MORCO/FAGOR FEB-20E

FIVE MINUTE FAULT FINDING GUIDE

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

CHECK HOT WATER FUNCTION FIRST

Here are some common problems:-

Regulators

Single appliance low capacity regulators plus ¾ flexible low pressure pipe, will reduce the efficiency dramatically. Ensure regulators and pipes are capable of delivering 37 mbar at the inlet under full load. A 2.5 mbar drop is acceptable.

Water Filter

Check for contamination with foreign objects, ie. sawdust, plastic pipe swarf, etc., at point of installation. Any blockage will reduce flow and may prevent the boiler firing up.

Hot and Cold Water Connections

Connections may be reversed at the boiler inlets, resulting in the boiler failing to commence ignition sequence, as the flow switch only operates in one direction (see note 10 flow switch).

Thermostatic Shower Mixer Valve

Faulty non return valves allow mains cold water to enter the domestic hot water pipework. The boiler will react to this 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 the result is no flow, or a very restricted flow of mains cold water will pass 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.

Water Supply

The FEB-20E combination boiler delivers up to 13.5 l/min 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 thermistor detecting a temperature greater than 70°C or the flow 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 pipework. The pressures should be checked when the domestic hot water flow is at maximum (13.5 l/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 PROBLEMS

Check the following first:-

Room Thermostat

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 insulation not removed from the conductor wire or loose feed wires (2 black) at the base of the connector.

Low Pressure on Gauge

Incorrect or too low a pressure in the system may cause the circulation pump to run dry and fail. Leaks can occur anywhere on the system including internal connections on the boiler. Also check that the central heating system was not drained by mistake, as the domestic hot and cold water drain cocks are adjacent to the central heating drain cocks.

Central Heating Low Pressure Switch

Later models with serial numbers beginning with 0210 are fitted with a pressure switch, which will prevent main burner ignition, if the pressure falls below 0.5 bar in the central heating system, but the circulation pump will carry on running and may fail if allowed to run dry.

Cold Radiators

Usually come in pairs, due to incorrect pipework on the system, ie. 1 radiator fed with 2 flows and a second radiator fed with 2 returns. This results in no circulation on the affected radiators.

Things To Check Before Making Any Other Adjustments

1. Mains cold water supply valve fully open.
2. Gas installation correct. Regulator size/change over regulators working etc.
3. Gas isolation valve at the boiler fully open.

At The Boiler, Remove The Front Cover and Inspect for the Following

4. Correct water pressure in the heating circuit (1 bar).
5. Wires and components not connected.
6. Modulating solenoid wires (2 white) are connected.
7. Spark generator attached to the gas valve correctly.
8. H.T leads from spark generator attached (2 of).
9. Domestic hot water thermistor attached to hot water outlet pipe and wires connected to the thermistor (2 brown).
10. Room thermostat (if fitted) wires at the connector block are secure.

IMPORTANT THINGS YOU WILL FIND IN THE WORKSHOP MANUAL:

Domestic Hot Water Ignition Sequence

This flow chart represents the general operating system in the domestic hot water mode and the sequence of events if temperatures exceed the specified limits which are predetermined by the P.C.B.

Central Heating Ignition Sequence

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

Please note that following the initial 30 seconds of minimum output, no modulation may be seen for a further 5 minutes if the central heating logic program is operating. ie. The boiler will not fire on full power if it has detected it is serving a system with a low load, as in most Caravan Holiday Homes. For more detailed information please see note on central heating logic program.

Lighting Up Sequence Flow Chart

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

Lockout Faults

Whenever a fault develops on the boiler which is liable to affect the safe operation it will lock out and show a fault code in the form of a flashing sequence on the red L.E.D. Lock out faults will require a component to be replaced or service work to be carried out. Identify the fault by reading the self diagnostic fault codes. Each fault code has a description as to the cause of the problem; read this carefully.

N.B. There will be a time delay of between a few seconds and 3 minutes between the fault occurring and the boiler locking out and showing the sequence. Each fault code carries a possible cause of the failure. In the manual you will find that each component on the boiler has a functional description and operating voltages where applicable. By reading this information on the relevant component and testing before replacing, this will ensure that the correct component has been diagnosed faulty, avoiding replacing components unnecessarily without solving the initial problem.

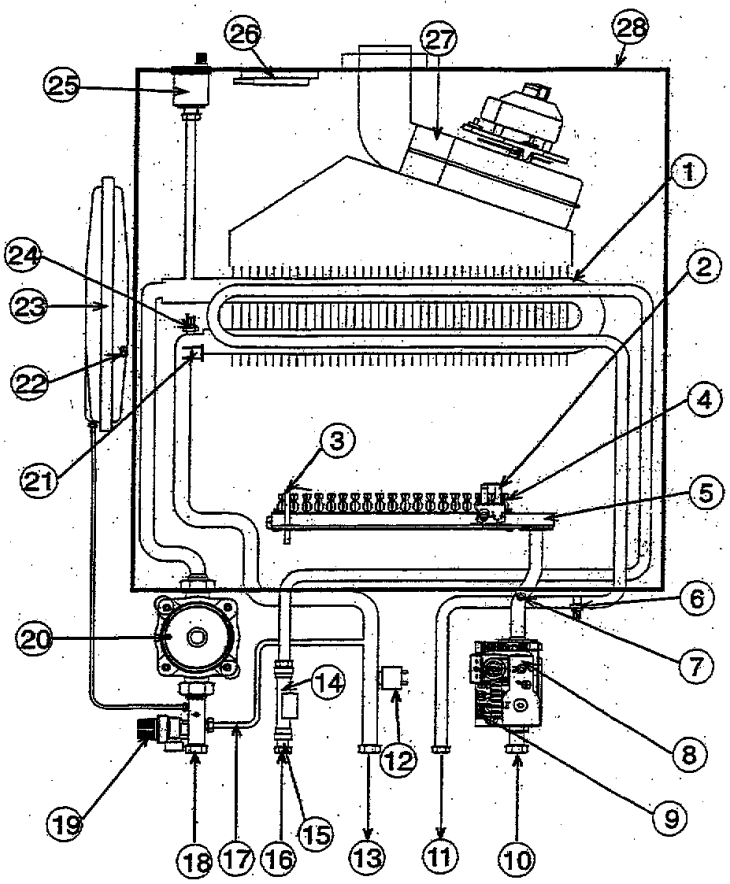
Fault Finding Flow Chart

These charts 1-7 contain information on fault finding and will be useful for isolating problems involving components which are not safety related to the operation of the boiler. Failure of certain components will affect the operation of the boiler without displaying a lock out fault, eg. time clock. Only basic information is contained in the flow chart. If in any doubt as to the function of the component and for more information on voltages please refer to the individual notes on each component.

CONTENTS

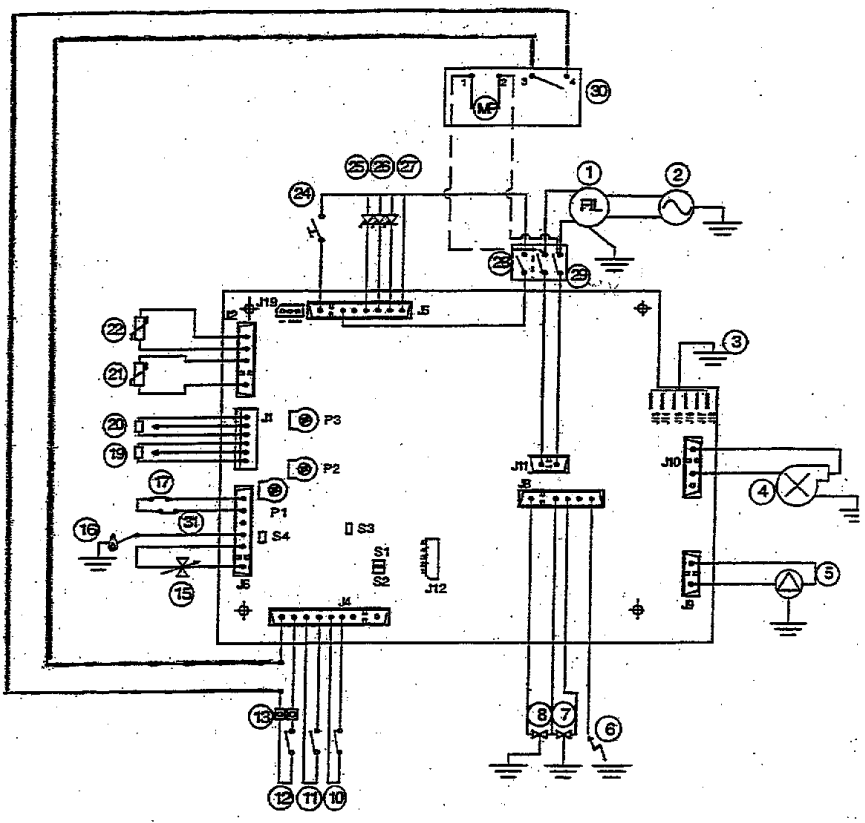
Model			FEB-20E UK
Category			II2H3P
Type			C12,C32,C42,C52
Central heating and domestic hot water performances.	Maximum output	kW	23.7
		Btu/h	80.840
	Minimum output	kW	9.3
		Btu/h	32.000
Nominal central heating and domestic hot input (Gross)	Maximum	kW	28.9
	Minimum	kW	11.4
Nominal central heating and domestic hot water input (Nett)	Maximum	kW	26
	Minimum	kW	10.3
Domestic hot water flow rate at 25°C (l/min)			13.5
Domestic hot water flow rate at 35°C (l/min)			9.6
Nominal D.H.W. flow rate at 33,7°C (l/min)			10
Minimum flow rate for activating D.H.W. (l/min)			2.5
Operating pressure (bar)	Maximum	Central heating	3
	Maximum	D.H.W	10
	Minimum D.H.W. activation		0.25
Expansion vessel capacity (l)			7
Temperature selection range (°C)	Central heating circuit		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)			154
Dimensions (mm)	Height		800
	Width		440
	Depth		317
Minimum clearance (mm)	Top		200
	Bottom		250
	Sides		5
	Front		5
	Gas inlet		15
	Domestic cold water inlet		15
	D.H.W.outlet		15
	Central heating flow		22
	Central heating return		22
Net weight (kg)			35
Type of gas	Propane G-31 (FEB20E UK GLP)		X

SCHEMATIC DIAGRAM FEB-20E



1. Heat Exchanger
2. Ignition Electrode
3. Ionisation Electrode
4. Burner
5. Injector Manifold
6. DHW Thermistor
7. Burner Pressure Nipple
8. Gas Valve
9. Inlet Pressure Nipple
10. Gas Inlet
11. DHW Outlet
12. CH Low Pressure Switch
13. Heating Flow
14. DHW Flow Switch
15. Water Filter
16. Cold Water Inlet
17. CH By-pass
18. Heating Return
19. Pressure Relief Valve
20. Circulation Pump
21. High Limit Thermostat
22. Expansion Vessel Filling Tap
23. Expansion Vessel
24. CH Thermistor
25. Automatic Air Vent
26. Air Pressure Switch
27. Fan
28. Sealed Air Box

WIRING DIAGRAM FEB-20E



1. Electrical Filter
2. Mains Supply
3. Earth Connections
4. Fan
5. Circulation Pump
6. Ignition Electrode
7. Gas Valve Solenoid
8. Gas Valve Solenoid
10. Flow Switch
11. Air Pressure Switch
12. Room Thermostat (Optional)
13. Room Thermostat Connector
15. Modulating Solenoid
16. Ionisation Electrode
17. Hi-Limit Thermostat
19. Domestic Hot Water Potentiometer
20. Central Heating Potentiometer
21. Domestic Hot Water Thermistor
22. Central Heating Thermistor
24. Reset Switch
25. Burner On Led (Amber)
26. Reset Indicator Led (Red)
27. Power On Indicator Led (Green)
28. Winter / Summer Switch
29. On / Off Switch
30. Time Clock
31. Central Heating Low Pressure Switch

1. ELECTRICAL FILTER
Cleans the incoming mains supply voltage to the P.C.B.

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
3 Core flex to electrical filter, fitted to a 3 amp fused supply on the plug, must be earthed.

3. EARTH CONNECTIONS
4 Earth connections must be connected to these terminals; Chassis, Gas Valve, Fan and Pump. The clock requires no earth.

4. FAN
The fan (220/230v ac 55watts) is operated by relay No:1(left), fed from J10 (blue & brown wires, non polorised). Must be earthed at fan and P.C.B.

5. CIRCULATION PUMP
The pump (230 v ac) is operated by relay 4 (right), fed from J9 (blue & brown wires). Must be earthed. Pump speed at position 3, direction arrow pointing upwards.
Pump over-run is at least 1 minute if burner shuts down at selected temperature + 3°c. Pump runs until thermistor detects selected temperature.
Pump over-run is 1 minute when room thermostat cuts with burner **on** or immediately when room thermostat cuts with burner **off**.

6. SPARK GENERATOR/IGNITION ELECTRODE
230 v ac is transformed to H.T. voltage by the spark generator fed from J8 (brown). Spark stops as burner ignites. Maximum duration of spark is 6 seconds on first attempt to ignite and 4 seconds on second attempt to ignite. Must be earthed at the P.C.B. Extreme caution must be taken as very high voltage is produced!

7. & 8. GAS VALVE SOLENOIDS
The burner solenoids (230 v ac) are operated by relays K1 and K3, (K1 relay centre left and K3 relay centre right). When initial power supplied to the P.C.B relay K3 contacts for 1 second then releases. On demand both relays operate simultaneously, on shut down relay K1 closes 1 second before relay K3.

N.B. Both solenoids must operate for the burner to ignite. Faulty solenoids can be replaced as

an independent unit, without the need for complete gas valve replacement.

10. FLOW SWITCH

When demand for domestic hot water is place on the outlet a magnetic plug contained within the flow switch body is carried upwards in the flow of the mains cold water to the boiler. Located at the top of the flow switch is a magnet sensitive switch, at this point the 21 v dc generated from J4 (pin 2, left hand brown) is switched and returned to the P.C.B. J4 (pin 1 right hand brown) to verify water is flowing through the appliance and initiate the domestic hot water lighting up sequence.

N.B. Early models where fitted with a pressure differential flow switch with an external micro-switch.

11. AIR PRESSURE SWITCH

The air pressure switch proves the fan is running, also that the flue/air intakes are not blocked. It is operated pneumatically by air tubes to the venturi housing which must be connected correctly - top and + bottom at venturi housing and correspond accordingly at air pressure switch.

Contacts in the air pressure switch close when fan runs and pressure differential created. 21 v dc from J4 (pin 4 left hand white) to 3 com on air pressure switch and returns to the P.C.B via 2 no on air pressure switch to J4 (pin 3 right hand white). Contacts in air pressure switch must be open prior to start up. Closed or linked out connections result in lock out after 15 seconds.

13. ROOM THERMOSTAT CONNECTOR

Connection for fitting external room thermostat to the boiler. 22v dc is fed from the time clock to the connector in both domestic hot water and central heating modes. Voltage is returned to the P.C.B (J4 right hand black wire) when thermostat contacts are closed.

15. MODULATING SOLENOID

A varying dc voltage sent from the P.C.B J6 to the modulating solenoid adjusts the burner pressure to achieve the correct water temperature as selected at the control panel. To achieve this the burner pressure will vary according to the temperature detected by the relevant thermistor and in conjunction with the P.C.B software which will calculate at what stage modulation of the burner pressure should occur. This ensures that the temperature is achieved in the most efficient time without overrun of the desired temperature.

As the voltage at the modulating solenoid increases, the burner pressure will increase also. The voltage is measured in parallel (across the two terminals on the gas valve) and will vary according from boiler to boiler.

Nominal figures are;

0.60 v dc at minimum burner pressure 2.9mbar.

9.50 v dc at maximum burner pressure 17.3mbar.

Maximum and minimum burner pressures can be adjusted at the solenoid, see setting burner pressures.

16. IONISATION ELECTRODE

The ionisation electrode is reliant on the ability of a flame to conduct an electric current. During combustion large numbers of free electrons and ions are present in the flame, which acts as an electrolyte in which current can flow. 28v ac fed from J6 (orange wire) is fed to the electrode, and the burner is firstly positively charged and then negatively charged as the current alternates.

Because the burner has a larger area than the flame electrode, more positive ions will be attracted to the burner when it is negatively charged than will strike the electrode when it becomes positively charged. Therefore more current flows when the burner becomes negative and a partially rectified current is produced. This is then rectified and amplified by the P.C.B.

To check current connect the multimeter in series with the electrode, select ac micro amps, with burner on maximum output expect 4.0 micro amps falling to 1.5 micro amps at minimum burner pressure. Electrode fails to detect once current falls to below 0.8 micro amps.

Faulty electrode may cause lack of spark at the lighting up sequence. Faults can be detected by the burner led (amber) not illuminating when main burner is lit.

17. HIGH LIMIT THERMOSTAT

Located top left hand side of heat exchanger, fully enclosed bi-metal contacts open at 102°c and breaks the circuit. 22v dc fed from J6 (second red), returns to J6 (top red), when contacts are closed. If contacts open, gas valve solenoid number 2 is disabled on ignition sequence and results in lock out fault 0. High limit thermostat resets automatically as cooling takes place, (**Note:** some earlier models where fitted with a manual reset button on the high limit thermostat itself).

19. & 20. DOMESTIC HOT WATER & CENTRAL HEATING POTENTIOMETERS

These are the variable resistors which work in conjunction with the thermistors and the modulating gas valve to control the temperature of the central heating and domestic hot water. Both potentiometers have the same values (0-10 k ohms) and work independently of each other. If a modulation fault develops the values of the potentiometers can be measured by unplugging the six cable harness from J1. Select 20 k ohms range on the multi-meter, from the terminals 1 and 2 (left and centre) values should be 10 k ohms with the control knob at minimum setting and reduces to 0 k ohms as the control knob is turned to maximum setting. If no variation in the resistence occurs or intermittent readings are shown replace the potentiometer harness.

Voltage can also be measured from terminal 2 (centre), 4.65 v dc on minimum setting to 0.4 v dc on maximum setting. These value will equal the supply voltage (5.05 v dc, unresistive) which is supplied by J1 pin 1 from the top (central heating) pin 4 (domestic hot water), this can only be checked by removing the multi-pin harness from J1 and testing to earth.

Most importantly is to remember the central heating potentiometer is selecting the desired temperature of the water within the heating circuit (minimum 60°c - maximum 85°c). If the

boiler is started from cold, i.e 25°c with the temperature selected at maximum, once the main burner has ignited the modulation of the main burner flame is controlled via the micro-processors, which will calculate the fastest and most efficient way to achieving this temperature. After 30 seconds of minimum burner pressure modulation will commence usually with maximum burner pressure. Because the minimum temperature of the central heating circuit is 60°c **No** modulation of the main burner will be seen if the control is turned to minimum heat. Modulation downwards will commence only as the desired temperature 60°c is approached. **Do Not** assume a faulty potentiometer if no modulation takes place when the temperature is adjusted whilst central heating is running up from cold.

N.B When replacing potentiometers the terminals face down.

21. DOMESTIC HOT WATER THERMISTOR

Detects the out going temperature of the domestic hot water at the boiler outlet pipe, as temperature increases the resistance decreases. Voltage can be measured in parallel at J2 (two brown wires) with the multi pin plug in situ with the P.C.B. Resistance can be measured at J2 (two black wires) with the multi pin plug removed from the P.C.B.

The signal from the thermistor is referenced to temperature selected at the control panel which interfaces with the P.C.B and modulating solenoid to achieve required temperature. The domestic hot water has an operating range between 35°c - 60°c during normal operation. Lock out F10 takes place if the thermistor is out of range and will reset automatically as the thermistor cools to within operating range.

If a fault develops on the domestic hot water thermistor which is not due to overheat, i.e open or closed circuit, or thermistor values do not return to normal operating range, then the thermistor must be replaced. The central heating will operate with a faulty thermistor until demand for domestic hot water is called for, if the thermistor is faulty lock out F10 will show. During lock out the central heating will also be disabled until the thermistor is replaced.

22. CENTRAL HEATING THERMISTOR

The central heating thermistor detects and polices the temperature of the central heating circuit (60°c - 85°c) and operates in both central heating and domestic hot water modes. The thermistor interfaces with the temperature selected at the control panel and modulating solenoid.

The thermistor also provides overheat protection with lock out F6 displayed at 105°c and automatic activation of the central heating pump in domestic hot water mode at 85°c.

First stage frost protection occurs at 9°c which activates the pump, if the temperature continues to fall, the main burner is then activated at 3°c and will continue to run until a temperature of 20°c is achieved.
Voltage can be checked in parallel at J2 (two black wires) with the multi pin plug in situ on the P.C.B. Resistance can be measured by unplugging the multi pin plug from the P.C.B.
See table next page for values.

Temperature (°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

A faulty thermistor affects central heating and domestic hot water modes and no ignition sequence will commence, fault F12 will be displayed on both central heating and domestic hot water modes.
Before draining down and removing a faulty thermistor it is possible to cheat by replacing with a dry thermistor to verify if original thermistor is faulty or not.
N.B. No temperature detection will take place with the thermistor hung dry, rapid overheat and boiling may occur. Also note that energy saving software built into the P.C.B override the control panel settings on the central heating setting, which may give the impression that the central heating thermistor and potentiometer may be faulty, due to non modulation on start up. See central heating logic program.

24. RESET SWITCH
The reset switch reboots the P.C.B in the event of a lock out. Power fed from J5 (brown) 22v dc to reset switch, (also feed for winter switch central heating mode from reset switch to main control switch), voltage from reset switch when pressed returns to the P.C.B J5 (black wire first left) 22v dc. Boiler will work with switch disconnected but must be reconnected to override lock out.
A faulty switch, ie permanently open or closed will not reboot the P.C.B after a lock out. In this situation the boiler will make no attempt to restart the lighting up sequence.

25. BURNER ON LED (AMBER)
Indicates via amber neon that flame is detected after ignition, failure to light indicates fault on flame detection circuit.

26. RESET INDICATOR LED (RED)
Indicates lock out. Number of flashes diagnose relevant fault or faulty component. Reset by pressing reset switch 24.
NB: Indicator led's are interchangeable. Should the situation occur of a failed red led combined with a lock out fault, temporarily use another led to obtain fault code. Voltages are 18v dc, J5 on P.C.B.

27. POWER ON INDICATOR LED (GREEN)
Indicates power to the P.C.B. If green neon does not light when power is confirmed at the P.C.B and the boiler fails to work, replace the P.C.B.

28. WINTER / SUMMER SWITCH
The winter / summer switch is used to select domestic hot water or central heating mode. When in summer setting (domestic hot water only) 230v ac is fed from the electrical filter via the double pole contacts marked L & N to the P.C.B J11.
On selecting the winter setting a third contact on the right closes and completes the circuit for the central heating. This central heating circuit is 22v dc, fed from the reset switch and returned to J5 (black wire second left). If replacing or testing the switch do not allow mains voltage to enter the low voltage circuit. **N.B** The contacts on the summer setting remain closed when winter setting selected.

29. ON / OFF SWITCH
Double pole switch fed from electrical filter 230v ac with a direct feed to the time clock motor from incoming terminals. Switch will only isolate the P.C.B when turned off, leaving power to the time clock. Isolate at mains and confirm no power to switch before working on electrical circuits.

30. TIME CLOCK
Permanent 230v ac supply fed to the motor drive from incoming side of main on/of switch. 22v dc switching voltage fed from J4 (black wire left hand) returned when contacts closed to J4 (black wire right hand), (may include room thermostat wired in series). All terminals are same size, do not allow 230v ac motor feed to enter dc circuit, motor feed clearly marked on rear of clock (1 and 2, both left terminals). Isolate at mains before working on the clock as supply is permanent regardless of position of on / off switch.

31. CENTRAL HEATING LOW PRESSURE SWITCH
Fitted to boilers (with serial numbers beginning 0210) on the central heating flow pipe and connected in series with the hi-limit stat. Contacts within the switch close at pressures above 0.5 bar and the circuit is made between the hi-limit stat and the P.C.B. Open circuit (low Pressure) will result in the main burner failing to ignite (see notes on hi-limit stat). Switch is wired Com / No (normally open), 22v dc should be present on both sides of switch (2 red wires) in normal operation above 0.5 bar.

DESCRIPTION OF THE P.C.B.

Many engineers panic at the sight of a P.C.B. and remain cautious when required to test various voltages generated by the P.C.B.. The next few pages will guide you through the basic operation of the P.C.B. without the need for a degree in electronic engineering. A basic knowledge of electricity and a digital multi meter wil be the only requirement for diagnosing possible faults without damaging the P.C.B. or yourself.

The golden rule when working on the P.C.B. 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 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 any 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 i.e. high limit thermostat, if allowed to short to earth will cause damage to the P.C.B.

The P.C.B generates a wide range of different voltages both ac and dc and 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 will apply to thermistors and 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 should develop on the boiler it is necessary to determine if the problem is internal or external. Internal refers to the P.C.B and external refers to all the controls/components which are attached to the P.C.B. Both internal and external systems must work together in order for the correct operation of the appliance.

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 <u>not</u> isolate faults on external controls which are used as demand detectors ie, flow switch, room thermostat and time clock.

When ever the P.C.B is powered up in the relevent mode, voltage is supplied to the external controls/components responsible for detecting demand and safe operation of the boiler.
Ignition sequence will not commence if;
A. Demand from external controls are not detected.
B. A component is faulty or out of range (temperature detection).
Lock out occurs before any ignition sequence commences.

ELECTRICAL COMPONENT TESTING

Because the P.C.B 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 P.C.B.
When working on the P.C.B it is possible to check for voltages from the multi pin plugs which are identified by the prefix 'J', and by using the circuit diagram and accompanying notes for each component. It is possible to 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 P.C.B.
When checking for output from the P.C.B 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 P.C.B will occur.

During stand by mode in the domestic hot water setting only a command action will activate the main burner (apart from the built in frost protection). The only possible way the main burner will light is by the contacts on the flow switch closing, this in turn will initiate the lighting up sequence for domestic hot water (slightly different to central heating mode).
If during a demand for domestic hot water the boiler fails to respond the initial investigation should involve checking if the flow switch is operating correctly, assuming the relevant checks have been carried out as to the correct connection and pressure on the incoming cold mains.
To test for voltage from the P.C.B. preferably use the main earth connection as negative or the boiler chassis for both ac and dc tests.
The voltage generated by the P.C.B. can vary according to the incoming mains voltage and therefore it may be necessary to select a different range if the need be, usually on the dc voltages which can fluctuate from 19-22v dc.
It is important to understand that the P.C.B. generates a voltage that requires switching at the relative component in order for the lighting up sequence to activate. In the case of the flow switch 21v dc is supplied from J4 (second wire from right) and assuming water is flowing through the flow switch and activating the internal magnetic switch, then the signal voltage will be switched and returned to the P.C.B. at J4 first wire on right. This principle applies to the external controls for the central heating contacts on the time clock and room thermostat, both must be closed for the central heating to operate.

DOMESTIC HOT WATER DEMAND SEQUENCE

With the control on the summer setting the ignition sequence will commence only after the demand for hot water has been detected by the flow switch. This can only occur if the correct flow direction and water pressure cause the magnet within the flow switch housing to lift and activate magnet sensing switch at the top of the housing.
This switch is wired in series with voltage supplied from J4 (second brown wire left) to one side of the switch. As the magnet makes contact with the switch, the supply voltage is returned to the P.C.B (J4 first brown wire right), ignition sequence can only commence once the P.C.B has detected this return voltage.

If no initial voltage is supplied to the switch then assume a faulty P.C.B, the flow switch can not return a voltage not received from the P.C.B initially.

Before embarking on changing the flow switch then every component on the boiler, satisfy yourself, especially on new installations, that;
A. Hot and cold outlets/inlets to the boiler are not crossed.
B. Hot and cold water circuits are not intertwined allowing mains cold water to flow through the hot tap, therefore not creating a flow through the boiler.
C. Sufficient water pressure and flow rates are available.
Once the above have checked out ok, see note 10 on flow switch for testing.

CENTRAL HEATING DEMAND SEQUENCE

Once again the boiler must have the returned voltage to the P.C.B to operate the central heating. The principal remains the same as the flow switch, but this time three external contacts must be closed for the voltage to return to the P.C.B and for the ignition sequence to commence,
these are;
A. Power-on switch set to winter position.
B. Time clock.
C. Room thermostat (if fitted).

If the winter setting is selected on the main control switch, 22v dc on the top contact (brown) will be switched to the bottom contact (black) which returns voltage to the P.C.B J5 (black wire second left), this completes the circuit for central heating demand. Providing the temperature selected at the control panel is greater than the temperature detected by the central heating thermistor and the contacts in the time clock and room thermostat are closed, the boiler will begin the ignition sequence.

The time clock and room thermostat are wired in series from J4 (black wire first left), is the feed to the clock contact (22v dc), returning to J4 (black wire second left) via the room thermostat if fitted or the link wire on the room thermostat connector block. The time clock and room thermostat contacts must be closed to complete the circuit. Voltage on this circuit is present in both domestic hot water and central heating modes, see notes 12 and 30 for testing time clock and room thermostat.

DOMESTIC HOT WATER SEQUENCE IN CENTRAL HEATING MODE

The ignition sequence for domestic hot water in central heating mode remains the same, but the transition between the two modes can vary depending on:

A. The temperature detected by the domestic hot water thermistor.
B. The temperature detected by the central heating thermistor.

Interrupted Sequence

Due to the tube in tube design of the heat exchanger, it is possible for static domestic hot water within the inner tubes to equal the surrounding temperature of the heating circuit. If the heating temperature is above 73°c and no hot water has been drawn off for a period of time, the initial flow of domestic hot water from the heat exchanger will be greater than 70°c as detected by the domestic hot water thermistor, the boiler will shut down and the ignition sequence will only commence once the flow of water (hot outlet) is less than the temperature selected at the control panel.

Uninterrupted Sequence

If domestic hot water is drawn off and the initial flow is detected at a temperature lower than 70°c or equal to the selected domestic hot water temperature due to:

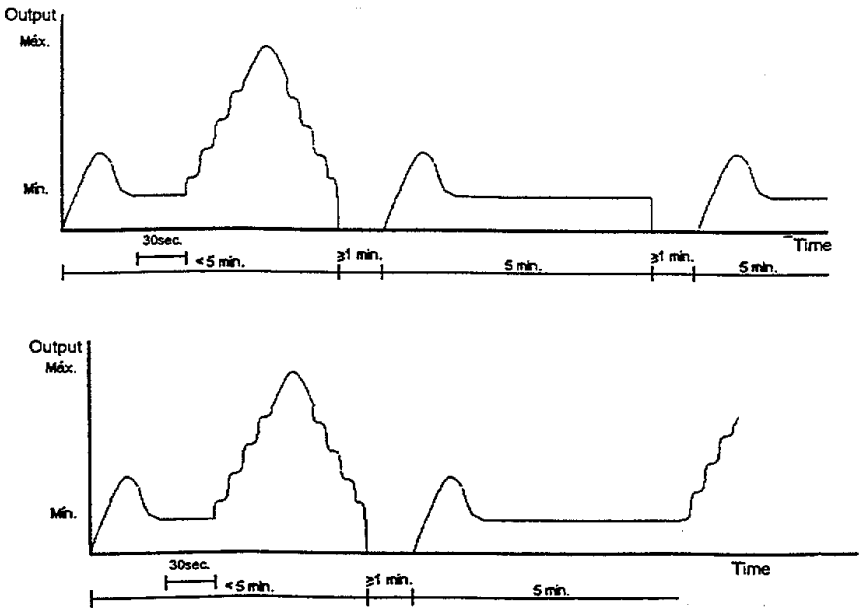
A. Heating is running below 73°c.
B. Domestic hot water is drawn off frequently. The transition will be uninterrupted with the fan and burner remaining on, followed by modulation of the burner to achieve the selected domestic hot water temperature. Selecting a low domestic hot water temperature will result in the boiler restarting the sequence.

If the temperature in the heating circuit equals 85°c and the domestic hot water temperature is lower than the selected temperature, then modulation at heating temperature 85°c will occur until the domestic hot water temperature equals the selected temperature. The central heating thermistor provides overheat protection in the domestic hot water mode. If the thermistor detects 91°c in the heating circuit due to false temperature readings from the domestic hot water thermistor; ie not connected to the outlet pipe, therefore modulation will be maximum burner pressure without the correct flow rate through the outlet. The result will be excessive heat within the heating circuit. Once 91°c is reached the gas valve closes and the fan remains on for 5 seconds followed by central heating pump start up. The pump runs until 85°c in the central heating circuit is reached and then followed by the ignition sequence.

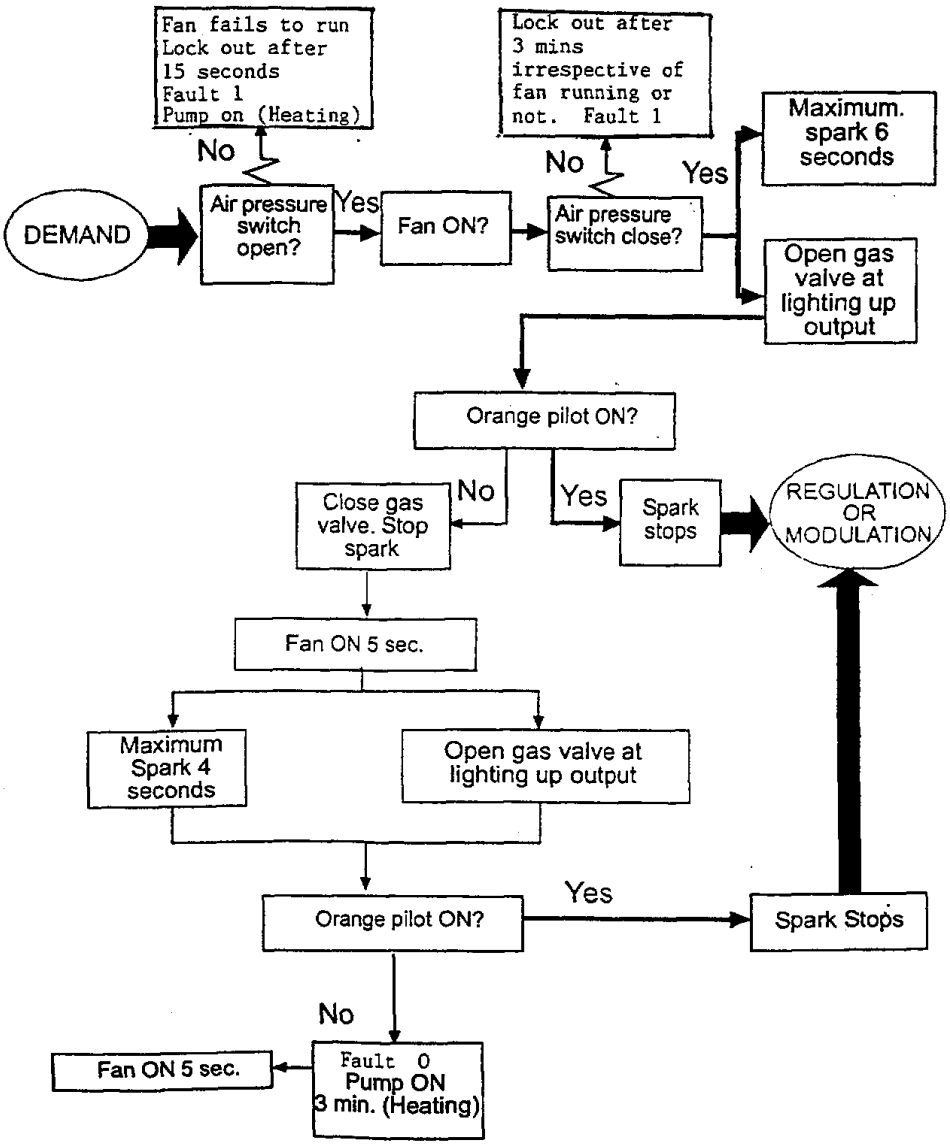
CENTRAL HEATING LOGIC PROGRAM

PLEASE NOTE:
With the appliance operating in central heating mode a built in logic program will monitor the modulation to determine the heat load of the appliance. Subsequent heating cycles will be automatically predetermined to avoid excessive gas use and increased cycling of the heating system.
The initial 30 seconds of output will remain at minimum burner pressure. Modulation (if necessary) after this 30 seconds of stabilisation will then take place. During modulation if the temperature selected at the control panel is achieved within 5 minutes the boiler will shut down. The next time the heating sequence commences, output will be at minimum for 5 minutes because a low heating load was detected on the initial heating demand. During this period of minimum output if the temperature selected at the control panel is not achieved within 5 minutes modulation will then commence to achieve the required temperature.

IMPORTANT NOTE
It is not possible for the user to override the logic program during the initial 30 seconds of the heating sequence, or if the boiler has established a minimum burn for 5 minutes. Then 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 the period. To initiate a 'clean start' to override the 5 minute minimum burn period 'reboot' the CH by switching the power off for 5 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. But initial lighting up pressure at restart will always be 30 seconds at minimum output.

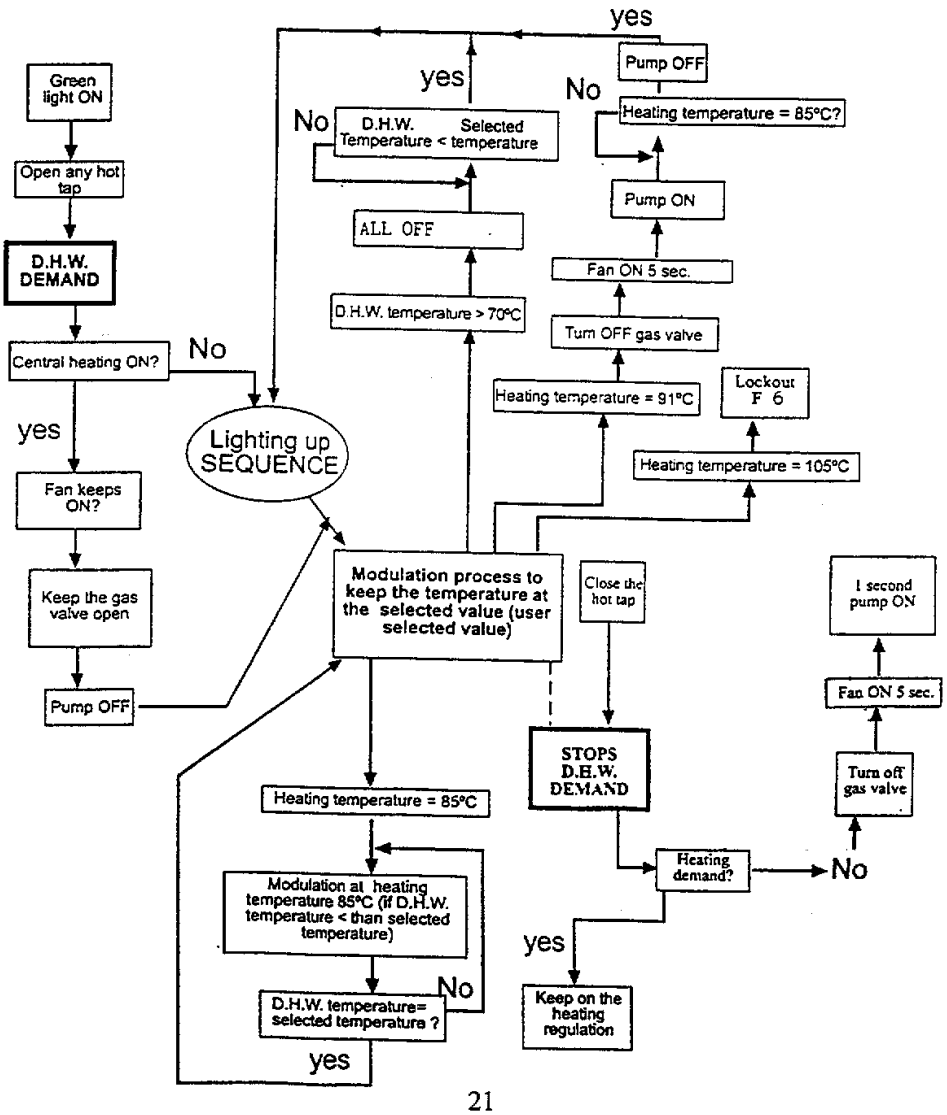


LIGHTING UP SEQUENCE FLOW CHART



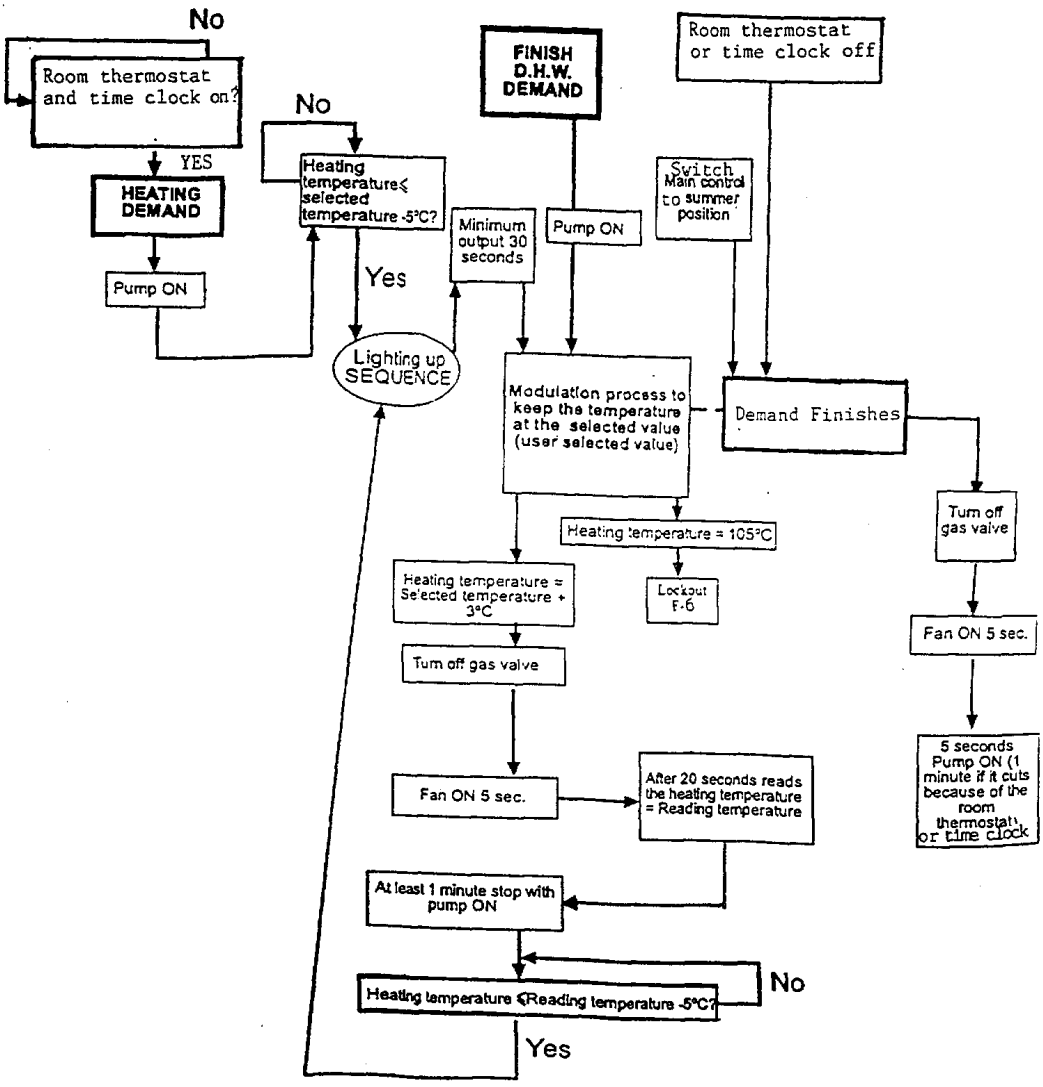
DOMESTIC HOT WATER IGNITION SEQUENCE FLOW CHART

Once the P.C.B receives the command for domestic hot water, the ignition sequence begins. All 230v ac contacts (fan, gas valve and spark generator), are fed supply voltage via relays, only the time clock remains independent for its 230v ac supply to the drive motor. Checking for voltages on the 230v ac supply to individual components is straight forward.
J10 is the output for the fan (230v ac blue and brown wires), once the fan has established and a differential pressure is created at the air pressure switch, the gas valve solenoids and spark generator are then supplied with power via J8 230v ac (black wire solenoid 1, red wire solenoid 2, brown wire spark generator and blue wire neutral).
Both solenoids must be open to establish main flame, once main flame has established spark ceases. First ignition attempt will last for 6 seconds and second attempt will last for 4 seconds.



CENTRAL HEATING IGNITION SEQUENCE FLOW CHART

Once the P.C.B receives the command for central heating, the ignition sequence is the same as for domestic hot water but, with the pump starting at the same time as the gas valve solenoids.



SELF DIAGNOSTIC FAULT CODES **PRE 2004**

The FEB-20E 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 a situation liable for the operation of the boiler to become unsafe, then the boiler will fail safe by locking-out which is displayed via the 'red neon' 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 neon' 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.

Eg: fault 6 water overheating would display the following sequence of the red neon;

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

N.B. The sequence repeats until either the reset button is depressed or the fault rectified. Some faults require the component temperature to return within operating range before reset, is possible also some sequences may take upto 3 minutes before lock-out is displayed, eg air pressure switch failure fault 1 or water over heating fault 6.

FAULT CODES		FAULT
0	Repeating 5 second flashes with no 1 second flashes	Lack of gas or ignition problems
		Minimum burner pressure set to low
		Flame supervision failure
		Burner on but flame indicator off
		Hi-Limit stat failure Low or no pressure in CH system
1	One 1 second flash	Air pressure switch 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

POST 2004

SELF DIAGNOSTIC FAULT CODES

The FEB-20E 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 a situation liable for the operation of the boiler to become unsafe, then the boiler will fail safe by locking-out which is displayed via the 'red neon' 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 neon' 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.

Eg: Fault 6 water overheating would display the following sequence of the red neon;

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

N.B. The sequence repeats until either the reset button is depressed or the fault rectified. Some faults require the component temperature to return within operating range before reset, is possible also some sequences may take up to 3 minutes before lock-out is displayed, e.g. air pressure switch failure fault 1 or water over heating fault 6.

FAULT CODES		FAULT
0	Repeating 5 second flashes With no 1 second flashes	Lack of gas or ignition problems
		Minimum burner pressure set to 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
3	Three 1 second flashes	Low central heating pressure or 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

These fault codes are for the new type PCB with the part number MU0870700, this can be found on the bottom right hand corner of the board. You can also easily identify this PCB which has two blue transformers attached.
This is a direct replacement for the older PCB with the part number MU0868700, this can be found on the bottom centre of the board.

Note: Fan wire will need threading down from the fan to allow the plug to reach the repositioned J10 terminal.

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 secs 5 secs

The FEB-20E will attempt twice to establish main burner flame, the first ignition sequence will last for 6 seconds. If no flame has been established or detected by the ionisation electrode or P.C.B. the boiler will pause for 5 seconds before commencing the second and final ignition sequence which will run for 4 seconds. If a main flame is not established or detected on the second sequence then lock-out will be displayed.

Fault 0 is displayed when a component or fault develops during the ignition sequence or the temperature has exceeded 105°c and caused the hi-limit stat to open. This is only possible should the central heating thermistor fail. The P.C.B. can only detect a failure of the main burner after 2 ignition sequences when demand for heat has been called for. The P.C.B. can not isolate a specific individual component responsible for the failed ignition sequence, which is SPARK-GAS-FLAME DETECTION. By noting at which point the sequence is broken the problem can be rectified quickly.

Eg: The spark sequence occurs followed by main burner ignition without the 'orange neon' (burner lit) illuminated, this would indicate failure of the ionisation electrode or P.C.B..

Possible Causes;
Faulty P.C.B.....No gas.....Faulty gas valve.....Faulty spark generator.....Minimum burner pressure low.....Faulty ionisation electrode.....Dirty burner.....Hi-limit stat activated or faulty.....Badly fitted flue or air restrictor ring missing on shortened flue (less than 1 meter).....Low or no CH pressure.

Fault 1 Air Pressure Switch Failure

5 secs 1 sec 5 secs

Prior to the ignition sequence starting the P.C.B. will check to ensure the contacts in the air pressure switch 1 and 2 are in the open position, this occurs before the fan runs. Should the switch be faulty, ie the contacts are closed the boiler will "fail safe" and lock-out will take place after 15 seconds. This type of lock-out will prevent any cheating of the air pressure switch by linking the terminal wires prior to the fan starting.
If the contacts are in the normal stand-by position, ie open the P.C.B. will initiate the fan sequence and a pressure differential from the venturi housing will be created and transferred via the silicon tubes

to the air pressure switch (- pressure top + pressure bottom). Ignition will not take place until the air pressure switch has proved the fan is running and creating the correct +/- pressure to close the contacts within the air pressure switch.

Failure to detect this process will cause the fan to run for 3 minutes, during this period if the contacts remain open lock-out will take place. This also applies if the fan is faulty of fails to run after the boiler has had a demand for made upon it.

Possible Causes;
Faulty air pressure switch.....Broken or slow running fan.....Obstruction within flue/air intake.....Air pressure tubes/wires fitted incorrectly.....Contamination off venturi housing (insects etc).

Fault 4 Printed Circuit Board Failure

5 secs 1 sec 1 sec 1 sec 1 sec 5 secs

The P.C.B. 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, 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 and only a replacement P.C.B. will rectify the fault.

Possible Causes ;
Faulty P.C.B.

FAULT 5 Flame Supervision Failure, Indicator Light On Burner Off

5 secs 1 sec 1 sec 1 sec 1 sec 1 sec 5 secs

With the boiler working the ionisation electrode detects that a flame is present across the burners, when the demand has finished the boiler starts the shut down sequence. If a flame is detected 10 seconds after shut down has occurred the boiler will lock out. This also applies should the ionisation electrode or the P.C.B. develop a fault, which detects a non existent flame, during this lock out sequence both the pump and fan will continue to run.

Possible Causes ;
Ionisation electrode breakdown.....Gas valve failure.....P.C.B. failure.

FAULT 6 Water Overheating

5 secs 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 5 secs

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 hi limit thermostat which operates on an electro mechanical principal.

Lock out takes place if the temperature of the heating circuit exceeds 105°c, any excess heat is dispersed by the pump which activates automatically in the event of overheat and will continue to run until 85°c is reached.

Possible Causes ;
Heating thermistor failure.....No water in the heating circuit.....Pump seized or faulty (with central heating temperature selected on maximum 85°c).....Minimum burner pressure too high.....Flow switch jammed.

Fault 7 Control Panel Failure

5 secs 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 5 secs

Before the start up sequence commences the P.C.B. 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 P.C.B.
N.B. When replacing the potentiometer harness, terminals face down.

Fault 9 Gas Valve Control Circuit Failure

5 secs 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 5 secs

When demand for heat has ceased the twin solenoids on the gas valve close in sequence, with a short delay of approximately 1 second between No:1 and No:2 solenoids closing.
Normally the main burner extinguishes instantly, however if a failure has occurred in the control circuit or gas valve and a flame is detected within 5 seconds from the initial gas valve shut down, the boiler will attempt a second time to close the solenoid which failed on the initial shut down sequence, lock out will occur if this second and final attempt fails.

Possible Causes ;
P.C.B. failure (electrovalve relay broken).....Gas valve failure.

Fault 10 Domestic Hot Water Thermistor Failure

5 secs 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 5 secs

During demand for domestic hot water if the values for the safe operation of the domestic hot water thermistor are out of range for more than 10 seconds (this is to allow for water drawn during central heating mode to stabilise) 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 P.C.B.

N.B. Lock out will occur on central heating if demand made for domestic hot water. Press reset to re-establish central heating. Drawing domestic hot water will cause lock out again.

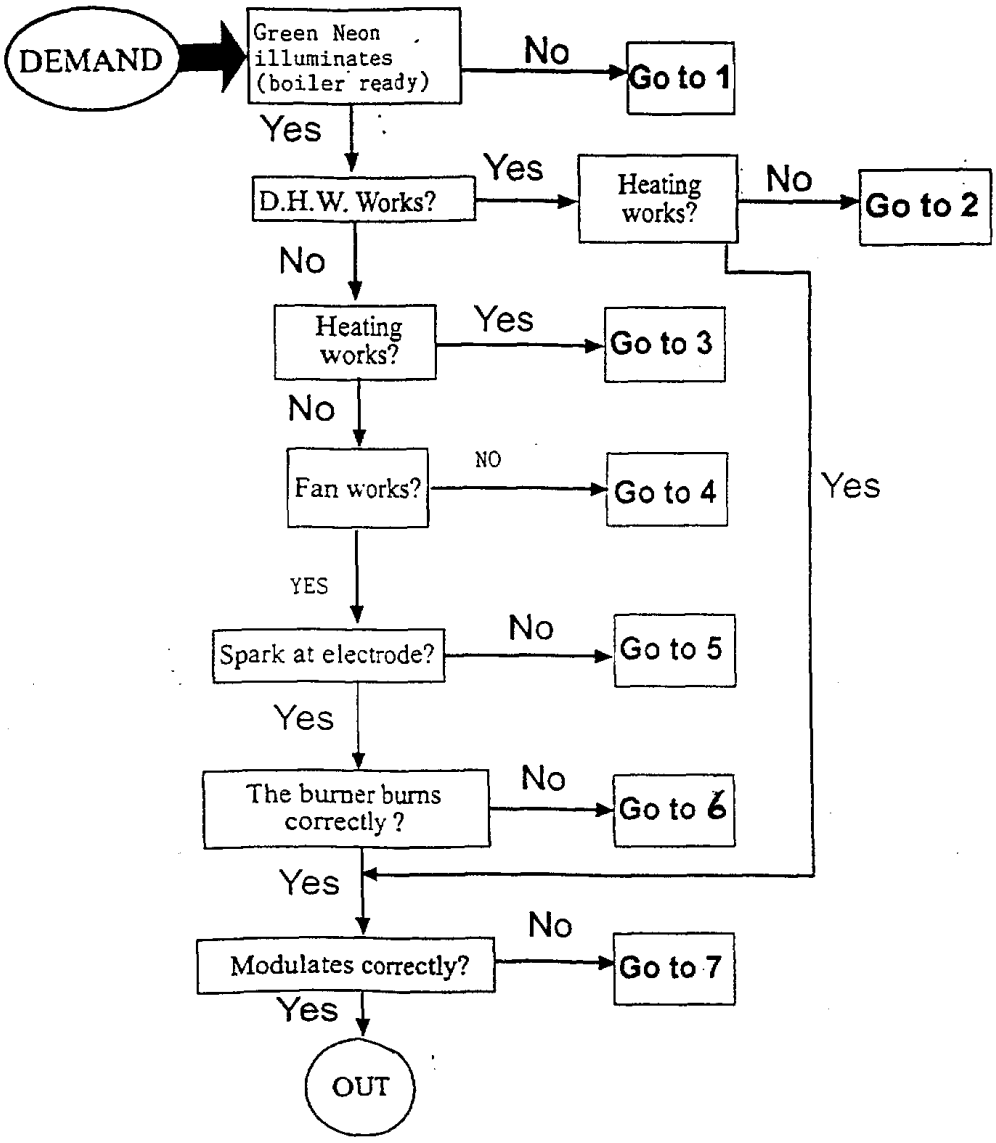
Fault 12 Central Heating Thermistor Failure

5 secs 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 1 sec 5secs

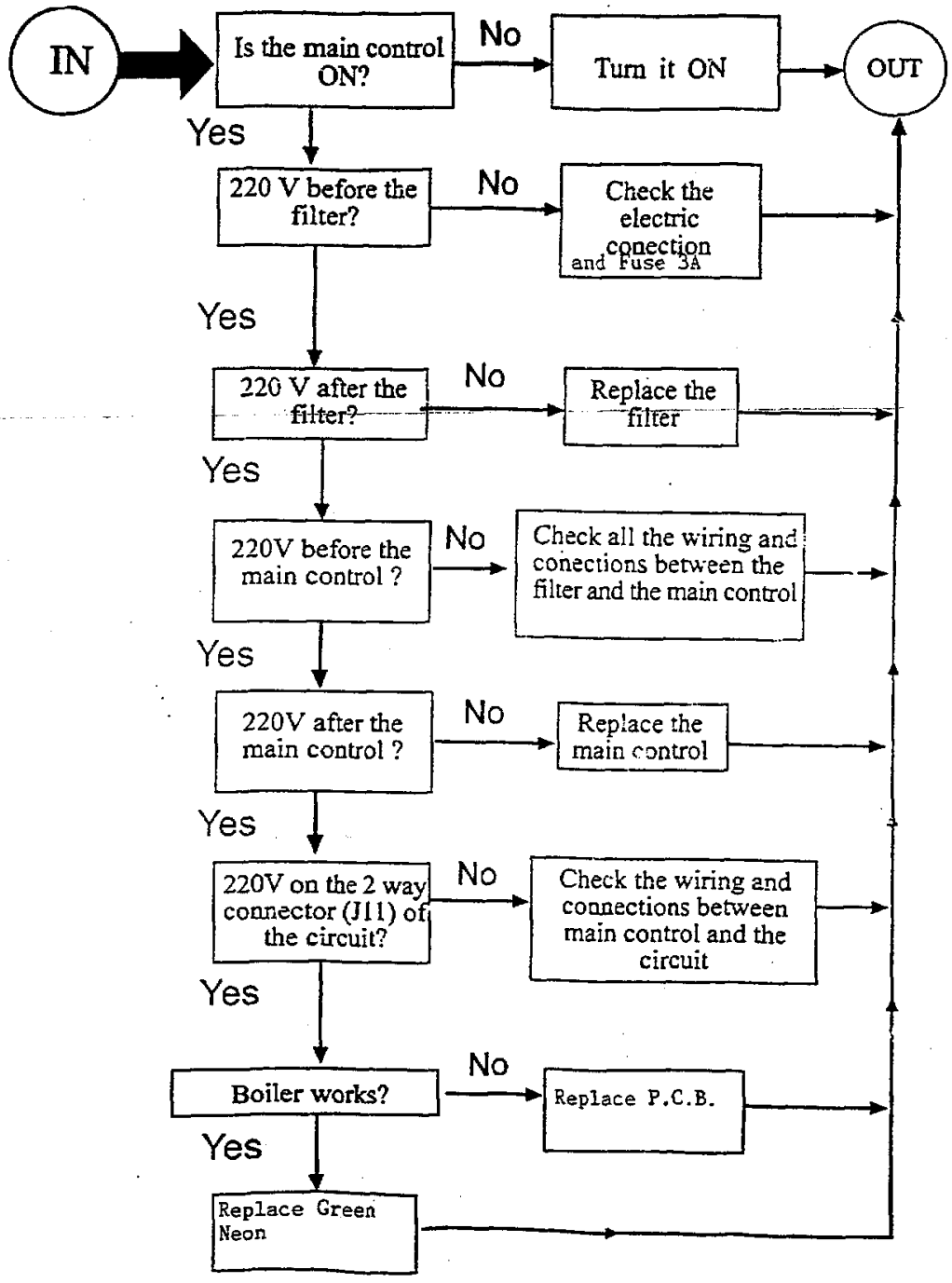
If the values of the central heating thermistor are out of range lock out will occur until values return to operational levels or the faulty thermistor is replaced.

Possible Causes ;
Faulty thermistor.....Thermistor open circuit.....Poor or faulty connections at thermistor or P.C.B.

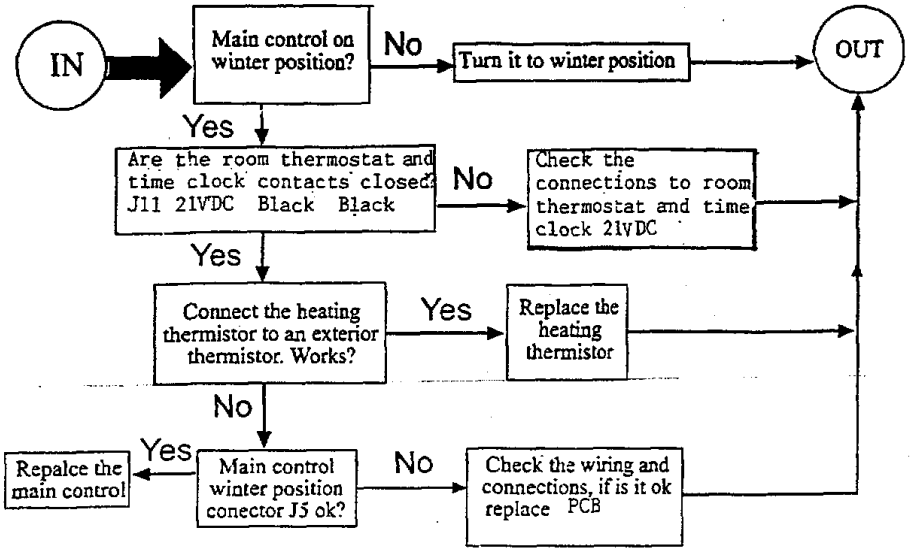
FAULT FINDING FLOW CHART



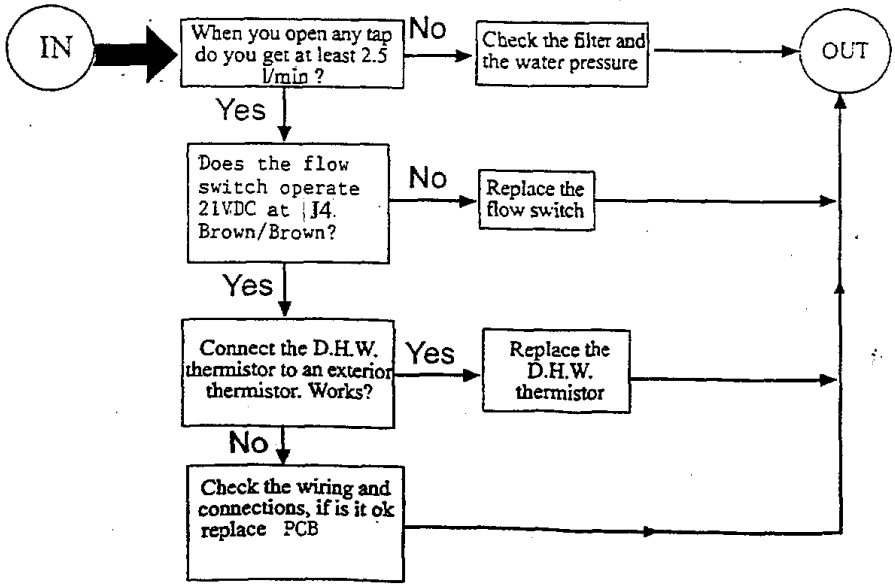
1. NO DOMESTIC HOT WATER OR CENTRAL HEATING



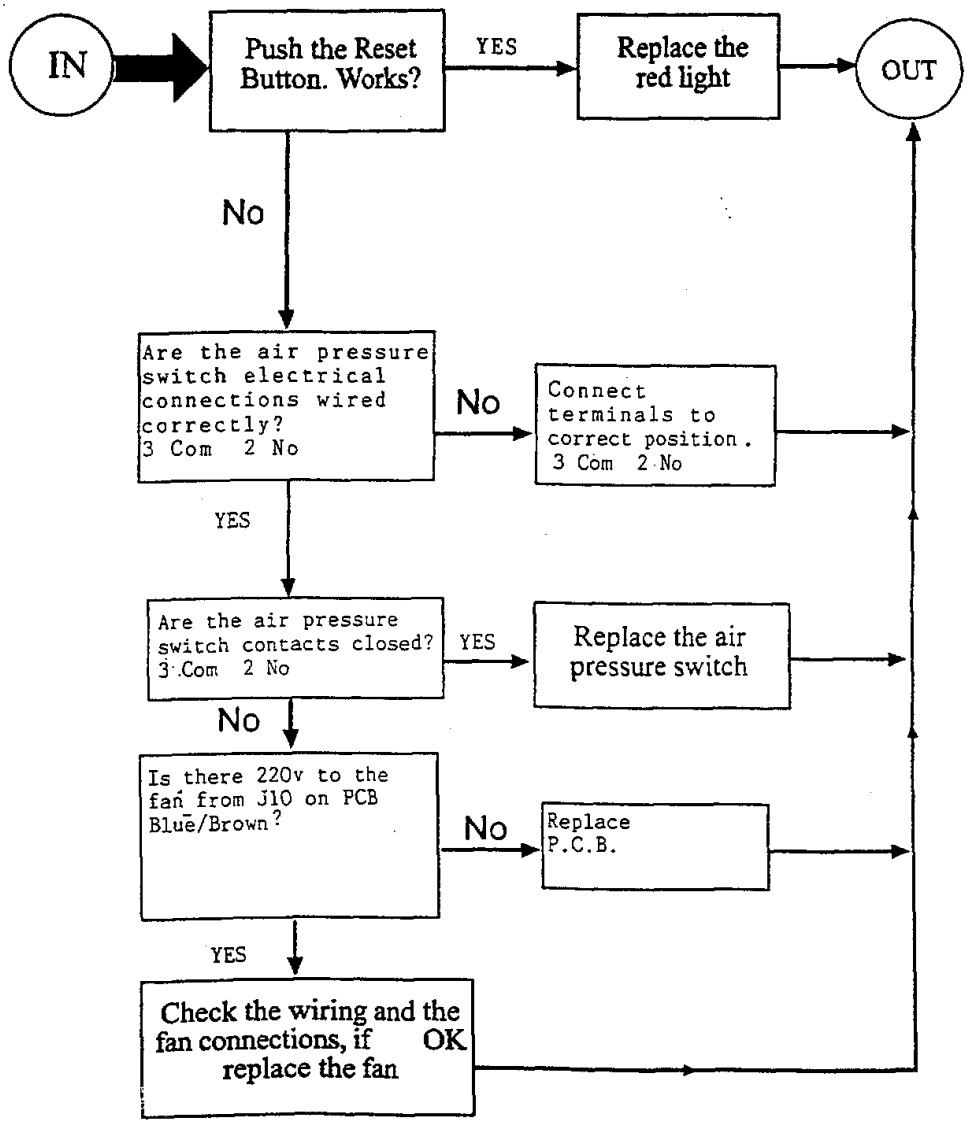
2. HEATING DOES NOT WORK BUT DHW WORKS



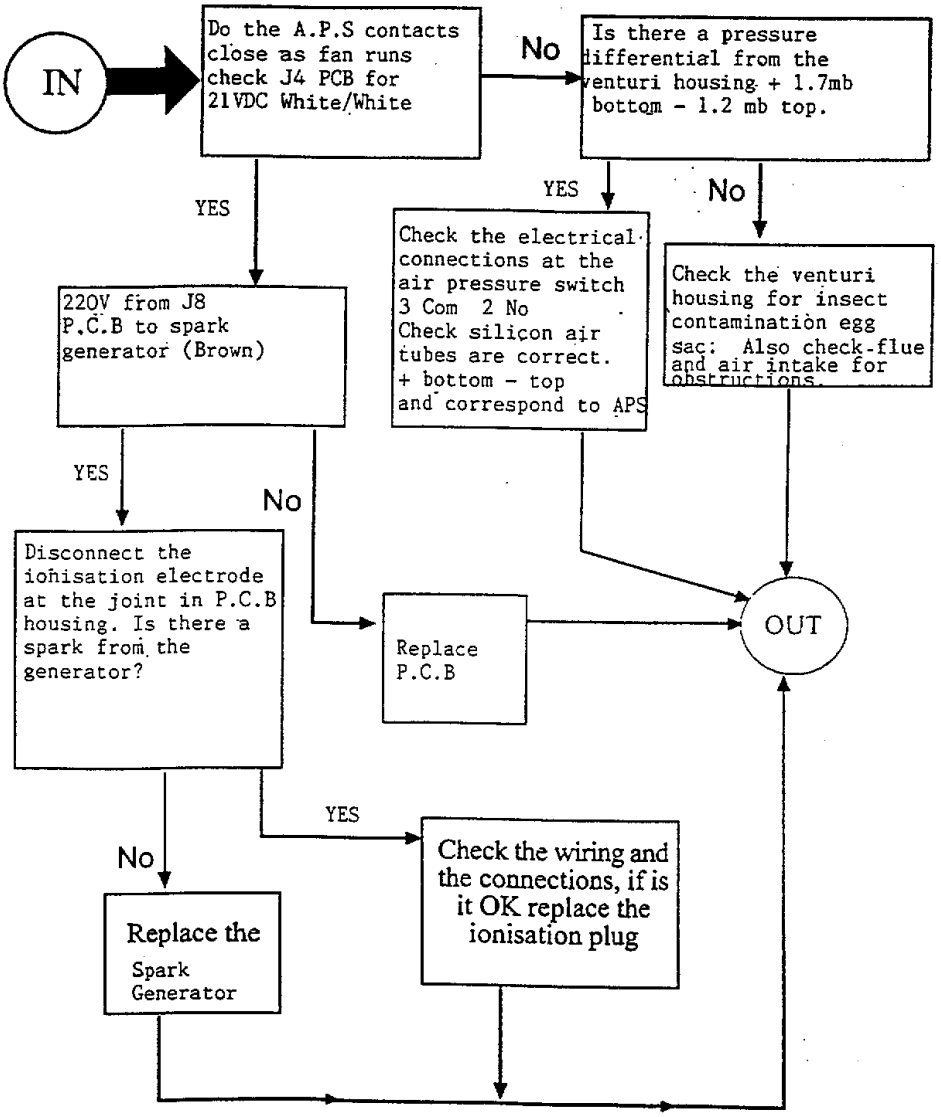
3. DHW DOES NOT WORK BUT HEATING DOES



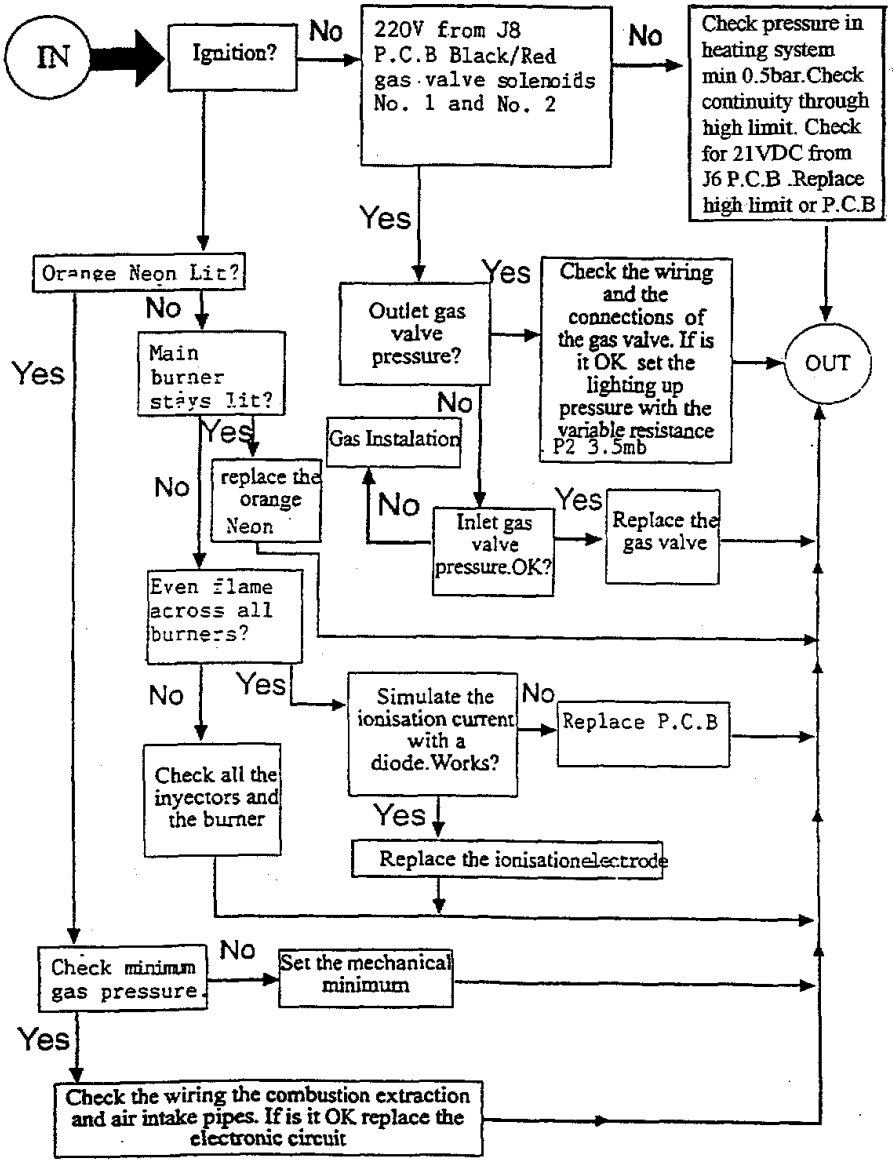
4. FAN NOT WORKING



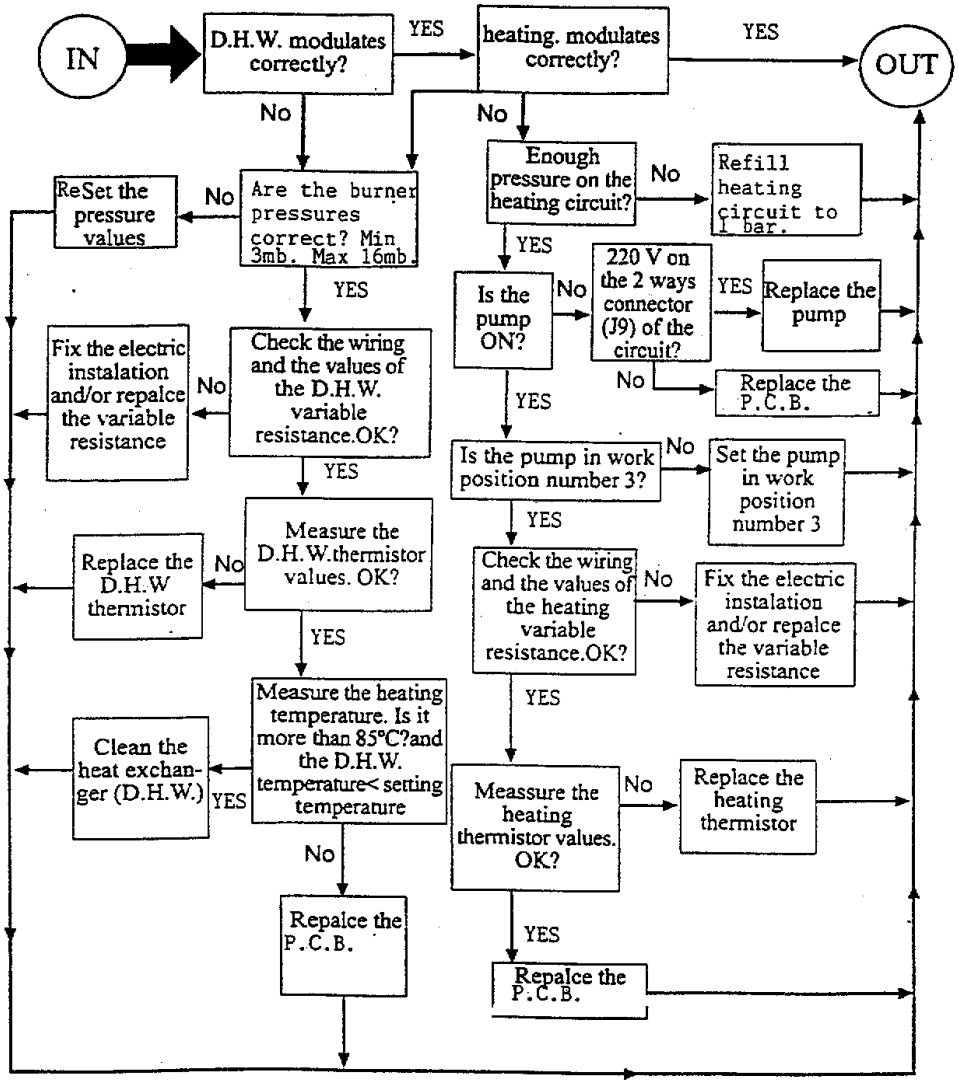
5. FAN WORKS BUT NO SPARK



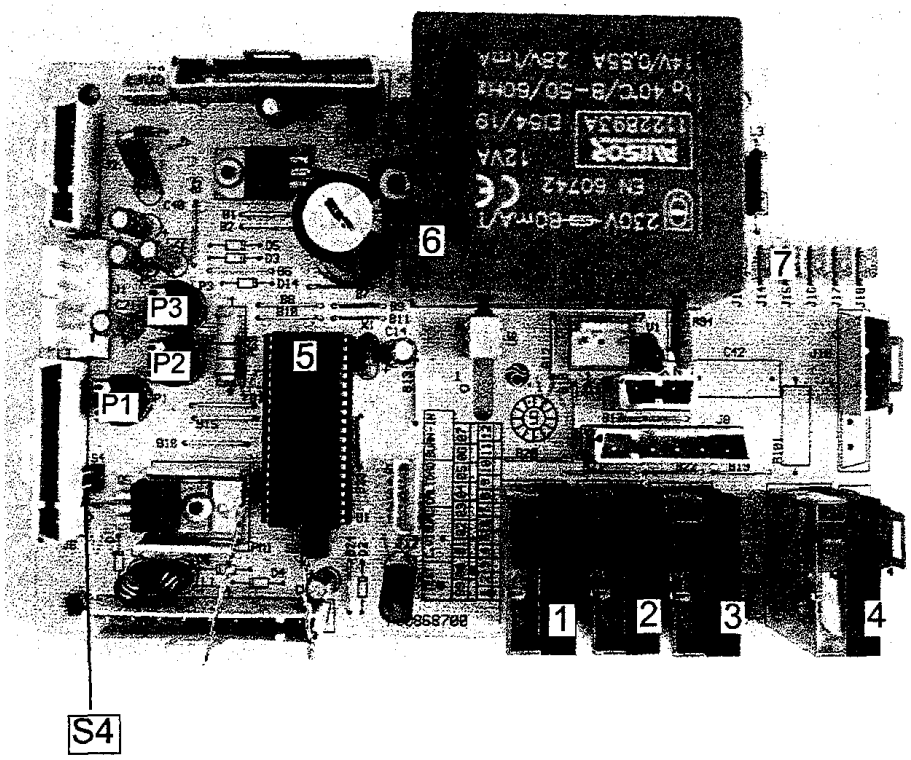
6. SPARK, NO FLAME/FLAME FAILS AFTER IGNITION



7. FAILURE TO MODULATE CORRECTLY

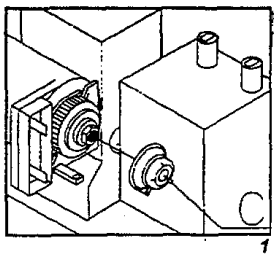


PRINTED CIRCUIT BOARD PHOTO DIAGRAM



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

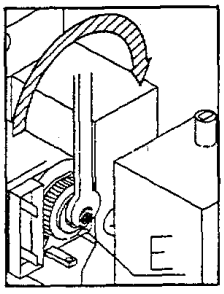
BURNER PRESSURE ADJUSTMENTS



1

A. Remove the control panel and the six screws which secure the P.C.B access cover.
B. Unclip the domestic hot water thermistor from the hot water outlet pipe.
C. Remove the protective cap from the modulating gas valve (figure 1).
D. Remove the burner test nipple screw and connect a manometer to the test nipple.

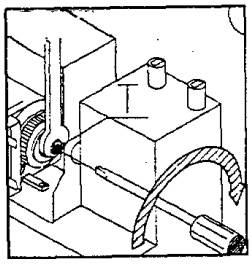
TO SET MAXIMUM BURNER PRESSURE



2

A. Select domestic hot water mode at main control.
B. At the P.C.B carefully adjust the variable resistance potentiometer P1 to maximum output (clockwise).
C. Open a hot tap to maximum flow rate (13.5 l/min).
D. Using a 10mm spanner, rotate the brass hexagon nut (E figure 2) to achieve maximum burner pressure, according to the table below. (clockwise increases pressure, anti-clockwise decreases pressure).
E. At the P.C.B slowly rotate the variable resistance potentiometer P1 anti-clockwise until the manometer reading begins to decrease (just below maximum pressure), at this point the electrical and mechanical settings are equal.

TO SET MINIMUM BURNER PRESSURE



3

A. With the hot tap still running, disconnect one of the wires from the modulating solenoid.
B. Hold the maximum burner pressure nut (E figure 2) with the 10mm spanner and using a phillips screwdriver rotate the plastic inner screw (T figure 3) to the correct minimum burner pressure (see table below). (clockwise increases pressure, anti-clockwise decreases pressure).
C. Reconnect the wire and protective cap to the modulating gas valve solenoid and turn off tap. Replace thermistor wire.
D. The gas valve is now correctly set for maximum and minimum use. It is now necessary to check the ignition burner pressure.

FEB-20E BURNER PRESSURES mbar		
OUTPUT kw	NATURAL GAS	PROPANE
23.7 kw	8.2 mbar	14.6 mbar
20.9 kw	6.5 mbar	11.5 mbar
17.4 kw	4.5 mbar	8.0 mbar
13.9 kw	2.6 mbar	5.0 mbar
11.6 kw	1.8 mbar	3.3 mbar
9.3 kw	1.1 mbar	2.3 mbar
BURNER JET SIZE	112	73

IGNITION BURNER PRESSURE

During each lighting up sequence the P.C.B increases the burner pressure to 3.5 mbar. This process ensures that air (if present) in the gas pipe is purged and a much greater chance of ignition takes place with the extra gas at the burner. This extra pressure is produced until the ionisation electrode detects the main burner flame. To accurately set the burner ignition pressure, the main burner flame must not ignite or be detected during the lighting up sequence, observing this pressure may be difficult until the ignition or detection controls are disabled.

TO ADJUST IGNITION BURNER PRESSURE

A. Ensure that maximum and minimum burner pressures are correct and both wires are connected to the modulating solenoid.
B. Disable either the spark electrode from the spark generator or disconnect the ionisation electrode from the joining connector at the P.C.B. These actions will ensure that the flame will fail to ignite or be detected.
C. With the manometer attached to the burner test nipple, open a hot tap to start the lighting up sequence. During the lighting up sequence the ignition pressure will be produced for 6 seconds on the initial attempt and 4 seconds on the following attempt before lock-out fault 0 takes place.
D. To adjust the ignition pressure use the variable resistance potentiometer P2 during the ignition sequence. Rotating P2 clockwise will increase the ignition pressure and anti-clockwise will reduce the pressure. Set the pressure according to the table below.

FEB-20E IGNITION PRESSURE mbar	
NATURAL GAS	PROPANE
2.0 mbar	3.5 mbar

TO ADJUST CENTRAL HEATING BURNER PRESSURE

A. Select central heating mode on the boiler and select maximum temperature at control panel.
B. Start lighting up sequence with the heating circuit cold and allow to run for the 30 seconds at minimum modulation to pass before full modulation takes place.
C. Use variable resistance potentiometer P3 to adjust burner pressure, (clockwise increases pressure and anti-clockwise decreases pressure) set normally to maximum (see table on burner pressures). Adjustment of the central heating burner pressure cannot increase the maximum pressure set at the gas valve.
D. Remove manometer, replace test nipple and check for leaks.
E. Close the cover on the P.C.B housing, taking care not to trap wires between the cover and box.