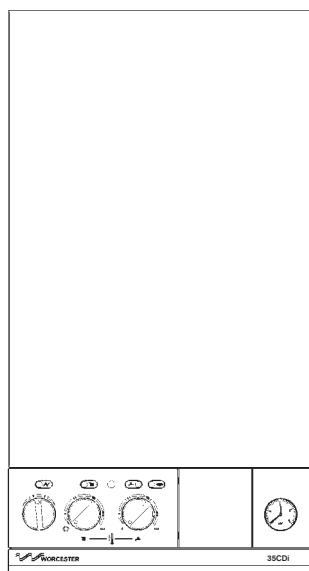


35CDi

WALL MOUNTED COMBINATION BOILER FOR CENTRAL HEATING
AND MAINS FED DOMESTIC HOT WATER

INSTALLATION AND SERVICING INSTRUCTIONS



This appliance is for use with Natural Gas or LPG (Cat II 2H3P).

GC NUMBER 47 311 39 (N.G.)

GC NUMBER 47 311 40 (L.P.G.)

CE 97/0086



Worcester Bosch Group supports
the Benchmark code of practice

APPLIANCE OUTPUTS

	Natural Gas		LPG (Propane)	
	Domestic Hot Water	Central Heating	Domestic Hot Water	Central Heating
Minimum	9.0 kW	9.0 kW	12.9 kW	12.9 kW
Maximum	35.17 kW	25.0 kW	35.17 kW	25.0 kW

IMPORTANT: THESE INSTRUCTIONS APPLY IN THE UK ONLY

AND MUST BE LEFT WITH THE USER OR AT THE GAS METER

Read the instructions before starting work - they have been written to
make the installation easier and prevent hold-ups.

Contents

1. Installation Regulations	Page 2	10. Electrical.....	Page 8
2. Introduction.....	Page 2	11. Installation.....	Page 13
3. Technical Data	Page 4	12. Commissioning	Page 17
4. Siting the Appliance	Page 6	13. User information.....	Page 19
5. Flue Terminal Position	Page 6	14. Inspection and Servicing	Page 19
6. Air Supply	Page 7	15. Replacement of Parts	Page 20
7. Sealed System.....	Page 7	16. Short Parts List	Page 26
8. Domestic Hot Water	Page 8	17. Operational Flow Diagrams.....	Page 27
9. Gas supply	Page 8	18. Fault Finding	Page 29

1. Installation Regulations

1.1 Gas Safety (Installation & Use) Regulations 1994 (Amended 1996) : It is the law that all gas appliances are installed by a competent person in accordance with the above regulations. Failure to install appliances correctly could lead to prosecution. It is in your interest, and that of safety, to ensure compliance with the law.

1.2 The manufacturers notes must not be taken, in any way, as overriding statutory obligations.

1.3 The compliance with a British Standard or European Norm does not, of itself, confer immunity from legal obligations.

1.4 The installation of the appliance must be in accordance with the relevant requirements of the Gas Safety Regulations, current IEE Regulations, Building Regulations, Building Standards (Scotland) and local water bye-laws.

1.5 The installation should follow the recommendations of the following British Standards unless otherwise indicated:

BS6798 - Specification for the installation of gas fired hot water boilers of rated input not exceeding 60kW (Gross).

BS5449 - Central heating for domestic premises.

BS5546:1 - Installation of gas hot water supplies for domestic purposes.

BS5440:1 - Flues and ventilation for gas appliances of rated input not exceeding 60kW (Gross): Flues.

BS5440:2 - Flues and ventilation for gas appliances of rated input not greater than 60kW (Gross): Air supply.

BS 5482 - Domestic butane and propane gas burning installations - permanent dwellings.

BS6891 - Installation of low pressure gas pipework installations upto 28mm (R1).

BS6700 - Domestic water supply in buildings.

BS7593 - Water treatment in domestic heating systems.

1.6. To ensure that the installation will perform to the highest standards, the system and components should conform to any other relevant standards.

1.7. The appliance and/or components conform, where applicable, with the Essential Requirements of the Gas Appliance Directive, the Boiler Efficiency Directive, the EMC Directive and the Low Voltage Directive.

1.8. In accordance with the requirements of COSHH the appliance does not contain any substances which are harmful to health.

1.9. Product Liability regulations indicate that, in certain circumstances, the installer can be held responsible, not only for mistakes on his part but also for damage resulting from the use of faulty materials. We advise that, to avoid any risk, only quality approved branded fittings are used.

1.10. LPG Installation. The appliance shall not be installed in a room or internal space below ground level when it is intended for use with LPG. This does not preclude the installation into rooms which are basements with respect to one side of the building but open to the ground on the opposite side.

1.11. The advice and instructions given in this document covers, as far as possible, the foreseeable situations which may arise. Contact Worcester Heat Systems Technical Department, Telephone: 0990 266241, for advice on specific installations.

2. Introduction

benchmark The **Benchmark** initiative is the new code of practice to encourage the correct installation, commissioning and servicing of domestic central heating boilers and system equipment.

The 'Log-book' is a vital document that must be completed by the installer at the time of installation. It confirms that the boiler has been installed and commissioned according to the manufacturers instructions.

Without the completion of the Log-book, manufacturers may refuse to respond to a call-out from a householder, who will be advised that he or she must call back the installer, who has not fulfilled his obligations to record the information required by the initiative.

It is important that:

The services and the system are properly flushed as specified.

The User is clearly instructed on the correct operation of the appliance.

The benefits of regular servicing are explained - to maintain the efficiency and extend the life of the appliance.

2.1. General Information

2.1.1. The appliance is set to give a maximum output of 35.17kW to the domestic hot water and 25kW to the heating system. The hot water flow rate is limited to a nominal 12.6 l/min at a maximum temperature rise of 40°C.

2.1.2. The sanitary water section of the appliance is suitable for water mains pressures of upto 10bar.

2.1.3. Conversion kits are available to convert the appliance from Natural Gas to Propane operation and vice versa. The kits include conversion instructions.

2.2 Electrical Supply

2.2.1. 230V ~ 50Hz. Load 180 watts. External fuse 3A, Internal fuses F1 - 2A, F2 - 1.25A (20mm).

2.3 Gas Supply

2.3.1. The appliance requires 4.12m³/h of natural gas (G20) or 1.64m³/h of propane (G31).

2.3.2. The meter or regulator should deliver 20mbar (G20) or 37mbar (G31) at the appliance, which is equivalent to about 18.5mbar or 35.5mbar at the gas valve inlet pressure test point.

2.4 Installation

2.4.1. The appliance is suitable for indoor installation only.

2.4.2. The appliance is for use with a sealed system only.

2.4.3. The clearances specified for servicing must not be reduced.

2.4.4. Do not place anything on top of the appliance .

2.4.5. It is a room sealed appliance and a separate combustion air supply is not required in any room or compartment in which the appliance is fitted.

2.4.6. If the appliance is fitted in a cupboard or a compartment is built around it after installation, then the structure must conform with the requirements of BS6798. However, because of the low casing losses, there is no need for the cooling ventilation openings in the compartment. The spaces specified for servicing must be maintained.

2.4.7. There is space for the service pipes to pass at the back of the appliance.

2.5 Flue

2.5.1. The flue can be to the right, left or rear.

2.5.2. The flue terminal, on the outside wall, must not be obstructed or damaged.

2.5.3. A terminal guard, Type K2 - GC 393 553, is available from Tower Flue Components, Vale Rise, Tonbridge TN9 1TB

2.5.4. An internal flue fitting kit is available. Fitting instructions are given in Section 11.9.

2.6. Controls

2.6.1. Control knob for switching the appliance On or Off.

2.6.2. Control knobs for adjusting the CH or DHW temperatures.

2.6.3. CH control knob switches the CH off and on.

2.6.4. A programmable room thermostat or a fascia mounted programmer or clock is available.

2.6.5. A radio frequency room thermostat is available.

2.6.6. A mains voltage room thermostat and/or an externally mounted mains voltage programmer may be connected to the appliance.

2.7. System

2.7.1. **benchmark** All dirt **must** be flushed from the system before connecting the appliance.

2.7.2. The connections in the system must withstand a pressure of upto 3bar.

2.7.3. Radiator valves must conform to BS2767:10:1977.

2.7.4. Table 3 gives the pump head available for the system and the required temperature differential.

2.7.5. A drain cock must be fitted to the lowest point of the system.

2.7.6. An air vent should be fitted to the highest point of the system.

2.8. Showers, Bidets, Taps and Mixing Valves

2.8.1. All taps and mixing valves must be suitable for the available mains pressure and temperatures upto 65°C. It may be necessary to fit a pressure reducing valve.

2.8.2. Hot and cold mains fed water can be supplied to overrim bidets but is subject to local water company requirements.

2.8.3. The flow of water from individual outlets varies on all mains fed systems that are not fitted with flow balancing valves.

2.8.4. If a pressure equalising valve is fitted then the domestic hot water temperature should be set to maximum.

2.8.5. Thermostatically controlled shower valves give extra comfort and protection.

2.9. Safety

2.9.1. The appliance must not be operated with the inner casing cover removed.

2.9.2. The gas and electricity supplies must be turned off before servicing or working on the appliance.

2.9.3. Temperature monitoring controls are fitted to prevent overheating.

2.9.4. Automatic frost protection is provided which will protect the appliance when no heat demand is present.

2.9.5. Automatic pump seizure protection is provided.

2.9.6. The gas valve solenoids are successively and alternately closed to check for gas tightness by reference to the flame cut-off time.

2.10. Operation

2.10.1. Central Heating:

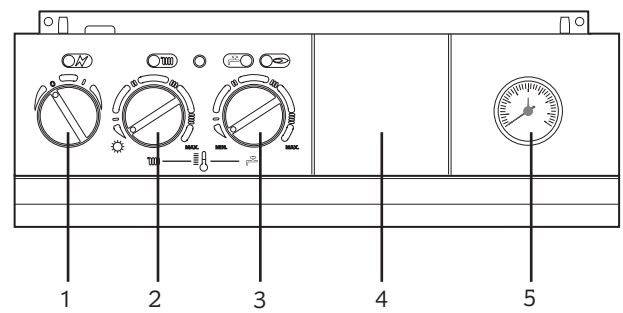
A demand for heat will ignite the burner and it will operate at minimum pressure for 2 minutes before increasing to the maximum over a period of 1 minute and then automatically match the system requirements. At the end of the demand the burner will go out and the pump will continue to run for upto 4 minutes or the fan for 15 seconds. There is an anti-cycle time of 3 minutes.

2.10.2. Domestic Hot Water:

A demand for hot water will light the burner with the pressure rising to maximum over a period of 4 seconds. At the end of the demand the fan will continue to run for 15 seconds if neither pump is operating. There is an anti-cycle time of 10 seconds.

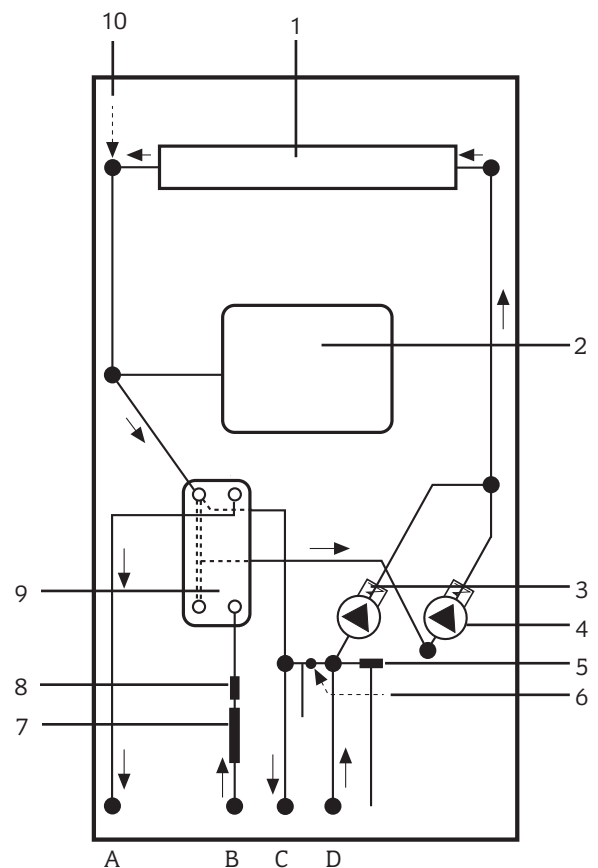
The demand for hot water will override the CH function for the period of the hot water demand. In winter when the inlet water temperature is very low it will be necessary to reduce the flow at the taps to maintain the delivery temperature.

Fig. 1. Facia Controls



1. Mains ON/OFF Control Knob
2. Central Heating Temperature Control Knob and CH ON/OFF Control
3. Domestic Hot Water Temperature Control Knob
4. Programmer/Clock Position - (Optional)
5. System Pressure Gauge

Fig. 2. Water Flow Diagram



- | | |
|-----------------------------------|--------------------------------------|
| 1. Primary Heat Exchanger | 7. Water Flow Regulator |
| 2. Sealed System Expansion Vessel | 8. Flow Switch |
| 3. Central Heating Pump | 9. Domestic Hot Water Heat Exchanger |
| 4. Domestic Hot Water Pump | 10. Primary Flow Manifold Pump |
| 5. Relief Valve | |
| 6. Bypass Adjuster | |
| A. Domestic Hot Water Flow | C. Central Heating Flow |
| B. Cold Water In | D. Central Heating Return |

3. Technical Data

Table 1.

NOMINAL BOILER RATINGS (10 Minutes After Lighting)							
BOILER ADJUSTED FOR G20 (Natural Gas)							
OUTPUT		INPUT (Net)		BURNER SETTING PRESSURE		GAS RATE	
kW	Btu/h	kW	Btu/h	m bar.	in. wg.	m ³ /h	ft ³ /h
9.0	30,700	11.42	38,900	1.5	0.6	1.19	41.98
25.0	85,300	28.52	97,300	8.3	3.3	2.97	104.8
35.17	120,000	39.61	135,100	14.2	5.8	4.12	145.5
BOILER ADJUSTED FOR G31 (Propane)							
12.9	44,000	16.5	56,300	6.0	2.4	0.68	24.0
25.0	85,300	29.14	99,400	19.0	7.6	1.23	43.3
35.17	120,000	40.5	138,200	34.7	13.9	1.64	57.9

Natural Gas: Net Input = Gross Input x 0.901

LPG (Propane): Net Input = Gross Input x 0.922

Table 2.

FLUE DETAILS			
HORIZONTAL FLUE TYPE C12		mm	inches
WALL HOLE DIAMETER	EXTERNAL FIX	125	5.0
	INTERNAL FIX	150	6.0
STANDARD FLUE	MINIMUM LENGTH	100	4.0
	MAXIMUM LENGTH	1000	39.3
EXTENDED FLUE	MAXIMUM LENGTH	2000	78.7
FLUE ASSEMBLY DIAMETER		110	4.3

Table 3

PUMP HEAD						
BOILER OUTPUT		HEAD		MIN. FLOW RATE		FLOW/ RETURN DIFFERENTIAL °C °F
kW	Btu/h	Metres	Feet	L/min.	Gal/Min.	
9.0	30,700	4.2	13.6	11.7	2.57	11°C 20°F
25.0	85,300	2.08	6.67	21.57	4.75	16.5°C 30°F

Table 4

MECHANICAL SPECIFICATIONS	
CENTRAL HEATING FLOW - COMPRESSION	22mm
CENTRAL HEATING RETURN - COMPRESSION	22mm
COLD WATER INLET - COMPRESSION	15mm
DOMESTIC HOT WATER FLOW - COMPRESSION	15mm
GAS INLET	Rc ¾
RELIEF VALVE DISCHARGE - COMPRESSION	15mm
CASING HEIGHT	900mm
CASING WIDTH	500mm
CASING DEPTH	310mm
WEIGHT - DRY	52kg
WEIGHT - MAXIMUM INSTALLATION	49kg
WEIGHT - PACKAGED	56kg

Table 5

PERFORMANCE SPECIFICATIONS		
PRIMARY WATER CAPACITY	3.0 litres	
MAXIMUM MAINS INLET PRESSURE	10 bar	
MINIMUM MAINS INLET PRESSURE (working) for max. hot water flow	1.3 bar	
MINIMUM MAINS INLET PRESSURE (working) to operate appliance	0.8 bar	
MAXIMUM CENTRAL HEATING FLOW TEMPERATURE	82°C nom	
MAXIMUM CENTRAL HEATING SYSTEM SET PRESSURE	1.5 bar	
MINIMUM CENTRAL HEATING SYSTEM PRESSURE	0.45 bar	
DOMESTIC HOT WATER TEMPERATURE RANGE	50 - 62°C	
OUTPUT TO DOMESTIC HOT WATER	NATURAL GAS (G20)	9.0 - 35.17 kw
	LPG - PROPANE (G31)	12.9 - 35.17 kw
OUTPUT TO CENTRAL HEATING	NATURAL GAS (G20)	9.0 - 25.0 kw
	LPG - PROPANE (G31)	12.9 - 25.0 kw
DOMESTIC HOT WATER SPECIFIC RATE AT 35° RISE	16.7 l/min	
MAXIMUM DOMESTIC HOT WATER FLOW RATE FROM APPLIANCE AT 40° RISE	12.6 l/min ± 15%	
NO _x CLASSIFICATION	Class 3	
MAXIMUM FLUE GAS MASS FLOW RATE	129.5 kg/h	
SEDBUK NUMBER	78.9%	
SEDBUK BAND	D	

Table 6

DOMESTIC HOT WATER - TEMPERATURE RISE				
DISCHARGE RATE l/min	10	11	12	13
TEMPERATURE RISE °C	50	45.5	41.5	38.5

Table 7

GAS SUPPLY SYSTEM - BASED ON NG (G20)			
TOTAL LENGTH OF GAS SUPPLY PIPE meters			
3	6	9	
GAS DISCHARGE RATE m ³ /h			PIPE DIAMETER mm
8.7	5.8	4.6	22
18.0	12.0	9.4	28

Table 8

CLEARANCES (mm)		
	INSTALLATION	SERVICE
ABOVE APPLIANCE	35	35
IN FRONT OF APPLIANCE	600	600
BENEATH APPLIANCE	200	200
RIGHT AND LEFT HAND SIDE	25	5*

* If a Side Flue Connection is made then this service clearance must be 25mm at that side.

Table 9

SYSTEM CAPACITY			
TOTAL SYSTEM VOLUME litres			
INITIAL PRESSURE bar	INITIAL CHARGE PRESSURE bar		
	0.5	1.0	1.5
1.0	72	92	-
1.5	39	53	64

4. Siting the Appliance

4.1. The appliance may be installed in any room but refer to the requirements of the current IEE regulations and, in Scotland, the relevant electrical provisions of the Building Regulations with respect to the installation of appliances in rooms containing baths or showers.

4.2. Where a room sealed appliance is installed in a room containing a bath or shower, any switch or appliance control using mains electricity must not be able to be touched by a person using the bath or shower.

4.3. The appliance is NOT suitable for external installation

4.4. No special wall protection is required.

4.5. The wall must be able to support the weight of the appliance. Refer to Table 4.

4.6. The specified clearances must be available for installation and servicing. Refer to Table 8.

4.7. The appliance can be installed in a cupboard/compartment to be used for airing clothes providing that the requirements of BS6798 and BS5440/2 are followed. Refer to Section 2.4.6.

4.7.1. The airing space must be separated from the boiler space by a perforated non-combustible partition. Expanded metal or rigid wire mesh is acceptable provided that the major dimension is less than 13mm.

4.7.2. The requirements for servicing space must be met when an appliance is in a cupboard or compartment used for airing clothes. Refer to Table 8.

4.7.3. The clearance between the front of the appliance and the cupboard/compartment door should be not less than 75mm.

4.7.4. If the installed boiler is to be enclosed then the requirements of BS6798 and BS5440:2 must be followed. Refer to Section 2.4.6.

4.8. The pipe connection positions on the manifold are shown in Fig. 4 and on wall template allowing the system to be pre-piped and flushed before the appliance is fitted. Refer to Section 2.4.6.

4.8.1. Always consider the possibility that the pipes may need to be separated from the appliance after installation.

4.9. LPG Installation. Refer to Section 1.10.

5. Flue Terminal Positions

5.1. The flue system must be installed following the requirements of BS5440:1.

5.2. Standard flue length is 100 - 1000mm. An extension kit for flues upto 2m is available.

Fig. 3. Casing Dimension and Clearances

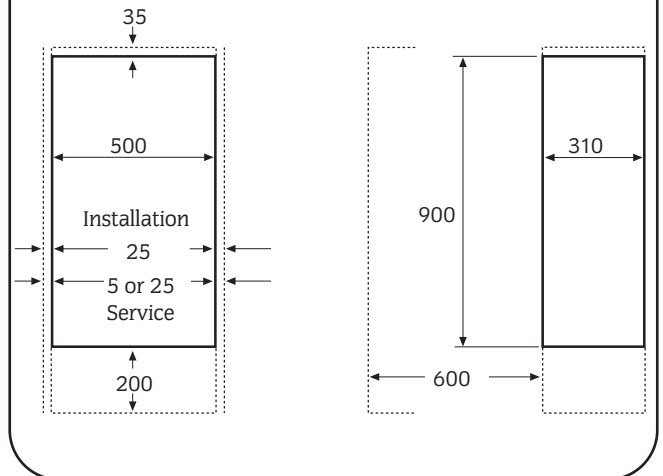
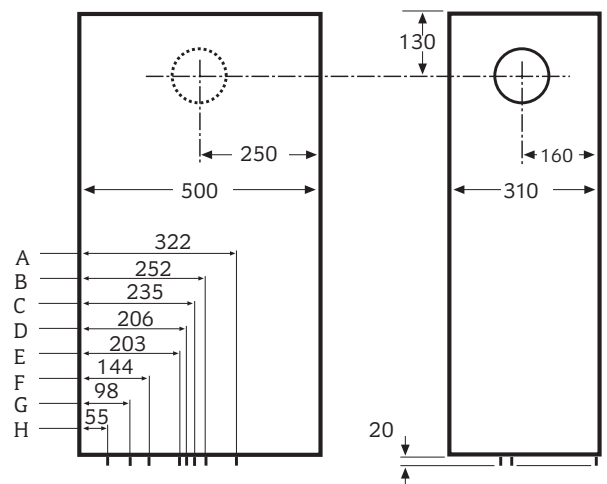
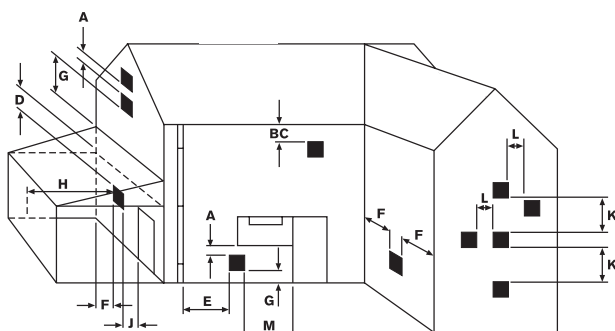


Fig. 4. Pipework Connections and Flue Position



- | | |
|---------------------------|----------------------------|
| A. Relief Valve Drain | F. Cold Water In |
| B. Central Heating Return | G. Domestic Hot Water Flow |
| C. Bypass Adjuster | H. Gas Inlet |
| D. Drain Point | |
| E. Central Heating Flow | |

Fig. 5. Flue Terminal Positions



TERMINAL POSITION	MIN. DISTANCE
A- Directly below an openable window or other opening e.g. air brick.	300 mm (12 in.)
B- Below gutters, soil pipes or drain pipes.	75 mm (3 in.)
C- Below eaves.	200 mm (8 in.)
D- Below balconies or car port roof.	200 mm (8 in.)
E- From vertical drain pipes and soil pipes.	75 mm (3 in.)
F- From internal or external corners.	300 mm (12 in.)
G- Above ground, roof or balcony level.	300 mm (12 in.)
H- From a surface facing a terminal.	600 mm (24 in.)
I- From a terminal facing a terminal	1200 mm (47 in.)
J- From an opening in a car port (e.g. door window) into dwelling.	1200 mm (47 in.)
K- Vertically from a terminal on the same wall.	1500 mm (59 in.)
L- Horizontally from a terminal on the same wall.	300 mm (12 in.)
M- From door, window or air vent (achieve where possible).	150 mm (6 in.)

5.3. The terminal must not cause an obstruction nor the combustion products a nuisance.

5.4. Under some climatic conditions the terminal might steam. Positions where this might be a nuisance should be avoided. Combustion products must not enter the roof space.

5.5. If the terminal is within 1m of a plastic or painted gutter or within 500mm of painted eaves then an aluminium shield at least 750mm long should be fitted to the underside of the gutter or painted surface.

5.6. If the terminal is less than 2m above a surface to which people have access then a guard must be fitted. The guard must be evenly spaced about the terminal and fixed with plated screws.

5.7. A guard, Type K2, can be obtained from Tower Flue Components, Vale Rise, Tonbridge, TN9 1TB.

6. Air Supply

6.1. A separate vent for combustion air is not required.

6.2. If the appliance is in a cupboard or compartment then, because of the low casing losses, it is not necessary to have additional ventilation for the boiler.

6.2.1. There must be proper clearance around the appliance to allow the free movement of the air. Refer to Table 8.

7. Sealed System

7.1. The system must comply with requirements of BS6798 and BS5449.

7.2. The appliance must not be operated without the system being full of water and correctly pressurised.

7.3. The pressure relief valve will operate at 3 bar. The discharge pipe must be directed away from any electrics and from where it might be a hazard.

7.4. The pressure gauge shows the required system pressure and the actual system pressure.

7.5. The expansion vessel, to BS4814, has a capacity of 10 litres charged to 0.5 bar, which is suitable for a static head of 5 metres. A schrader type valve allows the pressure to be increased if the static head is greater than 5 metres.

7.5.1. If the expansion vessel fails then it must be replaced with the designated spare part.

7.6. Refer to BS 7074:1, BS5449 and Table 9 for a guide to the available system capacity.

7.7. The maximum system design pressure is 1.5 bar. If the pressure is above 2.6 bar when the appliance is at maximum temperature then another expansion vessel must be fitted as near to the appliance as possible in the return pipe.

7.8. The filling point must be at a low level.

7.8.1. Water lost from the system must be replaced. The make-up connection must be close to the appliance in the heating return pipe through an approved non-return valve.

7.8.2. The system and the appliance must be properly vented. Repeated venting loses water from the system and usually indicates that there is a leak.

7.8.3. The connection to the mains water supply must have the approval of the local water company.

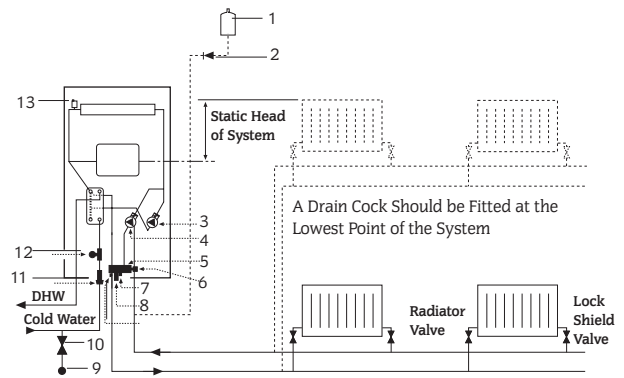
7.9. The integral by-pass should be adjusted to balance the system when commissioning the appliance.

7.10. The CH pump is set at maximum and must not be adjusted.

7.11. All connections in the system must withstand a pressure of up to 3 bar.

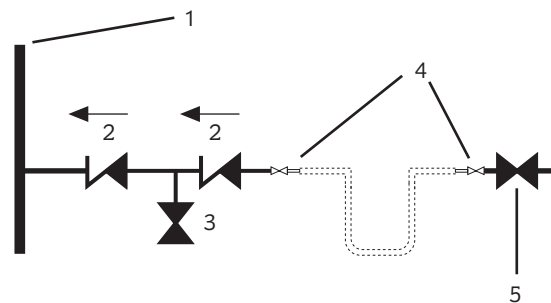
7.12. The radiator valves must conform to BS2767:10 and other valves to BS1010.

Fig 6 - Sealed system



- | | |
|----------------------------|--|
| 1. Make-up Bottle | 10. BS Stop Valve |
| 2. Non-return Valve | 11. Domestic Hot Water Flow Regulator and Switch |
| 3. Domestic Hot Water Pump | 12. Domestic Hot Water Expansion Vessel (Optional) |
| 4. Central Heating Pump | 13. Auto Air Vent |
| 6. Relief Valve | |
| 7. Drain Tap | |
| 8. Bypass Adjuster | |
| 9. Water Main | |

Fig 7 - System Fill



- | |
|---------------------------|
| 1. Central Heating Return |
| 2. Non-return Valve |
| 3. Test Cock |
| 5. Stop Cock |
| 6. Temporary Hose |

8. Domestic Hot Water

8.1. If necessary reference should be made to the local water company before connecting the appliance.

8.2. Devices which would prevent the flow of expansion water must not be fitted unless separate arrangements have been made. A mini-expansion vessel can be fitted within the casing if necessary. A thread sealant suitable for potable water must be used.

8.3. The last 600mm of mains water pipe before the appliance must be in copper.

8.4. The domestic hot water circuit of the appliance is suitable for a mains pressure of upto 10 bar. A pressure reducing valve must be fitted if necessary.

8.5. A mains supply isolating valve is fitted.

8.6. The DHW pump is set at maximum and must not be adjusted.

8.7. The maximum hot water flow rate is set at the factory to 12.6 ($\pm 15\%$) l/min giving a nominal temperature rise of 40°C with the temperature control at maximum. This rate is equivalent to a specific rate of 16.7 l/min at a rise of 35°C. Refer to Table 6.

8.8. The temperature rise, upto the maximum set by the user, is automatically maintained by the modulation of the heat input.

8.9. In winter, when the mains water temperature is very low, the water flow, adjusted at the tap or shower, should be reduced to maintain the required delivery temperature.

8.10. It is suggested that long pipe runs to taps or showers be insulated to prevent the rapid cooling of the water.

8.11. Hot and cold taps and mixing valves must be suitable for the available mains pressure. If necessary a pressure reducing valve should be fitted.

8.12. No anti-siphonage arrangements are necessary for fixed head showers.

8.13. The hose of a loose head shower must be fixed so that the shower head cannot get closer than 25mm to the top edge of the bath to prevent immersion in the water. Alternatively the shower can be fitted with an anti-siphonage device at the flexible hose connection.

8.14. Thermostatically controlled shower valves will give extra comfort and guard against extreme temperatures.

8.15. Hot and cold mains water direct to a bidet is, subject to the approval of the local water company, permissible provided that the bidet is of the overrim flushing type. The outlets must be shrouded and unable to be fitted with a hand-held spray. No anti-siphonage arrangements are needed.

8.16. The maximum temperature of the heat exchanger is limited and there is normally no need for water treatment to prevent scale formation.

8.17. If the water hardness is very high then an anti-scaling device can be considered. Further information is available from WHS Technical Information Department, Telephone 0990 266241.

8.18. The installation of a scale inhibitor must be strictly in accordance with the requirements of the local water company.

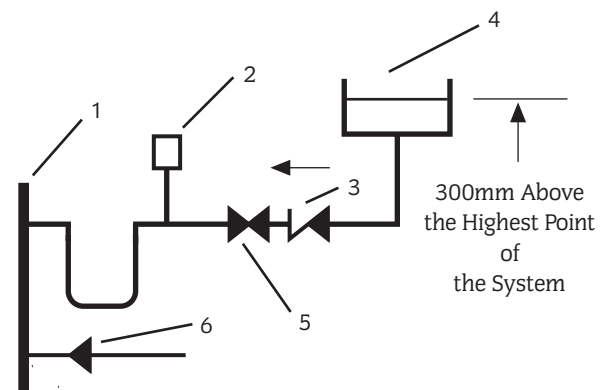
9. Gas Supply

9.1. The appliance requires 4.12 m³/h of natural gas (G20) or 1.64 m³/h of propane (G31). Check that the supply system can accommodate this together with any other appliances connected to it. Refer to Table 7.

9.2. A natural gas appliance must be connected to a governed meter.

9.3. There must be a pressure of 20mbar (G20) or 37mbar (G31) at the inlet to the appliance. This is equivalent to a pressure of 18.5 - 19.0mbar (G20) or 35 - 35.5mbar (G31) at the inlet to the gas valve.

Fig 8 - System Make Up



1. Central Heating Return
2. Auto Air Vent
3. Non-return Valve
4. Make-up Vessel
5. Stop Cock
6. Fill Point

10. Electrical

10.1. Mains supply : 230V ~ 50Hz, 180watts. External fuse 3A, Internal fuses F1 - 2A, F2 - 1.25A (20mm). Spare internal fuses are supplied with the appliance. Refer to Fig 15.

10.2. The appliance must be earthed.

It must be possible to completely isolate the appliance.

10.3. The mains cable must be 0.75mm² (24x0.20 mm) to BS6500-Table 15 or 16.

10.4 The mains cable must be connected to the terminal ST12 marked L (red or brown lead), N (black or blue lead) and the Earth stud (green or green/yellow lead) and secured with the cable clamp. Check that sufficient loose lead has been left to allow access to the control box. The Earth lead must be still be slack when the other leads are taut. Refer to Fig 9.

10.5. The connection to the mains must be either: A 3A fused three-pin plug and unswitched socket outlet, (both complying with BS1363) or a double pole isolator with a contact separation of 3mm in all poles and supplying the appliance and controls only.

10.6. Access to the mains connection on the driver board is gained by removing the bottom cover from the facia.

Refer to Fig 11.

10.7. A room thermostat or an externally mounted programmer must be suitable for mains voltage operation and the leads securely fixed in the clamps provided. The controls must be earthed at the bracket by the control board. Refer to Fig 10 and 12.

10.8. A programmer, to fit into the facia, is available to control the CH. Full instructions are sent with the programmer. Refer to Fig 16.

10.9. A clock, to fit into the facia, is available to control the operation of the appliance.

Fig 9 - Mains Electrical Connection

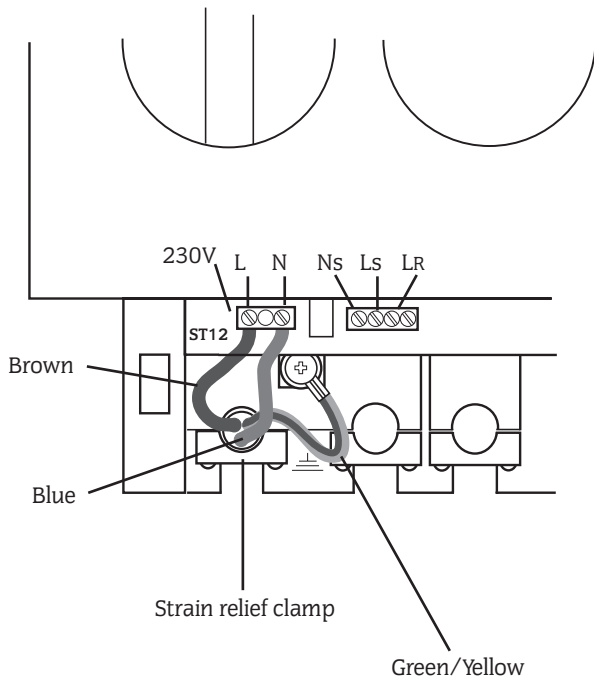
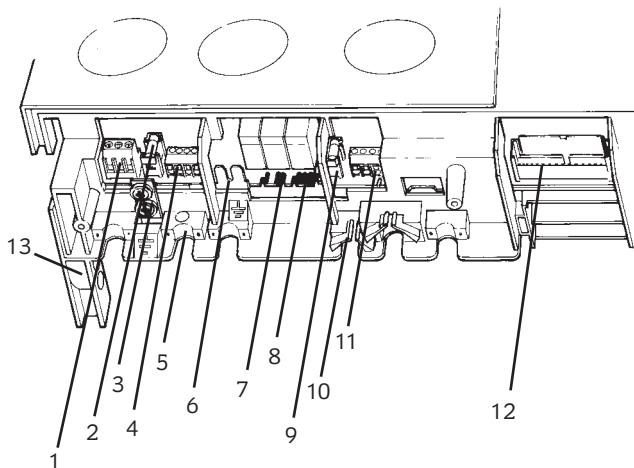


Fig 10 - Electrical Connections



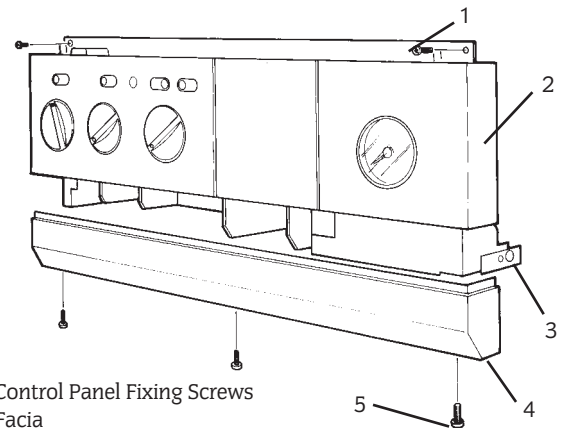
- | | |
|---|---|
| <ul style="list-style-type: none"> 1. ST12-Mains 2. Fuse-F1 3. Earth Screw 4. ST8-Room Thermostat and External Control -Mains Voltage 5. Cable Entry Screw Clamp 6. Earth Tag 7. ST15-Pump 8. ST1-Fan | <ul style="list-style-type: none"> 9. Fuse-F2 10. Cable Entry Clamp 11. ST13-24volt Controls (not used) 12. Main Harness and Clamp 13. Control Panel Pivot Point |
|---|---|

10.10. On very rare occasions an external frost thermostat might be considered where parts of the system are remote from the appliance. Refer to Worcester Heat Systems Technical Department for more information - Tel: 0990 266241.

10.11. A radio frequency room thermostat is available for use with the appliance.

10.12. Safety check: If there is an electrical fault after installation check for fuse failure, short circuits, incorrect polarity of connections, earth continuity or resistance to earth.

Fig 11 - Facia Connections Cover



- 1. Control Panel Fixing Screws
- 2. Facia
- 3. Control Panel Pivot Point
- 4. Connection Cover
- 5. Connection Cover Fixing Screws

Fig 12 - Mains Voltage External Controls Connections

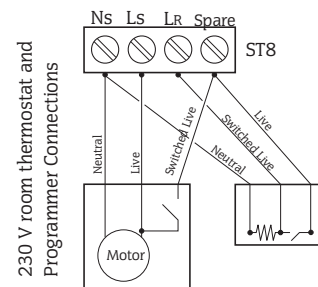
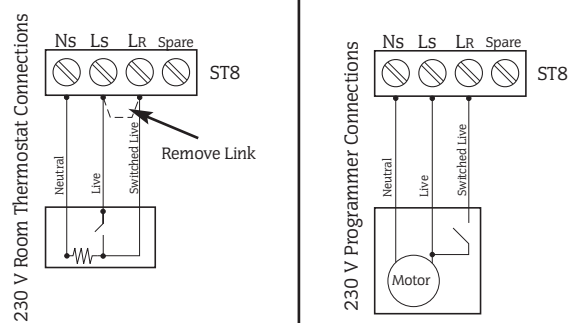


Fig 13 - Pictorial Wiring Diagram

1. Spark Generator
2. 6 Way In-Line Connector
3. 2 Way In-Line Connector
4. Gas Valve
5. Flow Switch
6. DHW Sensor
7. Spark Electrode
8. Sense Electrode
9. CH Pump
10. DHW Pump
11. Pump Relay PCB
12. CH Sensor
13. Fan
14. Overheat Cut-Off Thermostat
15. Air Pressure Switch

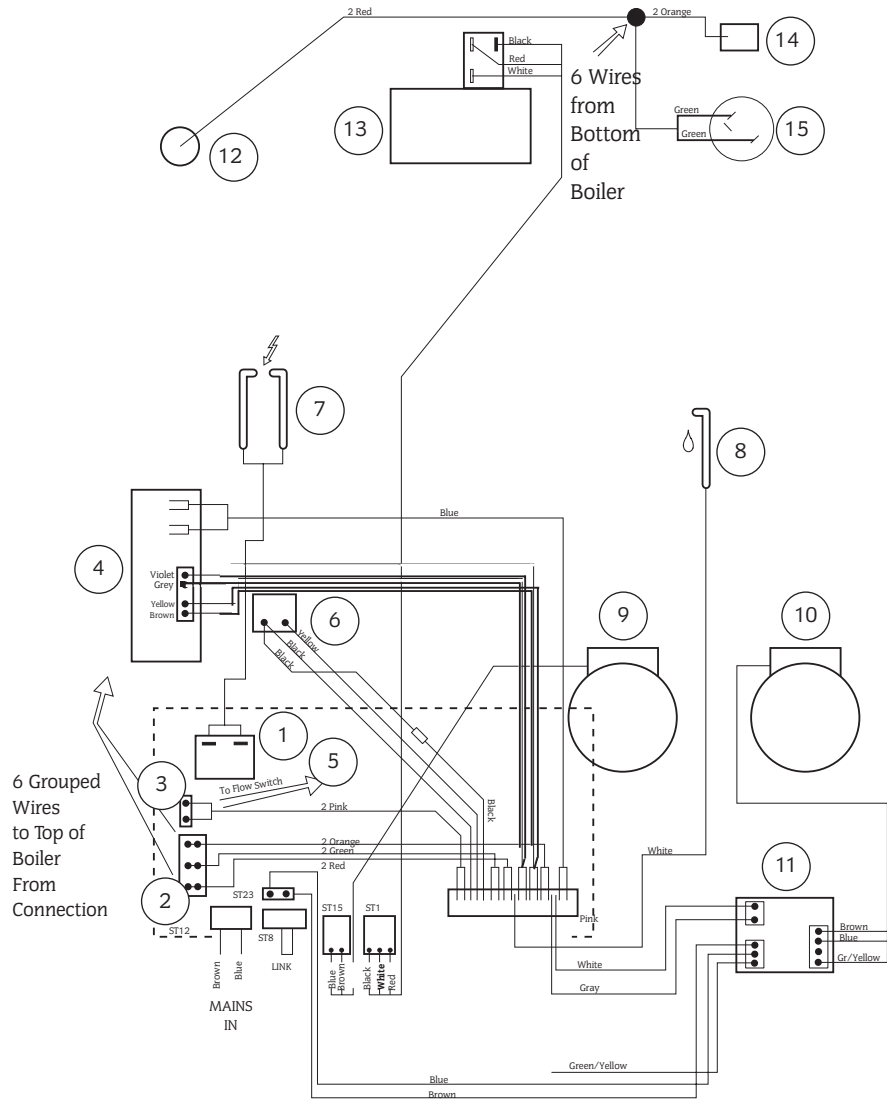
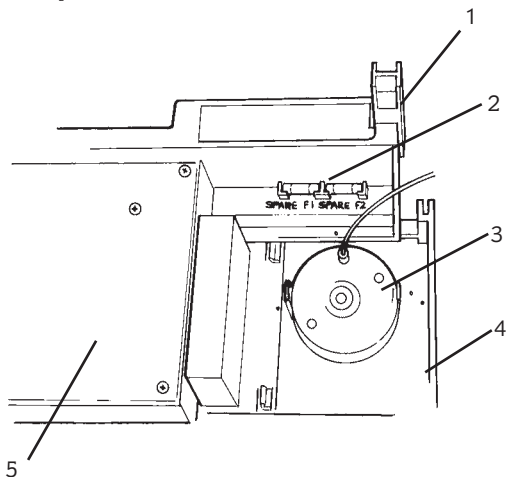


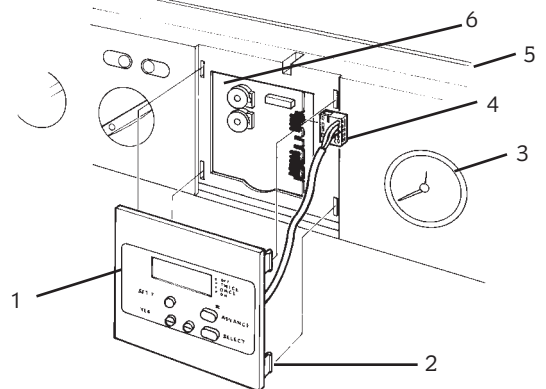
Fig 15 - Replacement Fuses



1. Control Panel Pivot Point
2. Fuses-F1, F2
3. Pressure Gauge

4. Facia Panel
5. Control Board Assembly

Fig 16 - Programmer Connection



1. Programmer
2. Programmer Fixing Clip
3. Pressure Gauge

4. Programmer Connector
5. Facia
6. Control Board

Fig 14 - Functional Wiring Diagram

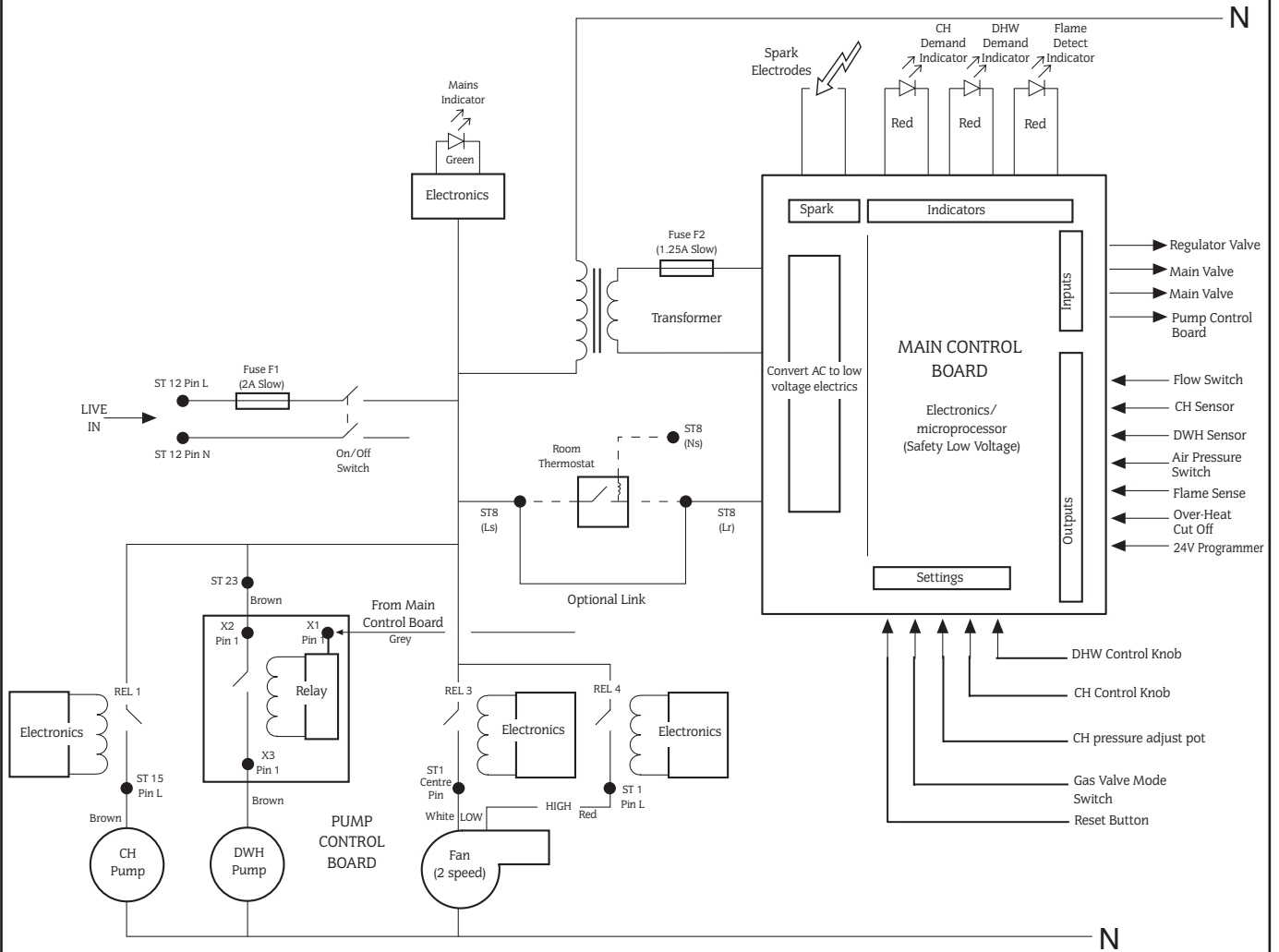
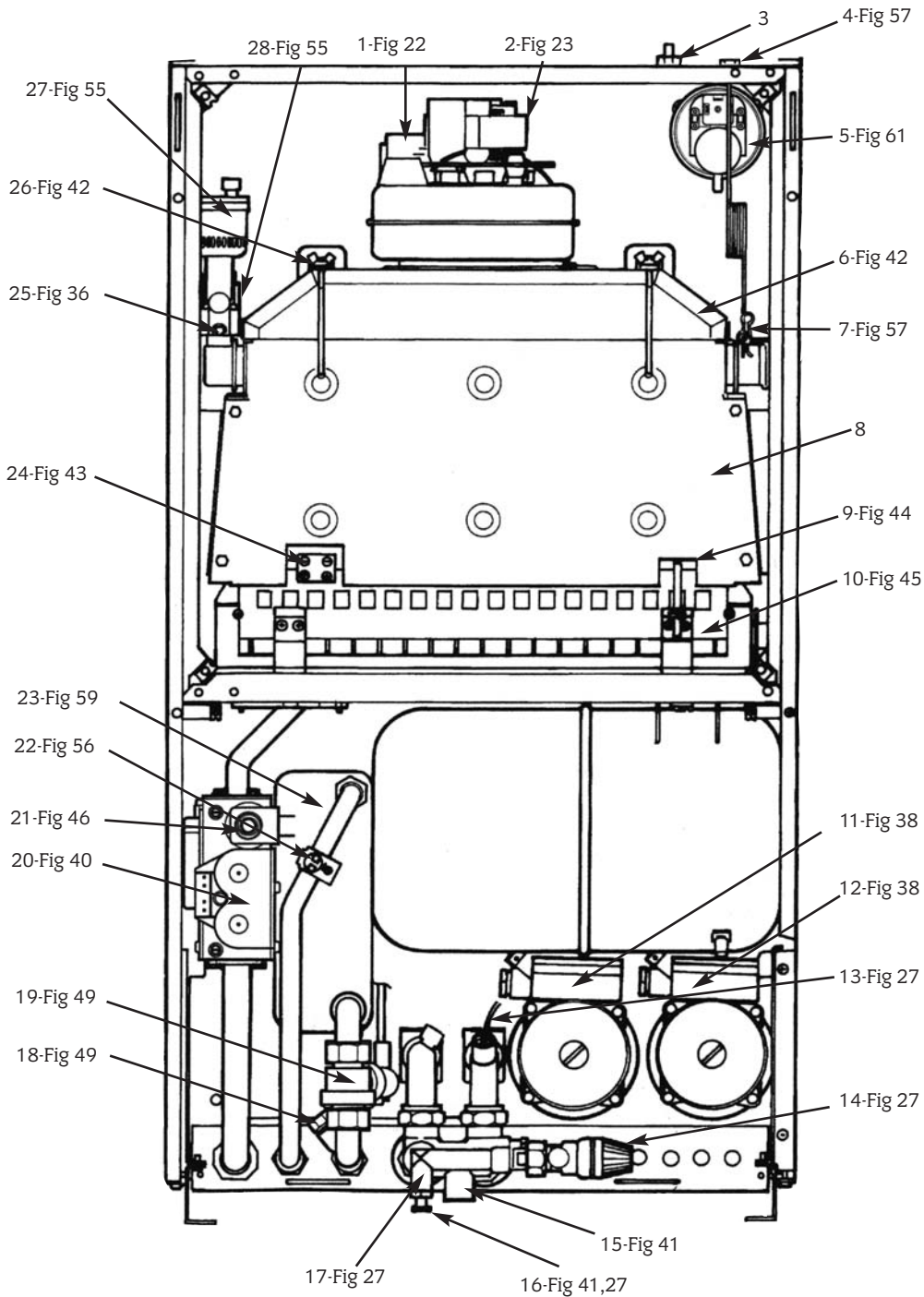


Fig 17- Front View of Appliance (control panel removed)



1. Fan & Flow Sensor
2. Fan Connections
3. Combustion Products Test Point
4. Overheat Thermostat
5. Air Pressure Switch
6. Flue Hood
7. Overheat Thermostat Phial
8. Combustion Chamber Cover
9. Flame Sense Electrode
10. Burner
11. Central Heating Pump
12. Domestic Hot Water Pump
13. Pressure Gauge Connection
14. Relief Valve
15. Bypass Adjuster
16. Drain Point
17. Flow/Return Manifold
18. Domestic Hot Water Expansion Vessel Connection (optional)
19. Domestic Hot water Flow Control Assembly
20. Gas Valve
21. Modulator Pressure Adjuster
22. Domestic Hot Water Sensor
23. Domestic Hot Water Heat Exchanger
24. Spark Electrode
25. Primary Flow Manifold
26. Flue Hood Fixing
27. Auto Air Vent
28. Primary (CH) Sensor

11. Installation

11.1. General.

- 11.1.1. The appliance is suitable for sealed systems only.
- 11.1.2. The flue must be installed in accordance with BS5440:1.

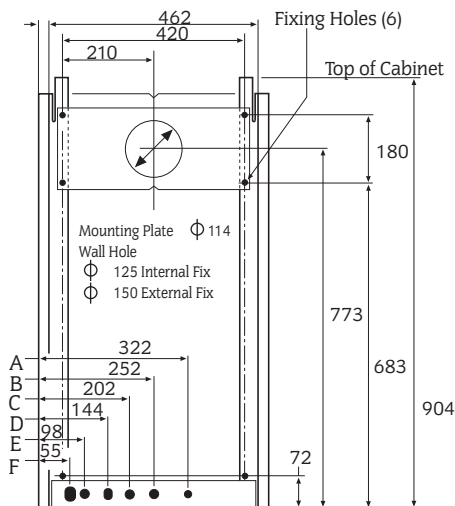
11.2. Unpacking and appliance preparation

- 11.2.1. Remove the appliance from its packing and lay it on its back.
- 11.2.2. Unscrew the connections linking the appliance to the wall mounting plate/manifold assembly and separate the two assemblies by lifting the base of the appliance and pulling the mounting plate/manifold assembly out from beneath the appliance.

11.3. Site preparation

- 11.3.1. Check that the wall is sound, flat and will support the weight of the appliance. Refer to Table 4.
- 11.3.2. Check that the correct position for the appliance has been chosen.

Fig 18- Wall Mounting Plate and Manifold Assembly



- | | |
|---------------------------|----------------------------|
| A. Relief Valve Discharge | D. Cold Water Inlet |
| B. Central Heating Return | E. Domestic Hot Water Flow |
| C. Central Heating Flow | F. Gas Inlet |

Fig 20- Rear Pipe Work Clearance

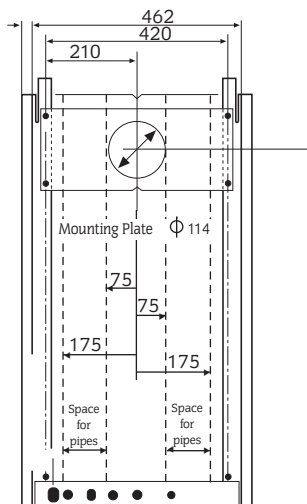
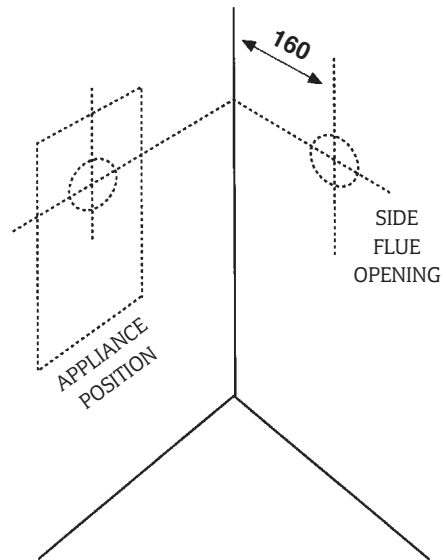


Fig 19- Side Flue Opening Position



11.4. Fixing holes and flue opening

- 11.4.1. Fix the template or the mounting plate/manifold assembly to the wall and mark the position of the fixing holes and the flue duct opening. Refer to Fig 18 and 19.
- 11.4.2. Check the position and alignment of the marks before drilling the fixing holes and the flue opening. **Note:** If a rear flue is to be used stick the foam gasket, supplied in the installation pack, onto the wall.

11.5. Wall mounting plate and manifold

- 11.5.1. If the flue is to be fitted from inside the room then it must be fitted through the wall before the wall mounting plate assembly is fitted to the wall. Refer to Section 11.8-9.
- 11.5.2. Fit the plugs and fix the plate/manifold assembly to the wall.
- 11.5.3. Check that the assembly is properly aligned before tightening the screws.
- 11.5.4. Notches on the manifold indicate the centrelines of the pipe connections.

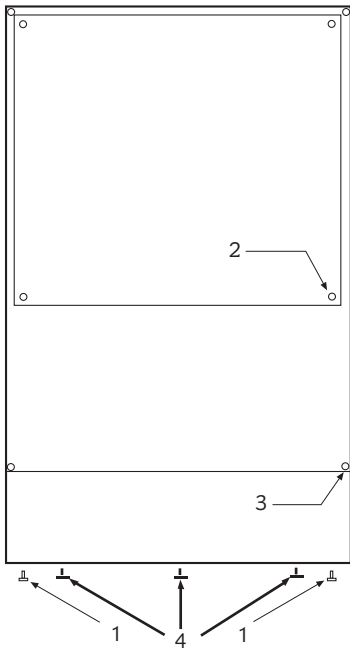
11.6. Gas and water pipes

- 11.6.1. Remove the gas cock, fix the appropriate fitting to connect the inlet pipe and replace. Refer to Fig 4.
- 11.6.2. **Pre-plumbing is not advised if no movement in the pipework is available.**

benchmark Before the appliance is fitted to the wall thoroughly flush the system and mains water supply.

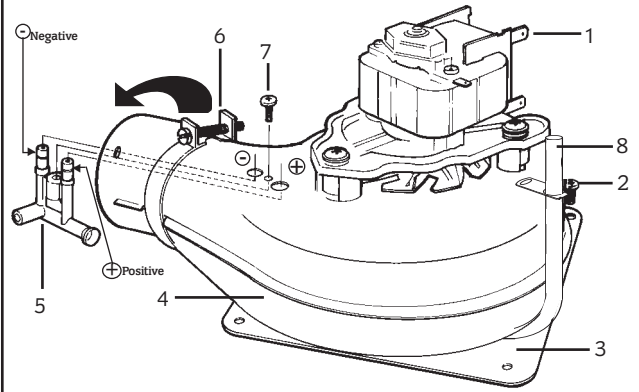
- 11.6.3. If it is necessary for any of the pipes to run up the back of the appliance then they must be arranged to pass either side of the flue duct outlet when a rear flue system is used. Refer to Fig 20.

Fig 21-Casing and Control Panel Fixing Screws



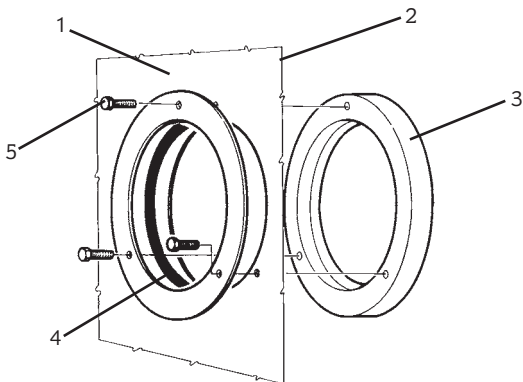
- 1. Transport Bracket and Bottom Panel Fixing Screws (2)
- 2. Inner Casing Fixing Screws (4)
- 3. Control Panel Fixing Screws (2)
- 4. Controls Connection Fixing Screws (3)

Fig 22- Fan and Air Flow Sensor Fixing



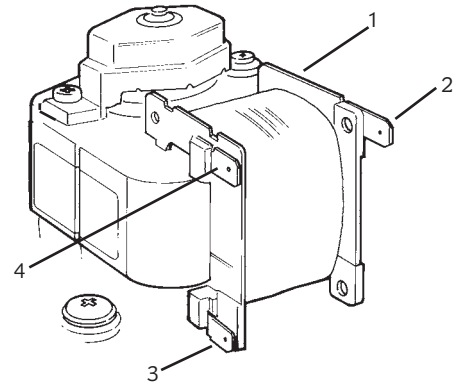
- 1. Electrical connections
- 2. Fan Assembly Fixing Screw
- 3. Fan Mounting Plate
- 4. Fan Casing
- 5. Air Flow Sensor
- 6. Flue Duct Clamp
- 7. Air Flow Sensor Fixing Screw
- 8. Flue Sample Tube

Fig 24-Air Duct Clamp Assembly



- 1. Air Duct - Inner
- 2. Cabinet Casing
- 3. Air Duct Clamp - Outer
- 4. Seal - Silicone
- 5. Fixing Screws (3)

Fig 23-Fan Motor Connections



- 1. Fan Motor
- 2. Connector - Neutral Black - 6.3mm
- 3. Connector - Low Speed White - 4.8mm
- 4. Connector - High Speed Red - 2.8mm

11.6.4. Pipework can only run horizontally outside the limits of the casing.

11.6.5. It is important that the pipes are not fixed near the appliance using clips that put a strain on the connections.

11.6.6. **Before the appliance is fitted to the wall thoroughly flush the system and mains water supply.**

11.7. Install Boiler

11.7.1. Remove the cabinet front panel by lifting off the bottom and pulling away.

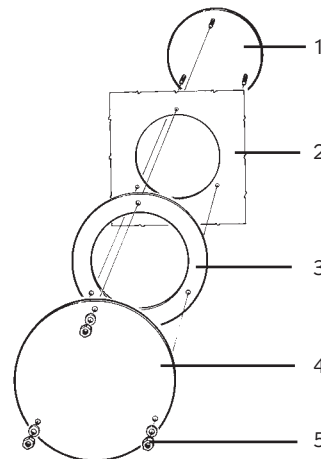
11.7.2. Remove the inner casing cover. Refer to Fig 21.

11.7.3. Pull off the tubes from the air flow detector and the flue sample tube. Carefully pull off the electrical connections at the fan. Refer to Fig 22,23.

11.7.4. Unscrew and remove the fan from the flue hood.

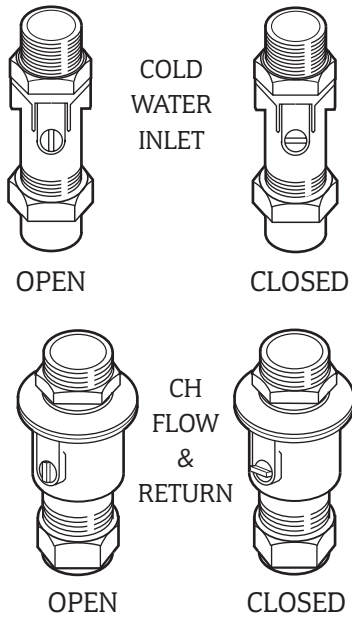
11.7.5. Fit the air duct clamp assembly to the appropriate exit from the appliance. Do not, at this stage, tighten the screws. Seal the unused openings using the cabinet blanking plate assembly. Refer to Fig 24,25.

Fig 25-Cabinet Blanking Plate Assembly



- 1. Outer Sealing Plate
- 2. Boiler Casing
- 3. Adhesive Sealing Gasket
- 4. Inner Sealing Plate
- 5. Nuts and Washers

Fig 26-Service Valve Operation



11.7.6. Check that the gas and water valves are closed. Refer to Fig 26.

11.7.7. Lift the appliance onto the wall mounting plate/manifold assembly ensuring that the connections fully enter the manifold fittings after it is supported at the top.

11.7.8. Secure the gas and water connections.

11.7.9. Fit a discharge pipe to the relief valve leading it away from any electrics or where it might be a hazard. The pipe must not be less than 15mm in diameter and must run continuously downward outside the appliance. Refer to Fig 27.

11.7.10. Remove the support brackets and fit the cabinet bottom panel. Refer to Fig 21.

11.8. Measure and cut the air and flue ducts

11.8.1. Measure the distance from the appliance. Refer to Fig 29,30.

11.8.2. Add the following distances onto the measurements.

- Rear: Air duct length = W + 65mm
- Flue duct length = W + 105mm
- Side: Air duct length = L + 15mm
- Flue duct length = L + 142mm

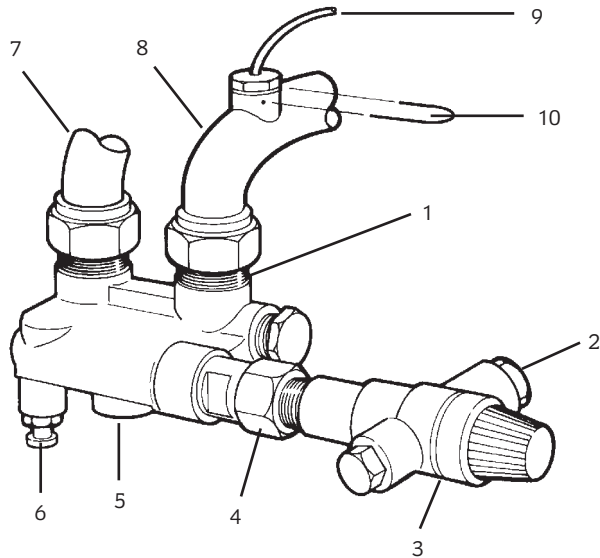


Fig 27-Relief Valve

1. Flow/Return Manifold
2. Discharge Pipe Connection
3. Relief Valve
4. Relief Valve Union Connection
5. Bypass Adjuster
6. Drain Point
7. Central Heating Flow
8. Central Heating Return
9. Pressure Gauge Capillary
10. Capillary Clip

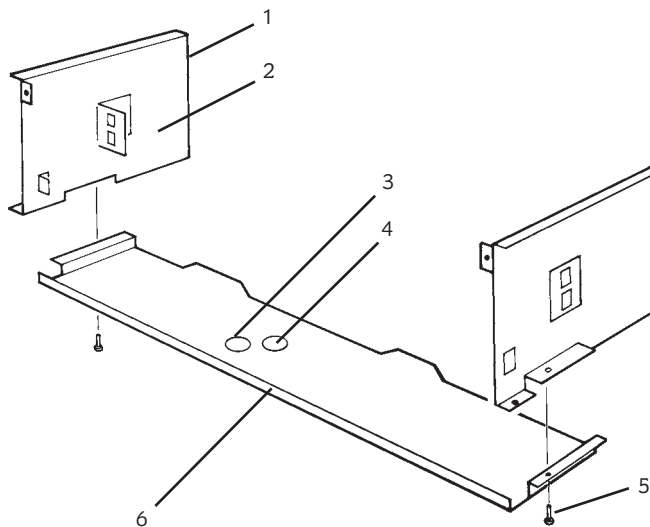


Fig 28-Casing Bottom Panel Fixing

1. Control Panel Side Support
2. In-line Connector Bracket
3. Drain Access Opening
4. Bypass Adjuster Access
5. Bottom Panel Fixing Screw (2)
6. Bottom Panel

11.8.3. Mark and cut the air and flue ducts to length. Always check the dimensions before cutting. Do not cut the drilled or the expanded ends of the ducts. Make the cuts square and smooth.

11.8.4 Assemble the air and flue ducts and the terminal assembly as shown in the diagrams. Do not forget to fit the flue support to an extended duct system. Refer to Fig 31,32.

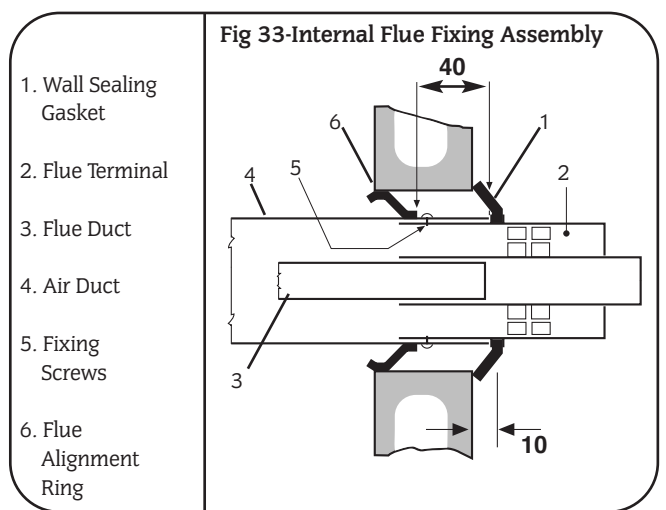
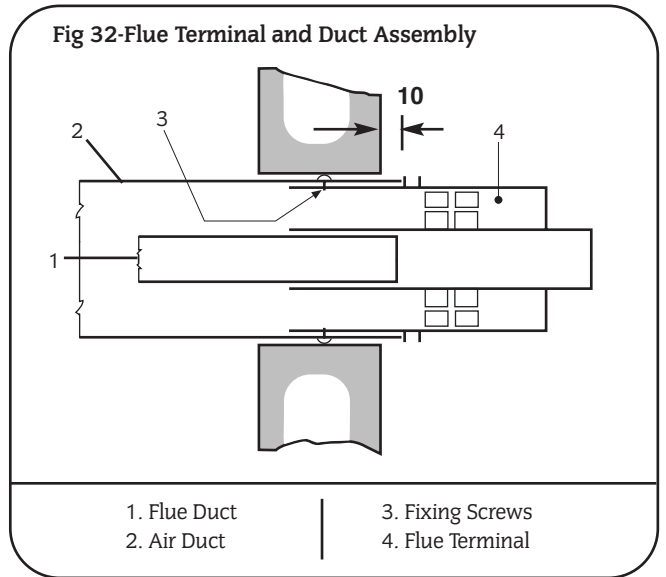
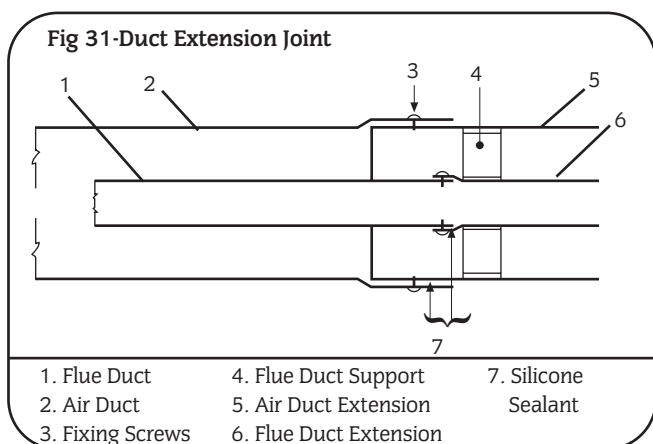
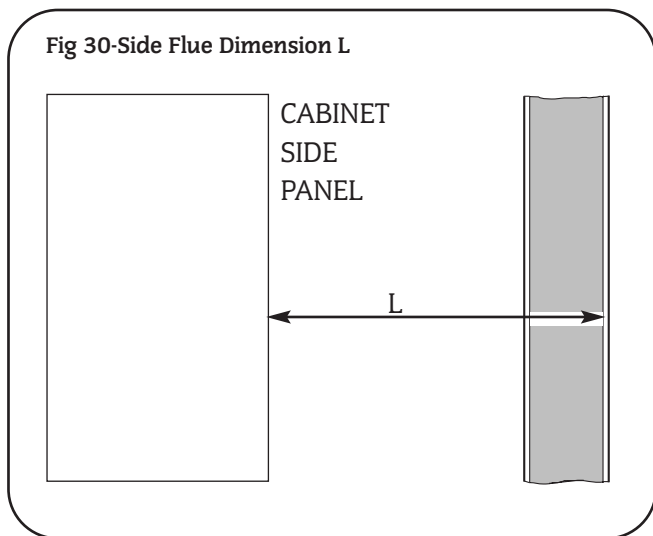
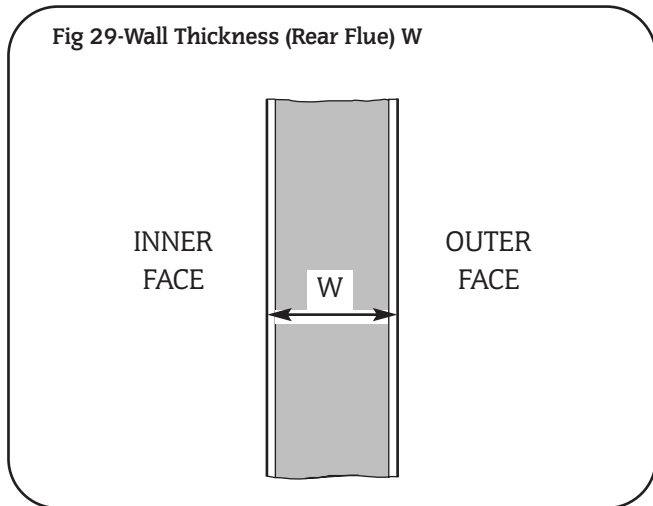
11.9. Internal fixing of the ducts

11.9.1. Fit the wall sealing collar and fix in place using the clip. Refer to Fig 33.

11.9.2. Tie a cord around the terminal from inside the flue duct leaving enough to grip and pull the duct into position.

11.9.3. Push the flue system through the hole in the wall until the sealing collar has passed through the outside wall.

Note: At this point fit the wall mounting plate/manifold assembly and the appliance. Refer to Section 11.7.7-10



11.9.4. Pull the cord to bring the flue sealing collar flush with outside wall.

11.9.5. Fit and secure the air duct into the clamp as shown in Fig.34. The air duct fits more easily if it is lubricated with soap solution. Fully engage the duct into the clamp taking care not to distort the seal. Tighten the three screws.

11.9.6. Pull the flue duct forward 50mm. Slide the flue clamp over the fan outlet.

11.9.7. Refit the fan in the appropriate position ensuring that the flue duct enters the fan outlet by 20mm before tightening the clamp as shown in Fig 36. **Note:** Remove the flue hood clamp wing-nut when a side flue arrangement is used. Replace and tighten the wing nut after re-fitting the fan.

11.9.8. Re-connect the tubes and electrical connections to the fan and air flow sensor ensuring that they are correctly positioned and to the flue sample tube. The **RED** tube is to the positive connection. Refer to Fig 22 and 23.

11.9.9. Make good the external brickwork or rendering. Make good the internal wall as necessary.

11.10. External fixing of the ducts

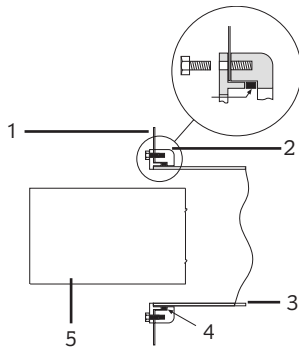
11.10.1. Prepare the duct assembly as described in Clause 11.8.

11.10.2. From outside ease the assembly through the wall.

11.10.3. Fit and secure the air duct into the clamp as shown in Fig 35. The air duct fits more easily if it is lubricated with soap solution. Fully engage the duct into the clamp taking care not to distort the seal. Tighten the three screws.

11.10.4. Pull the flue duct forward 50mm. Slide the flue clamp over the fan outlet.

Fig 34-Air Duct into Clamp



1. Boiler Casing
2. Air Duct Clamp Assembly
3. Air Duct
4. Silicone Rubber Ring
5. Flue Duct

11.10.5. Refit the fan in the appropriate position ensuring that the flue duct enters the fan outlet by 20mm before tightening the clamp as shown in Fig 36. **Note:** Remove the flue hood clamp wing-nut when a side flue arrangement is used. Replace and tighten the wing nut after re-fitting the fan.

11.10.6. Re-connect the tubes and electrical connections to the fan and venturi ensuring that they are correctly positioned and to the flue sample tube. Refer to Fig 22 and 23.

11.10.7. Make good the external brickwork or rendering and the flue sample tube. The inside edge of the rolled channel on the terminal assembly will be 10mm from the face of the wall. Make good the internal wall as necessary.

11.11. Completion of the installation

11.11.1. Remove the automatic air vent cap.

11.11.2. Replace the inner casing cover. Refer to Fig 21.

11.11.3. Check that all the gas and water connections on the manifold have been tightened.

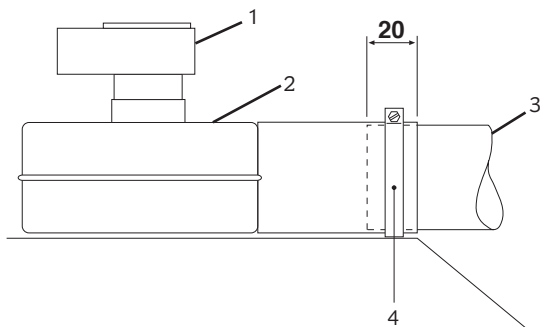
11.11.4. Fit the fascia mounted clock or programmer. Refer to the instructions sent with the control. Refer to Fig 16.

11.11.5. Remove the fascia bottom panel. Connect the mains supply to the appliance. The lead must be secured with the cable clamp provided. Check that there is sufficient loose lead to allow the release of the control box and that the earth lead of the mains supply is longer than the live and neutral leads. Refer to Fig 9, 10 and 11.

11.11.6. Test for gas soundness as described in BS6891.

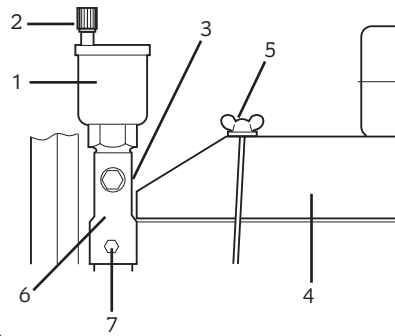
11.11.7. If the appliance is not to be commissioned immediately, replace the cabinet front and fascia bottom panels. Check that the gas, electricity and water connections are turned off. Refer to Fig 26.

Fig 36-Flue Duct into Clamp



- | | |
|---------------|--------------------|
| 1. Fan Motor | 3. Flue Duct |
| 2. Fan Casing | 4. Flue Duct Clamp |

Fig 35-Auto Air Vent



1. Auto Air Vent
2. Cap
3. Primary (CH) Sensor - Behind the Auto Air Vent
4. Flue Hood
5. Flue Hood Clamp
6. Primary Flow Manifold
7. Manifold Fixing Screw

12. Commissioning



Benchmark Water Treatment: For optimum performance after installation, this boiler and its associated central heating system should be flushed in accordance with the guidelines given in BS7593:1992 - Treatment of water in domestic hot water systems. Full instructions are supplied with proprietary cleansers sold for this purpose. If an inhibitor is to be used after flushing, it should be used in accordance with the inhibitor manufacturers instructions.

Suitable flushing agents and inhibitors are available from Betz Dearborn Tel: 0151 4209563 and Fernox Tel: 01799 550811. Instructions for use are supplied with these products.

12.1. Domestic hot water circuit: Confirm that the mains water supply has been flushed out at installation. If not it will be necessary to disconnect the cold water inlet pipe from the appliance and thoroughly flush.

12.2. Central heating system: Confirm that the system has been fully flushed out at installation using a flushing agent. Flush the system before starting to commission the appliance and, at the end of the commissioning procedure, add a suitable flushing agent and drain whilst hot. Immediately refill and re-pressurise.

12.3. Check that the gas service and electricity supply at the appliance are off.

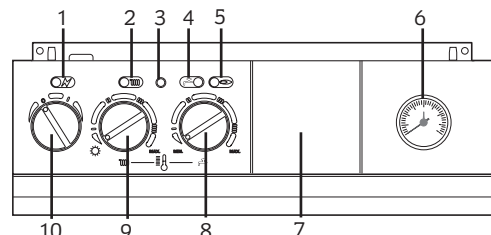
Check that the mains control knob or programmer is set to off. Refer to Fig 37.

Check that all the water connections throughout the system are tight.

12.4. Open the central heating system valves on the manifold. Open all the radiator valves and fill the system. The automatic air vent will vent the appliance. Remove the inner casing cover to check that the air vent cap has been removed. Replace the cover immediately. Vent each radiator in turn to remove air from the system. Refer to Fig 4, 21, 36.

12.5. Check that the pressure relief valve operates by turning the knob anti-clockwise until it releases water from the discharge pipe. Refer to Fig 27.

Fig 37-Facia Panel



- | | | |
|-----------------------|--|--|
| 1. Mains Supply Light | 6. System Pressure Gauge | 9. CH Temperature Control Knob and CH On/Off Control |
| 2. CH Demand Light | 7. Programmer/ Clock Position - (optional) | 10. Mains On/Off Control Knob |
| 3. Reset Button | 8. DHW Temperature Control Knob | |
| 4. DHW Demand Light | | |
| 5. Burner On Light | | |

12.6. Remove the cap from the front of each pump and turn the exposed shaft about half a turn using a flat bladed screw driver. Replace the caps. Refer to Fig 38.

12.7. Set the system pressure by filling the system until a pressure of 1.5 bar shows on the gauge and check for water soundness. Release water from the system through the pressure relief valve until the system design pressure is obtained.

System pressure in bar = Static head + 0.3.

Note 1bar = 10.2 metres of water.

The minimum system pressure should be 1bar.

Set the movable pointer on the gauge to coincide with the indicating pointer as a permanent record of the set system pressure.

12.8. The charge pressure of the expansion vessel must not be less than the static head at the vessel. The initial charge pressure of the expansion vessel is 0.5 bar (static head of 5 metres). A schraider type valve is fitted to the vessel for the charge pressure to be increased if necessary. Refer to Fig 39.

12.9. Refer to BS7074:1, BS5449 and Table 8 for details of the allowable system capacity.

If the system volume is greater than that which can be accommodated by the expansion vessel on the appliance then an extra vessel must be fitted as close to the appliance as possible in the return pipe.

12.10. Clock/Programmer: The controls fitted to the appliance should be set at this stage. Detailed instructions are sent with the control.

12.11. Check that the gas supply is turned off.

12.12. Connect a pressure gauge to the gas valve. Refer to Fig 40.

12.13. Check that the electricity supply is off.

12.14. Set the external controls and the domestic hot water temperature control knobs on the fascia to maximum. The central heating temperature control must be set at off (☸).

12.15. Turn the gas on at the service cock. Refer to Fig 26.

12.16. Turn on the electricity supply to the appliance. Refer to Fig 37.

12.17. Open the domestic water inlet valve and fully open a hot water tap.

12.18. Check Pressure. The boiler should light at minimum burner pressure of 1.5mbar (G20) or 6.0mbar (G31) and immediately increase to a maximum of 14.2mbar (G20) or 34.7mbar (G31). The pressures have been set at the factory and no adjustment of the gas valve should be necessary.

If the maximum pressure is not correct then check that the inlet pressure to the appliance is 20mbar (G20) or 37mbar (G31). Refer to Section 9.3.

If the burner does not light then check the overheat thermostat by pressing the reset button on the fascia. Refer to Fig 37. If it still does not light then turn the hot water tap on and off a few times to purge the gas line of air. If ignition still does not occur after several attempts then contact WHS Technical Information Department, Telephone 0990 266241.

With the boiler alight hot water at a rate of upto 12.6 (±15%) litres/min will be delivered at full temperature after a short warm up period.

Slowly close the tap and see the burner pressure drop.

Fully open the tap and the pressure should rise.

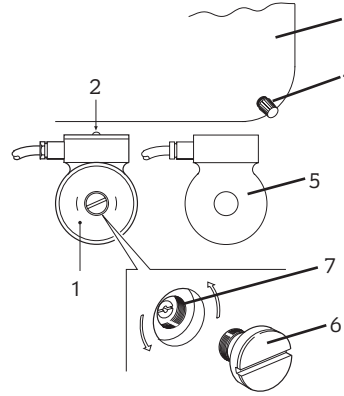
Shut the tap and check that the burner goes off, the fan or pump will continue to run for a short period.

12.19. Set the central heating temperature control to maximum.

12.20. The burner should light at the minimum burner pressure and remain at this figure for about two minutes and then increase over a 1 minute period to a pressure equivalent to a heating load of 25kW. The output will then automatically adjust to the system load.

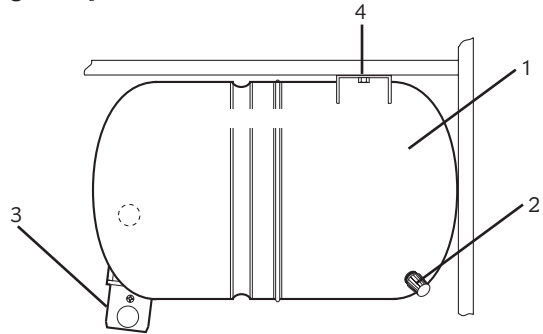
Check that all the radiators are heating evenly. Shut down some of the radiators and see the burner pressure fall and rise again as they are re-opened.

Fig 38-Pumps



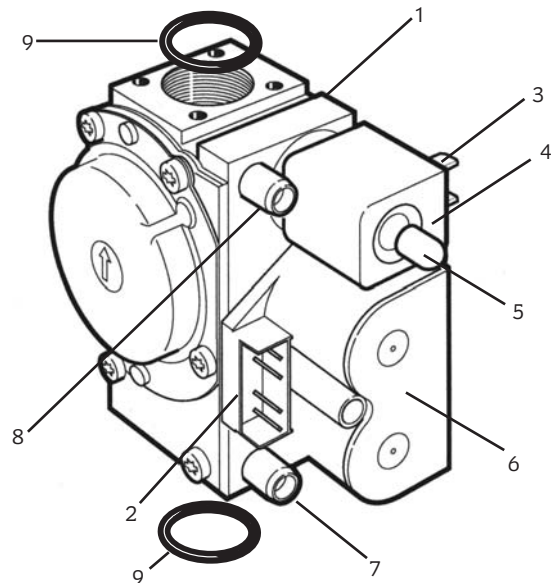
1. Central Heating Pump
2. Electrical Connection Cover Fixing Screw (not accessible with the pump in-situ)
3. Expansion Vessel
4. Charging Valve
5. Domestic Hot Water Pump
6. Pump Cap
7. Impeller Adjustment

Fig 39 Expansion Vessel



- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Expansion Vessel 2. Charging Valve | <ol style="list-style-type: none"> 3. Fixing Clip - UP to Release
DOWN to Lock 4. Fixing Screw |
|--|--|

Fig 40-Gas Valve



- | | |
|--|--|
| <ol style="list-style-type: none"> 1. Gas Valve 2. Connector 3. Connections 4. Modulator 5. Pressure Adjustment (shown with cap in place) | <ol style="list-style-type: none"> 6. Solenoids 7. Inlet Pressure Test Point 8. Burner Pressure Test Point 9. 'O'Rings |
|--|--|

Balance the system so that the specified temperature difference is obtained. Shut the radiators and adjust the bypass until the same temperature difference is obtained. Refer to Fig 41.

Set the room thermostat to minimum and check that the burner goes out and comes back on after a period of about three minutes after the room thermostat is reset to maximum. Switch the burner off by setting the CH temperature control knob to off.

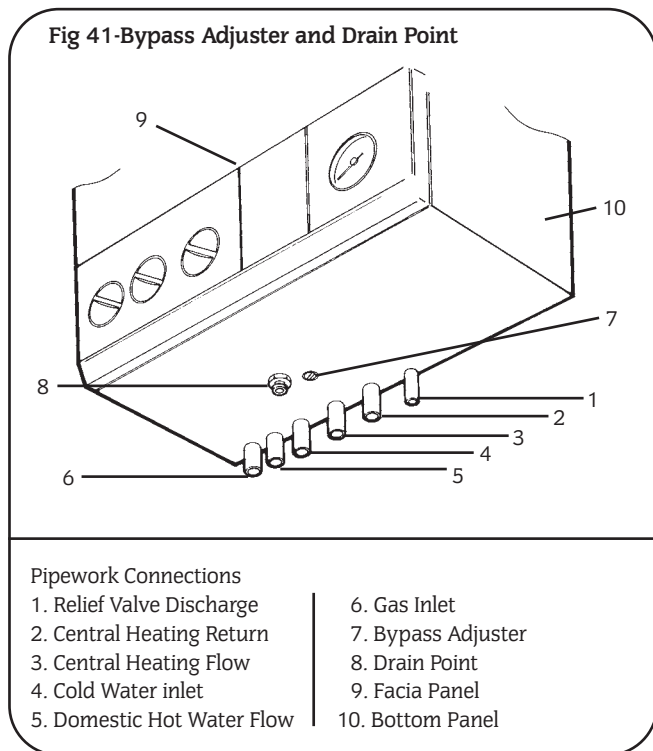
12.21. Turn off the electricity to the appliance. Drain the heating system as described in Section 15.3.1. Refill and re-pressurise as described in Section 12.4-8 adding a suitable proprietary inhibitor if necessary. Further information is available from WHS Technical Information Department, Telephone 0990 266241.

12.22. **Completion of Commissioning:** Disconnect the pressure gauge and tighten the test point screw. Restart the appliance and check for gas soundness around the test point screw.

Refer to Fig 40.

12.23. Refit the cabinet front panel.

12.24. If the appliance is to be passed over to the user immediately then set the controls to the users requirements. Refer to Section 13.



12.25. If the appliance is to be left inoperative in frosty conditions then check that the programmer, if fitted, is set to Off. The appliance will operate under the control of the integral frost protection facility. Do not switch the electricity supply off.

12.26. If there is any possibility of the appliance and the system being left totally unused in freezing conditions then switch off the gas and electricity and drain the appliance and the system. Refer to Fig 41.

13. User Information

13.1 Tell the user how to operate the appliance and hand over the Users Instructions leaflet.

13.2 Tell the user what to do if the heating system is not to be used in frosty weather.

13.3 Tell the user the sealed system set pressure.

13.4 Tell the user of the importance of regular servicing. Worcester Heat Systems Ltd. offer a comprehensive maintenance contract.

13.5 Set the system controls to the user's requirements.

13.6 **Complete and hand over to the user the Benchmark Log-Book.**

14. Inspection and Servicing

14.1 SERVICING

To ensure continued efficient operation of the appliance it must be checked and serviced as necessary at regular intervals. The frequency of servicing will depend upon the particular installation conditions and usage, but once per year should generally be adequate. The extent of the service required by the appliance is determined by the operating condition of the appliance when tested by fully qualified engineers.

Any service work must be carried out by competent engineers such as British Gas or Corgi registered personnel.

14.2. Inspection

14.2.1 Check that the flue terminal and the terminal guard, if fitted, are clear and undamaged.

14.2.2 If the appliance is in a compartment or cupboard, check that the service space around the appliance is clear. Refer to Fig 3.

14.2.3 Check all the joints and connections in the system and remake any that show signs of leakage. Refill and re-pressurise as described in Section 12.4-8 - Commissioning.

14.2.4 Operate the appliance and take note of any irregularities. Refer to Section 18, Fault Finding for rectification procedures.

Check the combustion performance. Remove the screw at the sample point, on top of the appliance. Connect the sampling meter. Refer to Fig 17. With the appliance at maximum rate and stable in the DHW mode expect readings of 4.5 - 6.5 % CO² and 0.0025-0.009% CO. Refit and tighten the screw after the test. These figures cover all the flue lengths.

14.2.5 **Disconnect the electrical supply at the mains and turn off the gas supply at the gas service cock on the appliance before starting any service procedures.**

14.2.6 Always test for gas soundness after the service has been completed.

14.3 Component Access

14.3.1 To service the appliance it may be necessary to remove some or all of the following parts to gain access to components which may need to be checked or replaced.

14.3.1.1 Cabinet front panel. Lift and pull away.

14.3.1.2 Facia/Control box. Unscrew the two screws and lower. Refer to Fig 21.

14.3.1.3 Inner casing cover. Unscrew the four screws and remove. Refer to Fig 21.

14.3.1.4 Combustion chamber cover. Unscrew the four screws, slacken the flue hood J-bolts and remove. Refer to Fig 42.

14.3.1.5 Fan. Carefully pull off the electrical connections, pull off the tubes from the air flow sensor and flue sample tube, unscrew the assembly fixing screw. Unscrew the flue duct clamp to release the flue duct and slide the fan assembly out. Refer to Fig 22, 23 and 34.

14.3.1.6 Flue hood. Remove the fan. Unscrew the two J-bolts and remove. Refer to Fig 42.

14.3.1.7 Burner blade assembly. Remove the spark and sensing electrodes and the support brackets. Refer to Section 15.4.2/3. Unscrew the blade assembly fixing screws and loosen the two locating screws. Lift the blade assembly from the appliance. Refer to Fig 43, 44, 45.

14.3.1.8 Cabinet bottom panel. Unscrew the two screws and remove. Refer to Fig 28.

14.4 Component Cleaning

Only use a non-metallic brush to clean components.

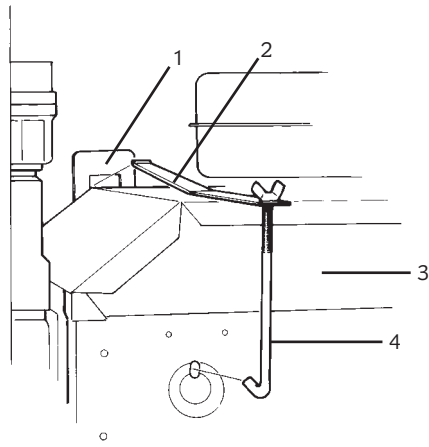
14.4.1 Clean the fan, taking care not to block the air flow detector.

14.4.2 Clean the burner blade assembly to ensure that all the ports are clear.

14.4.3 Clean the electrodes. Replace if there is any deterioration of an electrode.

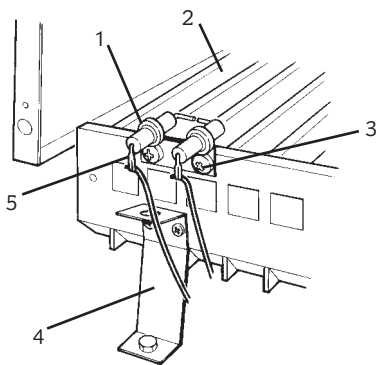
14.4.4 Clean the burner manifold. Inspect the burner manifold and remove any deposits. Do not use any metal probes to clean the injectors.

Fig 42-Flue Hood Fixing



- | | |
|--------------------|------------------------|
| 1. Clamp Location | 3. Flue Hood |
| 2. Flue Hood Clamp | 4. J-Bolt and Wing Nut |

Fig 43-Spark Electrode



1. Spark Electrode Assembly
2. Burner Blade Assembly
3. Fixing Screws (2)
4. Burner Support Bracket
5. Electrode Lead Connection (Push on)

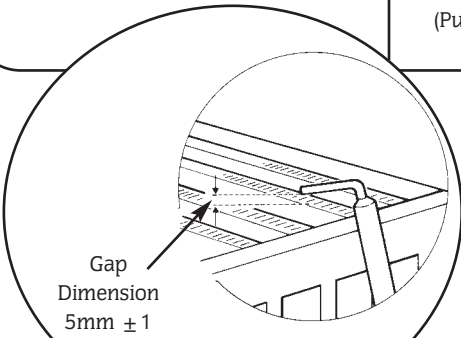


Fig 44-Flame Sense Electrode

1. Flame Sense Electrode
2. Electrode Mounting and Burner Support Bracket
3. Fixing Screws (2)
4. Burner Blade Assembly

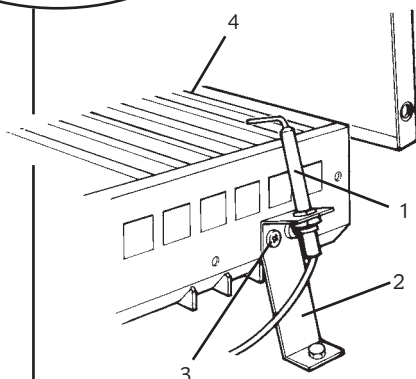
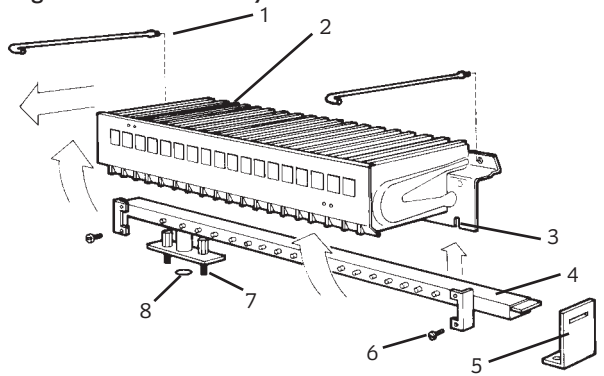


Fig 45-Burner Assembly



- | | |
|---|--------------------------------|
| 1. Burner Blade Assembly Fixing Screw (2) | 5. Manifold Support Bracket |
| 2. Burner Blade Assembly | 6. Burner Blade Locating Screw |
| 3. Burner Location Slot | 7. Manifold Fixing Screw |
| 4. Burner Manifold With Injectors | 8. O-Ring |

14.4.5 Clean the primary heat exchanger. Cover the burner manifold. Remove any deposits from the heat exchanger gaining access from the top and bottom. Carefully straighten any distorted fins on the heat exchanger.

14.4.6 Check the combustion chamber insulation. Replace the insulation if there is any damage or deterioration. Refer to Section 15.4.4.

14.4.7 Clean the controls in-situ using a non-metallic brush.

14.4.8 Carefully refit any components removed in the reverse order. Check that all screws are tight and the connections properly remade.

14.4.9 Recommission the appliance, as necessary, for correct operation to the users requirements.

15. Replacement of Parts

15.1 Important: Turn off the gas and electricity supplies before replacing any components.

After the replacement of any components always check for gas soundness where relevant and carry-out functional checks as described in Section 12 - Commissioning.

Any O-ring or gasket that appears damaged must be replaced. Complete gasket and O-ring packs are available for the gas and water connections on the appliance.

15.2. Component Access:

Refer to Section 14.3.1.1-4 for access to components.

15.3 Draining the Appliance

15.3.1 Primary System : Turn off the heating flow and return valves at the appliance. Refer to Fig 26. Fit a tube to the drain connection and open about one turn by turning anti-clockwise. Close the drain tap when the water flow from the appliance has stopped. Refer to Fig 41.

15.3.2 DHW Circuit : Turn off the mains cold water supply at the appliance. Refer to Fig 26. Open a hot tap below the level of the appliance to drain the domestic water circuit in the appliance.

15.3.3. Important: A small quantity of water will remain in some components even after the appliance has been drained. Cover any electrical components when removing these items.

15.4 Component Replacement:

Refer to Fig 17 for an indication of the location of the various components.

Replace any components removed from the appliance in the reverse order using new gaskets/O-rings/sealant where necessary. Always check that any electrical connections are correctly made and that all screws are tight.

Remove casing and cover panels and lower the facia, as necessary, to gain access to the controls. Refer to Clause 14.3.1.1-7.

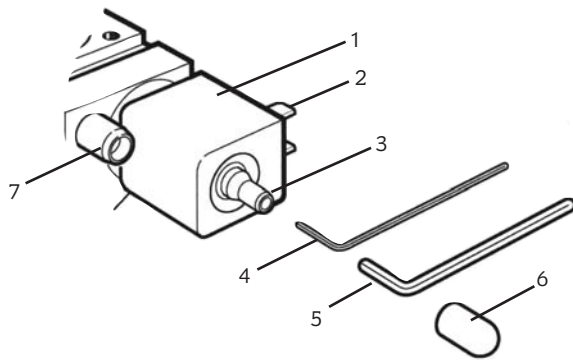
15.4.1. Gas valve

Disconnect or unplug the electrical connections at the valve. Remove the bottom panel. Unscrew the four flange screws at the top and the union connection at the bottom manifold and remove the assembly. Use the new O-rings provided when fitting the new valve. Refer to Fig 40.

Set the gas valve:

1. Connect a pressure gauge to the burner pressure test point on the gas valve. Refer to Fig. 40.
2. Switch on the gas and electrical supplies. Check for gas tightness at the gas valve inlet.
3. Carefully pull off a connection from the Modureg adjuster on the gas valve. Fully open a hot water tap. The burner will light and operate at the minimum pressure.
4. Remove the cap from the Modulator.
5. Adjust the Modulator with a 3mm hexagonal key to give the minimum pressure appropriate to the gas, clockwise to increase, and counter-clockwise to decrease the pressure. 1.5 mbar for natural gas (G20) or 6 mbar for propane (G31). Refer to Fig. 46.

Fig 46-Burner Pressure Adjuster (Modulator)



- | | |
|---|---|
| 1. Modulator | 5. 3mm Hexagonal Key
(Minimum Pressure Adjustment) |
| 2. Connections | 6. Modulator Cap |
| 3. Min/Max Pressure Adjuster | 7. Burner Pressure Test Point |
| 4. 2mm Hexagonal Key
(Maximum Pressure Adjustment) | |

6. Switch the appliance off. Refit the electrical connector to the Modulator. With the hot water tap fully open, turn on the appliance. The burner will light at the minimum pressure, and then quickly increase to the maximum pressure. Adjust the Modulator with a 2mm hexagon key to give the maximum pressure appropriate to the gas, clockwise to increase and counter-clockwise to decrease the pressure. 14.2 mbar for natural gas (G30) or 34.7 mbar for propane (G31).

NOTE: if there is any difficulty in achieving these pressures then check the inlet pressure at the gas valve. Refer to Section 9.3.

7. Turn off the hot water tap.
8. Replace the Modulator cap.
9. Run the appliance in each mode to check the setting pressures. Central heating, 8.3mbar for natural gas (G20) or 19.2mbar for propane (G31). Refer to Section 15.4.11 if necessary, to set the central heating pressure.
10. Switch off the appliance and disconnect the pressure gauge.
11. Relight the appliance and check for gas soundness.

15.4.2. Spark Electrode

Remove the inner casing cover.

Carefully pull off the leads at the electrode assembly. Unscrew the two screws and remove the spark electrode assembly from the burner. Refer to Fig 43.

15.4.3. Flame Sensing Electrode

Remove the inner casing cover.

Separate the electrode lead in-line connector. Release the locknut on the support bracket and remove the sensing electrode from the burner. Refer to Fig 44.

15.4.4. Burner and Manifold

Remove the electrodes.

Remove the burner support brackets.

Remove the combustion chamber cover. Unscrew the two blade assembly fixing screws and loosen the two locating screws. Lift the blade assembly from the manifold. Remove the two extended screws and lift out the manifold assembly. Do not omit the O-ring when fitting the new burner. Refer to Fig 45.

15.4.5. Combustion Chamber Insulation

Remove the combustion chamber cover.

Slide out the side insulation pads and then lift out the rear pad. Fit new insulation pads in the reverse order. Remove and replace the pad from the combustion chamber front cover. Refer to Fig 47. To avoid the risk of fine particles dampen the pads before removal.

15.4.6. Pressure Gauge

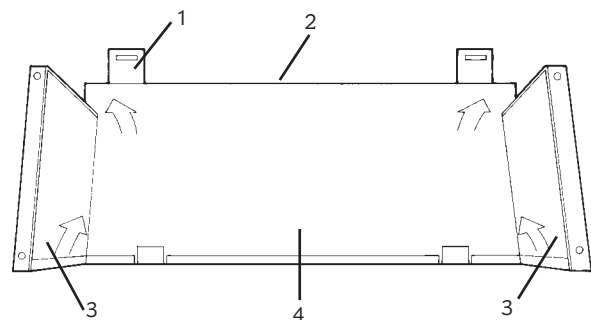
Drain the primary system. Refer to 15.3.1. Lower the facia and unclip the gauge. Pull out the clip from the manifold and remove the capillary. Refill and pressurise as described in Section 12.4.8 - Commissioning. Refer to Fig 27 and 48.

15.4.7. Relief valve

Drain the primary system. Refer to 15.3.1. Lower the facia.

Disconnect the relief valve drain pipe. Undo the union connection and remove the relief valve. Refill and pressurise as described in Section 11 - Commissioning. Refer to Fig 27.

Fig 47-Combustion Chamber Insulation



1. Flue Hood Clamp Location Slots
2. Combustion Chamber Casing
3. Side Insulation Pads
4. Rear Insulation Pad

15.4.8. Flow Regulator

Drain the hot water circuit. Refer to 15.3.2. Lower the facia.

Remove the bottom panel.

Slacken the inlet water pipe at the manifold. Disconnect and remove the flow switch. The flow regulator and its associated plastic retaining collar are located in the outlet of the flow switch body. Note the orientation of the regulator inside the flow switch body, remove the regulator and collar. Ensure the new regulator is correctly aligned and then insert the plastic collar. Ensure the flow switch is refitted with the arrow pointing upwards.

Refer to Fig. 49.

15.4.9. Inlet Water Filter

Drain the hot water circuit. Refer to 15.3.2. Remove the bottom panel. Lower the facia.

Disconnect the inlet water pipe at the manifold and the flow switch. Remove the filter. Ensure that the new filter is correctly aligned. Refer to Fig 49.

15.4.10. Flow Switch

Drain the hot water circuit. Refer to 15.3.2.

Lower the facia.

Unscrew and remove the flow switch. Ensure that the new switch is correctly aligned with the arrow pointing upwards.

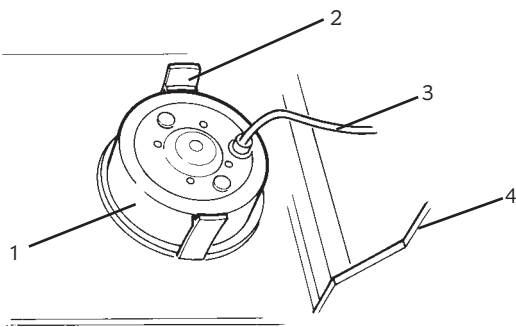
Refer to Fig 49.

15.4.11. Control Board

Remove the bottom cover from the facia by releasing the three screws. Unplug or disconnect all the connections at the board. Refer to Fig 9,10 and 11.

Unscrew and lower the facia. Refer to Fig 21.

Fig 48-Pressure Gauge Fixing



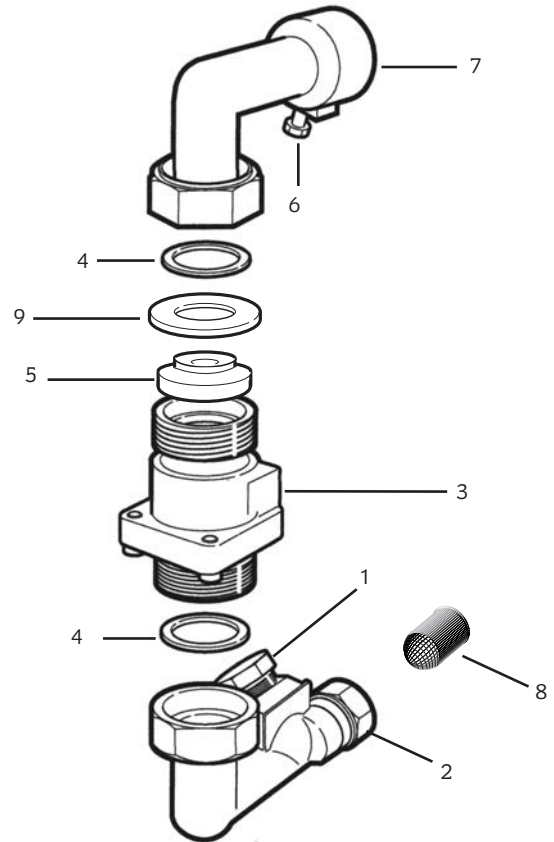
1. Pressure Gauge
2. Pressure Gauge Fixing Clip
3. Pressure Gauge Capillary
4. Facia

Unclip and remove the splash guard. Unscrew the four screws and remove the control board assembly. Remove the control board from the mounting plate by releasing the four clip fixings. Pull off the transformer and fit it to the new control board ensuring that it is properly aligned. Ensure that all connections are correctly made when re-assembling the control board. Refer to Fig 51 and 52.

Set the CH pressure:

1. Check the operation of the appliance to determine the minimum and maximum set burner pressures.
2. Reset, if necessary. Refer to Section 15.4.1.
3. Operate the appliance in the central heating mode with the control at maximum.
4. Turn the CH gas pressure adjuster fully clockwise, wait until the burner pressure has stopped increasing and then slowly turn the CH gas pressure adjuster anti-clockwise until the burner pressure is 8.3mbar for natural gas (G20) or 19.0mbar for propane (G31). Refer to Fig 51.
5. After completing the adjustments, check the pressure settings in both modes of operation and re-adjust as necessary.

Fig 49-Domestic Hot Water Control Assembly



- | | |
|--|---|
| 1. Domestic Hot Water Expansion Vessel Connection (optional) | 6. Hexagonal Fixing Screw |
| 2. Inlet Union Connector | 7. Domestic Hot Water Heat Exchanger Connection with O-Ring |
| 3. Flow switch body | 8. Inlet Water Filter |
| 4. Sealing Washer (2) | 9. Backing Collar |
| 5. Flow Regulator | |

15.4.12. Transformer

Follow the instructions given in Section 15.4.11 to remove the transformer.

15.4.13. Pump Control Board

Remove the bottom cover from the facia. Refer to Fig 11. Unplug and remove the pump control board. Refer to Fig 53.

15.4.14. Programmer

Remove the programmer assembly from the facia by carefully pulling it from the facia to free the clips. Unplug the connection at the control board. Comprehensive setting instructions are sent with the new programmer. Refer to Fig 16.

15.4.15. Fan

Remove the inner casing cover.

Refer to 14.3.1.1-5. Ensure that all the connections are correctly made to the new fan. Refer to Fig 22 and 23.

15.4.16. Air Flow Detector

Remove the inner casing cover.

Refer to 14.4.1-5 to remove the fan assembly. Unscrew and remove the detector. Check that the tubes are correctly fitted. Refer to Fig 22 and 23.

15.4.17. **CH Sensor**

Remove the inner casing cover.

Carefully pull off the connections and release the clip to remove the sensor. Apply heat transfer paste to the face of the new sensor. Refer to Fig 55. **Note:** If a left-hand flue is fitted then it is easier to remove the sensor and clip before pulling off the connections

15.4.18. **DHW Sensor**

Lower the facia.

Carefully pull off the connections and unscrew the clip to remove the sensor. Apply heat transfer paste to the face of the new sensor. Refer to Fig 56.

15.4.19. **Boiler Overheat Thermostat**

Remove the inner casing cover.

Carefully pull off the connections. Unscrew the thermostat locknut. Remove the split pin and pull out the phial from the heat exchanger pocket. Apply heat transfer paste to the phial. Refer to Fig 57.

15.4.20. **CH and DHW Pumps**

Lower the facia.

Drain the primary system. Refer to 15.3.1. Pull out the pump fixing clips and withdraw the pump. Improved access can be achieved by removing the expansion vessel. Refer to Section 15.4.21. Disconnect the leads at the appropriate pump head. Refer to Fig 17. **Note:** There will be a small amount of water still in the pump body. Refer to Fig 58.

The pump head is a Grundfos 15/60 and may be replaced leaving the body in place if necessary. Take care not to mark the mating surfaces if this done. Set to maximum. Refill and pressurise as described in Section 12.4-8 - Commissioning.

15.4.21. **Expansion Vessel**

Lower the facia.

Drain the primary system. Refer to 15.3.1. Unscrew the fixing screw. Release the vessel connection to the system by pushing the clip upwards and remove the vessel. **Note:** There will be a small amount of water in the vessel. Refill and pressurise as described in Section 12.4-8 - Commissioning. Refer to Fig 54.

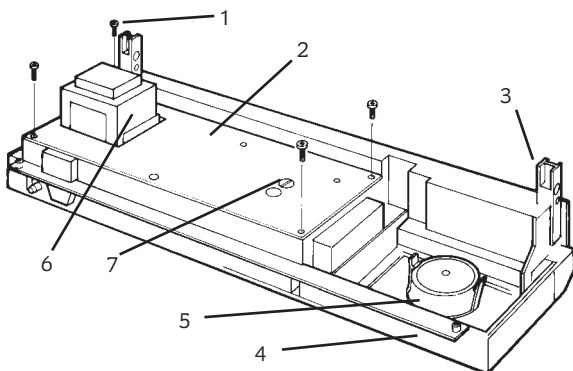
15.4.22. **DHW Heat Exchanger**

Lower the facia.

Drain the primary system and the DHW circuit. Refer to 15.3.1 and 15.3.2.

Carefully unscrew and remove the pipe connections to the heat exchanger. Release the clips and remove the heat exchanger. **Note:** There will be a small amount of water still in the heat exchanger. Do not strain the pipes when re-connecting them to the heat exchanger.

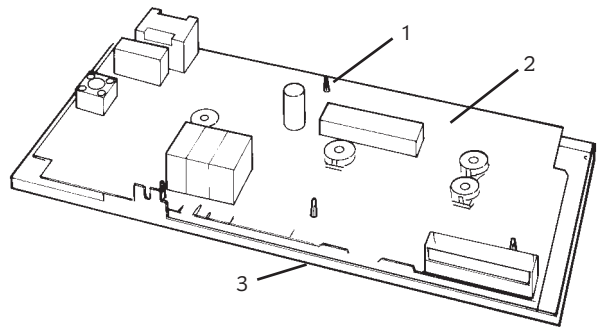
Fig 51-Control Board Mounting Plate Fixing



- | | |
|------------------------------|---|
| 1. Fixing Screws (4) | 7. Central Heating Mode Gas Pressure Adjuster |
| 2. Mounting Plate | |
| 3. Control Panel Pivot Point | |
| 4. Facia | |
| 5. Pressure Gauge | |
| 6. Transformer | |

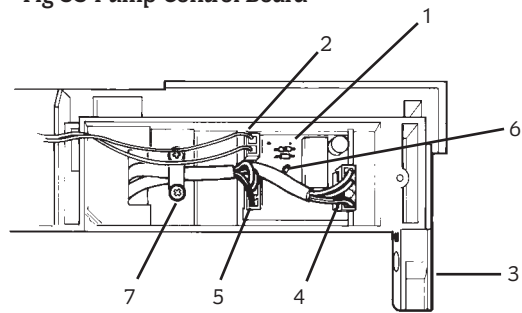
Note: Splash guard not shown.

Fig 52-Control Panel Fixing



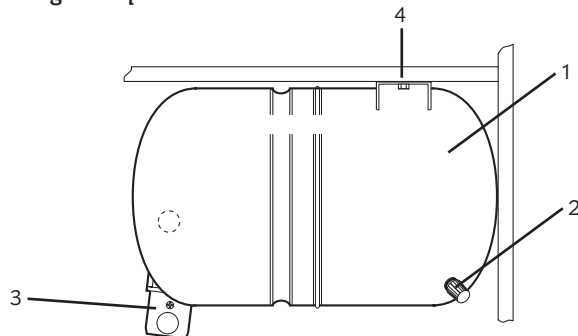
1. Fixing Clips (4)
2. Control Board
3. Mounting Plate

Fig 53-Pump Control Board



- | | |
|------------------------------|--------------------|
| 1. Pump Control Board | 5. X2 Connection |
| 2. X1 Connection | 6. Fixing Clip (1) |
| 3. Control Panel Pivot Point | 7. Cable Clamp |
| 4. X3 Connection | |

Fig 54 Expansion Vessel



- | | |
|---------------------|--|
| 1. Expansion Vessel | 3. Fixing Clip - UP to Release
DOWN to Lock |
| 2. Charging Valve | 4. Fixing Screw |

Use new seals and gaskets where necessary. Refill and pressurise as described in Section 12.4-8 - Commissioning. Refer to Fig 59.

15.4.23. Auto Air Vent

Remove the inner casing cover.

Drain the primary system. Refer to 15.3.1. Unscrew and remove the auto air vent. Remove the cap from the newly fitted vent. Refill and pressurise as described in Section 12.4-8 - Commissioning. Refer to Fig 35.

15.4.24. Primary Gas to Water Heat Exchanger

Remove the inner casing cover.

Drain the primary system. Refer to 15.3.1. Remove the fan assembly, flue hood, CH sensor (at the left hand side) and overheat thermostat from the heat exchanger. Disconnect the heat exchanger at the back panel by releasing clips at the right and left hand sides. Refer to Fig 60.

Withdraw the heat exchanger from the appliance. Note: There will be a small amount of water still in the heat exchanger. Use new seals and gaskets where necessary. Refill and pressurise as described in Section 12.4-8 - Commissioning.

15.4.25. Air Pressure Switch

Remove the inner casing cover.

Remove the switch by carefully prising away from the mounting tabs of the 'horseshoe' bracket.

Ensure that the connections are correctly made to the new switch. Refer to Fig. 61.

Fig 55-Primary (CH) Sensor

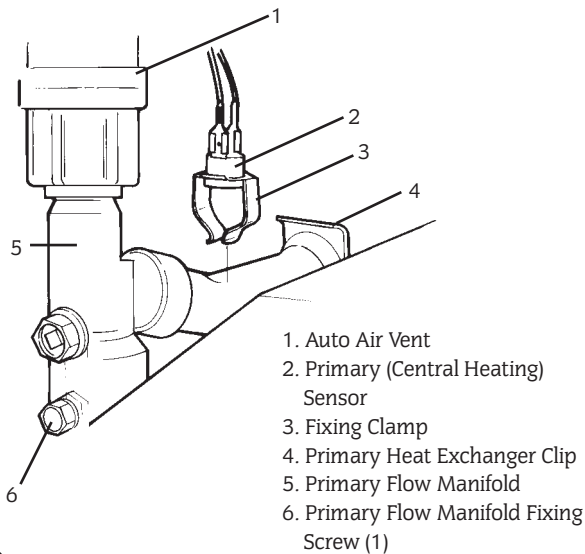


Fig 56-Domestic Hot Water Sensor

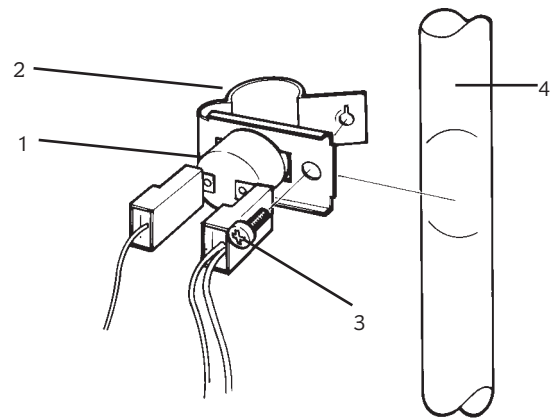


Fig 57-Boiler Overheat Thermostat

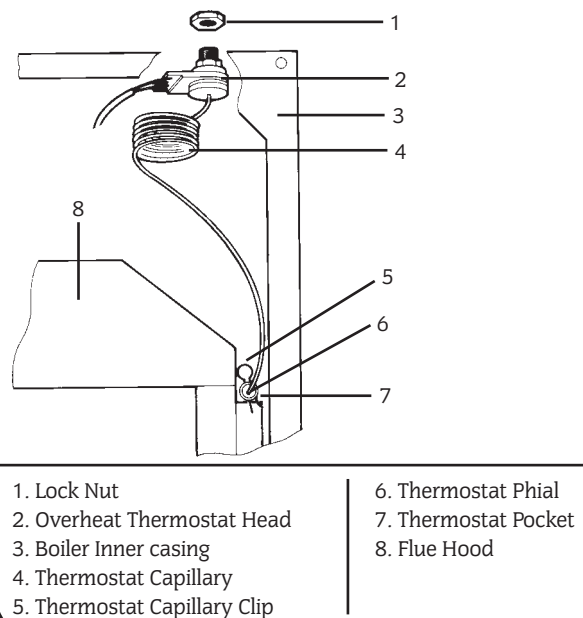


Fig 58-Pump Fixing-Rear View

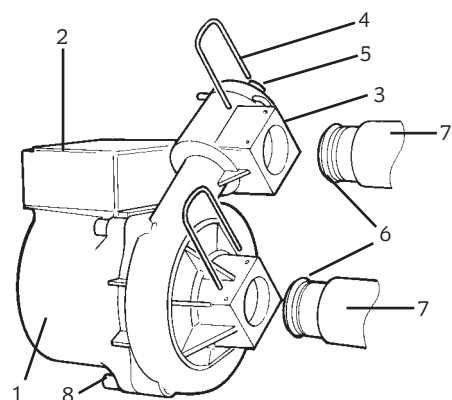


Fig 59-Domestic Hot Water Heat Exchanger

- 1. Fixing Clip (2)
- 2. Domestic Hot Water Heat Exchanger
- 3. Cold Water Inlet
- 4. O-Ring
- 5. Domestic Hot Water Flow

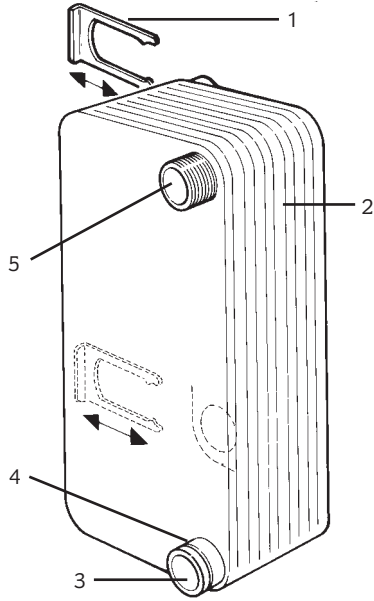
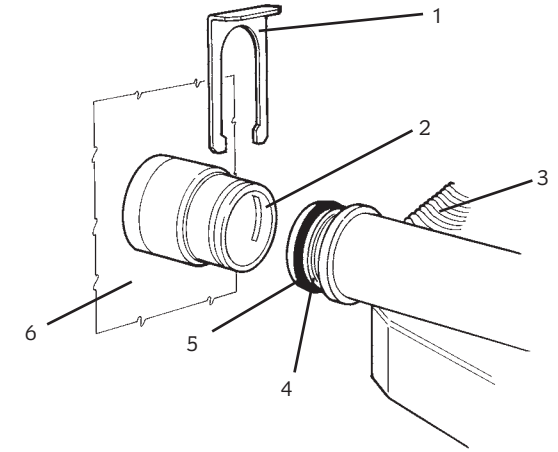


Fig 60-Primary Heat Exchanger Fixing



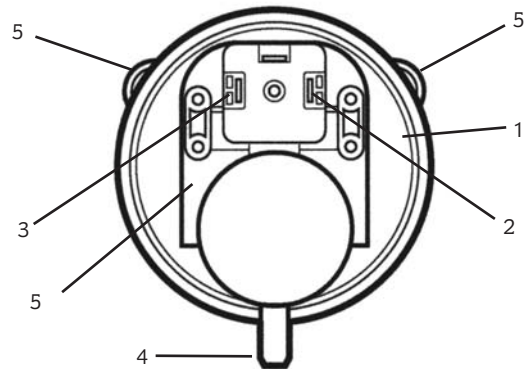
- 1. Fixing Clip (2)
- 2. Clip Locating Channel
- 3. Primary Heat Exchanger
- 4. Clip Locating Groove
- 5. O-Ring
- 6. Appliance Back Panel

Fig 61-Air Flow Switch

- 1. Air Pressure Switch
- 2. Electrical Connection
- 3. Electrical Connection
- 4. Air Flow Sensing Tube Connections

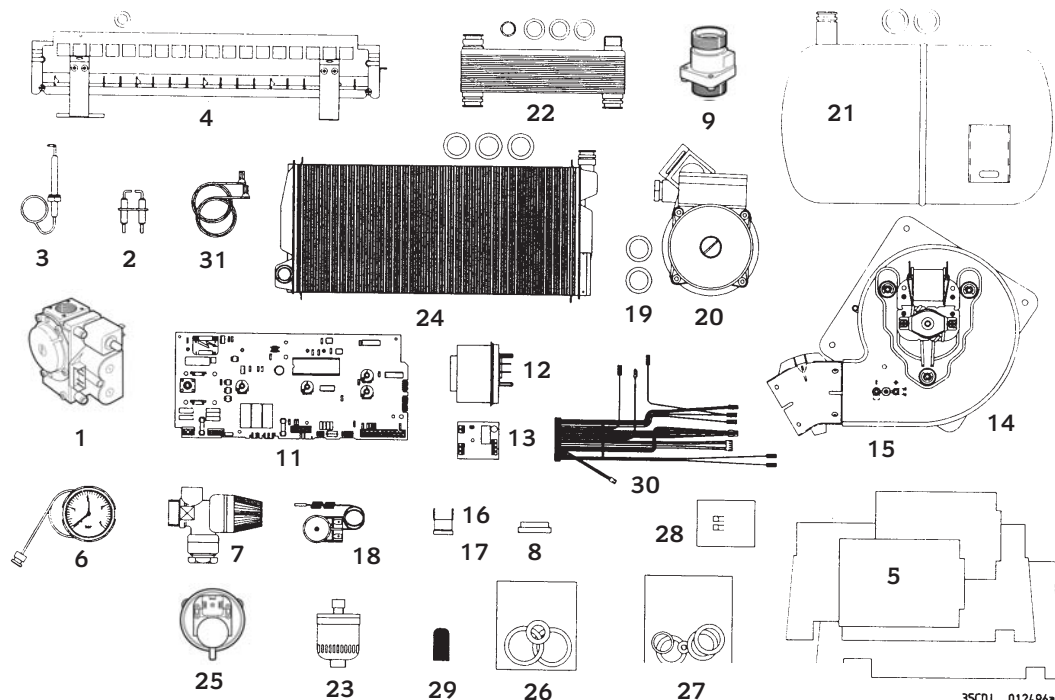
REAR	+ Positive
FRONT	Negative

- 5. Plastic 'horseshoe' mounting bracket



16. Short Parts List

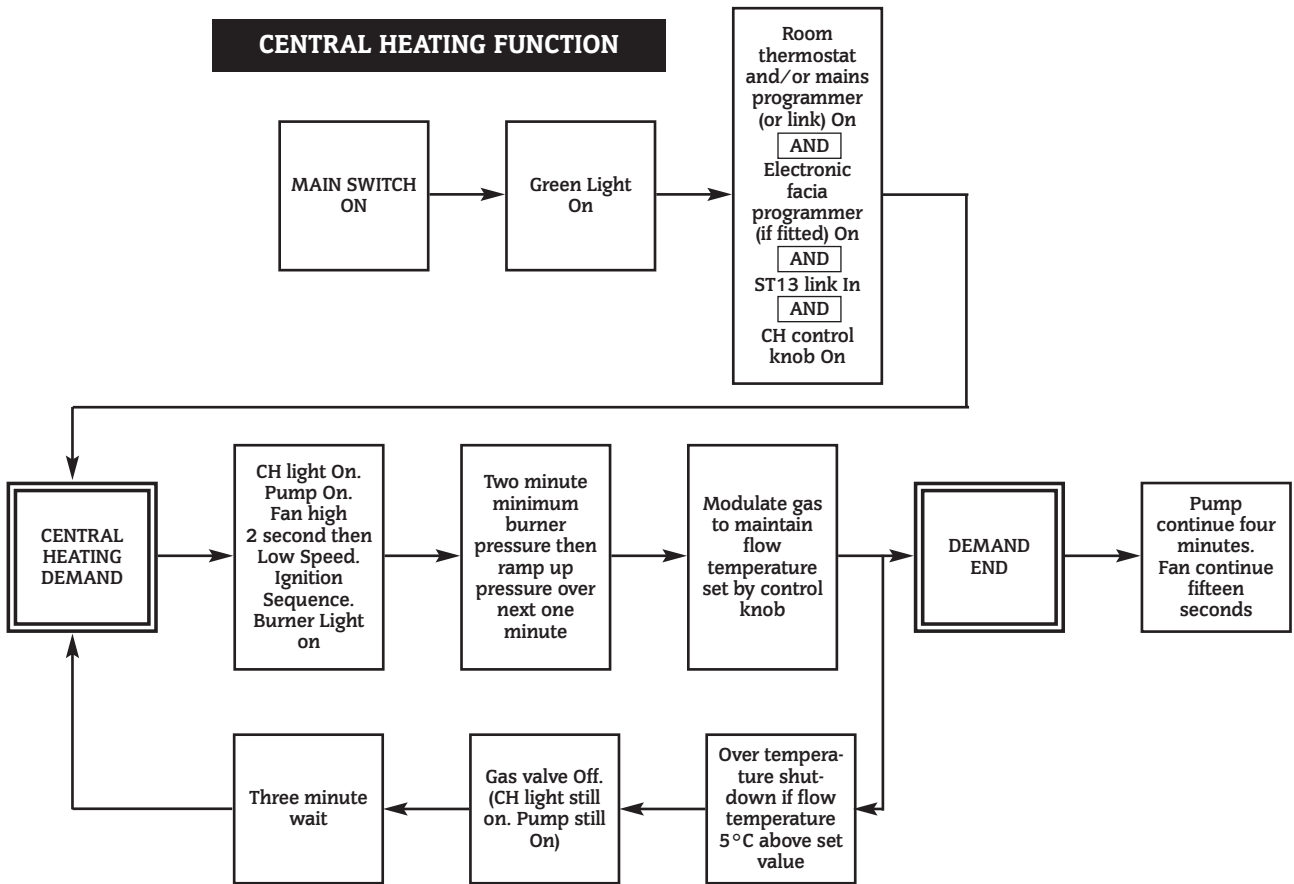
Key No.	GC Number	Description	Manufacturer	Qty	WHS Number
1	E02-827	Gas Valve - NG	Dungs	1	8 716 101 971 0
1	E02-828	Gas Valve - LPG	Dungs	1	8 716 101 972 0
2	E02-825	Ignition Electrode	Bucclough	1	8 716 142 127 0
3	E02-892	Flame Sense Electrode	Vernitron	1	8 716 121 207 0
4	E02-889	Burner E19 - NG	Furigas	1	8 716 142 642 0
4	E02-891	Burner E19 - LPG	Furigas	1	8 716 142 643 0
5	E02-838	Insulation Pack	Worcester	1	8 716 192 224 0
6	299-506	Pressure Gauge 4 Bar Dark Grey	Cewal	1	8 716 142 300 0
7	397-677	Pressure Relief Valve	Caleffi	1	8 716 142 416 0
8	395-767	Flow Regulator 12 Litres Red	Worcester	1	8 716 141 061 0
9	E02-823	Flow Switch	Altecnic-MG	1	8 716 101 973 0
11	E02-830	Control Board	Heatronic	1	8 748 300 297 0
12	299-516	Transformer	ERA	1	8 747 201 248 0
13	E02-831	Pump Control Board	Pactrol	1	8 716 146 302 0
14	E02-829	Fan Assembly	SEL	1	8 716 121 063 0
15	299-363	Air Flow Detector	Worcester	1	8 716 144 000 0
16	E02-835	CH Sensor	Shibura	1	8 716 142 376 0
17	E02-835	DHW Sensor	Shibura	1	8 716 142 376 0
18	E02-834	Over Heat Thermostat	Ranco	1	8 716 142 372 0
19	E02-880	CH Pump	Grundfos	1	8 716 143 109 0
20	E02-881	DHW Pump	Grundfos	1	8 716 143 111 0
21	229-029	Expansion Vessel	Zilmet	1	8 716 142 506 0
22	299-321	Heat Exchanger DHW	Dong IL	1	8 716 101 976 0
23	E00-717	Auto Air Vent	Intermes	1	8 716 140 500 0
24	371-528	Heat Exchanger Primary	Giannoni	1	8 716 142 804 0
25	E02-833	Air Pressure Switch	Huba	1	8 716 156 744 0
26	E02-836	Gasket/O'ring Pack - Water	Worcester	1	8 716 192 225 0
27	E02-837	Gasket/O'ring Pack - Gas	Worcester	1	8 716 192 226 0
28	299-357	Fuse Pack	Worcester	1	8 716 192 206 0
29	324-822	Inlet Water Filter	Worcester	1	8 716 148 401 0
30	E02-832	Main Harness	Worcester	1	8 716 121 014 0
31	E02-826	Spark Electrode Lead	Worcester	1	8 716 121 196 0



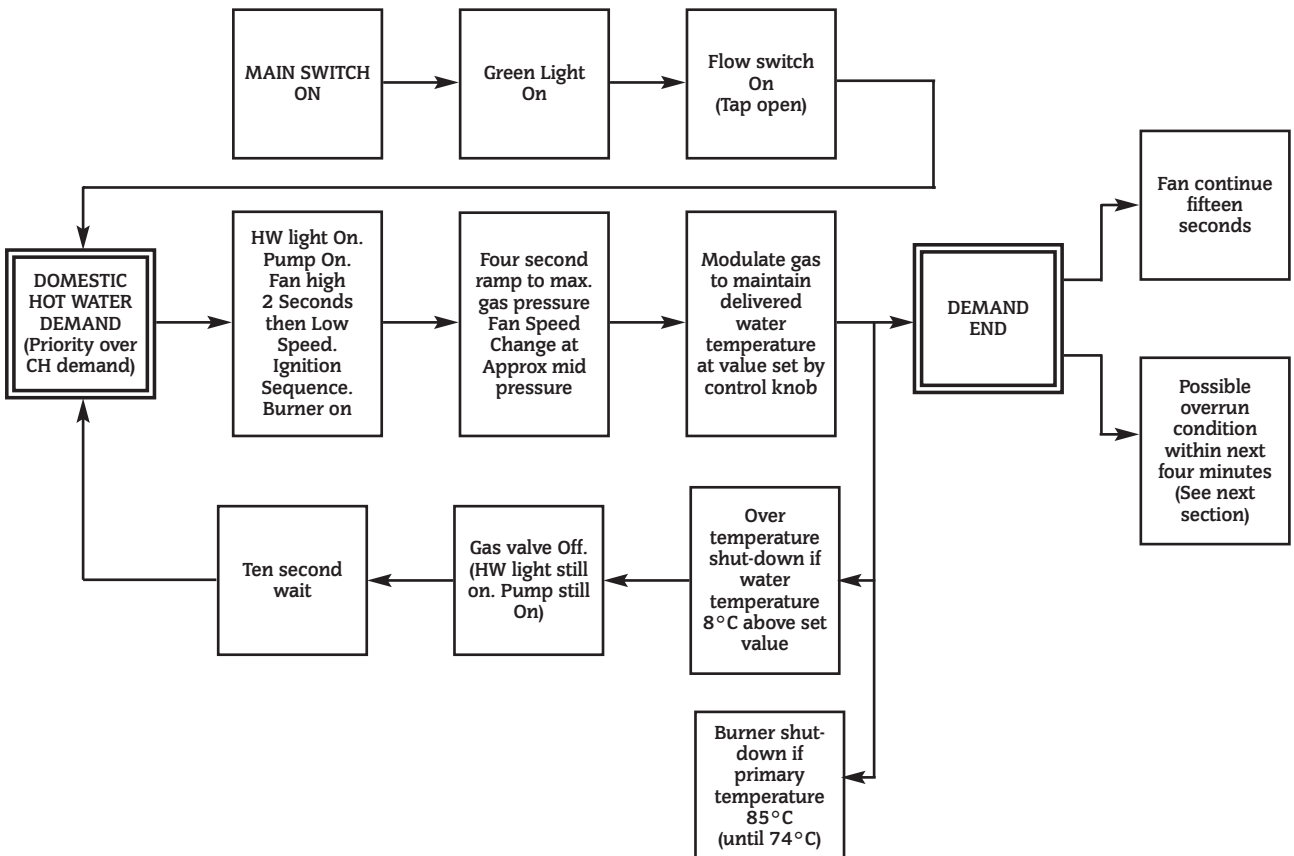
35CD1 012496a

17. Operational Flow Diagrams

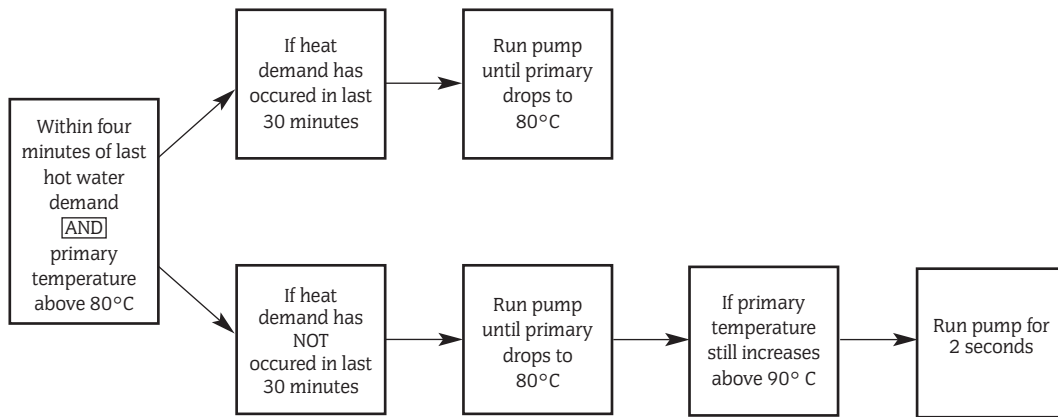
CENTRAL HEATING FUNCTION



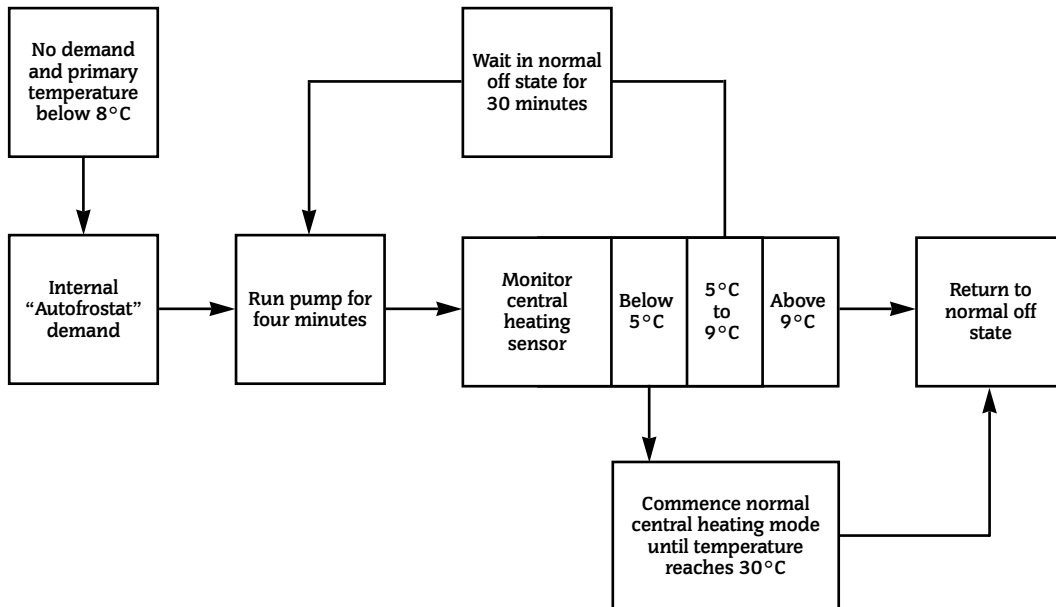
DOMESTIC HOT WATER FUNCTION



OVERRUN FUNCTION



AUTOFROSTSTAT FUNCTION



18. Fault Finding

Note: This information is for guidance only. Worcester Heat Systems cannot be held responsible for costs incurred by persons not deemed to be competent.

Preliminary Checks.

Electrical system checks are the first actions to be carried-out during a fault finding procedure. On completion of the Service or a fault finding task which has necessitated the breaking and remaking of electrical connections, check (a) Earth Continuity, (b) Short Circuit, (c) Polarity, (d) Resistance to Earth.

The electronic control system for this appliance uses the four lights on the facia. These show the normal operating status and, by flashing, help to provide a fault diagnostic system. With individual or groups of lights being permanently off, on or flashing, every normal fault can be identified.

Slow Flash - One per second

Can be cleared by pressing the facia reset button for at least one second.

Fast Flash - Five per second

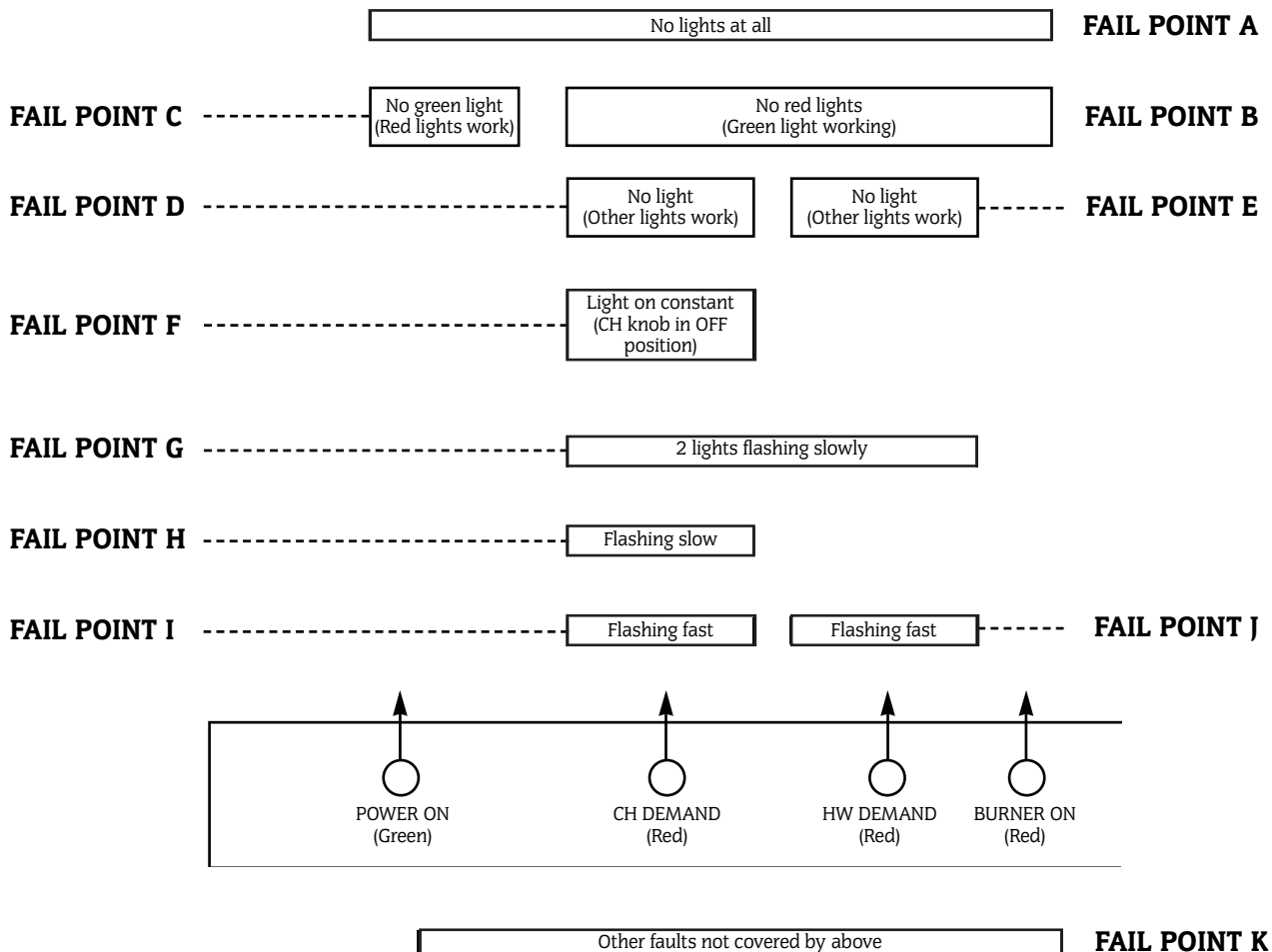
Can be cleared by removing the fault and/or switching the mains off and on.

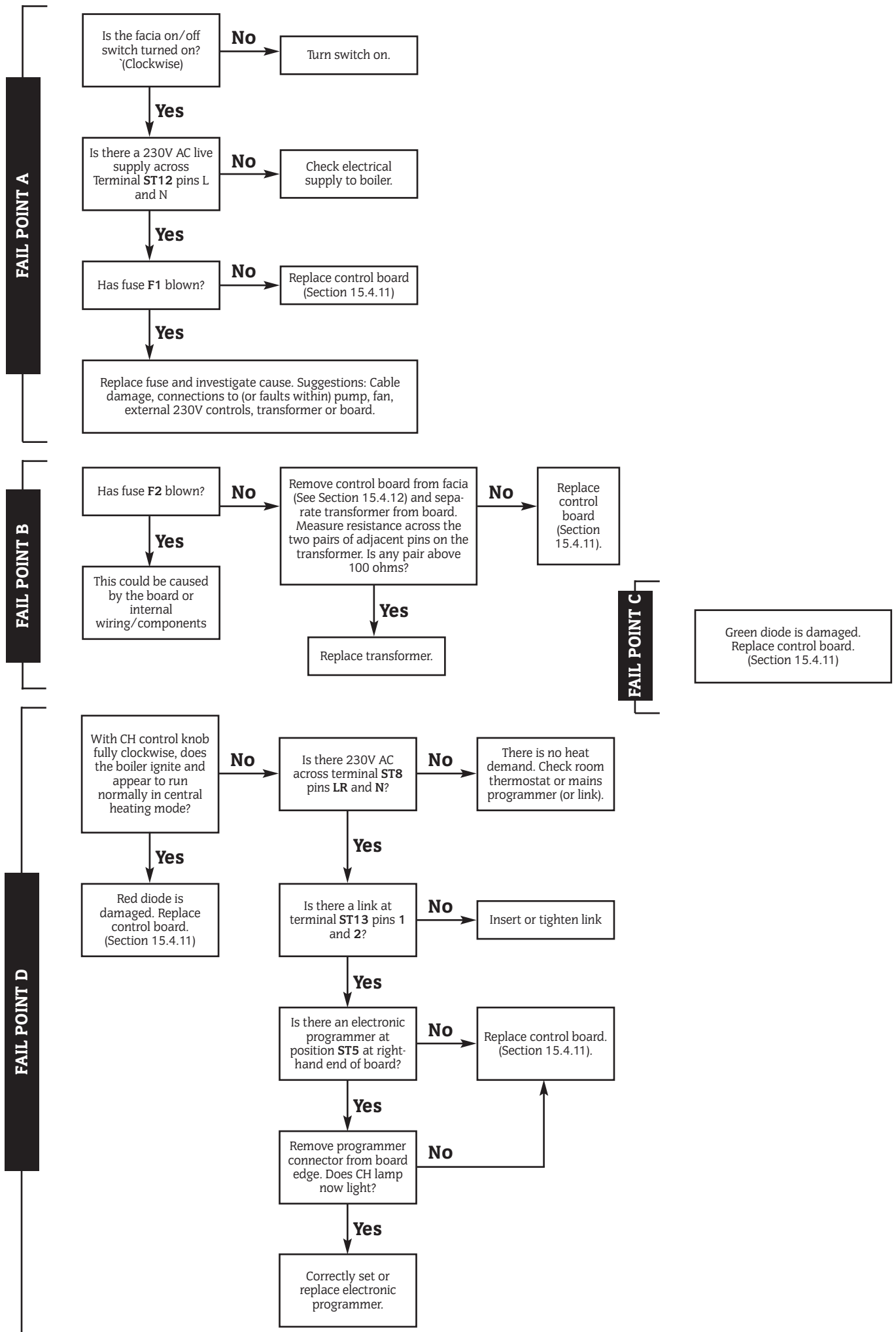
INDICATOR	RESULT	CAUSE	ACTION
CH Light Flashes Slow	Burner Lock - Out.	Flame Detect Fault. Internal TestFault.	Press Facia Reset Button For 1 Second.
CH & DHW Lights Flash Slow	Primary Overheat.	Overheat Thermostat Operated in Demand status.	As Above.
CH Light Flashes Fast	Sensor Fault.	Primary (CH) or DHW Sensor Open or Short Circuit. Internal Reference Voltage Error.	Switch Mains Supply Off /On or Rectify Fault.
DHW Light Flashes Fast	Air Pressure Fault or Blocked Flue or Water Pressure Fault	APS Permanently Closed. APS Does not Close. APS Open While Burner is On.	Switch Mains Supply Off/On or Rectify Fault.

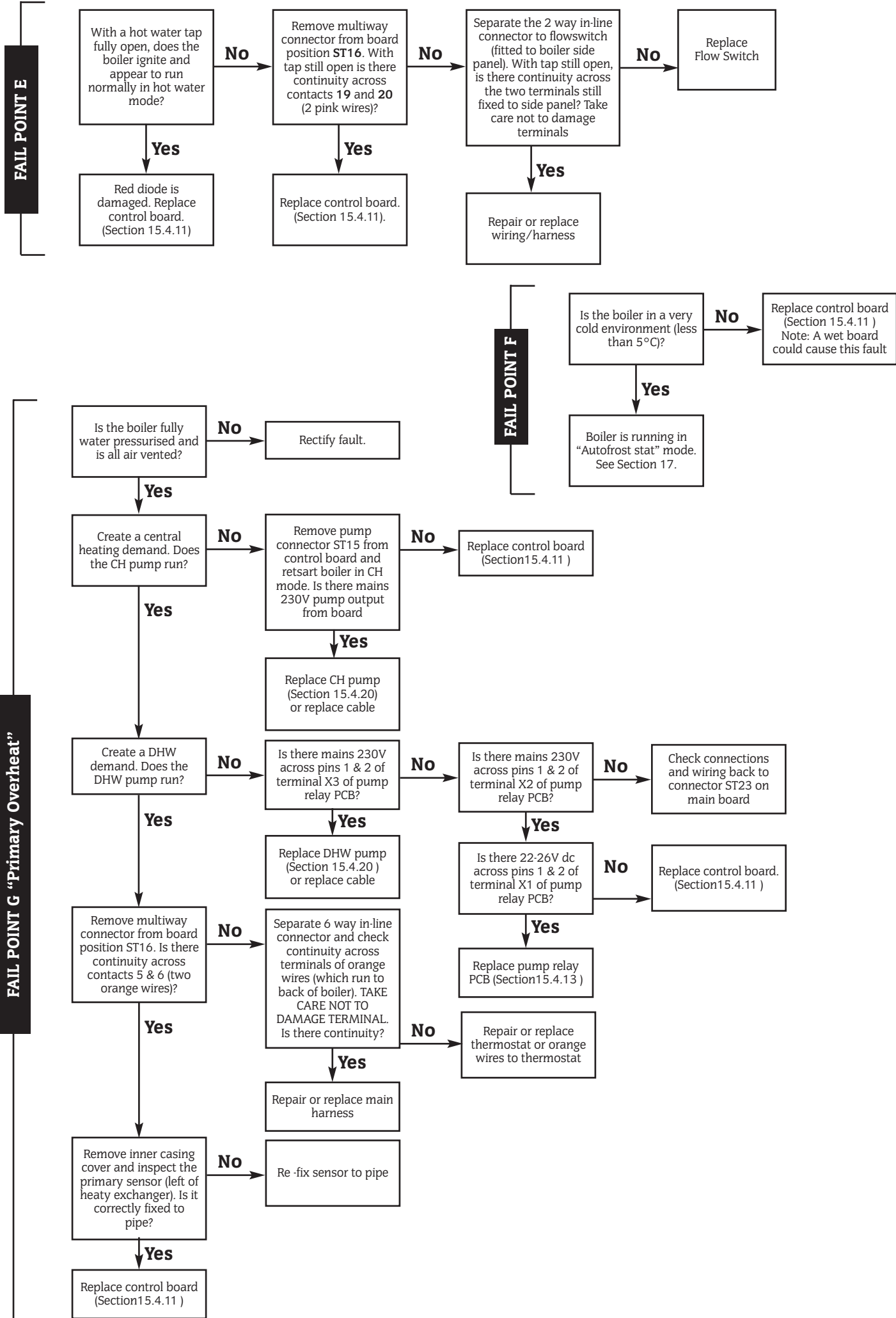
Fault Finding Chart

Select the appropriate indicator light situation. Refer to the appropriate section of the chart. This system assumes that the appliance has been operating correctly upto the point of failure.

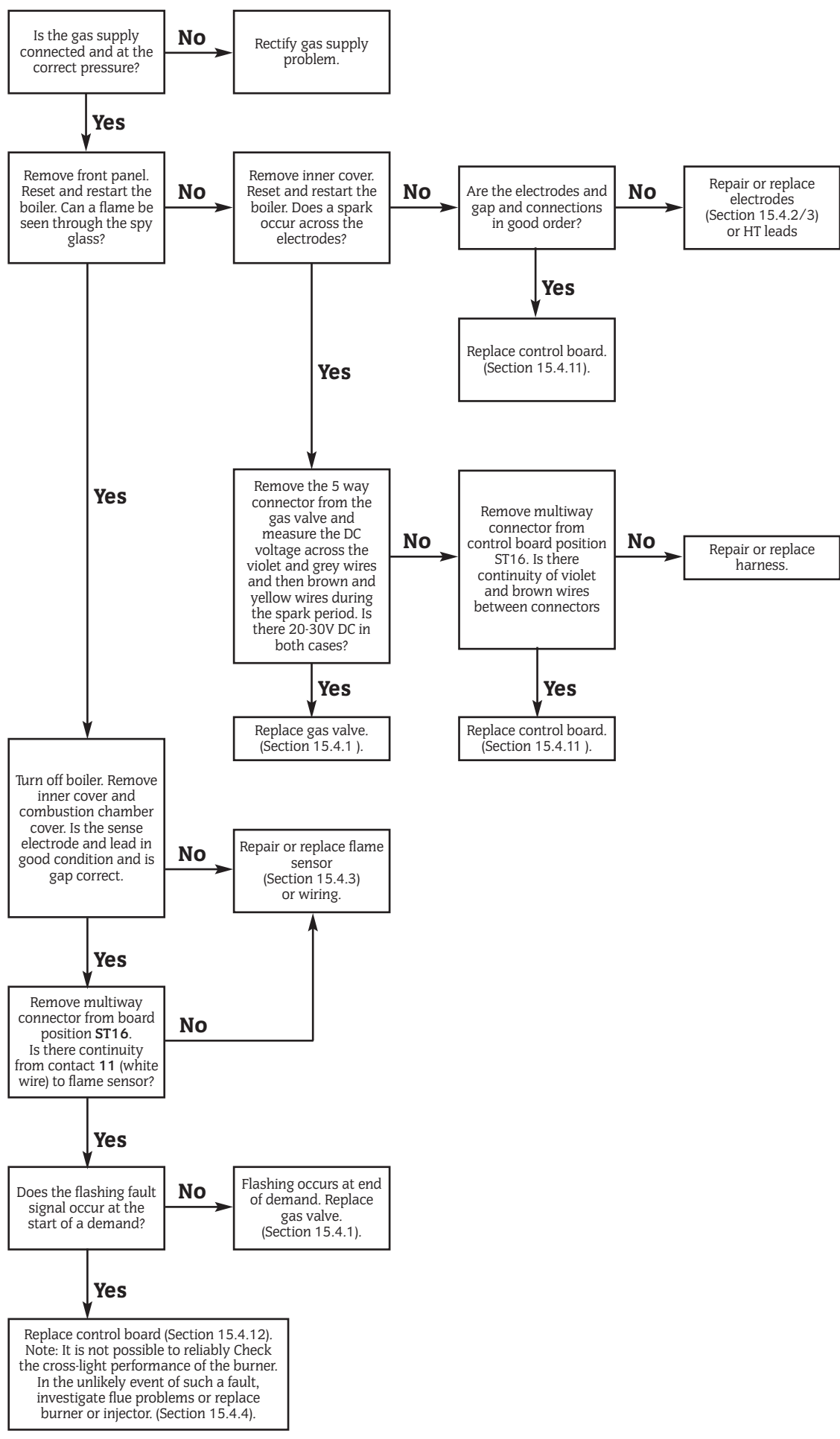
LIGHT SITUATION DURING FAULT

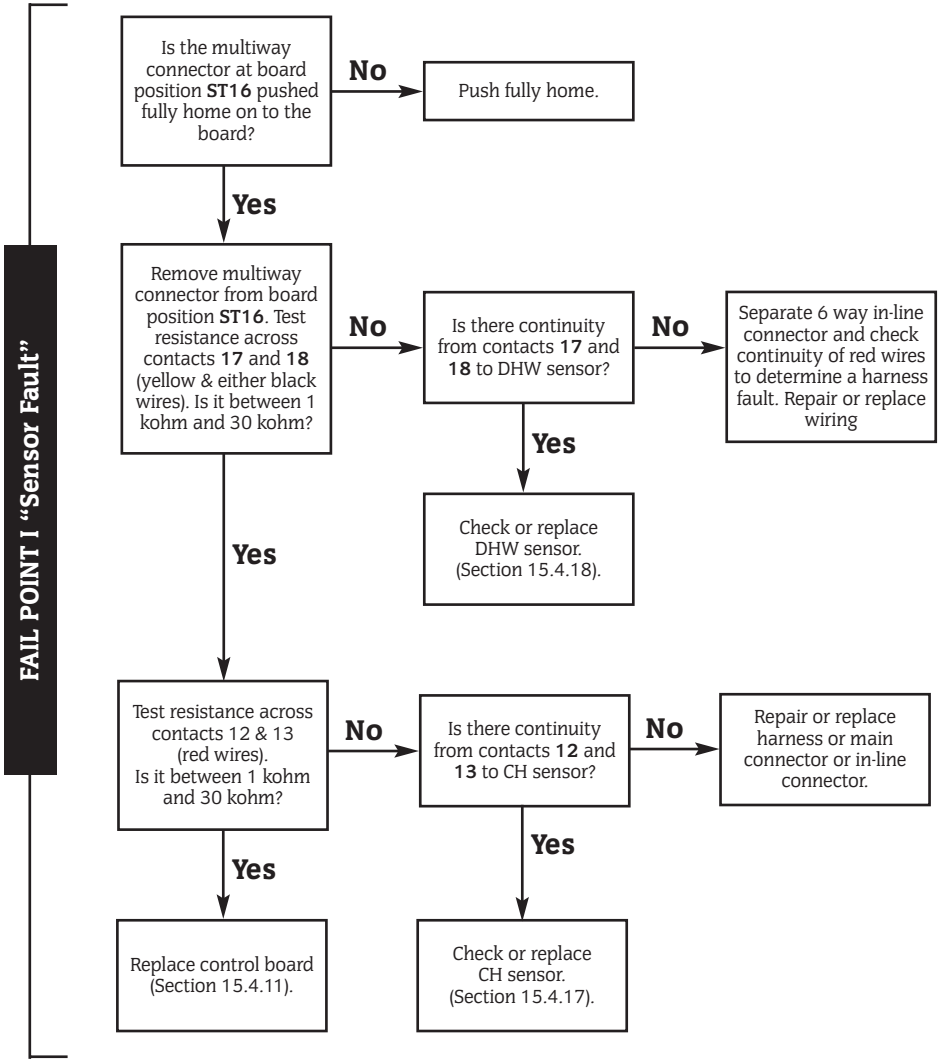




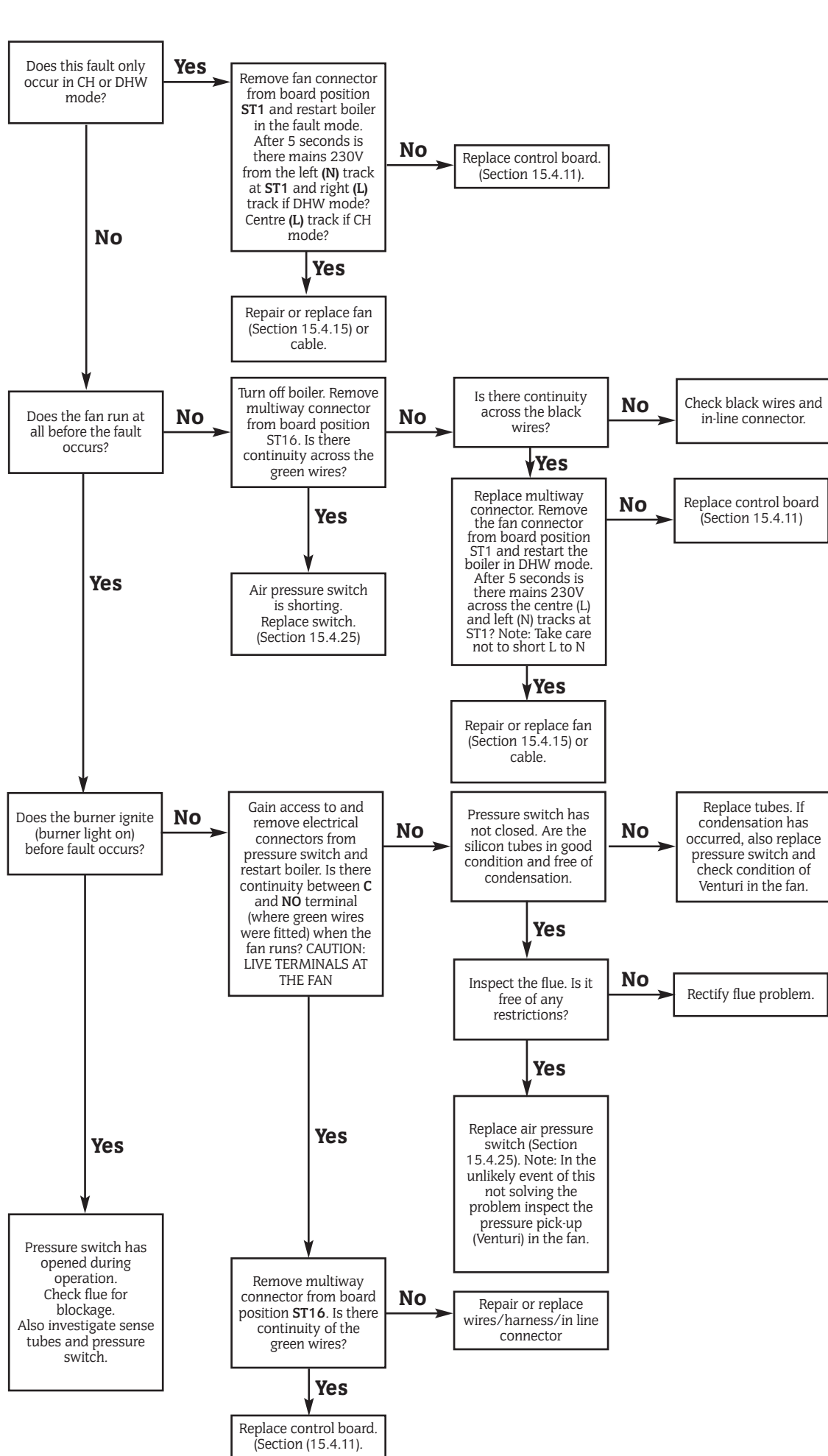


FAIL POINT H "Burner Lockout"

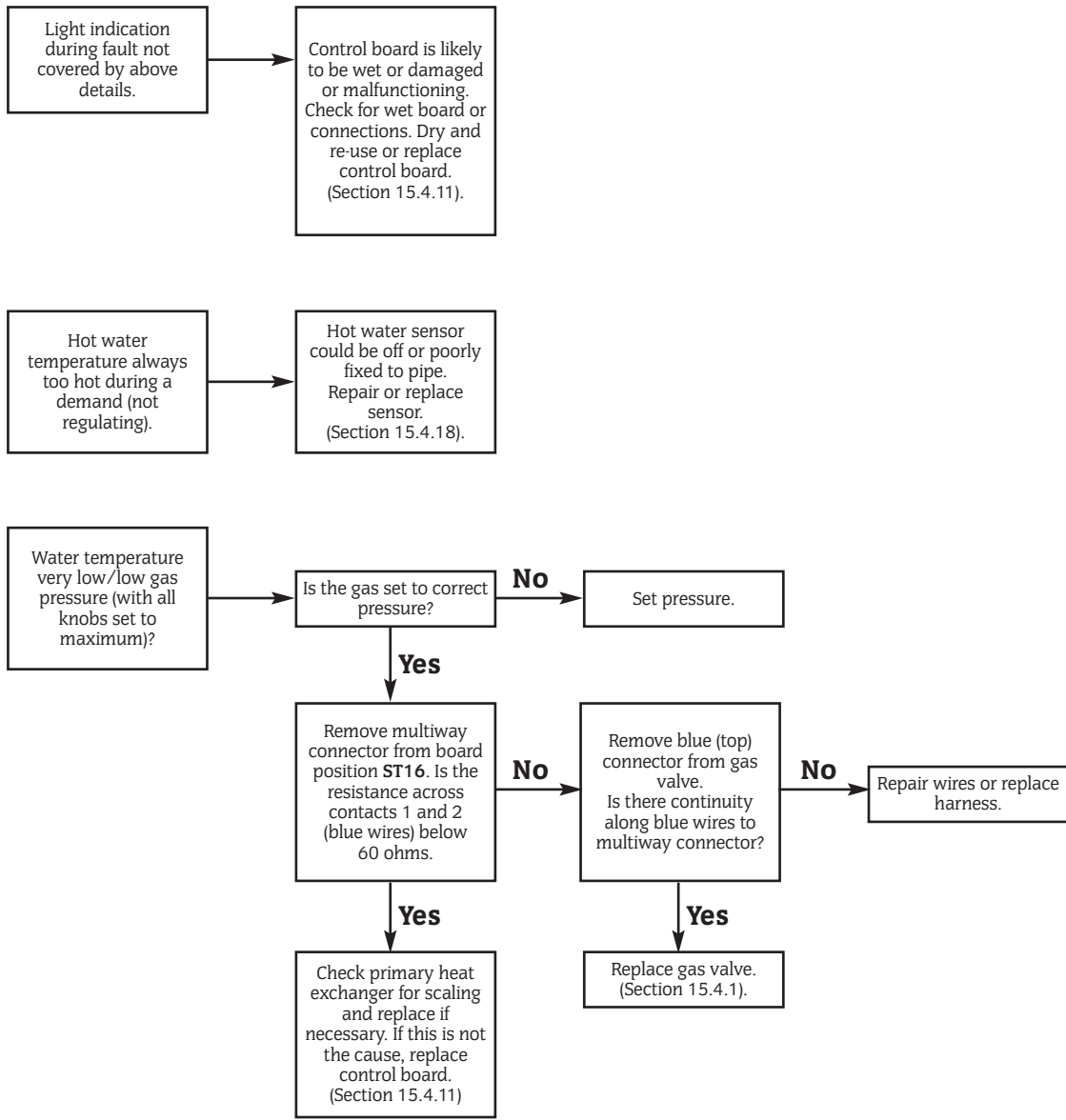




FAIL POINT J "Air or Water Pressure Fault"



FAIL POINT K



This manual is to be used in conjunction with the variant part number of the bar code below:



*Worcester Heat Systems Limited, Cotswold Way, Warndon, Worcester WR4 9SW.
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Technical Helpline (0990) 266241.*

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All goods sold are subject to our official Conditions of Sale, a copy of which may be obtained on application.

PUBLICATION 8 716 115 059a (05/08)