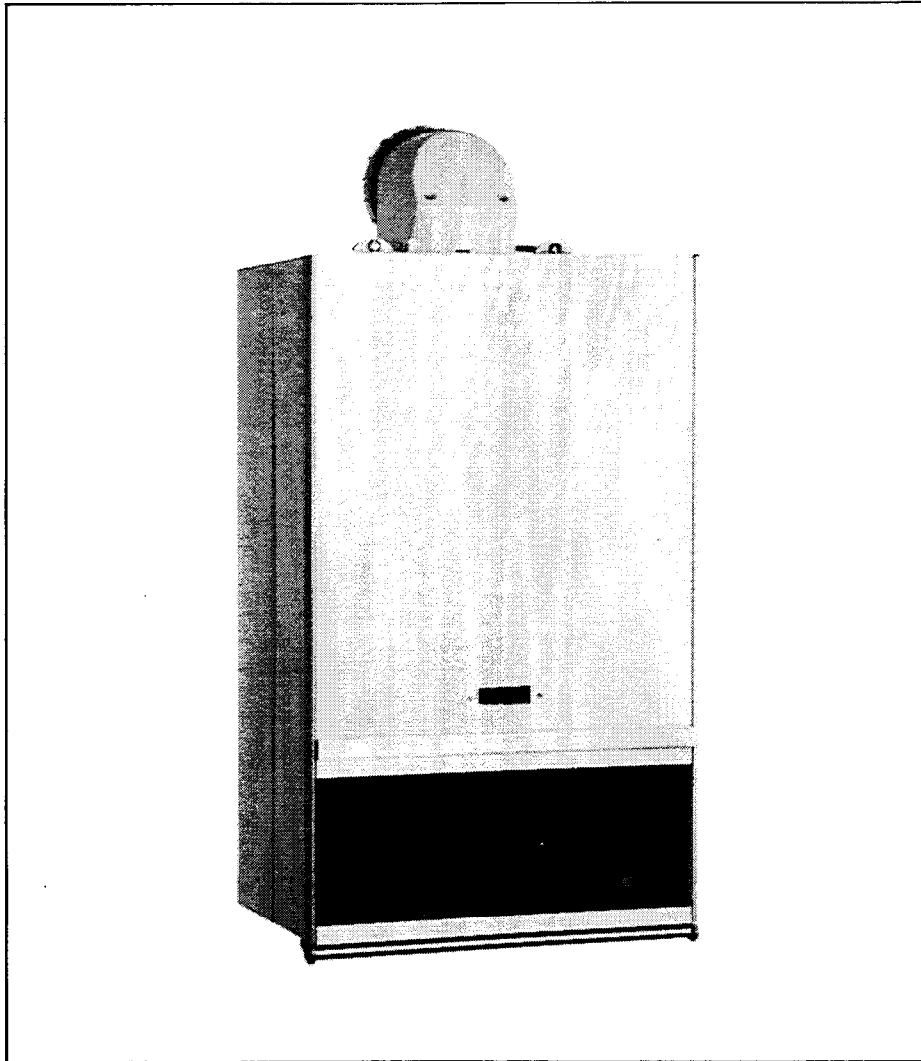


# CHALLENGER

## Fanned Flue Boilers

**30 FF**  
(GCN° 41.980.74)

**50 FF**  
(GCN° 41.980.77)



## **installation and servicing instructions**

(these instructions are to be left with the User or adjacent to the Gas meter)

The **CHALLENGER FF** is a wall mounted low water content gas fired boiler. There are 2 models in the series, each having a range rated output.

30 FF 8.7 kW (30,000 Btu/h) to 4.4 kW (15,000 Btu/h)

50 FF 14.6 kW (50,000 Btu/h) to 7.4 kW (25,000 Btu/h)

The boiler is designed for use on Natural Gas, unless otherwise stated. It is suitable for open and sealed water systems, and is approved to Supplement 1 of BS 5258 : Pt 1. Fan Powered Appliances.

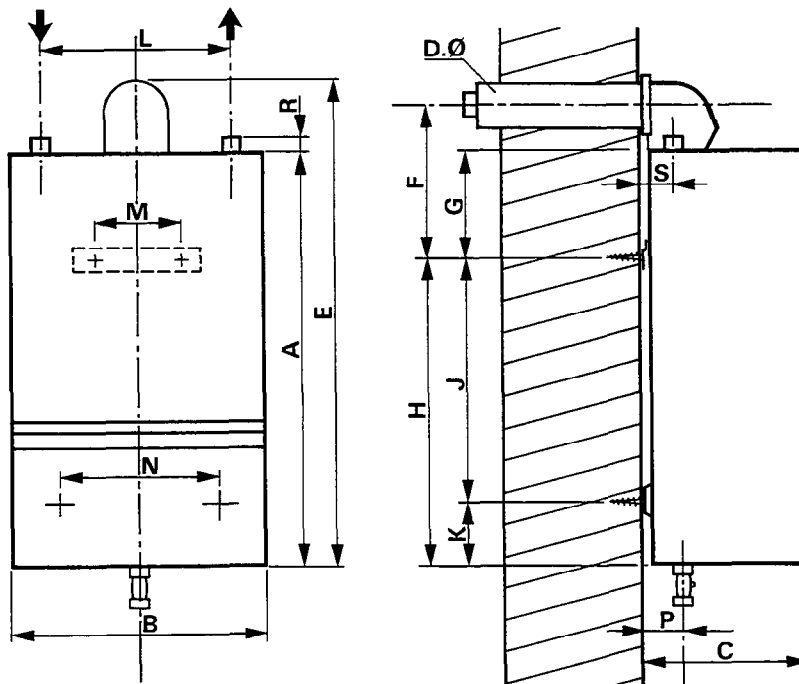
The boiler is designed for fully pumped systems only. It has a number of built in features.

- Fully adjustable electronic temperature regulation between 50° C and 82° C.
- Pump overrun function.
- Low resistance - water circulation.
- High limit temperature protection.
- Rear or side outlet flue connection.
- Flue lengths up to 3 metres.

## Guarantee

The manufacturer's guarantee is to supply free of charge any defective part of a Challenger boiler for a period of 24 months from the date of purchase. The guarantee is voidable if it is not installed in accordance with the recommendations made herein or in a manner approved by the appliance manufacturer.

## 1.1 TECHNICAL DATA



**CHALLENGER 30 - 50 FF**

	mm	ins
<b>A</b>	672	26.5
<b>B</b>	395	15.50
<b>C</b>	275	10.8
<b>D</b>	100	4
<b>E</b>	807	30.75
<b>F</b>	275	10.75
<b>G</b>	219	8.5
<b>H</b>	445	17.5
<b>J</b>	384	15.0
<b>K</b>	55	2
<b>L</b>	270	10.50
<b>M</b>	140	5.50
<b>N</b>	288	11.25
<b>P</b>	70	2.75
<b>R</b>	45	1.75
<b>S</b>	20	0.75

## 1.2

30 FF	OUTPUT		INPUT			HOT BURNER PRESSURE		GAS RATE	
	kW	Btu/h		kW	Btu/h	m.bar	ins.w.g.	m <sup>3</sup> /h	ft <sup>3</sup> /h
Max	8.79	30,000	Max	11.02	37,600	5.8	2.3	1.03	36.4
Min	4.4	15,000	Min	5.83	19,900	1.3	0.5	0.54	19.2

50 FF	OUTPUT		INPUT			HOT BURNER PRESSURE		GAS RATE	
	kW	Btu/h		kW	Btu/h	m.bar	ins.w.g.	m <sup>3</sup> /h	ft <sup>3</sup> /h
Max	14.65	50,000	Max	18.6	63,500	7.9	3.2	1.74	61.4
Min	7.33	25,000	Min	9.9	33,750	1.5	0.6	0.94	32.6

DIMENSIONS (Casing)		
	30 FF & 50 FF	
	mm	in
High	672	26.5
Wide	395	15.5
Deep	275	10.8

CLEARANCES		
	mm	in
Sides	5	1/4
Top	150	6
Bottom	150	6
Front	300	12

## 1.3

<b>Gas connection</b> .....	15 mm O.D. compression
<b>Water connection</b> .....	22 mm O.D. compression fittings
<b>Minimum flow rate</b> .....	<b>30 FF</b> 504 lt/h (1.85 gpm) <b>50 FF</b> 841 lt/h (3.08 gpm)
<b>Maximum static head</b> .....	30 m (98 ft)
<b>Minimum static head</b> .....	150 mm (6 ins) - See figs 7.12
<b>Electrical connection</b> .....	240 V single phase 50 hz supply fused 3 amp
<b>Weight</b> .....	<b>30 FF</b> - 24.77 kg (54.5 lb) <b>50 FF</b> - 25.9 kg (57 lbs)
<b>Water capacity</b> .....	<b>30 FF</b> - 0.5 lit. (0.11 gals) <b>50 FF</b> - 0.7 lit. (0.15 gals)
<b>Burner Injector Size</b> .....	1.18 mm (0.046 in) - marked 118
<b>Pilot injector</b> .....	0.3 mm (0.011 in) - marked 030
<b>Ignition</b> .....	Continuous spark – spark generator ANSTOSS
<b>Electrode</b> .....	Chaffoteaux – spark gap 5.0 mm
<b>Boiler thermostat</b> .....	Chaffoteaux – Electronic
<b>High Limit thermostat</b> .....	Ranco LM5
<b>Thermocouple and thermoelectric valve</b> .....	Chaffoteaux
<b>Fan motor</b> .....	AEG
<b>Pressure switch</b> .....	DUNGS

## 1.4

### HYDRAULIC RESISTANCE

The hydraulic resistance of the boilers vary with the water flow. The graph indicates resistance at various flow rates for both models.

The minimum flow rates are :

30 FF	504 lt/h (1.85 gpm)
50 FF	841 lt/h (3.08 gpm)

The minimum flow rate is equivalent to a temperature rise of 15° C (27° F).

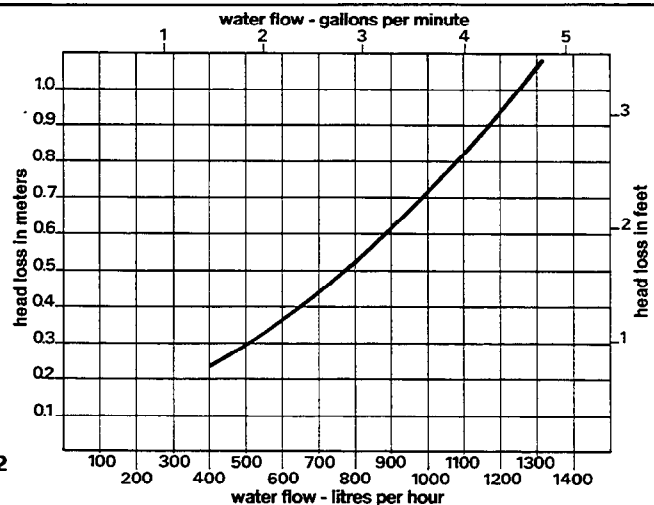
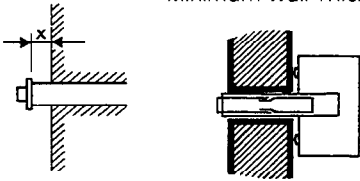


Fig. 2

## 1.5 Flue Length

The flue must be installed in accordance with BS 5440 Pt 1 1978  
Minimum Wall Thickness 76 mm (3 in) - Max Wall thickness 3 m (9'10")

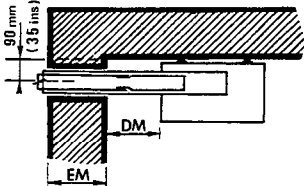
**Rear Outlet**



Wall thickness	Up to 612.5 mm	Over 612.5 mm
	Delivered with appliance	Extension available Pt N° 61061

Flue tube length = wall thickness + 25 mm + x  
Air inlet tube length = wall thickness + 25 mm + x

**Side Outlet**



EM + DM	Up to 500 mm	500 mm to 1400	1400 mm to 2300	2300 mm to 2787
	Deliv. with appliance	1 extn. Pt N° 61061	2 extn. 2 x 61061	3 extn. 3 x 61061

Flue tube length = EM + DM + 130 mm + x Max 3 m (9'8")  
Air inlet tube length = EM + DM + 130 mm + x

EM = Wall thickness  
DM = Distance from wall to case  
x = Extension beyond face of external wall

## 1.6 Description of operation

Pressing the igniter (ON) button disconnects the power supply to the pump, opens the thermoelectric valve and causes a continuous pilot ignition spark to be generated.

When a demand is indicated by a time clock, programmer, thermostat etc. the pump starts, the fan changes from low speed to high speed and is proved by the pressure switch before the 50 % fixed gas valve opens. After 3 seconds the second gas valve (variable output) opens.

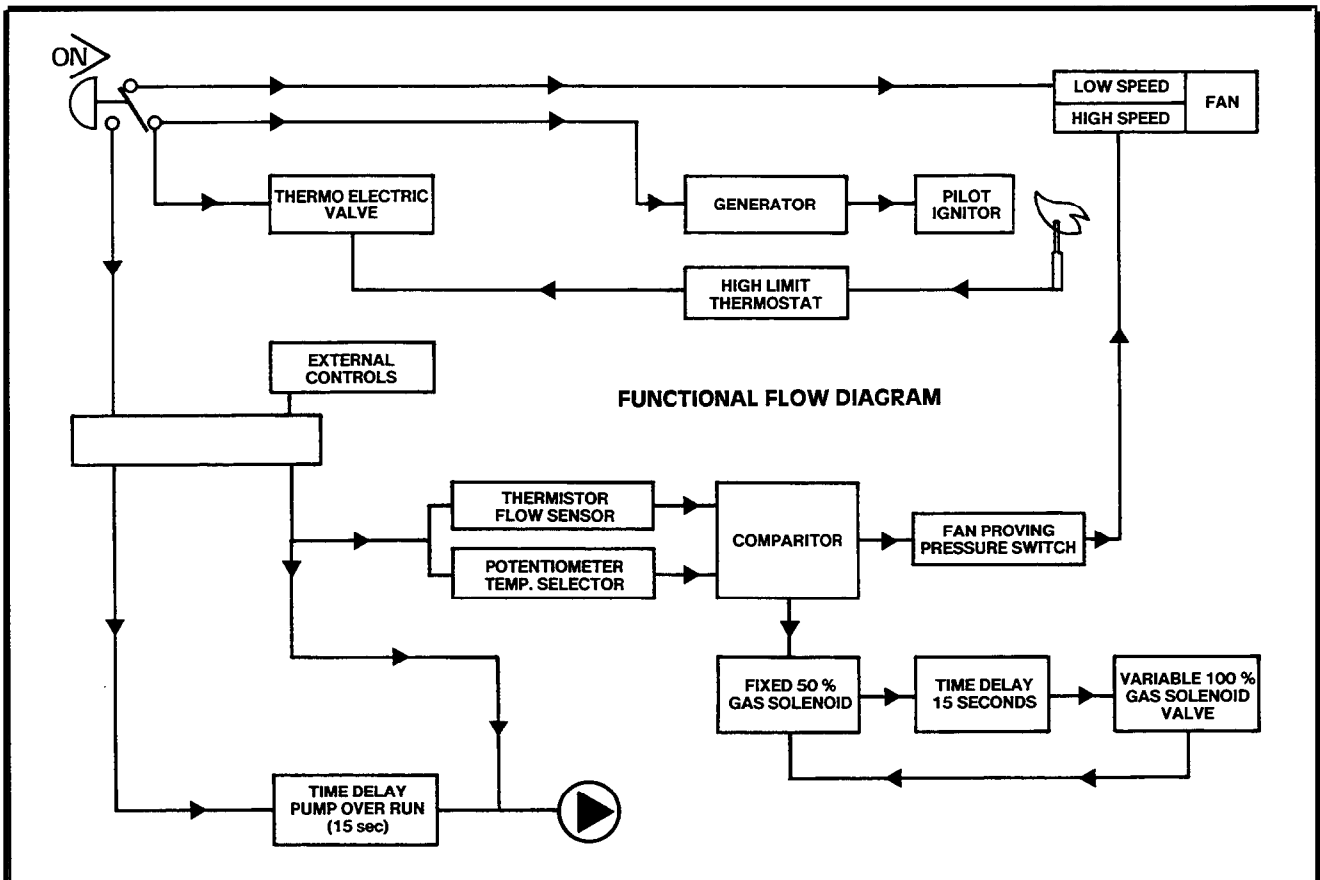
Temperature control is by means of a temperature sensing thermistor and potentiometer. These signals are fed to a comparator.

When the flow approaches the set temperature the main variable gas valve is closed and the boiler continues

to fire on 50 % fixed gas valve. When the set temperature is reached the boiler switches off. If flow temperature reduces the 50 % valve opens followed by the 100 % valve.

At the end of the 'on' cycle, under the control of a time clock or programmer or when the cylinder and room thermostat are satisfied, the boiler switches off but the pump continues to run for 15 seconds. The fan returns to operation at the low speed.

The high limit thermostat breaks the thermocouple circuit which extinguishes the pilot releasing the thermoelectric valve and closes the gas valve to the burner. Manual re-setting is required (See Section 5.4).



## 2. INSTALLATION REQUIREMENTS

### 2.1 General

The installation of the boiler must be in accordance with the Gas Safety (Installation and Use) Regulations 1984, Building Regulations, current I.E.E. Wiring Regulations and the Byelaws of the local Water Undertaking. It should be in accordance also with the BS Codes of Practice and the British Gas Specifications for Domestic Wet Central Heating Systems and any relevant requirements of the local Gas Region and Local Authority.

Detailed recommendations are stated in the following British Standard Codes of Practice: CP 331.3 1974, BS 5376:2 1970, BS 5440 1979, BS 5440:1 1978 and 2 1976, BS 5449:1 1977.

**Note : Gas Safety Installation and Use Regs 1984** It is the law that all gas appliances are installed by competent persons in accordance with the above regulations. Failure to install appliances correctly could lead to prosecution. It is in your own interest and that of safety to ensure compliance with the law.

### 2.2 Location

The position chosen for the boiler must permit the provision of a satisfactory flue termination. The location must also permit adequate space for servicing and air circulation around the boiler.

The boiler may be installed in any room or internal space although particular attention is drawn to the requirements of the IEE Wiring Regulations and, in Scotland, the electrical provisions of the Building Regulations applicable in Scotland, with respect to the installation of a heater in a room or internal space containing a bath or shower.

Where the installation of the boiler will be in an unusual location special procedures may be necessary and BS 5376:2 give detailed guidance on this aspect.

A compartment used to enclose the heater must be designed and constructed specifically for this purpose. An existing cupboard or compartment may be used provided that it is modified for the purpose.

Details of essential features of cupboard/compartment design are given in BS 5376:2.

### 2.3 Water Circulation Systems

Open or sealed type central heating systems should be in accordance with the relevant recommendations given in BS 5376:2, BS 5449:1 (for smallbore or microbore systems) and the British Gas Specifications for Central Heating Systems.

Hot water systems should be in accordance with the relevant recommendations given in BS 5546 and the above mentioned British Gas publication.

### 2.4 Siting the Flue Terminal

The flue installation must be in accordance with BS 5440 Pt 1 1978.

The standard flue set is suitable for walls having a thickness of 76 mm - 612 mm for rear outlet and 76 mm - 500 mm for side outlets - See 1.5. Other flue options are available to a maximum of 3 m (9 ft 10 in) to special order. (See 1.5).

The boiler must be installed so that the flue terminal is exposed to external air. The boiler must NOT be installed so that the terminal discharges into another room or space such as an outhouse or lean to. It is important that the position of the terminal allows a free passage of air

across at all times. The minimum acceptable spacings from the terminal to obstructions and ventilation openings are specified below :

Terminal position	Minimum spacing
1. Directly below an openable window air vent or any other ventilation opening.	300 mm (12 in)
2. Below guttering, drain pipes or soil pipes.	75 mm (3 in)
3. Below balconies or eaves.	200 mm (8 in)
4. Above adjacent ground or balcony	300 mm (12 in)
5. From vertical drain pipes or soil pipes	75 mm (3 in)
6. From internal or external corners	300 mm (12 in)
7. From a surface facing the terminal.	600 mm (24 in)
8. From a terminal facing the terminal.	1200 mm (48 in)

**Note :** The flue can be extended 150 mm (6 in) to clear a projection. Where the terminal is fitted within 850 mm (34 in) of a plastic gutter or 450 mm (18 in) from painted eaves, an aluminium shield of at least 750 mm (30 in) long should be fitted to the underside of the gutter or painted surface.

Where the lowest part of the terminal is less than 2 m (6.5 ft) above the level of any ground, balcony, flat roof or place to which any person has access and which adjoins the wall in which the terminal is fitted the terminal must be protected by a guard of durable material (A terminal guard is available from Chaffoteaux Ltd) or from Tower Flue Components. Tonbridge 351555.

The air inlet/products outlet duct and the terminal of the appliance must not be closer than 25 mm (1") to any combustible material. Detailed recommendations on the protection of combustible material are given in BS 5440 Pt.1 1978 (Sub Clause 20.1).

#### IMPORTANT NOTICE : TIMBER FRAMED HOUSES

IF THE BOILER IS TO BE FITTED IN A TIMBER FRAMED BUILDING, IT SHOULD BE FITTED IN ACCORDANCE WITH THE BRITISH GAS PUBLICATION - « GUIDE FOR GAS INSTALLATIONS IN TIMBER FRAMED HOUSING » reference DM2. IF IN DOUBT, ADVICE **MUST** BE SOUGHT FROM THE LOCAL REGION OF BRITISH GAS.

### Air Supply (BS 5440:2)

The room in which the boiler is installed does not require a purpose provided air vent.

If the boiler is installed in a cupboard or compartment permanent air vents are required in the cupboard or compartment, one at high level and one at low level either direct to the outside air or to a room. Both high and low level air vents must communicate with the same space.

#### Cupboard or compartment air supply

##### 30 FF

Position of air vents	Air from room	Air Direct from outside
High level	106 cm <sup>2</sup> (16 in <sup>2</sup> )	53 cm <sup>2</sup> (8 in <sup>2</sup> )
Low level	106 cm <sup>2</sup> (16 in <sup>2</sup> )	53 cm <sup>2</sup> (8 in <sup>2</sup> )

## 50 FF

Position of air vents	Air from room	Air Direct from outside
High level	168 cm <sup>2</sup> (26 in <sup>2</sup> )	84 cm <sup>2</sup> (13 in <sup>2</sup> )
Low level	168 cm <sup>2</sup> (26 in <sup>2</sup> )	84 cm <sup>2</sup> (13 in <sup>2</sup> )

## 2.6 Electrical Supply

This boiler must be earthed. All wiring must conform to the I.E.E. Wiring Regulations. The **CHALLENGER FF** requires a 240 V single phase, 50 Hz supply. A means of isolation must be provided adjacent to the boiler, this should preferably be an unswitched plug and socket which on disconnection has a separation of at least 3 mm on all poles. The supply cord must be 0.75 mm<sup>2</sup> three core heat resisting cable.

## 2.7 Gas Supply

The Challenger FF on Natural Gas requires :

30 FF 1.03 m<sup>3</sup>/h (36.4 ft<sup>3</sup>/h)

50 FF 1.74 m<sup>3</sup>/h (61.4 ft<sup>3</sup>/h)

The meter and supply pipes must be capable of delivering this quantity of gas in addition to the demand from any other appliances in the house.

The complete installation must be tested for soundness and purged as described in CP 331:3.

## 3 SYSTEM GUIDANCE

### 3.1 General

The CHALLENGER FF boiler series are low water content appliances designed ONLY for use with fully pumped systems. They may be used with open or sealed systems, all safety controls excluding the pressure relief valve being incorporated in the boiler. The thermostat is adjustable and, on its maximum setting, gives a nominal 82° C (180° F) flow temperature.

Detailed recommendations for water circulation are given in BS 5376:2 1976, BS 5449:1 1977, BS 5446:1979. Thermostatic control should be fitted to the hot water storage cylinder and heating system.

### 3.2 Strainers

Where a CHALLENGER FF is used as a replacement for a boiler on an existing system, ideally the water system should be flushed and cleaned using a suitable chemical cleaner following the manufacturer's recommendations and fitted with a strainer similar to that manufactured by Honeywell (Code FY 30) in the return before the boiler.

### 3.3 Control Systems

Most normal pumped primary control schemes can be used including thermostatic radiator and cylinder valves. When using motorised valves the controls should be so arranged to switch off the boiler when circuits are satisfied.

Chaffoteaux can be consulted where technical assistance is required.

### 3.4 Circulation Pump

The system circulating pump should be sized relative to the resistance of the connected load and the system design  $\Delta t$  selected. The mass flow rate through the boiler should not be less than :

CHALLENGER 30 FF 504 lt/h (1.8 gpm)

CHALLENGER 50 FF 841 lt/h (3.08 gpm)

The pump must be installed between isolating valves situated as close to the pump as practical. Most pump manufacturers require a minimum static head on the pump inlet to prevent cavitation. For boiler resistance, see graph on page 3 - fig. 2.

### 3.5 Cold feeds and open vents (figs. 7-13)

The cold feed and open vent should be so positioned that pumping over and cavitation or air entrainment are avoided see recommendations for various layouts on page 8. Chaffoteaux recommend that the 15 mm cold feed and 22 mm open vent are close coupled (within 150 mm (6")) on the low pressure side of the pump. The connection should be so arranged that there is a low velocity point at the open vent junction with the system. (Page 8 - Fig. 13).

### 3.6 Automatic Air Separator

Chaffoteaux strongly recommend the inclusion of a British Gas accepted automatic air separator in the system as shown in fig. 13.

The open vent should rise continuously from the system pipework.

It should not be entered horizontally into the system pipework. The use of an enlarged T to create a low velocity point is recommended. The preferred arrangements is shown in fig. 13.

### 3.7 Cylinder

The domestic hot water cylinder used with the CHALLENGER FF must be of the indirect and high recovery type to BS 1566 Pt. 1. Single feed cylinders are not suitable for use with this appliance. Flow and return to the cylinder must not be less than 22 mm pipe.

### 3.8 Feed and Expansion Tank

The feed and expansion tank should be adequately sized to accept the system water expansion. It should not be mounted closer than 230 mm (9") to a ceiling to allow access to the ball valve.

### 3.9 Inhibitors

Chaffoteaux Limited do not generally recommend the inclusion of an inhibitor with heating and hot water systems, utilising Challenger FF boilers. It is, however, appreciated that the use of a corrosion and limescale inhibitor may be desirable or specified.

The following are the appliance manufacturers recommendations :

- 1) Use only a British Gas or similar approved inhibitor from the Fernox range manufactured by Industrial (Anti Corrosion) Services, Britannica Works, Arkesdon Road, Clabering, Nr. Saffron Waldron.
- 2) Use only quantities specified by the inhibitor manufacturer.
- 3) Cleanse the system as required by the inhibitor manufacturer.
- 4) Add inhibitor only after flushing when finally refilling the system.

### 3.10 Add on Devices

This appliance is approved by British Gas for safety and performance. It is important that no external control devices - eg. flue dampers, economisers etc. - be directly connected to this appliance, unless covered by these Installation Instructions or agreed by the Manufacturer in writing. Any direct connection of a control device not approved by the manufacturer could invalidate British Gas approval and also infringe the Gas Safety (Installation and Use) Regulations 1984.

### 3.11 Electrical controls (Chaffoteaux recommendations)

CHALLENGER FF boilers can be used with most normal pumped primary schemes including non-electrical heating and hot water controls.

It is not normally possible to use full programming facilities when using a mixture of electrical and non-electrical controls. However, some non-electrical controls are now available with an external microswitch and these controls are preferred.

Where the thermostatic radiator valves are used, a system by-pass will be necessary to maintain the minimum flow rate – See section 1.4.

**NB :** All wiring to external controls must be in accordance with the IEE Wiring Regulations.

1. Fully pumped system independant control of central heating and hot water using two spring return motorised valves.

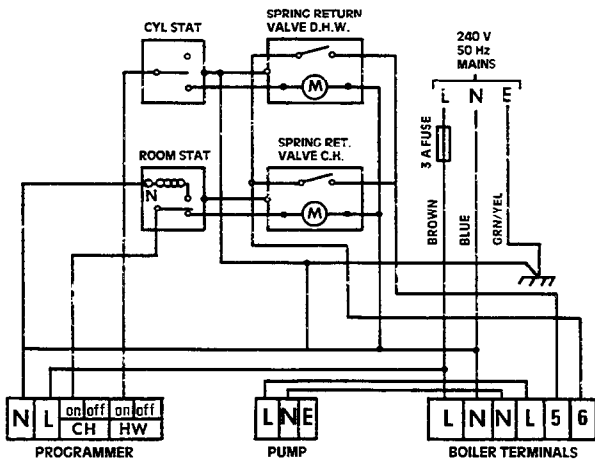


Fig. 3

2. Fully pumped systems independant control of central heating and hot water using two motorised valves.

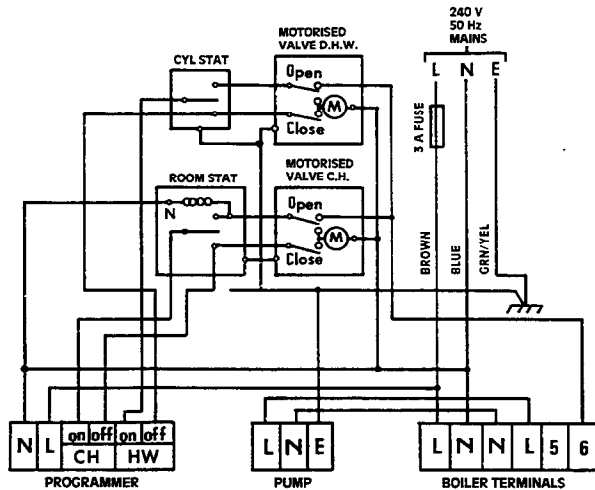


Fig. 4

3. Drayton flow share valve system.

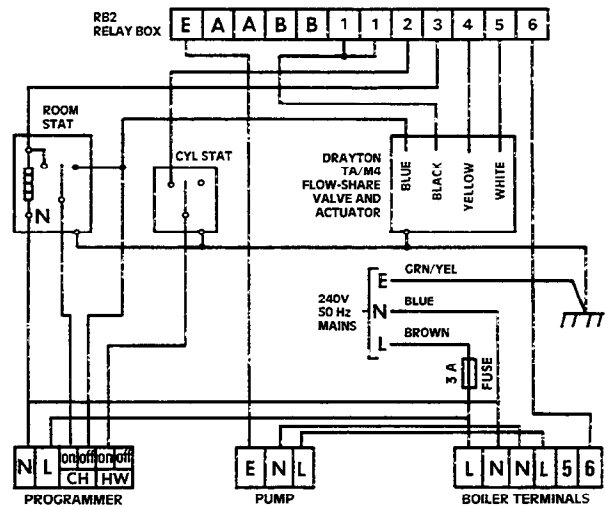


Fig. 5

4. Satchwell Duoflow system.

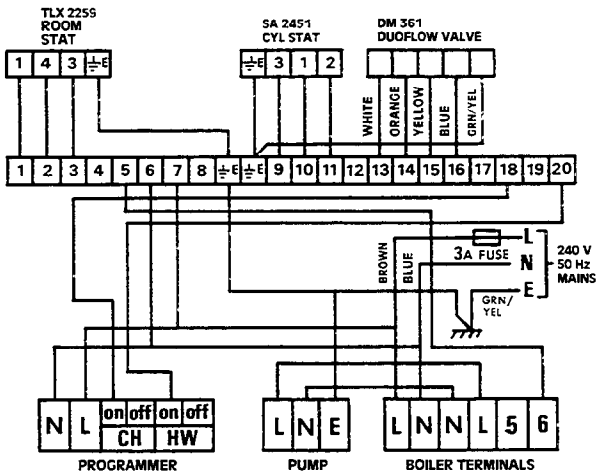
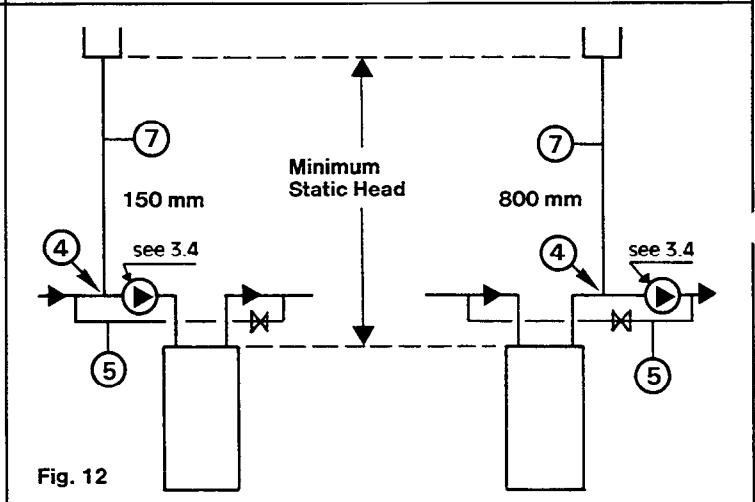
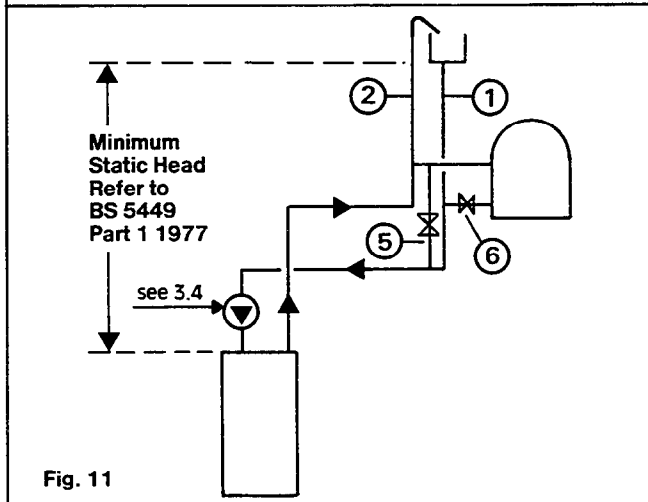
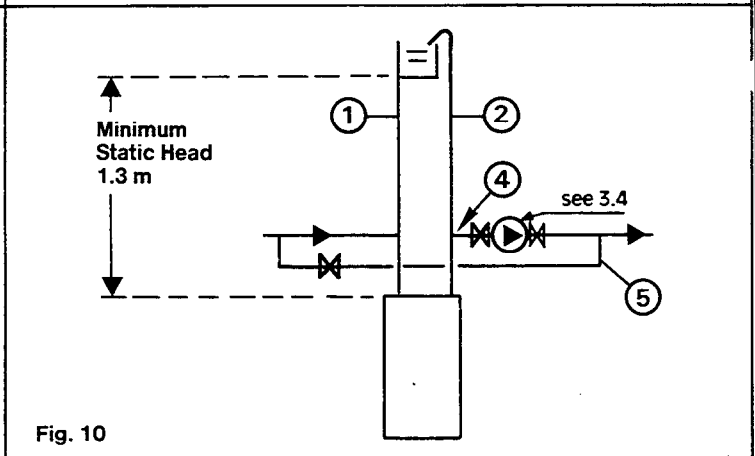
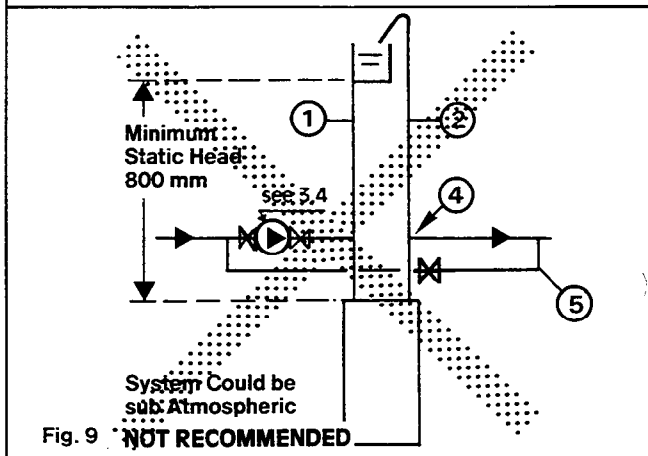
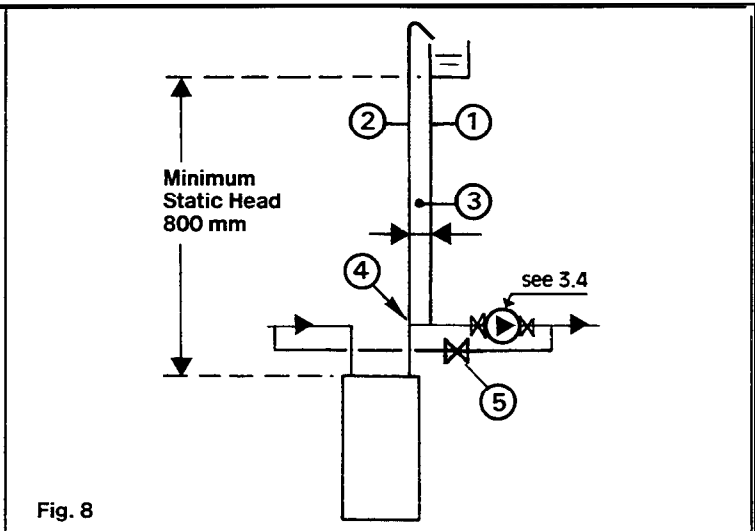
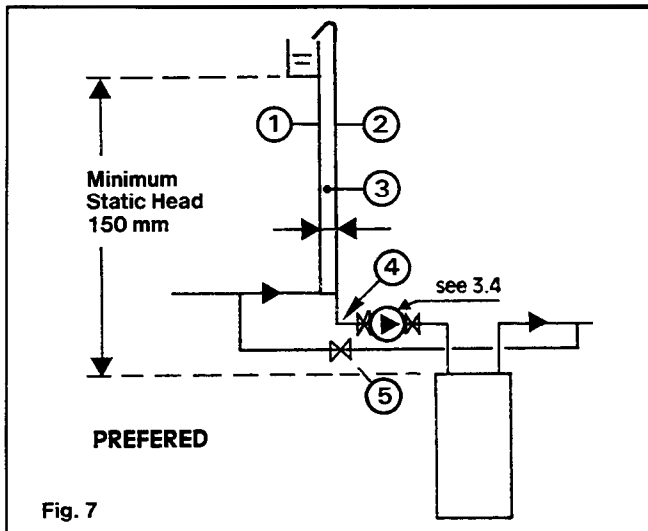


Fig. 6

# ALTERNATIVE SYSTEM LAYOUTS



Air separator or formed low velocity point

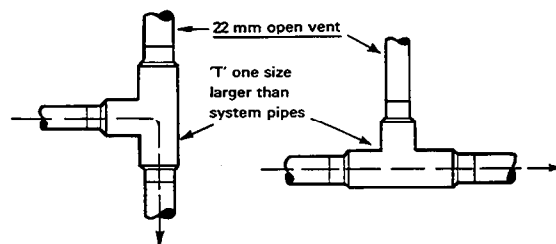
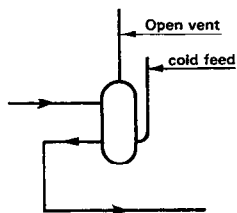


Fig. 13

1. Cold feed 15 mm
2. Open vent 22 mm
3. 6 in. maximum
4. See fig. 13
5. By pass 15 mm
6. Regulating motorised valve
7. Combined cold feed and open vent



## 4. INSTALLING THE BOILER

A vertical flat incombustible area is required for installation of the boiler as follows :

CHALLENGER 30 FF 445 mm wide × 955 mm high (17 1/2 in × 37 1/2 in)

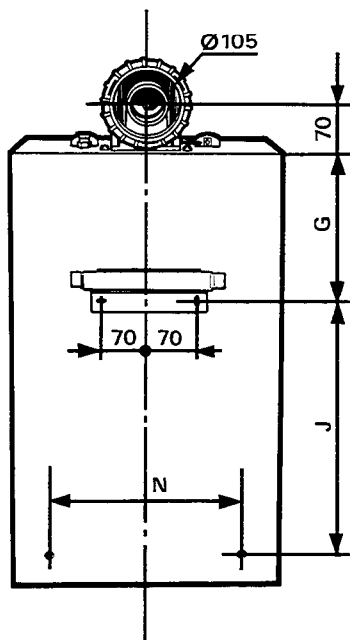
CHALLENGER 50 FF 445 mm wide × 955 mm high (17 1/2 in × 37 1/2 in)

The above dimensions include the necessary clearances around the boilers for case removal, air movement and installation and servicing.

The CHALLENGER FF and Flue assembly (standard length) are supplied in one carton in which there are 3 compartments.

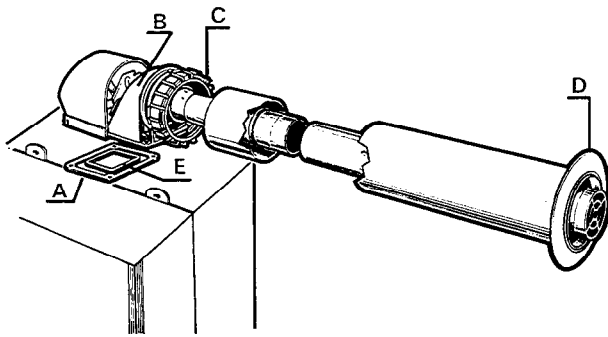
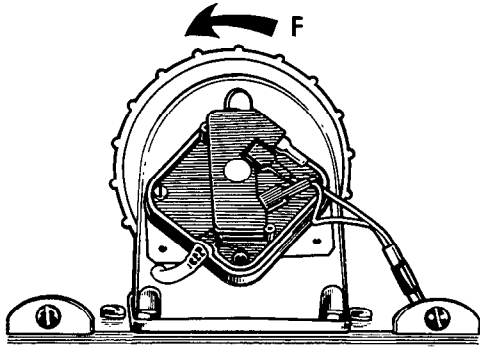
1. Assembled boiler
2. Air inlet duct and flue duct
3.
  - i) Flue turret assembled with pressure switch
  - ii) Box containing :
    - 2 nuts and olives 22 mm
    - 1 nut and olive 15 mm
    - 1 gas service cock
    - 1 filter washer
    - 1 mounting bracket
    - 4 wood screws and washers
    - 1 cable clamp and screws
  - iii) Plastic bag containing :
    - 1 locking ring
    - 1 'O' ring
    - 1 cork gasket
    - 1 channelled neoprene gasket
    - 4 fixing screws for flue turret
    - 2 screws for turret cover
  - iv) Plastic bag containing :
    - external wall plate with adhesive mastic.
  - v) Plastic flue turret cover.

### 4.1



- Remove boiler from carton
- Release the front case by unscrewing the three fixing screws and washers positioned two at the top and one at the bottom and two screws securing the case to the control box.  
**NB** : one washer is paint cutting to maintain electrical bond. (Front of appliance covered by glass drop down door. See 7.1).
- Remove the case by easing it forward at the bottom and lifting it clear of the top locating lugs.
- Set out and drill hole for flue using a 4 in core drill or metric equivalent.
- Using dimensions on page 2 drill and plug the wall and fit bracket to the wall using screws and washers provided. Check and ensure bracket is level.
- Temporarily hang the boiler on the bracket.
- Mark two fixings at the bottom of the boiler, remove the boiler and drill and plug the wall.
- Rehang and screw the boiler to the wall using the screws and washers provided.

## 4.2



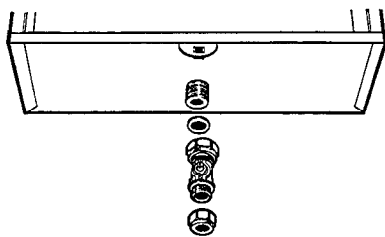
- Measure the wall thickness and cut the flue duct and air inlet duct to length – see 1.5 ANY SURPLUS LENGTH MUST BE CUT FROM PLAIN END.

**NB :** If cold the duct material becomes brittle – warm before cutting.

- Peel off protective paper from the adhesive side of the cork gasket A and place on mating surface of flue turret B lining up screw holes. Press down.
- Fit a channelled gasket E to products outlet on top of boiler.
- Assemble flue duct onto flue tube section.
- Fit locking ring C and 'O' ring over air duct as shown.
- Assemble the flue duct through the air duct so that it engages the terminal.
- Abutt the 'O' ring up to the turret and engage the locking ring over the lugs by turning in an anti-clockwise.
- Remove cable connection for pressure switch which in transit is tucked into top of casing.
- Pass assembled flue through the wall so that the terminal extends not less than 13 mm (1/2 in) beyond external wall surface.
- Seat the turret onto the flue outlet ensuring that gaskets A & E are in position.
- Check that the flue assembly is level.
- Secure with the 4 screws provided.
- Where necessary make good external wall and fit wall plate D with mastic sealant onto external surface. Make good internal wall.

**NB :** Do not fit turret cover or front case until gas and electrical connections have been made and tested.

## 4.3

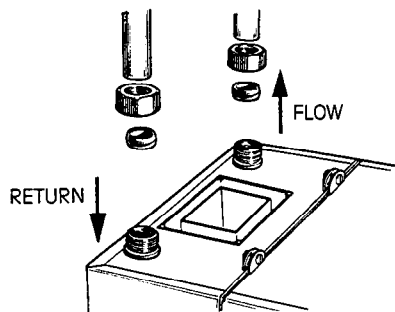


### Making the gas connection

- Remove the plastic cover from the gas inlet which is situated centre bottom of the boiler.
- Fit the gas service cock together with the filter washer packed in the accessory box.
- Fit the union nut and olive on the 15 mm gas supply pipe, and tighten.
- The gas supply pipe size should be sufficient to ensure that there is 20 mbar (8 in.w.g.) pressure at the service tap, with the boiler working.

**NB :** If space beneath boiler is restricted it is possible to fit a 3/4 BSP M & F elbow to the appliances. The gas service cock fits to the male thread.

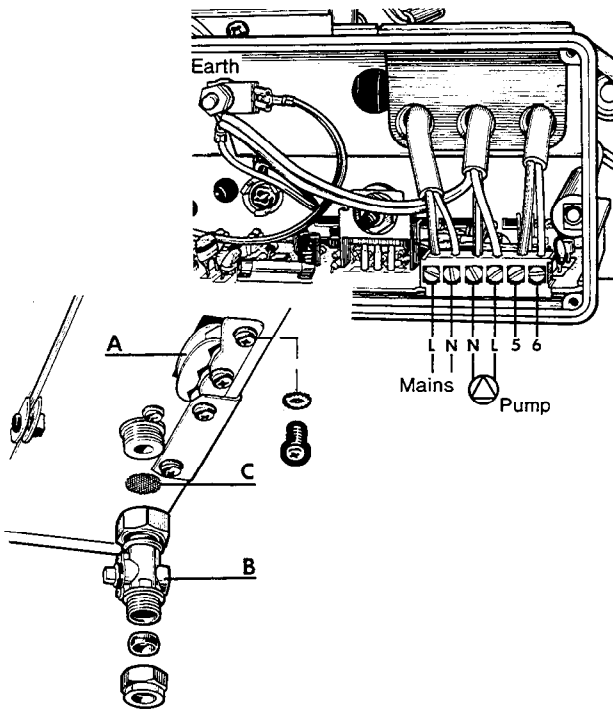
## 4.4



### Making the water connections

- Remove the plastic covers protecting the flow and return connection.
- Fit the union nuts and olives supplied in the accessory box on to flow and return pipes.
- Tighten compression fitting whilst holding connection inside case.

## 4.5

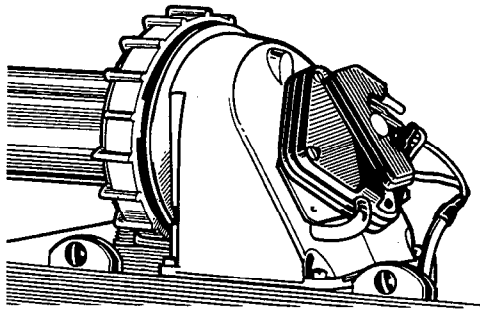


**Making Electrical Connection** (see section 2.6 for electrical supply requirements)

- Secure cable clamp A to the base of the appliance using the screws and paint cutting washers provided. Paint cutting washers must be used to maintain earthbond.
- Remove control box cover see 8.7.
- Three core heat resisting supply cable is passed through clamp and through slot in casing, and into rear of control box. Secure with clamp on top of electrical box so that there is sufficient length of cable between the 2 clamps to allow displacement of the electrical box without imposing strain on the earth bond. Connected to terminals on connection block and the earth connection made to the terminal.
- Connect pump cable to terminals and the earth on earth terminal.
- Connect ancillary controls across terminals marked 5 & 6. See controls diagrams. Figs 2-6 and 14-16.
- Clamp wires with cable clamp A.
- Replace control box cover.

**NB :** The length of the earth wire between the cord anchorage and the terminal must be such that the live and neutral wires become taut before the earth wire if the supply cord is pulled.

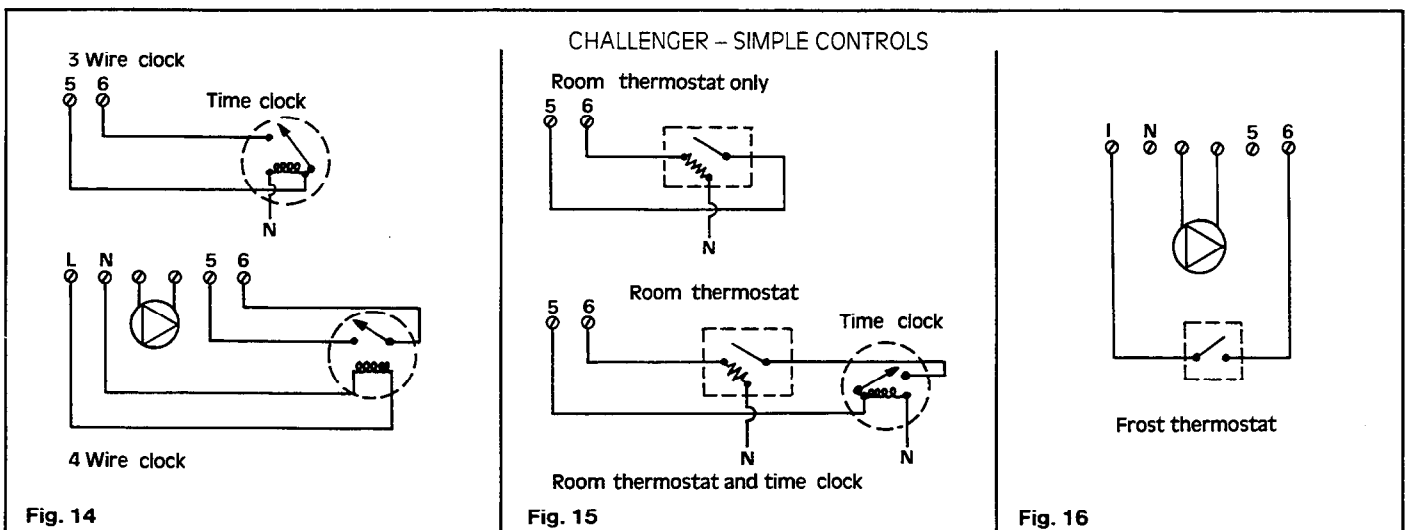
## 4.6



### Connection of the pressure switch

- Connect the violet wires in the wiring harness to terminal COM (P) and NO (2) common and normally open contacts.

In the event of an electrical fault after installation preliminary electrical system checks should be carried out. Checks to ensure electrical safety, earth continuity, polarity, and resistance to earth should be carried out by a competent person.



## 5 COMMISSIONING – OPEN VENTED SYSTEMS

### 5.1 Gas Installation

The whole of the gas installation, including the meter should be inspected and tested for soundness and purged in accordance with the recommendations of CP 331:3.

### 5.2 Water circulation system – Open vented systems only

The whole of the system should be filled and thoroughly flushed out with cold water without the pump in position. Ensure that all valves are open.

With the pump fitted the system should be flushed and air locks cleared. Vent all radiators and check for water soundness.

Light the boiler as detailed in 5.3

The water system should be heated to maximum working temperature and examined for water soundness. Both gas and water should then be turned off and the water system rapidly drained while still hot.

The system should again be filled, cleared of air locks and examined for water soundness and inhibitor added to the system if required in the specification (see section 3.9).

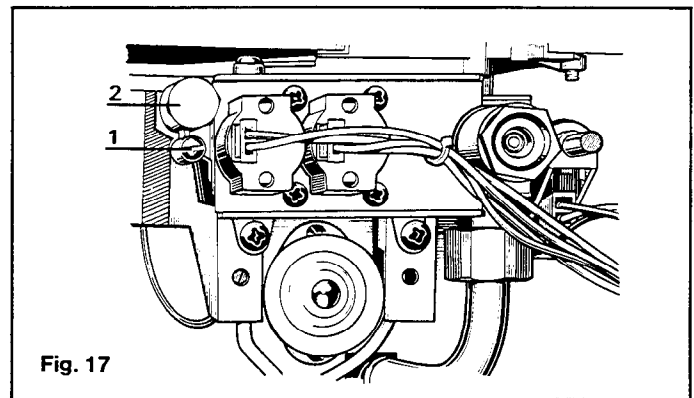
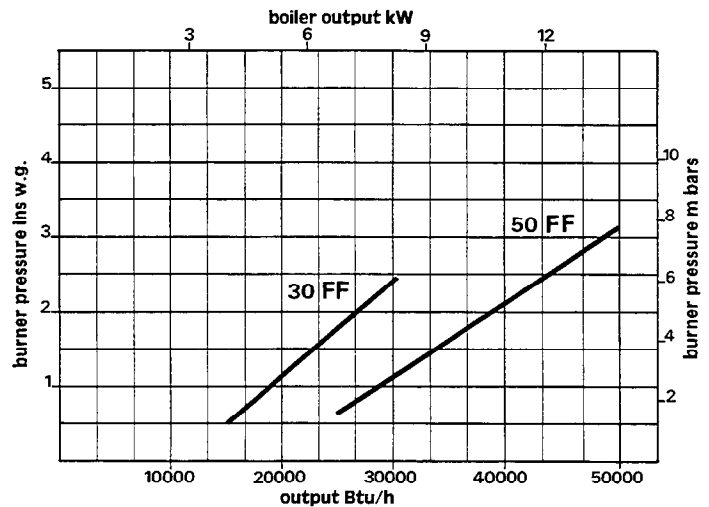
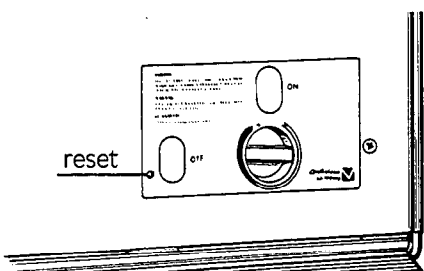
### 5.3 Lighting the boiler

- Check that the gas service cock is open.
- Push the ON button fully in and hold for 10 seconds.
- Check that pilot is alight and release slowly.
- If the pilot extinguishes press red reset button and repeat from (b). The pilot should be about 13 mm (1/2 in) long and impinge on the tip of the thermocouple.
- Switch system controls to a demand mode, ensuring that pump is running.
- After 30 seconds the main burner will light.
- If the pilot extinguishes, wait 3 minutes and repeat b) above.
- Check for gas soundness around the boiler gas components using leak detection fluid.
- Check and adjust gas rate as detailed in 5.5.

### 5.4 Resetting the high limit thermostat

- If for any reason the high limit thermostat operates the pilot will go off and the boiler will require manual re-setting.
- Re-establish the appliance by resetting the high limit thermostat by pressing the red reset button.
- Establish cause and rectify – See Fault Finding Chart, rear cover.

**NB :** If the mains electrical supply is interrupted the high limit thermostat may operate.



### 5.5 Gas rate adjustment (To be carried out before adjusting heating system by-pass).

**NB :** The boiler is supplied rated at the highest output. The boiler is fitted with a gas rate adjuster.

- Turn boiler to off by pressing OFF button.
- Remove the pressure test point screw (1) and connect a suitable pressure gauge (fig. 17).
- Remove the hexagonal cap from gas rate adjuster, (2) exposing the adjustment screw (fig. 17).
- Turn boiler on by pressing ON button (see lighting boiler 5.3 above).
- Adjust setting pressure. Setting pressures are given in graph relative to required output. The pressure will be reduced by clockwise movement of screw, increased by anti-clockwise movement.
- Turn boiler to OFF and refit pressure test point screw and gas rate adjuster cap and ensuring that a gas tight seal is made.
- Mark the data badge to indicate output.
- Replace front case. Particular care must be given to ensuring that the case seal is sound when the casing is replaced.
- After boiler has been running for 10 mins check the gas rate.
- Fit the plastic turret cover threading the harness through the slot provided.
- Secure cover with the thread forming screws provided.

## 5.6 Adjusting the heating system by-pass

**NB :** The by-pass valve should be of the lock shield pattern)

- Fire the boiler with the by pass fully closed and the system using the radiator lock shield valves to the system design temperature difference. Normally this will be 11° C (20° F).
- Adjust the system to minimum load. This will generally be central heating only with one radiator operating. Switch off radiators on the wheel head or thermostatic valves.
- Switch boiler thermostat to maximum.
- Open by pass until minimum flow rate across the boiler is achieved. This is equivalent to 15° C (27° F) temperature rise across the boiler.
- Open all radiators and check the system design temperature difference.

## 6. SEALED SYSTEMS

### 6.1 Safety valve

A safety valve shall be fitted close to the appliance on the flow pipe by a horizontal or vertically upward connection. Only safety valves set to operate at 3 bar shall be used ; they shall be so positioned or any discharge pipe so arranged, that discharge of water or steam from the valve cannot create a hazard to occupants of the premises or cause damage to electrical components and wiring.

### 6.2 Pressure gauge

A pressure gauge covering at least the range 0-4 bar (0-60 lb/in<sup>2</sup>) shall be fitted to the system adjacent to, and visible from, the filling point.

### 6.3 Expansion vessel

- A diaphragm type expansion vessel shall be fitted by a connection to the inlet side of the circulating pump, in a manner laid down in the vessel maker's instructions

Safety valve setting (bar)	3.0									
Vessel charge pressure (bar)	0.5			1.0				1.5		
Initial system pressure (bar)	0.5	1.0	1.5	2.0	1.0	1.5	2.0	1.5	2.0	
Total water content of system	Expansion Vessel Volume (litres)									
litres	0.5	1.0	1.5	2.0	1.0	1.5	2.0	1.5	2.0	
25	2.1	3.5	6.5	13.7	2.7	4.7	10.3	3.9	8.3	
50	4.2	7.0	12.9	27.5	5.4	9.5	20.6	7.8	16.5	
75	6.3	10.5	19.4	41.3	8.2	14.2	30.9	11.7	24.8	
100	8.3	14.0	25.9	55.1	10.9	19.0	41.2	15.6	33.1	
125	10.4	17.5	32.4	68.9	13.6	23.7	51.5	19.5	41.3	
150	12.5	21.0	38.8	82.6	16.3	28.5	61.8	23.4	49.6	
175	14.6	24.5	45.3	96.4	19.1	33.2	72.1	27.3	57.9	
200	16.7	28.0	51.8	110.2	21.8	38.0	82.4	31.2	66.2	
250	20.8	35.0	64.7	137.7	27.2	47.5	103.0	39.0	82.7	
300	25.0	42.0	77.7	165.3	32.7	57.0	123.6	46.8	99.3	
350	29.1	49.0	90.6	192.8	38.1	66.5	144.2	54.6	115.8	
400	33.3	56.0	103.6	220.4	43.6	76.0	164.8	62.4	132.4	
450	37.5	63.0	116.5	247.9	49.0	85.5	185.4	70.2	148.9	
500	41.6	70.0	125.9	275.5	54.5	95.0	206.0	78.0	165.5	
For systems volumes other than those given above, multiply the system volume by the factor across	0.0833	0.140	0.259	0.551	0.109	0.190	0.412	0.156	0.331	

For the CHALLENGER FF boiler the above table should be multiplied by 0.8

tions (see Fig. 7-13 for illustration of recommended system layouts). The expansion vessel shall be capable of accepting water up to at least 62.5 % of its volume without damage.

- The nitrogen or air charge pressure of the expansion vessel shall not be less than the hydro-static head (height of the top point of the system above the expansion vessel).
- The expansion vessel shall be sized in accordance with the following table :

### 6.4 Hot water storage cylinder

The hot water cylinder shall be the indirect coil type which is suitable for the system pressure.

### 6.5 Make-up system

Provision shall be made for replacing water lost from the system either :

- From a make-up vessel or tank mounted in a position higher than the top point of the system and connected through a non-return valve to the system on the return side of the hot water cylinder or the return side of all heat emitters, or -
- Where access to make up vessel would be difficult, by pressurisation of the system.

### 6.6 Mains connection

There shall be no connection to the mains supply or to the water storage tank supplying domestic water, even through a non-return valve, without the approval of the local Water Authority.

### 6.7 Filling point (see BS 5376 Pt 2 Appendix A)

- Through a temporary hose connection from a draw off tap supplied from a service pipe under mains pressure, provided that this procedure is acceptable to the local Water Authority.
- Through a self contained unit comprising a cistern, pressure booster pump if required and if necessary an automatic pressure reducing valve or flow restrictor.
- Through a cistern, used for no other purpose, permanently connected directly to a service pipe. The water distributing pipe. The static head available should be sufficient to provide the desired initial system design pressure.

### 6.8 Pipework

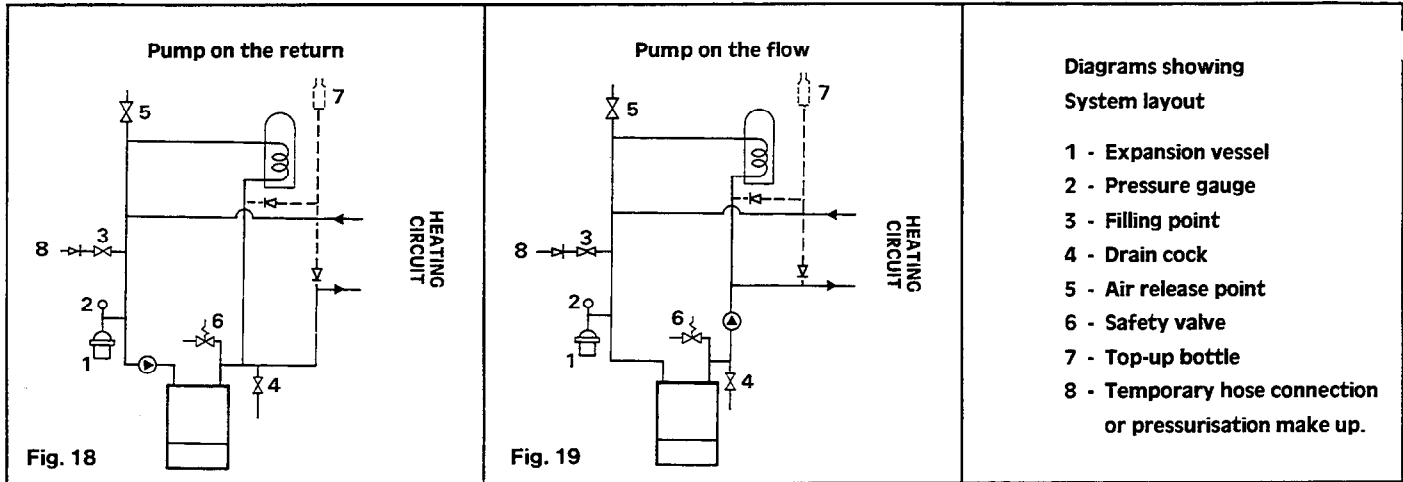
Pipework should be of copper ; small bore or microbore with capillary or compression jointing to a high standard. Leak sealant shall not be used in the system.

Where a vessel of the calculated size is not obtainable, the next available larger size should be used.

For the purpose of the above calculation, the volume of the system shall be determined as accurately as possible using manufacturers' data as appropriate. Alternatively the volumes given below may be used to give a conservative estimate of the system volume :

Boiler	0.5 litres (0.11 gallons)
Small bore pipework	0.3 litres (0.07 gallons)
per 0.292 kW (1000 Btu/h) of system output	
Microbore pipework	7 litres (1.5 gallons)
Steel panel radiators	2.3 litres (0.5 gallons)
per 0.292 kW (1000 Btu/h) of system output	
Hot water cylinder	2 litres (0.44 gallons)

If a system is extended, an expansion vessel of increased volume may be required unless previous provision has been made for the extension.



## 6.9 Commissioning Sealed System Only

The whole of the system should be filled and thoroughly flushed out with cold water without the circulating pump in position. Ensure that all valves are open. (The system must be filled with water either from a sealed system filler pump with a break tank, or by any other method approved by the Local Water Undertaking).

With the circulating pump fitted the system should be filled and air locks cleared until the pressure gauge registers 1.5 bar (21.5 lbs/in<sup>2</sup>). Vent all radiators and check for water soundness.

Manually raise the water pressure to ensure that the safety valve lifts. This should occur within  $\pm 0.3$  bar ( $\pm 4.3$  lbf/in<sup>2</sup>) of the preset lift pressure, i.e. 3 bar (43.5 lbf/in<sup>2</sup>).

Release water from the system until the initial system

design pressure is attained, taking into account any difference in height between the pressure gauge and the point at which the pressure vessel is connected.

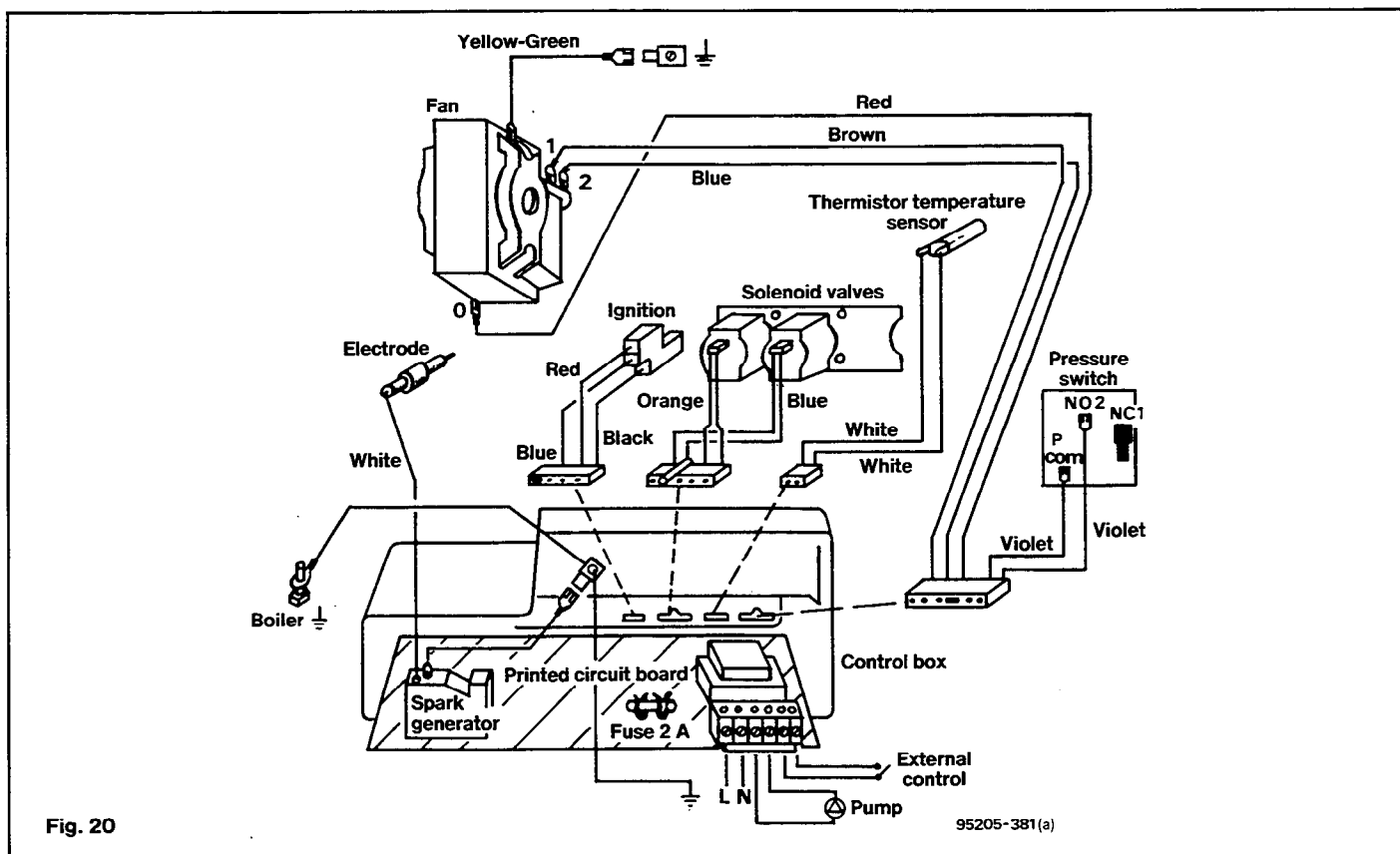
Light the boiler as detailed in 5.3.

The water system should be heated to maximum working temperature and examined for water soundness. Both gas and water should then be turned off and the water system rapidly drained whilst still hot.

The system should again be filled, and inhibitor added to the system, if required in the specification (see 3.9). Clear all air locks and adjust to the initial design pressure. Any set pointer on the pressure gauge should be set to coincide with the indicating pointer. Examine for water soundness. Now adjust gas rate and system by pass.

**NB :** The boiler is supplied rated at highest output.

The boiler is fitted with a gas rate adjuster. (See 5.5 for adjustment procedure).





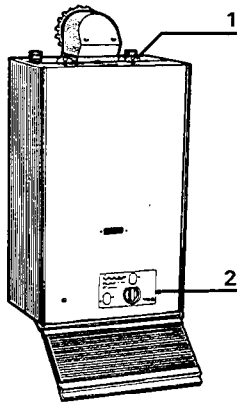
## 7. SERVICING

For efficient and trouble free operation it is important that the CHALLENGER FF boiler receives regular maintenance. The following schedules are recommended. Check function of appliance and observe flame picture. Check clean or replace components as necessary.

Before commencing any work turn off the gas at the gas service cock (4.3 Page 10) Ensure that the electricity supply is isolated.

**NB :** Always test for gas soundness after completing any servicing or exchange of gas carrying components.

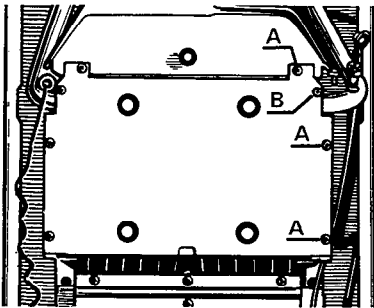
### 7.1



#### Remove front case

- Remove screws and washers (1) two at top and one at bottom of boiler. (One washer paint cutting to maintain electrical bond).
- Remove two screws from lower front of case (2).
- Remove case by easing forward at the bottom and lifting clear of the top locating lugs.

### 7.2



#### 30 FF

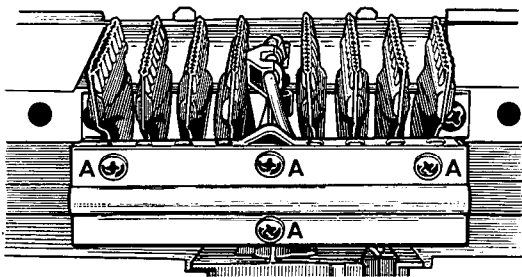
#### Remove combustion chamber front panel

- Remove four screws A and two nuts screws and washers B securing front panel of combustion chamber.
- Remove panel complete with regulator plate by easing forward.

#### 50 FF

- Remove six screws A and two nuts screws and washers B securing front panel of combustion chamber.
- Remove panel by easing forward at bottom and disengage.

### 7.3

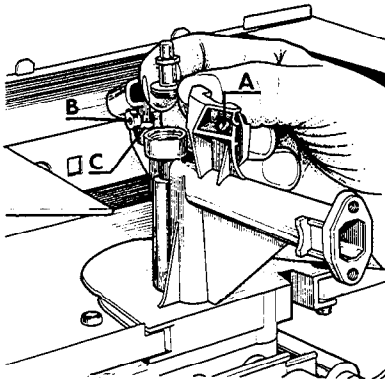


#### Remove the burner assembly

- Remove the screws A securing burner manifold to gas section.
- Remove gasket and retain in safe place.
- Remove burner.

**NB :** When replacing burner ensure that the lugs are located to the rear bracket and the faces of the fixings on rear of burner are in cut outs provided taking care not to trap electrode lead.

### 7.4



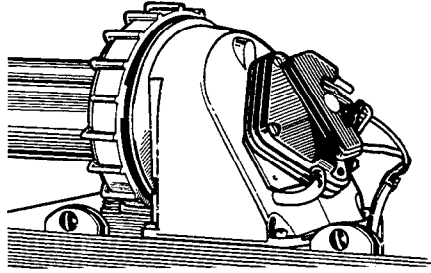
#### To remove pilot

- Release thermocouple from bracket by removing screw securing clamp (A) and removing clamp. Move thermocouple to the side.
- Release the electrode by loosening screw on right hand side of assembly and rotating clip (B).
- Remove pilot gauze and filter by removing screw securing gauze to assembly (C).
- Lift out pilot deflector plate.
- Remove pilot by unscrewing (nut size 8 mm AF).
- The pilot injector can be cleaned and should be replaced bright side uppermost.





8.4

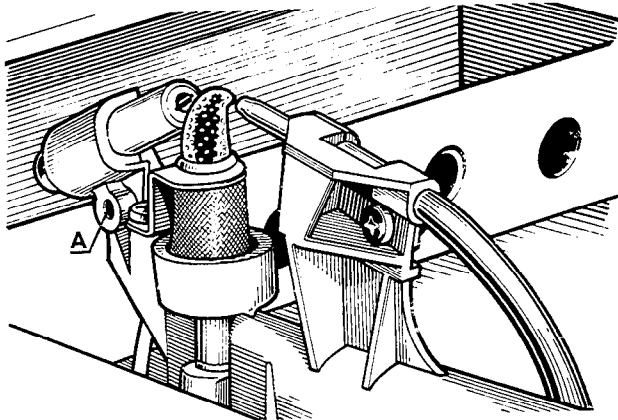


**To replace pressure switch**

- a) Remove two screws retaining plastic turret cover.
- b) Note position of spade connectors and remove.
- c) Disconnect pressure sampling tube by pulling off nipple.
- d) Remove two screws retaining pressure switch.
- e) Replace in reverse order.

**NB** : See 4.6 – electrical connections.

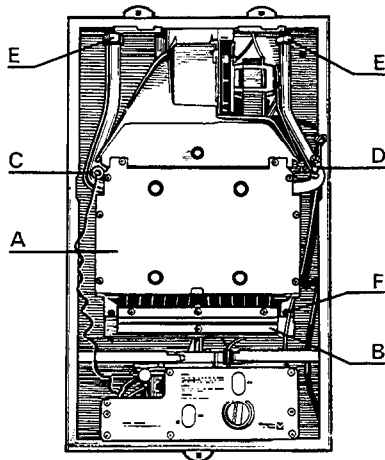
8.5



**Replace spark electrode and lead**

- a) Remove front case 7.1
- b) Remove combustion chamber front panel 7.2
- c) Remove burner assembly 7.3
- d) Remove thermostat knob and six screws and screw seats from the electrical control box.
- e) Remove plugs from rear of electrical control box.
- f) Slide PCB forward and disconnect spark lead from ignition generator.
- g) Feed lead out through rear of control box.
- h) Loosen screw securing clip retaining electrode and turn clip through 90° C.
- i) Slide electrode sideways complete with lead. Release spark lead from sealing gland.
- j) Replace in reverse order taking care to locate electrode in locating ring and replace plugs in rear of control box.

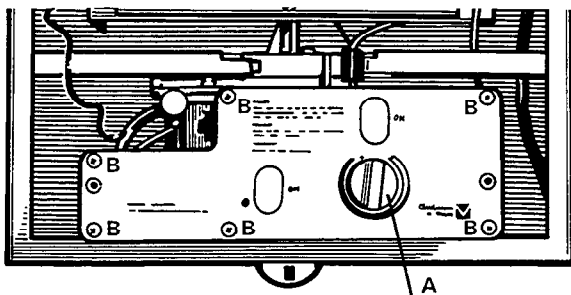
8.6



**To replace heat exchanger**

- a) Drain system.
- b) Remove front case 7.1.
- c) Remove combustion chamber front panel (A) 7.2.
- d) Remove burner assembly (B) 7.3
- e) Remove high limit thermostat phial – left hand side (C).
- f) Withdraw thermostat temperature sensor – right hand side (D) 8.13
- g) Unscrew nuts on flow and return connections (E) (30 mm AF).
- h) Remove two screws securing combustion chamber to rear chassis (F).
- i) Drop assembly and withdraw forwards.
- j) Remove two screws from rear of assembly retaining heat exchanger to combustion chamber.
- k) Repace in reverse order.

8.7

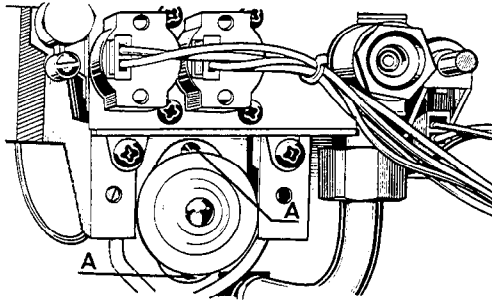


**To remove the electrical control box**

- a) Remove front case 7.1.
- b) Remove the boiler thermostat knob (A) by pulling off the spindle.
- c) Remove six screws and screw seats retaining the electrical box cover (B) and remove cover taking care not to lose the red reset button.
- d) Mark and remove the mains, pump and external controls wiring.
- e) Remove plugs at rear of electrical box and disconnect earth.
- f) Ease PCB forward and remove spark electrode cable.
- g) Remove two screws in the rear of the box securing box to chassis and remove box.
- h) Replace in reverse order.

**NB** : Omit d & e above if the box is to be temporarily displaced to gain access to another component.

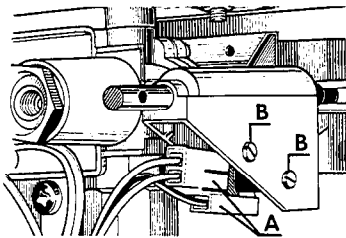
8.8



**Replace high limit thermostat**

- Remove front case 7.1 and remove or displace as necessary electrical control box 8.7.
- Remove combustion chamber front panel.
- Remove two screws (A) securing high limit thermostat.
- Disconnect conductors at pin connectors by pulling apart.
- Remove sensor from dry thermostat pocket first removing split pin.
- Unclip capillary.
- Replace in reverse order using a heat sink grease on the thermostat phial.

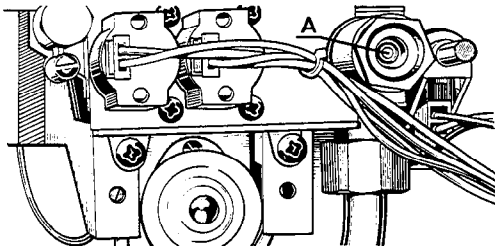
8.9



**To replace microswitch and lead assembly**

- Remove front case 7.1
- Remove or displace as necessary the electrical control box 8.7.
- Pull off connector (A).
- Remove two screws retaining microswitch (B).
- Replace in reverse order.

8.10

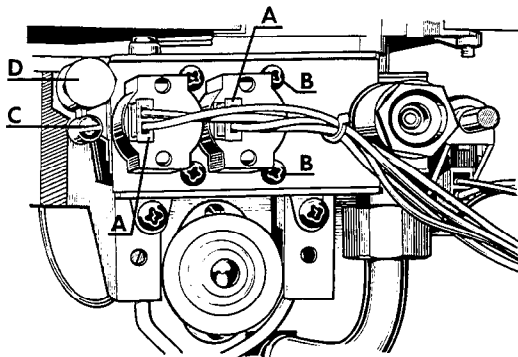


**To replace thermoelectric valve**

- Remove front case 7.1
- Remove or displace as necessary the electrical box 8.7.
- Remove thermocouple connection from thermoelectric valve (A).
- Remove nut securing thermoelectric valve (nut size 25 mm AF).
- Withdraw thermoelectric valve.
- Replace in reverse order.

**NB :** Care should be taken when replacing the nut securing the thermoelectric valve - FINE THREADS.

8.11



**To replace solenoid valves**

- Remove front case 7.1
- Remove or displace as necessary the electrical control box 8.7.
- Disconnect plug connectors (A) from solenoid valves (colour coded).
- Remove four screws (B) securing solenoid valve mounting plate.
- Remove mounting plate and solenoids – take **care not to misplace valve springs** or damage gasket.
- Replace in reverse order using new gasket.

8.12

**Replace pilot injector**

- Proceed as for servicing 7.4.
- Replace injector ensuring it is fitted bright side uppermost.

8.13

**To replace boiler thermostat sensor and lead**

- a) Isolate electrical supply.
- b) Remove front case 7.1.
- c) Undo knurled ring retaining thermostat sensor phial and remove phial.
- d) Unplug from rear of control box.
- e) Replace in reverse order using heat sink grease on thermostat sensor phial.

8.14

**To replace fuse**

- a) Isolate electrical supply.
- b) Remove front case 7.1.
- c) Remove cover on electrical control box 8.7.
- d) Remove and replace fuse (2 amp).
- e) Replace in reverse order.

8.15

**To replace PCB**

- a) Isolate electrical supply.
- b) Remove front case 7.1.
- c) Remove cover on electrical control/box.
- d) Ease forward PCB and remove spark electrode wire and earth wire from spark generator NB. PCB is a wedge shape and it will be found easier to ease front corners first.
- e) Remove plugs from rear of electrical control box.
- f) Slide board forward and remove.
- g) Replace in reverse orders.
- h) Check function of controls.

8.16

**Testing of FDD Circuit**

**Closed circuit**

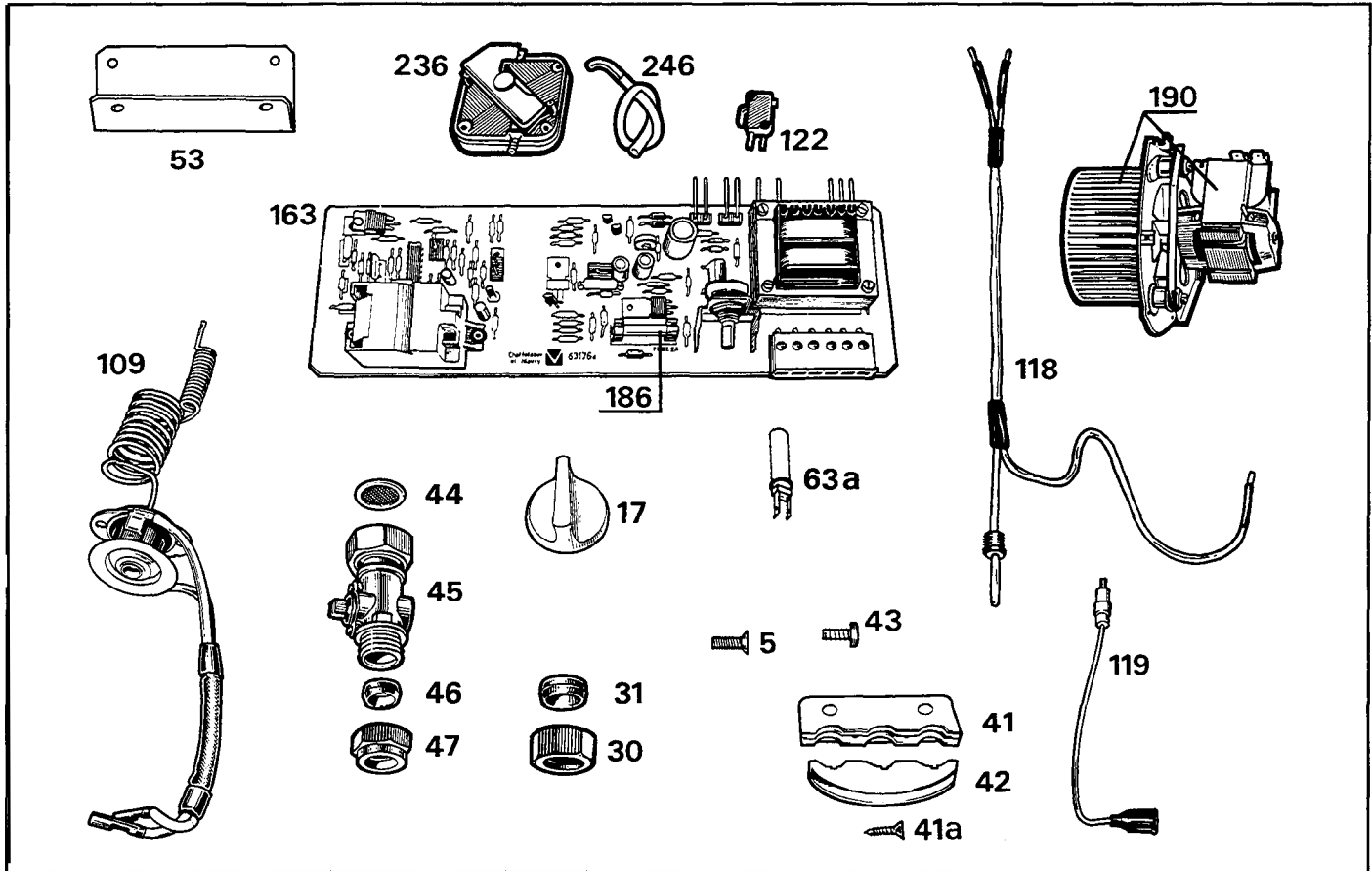
- Slide back insulation at plug in connection and attach millivolt meter using crocodile clip connectors.
- Output should not be less than 3 mv.

**Open circuit**

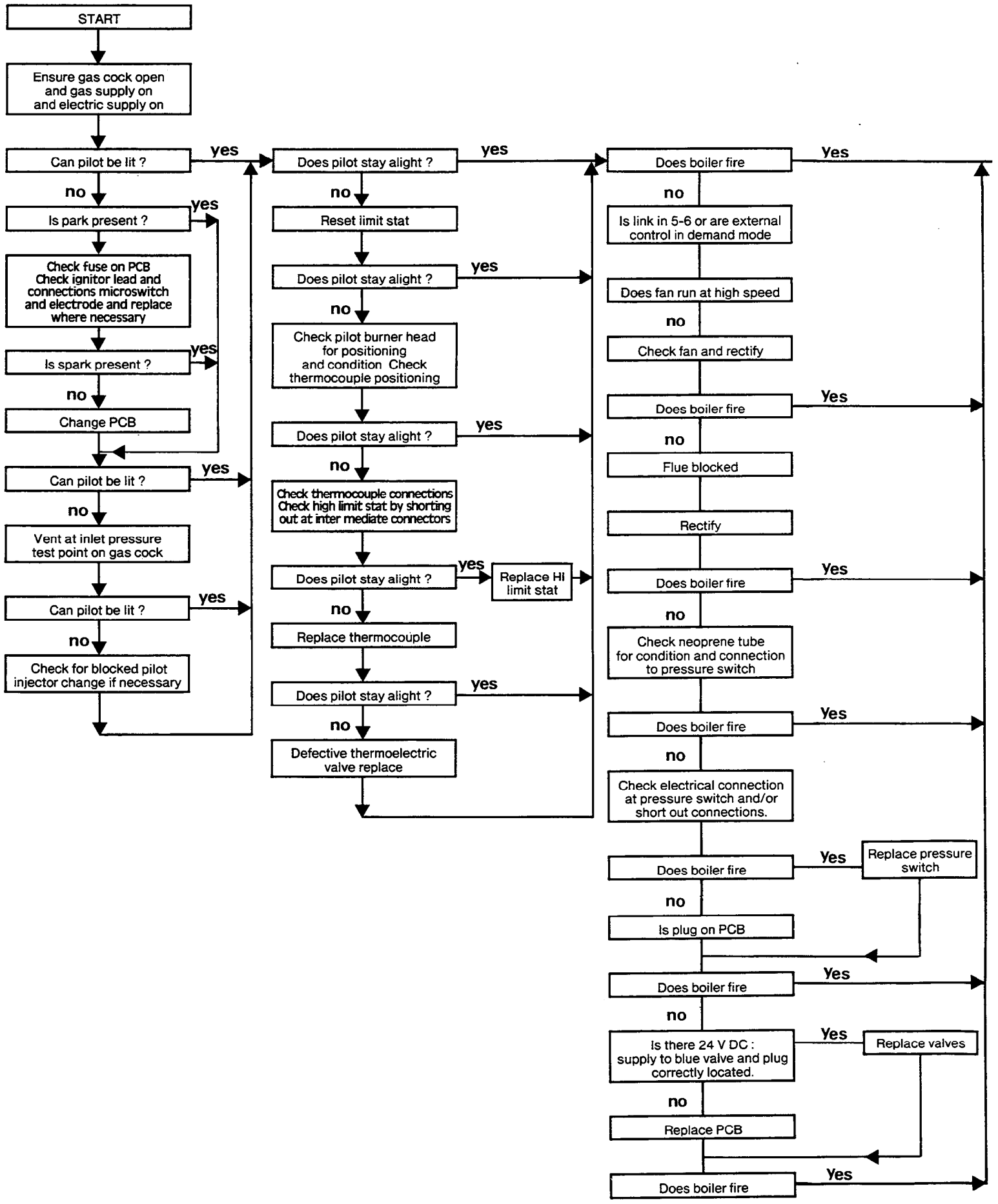
- Disconnect round pin connectors.
- Attach millivolt meter using crocodile clips to the thermocouple side male connectors.
- Press and hold igniter button.
- **Output with pilot on should not be less than 14 mv.**

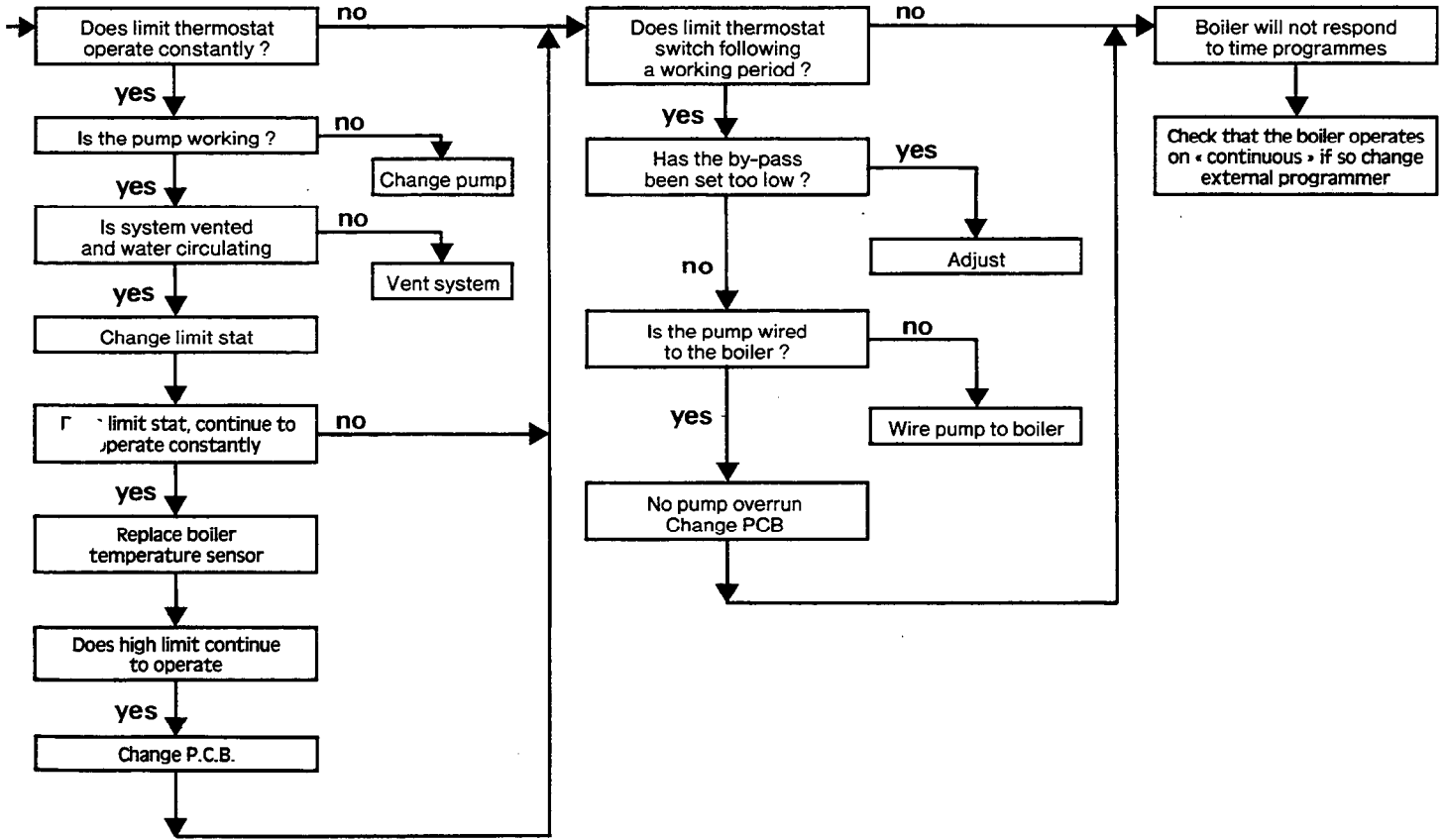
**NB :** If closed circuit output is high and approaching the open circuit voltage obtained, then suspect faulty thermoelectric valve.

## SHORT LIST



Key No	Description	GC Number	Part Number
5	Screw front case securing . . . . .	406 327	45817
7	Door assembly 30 FF (not illustrated)	366 678	64145
	Door assembly 50 FF (not illustrated) . . . . .	366 677	64144
17	Temperature selector knob . . . . .	366 553	64051
30	Nut 3/4 BSP . . . . .	366 558	47509
31	Olive 32 mm . . . . .	366 559	47508
41	Cable clamp bracket . . . . .	366 564	65519/06
41a	Screw bracket to rear case securing . . . . .	366 715	66207
42	Cable clamp . . . . .	366 565	27834
43	Screw cable clamp/bracket . . . . .	366 714	45654
44	Gas filter washer . . . . .	263 545	37309
45	Gas service cock . . . . .	366 566	65960
46	Olive 15 mm . . . . .	263 800	56489
47	Nut 1/2 in BSP . . . . .	366 642	56490
53	Mounting bracket . . . . .	264 305	28697/06
63a	Thermistor temperature sensor . . . . .	366 570	64153
109	High limit thermostat . . . . .	366 636	65962
118	Thermocouple . . . . .	366 667	64744
119	Electrode and lead assembly . . . . .	366 593	63404
122	Microswitch . . . . .	366 668	65651
163	Printed circuit board . . . . .	366 614	66102
186	Fuse (2 amp) . . . . .	264 446	44790
190	Fan assembly . . . . .	264 434	56401
236	Pressure switch . . . . .	366 685	63856
246	Sample tube . . . . .	264 444	69068







Chaffoteaux Ltd, Concord House, Brighton Road, Salfords, Redhill, Surrey RH1 5DX. Telephone: Horley (0293) 772744. Telex: 87378.

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