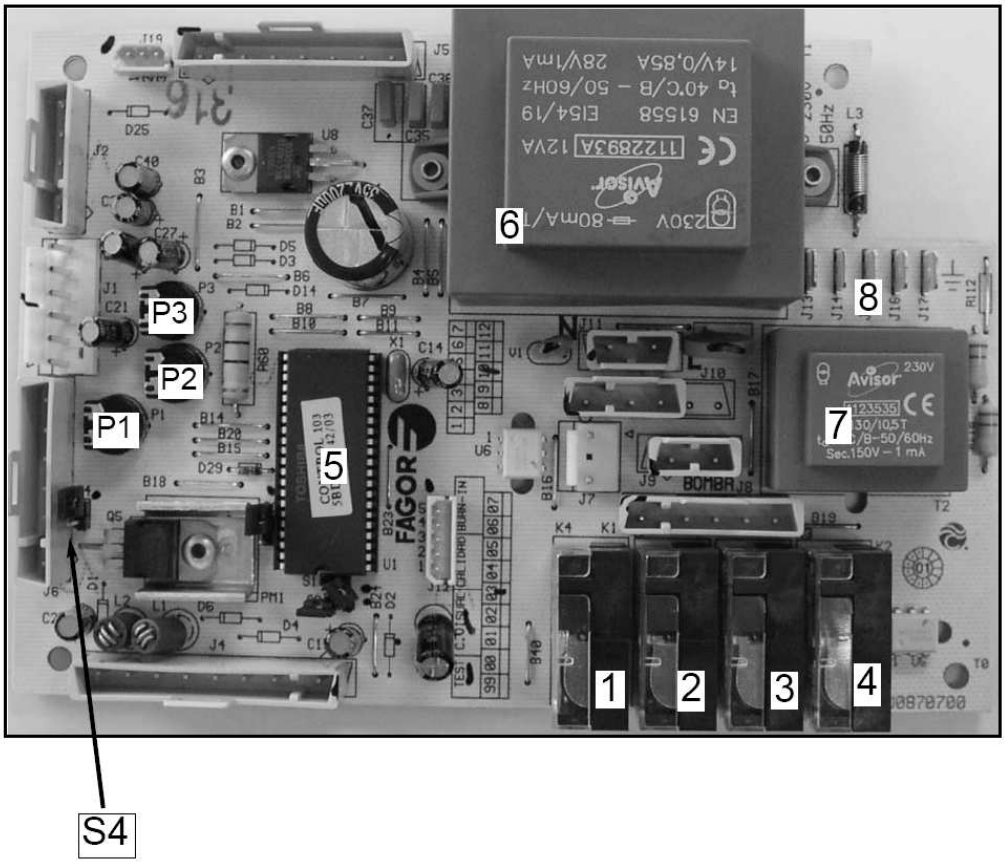


2. Electrical Components

Electrical Circuit Diagram



PRINTED CIRCUIT BOARD PHOTO DIAGRAM



1	FAN RELAY		P1	MAXIMUM OUTPUT REGULATION
2	ELECTROVALVE 1 RELAY		P2	IGNITION BURNER PRESSURE REGULATION
3	ELECTROVALVE 2 RELAY		P3	MAXIMUM HEATING
4	PUMP RELAY		S4	GAS TYPE: PROPANE OR NATURAL GAS PROPANE BRIDGED , NATURAL GAS UNBRIDGED
5	EPROM (MICROPROC ESSOR)			
6	TRANSFORMER PRIMARY 230 v	SECONDARY 1:14 v ac		
		SECONDARY 2:28 v ac		
7	EARTH			

The Heading Numbers refer to the Electrical Circuit Diagram

1. ELECTRICAL FILTER

This cleans the incoming mains supply voltage to the PCB

It is wired as follows:	L2	Live In	(Brown)
	N4	Neutral In	(Blue)
	U1	Live Out	(Grey)
	3U	Neutral Out	(Grey)
	=	Earth to Chassis	(Green & Yellow)

2. MAINS SUPPLY

This is provided via a 3 core flex to the electrical filter, fitted to a 3 amp fused supply on the plug and must be earthed.

3. EARTH CONNECTIONS

Four earth connections must be connected to the following terminals:

- Boiler Chassis
- Gas Valve
- Fan
- Central Heating Pump.

The clock requires no earth.

4. FAN

The fan draws 55 watts and runs on 220/230v ac. It is operated by relay number 1 and fed from J10 (blue & brown wires, non- polarised). It must be earthed at the fan and at the PCB

5. CENTRAL HEATING CIRCULATION PUMP

The pump operates in both central heating and domestic hot water modes. Supply voltage is 230V ac fed from J9 on the PCB (blue & brown). Always operate at number 3 speed.
If power is supplied to the boiler and the pump has not run for 24 hours the PCB will power up the pump for 1 minute. In addition, should the temperature at the central heating thermistor fall to 6 degrees Celsius, the pump will run until a temperature of 9 degrees Celsius is achieved. This is classed as first stage frost protection. For further details on pump overrun times see box charts on D.H.W. and C.H. service (page 26)

6. SPARK GENERATOR

The spark generator is located as a separate component on the gas valve and has two functions.

1. To produce a high tension voltage to produce an ignition spark at the electrode
2. To supply the 230V ac from the PCB to the main gas valve solenoids. (See section 7&8)

The 230V ac fed from J8 (brown) is transformed to HT voltage by the spark generator and the maximum duration of the spark is 18 seconds in 3 x 6 second sequences. The supply voltage to the spark generator from the PCB ceases as soon as the ionisation electrode detects the main burner flame has been established. The unit can be removed from the gas valve by removing the forward facing self tapping screw located on the top of the unit, this will then allow the unit to be unplugged from the gas valve.
N. B. Care must be taken when replacing the unit not to damage or bend the pins on the gas valve solenoid.

7. & 8. GAS VALVE SOLENOIDS

The gas valve is fitted with twin solenoids moulded into a single removable unit. In order for the gas valve to open and allow gas to the burner, both of the solenoids must be energised. The supply voltage for this action is 230V ac and supplied from J8 (red / black) on the PCB
To remove the solenoid from the gas valve remove the spark generator (see above) then remove the central locating screw, this will allow the solenoid to be pulled away from the gas valve.
N.B. faulty solenoids can be replaced, without the need to replace the complete gas valve. (Part Number FCB 1501).
Nominal resistance values for the solenoids can be taken from the disconnected spark generator plug J8.
EV1 = 0.84 kOhms (nominal) between black and blue (pins 4 and 3 on solenoid).
EV2 (small) = 7.00 kOhms (nominal) between red and blue (pins 1 and 3 on solenoid).

9. TEMPERATURE CONTROL P.C.B.

The temperature control PCB provides three types of functions for the boiler as follows.
1. on /off selection for domestic hot water / central heating /reset boiler after lock out
2. Temperature selection for either domestic hot water/central heating.
3. LED displays for standby / burner on / lockout display.

Maximum resistance value for P1 D.H.W is 5.20kΩ.
Maximum resistance value for P2 C.H. is 5.20kΩ.
Voltage is supplied to the PCB from J1 black at 5V dc.

Voltage readings between black/ blue (P1), range from 0V dc in off position to 4.20V dc in the max position.
Voltage readings between black/ brown (P2), range from 0V dc in the off position to 4.20V dc in the max position.

10. HYDRAULIC UNIT THREE-WAY VALVE MICRO SWITCH

This is located on the 3 way valve to the left hand side of the brass diaphragm housing. In the central heating (C.H.) mode the switch is kept closed, as the tip of the switch rests on the diaphragm push rod. When hot water is demanded the disc and push rod both move. This releases the micro switch. Once this occurs the boiler is operating in the D.H.W. mode.

In standby mode the supply voltage to the switch is 22V dc from J4 (blue)
In operation the voltage is 12.2V dc returning to the P.C.B. to J4 (brown)

11. AIR PRESSURE SWITCH

The air pressure switch proves that the fan is running and creating enough air flow through the boiler for combustion. The correct operation of the switch is dependant on the plastic venturi which is located at the top of the fan housing outlet.
In normal operation the fan creates an air flow though the venturi causing a pressure drop inside the venturi. This is transmitted to the air pressure switch via the connecting tubes. This causes the contacts within the switch to make, and the ignition process begins.
Voltage is supplied to the switch from J4 (21V dc) 3rd black from left
Voltage returns to PCB from the switch. J4 (21V dc) 4th black from left. This occurs when switch contacts are closed.
If the contacts in the switch jam and remain in the closed position after the fan has stopped running. Then the boiler will fail on the next ignition sequence and fault 1 will be displayed after 15 seconds.

Connections of the air tubes to the switch are as follows.
Top tube from venturi to P2 on air pressure switch (left hand side) provides negative pressure to switch from venturi

Bottom tube from venturi to P1 on air pressure switch (right hand side) provides positive pressure to the air pressure switch.

To check for correct operation of the venturi place a manometer on one of test points located on the top of the boiler. With the fan running note the reading on the manometer and then take a 2nd reading from the other test point. The difference between the two readings is the differential pressure.

Minimum differential pressure to activate the switch is 1.4mb.
Switch will deactivate as the differential pressure falls below 0.9 mb
Readings for a 600 mm horizontal flue in still air are:

REAR TEST POINT + 2mb
= 3.9 mb
FRONT TEST POINT – 1.9mb

N.B. Contamination of the venturi by insects will prevent sufficient airflow to produce the required pressure drop and will cause the boiler to lock out. Please see section 4 (fault code 1) for more details.

13. ROOM THERMOSTAT CONNECTOR

Located within the PCB electronics box is the room thermostat connector block. Access to the connector is via the small removable panel on the under side of the electronics box. Voltage is fed from the PCB J4 22V dc (left hand black) and returns to the PCB J4 right hand black via the time clock terminals 4 and 1. Voltage reduces to 12.5V dc when clock and thermostat contacts are both closed.
N.B. Loose or poorly connected room thermostat link wires at the connector block will cause problems with the heating demand, and will not be displayed as a fault code as the failure is not a safety related mater.

15. MODULATING GAS SOLENOID VALVE

This is located on the main gas valve. It adjusts the burner pressure in proportion to the temperature selected at the control panel, and the real time temperature values at the thermistors.
Voltage is supplied from the PCB from J6 (lower 2 whites) as voltage to the solenoid increases, the burner pressure will increase also. The voltage is measured in parallel at the terminals at the solenoid.
Nominal figures are;
0.8V dc at minimum burner pressure (4.0 mb)
12.5V dc at maximum burner pressure (35.0 mb)
6.5V dc at ignition pressure (8.0 mb)
Resistance value of the coil with leads disconnected = 78 Ohms
The ignition pressure cuts as soon as the ionisation electrode detects that the main burner flame has established.

16. IONISATION ELECTRODE

The ionisation electrode is located on the left hand side of the burner and is responsible for detecting that a flame is present across the entire burner.
The electrode is reliant on the ability of the flame to conduct an electric current.
During combustion large numbers of free electrons and ions are present in the burner flame, which acts as an electrolyte in which a current can flow.
The voltage to the electrode is supplied from the PCB 96V ac (J6 orange)
To check current connect a multimeter in series with the electrode. Select DC micro amps.
With the burner at maximum power expect 5 to 7 micro amps.

When the flame is detected the green neon will change from the solid green to a flashing green to indicate that a flame has been detected along the full width of the burner.

17. HIGH LIMIT THERMOSTAT

Located on the front of the primary heat exchanger, the fully enclosed bi metal contacts open if the temperature exceeds 102 degrees centigrade breaking the circuit to the PCB.
Voltage 22V dc is fed from the PCB (J6 second white) and returns to the PCB (J6 top white) when the contacts are closed (normal position).
The high limit thermostat automatically resets as cooling takes place, but the boiler will require the lockout (fault 3) to be manually reset at the control panel, before it will resume normal operation.
N.B. The thermostat is dry mounted on the heat exchanger, (you can remove without draining down). Never loosen or tighten using the electrical spade terminals.

21. DOMESTIC HOT WATER THERMISTOR

The thermistor screws into a wet pocket (under mains water pressure) at the hot outlet side on the hydraulic unit and provides the PCB with the temperature of the domestic hot water exiting the boiler.
As the temperature of the thermistor increases, the resistance decreases. This information is used by the PCB and ensures that the gas valve modulates to achieve the correct temperature as selected at the control panel.
In the domestic hot water mode the boiler has an operating range between 35 – 60 degrees centigrade during normal operation. If the thermistor detects a temperature greater than 70 degrees centigrade then the boiler will shut down and the ignition sequence will commence when the hot water temperature is lower than the selected temperature.
If a fault develops on the hot water thermistor (out of range /false temp readings) lock out will occur and fault code 10 will be displayed, if the thermistor cools to normal values then the boiler will reset automatically.
If the thermistor fails to return to within normal range then the lock out will not reset and the thermistor must be replaced.

Faulty domestic hot water thermistors will allow the boiler to operate in central heating mode. If a demand for hot water is made during the heating sequence then the boiler will lock out. (Fault 10). Values of the thermistor can be checked by measuring voltage in parallel at J2 (black /black) with the power on at the boiler and the plug in situ on the PCB.

To check values by resistance, remove the multi pin plug from the P.C.B and check values on the (black/ black) using 20 Ω range.

IMPORTANT. The D.H.W. thermistor on the FEB-24E is the same type as the central heating thermistor used on the FEB-20E. New thermistors are not supplied with the sealing “O” ring. Please remove and re-use existing “O” ring.

22. CENTRAL HEATING THERMISTOR

The central heating thermistor is a clip on type, located either on the heating flow pipe above the hydraulic unit or on later models on the top left hand side of the primary heat exchanger. Temperature range for central heating is 60°C -85°C.

The thermistor detects the temperature of the heating circuit (primary circuit in D.H.W. mode) and provides the initial over heat protection for the boiler at 105 °C with fault 6 displayed. A faulty thermistor affects both the central heating and hot water.
A thermistor that is out of range or open circuit will cause the boiler to lock out (fault 12) As the thermistor cools and re-enters normal operating range reset will automatically take place, if the thermistor is faulty or open circuit then it must be replaced.

The thermistor also provides frost protection for the boiler if a temperature of 6°c is detected the pump will run until the temperature reaches 9°C if the temperature continues to fall until the thermistor reads 3°C Then the boiler will ignite at minimum output until the heating circuit temperature is 20°C. To check values of the thermistor use the same procedure as for checking the D.H.W. thermistor, or gain access directly to the thermistor via the boiler without the need for entering the PCB

TEMPERATURE ^{0}C	VOLTAGE (VOLTS)	RESISTANCE (K OHMS)
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

23. CENTRAL HEATING LOW PRESSURE SWITCH

Located on the on the return pipe (above the pump) the low pressure switch provides protection for the boiler in the event of pressure loss in the primary system.
Voltage to the switch (22V dc) is supplied from the PCB junction J4 (left hand red wire) and returns to the PCB J4 (right hand red wire). Providing the pressure in the boiler is greater than 0.7 bar the contacts in the switch will be closed and the supply voltage will return to the PCB J4 (left hand red).

Failure to detect sufficient pressure in the system will result in the boiler locking out with fault 2 being displayed.
The switch has 3 terminals, however connections with the red wire should be made to terminals marked “COM” and “NO”.
IMPORTANT. If using an un-insulated screwdriver to lever the terminals from the switch, voltage from the switch terminals may short to boiler pipe work and damage the PCB.

25. GREEN LED POWER ON & BURNER FUNCTIONING

The green LED has two display modes:
A constant green light indicates the boiler is ready to supply hot water or central heating on demand.
A flashing green light indicates the burner is firing and operating in either hot water or central heating mode.
Voltage is supplied to the LED from the PCB J5 22V dc between (black and brown) when in standby mode.
Voltage changes to pulse mode 22V dc to 0 v dc between (black and brown) when the main burner flame is detected.

N.B. mains voltage is still present at the PCB until the supply voltage to the boiler is isolated.

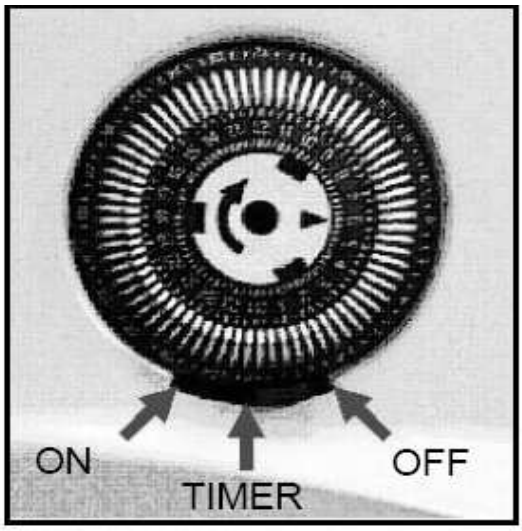
26. RED LED LOCK- OUT INDICATOR

In the event of a boiler malfunction the red LED will flash in a sequence of self diagnostic fault codes to indicate the relevant fault with the boiler/system or components.
Voltage is supplied from J5 on the PCB 22V dc between (black and red) in the event of lockout.

30. TIME CLOCK

Two different types of time clocks have been fitted to the boiler serial numbers 050512656 onwards have a basic time clock without an override facility, and rely on the tappets on the clock to be in the outward position for the heating to work.
Later models incorporate a clock with a built in override switch.
POSITIONS OF THE SWITCH ARE AS FOLLOWS

1. Switch to the left overrides timed positions and heating is on constant.
2. Switch in the centre position heating is on or off according to tappet timed positions on the clock
3. Switch to the right heating is off.



The clock has 2 power supplies. A 230V ac supply from the electrical filter to drive the motor within the clock. The second supply is the low voltage switching supply for the heating demand.

Supply voltage to the clock switching circuit is fed from J4 22V dc (left hand black) via the room thermostat connector block to the micro switch on the clock. (Contact number 4) When the contacts in the clock are in the closed position (heating on) voltage is returned from the clock (contact number 1) to the PCB J4 12V dc (right hand black).

N.B. All the connection terminals on the clock are of the same type DO NOT allow the 230V ac motor supply to enter the low voltage circuit which are clearly marked 1 and 4 on the micro switch.
Remember to isolate the boiler at mains supply before working on clock, as power is permanent regardless of the position of the on / off switch.

THE PRINTED CIRCUIT BOARD (PCB)

MOST IMPORTANT – MISTAKEN PCB's

Both the Feb-20E (later models) and the FEB 24E use a PCB with a common chassis. Both Boards look identical to each other until closer inspection. There is a potential for a boiler to be fitted with an incorrect PCB. No damage or danger will result from this mistake – the boiler simply will not work.

If a FEB-20E PCB is fitted to a FEB-24E boiler the following will occur:

1. With jumpers S1 and S2 open – no green or red LED's will work
2. With jumpers S1 and S2 closed – green LED off and red LED will display fault 2

To identify the correct PCB please observe the following rules:

1. The main EPROM chip (position 5 in photo) contains the software for the boiler. All FEB-24E boilers run on chips marked "**control 205**" or "**control 204**". The identifying labels on the chip are either blue or yellow with a small number of boards containing chips with hand written white labels.

2. Identification of the FEB-24E PCB can also be achieved by locating the number "**N03G009M8**" on the large transformer. This will also be marked with "**control 205**" or "**control 204**".

DESCRIPTION OF THE PCB

While the PCB can appear complex and difficult at first, understanding its operation and how to test voltages can result in a speedy resolution of any problems.
The next few pages will guide you through the basic operation of the PCB without the need for a degree in electronic engineering. A basic knowledge of electricity and a digital multi meter will be the only requirement for diagnosing possible faults without damaging the PCB or yourself.

The golden rule when working on the PCB is not to allow mains 230V ac to enter the low voltage circuit i.e. via the room thermostat or the time clock. Care must be taken when reconnecting terminals on the time clock if they have been disconnected as all the terminals are of a standard size. It is possible to connect the 230V ac motor supply for the clock to the 24V dc control circuit. It is also important to isolate at the mains supply and check that no power is present at the appliance before carrying out work or changing components. This will eliminate any possibility of creating a short circuit to earth, which even in the case of low voltage 24V dc components e.g. high limit thermostat will cause damage to the PCB if allowed to short to earth.

The PCB generates a wide range of different voltages both ac and dc. With care these can be checked from the multi pin sockets as shown on the circuit diagram. In most cases when checking voltages the return (neutral) will be to earth and occasionally in parallel (across the two connections), this applies to the thermistors and the modulating gas valve solenoid.

Components such as variable resistors and thermistors can be checked on the ohms range on the multi meter. Flame detection signal can be checked by using micro amps ac or ac volts.

If a fault develops on the boiler it is necessary to determine if the problem is internal or external. Internal refers to the PCB and external refers to all the controls/components which are attached to the PCB. Both internal and external systems must work together in order for the appliance to operate correctly.

Many of the external controls are associated with the safe operation of the boiler, and should a fault develop the self diagnostic codes will indicate the faulty component. This system will not indicate faults on external controls which are used as demand detectors e.g. Microswitch, room thermostat and time clock.

Whenever the PCB is powered up in the relevant mode, voltage is supplied to the external controls/components responsible for detecting demand and safe operation of the boiler. Ignition sequence will not begin if;

A Demand from external controls is not detected.
B A component is faulty or out of range (temperature detection).
C Lock out occurs before any ignition sequence commences.

ELECTRICAL COMPONENT TESTING

The PCB contains sensitive electronics and software programs that will become permanently damaged if mains power 230V AC is allowed to enter the low voltage circuits. This can only occur if care is not taken when testing the PCB. When working on the PCB it is possible to check for voltages from the multi pin plugs which are identified by the prefix 'J'. By using the circuit diagram and accompanying notes from each component you can select the correct range on the multi meter for testing purposes.

DO NOT ATTEMPT to test individual transistors, chips, etc. which are built into the PCB. When checking for output from the PCB the multi pin plug must be left in position, and the tip of the test lead probe must make contact with the exposed part of the cable connector at the entry point of the multi pin plug.

DO NOT ALLOW wires to short out to earth when changing components, even if they are low voltage as damage to the PCB will occur.

To test for voltage from the PCB preferably use the main earth connection as negative or the boiler chassis for both AC and DC tests.

The voltage generated by the PCB can vary according to the incoming mains voltage and therefore it maybe necessary to select a different range on your multimeter. These are DC voltages which can fluctuate from 19 – 22V DC.

It is important to understand that the PCB generates a voltage that requires switching at the relative component in order for the lighting up sequence to activate. In the case of the micro switch 21V DC is supplied from J4 (second wire from right) and assuming water is flowing through the hydraulic valve, then the signal voltage will be switched and returned to the PCB at J4 first wire on the right. This principle also applies to the external controls e.g. the time clock and room thermostat. The contacts in either of these must be closed for the central heating to operate.

3. Central Heating Logic Programme

PLEASE NOTE:

With the appliance operating in central heating mode a built in logic programme will monitor the modulation to determine the heat load of the appliance. Subsequent heating cycles will be automatically pre-determined to avoid excessive gas use and un-necessary cycling of the heating system.

1. The initial 30 SECONDS of output will remain at minimum burner pressure. After this period of stabilisation “modulation” will then take place if required.
2. During modulation, if the temperature selected at the control panel is achieved within 5 MINUTES, the boiler will shut down and the next cycle will be pre-determined at minimum burner pressure. (see fig. 1)
3. When the water in the CH circuit cools below that set on the control panel the boiler will fire up on minimum burner pressure for 5 MINUTES. This is due to a low heating load being detected. If the temperature selected at the control panel is not achieved WITHIN 5 minutes, the normal modulation will resume in order to achieve the desired temperature. (see fig. 2)

IMPORTANT NOTE: It is not possible for the user to over ride the logic program during either the initial 30 seconds of the heating sequence or during the subsequent 5 minutes running on minimum burner pressure.
Adjusting the temperature upwards at the control panel will not increase the burner pressure. This may give the impression the modulation may be faulty. DO NOT attempt to reset gas pressures etc. during this period. To initiate a 'clean start' to override the five minute minimum burn period 'reboot' the central heating by switching the mains power off for five seconds. When power is restored the appliance will then restart with the 30 seconds of minimum output followed by modulation (if necessary) following the same timing sequence as before. Interruption by room thermostat does not activate the period of 5 minutes minimum output. Initial lighting up pressure at re start will always be 30 seconds at minimum output.

Central Heating Logic Programme

Figure 1

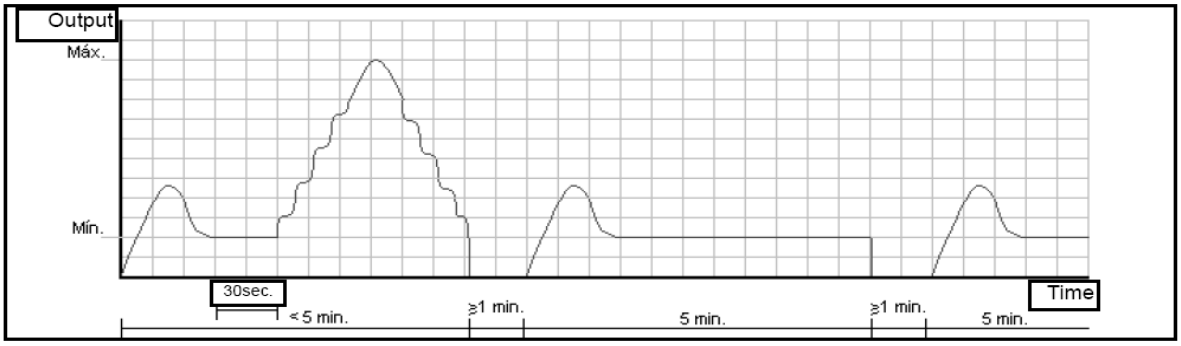
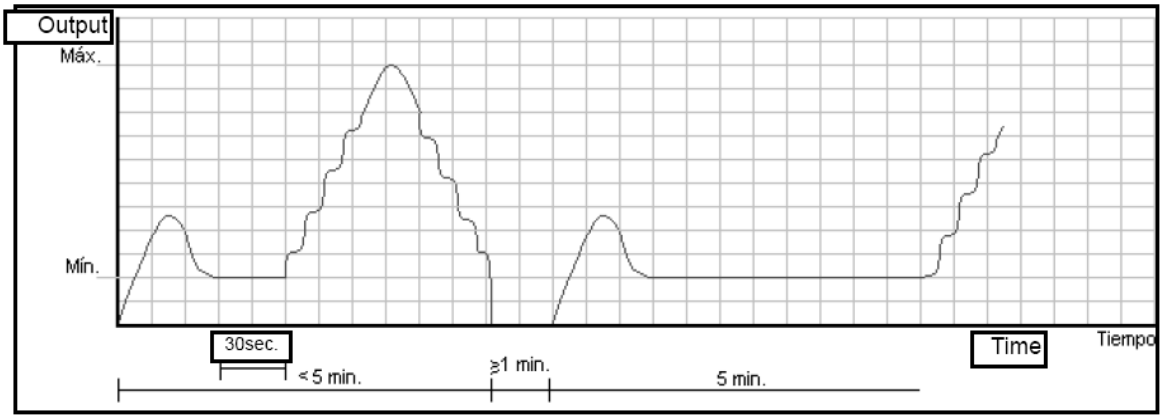
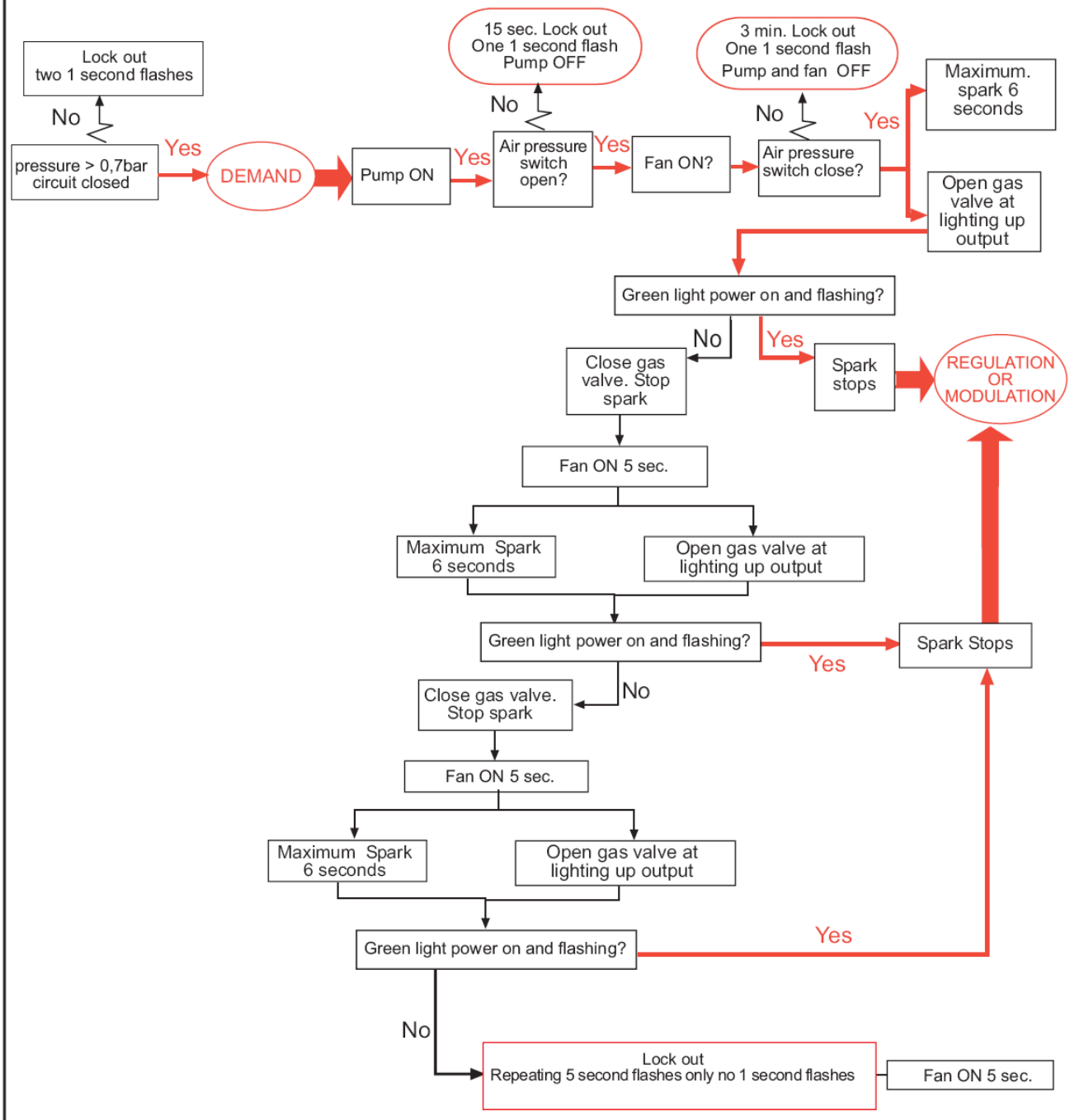


Figure 2



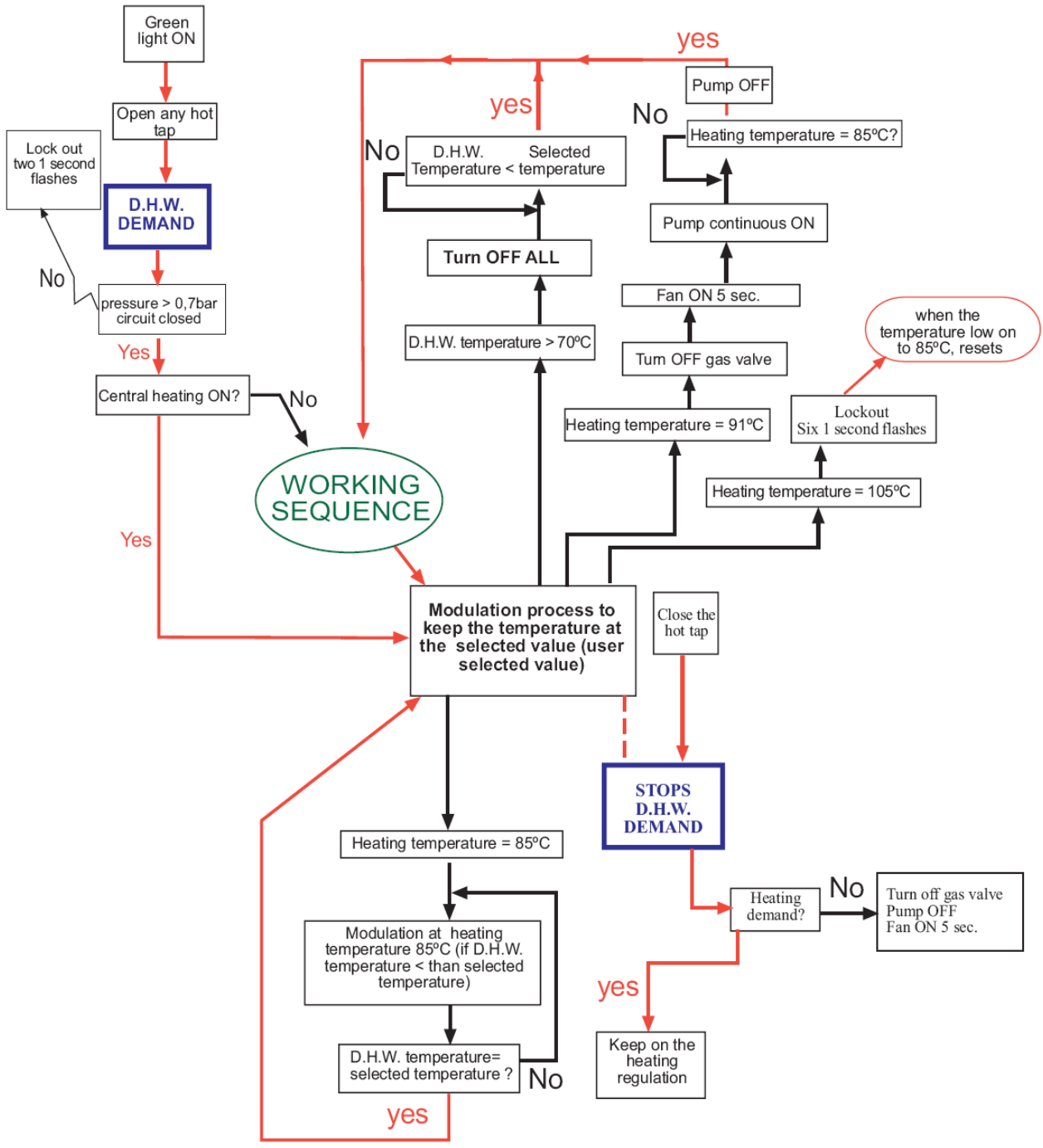
MORCO
HEATING & HOT WATER

WORKING SEQUENCE



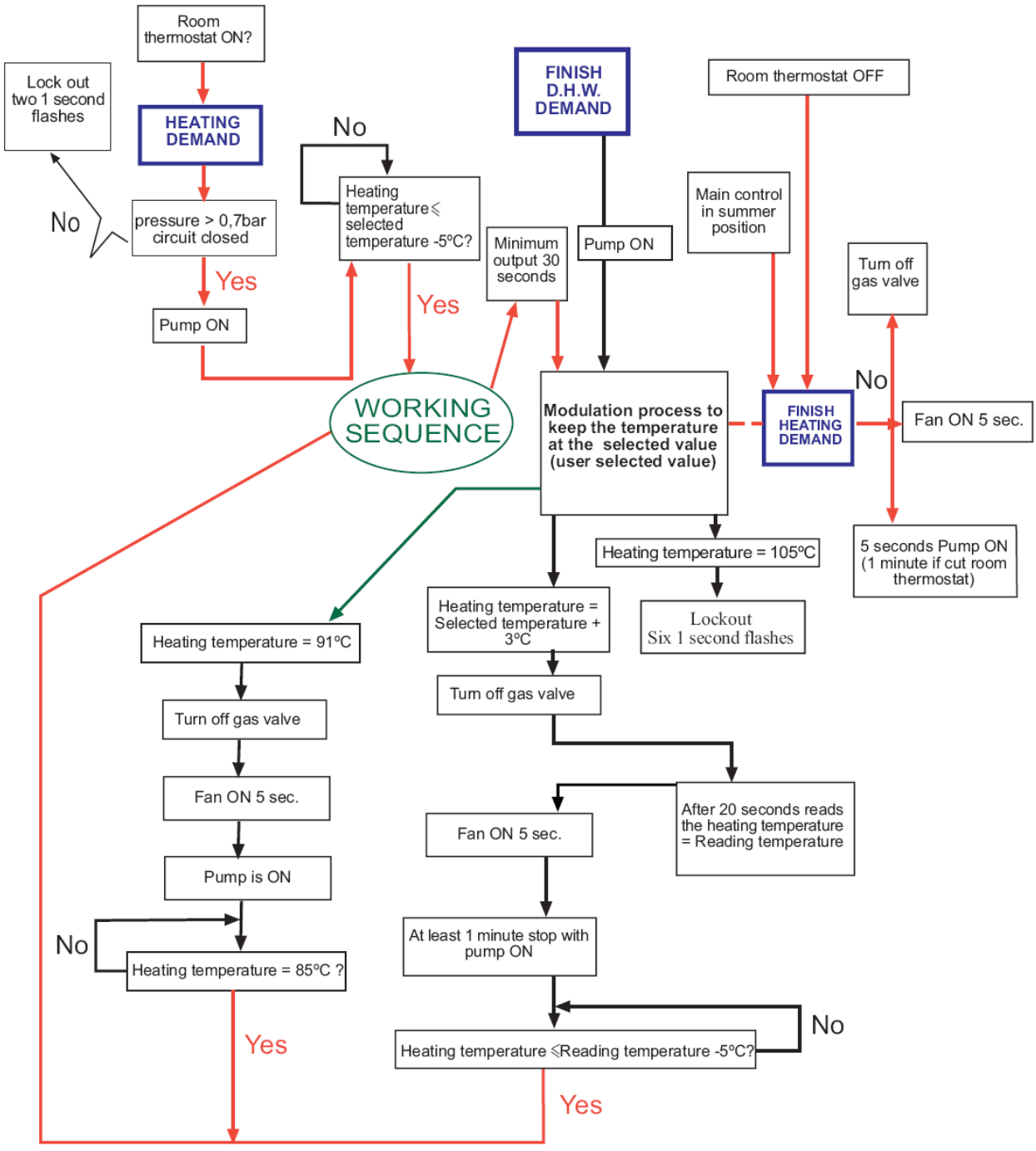
MORCO
HEATING & HOT WATER

D.H.W. SERVICE



MORCO
HEATING & HOT WATER

HEATING SERVICE



4. Explanation of Self-Diagnostics

The FEB-24E has a built in self diagnostic fault finding system incorporated into the P.C.B. Should a fault develop on the boiler which could cause an unsafe situation the boiler will “fail safe”. It does this by suspending all operations or “locking-out” and displaying a fault code via the 'red LED' on the control panel.

The fault can be identified by the different sequences in which the 'red neon' flashes and the duration that the neon stays illuminated. The electronic fail safe is also backed by a mechanical means of protection, should the electronics fail to detect a fault. These mechanical forms of protection will protect and ensure the safe shut down of the boiler.

The software protection built into the P.C.B. will run a system check on components which are essential to the safe operation of the boiler. This occurs before any ignition sequence takes place. If any component is found to be faulty or out of a predetermined range, then lock-out will be displayed.

Each fault code begins and finishes with the 'red LED' illuminated for 5 seconds, the relevant fault is then indicated by the number of 1 second flashes which occur between the initial 5 second flash and the closing 5 second flash. These range from 0 - 12. Please be patient when counting the sequence as the correct identification of the fault will save time on isolating and rectifying the problem.

E.g.: Fault 6 water overheating would display the following sequence of the red LED;

5 seconds 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 5 seconds

N.B. The sequence repeats until either the boiler has been reset or the fault rectified. Some faults require the component temperature to return within operating range before resetting automatically. Some sequences may take up to 3 minutes before lock-out is displayed, e.g. air pressure switch failure fault 1.

FAULT CODES	FAULT
0 Repeating 5 second flashes With no 1 second flashes	Lack of gas or ignition problems
	Minimum burner pressure set too low
	Flame supervision failure
	Burner on but flame indicator off
1 One 1 second flash	Air pressure switch failure, crossed tubes or flue venturi blocked
2 Two 1 second flashes	CH pressure below 0.7bar
3 Three 1 second flashes	Hi-limit stat failure
4 Four 1 second flashes	Printed circuit board failure
5 Five 1 second flashes	Flame supervision failure, indicator light on burner off
6 Six 1 second flashes	Water overheating
7 Seven 1 second flashes	Control panel failure
9 Nine 1 second flashes	Gas valve control circuit failure
10 Ten 1 second flashes	Domestic hot water thermistor failure
12 Twelve 1 second flashes	Central heating thermistor failure

FAULT CODES
FAULT 0

Flame Fails to Establish / Flame Fails After Ignition

5 seconds - 5 seconds

The FEB-24E will attempt 3 times to establish main burner flame, each ignition sequence will last 6 seconds, with a 5 second pause between each sequence. If by the third ignition sequence no flame has been established and detected then the boiler will lock- out and fault code 0 will be displayed.

The P.C.B. cannot identify the component or problem responsible for the failure of the main burner to fire up. In order to diagnose the problem the sequence at which the boiler fails to light must be established. The sequence is:

- SPARK – GAS - FLAME DETECTION

By following the flow diagram number 6 “NO FLAME”, the point of failure can be diagnosed.

POSSIBLE CAUSES

- No gas
- Faulty gas valve/ solenoid
- Faulty spark generator
- Faulty ionisation electrode
- Faulty P.C.B
- Minimum burner / ignition pressure low
- Badly fitted flue.

FAULT 1

Air Pressure Switch Failure.

5 seconds - 1 sec - 5 seconds

Prior to the ignition sequence starting the P.C.B. will check to ensure that the contacts in the air pressure switch are in the open position, this check occurs before the fan runs. Should the air pressure switch be faulty, i.e. the contacts in the switch have remained closed after the fan shut down from the last time of running. The boiler will fail safe and lock –out will take place after 15 seconds of demand taking place.

If the contacts are in the normal stand-by position, i.e. open then the PCB will initiate the fan. As sufficient air flows through the plastic venturi (located in the fan spigot) a differential pressure is produced and transferred via the silicon tubes to the air pressure switch. The contacts in the air pressure switch make, and the ignition sequence commences.
Failure to detect a differential pressure will result in the fan running for 3 minutes before lock –out takes place. Investigation as to the cause of the switch not activating is usually required, as replacing the switch is not usually the cure for the fault.

POSSIBLE CAUSES

- Insect contamination of the venturi
- Faulty Air Pressure Switch
- Faulty or Slow running Fan
- Air tubes incorrectly fitted or Loose
- Test point cap missing
- Blocked or badly fitted Flue
- Venturi fitted upside down

FAULT 2

Central Heating Pressure below 0.7 bar.

5 seconds - 1 sec - 1 sec - 5 seconds

If the pressure in the heating circuit falls below 0.7 bar the low pressure switch contacts open and the boiler is totally disabled until the pressure is increased, or the faulty switch replaced.

POSSIBLE CAUSES

- Low pressure in the heating circuit
- Faulty Low Pressure Switch

FAULT 3

High Limit Thermostat Failure.

5 seconds – 1 sec - 1 sec – 1 sec - 5 seconds

The high limit thermostat provides a mechanical form of high temperature protection if the electronic system fails (Thermistor). The high limit stat becomes open circuit at 102° and fault 3 will be displayed.
The thermostat will automatically reset as temperature reduces, but manual reset of the boiler will be required at the control panel.

POSSIBLE CAUSES

- Central heating thermistor faulty or not attached to pipe work
- Primary heat exchanger needs venting (loosen automatic air vent cap)
- Faulty high limit thermostat
- Faulty Connections at PCB

FAULT 4

Printed Circuit Board Failure

5 seconds - 1 sec - 1 sec - 1 sec - 1 sec - 5 seconds

The PCB incorporates a pre-programmed chip which contains the software essential for the safe operation of the boiler. The chip is responsible for ensuring the timing sequences for the gas valve, and that the fan and pump run at the correct times. Also the chip contains data to ensure that temperature values do not exceed design specifications, and is in effect the brain of the boiler. NO attempt should be made to replace the chip. Only a replacement PCB should be used to rectify the fault.

POSSIBLE CAUSES

- Faulty PCB

FAULT 5

Flame Supervision Failure, Indicator Light On, Burner Off

5 seconds - 1 sec - 1 sec - 1sec - 1 sec - 1 sec - 5 seconds

If a flame is detected 10 seconds after shut down has occurred, the boiler will lock out. During this lock out sequence, both the pump and fan will continue to run.

POSSIBLE CAUSES

- Ionisation electrode breakdown
- Gas valve failure
- PCB failure.

FAULT 6

Water Overheating

5 seconds - 1 sec - 1 sec - 1 sec - 1 sec - 1 sec - 1 sec - 5 seconds

Overheat protection is maintained electronically via the central heating thermistor which 'polices' the primary water circuit within the heat exchanger and operates in both domestic hot water and central heating modes. Further overheat protection is provided by the high limit thermostat which operates on an electro mechanical principal.

POSSIBLE CAUSES

- Lock out takes place if the temperature of the heating circuit exceeds 105 deg C, any excess heat is dispersed by the pump which activates automatically in the event of overheat and will continue to run until temperature reduces to 85 deg Celsius.
- Minimum burner pressure too high
- Flow switch jammed.

FAULT 7

Control Panel Failure

5 seconds – seven 1 second flashes - 5 seconds

Before the start up sequence commences the PCB carries out a functional check of the potentiometers (temperature controls), if a fault is detected within 5 seconds, the ignition sequence will not take place and lock out will be displayed.

POSSIBLE CAUSES

- Faulty potentiometer
- Faulty PCB

FAULT 9

1. Residual Ionisation Signal
2. Gas Valve Control Circuit Failure

5 seconds - nine 1 sec flashes - 5 seconds

1. Residual Ionisation Signal

The most common cause of F9 is due to the P.C.B. detecting an ionization signal after the gas valve relays have closed CORRECTLY.
There are a various reasons why the ionization signal continues to be produced after the gas valve has closed:

1. A high residual temperature within the combustion chamber
2. The distance between the ionization electrode and the burner being too short (see below)
3. Environmental conditions such as supply voltage or humidity

Extensive testing has determined that if the boiler has failed with F9 and the gas solenoids are working correctly, potential reoccurrence can be avoided by replacing the ionization electrode with a modified version featuring a reduced length of porcelain insulation.

All new electrodes have a porcelain length of 45mm and should be set at a distance of between 7mm and 10 mm above the burner.
Older type electrodes which could potentially detect a residual ionization signal have a porcelain length of 55mm and should be set at a height of 13mm above the burner to reduce the risk of the fault reoccurring.

Replacement to the new type electrode is strongly recommended as soon as possible if the boiler has faulted to F9.

The potential for the printed circuit board /gas valve failure does exist and therefore testing the gas valve soundness after the boiler shuts down should be checked as a matter of routine.

Printed circuit boards that have locked with fault 9 can be reused once the software has been re- booted. Please contact our technical helpline for details

2. Gas Valve Control Circuit Failure

Fault 9 may also be the result of the P.C.B. detecting an ionization signal indicating that that a flame is still present at the burner after the demand for heat / hot water has finished. Normally the main burner extinguishes the instant the gas valve closes.
If however, the ionization signal can still be detected 5 seconds after the gas valve relays have closed then a second attempt will be made to close the gas valve relays. If this fails the boiler will lock out in a safe mode fault 9.
In this safe mode of F9 the boiler will continue to run the fan to avoid the possibility of gas build up within the boiler. It is not possible to stop the fan running by switching off the boiler by the control panel. Only by isolating the boiler from the mains electrical supply will the fan stop running. Also if the boiler is in F9 then it is not possible to reset the lockout by the control panel. The P.C.B. must be replaced or the software within the board must be reset by using an “Autotest Unit”.

POSSIBLE CAUSES

- PCB failure (electro-valve relay broken)
- Gas valve failure
- Residual Ionisation Signal

FAULT 10

Domestic Hot Water Thermistor Failure – Screw in Type

5 seconds – ten 1 second flashes - 5 seconds

This occurs when the values for the safe operation of the domestic hot water thermistor are out of range for more than 10 seconds during demand for domestic hot water. This 10 second delay is to allow for water drawn during central heating mode to stabilise. After more than 10 seconds lock out will occur.

Reset is automatic once the thermistor values return to operational values or the faulty thermistor is replaced.

POSSIBLE CAUSES

- Faulty thermistor
- Thermistor wiring open circuit
- Poor or faulty connections at thermistor or PCB.

N B The central heating mode of the boiler is not affected by a faulty D.H.W. thermistor. Lock out will only occur during a demand for hot water.
Also note that during the lockout sequence (no burner running); the thermistor will cool if the tap remains open. This action may result in the thermistor returning to within its normal operating range. When this occurs the boiler will relight to produce hot water then return to lockout when the thermistor temperature increases. If the thermistor is subject to the above conditions then it will not be possible to obtain the full fault code of 10 one second flashes. This may result in an incorrect fault code being observed.
A Complete fault code must have a 5 second flash at the **Start** and the **End** of the sequence.

FAULT 12

Central Heating Thermistor Failure – (Clip on Type)

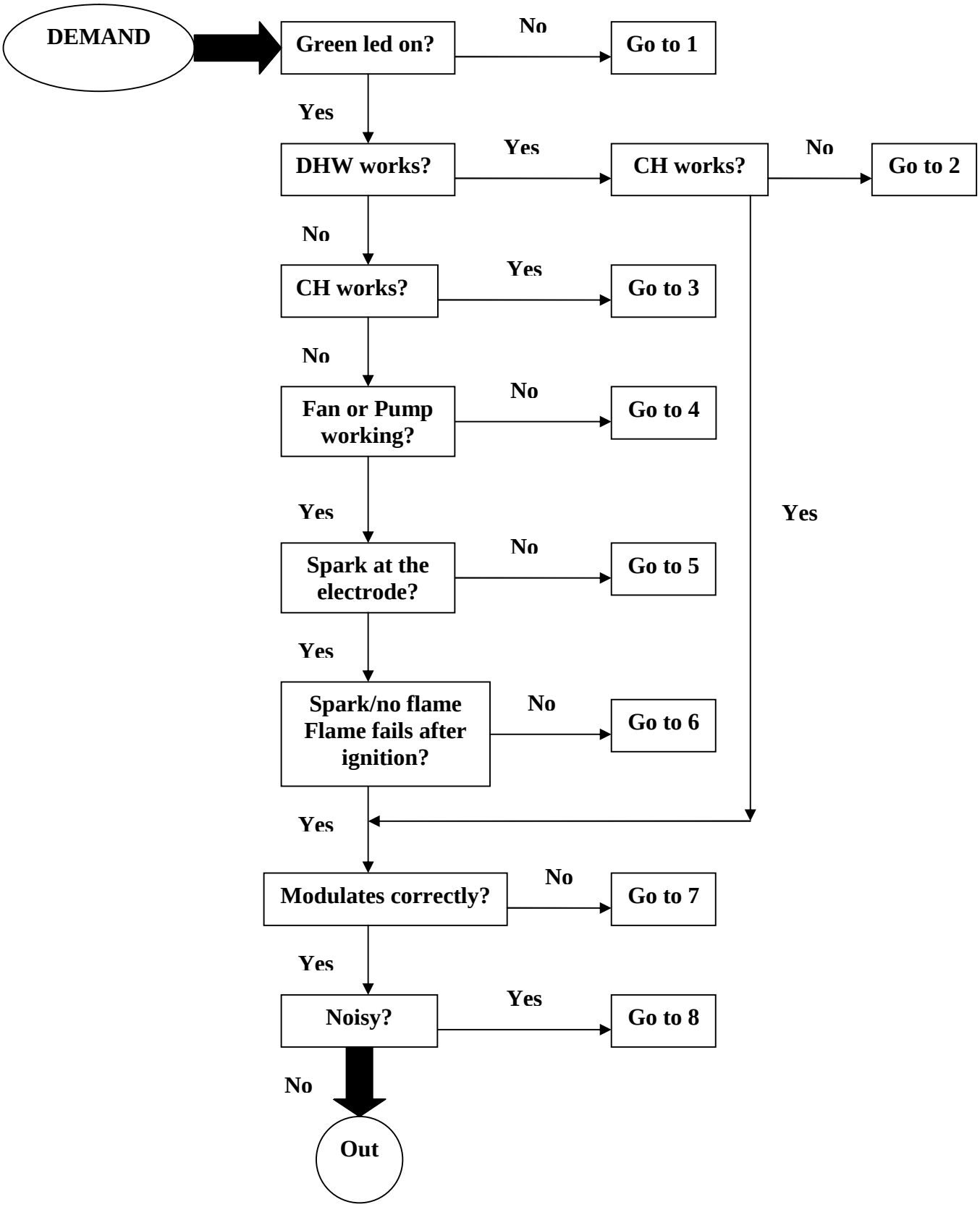
5 seconds – twelve 1 second flashes - 5 seconds

If the values of the central heating thermistor are out of range lock out will occur until values return to operational levels or the faulty thermistor is replaced.

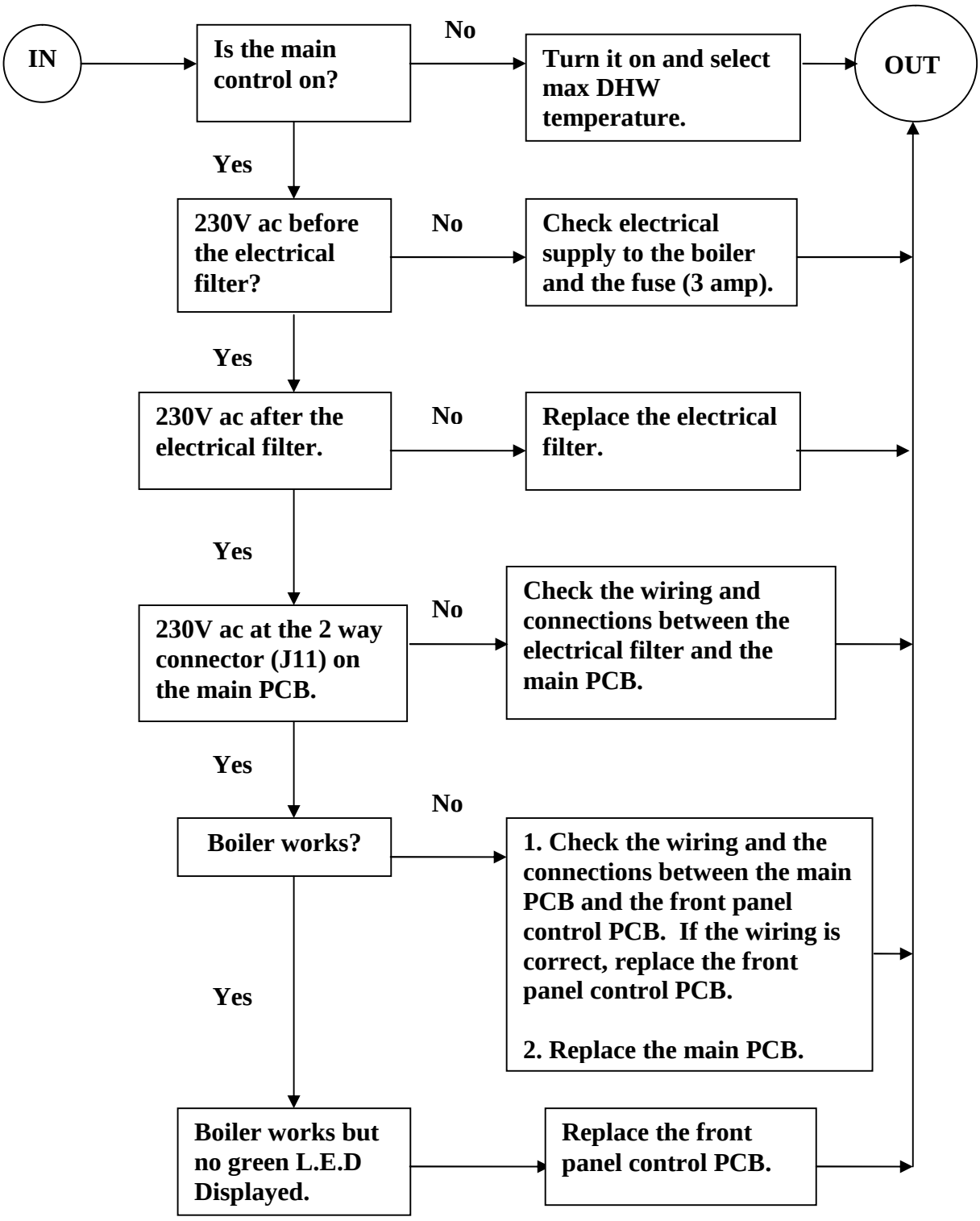
POSSIBLE CAUSES

- Faulty thermistor
- Thermistor open circuit
- Poor or faulty connections at thermistor or PCB

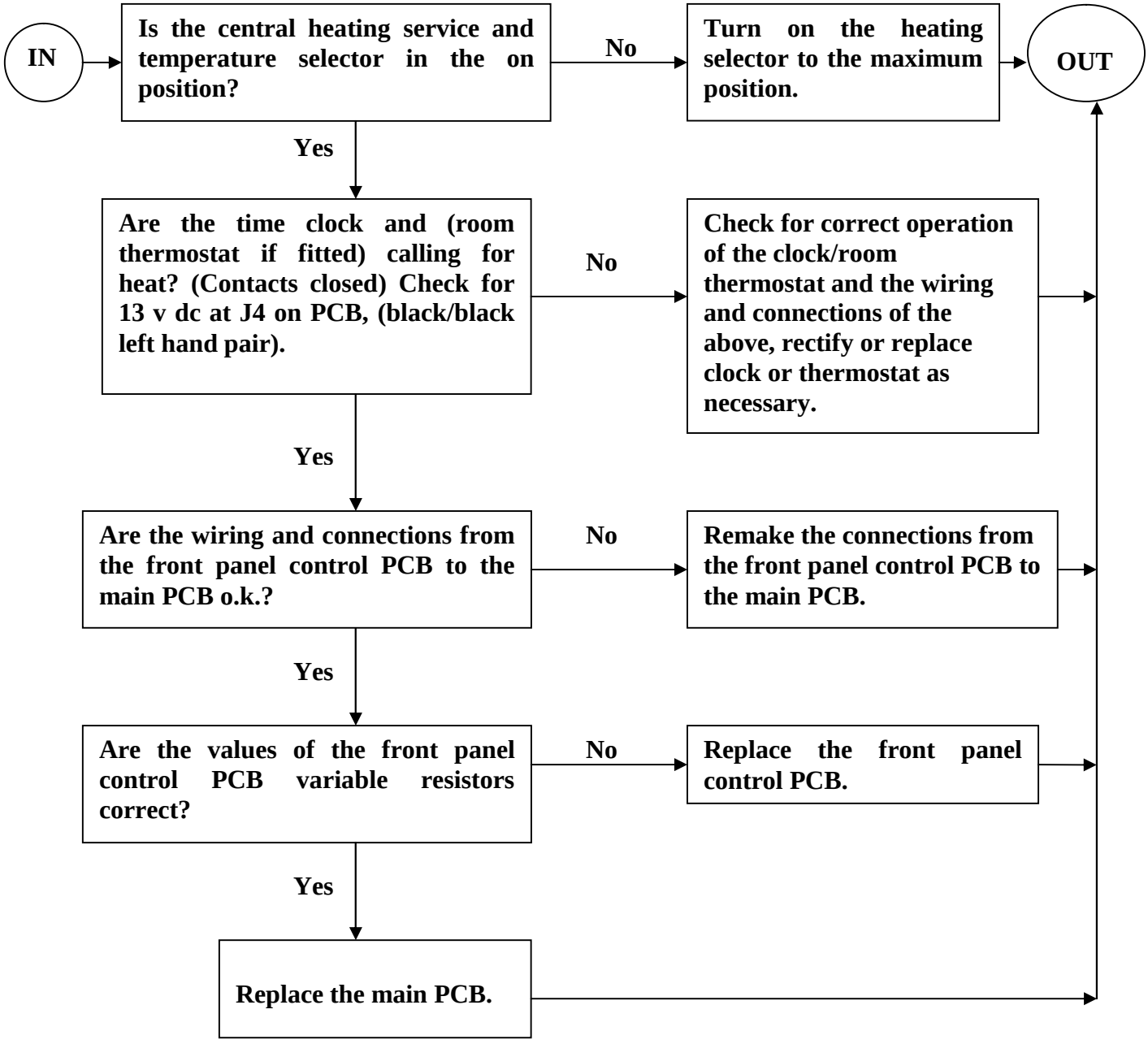
Boilers with serial numbers after 050410747 have the thermistor located on the left hand side of the primary heat exchanger (to the left of position 11 in the hydraulic circuit diagram on page 10) Boilers prior to serial numbers 050410747 have the thermistor located on the flow pipe to the 3 way valve. (Position 4 on the hydraulic circuit diagram on page 10).


DEMAND
Green led on?
No
Go to 1
Yes
DHW works?
Yes
CH works?
No
Go to 2
No
CH works?
Yes
Go to 3
No
Fan or Pump working?
No
Go to 4
Yes
Spark at the electrode?
No
Go to 5
Yes
Spark/no flame Flame fails after ignition?
No
Go to 6
Yes
Yes
Modulates correctly?
No
Go to 7
Yes
Noisy?
Yes
Go to 8
No
Out

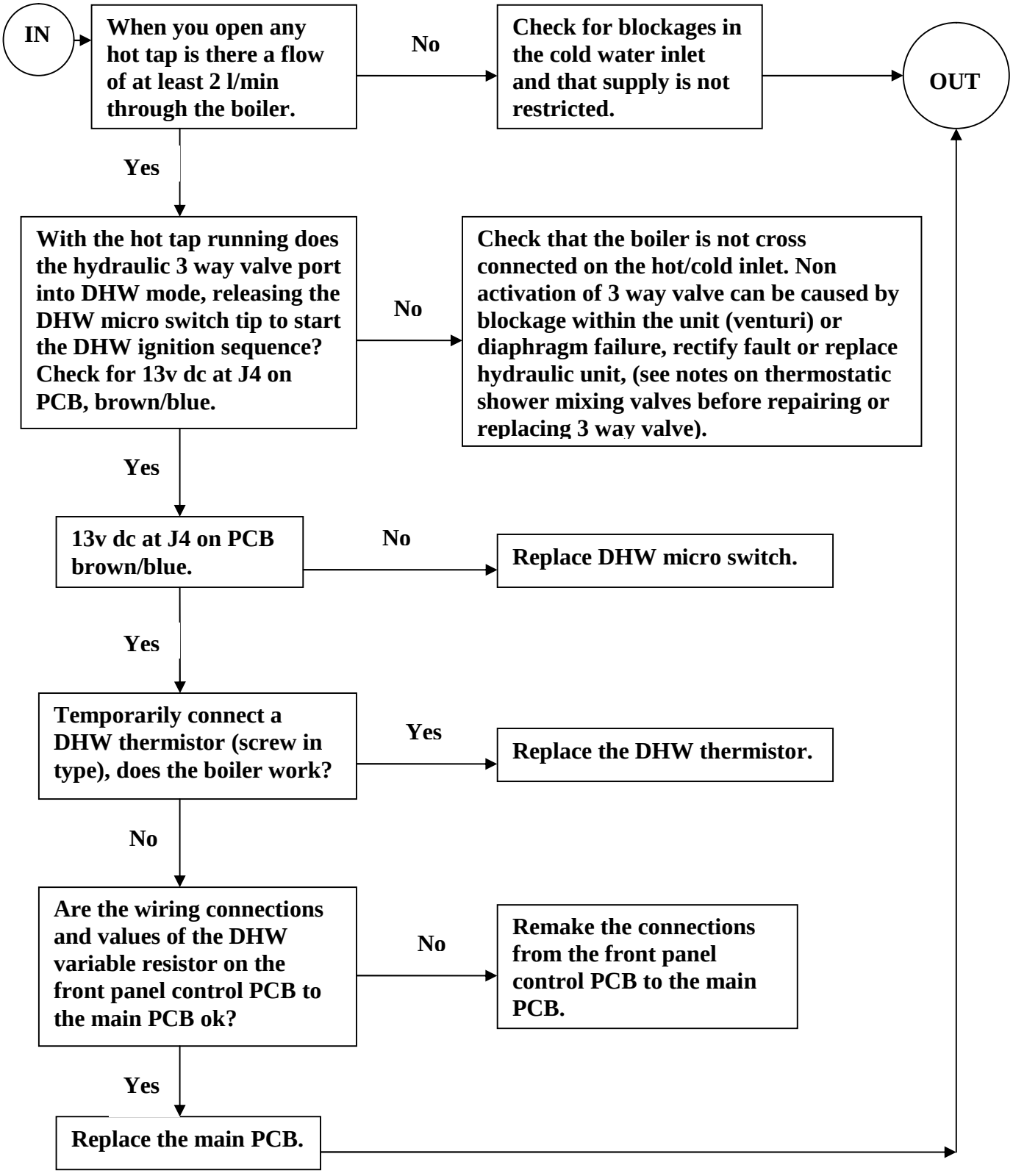
1. NO GREEN L.E.D DISPLAYED.



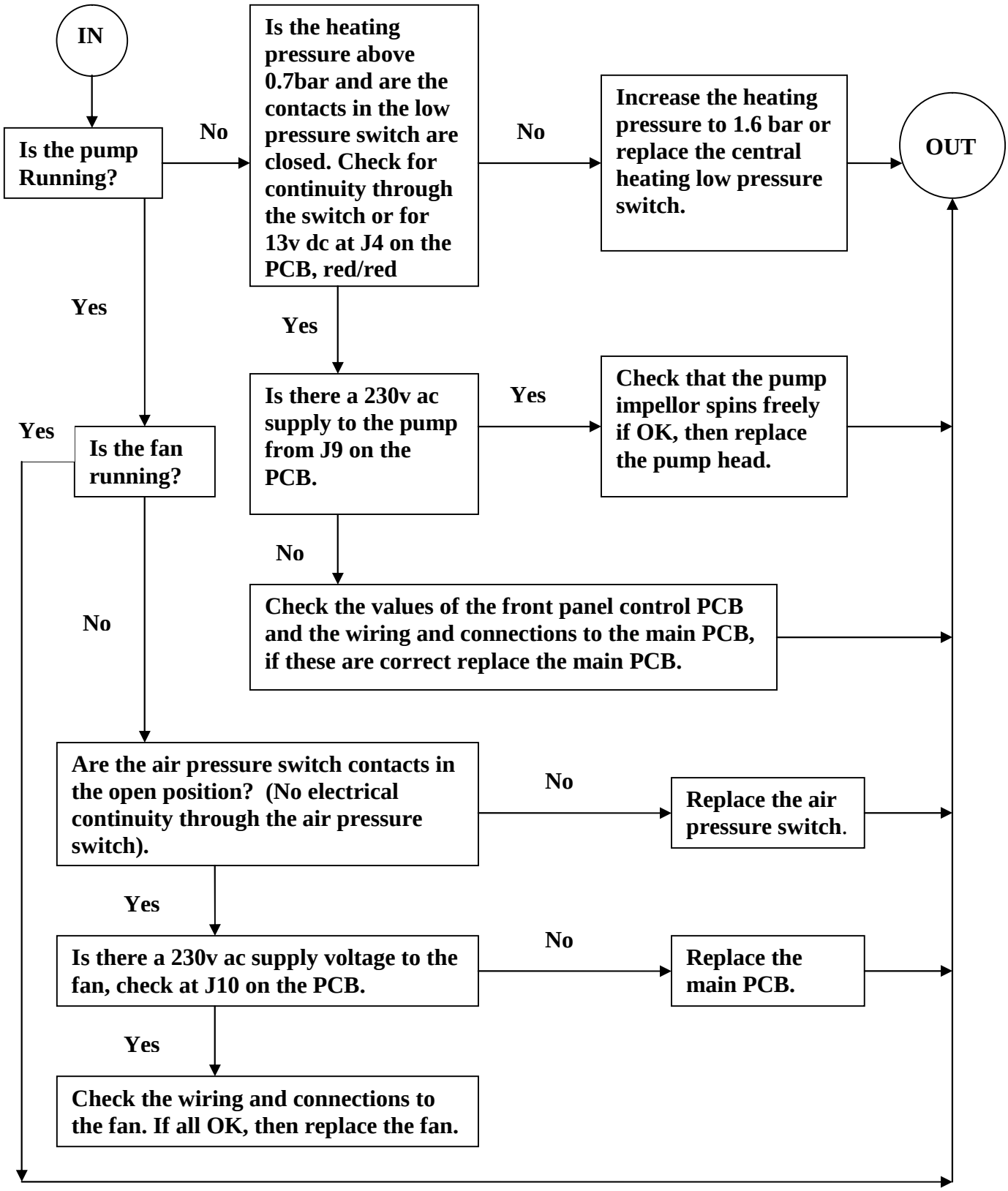
2. HEATING DOESN'T WORK BUT HOT WATER WORKS.



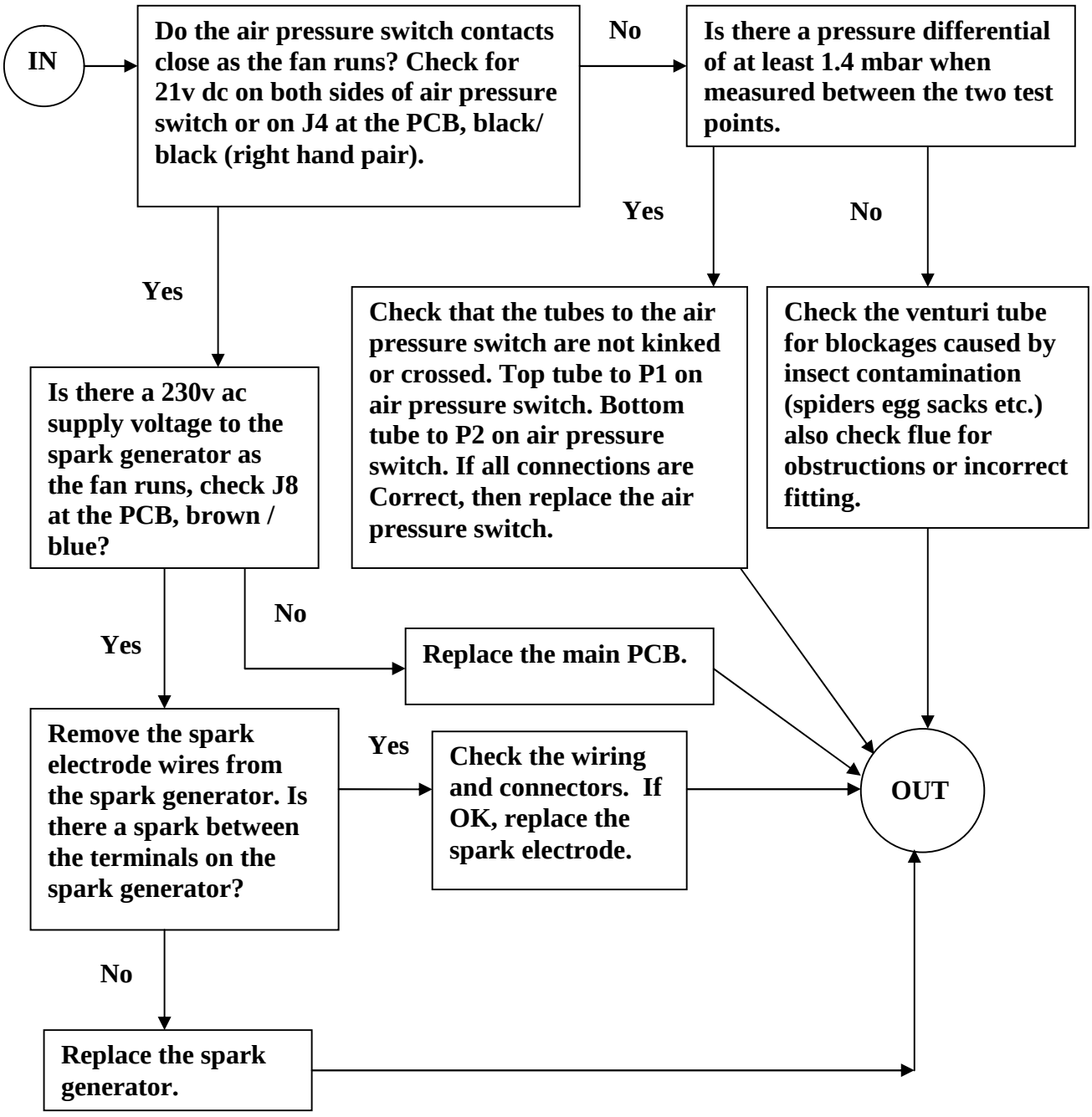
3. DHW DOES NOT WORK BUT CH DOES.



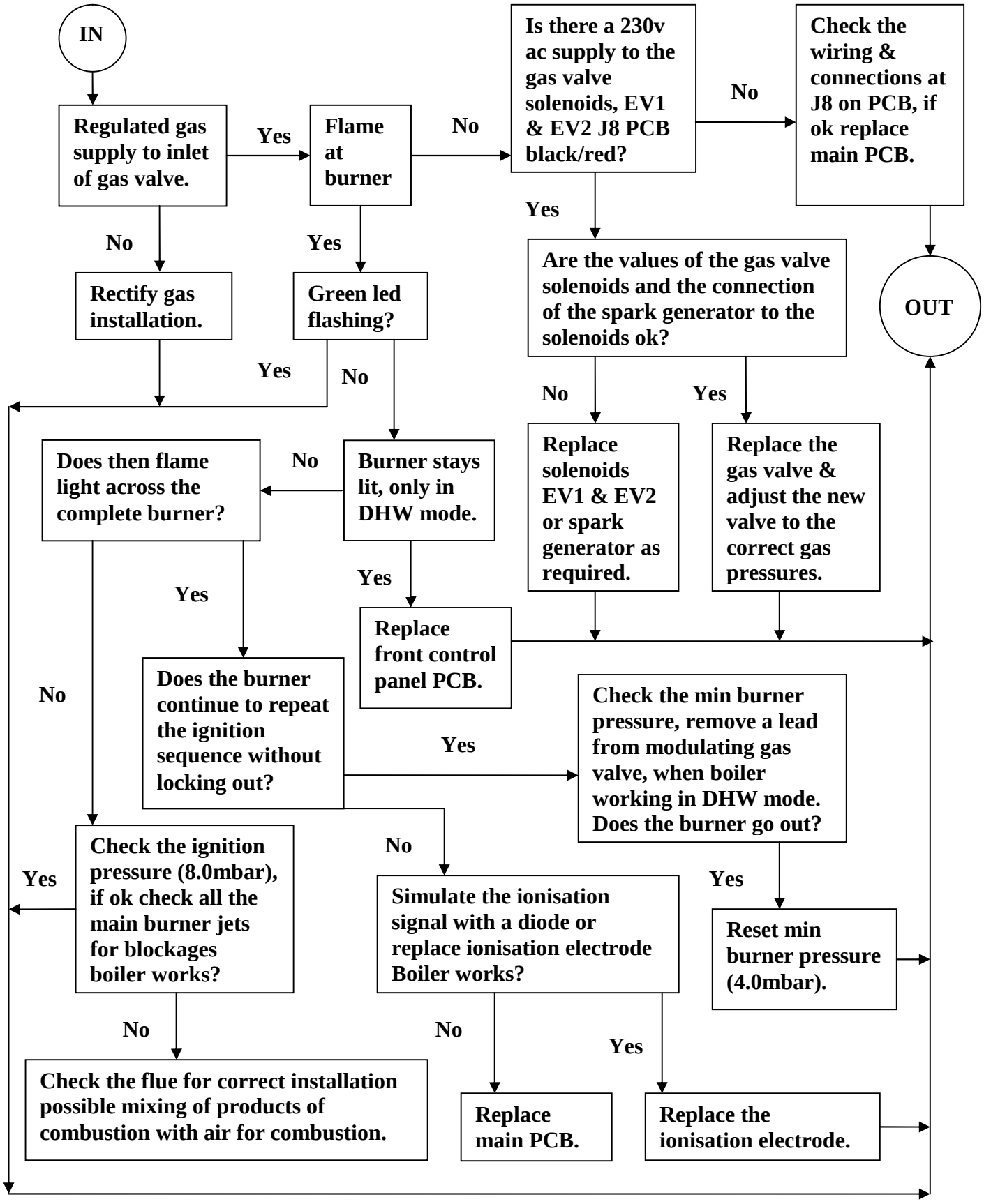
4. FAN OR PUMP WILL NOT WORK.



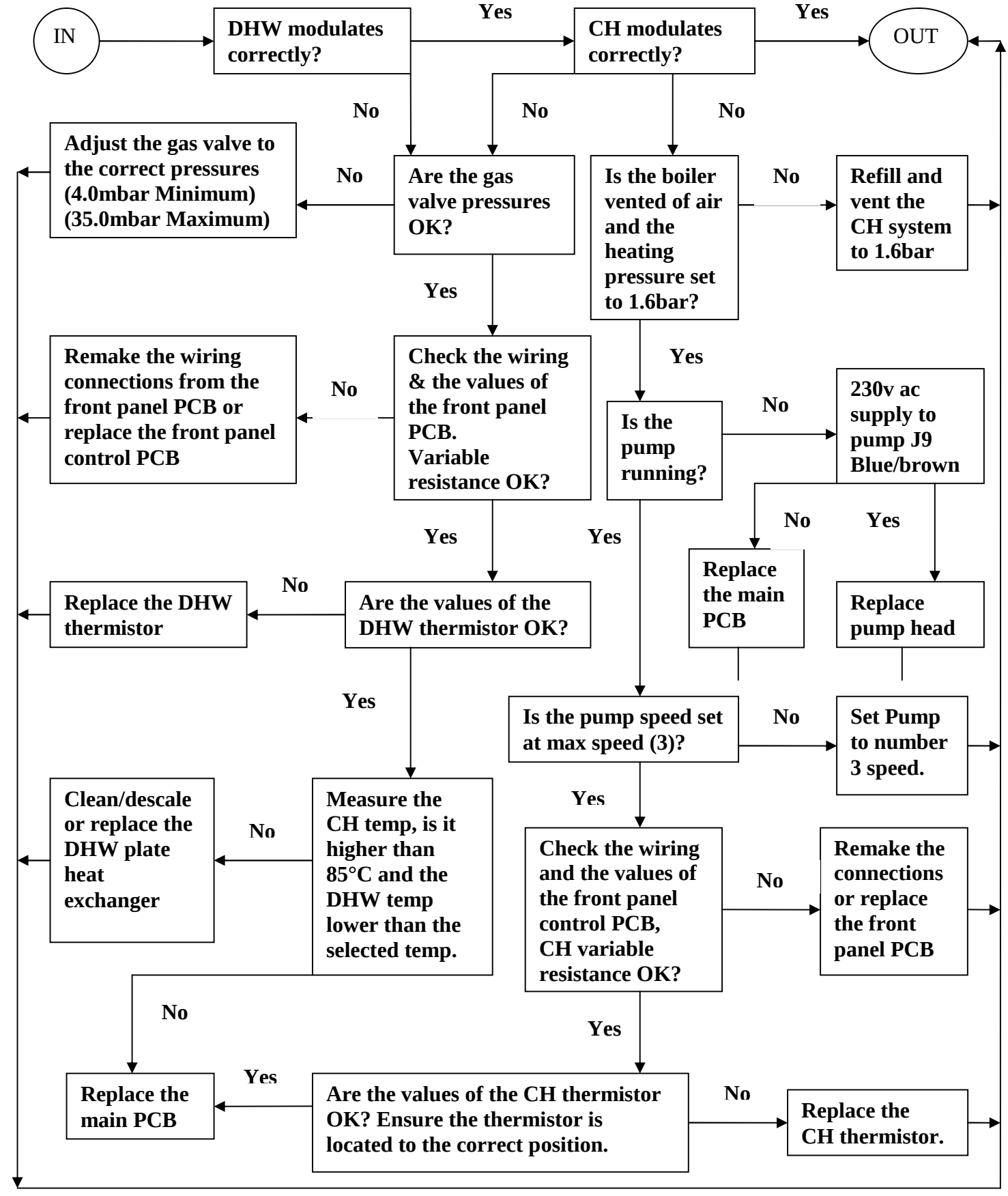
5. FAN WORKS BUT THERE IS NO SPARK.



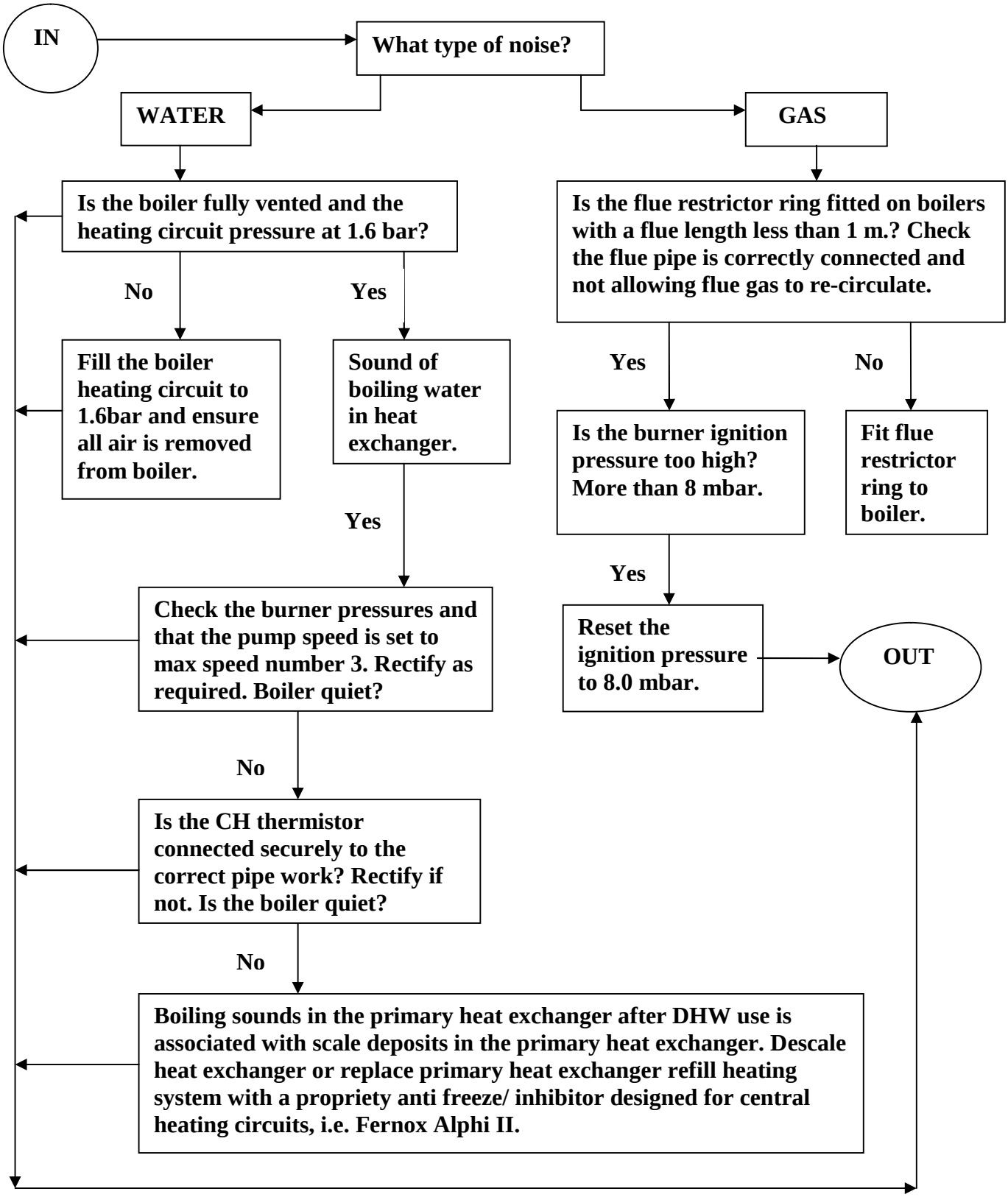
6. SPARK WORKS BUT NO FLAME/FLAME FAILS AFTER IGNITION.



7. MODULATION INCORRECT.



8.NOISY.


IN
What type of noise?
WATER
GAS
Is the boiler fully vented and the heating circuit pressure at 1.6 bar?
No
Yes
Fill the boiler heating circuit to 1.6bar and ensure all air is removed from boiler.
Sound of boiling water in heat exchanger.
Yes
Check the burner pressures and that the pump speed is set to max speed number 3. Rectify as required. Boiler quiet?
No
Is the CH thermistor connected securely to the correct pipe work? Rectify if not. Is the boiler quiet?
No
Boiling sounds in the primary heat exchanger after DHW use is associated with scale deposits in the primary heat exchanger. Descale heat exchanger or replace primary heat exchanger refill heating system with a propriety anti freeze/ inhibitor designed for central heating circuits, i.e. Fernox Alphi II.
Is the flue restrictor ring fitted on boilers with a flue length less than 1 m.? Check the flue pipe is correctly connected and not allowing flue gas to re-circulate.
Yes
No
Is the burner ignition pressure too high? More than 8 mbar.
Fit flue restrictor ring to boiler.
Yes
Reset the ignition pressure to 8.0 mbar.
OUT

CHANGING TO A DIFFERENT TYPE OF GAS.

Should a different gas be used from the gas for which the boiler has been equipped, the following parts must be replaced.

● Burner injectors (12 MCB2149).

● Burner pressures must be adjusted.

These modifications, together with the regulating process, must be carried out by a qualified Corgi registered engineer.

● Remove the front cover.

● Remove the room sealed cover, (8 screws).

● Unscrew the 4 screws from the electronic box, (2 screws on the front and 2 at the bottom of the unit). Move the electronic box down.

● Remove the ionisation and spark electrodes.

● Unscrew the hexagonal nut (**B**) which holds the manifold to the gas valve, (figure 1).

● Unscrew the 4 screws (**A**) which hold the manifold onto the burner. Remove the manifold, (figure 1).

● Change 12 burner injectors (**E**), (figure 2).

● Refit the manifold, ionisation & spark electrodes. Reconnect the manifold to the gas valve (**B**). Refit room sealed cover.

● To adjust the burner pressures to the new type of gas, proceed as follows:

● Remove the plastic cap (**D**) of the electronic box. The bridge S4: (figure 7).

- for LPG must be bridged.
- for Natural Gas must be un-bridged.

● Remove the clear plastic cap (**C**) (figure 4) from the gas valve and run the boiler in DHW mode.

Set the maximum burner pressure:

● Set the DHW temperature to maximum.

● Adjust the variable resistance (**P1**) to maximum, (rotate fully clockwise), (figure 7).

● Open a hot tap.

● Adjust the maximum burner pressure (chart 1). Using a 10mm spanner rotate the nut (**E**) of the gas valve (figure 5). Rotating clockwise increases the burner pressure.

● Adjust the variable resistance (**P1**), rotating it anti-clockwise until the burner pressure starts to drop.

Set the minimum burner pressure:

● Open a hot tap.

● Disconnect one of the modulating electro valve terminals on the gas valve.

● Adjust the burner pressure to the value indicated in chart 1. Holding hexagonal nut (**E**) with the spanner, rotate the star screw (**T**). Rotating clockwise will increase the pressure and anti-clockwise will decrease the pressure.

Once the pressure is set, reconnect the terminal.

Set the ignition pressure:

● Adjust the ignition pressure on variable resistance (**P2**), rotating clockwise increases the pressure and anti-clockwise decreases the pressure (chart 1). To do this you must do the following:

● Disconnect or remove the ionisation electrode.

● Turn on the boiler and during ignition, (when sparking) adjust the variable resistance (**P2**) to the correct value, (chart 1).

● Reconnect or refit ionisation electrode.

● To regulate the maximum heating output, you adjust the variable resistance (**P3**). To do this the boiler should be working in heating mode on maximum temperature. Rotate (**P3**) clockwise to increase pressure and anti-clockwise to decrease pressure, (chart 1).

Note: The central heating power is factory set at 70% of its maximum.

● Refit the clear plastic cap onto the gas valve.

IMPORTANT: When finished, make sure the outlet burner pressure nipple is fitted.

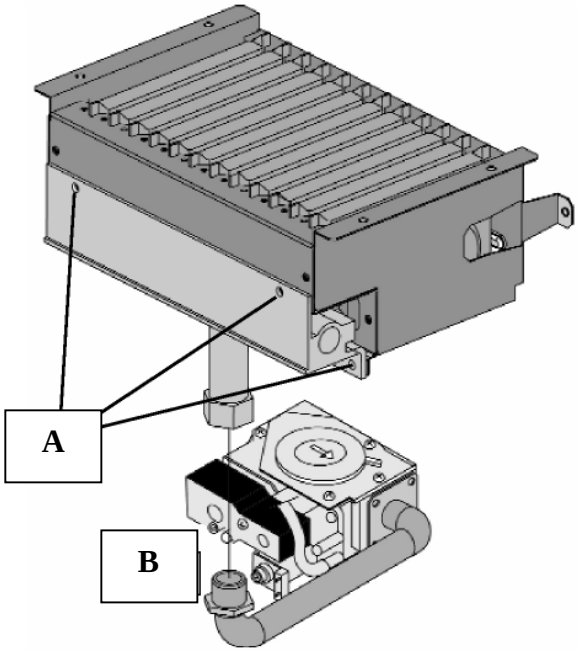


Figure 2

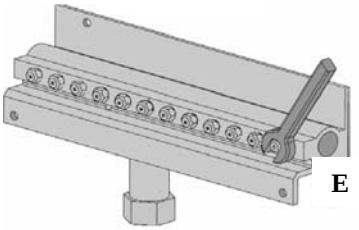
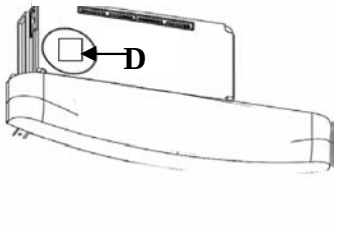


Figure 3



Chart

Output (kW)	Burner pressure			
	mbar		inch wg	
	Natural	Propane	Natural	Propane
23.7	18.0	35.0	7.2	14.0
7.6	2.0	4.0	0.8	1.6
Ignition Pressure	4.0	8.0	1.6	3.20
Ø Injectors (mm)	1.14	0.75	1.14	0.75

Gas valve details

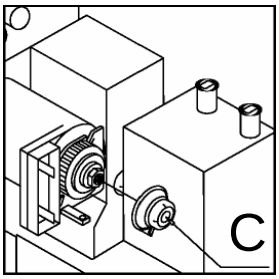


Figure 4

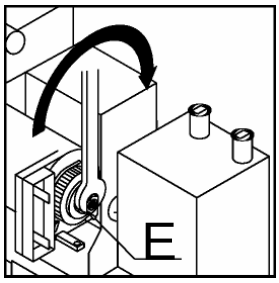


Figure 5

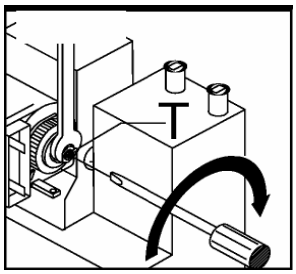


Figure 6

P1 Maximum power adjustment
P2 Minimum Lighting pressure
P3 Output for central heating adjustment

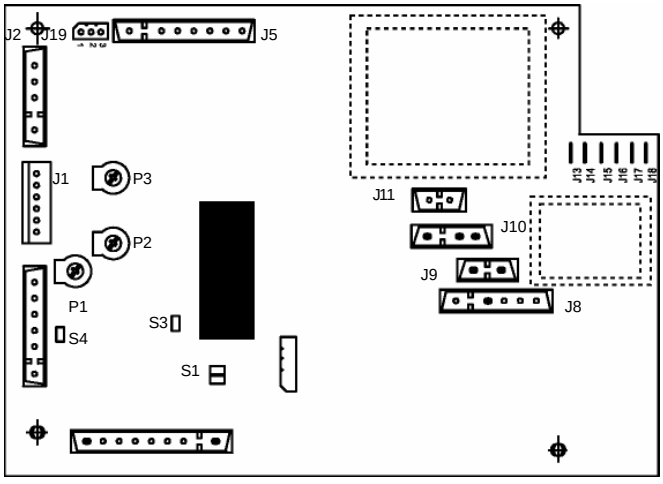


Figure 7

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