

**British Gas** 

**Scottish Gas** 

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# C1

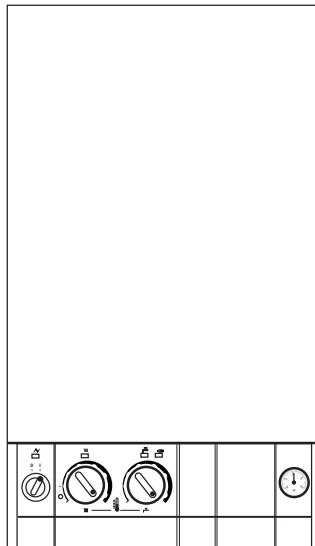
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WALL MOUNTED COMBINATION BOILER FOR CENTRAL HEATING  
AND MAINS FED DOMESTIC HOT WATER

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## INSTALLATION AND SERVICING INSTRUCTIONS

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**benchmark**

This appliance is for use with Natural Gas.

GC NUMBER 47 311 53 (N.G.)

### APPLIANCE OUTPUTS

CE

	Natural Gas	
	Domestic	Central Heating
Minimum	8.5 kW	8.5 kW
Maximum	28.0 kW	28.0 kW

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IMPORTANT: THESE INSTRUCTIONS APPLY IN THE UK ONLY

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

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

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## 1. Installation Regulations

### 1.1 Gas Safety (Installation & Use) Regulations 1998.

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, in 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 and to any other relevant standards.

BS5440:1 - Flues and ventilation for gas appliances: Flues

BS5440:2 - Flues and ventilation for gas appliances: Air supply.

BS5449 - Central heating for domestic premises.

BS5546:1 - Installation of gas hot water supplies.

BS6700 - Domestic water supply (when relevant).

BS6798 - Installation of gas fired hot water boilers.

BS6891 - Low pressure gas pipework installations up to 28mm (R1).

BS7593 - Water treatment.

1.6 The appliance and/or components must conform, where applicable, to all relevant Directives.

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

1.8 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.

1.9 These instructions cover, as far as possible, the foreseeable situations which may arise. Contact Worcester Heat Systems Technical Department, Telephone: 08705 266241, for advice on specific installations.

## 2. Introduction

### 2.1 General Information

The appliance is set to give the maximum output of 28 kW to the domestic hot water and to the heating system. The hot water flow rate is limited to a nominal 10 l/min at a maximum temperature rise of 40°C.

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

### 2.2 Electrical Supply

230V - 50Hz. Load 180 watts. External fuse 3A, Internal fuses F1 - 2A, F2 - 1.6A (20mm).

### 2.3 Gas Supply

The appliance requires a maximum of 3.38 m<sup>3</sup>/h of natural gas (G20). The installation and the connection of the gas supply to the appliance must be in accordance with BS6891.

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

### 2.4 Installation

The appliance is suitable for indoor installation only and for use with a sealed system only.

Do not place anything on top of the appliance.

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.

If the appliance is fitted in a cupboard or a compartment is built around it after installation, then the structure must conform to the requirements of BS6798 and BS5440 Part 2. However, because of the low casing losses, there is not a need for the cooling ventilation openings in the compartment. **The spaces specified in Section 6. Air Supply must be provided.**

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

### 2.5 Flue

The flue can be to the right, left or rear. A vertical flue system is available.

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

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

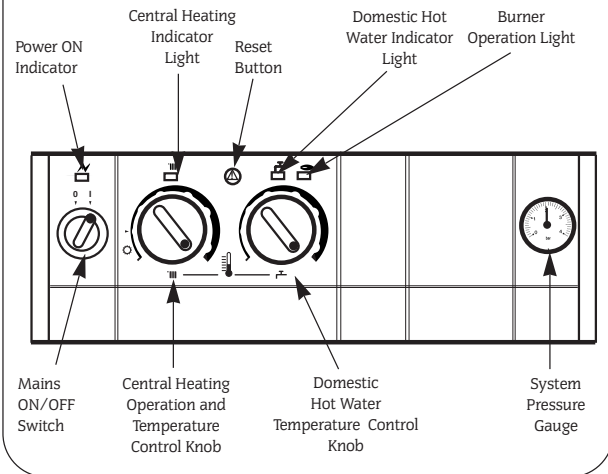
### 2.6 Controls

Controls for switching the appliance On or Off and for adjusting the CH and DHW temperatures. The CH control knob also switches the CH off and on.

A fascia mounted programmer is supplied as standard.

A room thermostat and/or an externally mounted programmer for mains voltage operation may be connected to the appliance. **Only double insulated mains voltage controls not requiring an earth can be used.**

**Fig. 1. Facia controls**



**2.7 System**

*(benchmark)* All dirt must be flushed from the system before connecting the appliance.  
The system can be pre-piped and flushed before the appliance is fitted.

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

Radiator valves must conform to BS2767: 10:1977.

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

A drain cock must be fitted to the lowest point and an air vent to the highest point of the system.

**2.8 Showers, Bidets, Taps and Mixing Valves**

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

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

The flow of water from individual outlets varies on all mains fed systems that are not fitted with flow balancing valves. If a pressure equalising valve is fitted then the domestic hot water temperature should be set to maximum.

Thermostatically controlled shower valves give extra comfort and protection.

**2.9 Safety**

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

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

Temperature monitoring controls are fitted to prevent overheating. Automatic frost protection is provided together with automatic pump seizure protection.

The gas valve solenoids are automatically checked for gas soundness.

**IMPORTANT: Where back-flow prevention devices, including water meters, are fitted the expansion of hot water into cold water main can be prevented. This can result in a pressure build-up that may cause damage to the boiler and household devices such as showers, washing machines etc.**

**In these cases we recommend that a mini-expansion vessel be fitted adjacent to the boiler in the cold water pipe.**

**2.10 Operation**

**Central Heating**

A demand for heat will ignite the burner. It will operate at minimum pressure for 2 minutes before increasing to the maximum pressure over a period of 1 minute and then automatically match the system requirements. At the end of the demand the burner will go out, the pump will continue to run for up to 4 minutes or the fan for 35 seconds. There is an anti-cycle time of 3 minutes.

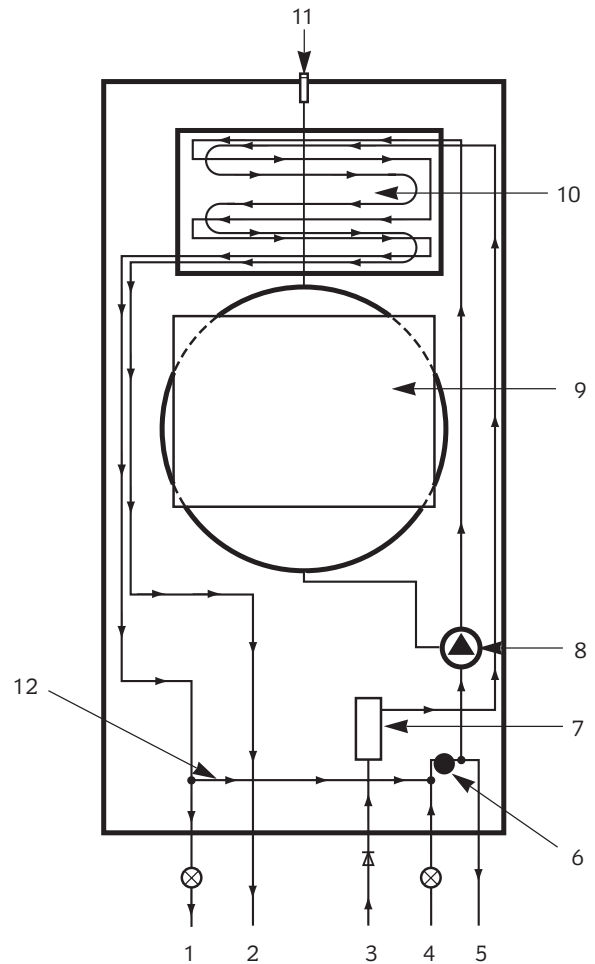
**Domestic Hot Water**

A demand for hot water will ignite the burner. The burner pressure will immediately rise to maximum.

At the end of the demand the fan will continue to run for 35 seconds if there is no heating demand.

The demand for hot water will override the CH function. In winter it may be necessary to reduce the flow at the taps to maintain the delivery temperature.

**Fig. 2. Water flow diagram.**



- 1. CH Flow.
- 2. Domestic Hot Water Supply.
- 3. Domestic Cold Supply.
- 4. CH Return.
- 5. Relief Valve Discharge.
- 6. Relief Valve.
- 7. Domestic Water Flow Switch.
- 8. Pump.
- 9. Sealed System Expansion Vessel.
- 10. Bi-thermal gas to water Heat Exchanger.
- 11. Automatic Air Vent.
- 12. Fixed By-Pass.

### 3. Technical Data

The data plate is fixed to the inner casing cover.

Table 1.

NOMINAL BOILER RATINGS (10 Minutes After Lighting)			
BOILER ADJUSTED FOR G20 (Natural Gas)			
OUTPUT	INPUT (Net)	BURNER PRESSURE	GAS RATE
kW	kW	m bar.	m <sup>3</sup> /h
8.5	10.5	0.7	1.12
28.0	31.1	14.1	3.38

Natural Gas: Net Input = Gross Input x 0.901

Table 2.

FLUE DETAILS		
HORIZONTAL FLUE		mm
WALL HOLE DIAMETER	EXTERNAL FIX	110
	INTERNAL FIX	150
STANDARD FLUE	MINIMUM LENGTH	330/425*
	MAXIMUM LENGTH	725
EXTENDED FLUE	MAXIMUM LENGTH	2975
FLUE ASSEMBLY DIAMETER		100

\* NOTE : Flue lengths between 330mm and 425mm require the flue to be cut.

Table 3

MAXIMUM AVAILABLE PUMP HEAD			
BOILER OUTPUT kW	HEAD Metres	MIN. FLOW RATE L/min.	FLOW/RETURN DIFFERENTIAL °C
8.5	5.9	11.0	11
28	2.0	30.5	13

Table 4

MECHANICAL SPECIFICATIONS	
CENTRAL HEATING FLOW - COMPRESSION	22mm
RETURN - COMPRESSION	22mm
COLD WATER INLET - COMPRESSION	15mm
DOMESTIC WATER FLOW - COMPRESSION	15mm
GAS INLET	Rp <sup>3</sup> / <sub>4</sub>
RELIEF VALVE DISCHARGE (PUSH FIT)	15mm
CASING HEIGHT	800mm
CASING WIDTH	440mm
CASING DEPTH	360mm
WEIGHT - LIFT	42.3kg
WEIGHT - UNPACKED	45.8kg
WEIGHT - PACKAGED	52kg

Table 5

PERFORMANCE SPECIFICATIONS			
PRIMARY WATER CAPACITY	litres		2.0
MAXIMUM MAINS INLET PRESSURE	bar		10
MINIMUM MAINS INLET PRESSURE (WORKING) FOR MAXIMUM FLOW	bar		1.3
MINIMUM MAINS INLET PRESSURE (WORKING) FOR OPERATION	bar		0.5
DOMESTIC HOT WATER TEMPERATURE RANGE	°C		40 - 62
MAXIMUM CENTRAL HEATING FLOW TEMPERATURE	°C		82 (nom)
MAXIMUM CENTRAL HEATING SYSTEM SET PRESSURE	bar		2.5
MINIMUM CENTRAL HEATING SYSTEM PRESSURE	bar		0.5
OUTPUT TO DOMESTIC HOT WATER	kw	NATURAL GAS (G20)	8.5 - 28.0
OUTPUT TO CENTRAL HEATING	kw	NATURAL GAS (G20)	8.5 - 28.0
DOMESTIC HOT WATER SPECIFIC RATE -		30°C RISE l/min	13.4
MAXIMUM DOMESTIC HOT WATER FLOW RATE -		40°C RISE l/min	10.0
NOx CLASSIFICATION			Class 2
SEDBUK NUMBER			78.7
SEDBUK BAND			D

Table 6

DOMESTIC HOT WATER TEMPERATURE RISE				
DISCHARGE RATE l/min	7	8	9	10
TEMPERATURE RISE °C	57	50	45	40

Table 7

GAS SUPPLY SYSTEM - BASED ON NG (G20)				
TOTAL LENGTH OF GAS SUPPLY PIPE (COPPER) metres				
3	6	9	12	
GAS DISCHARGE RATE - PRESSURE DROP 1mbar. m <sup>3</sup> /h				PIPE DIAMETER mm
8.7	5.8	4.6	3.9	22
18.0	12.0	9.4	8.0	28

Table 8

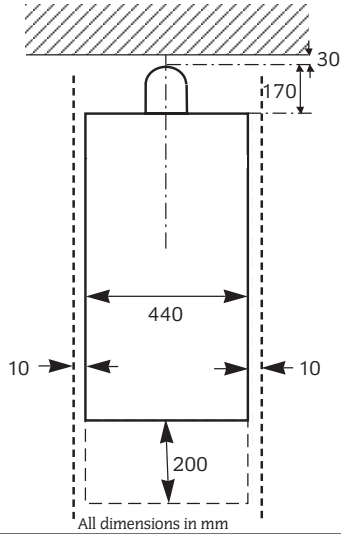
	CLEARANCES (mm)	
	INSTALLATION	SERVICE
ABOVE APPLIANCE AND/OR FLUE ELBOW	30	30
IN FRONT OF APPLIANCE	600	600
BENEATH APPLIANCE	200	200
RIGHT AND LEFT HAND SIDE	10	10

Refer to Section 6.

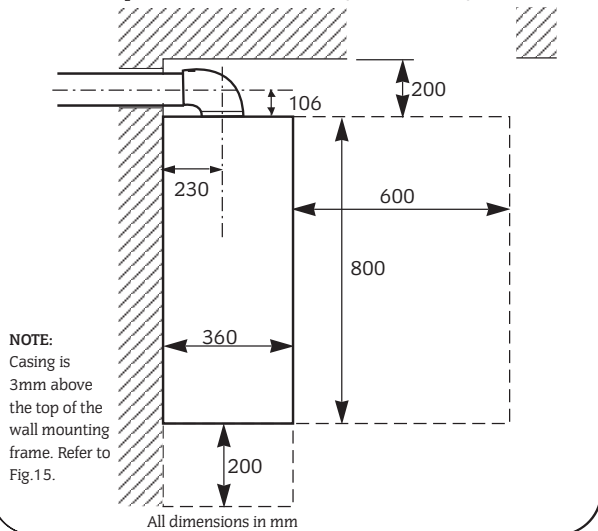
Table 9

SYSTEM CAPACITY			
TOTAL SYSTEM VOLUME litres			
INITIAL PRESSURE bar	INITIAL CHARGE PRESSURE bar		
	0.5	1.0	1.5
1.0	57	75	N/A
1.5	31	42	52

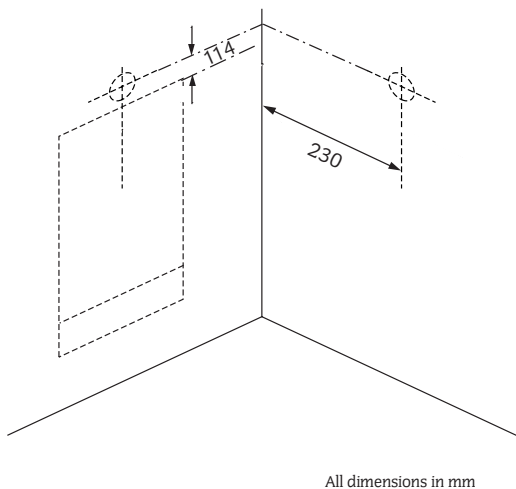
**Fig. 3. Appliance casing dimensions and required clearances (front view).**



**Fig.4. Appliance casing dimensions and required clearances (side view).**



**Fig. 5. Side flue opening**



## 4. Siting The Appliance

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.

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.

The appliance is NOT suitable for external installation.

No special wall protection is required.

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

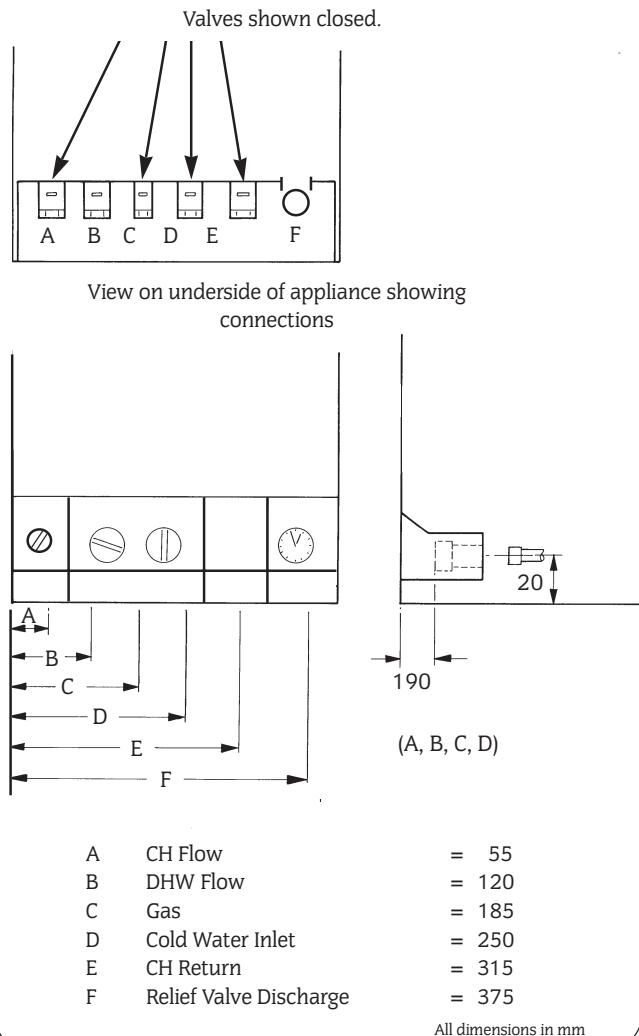
The specified clearances must be available for installation and servicing. Refer to Table 8, Fig.3, 4 and Section 6. Air Supply.

The appliance can be installed in a cupboard/compartment to be used for airing clothes providing that the requirements of BS6798 and BS5440 Part 2 are followed. Refer to Section 2.4.

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.

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

**Fig. 6. Pipework connections**



## 5. Flue terminal positions

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

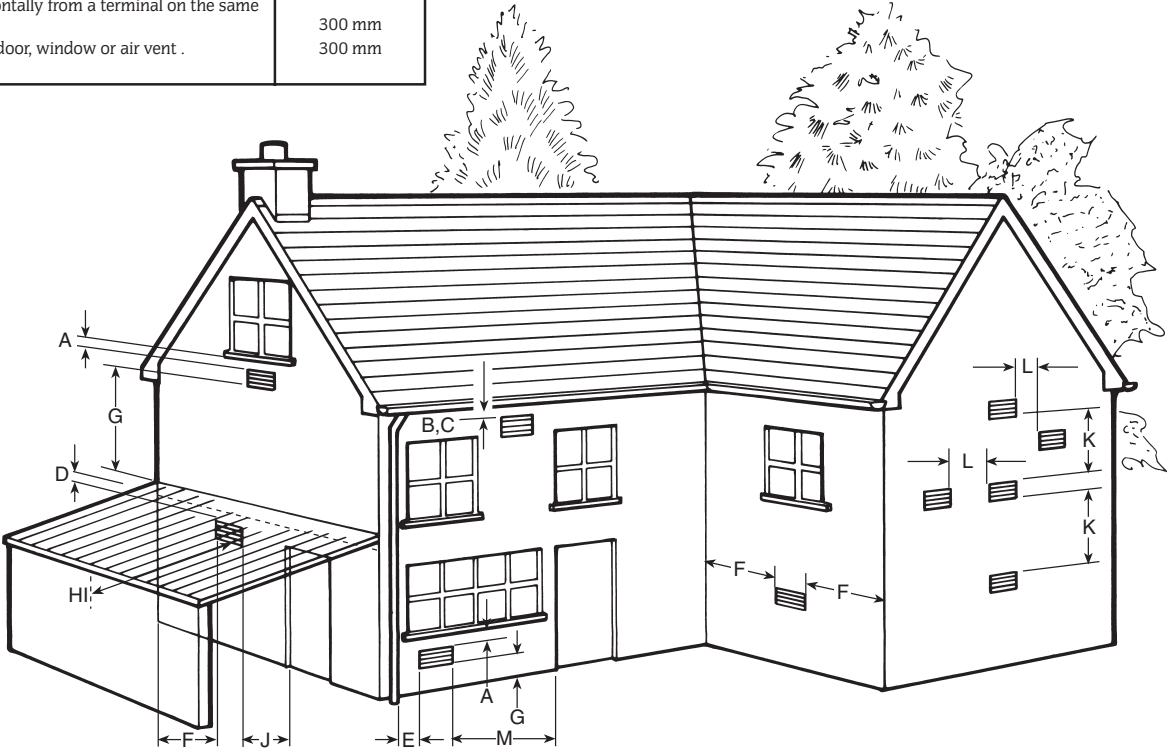
Standard flue kit length is 330 - 725mm (as measured from the centre of the flue turret) with extension kits for flues up to 2975mm measured from the central line of the flue turret.

The terminal must not cause an obstruction or the combustion products a nuisance.

Under some conditions the terminal might steam and positions where this might be a nuisance should be avoided. Refer to Fig 7 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. A Type K2 guard is available from Tower Flue Components, Vale Rise, Tonbridge, TN9 1TB.

**Fig. 7. Siting of the flue terminal.**

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



## 6. Air Supply

**6.1** The appliance does not require a separate vent for combustion air.

**6.2** The appliance can be fitted in a cupboard with no vents for cooling but the minimum clearances must be increased to those given below (note the clearances at the front are for a removable panel e.g. a door).

Above the Turret	20mm
In front	250mm
Below	200mm
Right-hand side	75mm
Left-hand side	75mm

**6.3** If the appliance is to be fitted in a cupboard or compartments with less clearance than those above (minimum clearances given in Section 4. Siting The Appliance) then permanent vents for cooling are required. One at high level and one at low level, either direct to outside air or to a room. Both vents must pass to the same room or be on the same wall to the outside air.

**6.4** The minimum free areas required are:

POSITION OF AIR VENTS	AIR FROM THE ROOM	AIR DIRECT FROM OUTSIDE
HIGH LEVEL	315cm <sup>2</sup>	158cm <sup>2</sup>
LOW LEVEL	315cm <sup>2</sup>	158cm <sup>2</sup>



## 7. Sealed System

The system must comply with requirements of BS6798 and BS5449 and must not be operated without being full of water and correctly pressurised. Refer to Fig 8.

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

The expansion vessel, to BS4814, has a capacity of 8 litres charged to 0.5 bar, which is suitable for a static head of 5 metres. A schraider type valve allows the pressure to be increased if the static head is greater than 5 metres.

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

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

The maximum system design pressure is 1.5 bar. If the pressure is above 2.65 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. The pressure gauge shows the system pressure.

Fill and pressurise the system through a WRc approved filling kit. Refer to Fig 9.

The system and the appliance must be properly vented. Repeated venting loses water from the system, which must be replaced. The make-up connection must be close to the appliance in the heating return pipe through an approved non-return valve. Refer to Fig 10.

The connection to the mains water supply must have the approval of the local Water Company.

The integral by-pass is not adjustable.

The pump is set at maximum and should not be adjusted.

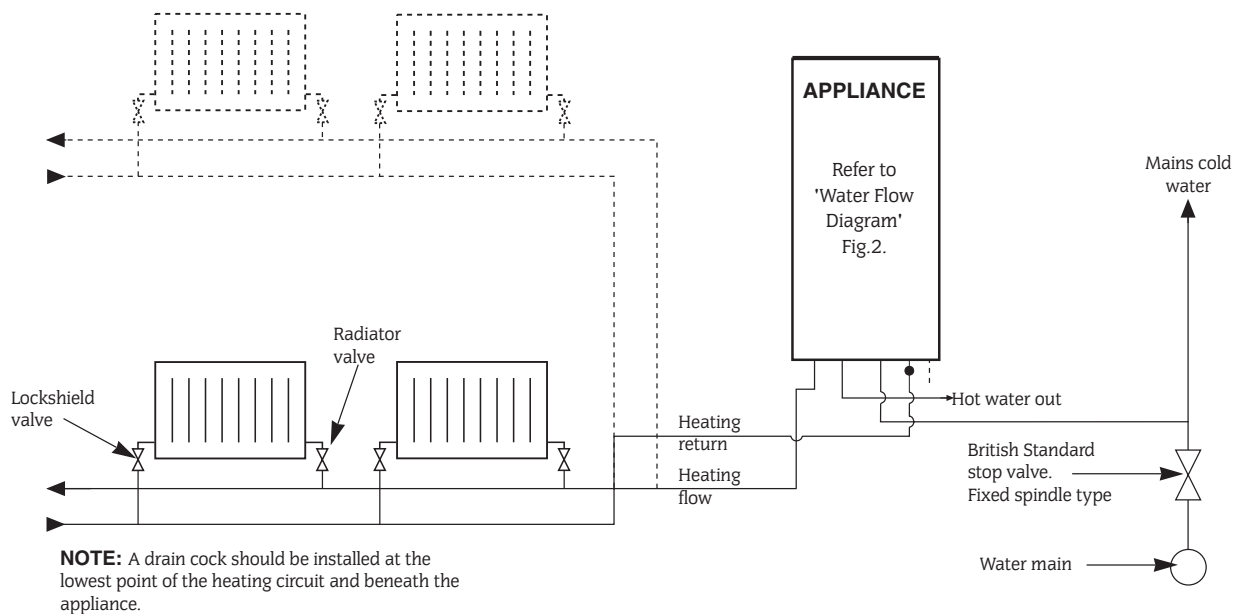
All connections in the system must withstand a pressure of up to 3 bar.

The radiator valves must confirm to BS 2767:10 and other valves to BS1010.

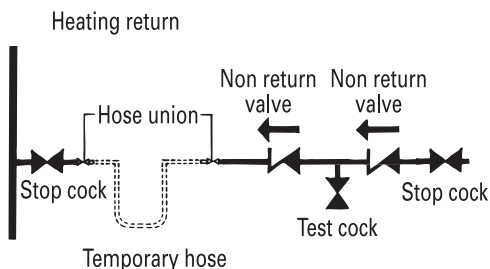
### Open Vent System

**This appliance is NOT suitable for connection to an open vent system.**

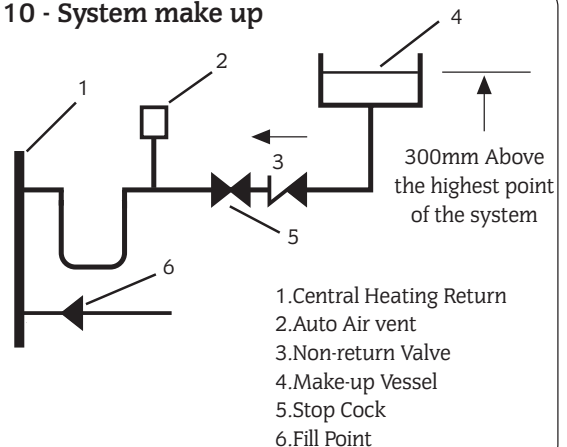
**Fig. 8. Sealed primary water system.**



**Fig 9 - System Fill**



**Fig 10 - System make up**





## 8. Domestic Hot Water

It may be necessary to contact the local Water Company before connecting the appliance.

Devices, which would prevent the flow of expansion water, must not be fitted unless separate arrangements have been made. A mini-expansion vessel kit is available as an optional extra.

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

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

A mains water supply isolating valve is fitted.

The maximum hot water flow rate is set at the factory to 10 l/min giving a nominal temperature rise of 40°C with the temperature control at maximum. Refer to Table 6. The temperature rise, up to the maximum set by the user is automatically maintained by the modulation of the heat input.

In winter it may be necessary to reduce the water flow at the tap or shower to maintain the required delivery temperature.

It is recommended that long pipe runs to taps or showers are insulated to prevent the rapid cooling of the water.

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

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

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 its immersion in the water. Alternatively the shower can be fitted with an anti-siphonage device at the flexible hose connection.

Thermostatically controlled or pressure balancing shower valves should be used where possible to give extra comfort and guard against extreme temperature.

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-siphon arrangements are needed.

**LIME SCALE:** In areas of temporary hardness [greater than 200ppm of calcium bicarbonate] it is suggested that a proprietary scale reducer is fitted in the mains cold water connection to the appliance. Installation of a scale inhibitor assembly should be in accordance with the requirements of the local Water Company. An isolating valve should be fitted to allow servicing. The water hardness can be determined by reference to the local Water Company.

## 9. Gas Supply

The appliance requires a maximum of 3.38 m<sup>3</sup>/h of natural gas (G20). Refer to Table 7.

A natural gas appliance must be connected to a governed meter. The installation and connection of the gas supply to the appliance must be in accordance with BS6891.

The meter and the pipework to the appliance must be checked, preferably by the gas supplier, to ensure that a dynamic pressure of 20mbar is available at the appliance [equivalent to about 18mbar at the gas valve inlet pressure connection] and that the gas flow is adequate for all the installed gas appliances operating together.

## 10. Electrical

Mains supply: 230V ~ 50 Hz 180watts. External fuse 3A. Internal fuses F1-2A, F2-1.6A (20mm). Spare internal fuses are supplied with the appliance. Refer to Fig 13.

The appliance must be earthed and it must be possible to completely isolate the appliance.

The mains cable must be 0.75mm<sup>2</sup> (24x0.20 mm) to BS6500 - Table 15 or 16.

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. The Earth lead must be still be slack when the other leads are taut. Refer to Fig 14.

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.

A room thermostat or an externally mounted programmer must be suitable for mains voltage operation, the leads must be securely fixed in the cable clamps. **Only double insulated mains voltage controls not requiring an earth lead may be used.** The control board is accessed by removing the controls connections cover. Refer to Fig 29.

A programmer or clock is available to fit into the fascia. Full instructions are sent with the control.

On very rare occasions an external frost thermostat might be considered where parts of the system are remote from the appliance. Refer to WHS Technical Department for more information, Tel: 08705 266241.

**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. Wiring diagram.

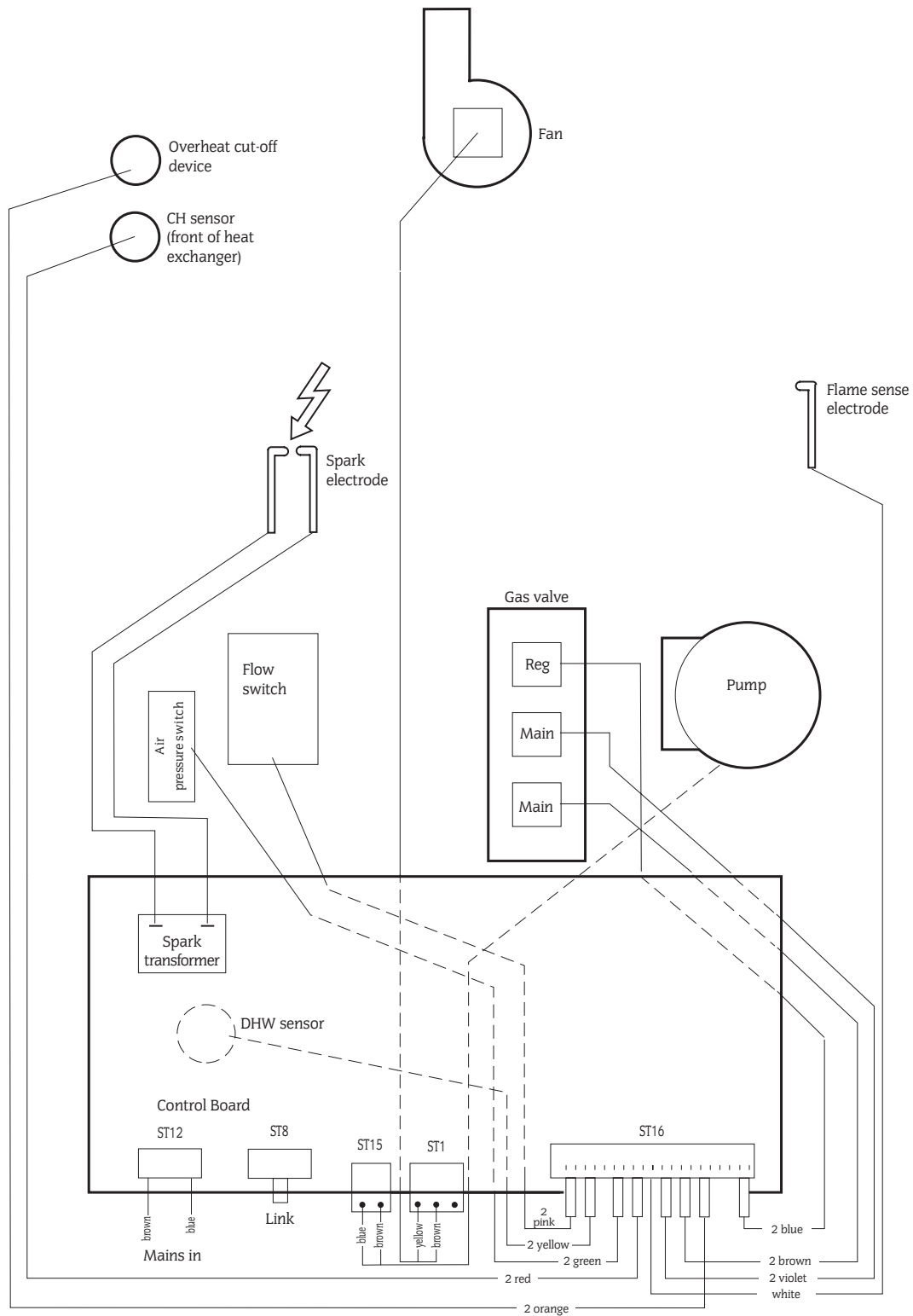
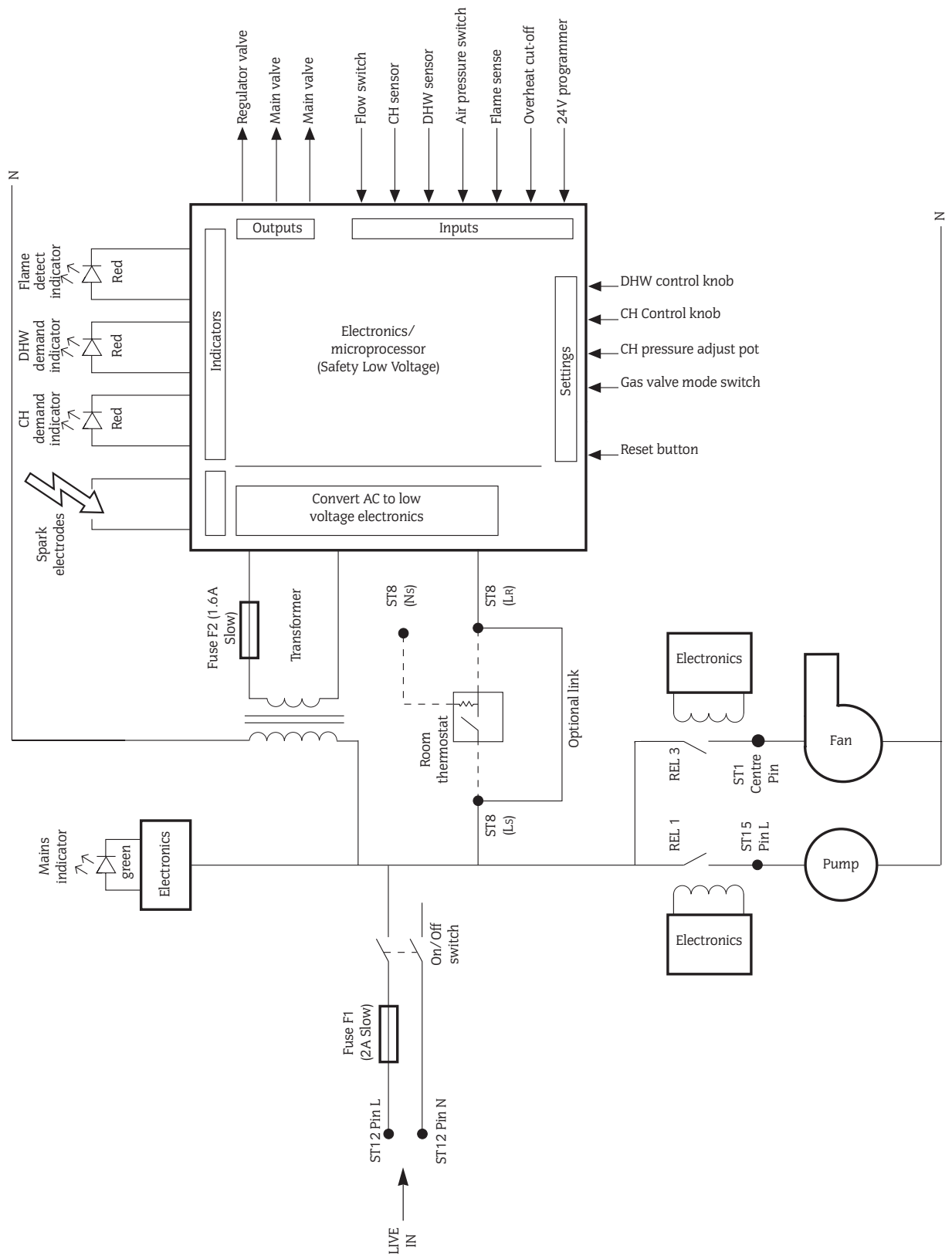
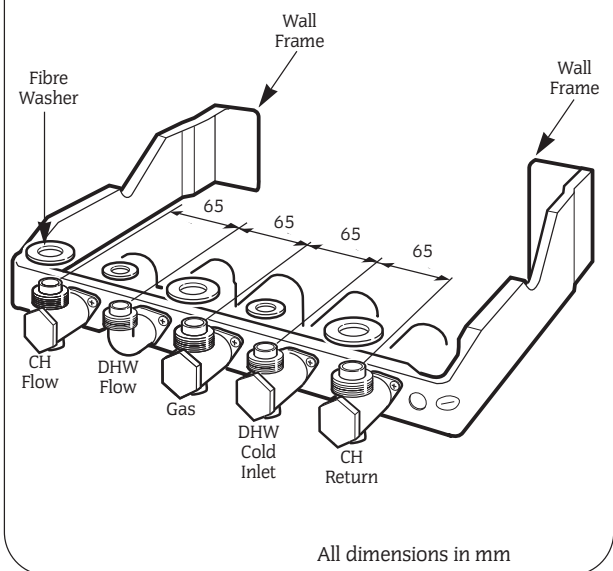


Fig. 12. Functional flow diagram.





**Fig.16 . Manifold assembly**



**11.7 Install the Boiler**

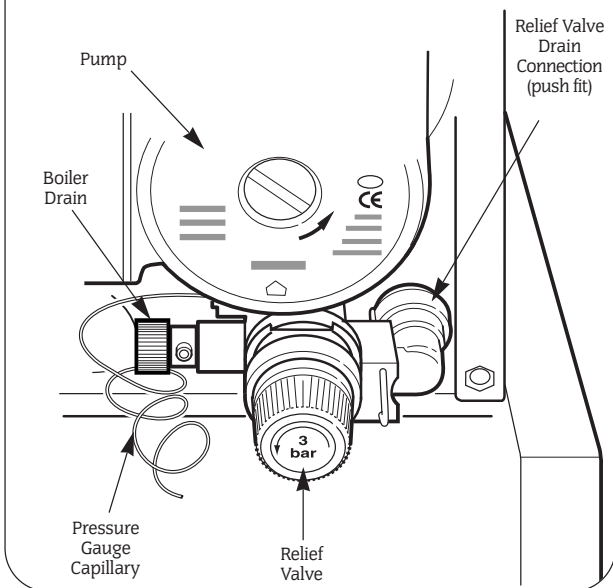
Remove the cabinet by unscrewing the screw at the top front and releasing the sides. Lift from the top location. Refer to Fig. 18.

Check that the gas and water valves are closed. Refer to Fig.16. Fit the new seals, in the hardware pack, to the service valves on the manifold.

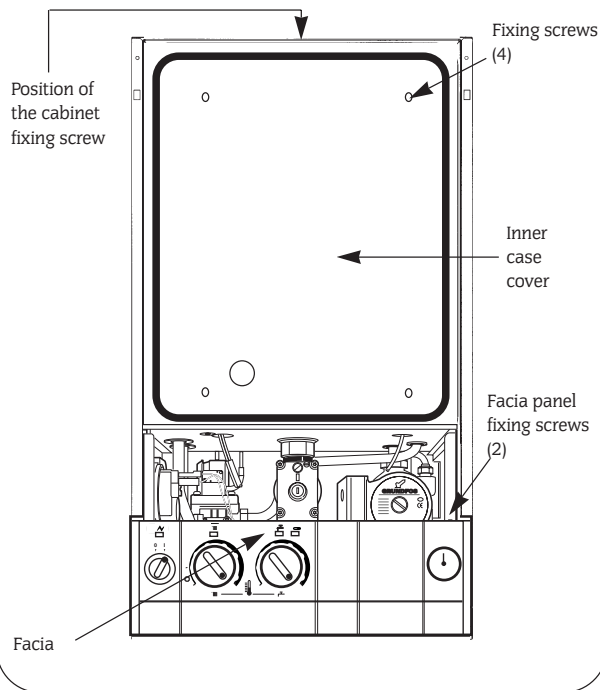
Lift the appliance to the wall, engage in the top support and lower onto the manifold assembly. Tighten the gas and water connections.

Fit a discharge pipe to the relief valve leading it away from any electrics or where it might be a hazard. Lower the facia to gain access. The pipe must not be less than 15mm in diameter and must run continuously downward outside the appliance. Refer to Fig 17.

**Fig.17 . Relief valve drain connection**



**Fig.18. Inner case and facia fixing**



**11.8 Air and Flue Duct Preparation**

The method of installation of the flue system may be varied to suit the actual site conditions. The instructions for connecting and fixing the ducts must, however, be strictly followed.

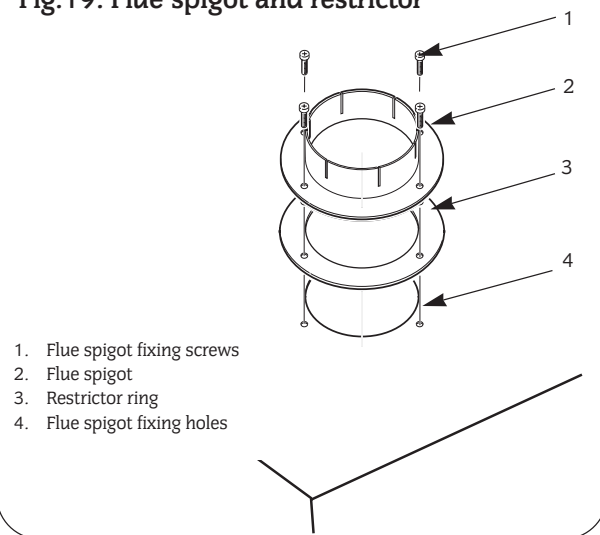
Remove all packing material from the flue components. Fit the flue restrictor ring by unscrewing and removing the flue spigot from the boiler. Refer to Fig.19.

Restrictor Size 79mm to all Horizontal and Vertical flues upto 725mm long.

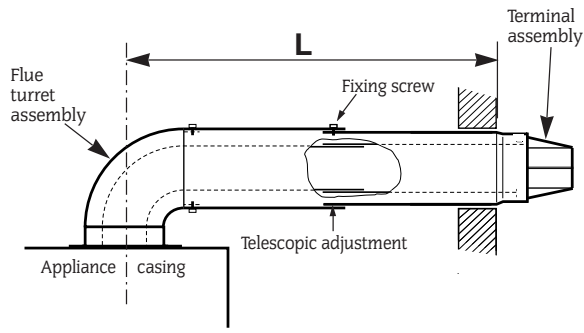
The standard telescopic flue assembly is suitable (without cutting) for flues from 425mm up to 725mm measured from the centre-line of the boiler flue outlet to the outer face of the wall. Refer to Fig.20.

The minimum length of the standard flue, after cutting is 330mm.

**Fig.19. Flue spigot and restrictor**



**Fig.20. Standard flue assembly**



If L is greater than 725mm then extension duct kit/s will be required - each kit extends the flue by 750mm up to a maximum of 2975mm. See table below.

EXTENSION	MAXIMUM FLUE LENGTH mm
1	1475
2	2225
3	2975

**11.9 Measure and Cut the Ducts.**

**General:** Cut the ducts as necessary, ensuring that the ducts are square and free from burrs. Always check the dimensions before cutting.

Measure the distance L. Refer to Fig. 22 and 23.

The standard flue can be telescopically adjusted to any length between 425mm and 725mm measured from the centre of the turret.

Fix the flue assembly together using the self-tapping screw provided. Refer to Fig. 20.

It will only be necessary to cut the standard assembly if L is less than 425mm. Cut the flue turret assembly and the terminal assembly by the same amount i.e L = 350 - remove 75mm from each assembly.

Minimum side flue length = 330mm (accommodating a 10mm Service clearance and a 100mm wall)

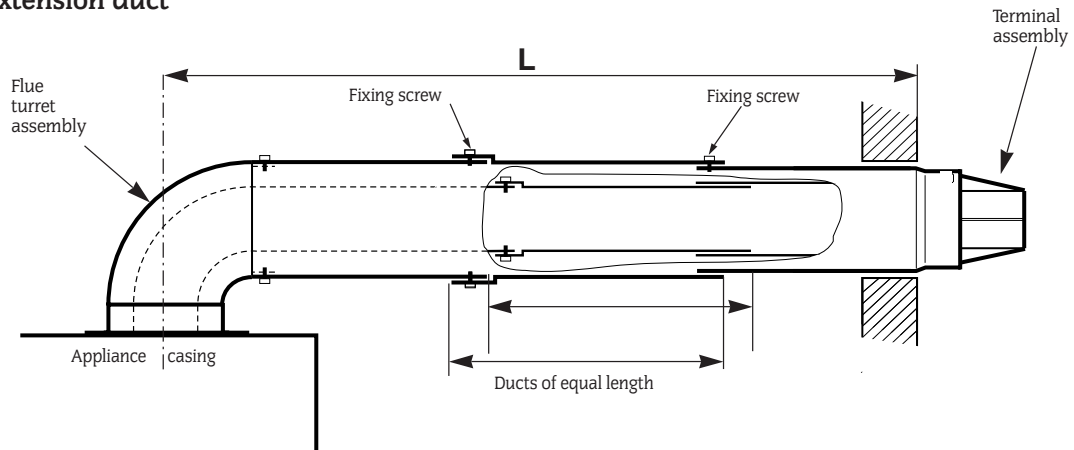
Minimum rear flue length = 300mm (accommodating a 100mm wall)

If L is between 1175 - 1475mm (1 extension)  
 1925 - 2225mm (2 extension)  
 2675 - 2975mm (3 extension)  
 it is not necessary to cut the ducts.

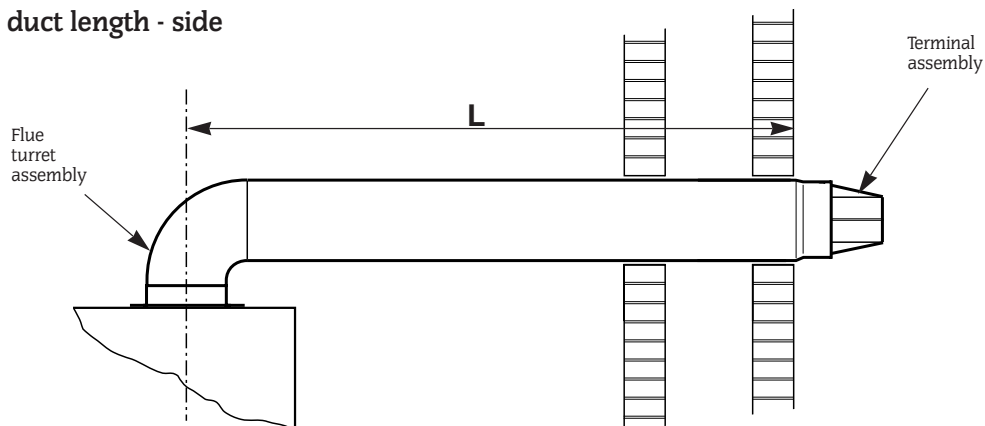
If L is between 725 - 1175mm (1 extension)  
 1475 - 1925mm (2 extension)  
 2225 - 2675mm (3 extension)

It is necessary to shorten the assembly by cutting the first extension duct assembly i.e. L = 1000mm - remove 175mm from the air and flue ducts.

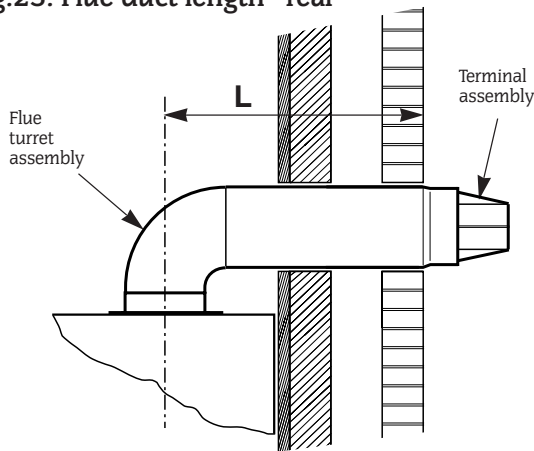
**Fig.21. Extension duct**



**Fig.22. Flue duct length - side**



**Fig.23. Flue duct length - rear**



NOTE: Extension duct measurements do not include the socketed end. Unless specifically instructed the socketed end must not be removed.

Fix the flue ducts together before fixing the surrounding air duct, the cut ducts fit into the flue assembly.

**11.10 Fitting the Flue Assembly with Access to the Terminal.**  
Prepare the flue duct assembly as described in Section 11.8. Apply the plastic tape to the air duct in contact with the external brickwork.

From inside push the assembly through the wall. Align the flue turret and push fully onto the spigot on the appliance. Tighten the clamping ring and fix with the screw provided. Refer to Fig. 24.

Make good the internal wall face and the external brickwork or rendering.

**11.11 Fitting of the Flue Assembly without access to the Terminal.**  
A rubber gasket kit is available from Worcester Heat Systems.  
NOTE: A larger diameter opening in the wall is required. Refer to Table 2.

Prepare the flue assembly as described in Section 11.8.

Fit the rubber sealing gasket centrally onto the terminal assembly and tighten the clamp. Refer to Fig. 25.  
Apply the plastic tape to the air duct in contact with the external brickwork.

From inside push the assembly through the wall so that the gasket flange is against the outer face. Refer to Fig. 25.  
It may be necessary to adjust the legs of the flue centering ring. Align the flue turret and push fully onto the socket on the appliance. Tighten the clamping ring and fix with the screw provided. Refer to Fig.24.

Seal the gap around the duct at the inner wall face with the flexible seal provided and make good.

**11.12 Flue Bends.**

90° and 45° bends are available. A maximum of two bends may be used in addition to the first bend on the flue turret.

A 90° bend is equivalent to 1m of straight duct.

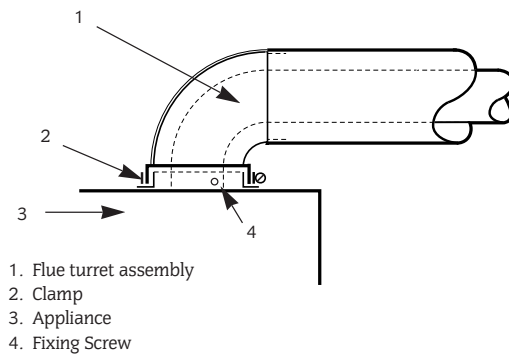
A 45° bend is equivalent to 0.5m of straight duct.

A maximum flue assembly of 2m is possible with 1 X 90° bend and 1m with 2 X 90° bends.

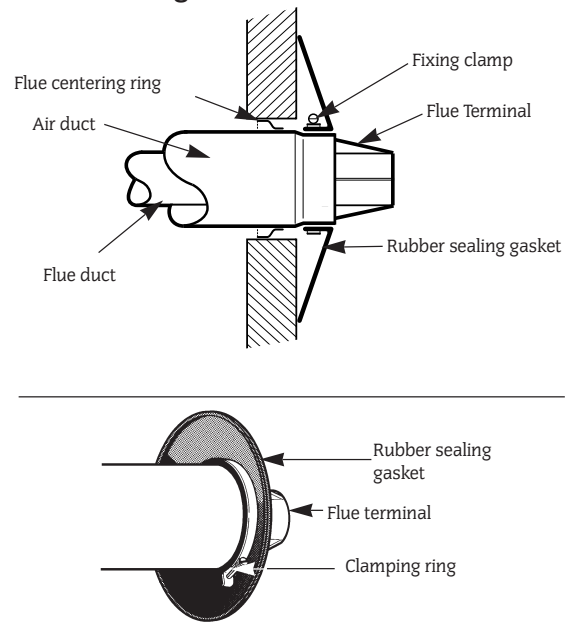
Measure the lengths X,Y and Z. Refer to Fig.26.

The maximum value of X using the turret assembly only is 506mm. Reduce the ducts to the appropriate length i.e. X = 406mm, cut 100mm from the air duct and 120mm (to cover the entry into the 45° or 90° elbow) from the flue duct. Refer to Fig.27.

**Fig.24 . Flue Turret Fixing**



**Fig.25 . Terminal assembly for internal fitting of the flue.**



NOTE: The flue system ducts between the elbows, dimension Y, requires the socketed ends (of the first extension if two or more are used) to be removed and the air and flue tubes to be cut to the same length.

Cut the ducts to a length Y - 162mm. Refer to Fig.26.

The final section, dimension Z, of the flue system must include a section of plain duct assembly i.e. an extension assembly with the sockets removed. Reduce the final section, including the terminal assembly, by the appropriate amount i.e. Air duct Z - 81mm and the flue duct Z - 51mm. Refer to Fig.26.

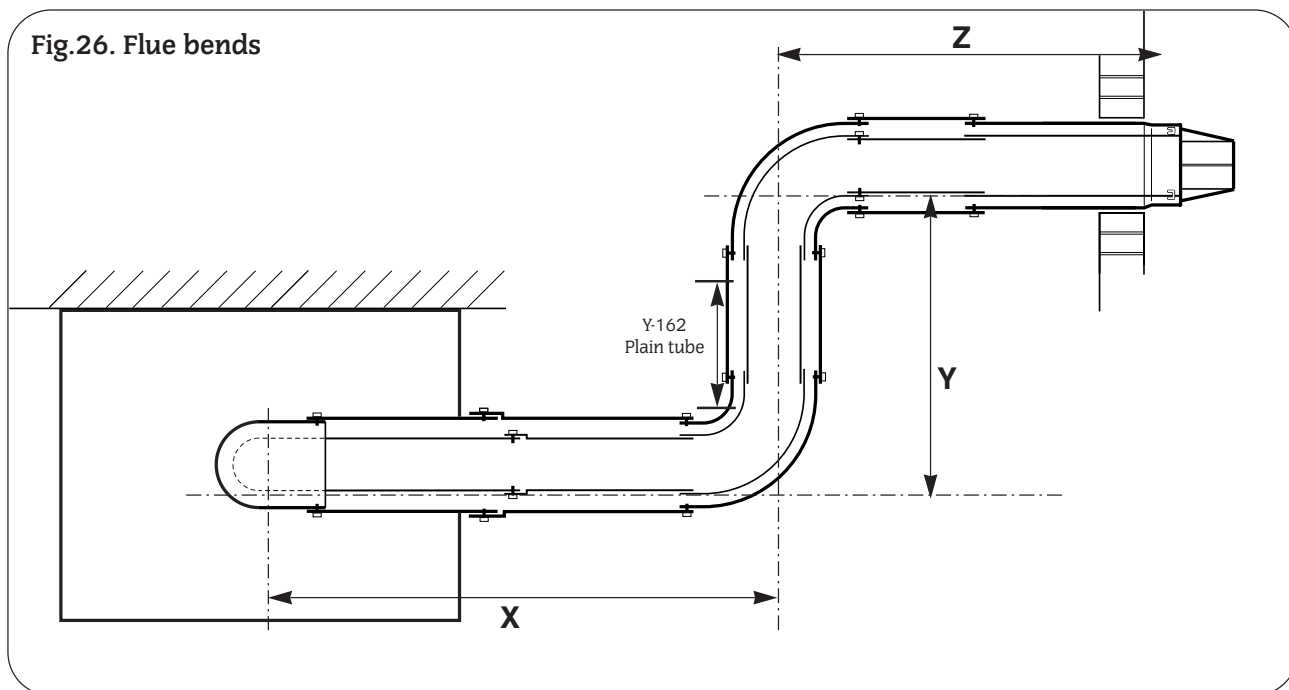
If Z is less than 425mm it will be necessary to cut the air and flue ducts of the extension to a plain length of 100mm and reduce the length of the terminal assembly i.e. Z=350mm - remove 75mm from the terminal assembly.

If Z is 425 - 725mm it is not necessary to cut the terminal assembly or use a second extension duct as the length can be set telescopically.

If Z is greater than 725mm then two extension duct assemblies will be required, the first assembly being cut to length as plain tubes.



**Fig.26. Flue bends**



If more than two extension ducts are needed in any section to achieve the required length then the final section of the assembly must not be less than 325mm without cutting the terminal assembly.

NOTE: The flue duct of the final extension must be 30mm longer than the air duct.

Each section must be connected to the previous section of the flue bend by fixing the flue ducts together and then similarly fixing the air ducts which engage the elbows.

Fit the assembly as described in Section 11.9, 11.10 as appropriate.

Make good the internal and external brickwork or rendering.

#### 11.13 Vertical Adapter for Horizontal Flues.

An adapter is available for an initial short section of vertical flue. Refer to Fig. 28.

Measure and cut the flue as described in Section 11.11.

The first, vertical, section (equivalent to dimension X) is measured from the top of the boiler casing. Cut the vertical section of the extension duct to 167mm less than the measured distance. Do not remove the socketed ends.

The minimum measured distance is 167mm.

Seal the air duct to the spigot using silicone sealant.

Fix the adaptor with the clamp and screw provided.

#### 11.14 Completion of the Installation.

Check that all the connections on the manifold have been tightened. Refer to Fig.6.

Remove the fascia bottom panel. Refer to Fig.29.

Connect the mains electricity supply lead to the appliance and secure the cable clamp. Refer to Fig.14.

Check there is sufficient loose lead to allow the release of the

facia panel assembly and that the earth lead of the mains supply cable is longer than the live and neutral leads.

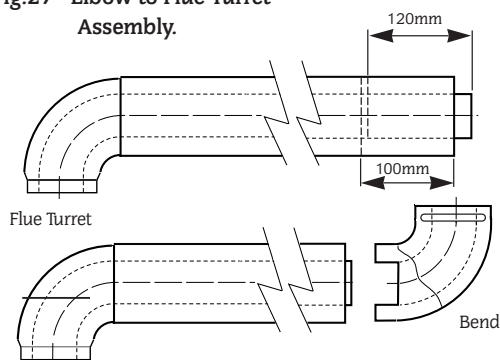
Fit the fascia mounted programmer. Refer to Fig.31.

Connect any external controls ensuring that the leads pass through the appropriate clamps. refer to Fig.32.

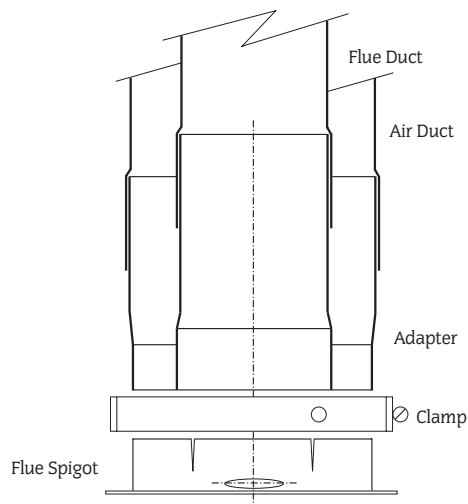
Test for gas soundness as described in BS6891.

If the appliance is not commissioned immediately, replace the cabinet and fascia bottom panel. Check that the gas and electricity services have been turned off.

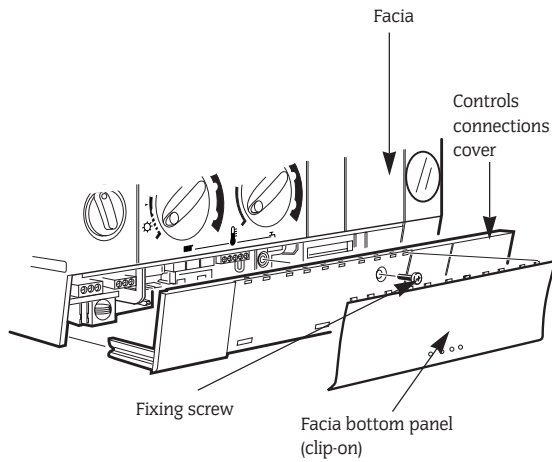
**Fig.27 - Elbow to Flue Turret Assembly.**



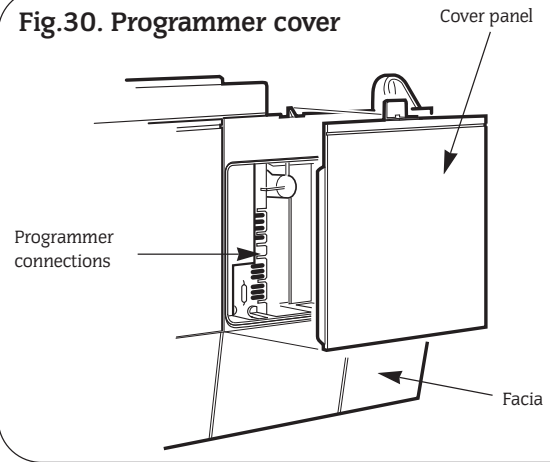
**Fig.28 Vertical Adapter.**



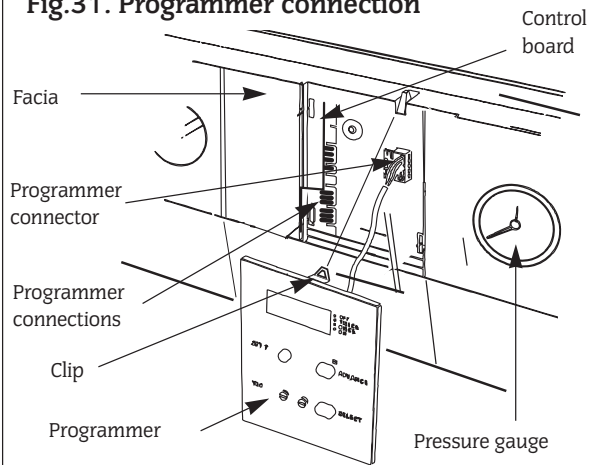
**Fig.29. Facia connections cover**



**Fig.30. Programmer cover**

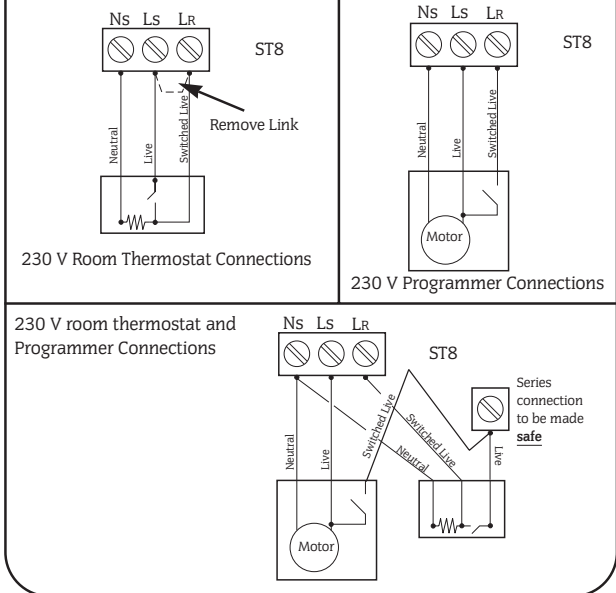


**Fig.31. Programmer connection**

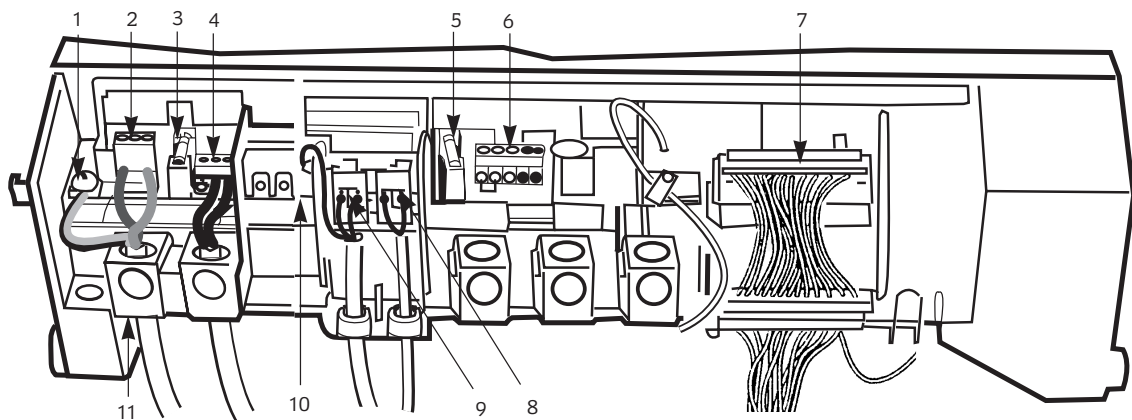


**Fig 32 - Mains Voltage External Controls Connections**

**NOTE: Only double insulated controls not requiring an earth can be used**



**Fig.33. Facia connections**



1. Earth screw
2. Mains connection (L N)
3. Fuse F1
4. Mains voltage room thermostat/external control-mains voltage ST8
5. Fuse F2

6. Controls 24V - ST13
7. Mains harness
8. Fan ST1
9. Pump ST5
10. Earth tag
11. Cable clamps (threaded)

## 12. Commissioning The Appliance

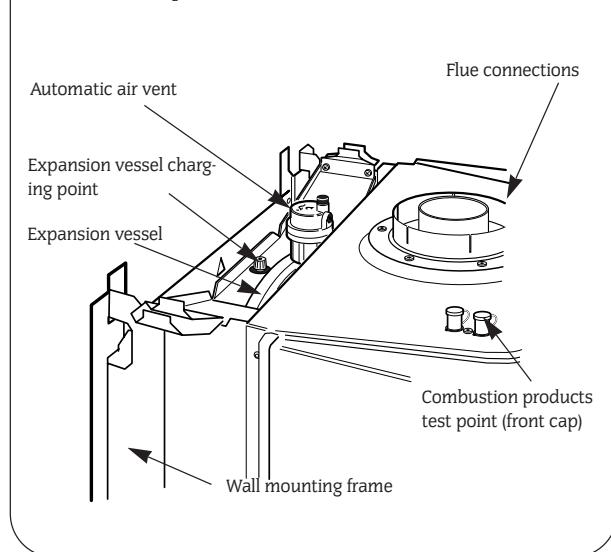
**12.1** Remove the appliance cabinet by removing the screw at the top centre of the cabinet.

Check that the electrical supply and the gas supply to the appliance are turned off and that all the water connections throughout the system are tight.

Open the system valves at the appliance. Refer to Fig.6.

Open all the radiator valves. Remove the automatic air vent cap. Refer to Fig. 34.

**Fig.34. Automatic air vent and combustion test point**



Fill the system through the external filling loop. Refer to Section 7, Sealed System.

**(benchmark)** For optimum performance after installation, this boiler and its associated central heating system must be flushed in accordance with the guidelines given in BS7593:1992, 'Treatment of water in domestic hot water central heating systems'.

This must involve the use of a proprietary cleaner, such as Betz Dearborn's Sentinal X300 or X400, or Fernox Superfloc. Full instructions are supplied with the products, but for immediate information, please contact Betz Dearborn on 0151 420 9563 or Fernox on 01799 550811.

For long term protection against corrosion and scale, after flushing, it is recommended that an inhibitor such as Betz Dearborn's Sentinal X100 or Fernox MB-1 is dosed in accordance with guidelines given in BS7593:1992.

Failure to implement the guidelines may invalidate the warranty.

Vent each radiator in turn. The automatic air vent will vent the appliance. Refer to Fig 34.

Remove the cap from the pump and turn the shaft about half a turn. Replace the cap. Refer to Fig 35.

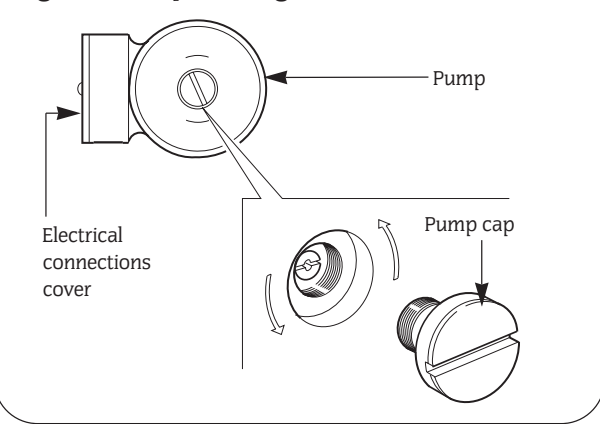
Check that the pressure relief valve operates by turning the knob anti-clockwise until it releases. Lower the facia to gain access to the relief valve. Refer to Fig 17. Water should be expelled from the discharge pipe.

**12.2 Set the Expansion Vessel Pressure**

The charge pressure of the expansion vessel as dispatched is 0.5bar, which is equivalent to a static head of 5m [17ft]. The charge pressure must not be less than the static head at the point of connection. A Schraeder type valve is fitted to the expansion vessel to allow the charge pressure to be increased if necessary. Refer to Fig 34. The expansion vessel must be charged to 0.35bar less than the initial system design pressure.

Note: 1bar = 10.2m = 33.5ft of water.

**Fig. 35. Pump venting.**



**12.3 Set the System Pressure**

Fill the system until the pressure gauge is at 2.5bar and check for leaks.

Release water from the system using the relief valve test knob until the required system pressure is obtained, upto a maximum of 1.5bar.

Set the pointer on the pressure gauge to record the set system pressure.

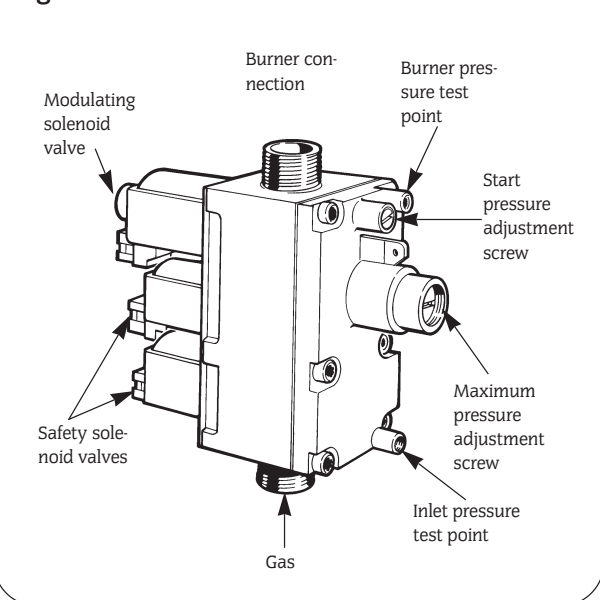
If the pressure indicated on the gauge is greater than 2.65bar when operating at the maximum central heating temperature, an extra expansion vessel must be fitted to the system as close as possible to the appliance central heating return connection.

The appliance [as despatched] can accommodate a system volume of 100 litres with a system pressure of 0.5bar. Refer to BS7074 Part 1, BS5449 and Table 8. If the system volume is greater then an extra vessel must be fitted as close as possible to the appliance central heating return connection and pressurised to the same figure as the integral vessel.

**12.4 Clock/Programmer:** The controls fitted to the appliance should be set up at this stage.

**12.5** Check that the gas and electricity supplies are turned off. Connect a pressure gauge to the gas valve burner pressure test point. Refer to Fig 36.

**Fig. 36. Gas valve.**



Remove the clip-on fascia bottom cover and the controls connections cover. Refer to Fig 29.

Slide down the access panel to display the mode switch and the adjusting tool. Refer to Fig 37.

### 12.6 Checking the Burner Pressure

Check that all the radiator valves are open.

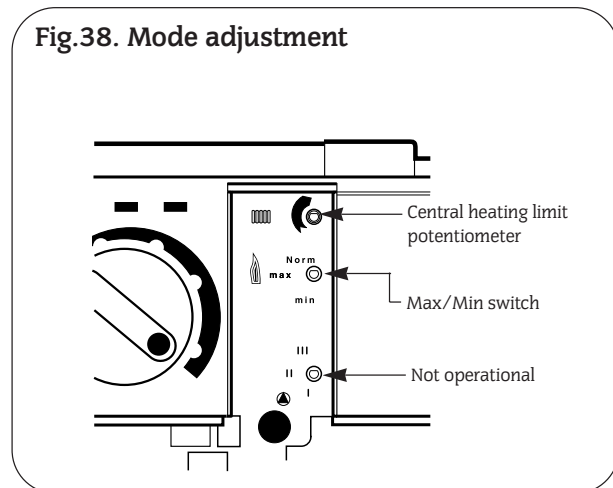
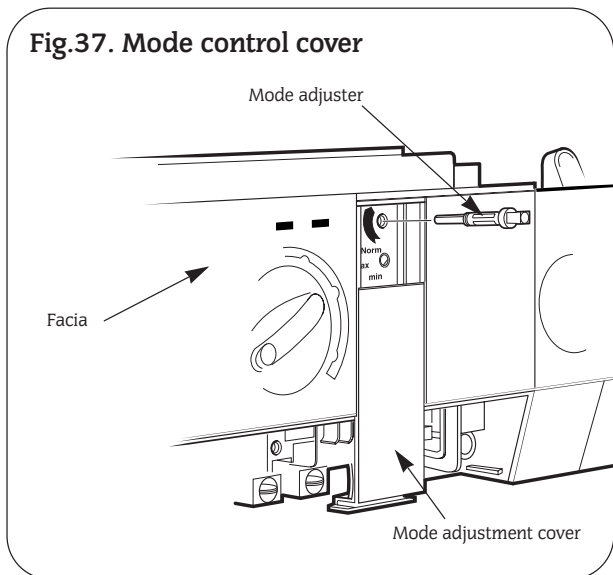
Check that the system is pressurised and set to the required pressure as indicated on the gauge.

Set the temperature control knobs to maximum and the clock/programmer to operate continuously.

Turn on the gas and electricity supplies.

Set the mode switch to MAX using the mode adjuster tool.

Refer to Fig 37 and 38. **NOTE: Two red lights will flash rapidly on the fascia.**



A continuous spark will occur until the burner is alight and sensed by the control circuit. The burner will remain at its maximum domestic hot water pressure for one minute. Refer to Table 1.

It should not be necessary for the gas valve to be adjusted.

Note: The burner pressure is factory set and if, after checking that the dynamic (working) supply pressure is sufficient i.e. 18.0mb approx, at the gas valve inlet pressure test point, the correct pressure cannot be obtained then Worcester Heat Systems Service Department should be contacted.

If the appliance does not light then check that it is not in the 'lock-out' state by pressing the reset button. Refer to Fig 39.

Set the mode switch to Normal.

The burner pressure will drop to the minimum setting and will ramp up to the maximum central heating pressure appropriate to the appliance and the gas. Refer to Table 1. It should not be

necessary for the central heating potentiometer to be adjusted to change the burner pressure. If adjustment is required then the adjusting tool is used to alter the setting of the potentiometer. Refer to Fig 38.

Set the mode switch to MIN. **NOTE: Two red lights will flash rapidly on the fascia.**

The burner pressure will drop to the minimum pressure appropriate to the appliance and the gas for both the central heating and domestic hot water modes. Refer to Table 1. It should not be necessary for the central heating potentiometer to be adjusted.

Test for gas soundness at the joint between the burner and the gas valve with leak detection fluid.

Set the mode switch back to Normal.

Turn the electricity supply off and then back on to reset the controls.

Replace the fascia cover panels.

### 12.7 Domestic Hot Water

Turn the central heating temperature control knob fully anti-clockwise. Refer to Fig. 39.

Open a hot tap near the appliance. The burner will light and go to the maximum burner pressure appropriate to the appliance and the gas. Refer to Table 1.

Gradually close the tap and check that the burner pressure falls. Fully open the tap and check that the pressure rises.

Close the tap and check that the burner goes out.

The fan may continue running until the appliance has cooled to a pre-set temperature.

### 12.8 Central Heating

Check that all the radiator valves are open.

Check that the system is pressurised and set to the required pressure as indicated on the gauge.

Check that the clock/programmer is set to operate continuously.

Set the room thermostat and the central heating temperature control to maximum.

The burner will light and the appliance will modulate its output from minimum to maximum over a period of about two minutes.

Check that all the radiators are heating up evenly.

Shut down all but one of the radiators and observe the burner pressure fall. Open all the radiators and check that the burner pressure rises.

12.9 Balance the system to give a temperature differential of 11°C. A non-adjustable by-pass is fitted to the appliance.

12.10 Set the room thermostat to minimum and check that the burner goes out. Reset the room thermostat to maximum and the burner will re-light and follow the normal operating procedure.

Turn off the gas service cock. The burner will go out but sparking from the electrode will continue for 10 seconds when the appliance will 'lock-out'. After 60 seconds carefully open the gas service cock, press the reset button and observe the burner re-light and follow the normal sequence of operation. Refer to Fig 6 and 39.

Turn off the gas service cock and the electricity supply to the appliance.

Drain the system while the appliance is hot.

Refill, vent and re-pressurise the system as described in Section 12.1 preceding, adding, if necessary, a suitable proprietary inhibitor. Further information is available from Betz Dearborn 0151 420 9563 or Fernox 01799 550811.

### 12.11 Domestic Hot Water and Central Heating

Set all controls to maximum.

Turn on the electricity supply to the appliance and open the gas service cock at the appliance.

The burner will light and heat will pass into the system. Turn on a hot tap and check that hot water is soon discharged from the tap. Close the tap.

The appliance will then return to the central heating mode and automatically balance with the system requirements.

Turn off the appliance.

### 12.12 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.

Refit the cabinet.

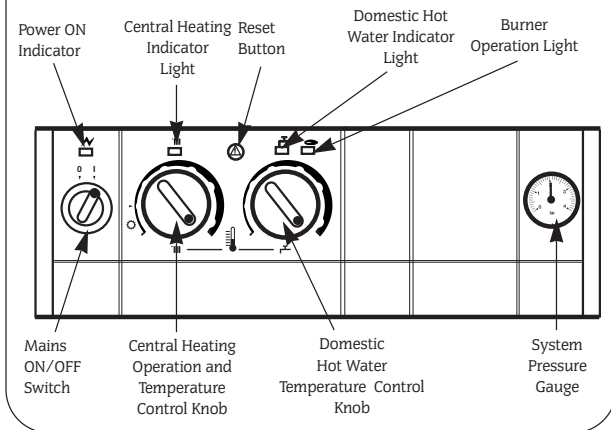
If the appliance is to be passed over to the user immediately then set the controls to the users requirements.

If the appliance is to be left inoperative in frosty conditions then set the programmer, if fitted, to off. Do not turn the electricity or gas supplies off. The appliance will operate under the control of the integral frost protection facility.

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

## 13. Instructions To The User

Fig. 39. Facia controls



**benchmark**

13.1 Hand over the User Booklet.

13.2 Explain how to operate the appliance safely and efficiently.

13.3 Tell the user what to do if the appliance is not to be used in very cold conditions.

13.4 Tell the user what to do if the system pressure falls.

13.5 Explain that regular servicing will maintain the safe and efficient operation and extend the life of the appliance. WHS can offer a comprehensive maintenance contract.

13.6 Tell the user that any work on the appliance must only be carried out by a competent, CORGI registered, person.

## 14. Inspection And Service

14.1 The extent of the service is determined by the operating condition of the appliance when tested by a competent person.

It is the law that any service work is carried out by a competent CORGI registered person.

14.2 Inspection

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

If the appliance is in a compartment or cupboard check that the specified service space around the appliance is clear. Refer to Table 8.

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-Commissioning.

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

Check the combustion performance

Remove the cap from the sample point on the top of the appliance. Refer to Fig 34.

Connect the sampling meter.

With the appliance at maximum rate and stable in the DHW mode expect readings of NG 5.5 - 8.5% CO<sub>2</sub>, 0.002 - 0.015% CO. These figures cover all flue conditions.

Refit the cap after the test.

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.

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

14.3 Component Access

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.

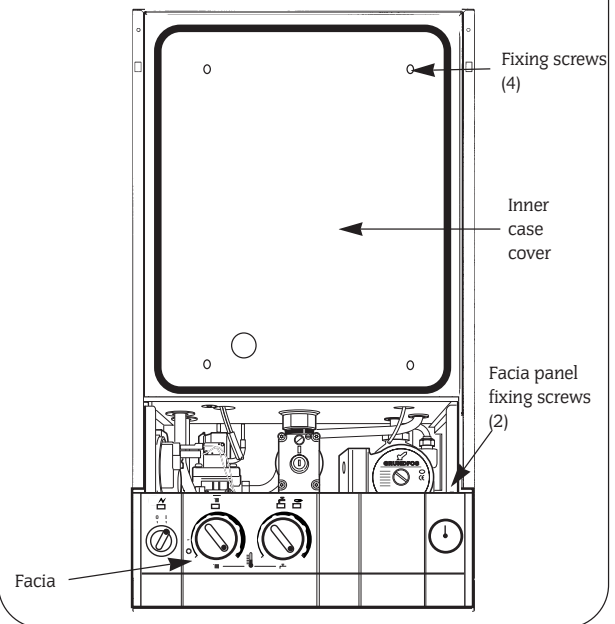
**Cabinet** Unscrew the screw at the top of the cabinet, release the side. Lift up and away from the top locating pegs.

**Facia Panel** Unscrew the two screws and lower. Refer to Fig 40.

Unscrew the four screws, pull forward and remove. Refer to Fig 40.

**Inner Case Cover** Unscrew the four fixing screws and remove the cover. Refer to Fig 40.

Fig.40. Inner case and facia fixing



**Combustion Chamber** Unscrew the two screws at the top and the two wing nut extended screws at the sides, pull forward and remove. Refer to Fig 41.

**Fan** Carefully pull off the electrical connections and the tubes from the airflow-sensing device. Unscrew the four screws and remove the fan assembly. Refer to Fig 42.

**Flue Hood** Remove the fan. Unscrew the four screws and remove the hood. Refer to Fig 43.

**Burner** Remove the combustion chamber. Carefully pull off the connections to the spark and flame sensing electrodes. Release the union nut beneath the burner and remove. Refer to Fig 44.

14.4 Component Cleaning

Only use a non-metallic brush to clean components.

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

Clean the burner to ensure that the blades and injectors are clear. Do not use a metal probe to clean the injectors.

Clean the electrodes, replace if there is any sign of deterioration.

Clean the heat exchanger. Cover the gas inlet tube and remove any deposits from the heat exchanger from the top and bottom.

Carefully straighten any distorted fins on the heat exchanger.

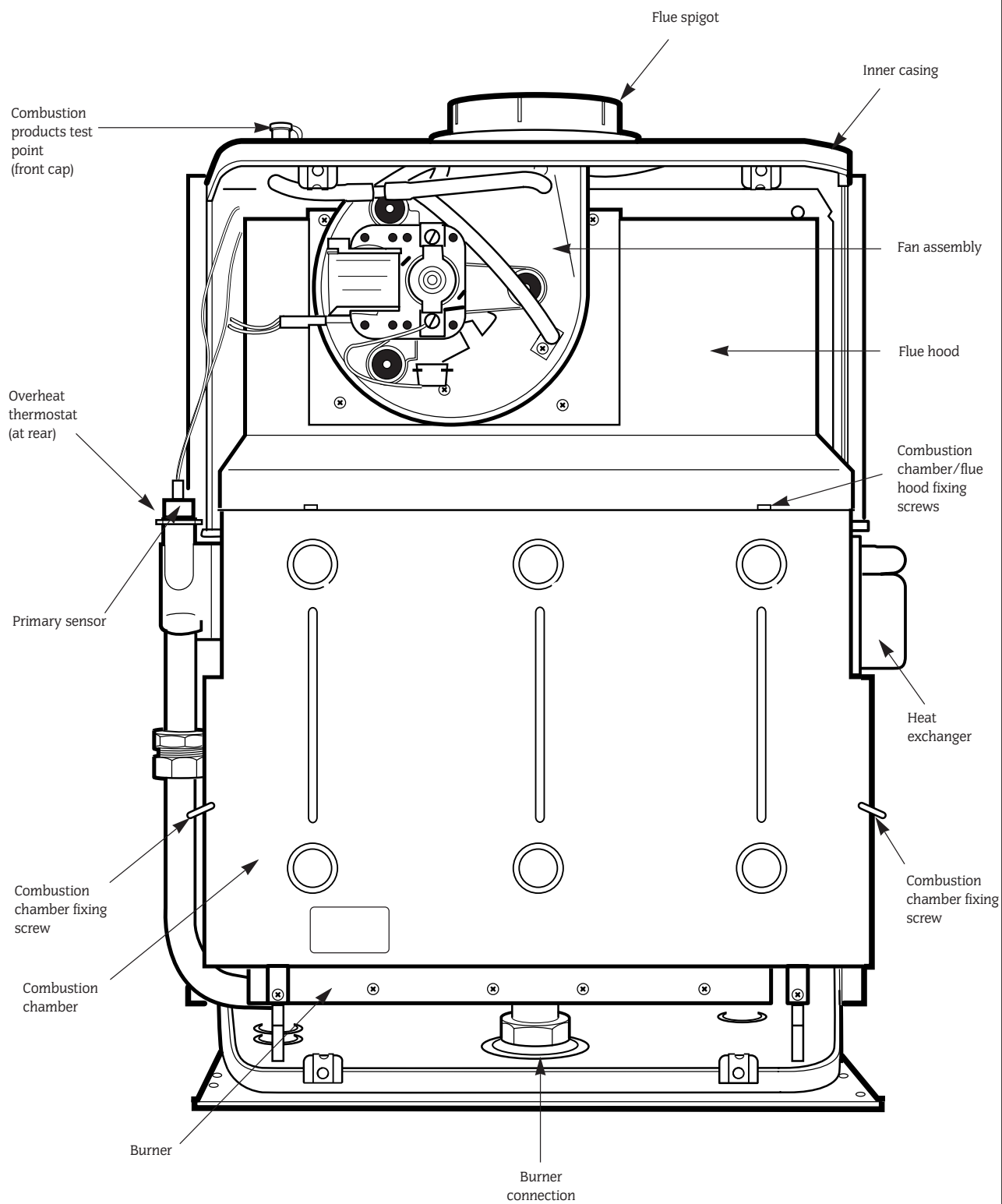
Check the combustion chamber insulation and replace if there is any sign of damage or deterioration. Refer to Section 15.4.5.

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

Carefully refit any components removed in the reverse order. Check that all screws are tight and the connections properly remade with the appropriate gaskets/O-rings.

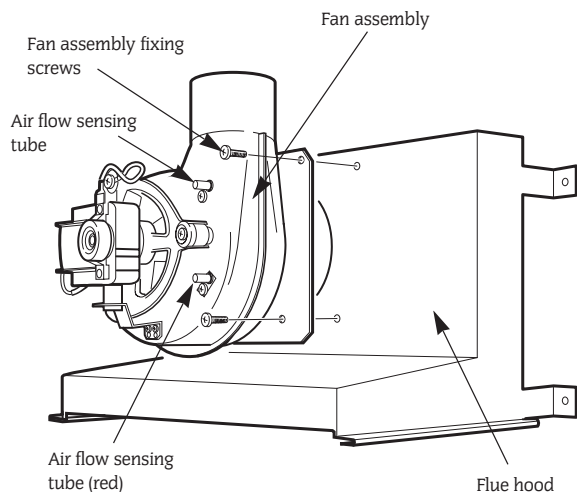
Re-commission, as necessary, for correct operation to the users requirements. Refer to Section 12 Commissioning.

Fig.41. Inner case components

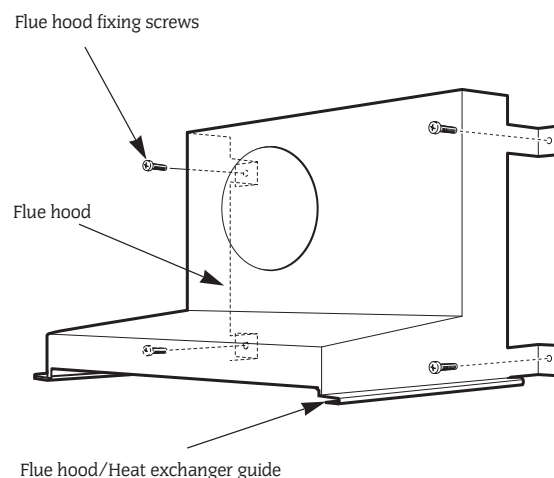




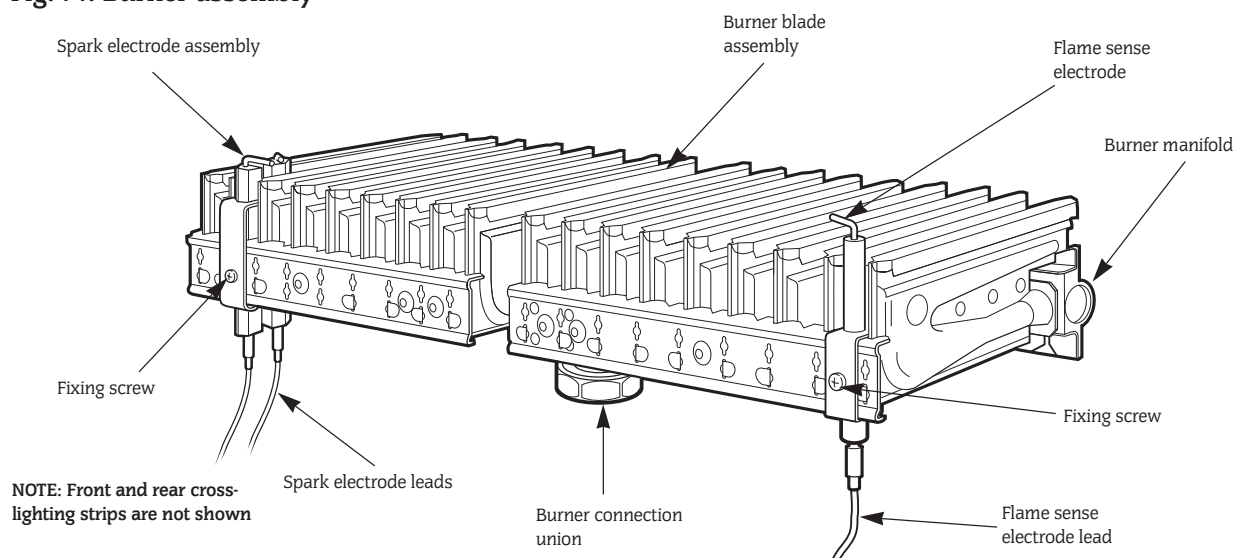
**Fig.42. Fan assembly**



**Fig.43. Flue hood**



**Fig.44. Burner assembly**



## 15. Replacement Of Parts

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

**15.1** After the replacement of any components always check for gas soundness where relevant and carryout 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 gas and water connections on the appliance.

### 15.2 Component Access

Refer to Section 14, Inspection and Servicing for access to components.

### 15.3 Draining the Appliance

**Primary System:** Turn off the heating flow and return valves at the appliance. Refer to Fig 16.

Open the drain tap. Refer to Fig 17. Close the drain tap when the flow from the appliance has stopped.

**DHW Circuit:** Turn off the mains cold water supply at the appliance. Refer to Fig 16.

Open a hot tap below the level of the appliance to drain the domestic hot water from the appliance.

**Important:** A small quantity of water will remain in some components even after the appliance has been drained. Protect any electrical components when removing items from the water circuits.

### 15.4 Component Replacement

Refer to Fig 41 and 45 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/heat transfer paste 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 components. Refer to Section 14, Inspection and Servicing.

#### 15.4.1 Gas Valve

Do not remove the inner casing.

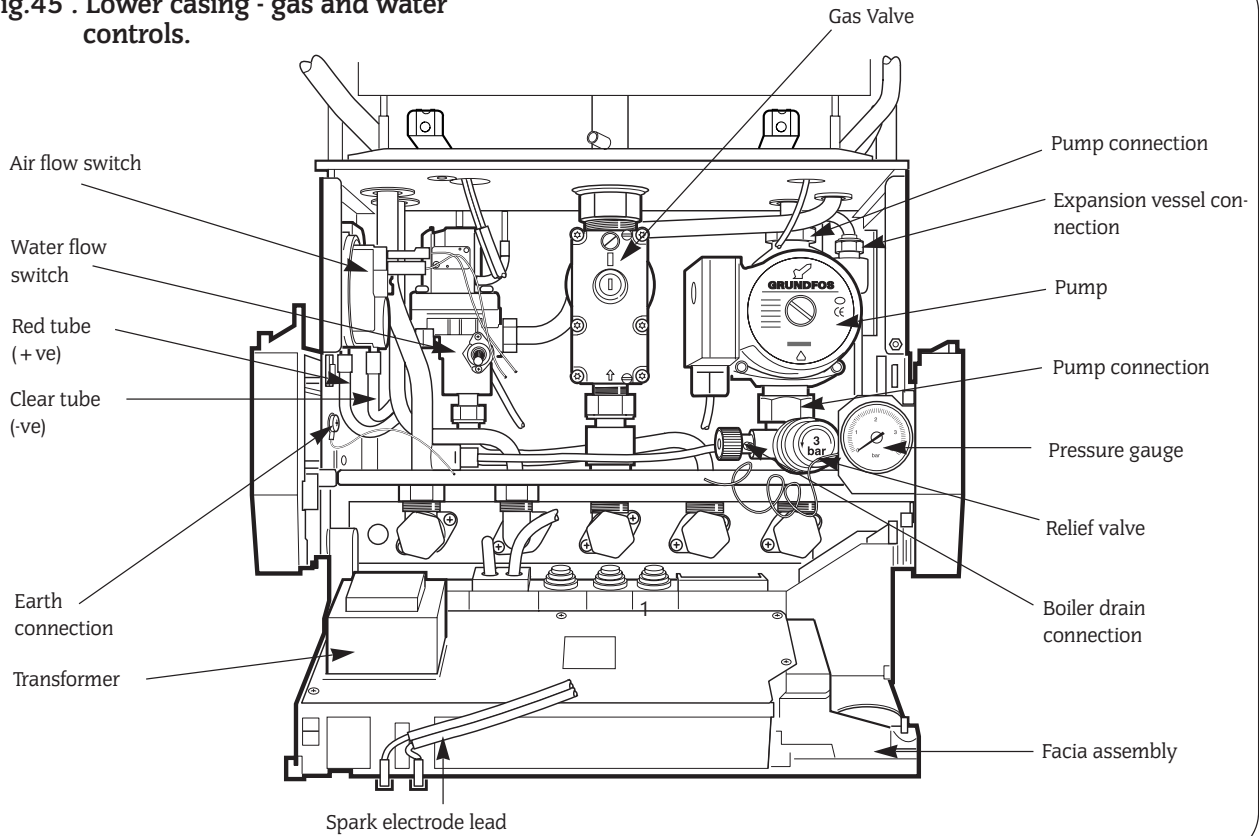
Unscrew the union connections above and below the gas valve and remove the assembly. Disconnect/unplug the electrical connections from the valve. Use new gaskets when replacing the valve. Refer to Fig 45.

Set the Gas Valve:

Connect a pressure gauge to the burner pressure test point on the valve. Refer to Fig 36.



**Fig.45 . Lower casing - gas and water controls.**



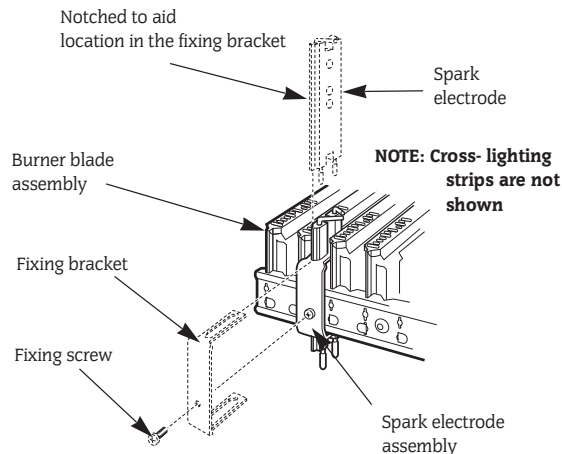
Switch on the gas and electricity supplies. Check for gas tightness at the gas valve inlet. Refer to Section 12-Commissioning for the method of checking the pressures.

Check for gas soundness at the gas valve outlet. Adjust the maximum and start pressure [minimum], as necessary, to obtain the required pressures. Switch off the appliance and disconnect the pressure gauge.

**15.4.2 Spark Electrode**

Remove the inner casing and the combustion chamber. Carefully pull off the leads from the electrodes. Loosen the screw and remove the spark electrode assembly. Refer to Fig 46.

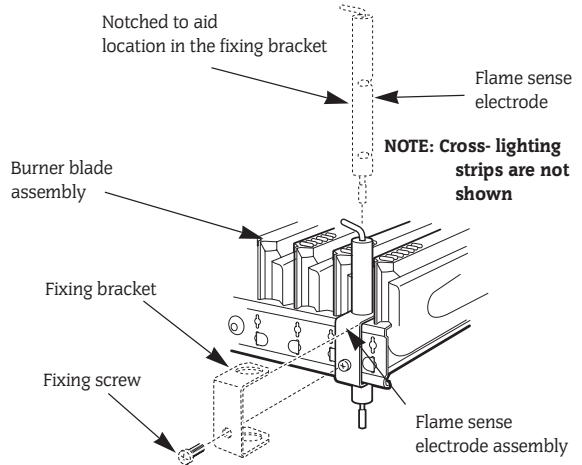
**Fig.46. Spark electrode assembly**



**15.4.3 Flame Sense Electrode**

Remove the inner casing and the combustion chamber. Carefully pull off the lead from the electrode. Loosen the screw

**Fig.47. Flame sense electrode**



and remove the flame sensing electrode assembly. Refer to Fig 47. Ensure that the electrode is at the correct height above the burner blade.

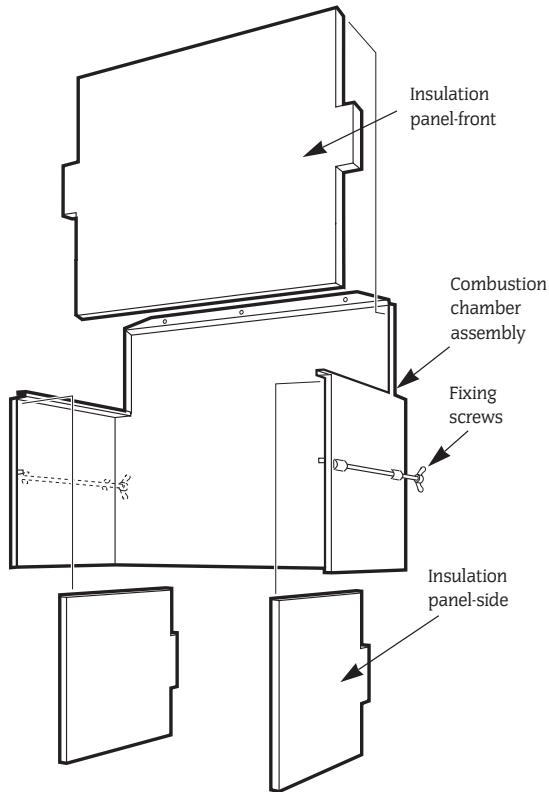
**15.4.4 Burner**

Remove the inner casing and the combustion chamber. Remove the electrode connections. Release the union connection beneath the burner and remove the burner from the appliance. Refer to Fig 44. Do not omit the gasket when fitting the new burner.

**15.4.5 Combustion Chamber Insulation**

Remove the burner as described in 15.3.4 preceding. Remove the primary heat exchanger as described in 15.4.21 following. Replace the side and front pads in the combustion chamber assembly. Refer to Fig 48. Replace the rear insulation pad.

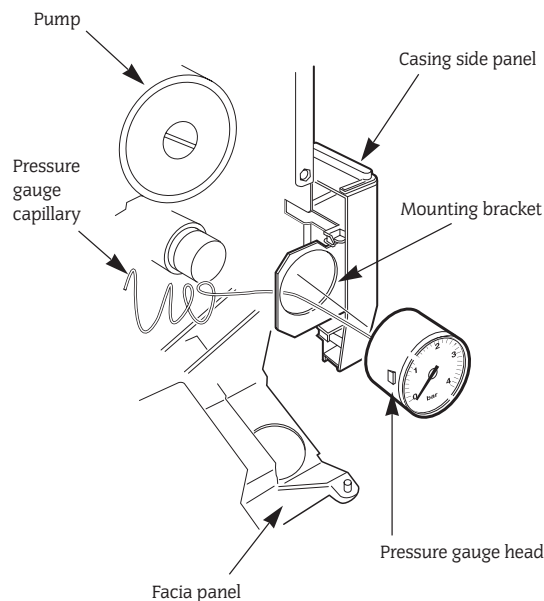
**Fig.48. Combustion Chamber Insulation.**



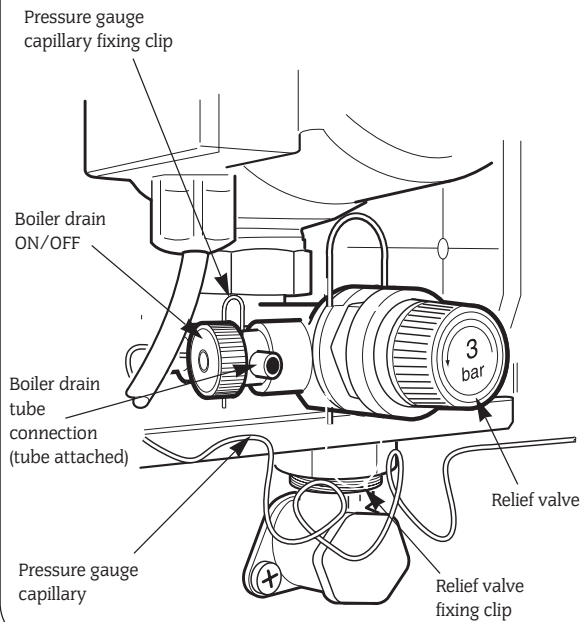
**15.4.6 Pressure Gauge**

Remove the cabinet and lower the facia panel. Refer to Fig 40. Check that the appliance has been fully drained. Withdraw the clip and remove the pressure-sensing head. Refer to Fig 50. Unclip the gauge head from its mounting bracket and remove. Refer to Fig 49

**Fig.49. Pressure Gauge head**



**Fig.50. Pressure Gauge capillary fixing**

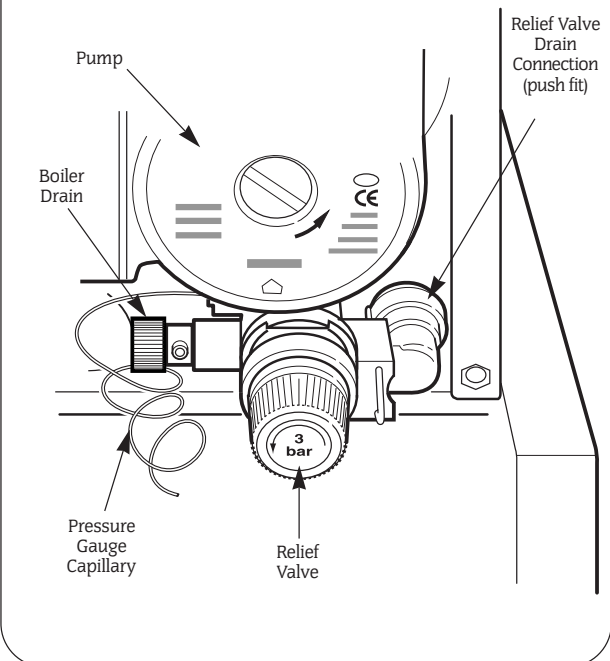


Do not omit the O-ring from the pressure capillary when fitting the replacement gauge.

**15.4.7 Relief Valve**

Remove the cabinet and lower the facia. Check that the appliance has been fully drained. Disconnect the relief valve drainpipe. Unclip and pull-out the valve. Refer to Fig 51.

**Fig.51 . Relief valve drain connection**



#### 15.4.8 Flow Switch

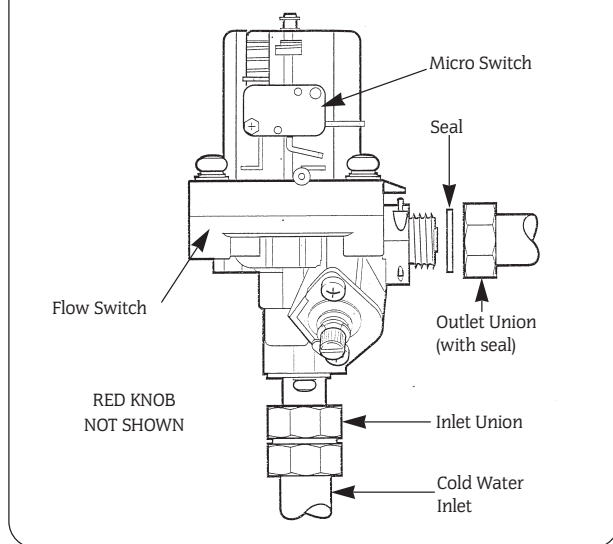
Drain the DHW circuit as described in 15.3 preceding. Remove the cabinet and lower the facia panel.

Carefully pull off the connections from the micro-switch. Undo the two union connections on the valve and remove the valve. Refer to Fig 52. Do not omit the gaskets when fitting the replacement switch.

The new flow-switch must be set to deliver the correct flow rate to give a temperaturerise of 35°C ie 10 l/min.

The adjustment is made by turning the red adjuster clockwise to reduce the flow rate and anti-clockwise to increase the flow rate. Make the adustment with the gas turned off.

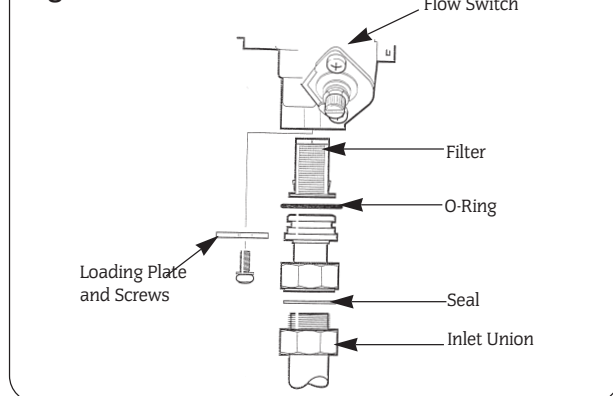
**Fig. 52. Water Flow switch.**



#### 15.4.9 Inlet Water Filter

Remove the flow switch as described in 15.4.8 preceding. Unscrew the two screws and remove the securing plate. Firmly withdraw the union connection assembly and pull out the filter. Refer to Fig 53. Carefully clean or replace the filter.

**Fig. 53. Inlet water filter**



#### 15.4.10 Control Board

Remove the facia bottom panel and carefully disconnect all the electrical connections. Refer to Fig 33.

Remove the cabinet and lower the facia panel as described in Section 14.3, Inspection and Servicing.

Disconnect the earth connection at the appliance. Refer to Fig 45.

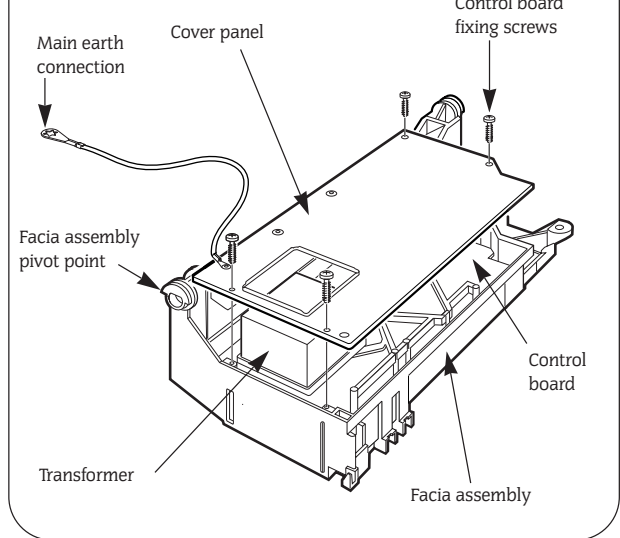
Unscrew the four screws and remove the metal cover. Refer to Fig 54.

Lift out the control board. Refer to Fig 55

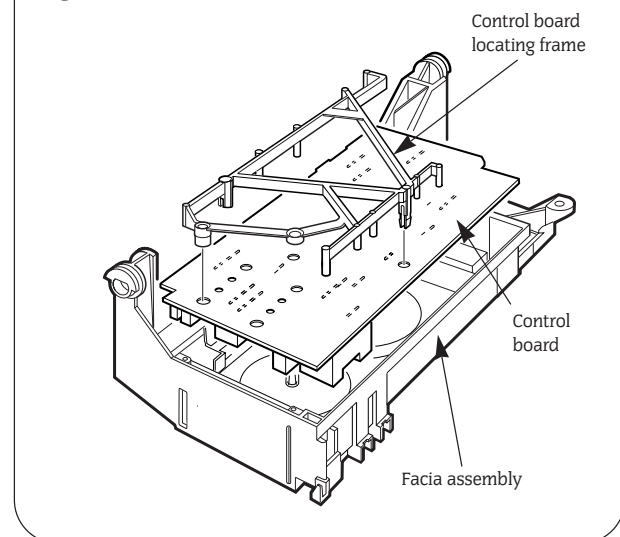
Pull out and transfer the transformer to the new board together with the plastic locating frame.

Re-commission the appliance to check and set the burner pressures. Refer to Section 12, Commissioning.

**Fig.54. Control board cover**



**Fig.55. Control board**

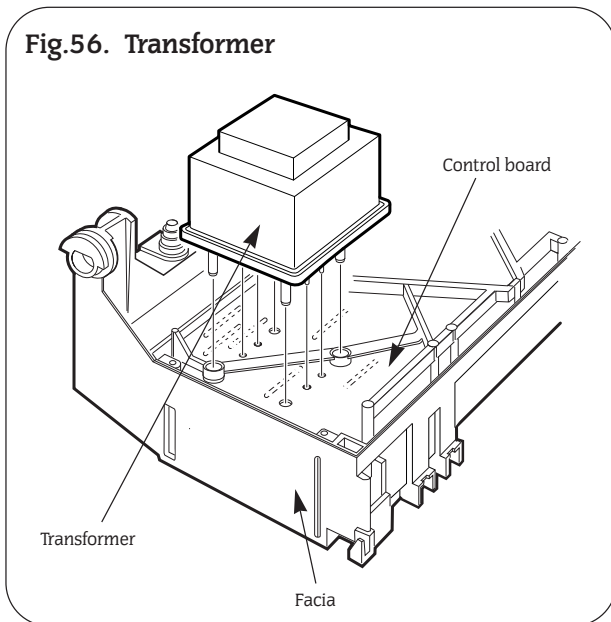


#### 15.4.11 Transformer

Remove the cabinet and lower the fascia panel as described in Section 14, Inspection and Servicing.

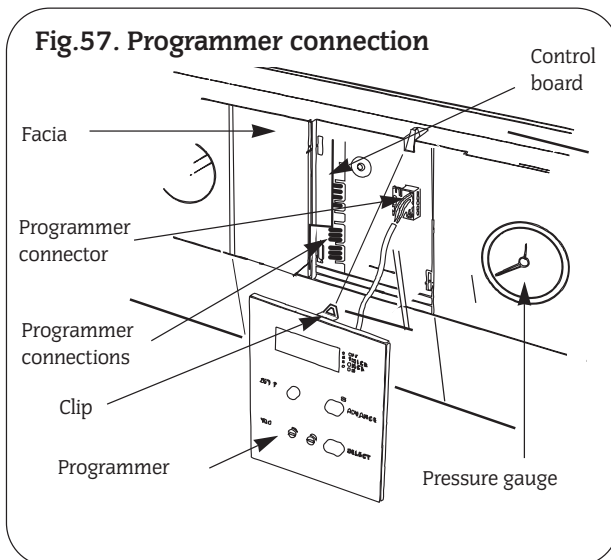
Unscrew the four screws and remove the metal cover. Refer to Fig 54.

Pull out the transformer. Refer to Fig 56.



#### 15.4.12 Clock/Programmer

Remove the clock/programmer assembly by carefully pulling it from the fascia to release the clips. Unplug the connector at the control board. Comprehensive instructions are sent with the new control. Refer to Fig 57.



#### 15.4.13 Fan

Remove the inner casing.

Remove the fan as described in Section 14.3, Inspection and Servicing. Ensure that all the connections are correctly made to the new fan.

#### 15.4.14 Air Flow Detector

Remove the fan as described in 15.3.13 preceding.

Unscrew and, through the fan outlet, withdraw the airflow detector. Refer to Fig 42.

#### 15.4.15 Primary [CH] Sensor

Remove the cabinet and inner casing.

Carefully pull-off the connections.

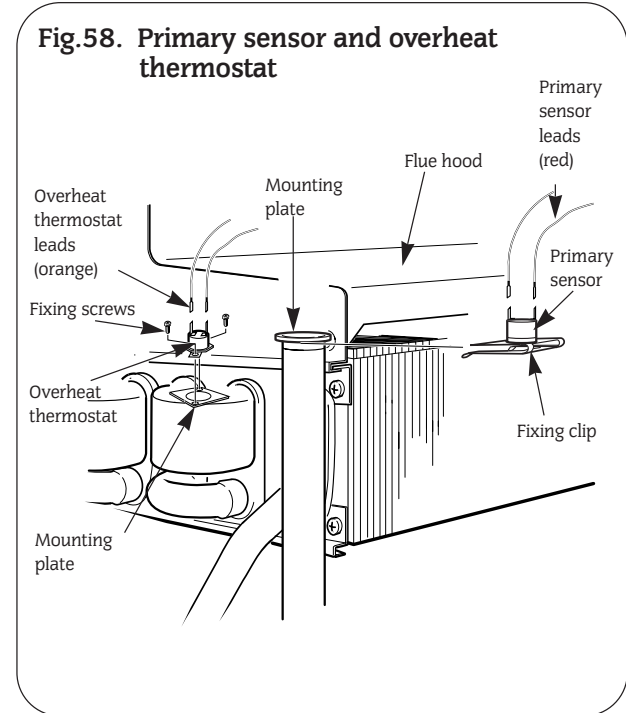
Withdraw the clip and lift off the sensor. Refer to Fig 58.

Do not omit the heat transfer paste when fitting the replacement sensor.

#### 15.4.16 Overheat Thermostat

Remove the cabinet and the inner casing.

Carefully pull-off the connections. Unscrew the two screws and remove the sensor. Refer to Fig 58.



Apply a small quantity of heat transfer paste to the face of the replacement sensor.

Carefully reposition the sensor so that the connections are away from the flue hood. Reconnect the sensor.

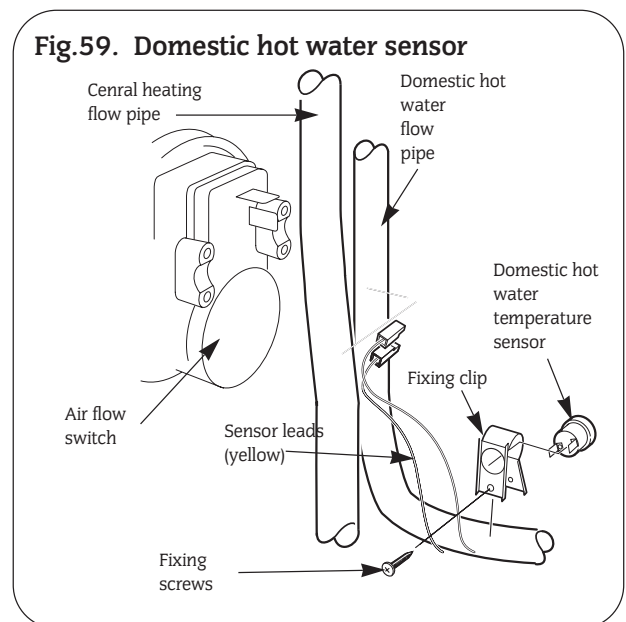
#### 15.4.17 DHW Sensor

Remove the cabinet and lower the fascia.

Carefully pull off the connections. Unscrew the clip and remove the sensor.

Apply a small quantity of heat transfer paste to the face of the replacement sensor.

Refer to Fig 59.



#### 15.4.18 Pump

Check that the primary circuit has been fully drained as described in 15.3 preceding.

Release the water connections and remove the pump. Refer to Fig 45.

Disconnect and transfer the electrical connections to the new pump. Set the pump speed to maximum. Do not forget the gaskets at the connections.

Alternatively the pump head only [Grundfos 15-60] may be replaced by unscrewing the four securing screws. Take care not to scratch the mating surfaces .

#### 15.4.19 Expansion Vessel

The specified replacement can be fitted into the system return as close to the appliance as possible. Re-fill and pressurise the system as described in Section 12 Commissioning.

#### 15.4.20 Auto Air Vent

Drain the primary circuit as described in 15.3 preceding.

Unscrew and remove the auto air vent.

Do not omit the sealant (Loctite 575) when fitting the replacement air vent.

Remove the cap. Refer to Fig 34.

#### 15.4.21 Primary Heat Exchanger

Check that the appliance has been fully drained as described in 15.3 preceding.

Remove the combustion chamber as described in Section 14.3, Inspection and Servicing.

Remove the temperature sensors as described in 15.4. 15, 16 and 17 preceding.

Undo the four union connections and remove the heat exchanger.

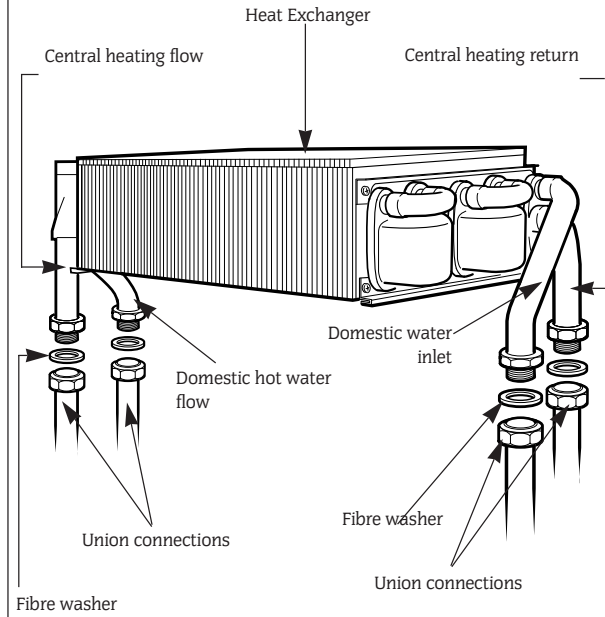
Do not omit the sealing washers when fitting the replacement heat exchanger. Refer to Fig 60.

#### 15.4.22 Air Flow Switch

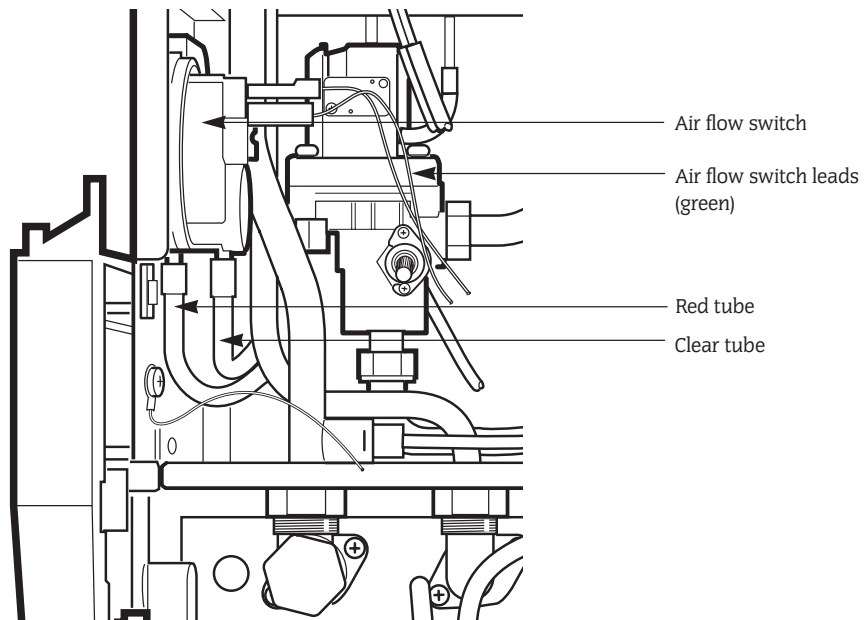
Carefully pull-off the connections from the switch. Unclip and remove the switch. Refer to Fig 61.

Ensure that the connections are correctly made on the replacement switch.

**Fig.60. Primary heat exchanger**



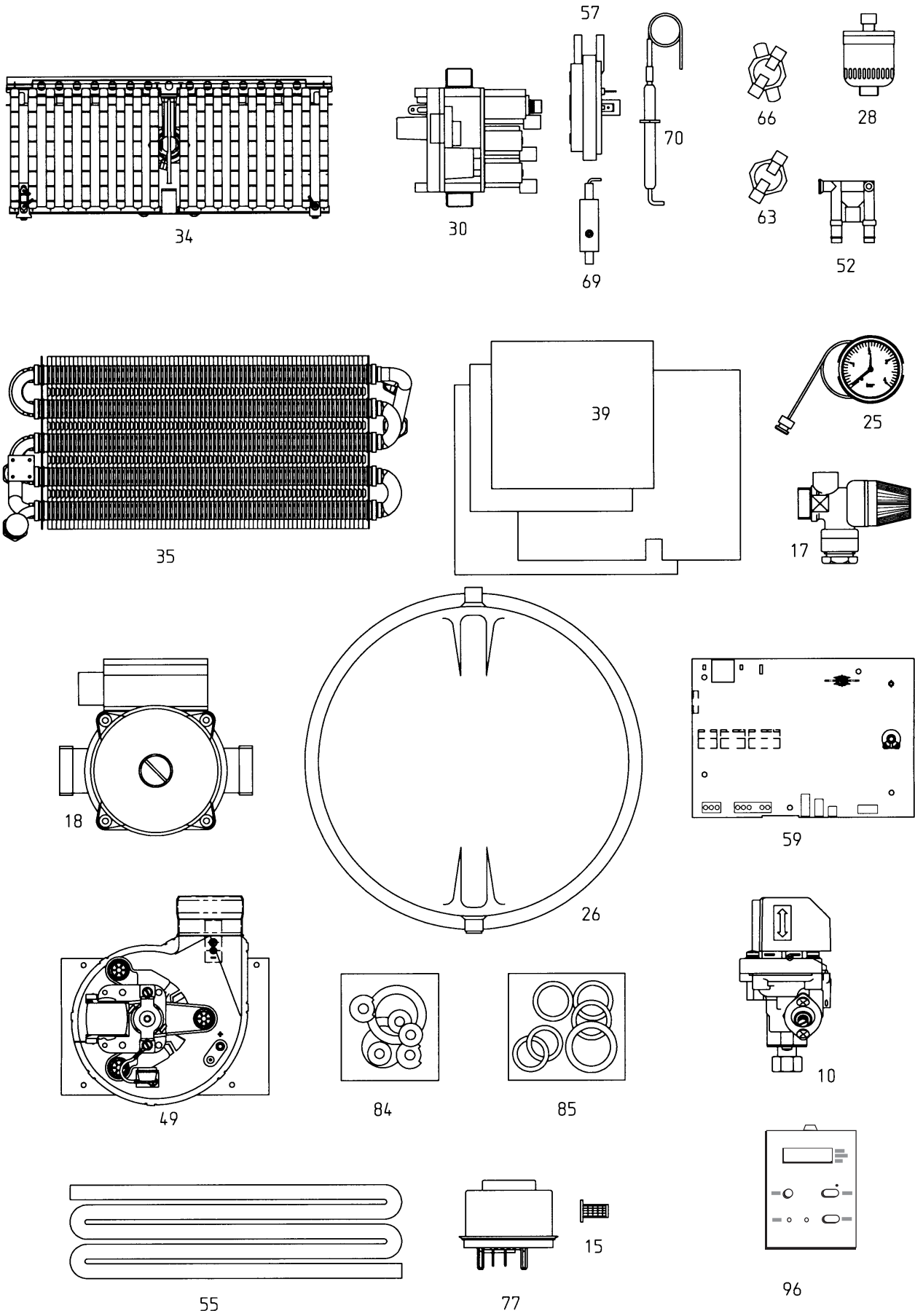
**Fig.61. Air flow switch**



## 16. Short Parts List

Key No.	G.C. No.	Part	Manufacturer's Reference	Qty	WHS Part No.
10	E27-572	Flow Switch	Prettl	1	8 717 002 122 0
15	E27-578	Water Filter	Prettl	1	8 716 148 410 0
17	E27-580	Pressure Relief Valve	Altechnic	1	8 716 156 764 0
18	E27-582	Pump	Grundfos 59896603	1	8 716 143 114 0
25	E27-586	Pressure Gauge	Inter Albion x 32556	1	8 716 142 388 0
26	E27-587	Expansion Vessel	Winkleman & Panhof 15K	1	8 715 407 154 0
28	E01-601	Automatic Air Vent	Caleffi 502632CST	1	8 716 140 504 0
30	E27-592	Gas Valve	Junkers	1	8 747 003 381 0
34	E27-596	Burner (NG)	Vulcano	1	8 718 120 565 0
34	E27-597	Burner (LPG) 28Si	Vulcano	1	8 718 120 566 0
34	E27-598	Burner (LPG) 25Si	Vulcano	1	8 718 120 569 0
35	E27-600	Primary Heat Exchanger	ELM	1	8 716 759 081 0
39	E27-605	Combustion Chamber Insulation	Avon	1	8 716 121 601 0
49	E27-616	Fan Assembly	WHS	1	8 716 121 546 0
52	299-363	Air Flow Detector		1	8 716 141 000 0
55	E27-618	Inner Case Seal	WHS	1	8 716 121 602 0
57	E27-620	Air Flow Switch	Huba 605.99486	1	8 716 142 387 0
59	E27-623	Control Board	Junkers Heatronic	1	8 748 300 336 0
63	375-696	Primary (CH) Sensor	Elmwood	1	8 716 142 302 0
63	375-696	DHW Sensor	Elmwood	1	8 716 142 302 0
66	299-495	Overheat Thermostat	Elmwood	1	8 716 142 389 0
69	E25-322	Spark Electrode Assembly	Vulcano	1	8 708 107 008 0
70	E25-323	Flame Sense Electrode	Vulcano	1	8 708 107 009 0
77	E27-636	Transformer	Junkers	1	8 747 201 274 0
84	E27-643	Fibre Washer Pack		1	8 716 121 603 0
85	E27-644	O-Ring Pack		1	8 716 121 604 0
96	E27-648	Digital Timer		1	7 716 192 019
		Fuse Pack		1	8 716 156 013 0
<b>FLUE OPTIONS</b>					
		Telescopic Horizontal Flue Kit	425 - 725mm		7 716 191 068
	E01-943	Extension Flue Kit	750mm		7 716 191 006
	E01-944	Vertical Flue Kit			7 716 191 069
	E01-945	Vertical Flue Adaptor			7 716 191 016
	E01-946	Internal Fixing Kit	Telescopic Flue		7 716 191 019
	E01-058	Flue Elbow Kit	90 deg.		7 716 191 013
	E01-059	Flue Elbow Kit	45 deg.		7 716 191 014

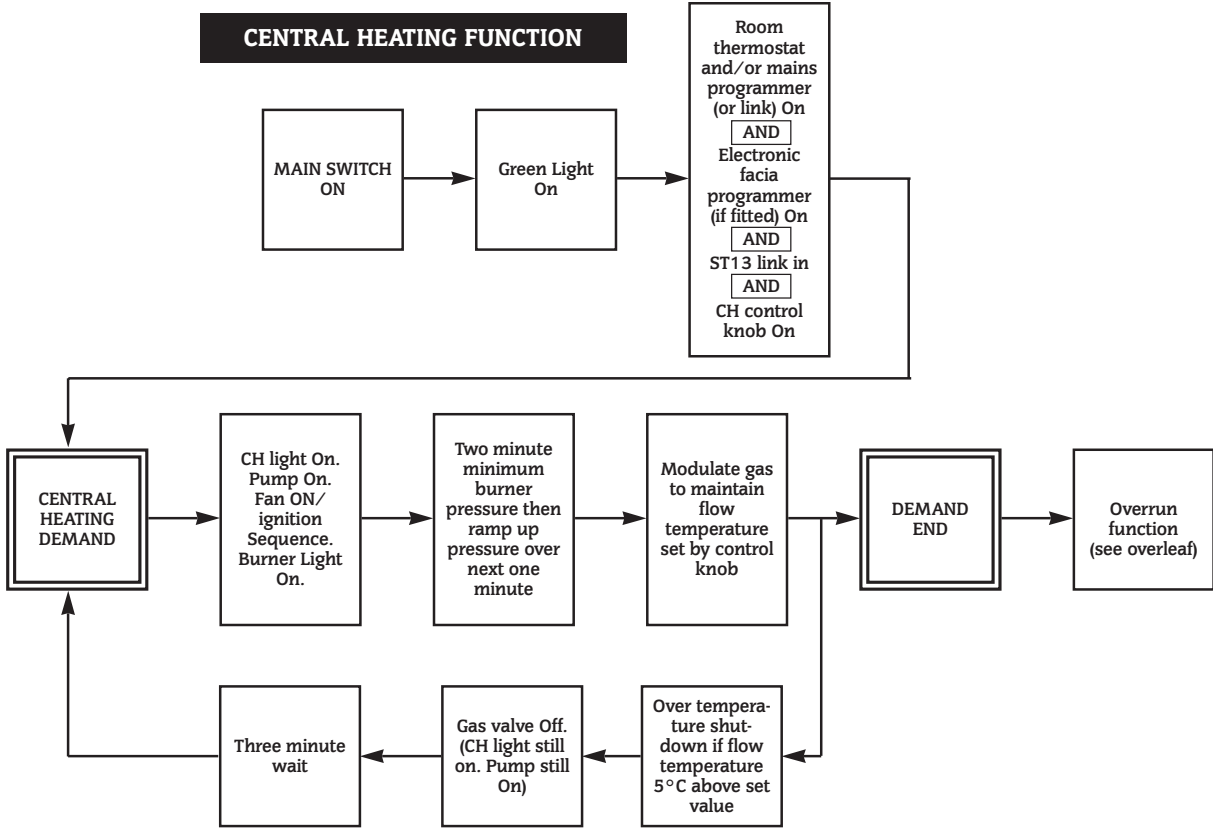




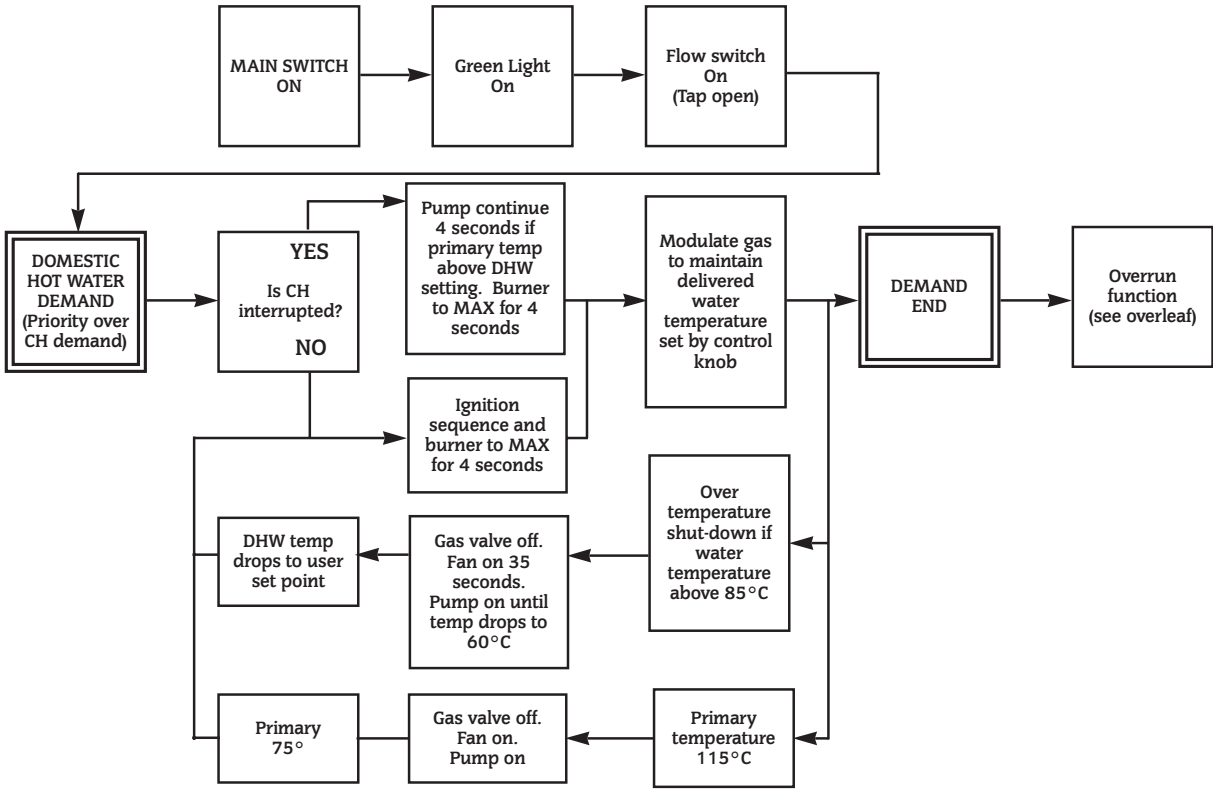


# 17. Operational Flow Diagrams

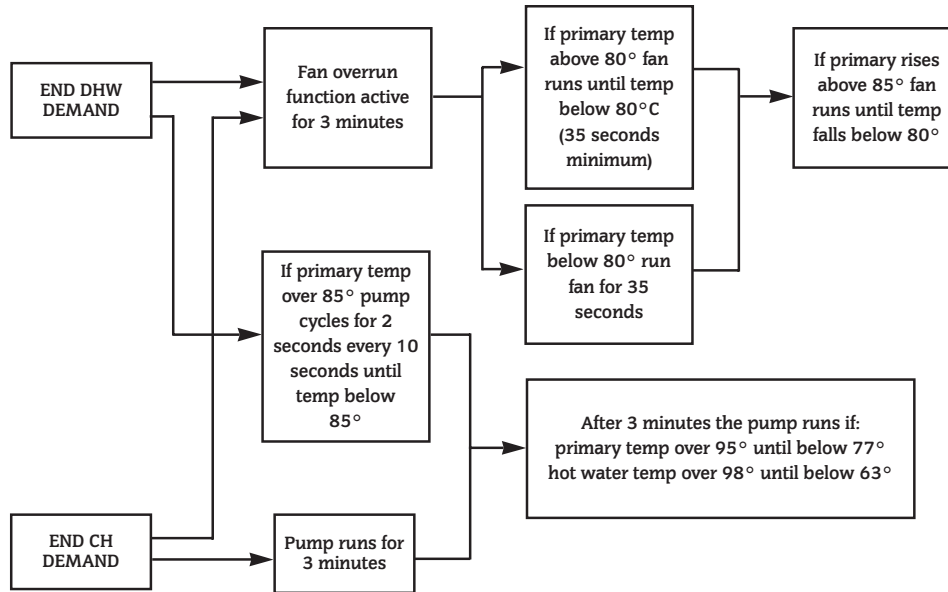
## CENTRAL HEATING FUNCTION



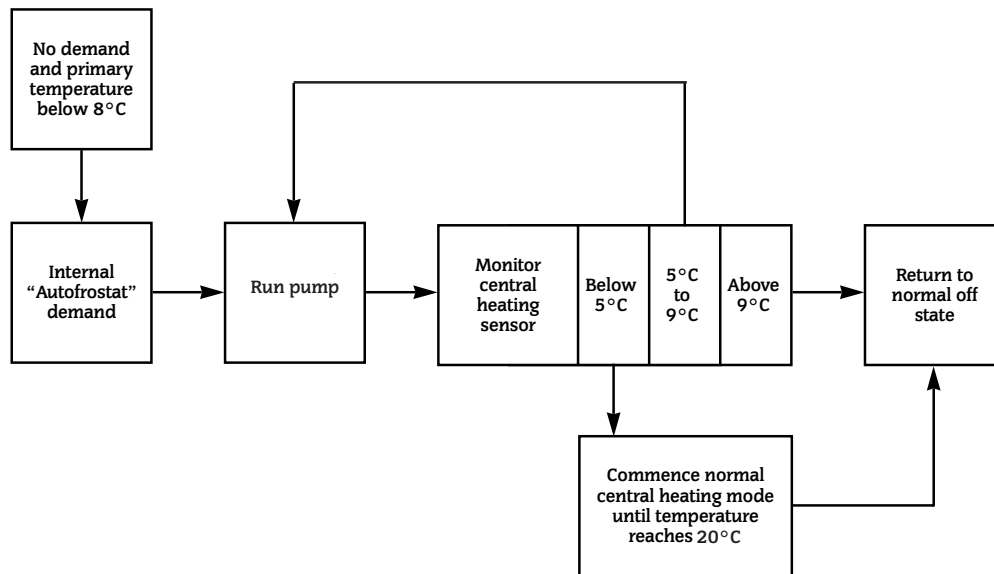
## DOMESTIC HOT WATER FUNCTION



## OVERRUN FUNCTION



## AUTOFROSTAT FUNCTION



## 19. Fault Finding

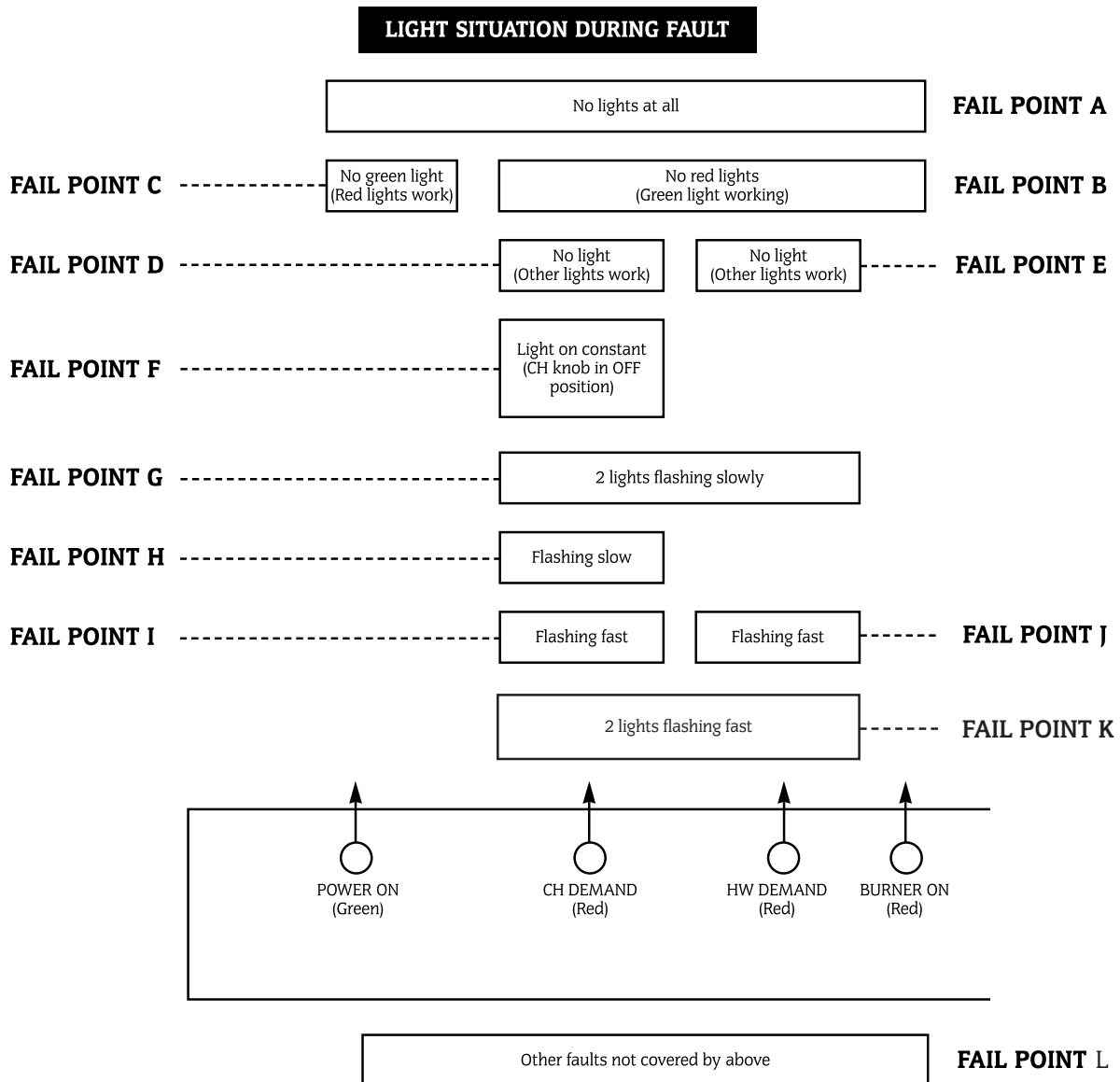
**Note:** This fault-finding information is for guidance only. Worcester Heat Systems cannot be held responsible for costs incurred by persons not deemed to be competent.

The electronic control system for this boiler incorporates four lights on the facia. These are used to show normal operating status. But as a secondary function, by flashing, they can also be used to help provide fault diagnostics. Therefore, with individual or groups of lights being permanently off, on or flashing, every normal fault can be identified.

To use the fault finding system, select a box below which represents the light situation during your fault. Then refer to the appropriate following section. This fault-finding system assumes that the appliance has been operating correctly until the time of failure.

### PRELIMINARY CHECKS

Preliminary electrical system checks are the first electrical checks to be carried out during a fault-finding procedure. On completion of the Service/Fault-Finding task which has required the breaking and remaking of electrical connections, check (a) EARTH CONTINUITY, (b) SHORT CIRCUIT CHECK, (c) POLARITY and (d) RESISTANCE TO EARTH.

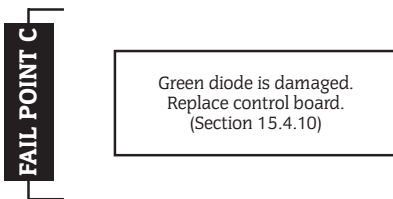
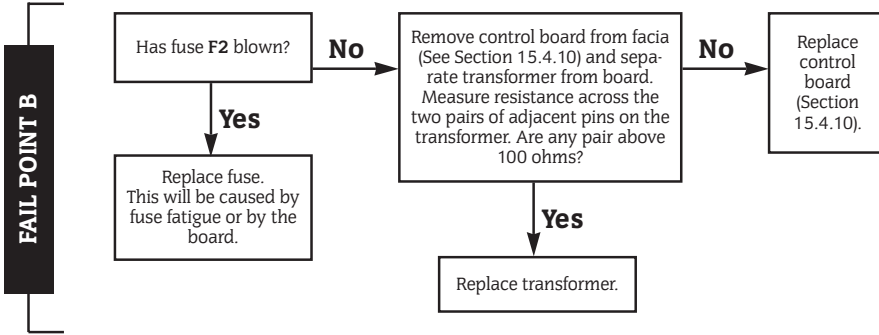
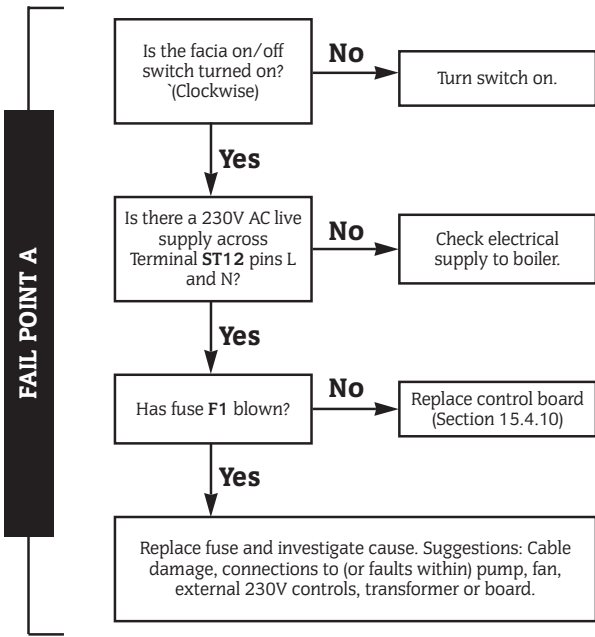


**Note:**

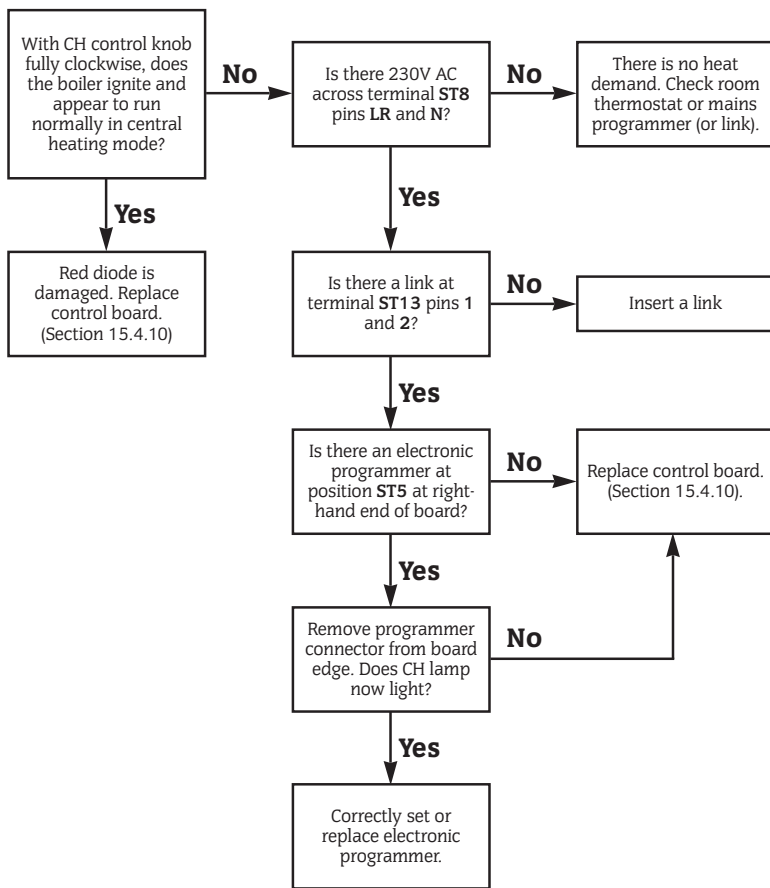
Slow flash is once per second, fast flash is five times per second.

Slow flash can only be cleared by using the facia reset button (press for at least one second).

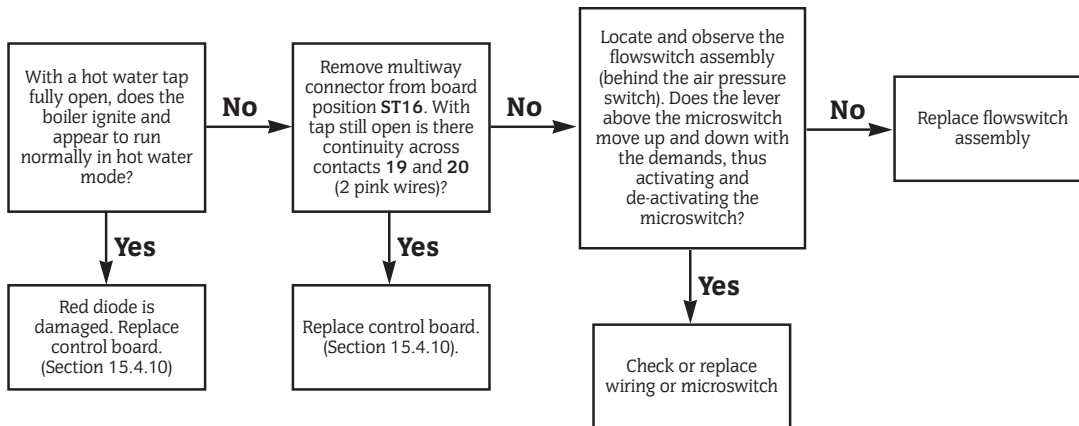
Fast flash is cleared by removing fault and/or main switch off/on.

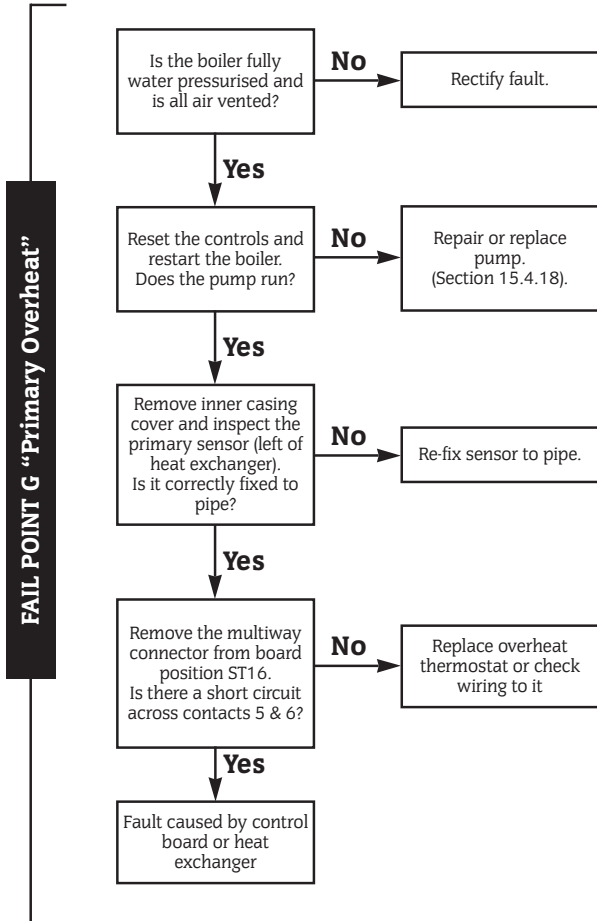
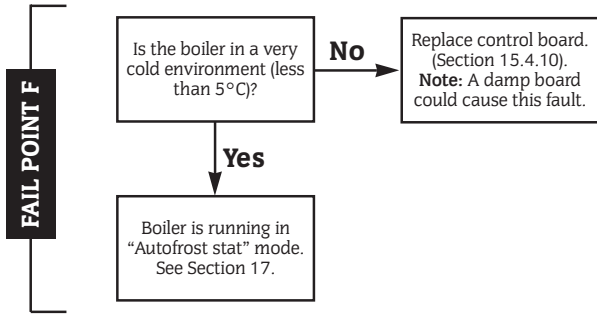


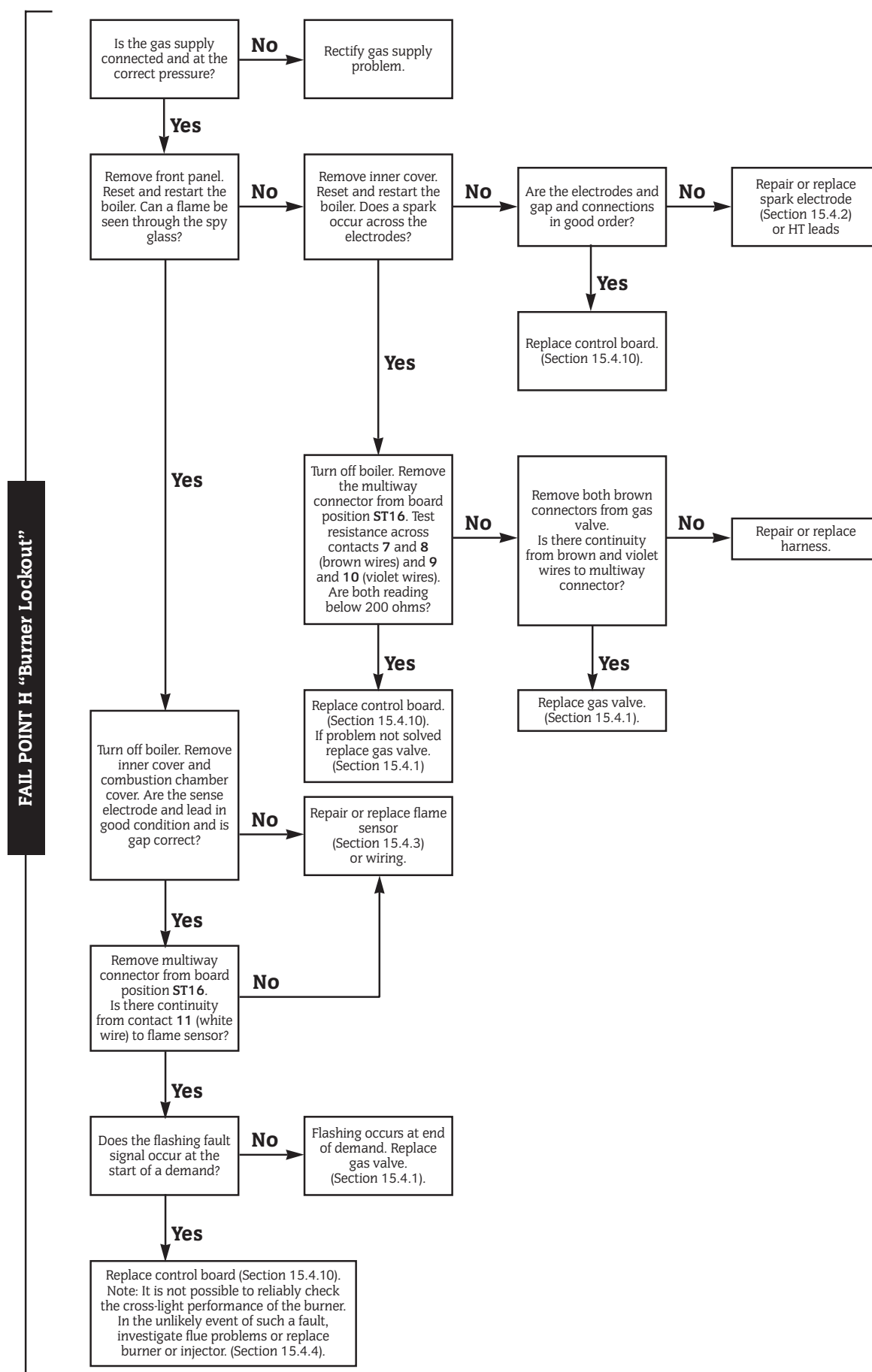
**FAIL POINT D**



**FAIL POINT E**

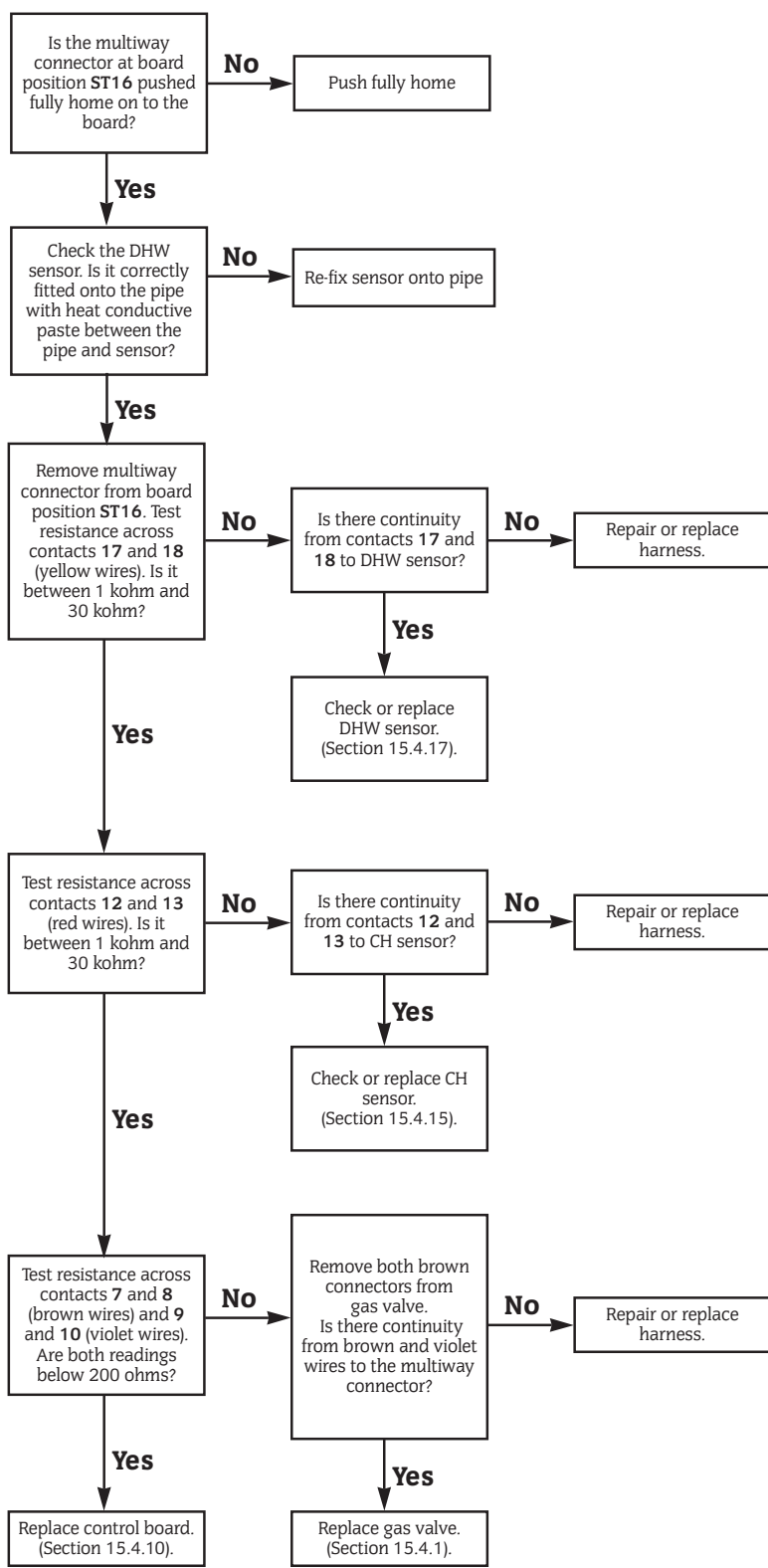




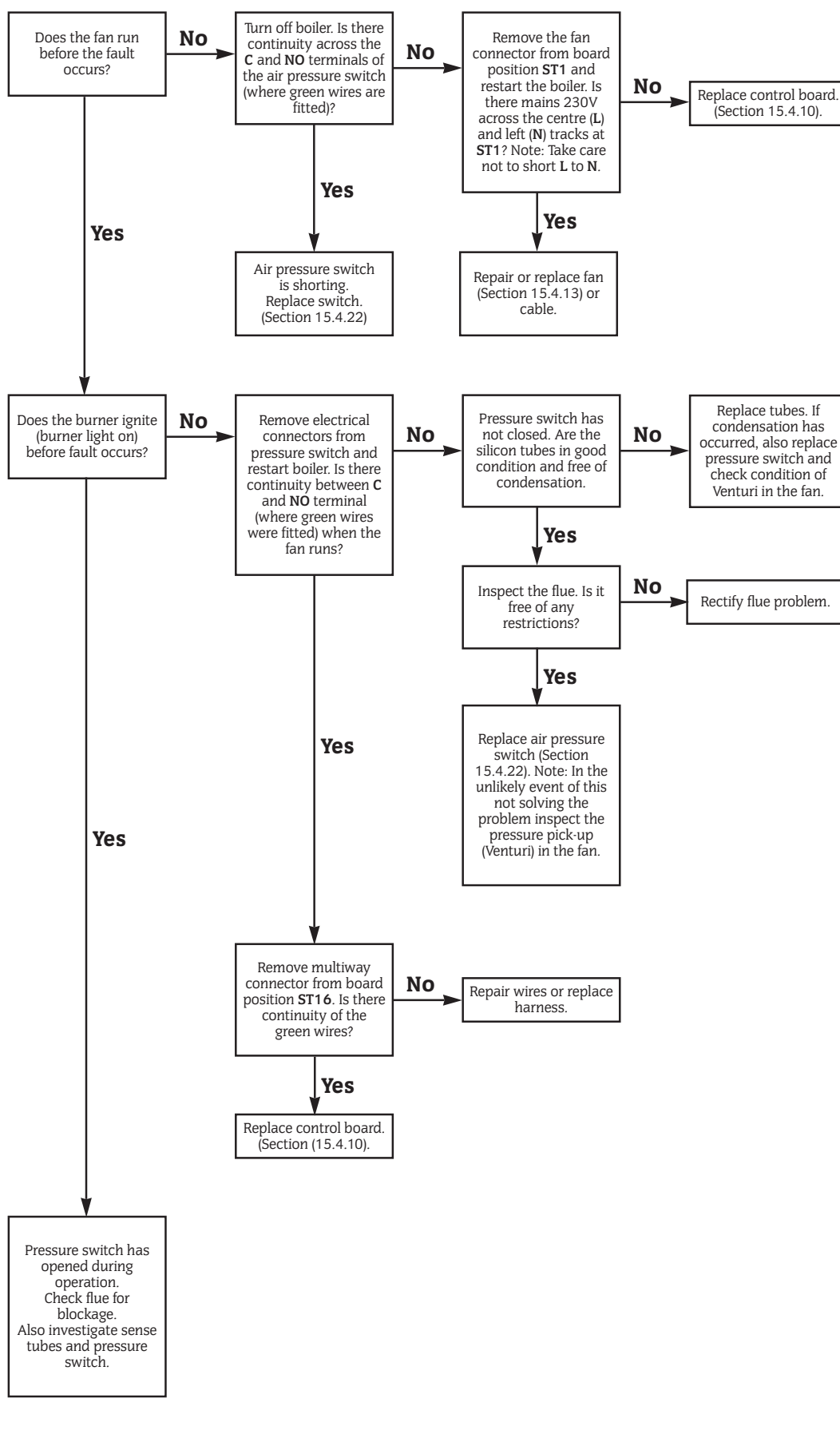


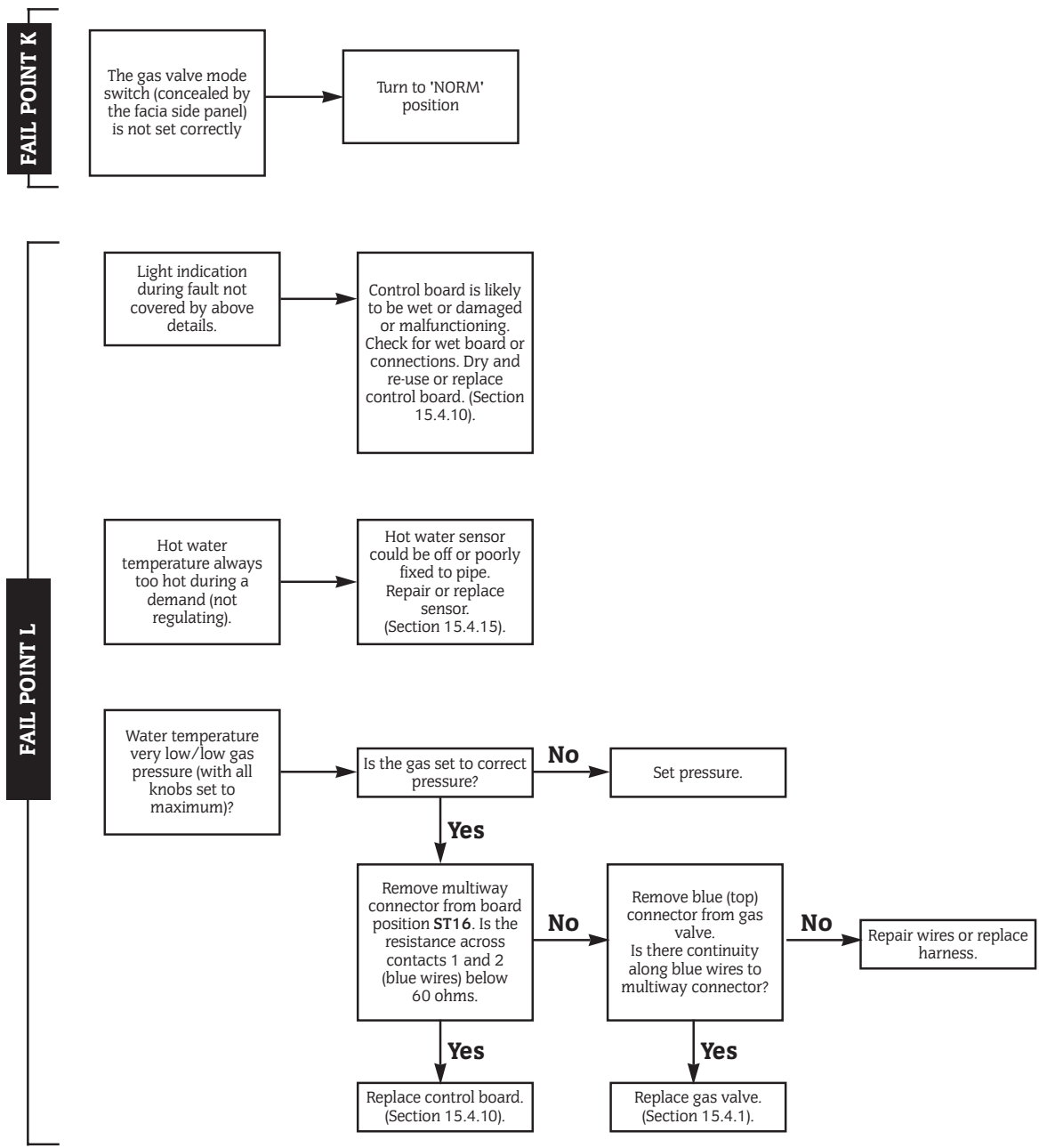


**FAIL POINT I "Sensor Fault"**

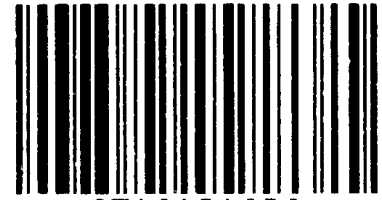


**FAIL POINT J "Air Pressure Fault"**





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



**British Gas** 

**Scottish Gas** 

Manufactured exclusively for British Gas by  
Worcester Heat Systems Limited (Bosch Group), Cotswold Way, Warndon, Worcester WR4 9SW.  
Telephone: (01905) 754624. Fax: (01905) 754619.  
Technical Helpline 08705 266241.  
[www.worcester-bosch.co.uk](http://www.worcester-bosch.co.uk)

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This booklet is accurate at the date of printing but will be superseded and should be disregarded if specifications and/or appearances are changed in the interests of continued improvement.

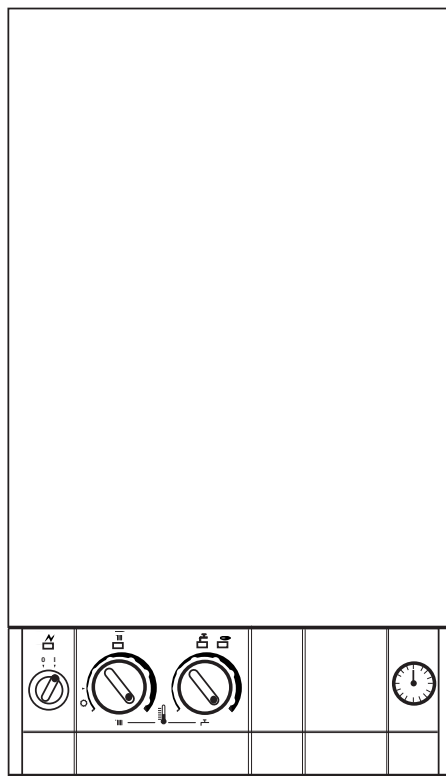
All goods sold are subject to our official Conditions of Sale, a copy of which may be obtained on application.

**PUBLICATION 8 716 145 216 f 04/02**

**British Gas**



**Scottish Gas**



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# C1

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G.C. NUMBER : 47 311 53



# USER INSTRUCTIONS & CUSTOMER CARE GUIDE



# EXCELLENCE COMES AS STANDARD

Thank you for purchasing a C1 gas-fired combination appliance.

The C1 appliances are made by Worcester Heat Systems and the strictest quality control standards are demanded throughout every stage of production.

The result is that your new C1 appliance offers you the very best of everything - quality, efficiency, economical running costs, proven reliability and value for money.

What's more, you also have the assurance of our no-nonsense 1 year parts and labour guarantee.

No wonder that more and more people are agreeing that when it is gas, it has to be British Gas.

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# GENERAL INFORMATION

## GAS SAFETY (INSTALLATION AND USE) REGULATIONS 1998

It is the law that all gas appliances must be 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. The manufacturers notes must not be taken, in any way, as over-riding statutory obligations.

**WARNING:** This appliance must be earthed and protected by a 3 amp fuse.

**ELECTRICITY SUPPLY:** 230V ~ 50Hz

**IMPORTANT:** To get the best from your C1 appliance please read these instructions carefully.

**NOTE:** In the event of a fault the appliance should not be used until the fault has been corrected by a competent person.

## GENERAL DESCRIPTION

(See Fig.1.)

The C1 MODELS are combined domestic hot water and central heating appliances. They consist of a gas fired boiler having a varying output of between 8.5kW and 28kW and all the necessary controls to provide mains fed domestic hot water and central heating.

The appliances are fitted with a manual Operating Switch.

The appliances can operate in one of two modes. Hot water only or hot water and central heating.

### Hot Water Mode:

When a demand is made for hot water by opening a tap or shower; the flow switch will energise the boiler. The burner will light at its maximum setting and hot water will be delivered to the tap or shower.

When hot water is no longer required the appliance pump or fan may continue to operate to dissipate the excess heat within the boiler.



The flow is limited within the appliance to give a hot water delivery rate to a maximum of 10.0 ( $\pm 15\%$ ) litres/minute (2.0 gallons/minute).

### Hot Water and Central Heating mode:

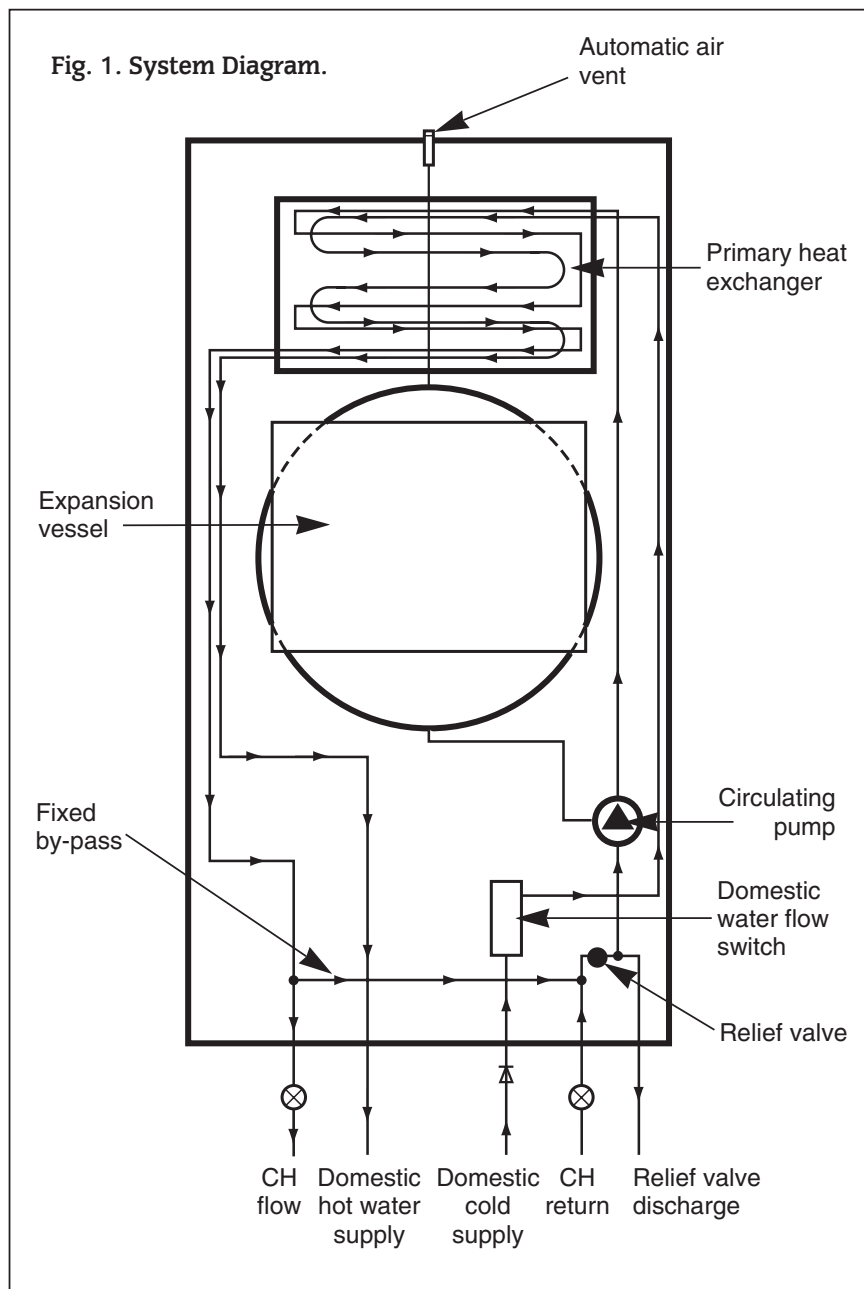
When a demand is made for heating by the system controls (i.e. a programmer or room thermostat).

The pump will energise circulating primary water around the heating system and the burner will light. The heat output from the appliance in this mode has been factory set to maximum. The appliance will operate as necessary to maintain the temperature of the radiators at the level set by the adjustment of the Heating

Temperature Control Knob.  
(See Fig. 2.)

If the system no longer requires heat to maintain the desired room temperature, the burner will extinguish. The pump will continue to run for a short period to dissipate the residual heat from the appliance and then switch off.

The appliance will supply heat to the central heating system as required. A demand for hot water at a tap or shower will override the central heating function for the period of the domestic hot water demand.





# GENERAL NOTES

## CENTRAL HEATING SYSTEM

During the first few hours of operation of the central heating system, check that all radiators are being heated at an even rate. Should the upper area of a radiator be at a lower temperature than the base of the radiator, it should be vented by releasing air through the venting screw at the top of each radiator. Make sure your installer shows you how to carry out the operation. Repeated venting will reduce the quantity of water in the system and this must be replenished for safe and satisfactory operation of the appliance. Should water leaks be found in the system or excessive venting be required from any radiator, a service engineer should be contacted and the system corrected.

## SEALED HEATING SYSTEM

The appliance must be fitted to a sealed heating system which is pre-pressurised. Your installer will advise you on the minimum and maximum pressure that should be indicated on the pressure gauge. See Fig. 2. Check regularly that this pressure is maintained and contact your installer or maintenance engineer if there is a permanent significant drop in pressure indicated on the gauge. If the system loses pressure it should be re-pressurised as instructed by the installer (**N.B. Maximum operating pressure 2.5 bar**).

## CLEARANCES

Your installer will have provided adequate space around the appliance for safety and servicing. Do not restrict this space by the addition of cupboards, shelves etc. close to the appliance.

	RSF
Left-hand side	10
Right-hand side	10
In Front	600
Above the casing	180
Below	200

Minimum clearances in millimetres.

**NOTE: If the appliance is to be enclosed after the installation then the instructions given in Section 6, Air Supply, of the Installation Book MUST be followed.**

## ROOM THERMOSTAT

A room thermostat may be fitted for control of the central heating temperature. It will be located in one room of the home. The method of setting a room thermostat varies with the type and manufacture. Refer to the instructions supplied with the room thermostat.

## THERMOSTATIC RADIATOR VALVES

If thermostatic radiator valves are to be fitted to the system then they must conform to the requirements of BS2767:1972. It is advisable to leave one valve permanently set at maximum to prevent the boiler short cycling.

## SHOWERS, BIDETS, TAPS AND MIXING VALVES

Standard hot and cold taps and mixing valves used with the appliance must be suitable for operating at mains pressure. Thermostatically controlled shower valves will guard against the flow of water at too high a temperature.

If using a pressure equalising valve, set the Domestic Hot Water temperature control knob to the 'MAX' position.

Hot and cold mains fed water can be supplied direct to an overrim flushing bidet subject to local water company requirements.

With all mains fed systems the flow of water from the individual taps will vary with the number of outlets operated simultaneously and the cold water mains supply pressure to the property. Flow balancing using 'Ball-o-Fix' type valves is recommended to avoid an excessive reduction in flow to individual outlets.

For further information contact Worcester Heat Systems Technical Helpline.

## HOT AND COLD FLOW

If the flow of water demanded from both hot and cold service outlets is dependent upon mains supply, it may not be possible in some installations to operate all outlets simultaneously.

## WATER MAINS FAILURE

It is important to note that in the event of a mains water supply failure, no tap water will be available until the mains supply is restored. The appliance can still be used for heating provided that the system is of the sealed system type.

## **USE IN HARD WATER AREAS**

Normally there is no need for scale protection. However, in areas of exceptionally hard water supply it is recommended that an In-Line scale inhibitor be fitted.

Installation should be strictly in accordance with the requirements of the local Water Company. An isolating valve to facilitate servicing should be incorporated.

The water hardness may be determined using the standard test paper or by reference to the local Water Company.

Further information may be obtained from Worcester Heat Systems Technical Helpline.

## **VENTILATION OF ROOM SEALED FANNED FLUE (RSF) APPLIANCES**

These are room sealed appliances and any ventilation openings in a wall or door must not be obstructed. Do not allow the flue terminal fitted on the outside wall to become obstructed or damaged.

**NOTE:** Do not place anything on top of the appliance. If the appliance is fitted in a compartment do not use the compartment for storage purposes unless it conforms to the requirements of BS 6798:1987: Section 6. It is essential that the airing space is separated from the boiler space by a perforated non-combustible partition as described in BS 6798:1987.

## **CIRCULATING PUMP**

This may be fitted with a speed adjuster. If so it will be factory set at maximum and should not be changed.

## **FROST PRECAUTIONS**

If the appliance is not to be used for a long period of time and there is a likelihood of freezing, then the appliance should be drained. The Worcester Heat Systems Technical Helpline will advise you on suitable frost precautions. For short periods the built-in frost protection of the appliance will be adequate.

## **SERVICE**

Annual servicing is important in order to ensure continuing high efficiency and long life for your appliance. Three star service cover from British Gas can offer comprehensive cover for your central heating - please call 0845 9 60 50 40 for further details.

## **WARNING**

If a gas leak exists, or is suspected, turn off the gas supply to the appliance at the service cock and consult your local service engineer.

Do not touch any electrical switches to turn them either on or off. Open all windows and doors. Do not smoke. Extinguish all naked lights.

## **CLEANING**

Do not use abrasive cleaners on the outer casing. Use a damp cloth and a little detergent.



# OPERATION OF CONTROLS

The appliance is fitted with the following controls:

## OPERATING SWITCH

In the '0' position there is no mains electricity to the control board.

In the 'I' position mains electricity is connected to the control board.

## CENTRAL HEATING TEMPERATURE CONTROL

The position of this knob will determine the temperature of the water delivered to the radiators between fully clockwise and anti-clockwise to the ► mark. When the knob is turned anti-clockwise past the 'I' position towards the '☀' (Summer Position), then the appliance will operate in the HOT WATER mode only and no heat will be delivered to the radiators.

## DOMESTIC HOT WATER TEMPERATURE CONTROL

The position of this knob will determine the temperature of the water delivered at the domestic hot water taps between fully clockwise and anti-clockwise positions.

By slightly reducing the flow of domestic water from the tap, the delivery temperature of the water will be further increased. This is of particular advantage in the winter, for example to increase bath water temperature and to remove heavy grease deposits on plates, etc. Also this will provide an added advantage of reducing the delay before hot water is obtained.

## FACIA MOUNTED PROGRAMMER

Your installer may have mounted either an electronic programmer into the fascia of your appliance. Operating instructions are supplied with the programmer.

## RESET BUTTON

Press this button in for five seconds if any of the indicator lights are flashing slowly.

## SYSTEM PRESSURE GAUGE

The grey needle will show the actual pressure in the system. When operating the pressure indicated must not be greater than 2.5bar. If it is then contact your installer.

## INDICATOR LIGHTS



### Mains electricity indicator:

**OFF** : No mains electricity to the control board

**ON** : Mains electricity is connected to the appliance



### Central heating demand indicator:

**OFF** : No demand for heat to the central heating circuit

**ON** : Central heating or autofrost demand

**FLASHING SLOW** : Ignition lockout

(once per second)

**FLASHING FAST** : Appliance fault (other than ignition lockout)

(five times per second)



### Domestic hot water demand indicator:

**OFF** : No demand for domestic hot water

**ON** : Domestic hot water demand

**FLASHING FAST** : Air flow fault

(five times per second)



### Central heating and domestic hot water demand indicators:

**BOTH FLASHING SLOW** : Overheat cut-off

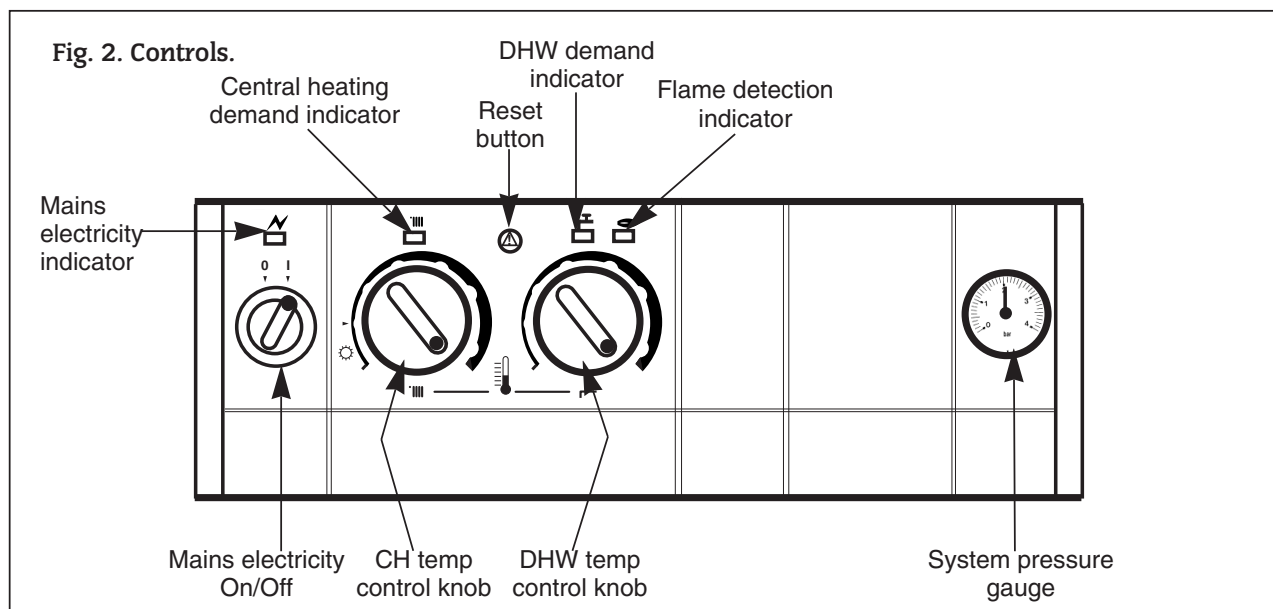
(once per second)



### Flame detection indicator:

**OFF** : Burner off

**ON** : Burner on





# TO LIGHT AND STOP THE APPLIANCE

## TO LIGHT THE APPLIANCE

Check that the water valves to the central heating circuit are open.

On sealed systems check that the grey needle on the pressure gauge is not below the required pressure.

Switch on the mains electricity. The green power on indicator will light. Set the room thermostat, if fitted, to maximum. Turn the central heating temperature control knob to '**MAX**'. The red central heating demand indicator will light.

The burner will light and the red flame detection indicator will light.

Set the central heating and hot water temperature control knobs and the room thermostat, if fitted, to the desired temperature.

## TO STOP THE APPLIANCE

### For Short Periods

Turn the central heating temperature control knob fully anti-clockwise to the '**O**' position.

### For Long Periods

Turn the operating switch to the '**O**' position. Switch off the mains electricity.

A fascia mounted electronic programmer will retain its settings for about two weeks, after which it will return to the factory set programme. The display will disappear after approximately 12 hours.

A fascia mounted mechanical programmer will require resetting once the operating switch has been set to '**O**', or the mains supply has been disconnected.

## ELECTRICITY SUPPLY

### FAILURE

If the electricity supply fails the appliance will not operate. Once the supply is restored the appliance will return to normal operation. If a programmer is fitted, check that the settings have been maintained.

## OVERHEAT CUT-OFF

### THERMOSTAT

The appliance will enter a lockout condition in the event of overheating.

An overheat cut-off thermostat is fitted to the appliance which will interrupt the electricity supply to the gas valve.

If the overheat cut-off has operated, both the central heating and the hot water demand indicators will flash together.



The appliance can be reset by pressing the reset button and holding in for 5 seconds when the appliance has cooled.

## **IGNITION LOCKOUT**

The appliance will enter a lockout condition in the event of the burner failing to ignite.

If the burner fails to light after 5 attempts the electricity supply to the gas valve will be interrupted.

If ignition lockout has occurred, the central heating demand indicator will flash slowly (approximately once per second).

The appliance can be reset by pressing the reset button and holding in for 5 seconds. Check that the gas supply has not been interrupted.

If this condition continues to occur, then call a service engineer.

## **AIR FLOW DEVICE**

The appliance will enter a lockout condition in the event of an air flow fault.

If the controls fail to detect the correct air flow through the appliance the electricity supply to the gas valve will be interrupted.

If an air flow fault has occurred, the domestic water demand indicator will flash (approximately five times per second).

The appliance will try to re-light after a waiting period of approximately 4 minutes. Check that the flue terminal has not been obstructed or damaged.

If this condition continues to occur, then call a service engineer.



# APPLIANCE FAILS TO OPERATE

If your C1 appliance should fail to operate correctly, please call British Gas on:

**0845 9 60 50 40**

## **IMPORTANT**

Do not touch or adjust  
any sealed component



# MAINTAINING YOUR APPLIANCE

Your new C1 gas-fired appliance represents a long-term investment in a reliable, high quality product.

In order to realise its maximum working life, and to ensure it continues to operate at peak efficiency and performance, it is essential that your boiler receives regular, competent servicing and annual maintenance checks beyond the initial 12 month guarantee period.

To arrange for a British Gas Three Star Cover agreement please call 0845 9 60 50 40.





# YOUR C1 GUARANTEE

This appliance is guaranteed against faulty materials or workmanship for a period of twelve calendar months from the date of installation subject to the following conditions and exceptions.

1. That during the currency of this guarantee any components of the unit which are proved to be faulty or defective in manufacture will be exchanged or repaired free of material charges and free of labour charges by Worcester Heat Systems Limited.
2. That the householder may be asked to prove the date of installation, that the appliance was correctly commissioned and, where appropriate, the first 12 month service has been carried out to the satisfaction of Worcester Heat Systems Limited when requested.
3. That any product or part thereof returned for servicing under the guarantee must be accompanied by a claim stating the Model, Serial Number, Date of Installation.
4. That Worcester Heat Systems Limited will not accept responsibility for damage caused by faulty installation, neglect, misuse or accidental damage, the non-observance of the instructions contained in the installation and Operating Instructions Leaflets.
5. That the appliance has been used only for normal domestic purposes for which it was designed.
6. That this guarantee applies only to equipment purchased and used in mainland Great Britain.

This guarantee is given in addition to all your normal statutory rights.



# GUARANTEE REGISTRATION

You should complete and return the postpaid Guarantee Registration Card within 14 days of purchase.

The card will register you as the owner of your new C1 appliance and, while this will not affect your statutory rights in any way, it will assist us to maintain an effective and efficient customer service by establishing a reference and permanent record for your boiler.

**IMPORTANT:** SERIAL NUMBER. Copy the number off the Guarantee Card.

FOR YOUR OWN RECORD

MODEL

SERIAL NUMBER

TYPE/SIZE

DATE OF INSTALLATION

**British Gas** 

**Scottish Gas** 

**MANUFACTURED EXCLUSIVELY FOR BRITISH GAS BY  
Worcester Heat Systems Limited. Cotswold Way, Warndon, Worcester WR4 9SW.**

**Telephone: (01905) 754624 Fax: (01905) 754619.**

**Technical Helpline (0990) 266241.**

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