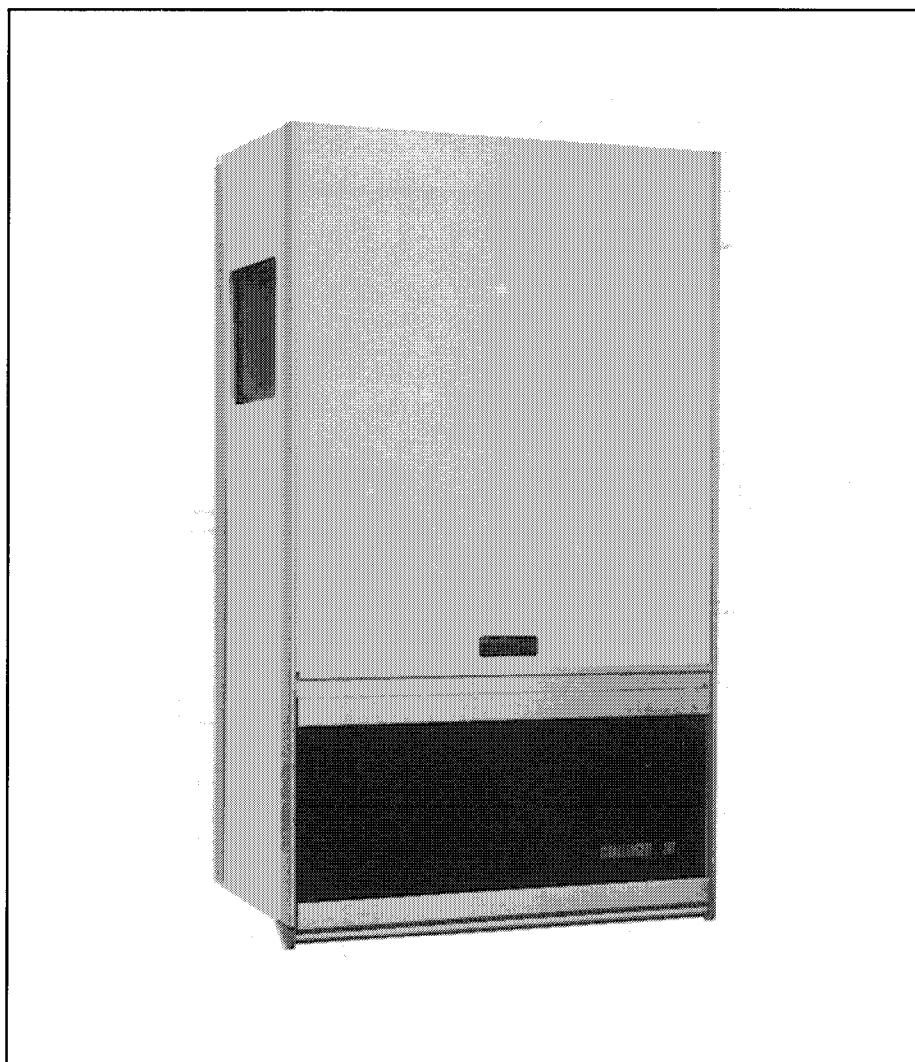


# CHALLENGER

## Open Flue Boilers

**30 OF**  
(GCN° 41.980.72)

**50 OF**  
(GCN° 41.980.76)



## **installation and servicing instructions**

(leave these instructions with the User or at the Gas Service meter)

CHALLENGER OF are low water content gas fired boilers.

**CHALLENGER 30** is rated between 4.14 Kw (14,150 Btu/h) and 9 Kw (30,375 Btu/h).

**CHALLENGER 50** is rated between 7.33 Kw (25,000 Btu/h) and 14.6 Kw (50,000 Btu/h).

The boiler is designed for use on Natural Gas, unless otherwise stated. It is suitable for open systems and sealed systems.

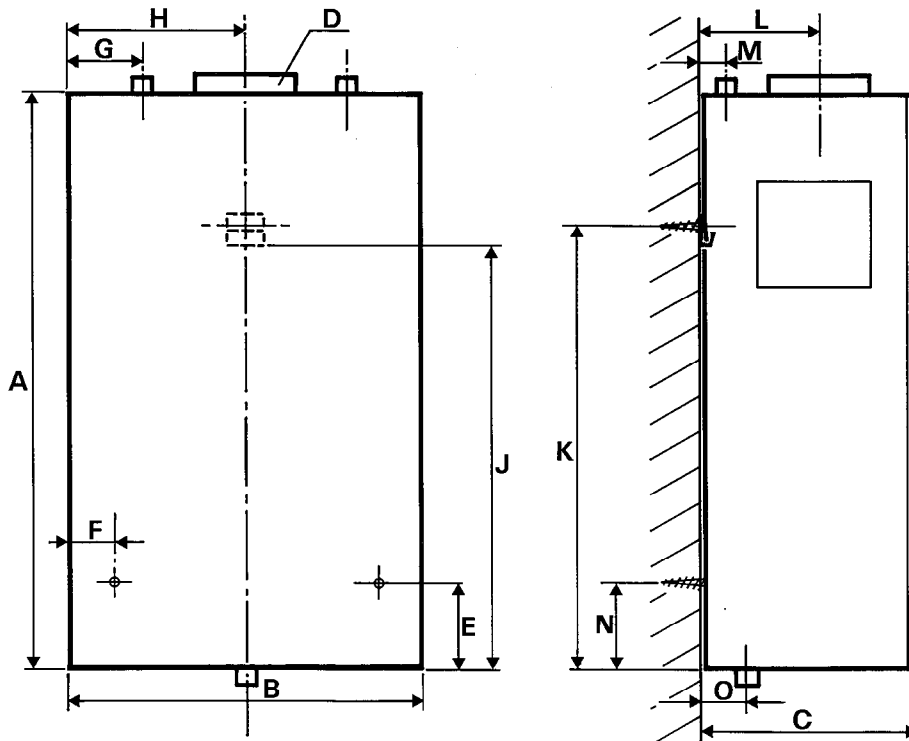
The boiler is designed for fully pumped systems only with a number of incorporated features.

- Fully adjustable electronic temperature regulation between 60 °C and 82 °C.
- Automatic alternation high flame/low flame.
- Pump overrun.
- Low resistance.
- High limit thermostat.

## Guarantee

The manufacturer's guarantee on the appliance is for 24 months from the date of installation. The guarantee is voidable if it is not installed in accordance with the recommendations made herein or in a manner approved by the manufacturer.

## 1. TECHNICAL DATA



CHALLENGER 30 OF-50 OF

	mm	ins
<b>A</b>	640	25.2
<b>B</b>	375	14.75
<b>C</b>	250	9.84
<b>D</b>	115 (int)	4.5
<b>E</b>	100	4.0
<b>F</b>	50	2.0
<b>G</b>	45	1.75
<b>H</b>	187	7.4
<b>J</b>	475	10.7
<b>K</b>	500	19.7
<b>L</b>	135	5.3
<b>M</b>	25	1.0
<b>N</b>	100	4.0
<b>O</b>	50	2.0

## 1.2

30 OF	OUTPUT		INPUT			BURNER PRESSURE (HOT)		GAS RATE	
	kW	Btu/h		kW	Btu/h	m.bar	ins.w.g.	m <sup>3</sup> /h	ft <sup>3</sup> /h
Max	9.	30,375	Max	11.7	39,995	8.0	3.2	1.09	38.67
Min	4.14	14,150	Min	5.63	19,226	1.47	0.5	0.52	18.59

50 OF	OUTPUT		INPUT			BURNER PRESSURE (HOT)		GAS RATE	
	kW	Btu/h		kW	Btu/h	m.bar	ins.w.g.	m <sup>3</sup> /h	ft <sup>3</sup> /h
Max	14.6	50,000	Max	18.94	64,661	7.3	2.9	1.77	62.53
Min	7.32	25,000	Min	9.95	33,800	1.9	0.08	0.88	31.39

NB : For mid position setting pressures see section 5.4

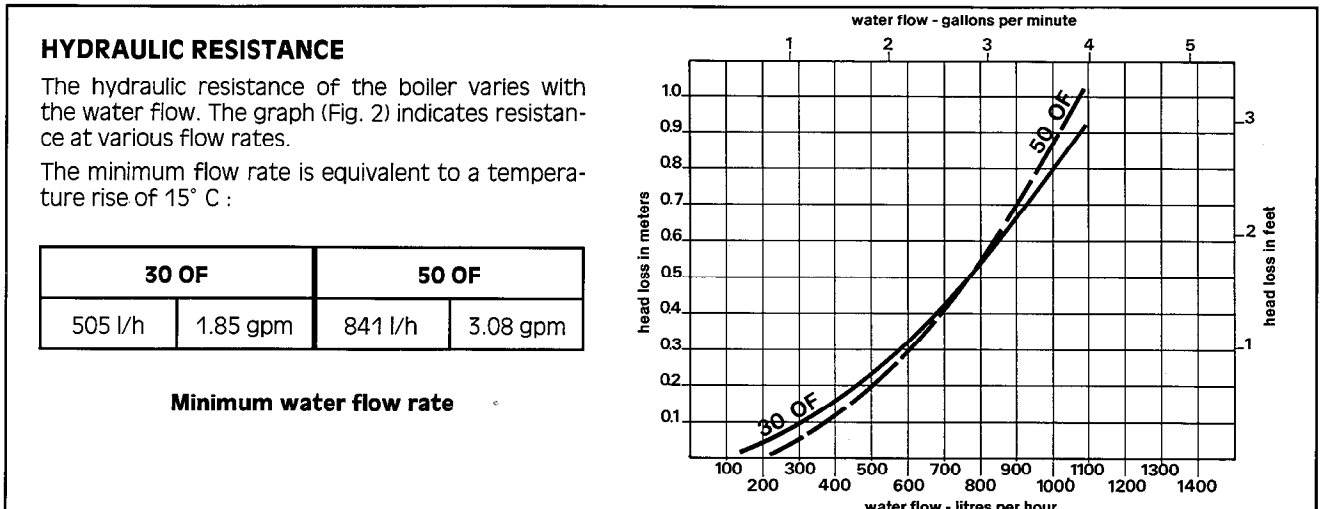
DIMENSIONS (Casing ex connections)		
	30 OF & 50 OF	
	mm	ins
High	665	26
Wide	373	14.6
Deep	252	10.0

	CLEARANCES	
	mm	ins
Sides	76	3
Top	76	3
Bottom	127	5
Front	500	20

## 1.3

<b>Open flue</b> .....	Requires a nominal 100 mm (4 in) flue pipe. Draught diverter is intergral and is suitable for flues to BS 715. If flues to BS 567 are used an adaptor will be required
<b>Gas connection</b> .....	15 mm compression fitting
<b>Water connection</b> .....	22 mm compression fittings
<b>Minimum flow rate</b> .....	<b>30 OF</b> 505 lit/hr (1.85 gpm) <b>50 OF</b> 841 lit/hr (8.08 gpm) equivalent to 15° C (27° F) temperature rise
<b>Maximum static head</b> .....	30 m (98 ft)
<b>Minimum static head</b> .....	150 mm (See page 7)
<b>Electrical connection</b> .....	240 V single phase 50 hz supply fused 3 amp
<b>Weight</b> .....	<b>30 OF</b> - 18.63 kg (41 lbs) <b>50 OF</b> - 19.54 kg (43 lbs)
<b>Water capacity</b> .....	0.5 lit. (0.11 gals.)
<b>Burner Injector Size</b> .....	<b>30 OF</b> 1.18 mm <b>50 OF</b> 1.23 mm
<b>Pilot injector</b> .....	0.3 mm (0.011 ins.)
<b>Ignition</b> .....	Continuous spark – spark generator ANSTOSS
<b>Electrode</b> .....	Chaffoteaux – spark gap 5.0 mm
<b>Boiler thermostat</b> .....	Electronic – Chaffoteaux Ltd
<b>High Limit thermostat</b> .....	Ranco LM5
<b>Thermocouple and thermoelectric valve</b> .....	Chaffoteaux Ltd

## 1.4



## 1.5 Description of Operation

Pressing the ignitor (on) button disconnects the supply to the pump, opens the thermo electric valve and causes a continuous pilot ignition spark to be generated and the pilot is ignited.

If there is a demand the pump will start when the on button is released. The burner will commence after a 30 sec. delay when the 50 % valve opens. After 3 seconds the 2nd 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 temperature approaches the set temperature the main 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 % fixed gas valve opens followed by the variable valve.

At the end of an '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 high temperature cut out breaks the thermocouple circuit which extinguishes the pilot and closes the gas supply to the burner. Manual re-setting is required. (See section 4.7).

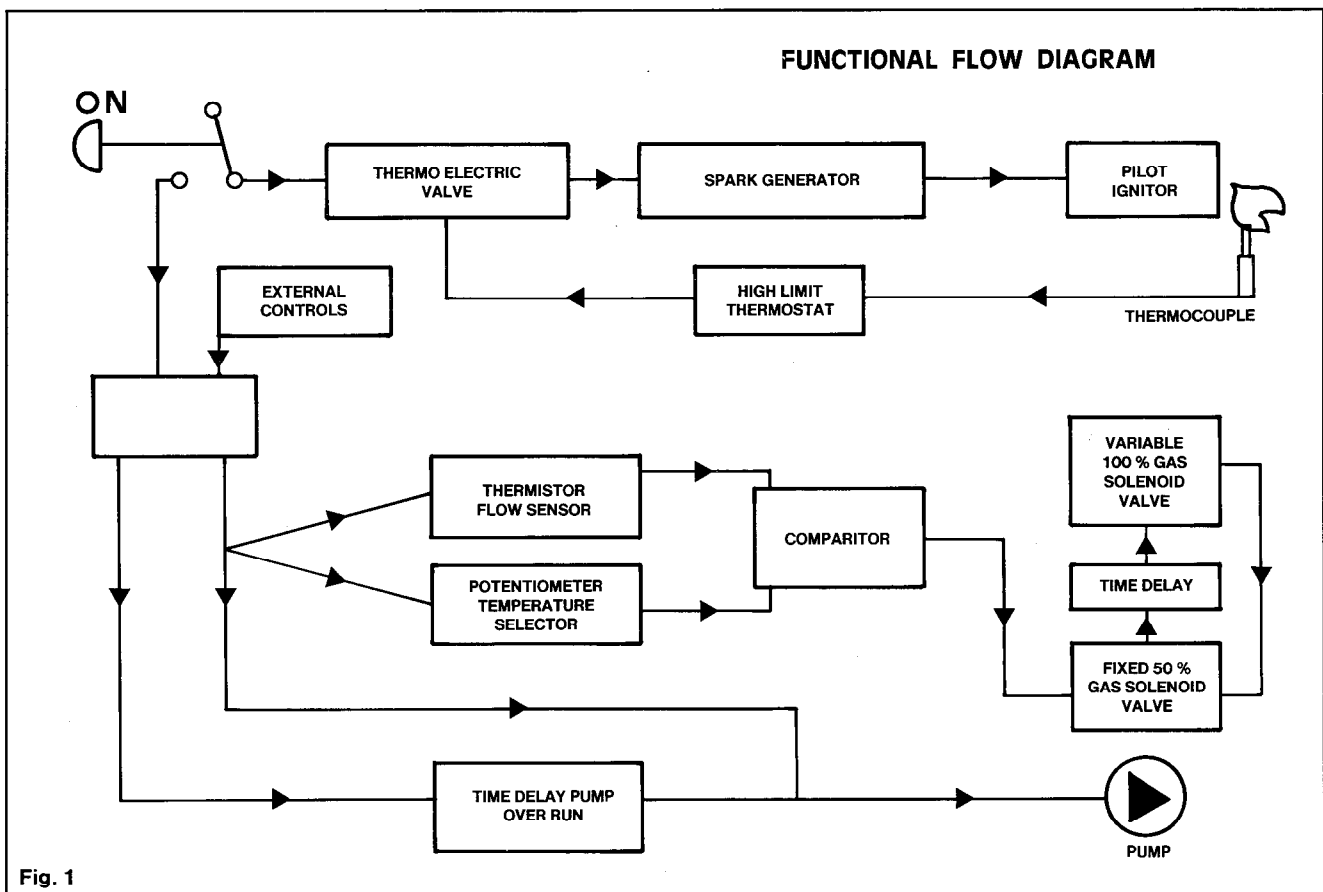


Fig. 1

## 2. INSTALLATION REQUIREMENTS

### 2.1 General

The installation of the boiler must be in accordance with the Gas Safety Regulations, Building Regulations, I.E.E. Regulations and the Byelaws of the local Water Undertaking. It should be in accordance also with 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, BS 5376:2, BS 5546, BS 5440:1 and 2, BS 5449:1.

**Note :** Gas safety (Installation and Use) regulations 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 should permit the provision of a satisfactory flue termination. The position should also provide adequate space for servicing and air circulation around the boiler. (See 1.3).

Where installation will be in an unusual position, special procedures may be necessary, and BS 5376:2 gives detailed guidance on this aspect.

A cupboard or compartment used to enclose the boiler 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 (see Section 5) 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 Domestic Wet Central Heating Systems.

Hot water systems should be in accordance with the relevant recommendations given in CP 342:1 and the above mentioned British Gas publication and BS 5546.

## 2.4 Air supply – Open Flue Version

### 2.4.1 Room air supply

Where a boiler is to be installed in a room or internal space, the boiler requires the room or internal space containing it to have a permanent air vent. This vent must be either direct to outside air or to an adjacent room or internal space which must itself have a permanent air vent of at least the same size direct to outside air.

The minimum effective area of the permanent air vent(s) is related to the maximum rated input of the boiler and should be not less than :

**CHALLENGER 30 OF** 21.15 cm<sup>2</sup> (3.27 ins<sup>2</sup>)

**CHALLENGER 50 OF** 53.73 cm<sup>2</sup> (8.32 ins<sup>2</sup>).

### 2.4.2 Compartment air supply

If an open flued boiler is installed in a cupboard or compartment permanent air vents are required in accordance with the following table.

Note that both air vents must communicate with the same room or internal space and must both be on the same wall to outside air.

Where cupboard or compartment vents communicate with a room or internal space the room or internal space must itself have a permanent air vent(s) as specified in BS5440 pt2.

An open flued appliance must not be installed in a bathroom bedroom or bedsitting room or in a compartment communicating with a bathroom, bedroom or bed sitting room. An open flued boiler must not be installed in a garage.

#### Cupboard or compartment air supply

##### 30 OF

Position of air vents	Air from room or internal space	Air direct from outside
High level	106 cm <sup>2</sup> 16 ins <sup>2</sup>	53 cm <sup>2</sup> 8 ins <sup>2</sup>
Low level	211 cm <sup>2</sup> 32 ins <sup>2</sup>	106 cm <sup>2</sup> 16 ins <sup>2</sup>

##### 50 OF

Position of air vents	Air from room or internal space	Air direct from outside
High level	171 cm <sup>2</sup> 26 ins <sup>2</sup>	86 cm <sup>2</sup> 13 ins <sup>2</sup>
Low level	341.0 cm <sup>2</sup> 52 ins <sup>2</sup>	171 cm <sup>2</sup> 26 ins <sup>2</sup>

### 2.4.3 Effect of an extract fan

If there is any type of extract fan fitted in the premises there is the possibility that if adequate air inlet area from the outside is not provided, spillage of the products from the boiler flue could occur when the extract fan is operating. Where such installations occur a spillage test as detailed in BS5440:1 must be carried out and any necessary action taken.

## 2.5 Flue System

The boiler should be sited such that the maximum possible length of the flue system can be contained within the building and that the route of the flue rises continuously to the terminal and is as direct as practicable.

The first 600 mm (2ft) of flue pipe should rise vertically from the draught diverter connection before the use of any bends of elbows.

Horizontal or shallow angle runs, right angled bends or mitred elbows should be avoided.

Where an existing brick chimney is to be used it should be swept thoroughly before connection of the new boiler, and the chimney should be lined.

An approved British Gas terminal must be fitted and the terminal sited at the adjacent roof edge and, where possible, above the ridge line. The flue must not be terminated at or adjacent to a wall face.

The cross sectional area of the flue must not be less than the area of the flue outlet serving the boiler. The point of termination must not be within 600 mm (2 ft) of an openable window, air vent or other ventilation opening.

Before installing the boiler to an existing flue system, the flue system must be checked by applying a smoke match to the opening at the base of the flue system.

The flue pipe must not be closer than 25 mm (1 ins) to combustible material. For twin walled flue pipe the 25 mm (1 in) distance is measured from the internal pipe.

## 2.6 Electrical Supply

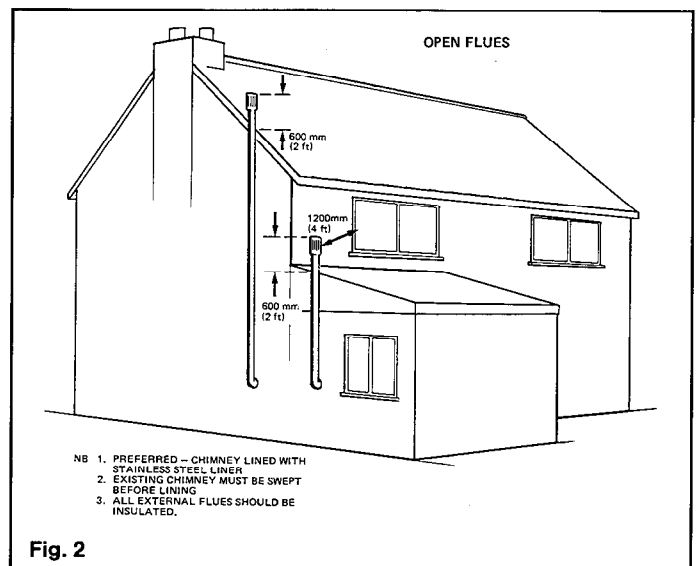
This appliance must be earthed. All wiring must conform to the I.E.E. Regulations. The CHALLENGER requires a 240 V single phase, 50 Hz supply. A means of isolation must be provided adjacent to the boiler, this should preferably be an unswitched plug and socket. Alternatively a double pole isolator having a contact separation of at least 3 mm on both poles must be used. The fuse rating should be 3 amp. The supply cord must be 0.74 m<sup>2</sup> three core heat resisting cable.

## 2.7 Gas Supply

The CHALLENGER 30 requires 1.09 m<sup>3</sup>/h 38.67 ft<sup>3</sup>/h.

CHALLENGER 50 requires 1.77 m<sup>3</sup>/h 62.53 ft<sup>3</sup>/h of natural gas. 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 as described in CP 331:3



## 3. SYSTEM GUIDANCE

### 3.1 General

The CHALLENGER is a low water content boiler designed ONLY for use with fully pumped systems. It 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) ± 4 °C (7 °F).

Detailed recommendations for the water circulation are given in BS 5376.2 19876, BS 5449.1 1977 and BS 5546:1979.

Thermostatic control should be fitted to the cylinder and heating circuits.

### 3.2 Strainers

Where the CHALLENGER is used as a replacement for a boiler on an existing system, ideally the 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.

### 3.3 Control Schemes

The boiler is electrically controlled.

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 that stated in section 1.4. The pump must be installed between isolating valves. Most pump manufacturers require a minimum static head on the pump inlet to prevent cavitation. For boiler resistance see graph on page 3. (Sect. 1.4).

### 3.5 Cold feeds and open vents

The cold feed and open vent should be so positioned that pumping over and sub-atmospheric pressures are avoided. Recommendations for various layouts are given on page 7.

The connection should be so arranged that there is a low velocity point at the open vent junction with the system.

### 3.6 Automatic Air Separator

Chaffoteaux Limited strongly recommend the inclusion of a British Gas accepted automatic air separator in the system as shown in fig. 9.

The open vent pipe 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 arrangement is shown in fig. 9.

### 3.7 Cylinder

The domestic hot water cylinder used with the CHALLENGER must be of the indirect and high recovery

type to BS 1566 Pt. 1. Single feed cylinders are not suitable for use with the appliance. Flow and return pipework to the cylinder should be in 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 9 in. 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 CHAFFOTEUX boilers. It is, however, appreciated that the use of a corrosion and limescale inhibitor may be desirable or specified.

The following are the appliance manufacturer recommendations :

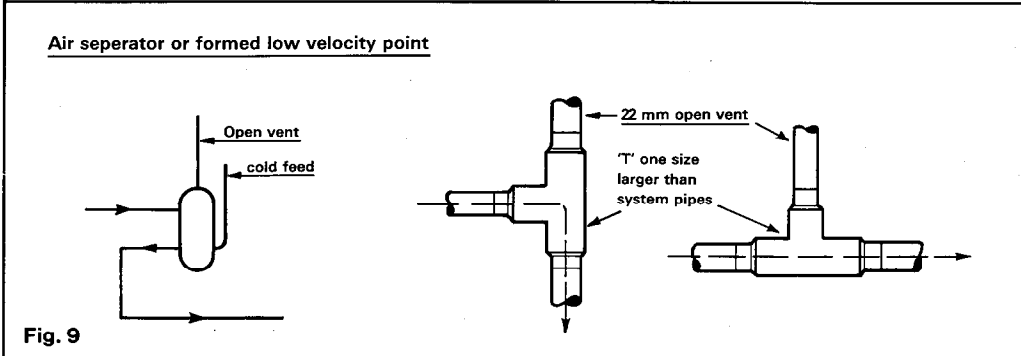
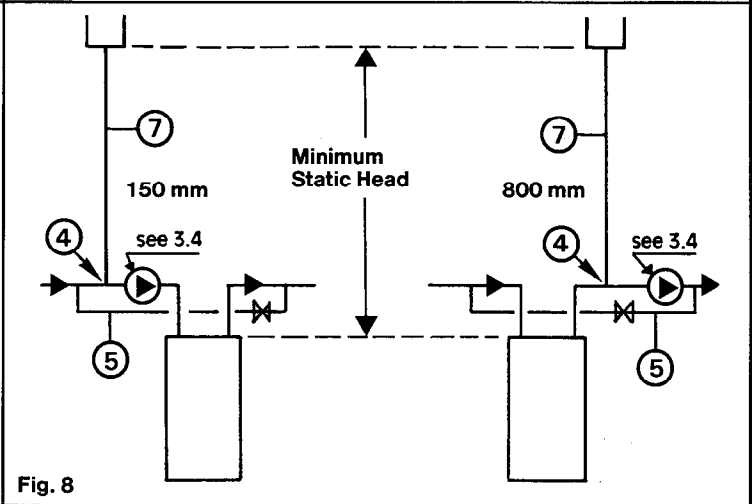
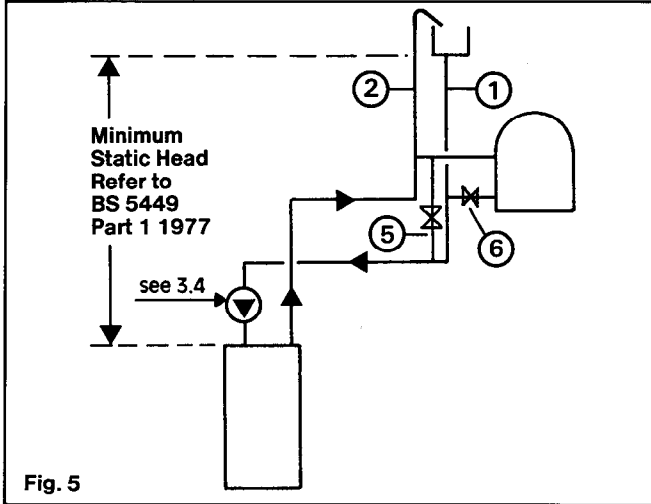
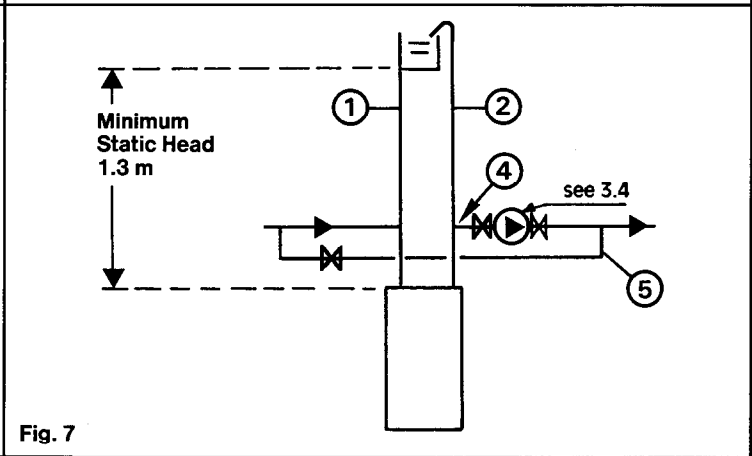
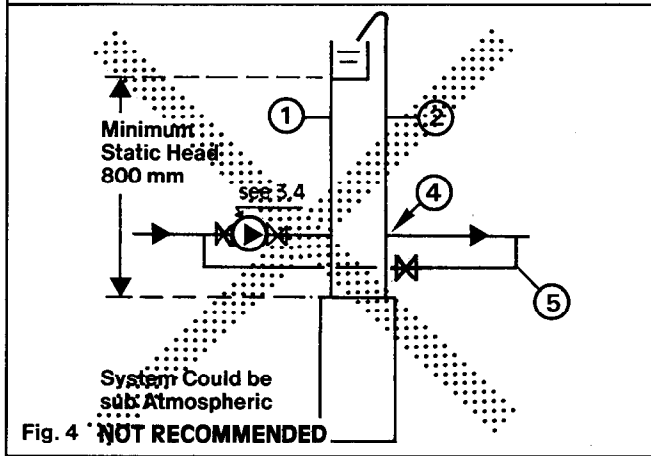
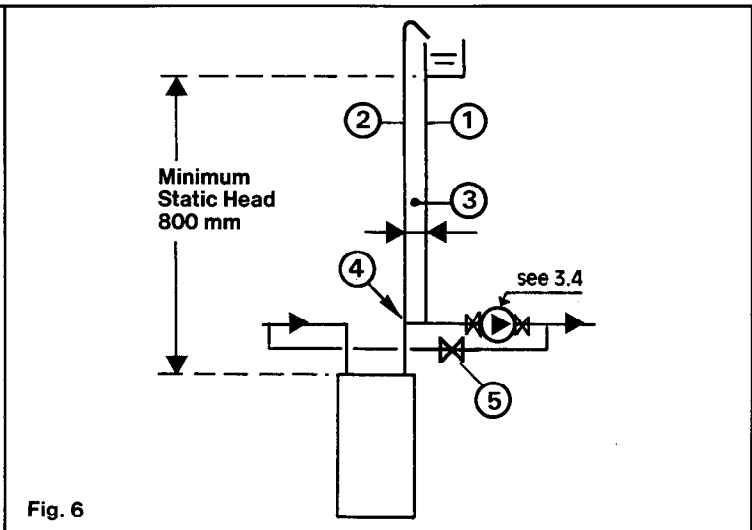
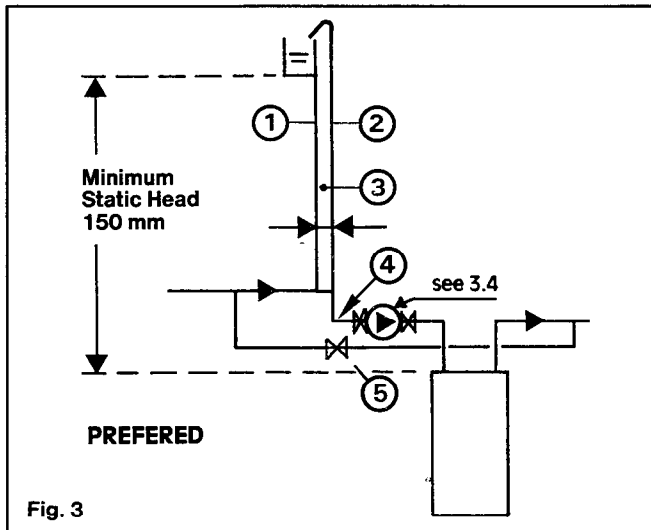
- 1) Use only a British Gas or similar approved inhibitor from the Fernox range manufactured by Industrial (Anti-Corrosion) Services, Brittanica Works, Arkesdon Road, Clabering, Nr Saffron Waldon.
- 2) Use only the quantities specified by the inhibitor manufacturer.
- 3) Cleanse the system as may be 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 Regulations.

# ALTERNATIVE SYSTEM LAYOUTS



1. Cold feed 15 mm
2. Open vent 22 mm
3. 6 in. maximum
4. See fig. 9
5. By pass 15 mm
6. Regulating motorised valve
7. Combined cold feed and open vent

# 3.11 Electrical Controls

## (Chaffoteaux recommendations)

CHALLENGER 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 where 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.

**Important:** All external wiring to and from the boiler must be in accordance with the current edition of the IEE Wiring Regulations.

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

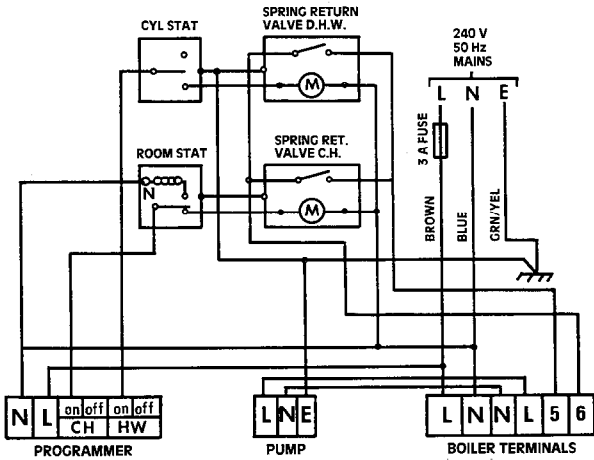


Fig. 10

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

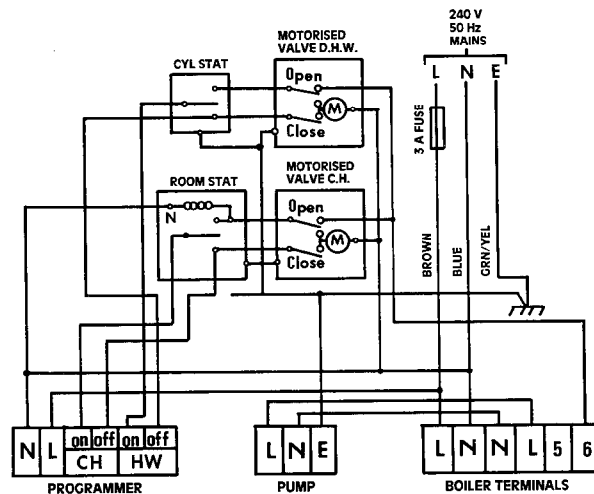


Fig. 11

3. Drayton flow share valve system.

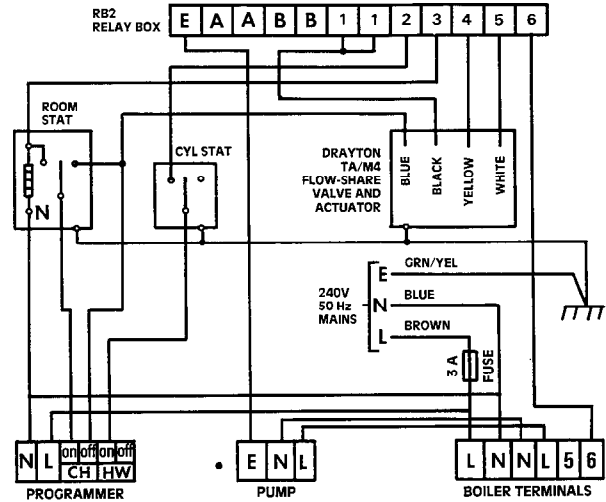


Fig. 12

4. Honeywell Sundial 'Y' plan.

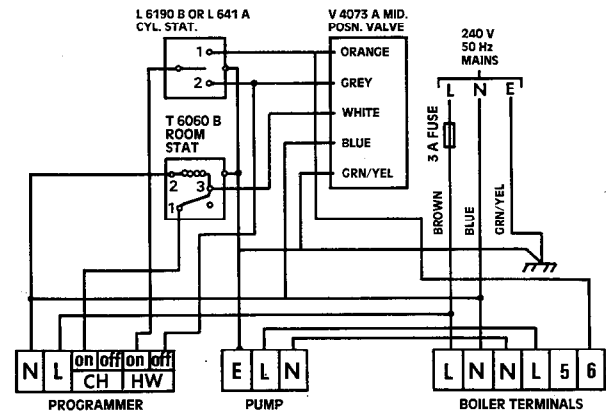


Fig. 13

5. Satchwell Duoflow system.

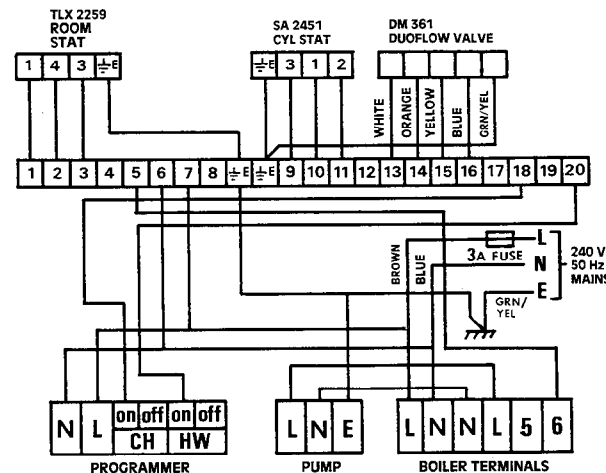


Fig. 14



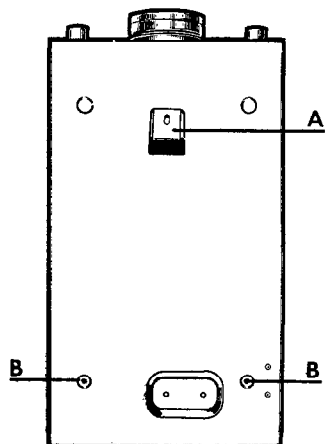
## 4. INSTALLING THE BOILER

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

525 mm wide x 865 mm high (21 ins x 34 ins)

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

### 4.1



#### Position the boiler

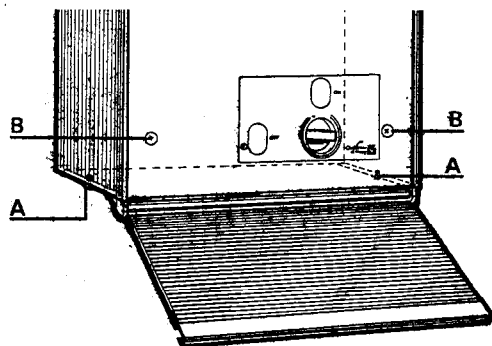
- Using dimensions on page 2 mark position of fixings for top wall bracket (A).
- Drill and plug wall and fix bracket using screw provided.
- Ensure appliance is square on wall.
- Mark bottom fixing holes (B). Drill and plug the wall and fix appliance.

### 4.2

#### IMPORTANT NOTICE : TIMBER FRAMED HOUSES

If the appliance 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 DM 2. If in doubt, advice must be sought from the local Gas Region of British Gas.

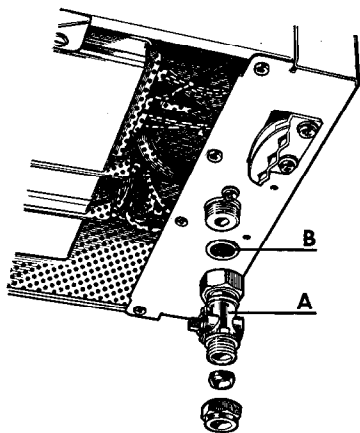
### 4.3



#### Fitting the boiler

- Remove the front case by
  - Removing 2 screws bottom rear of boiler (A).
  - Removing 2 screws securing front casing to electrical box (B).
- Remove case by pulling out at the bottom and lifting off locating hooks at the top of boiler.

### 4.4

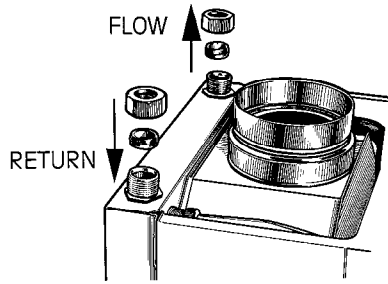


#### Making the gas connection

- Fit the gas service tap (A) together with the filter washer.
- 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 appliance working.

**n.b.** The gas supply pipe size should not be less than the gas inlet to the appliance.

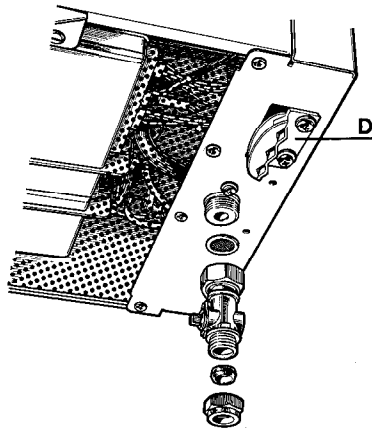
### 4.5



#### Making the water connections

- Fit the nuts and olives supplied in the accessory box.
- Enter the FLOW pipe into the RIGHT hand connection, the RETURN goes to the LEFT hand connection.
- Tighten compression fitting holding connection on inside of boiler.

### 4.6



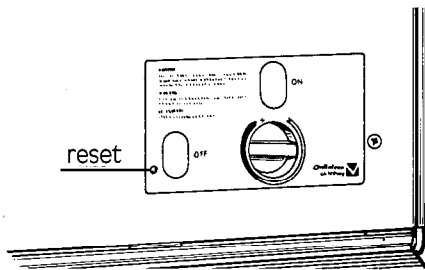
#### Making Electrical Connections

(See section 2 for electrical supply requirements)

- Secure cable clamp (D) to base of appliance using the screws provided.
- Remove control box cover.
- Three core heat resisting cable is passed through the clamp and through the slot in casing, and into the rear of electrical box and connected to terminals on connection block and the earth connection made to earth terminal.
- Connect pump cable to terminals (⚡) and the earth on earth terminal.
- Connect ancillary controls across terminals marked 5 and 6. See controls diagrams page 8.
- Clamp wires with cable clamp.
- Replace control box cover.

**n.b.** 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.

### 4.7



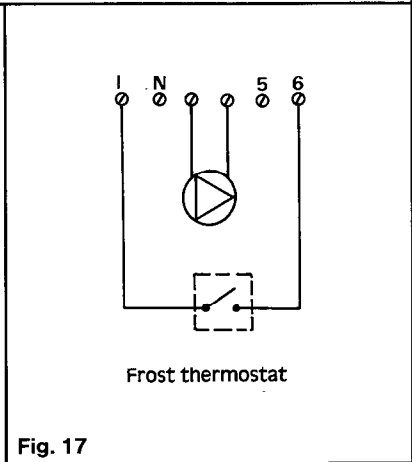
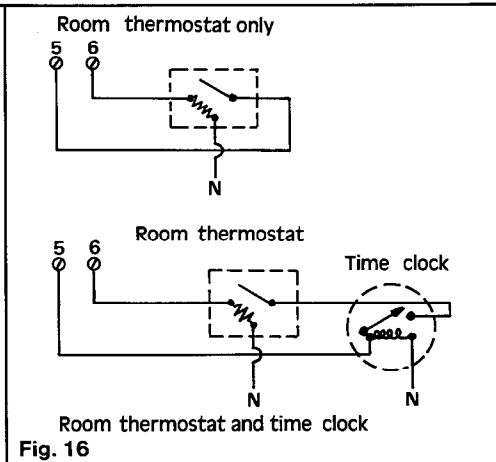
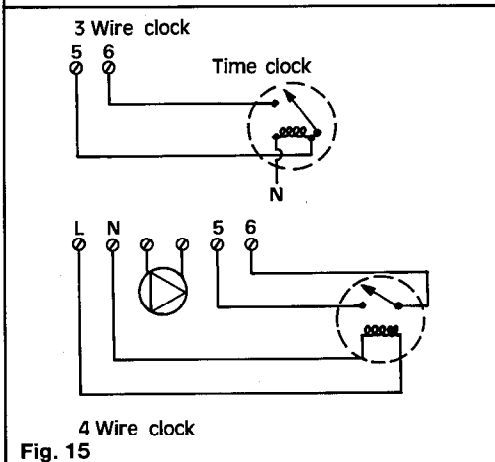
#### Resetting high limit thermostat

- 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 re-setting the high limit thermostat by pressing the red button on the electrical box.
- Establish cause and rectify - see fault finding chart, rear cover.

In the event of an electrical fault after installation preliminary electrical system checks as described in the Multimeter Instruction book should be carried out.

Checks to ensure electrical safety should be carried out by a competent person, i.e. earth continuity, polarity and resistance to earth.

#### CHALLENGER - SIMPLE CONTROLS



## 5. COMMISSIONING

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

### 5.4 Gas rate adjustment

(To be carried out before adjusting by-pass.)

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

- Switch boiler to off by pressing OFF button.
- Remove the pressure test point screw (1) (fig. 18) and connect a suitable pressure gauge.
- Remove the hexagonal cap from gas volume adjuster, (2) (fig. 18) exposing the adjustment screw.
- Turn boiler on by pressing ON button (see lighting boiler – page 11 - 5.3).
- Adjust pressure after boiler has been running for 10 minutes. Setting pressures are given in graph relative to required output and then check the gas rate. 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 volume regulator cap. Test for gas leakage around pressure test point.
- Mark the badge to indicate output to which boiler has been set.

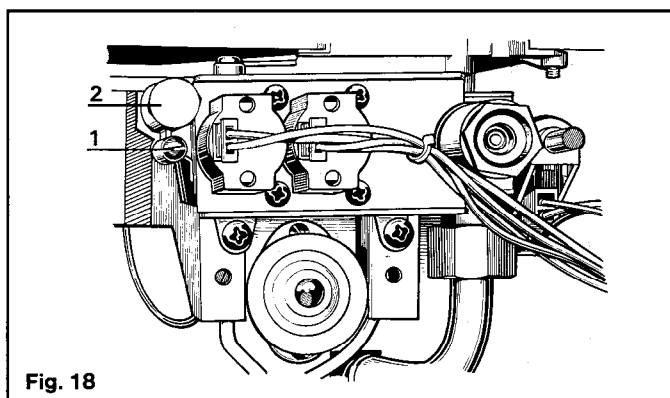
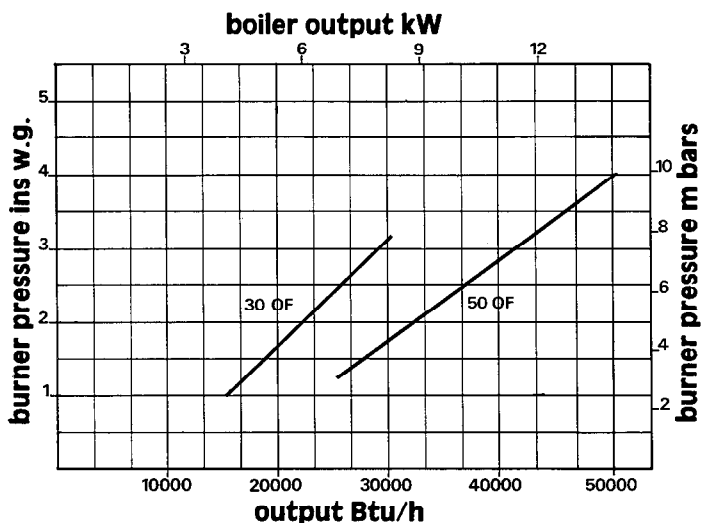


Fig. 18

### 5.5 Adjusting the by-pass

**n.b.** The by-pass valve should be of the lock shield pattern.

- Set the pump to achieve the system requirements but ensure that the minimum flow rate through the boiler is achieved (See 1.4 - page 3). (This is equivalent to a temperature rise across the boiler of 15 °C (27 ° F). (Set boiler thermostat to maximum.)
- Fire the boiler with the by-pass fully closed and the system on full load, i.e. central heating and domestic hot water.
- Adjust the system to minimum load. This will normally be central heating only with one radiator operating.
- Open the by-pass gradually until the boiler operates quietly at all flow temperatures until the boiler thermostat turns off the gas.

## 6. SEALED SYSTEMS

### 6.1 Safety valve –

A safety valve shall be fitted close to the appliance on the flow pipe. 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

- (i) 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 makers' instructions (see fig. 18 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.
- (ii) 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).
- (iii) The expansion vessel shall be sized in accordance with the following Table.

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										
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 boilers the above table should be multiplied by 0.8

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:

- Capacity 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.

### 6.4 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:

- (i) 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 -
- (ii) Where access to make up vessel would be difficult, by pressurisation of the system.

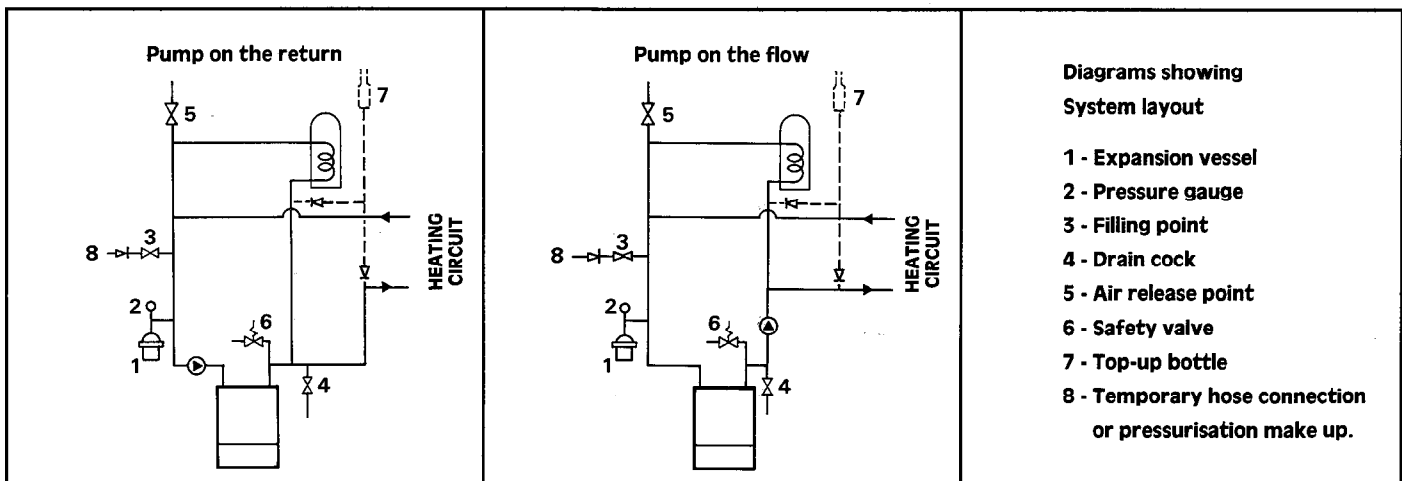
### 6.6 Mains Connection

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

For the filling system see BS 5376 Part 2 appendix A.

**NB.** A temporary hose connection is only permissible if acceptable to the local Water Authority.



## 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.

## 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 airlocks cleared until the pressure gauge registers 1.5 bar (21.5 lbf/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, ie. 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, add inhibitor to the system, if required in the specification (see 3.9), cleared of air locks and adjusted 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 the gas rate and the system by pass - See 5.4 and 5.5.

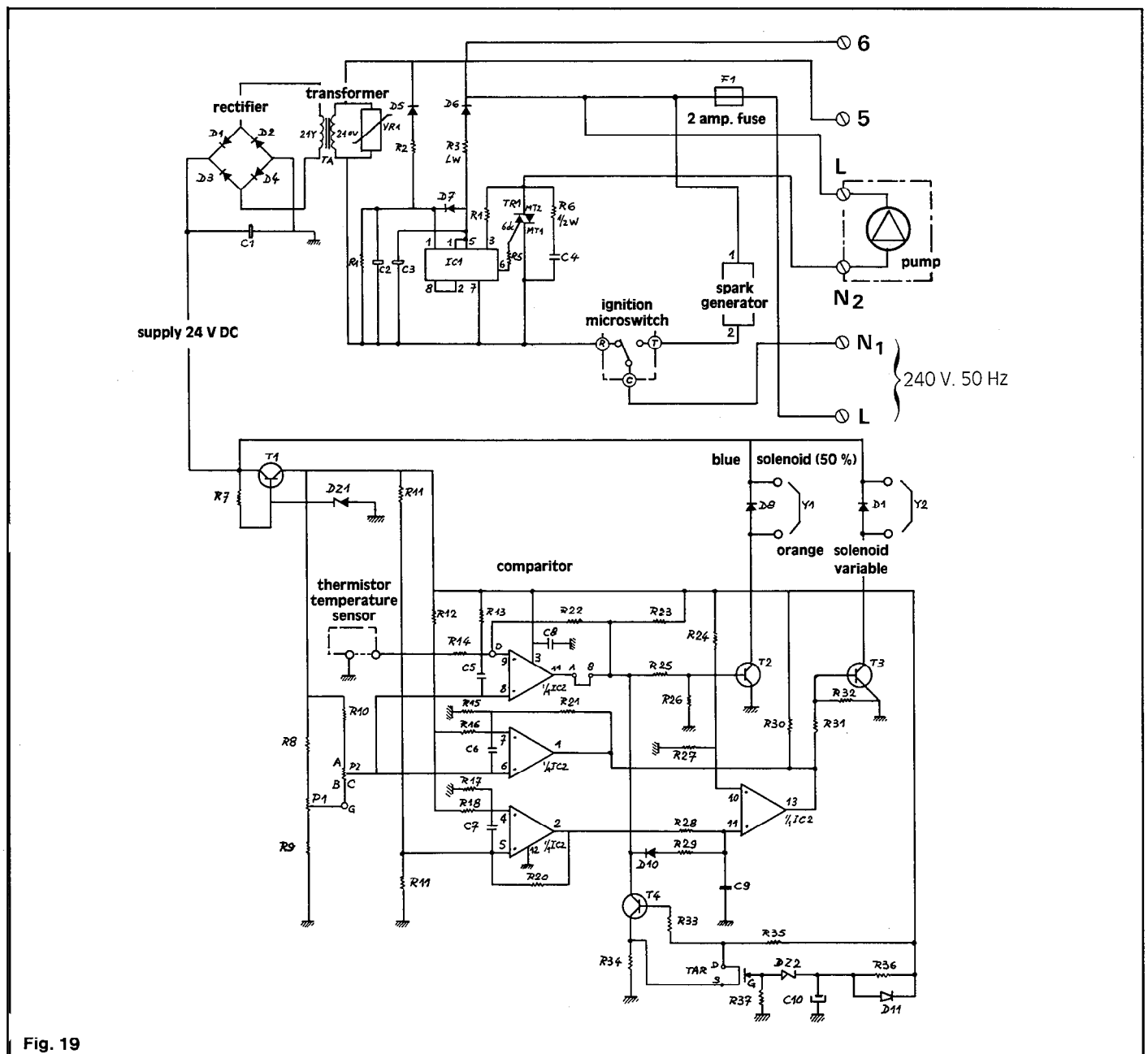


Fig. 19

### CHALLENGER TEST POINTS

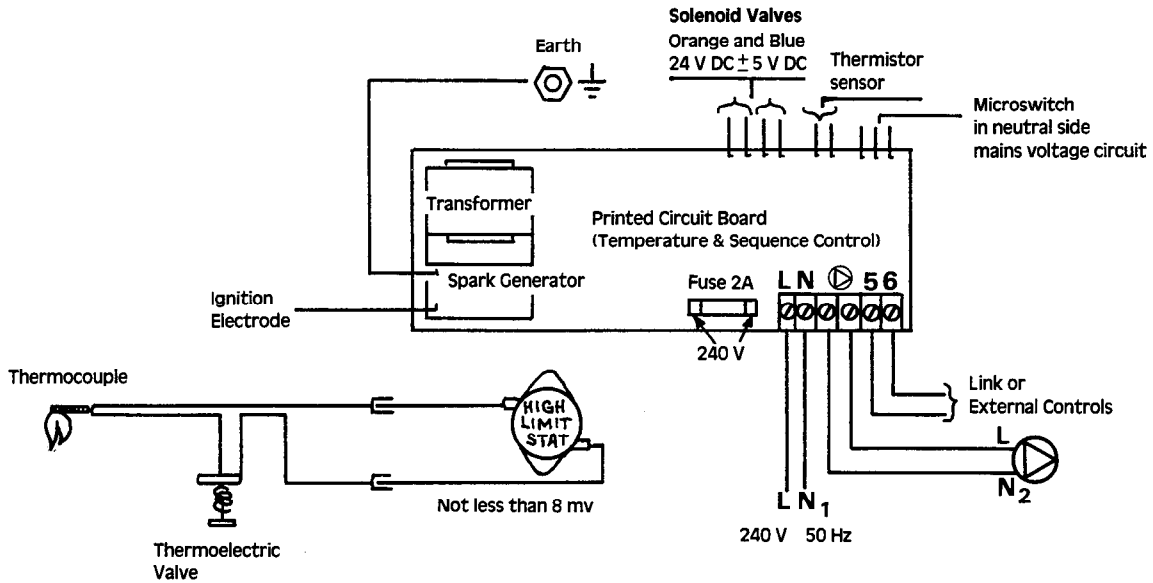


Fig. 20

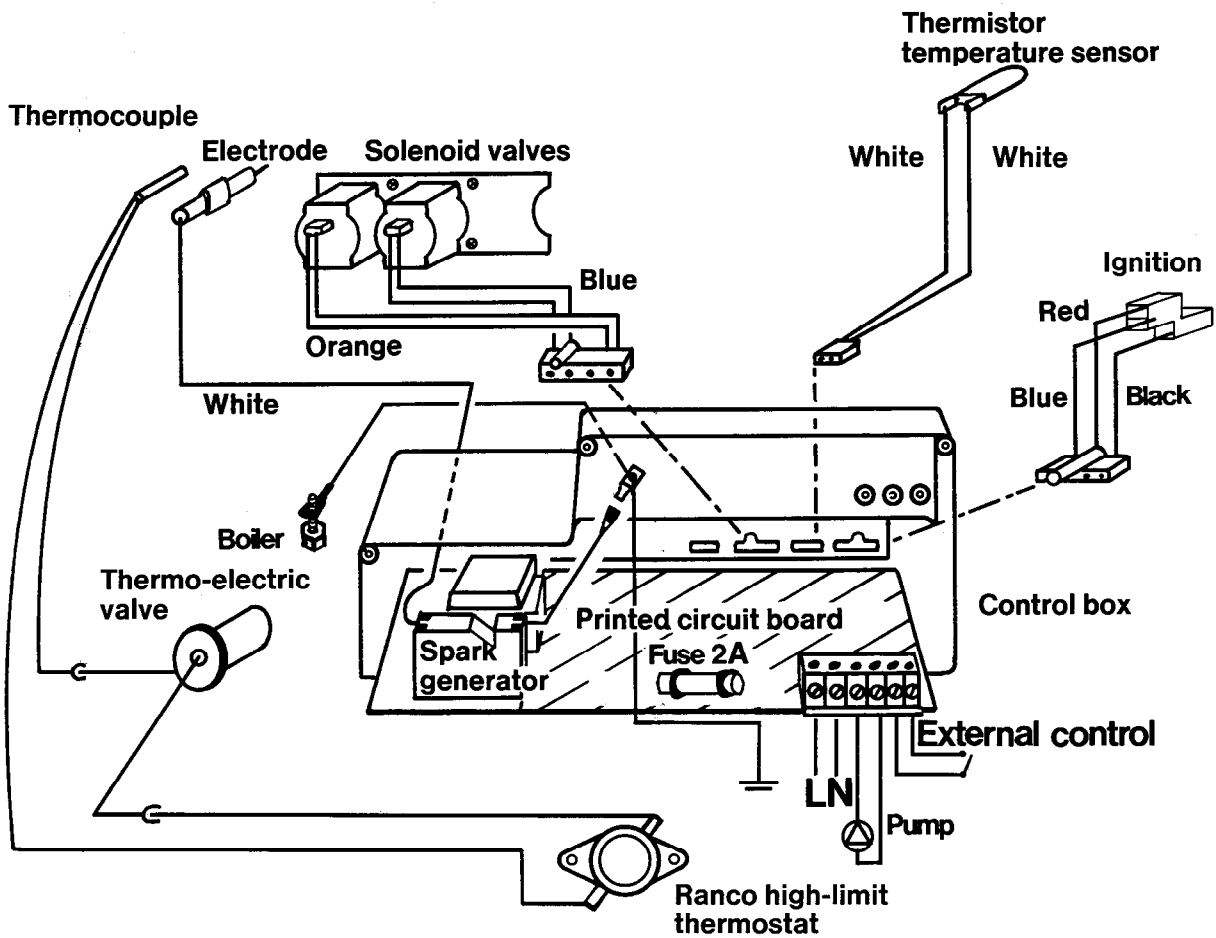


Fig. 21

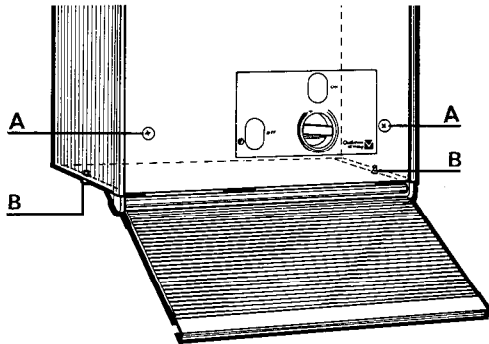
## 7. SERVICING

For efficient and trouble free operation it is important that the CHALLENGER receives regular maintenance. The following schedules are recommended.

Before commencing any work turn off the gas at the gas inlet tap (section 4.4). Ensure that the electricity supply is disconnected.

**Important :** Always test for gas soundness after completing and service or exchange of gas carrying components.

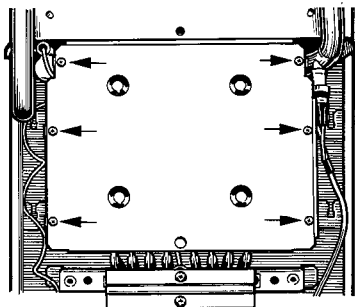
### 7.1



#### Remove front casing

- Remove screws (A) from front of boiler - securing front case to electrical control box.
- Remove 2 screws (B) bottom rear of boiler.
- Ease bottom forward and lift off front case from retaining hooks situated top rear of boiler.
- Replace in reverse order.

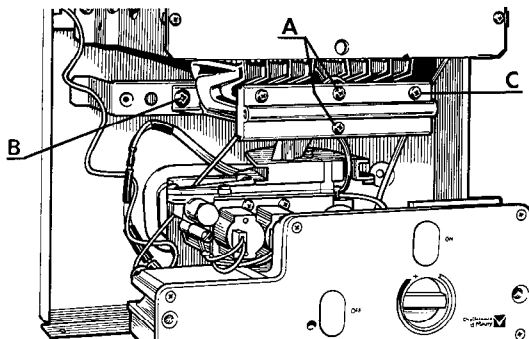
### 7.2



#### Remove combustion chamber front panel

- Remove six screws securing front panel of combustion chamber.
- Remove panel by easing forward at bottom and disengage from draught diverter by pulling downwards.
- Replace in reverse order.

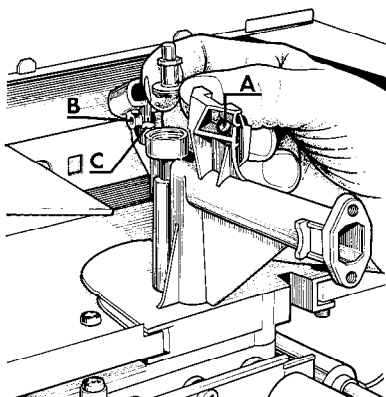
### 7.3



#### Remove burner assembly

- Remove two screws securing burner manifold to gas section (A) and 2 outer screws (C) (50 OF only).
- Remove gasket and retain in safe place.
- Remove 2 screws (B) securing burner head to rear chassis.
- Replace in reverse order.

### 7.4



#### To remove pilot

- Release thermocouple from bracket removing nut and bolt (A) securing clamp. Move thermocouple to the side.
- Release the electrode by loosening screw (B) on right hand side of assembly and rotating retaining clip.
- Remove pilot gauze and filter by removing screw securing gauze to assembly.
- Remove pilot by unscrewing (nut size 8 mm AF) using set or adjustable spanner.
- The pilot injector can be cleaned and should be replaced bright side uppermost.
- Replace in reverse order.

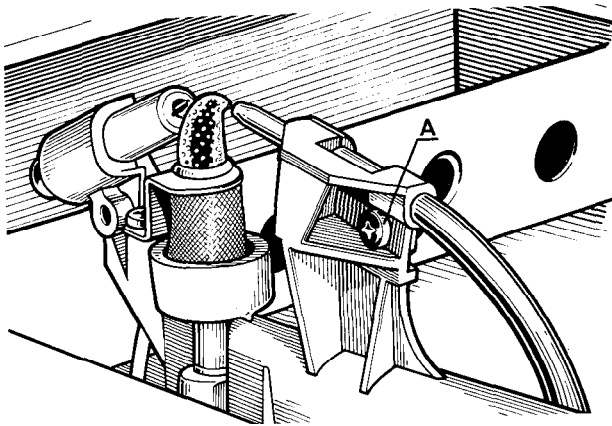
### Cleaning the parts

- a) The burner can be cleaned by inverting and brushing with a soft brush.
- b) The heat exchanger matrix can be cleaned by brushing. If deposits are too hard to remove by brushing, the matrix can be removed – see section 8.7 page 17 and washed with hot water and detergent.
- c) Any lint deposits in the burner ports should be removed using a suction cleaner and or washing.
- d) The gas filter (B - 4.4) can be cleaned using water and detergent. **DO NOT USE SOLVENTS.**
- e) Replace all components in reverse order.

## 8. REPLACEMENT OF PARTS

Before proceeding - turn off gas and isolate electrical supply.

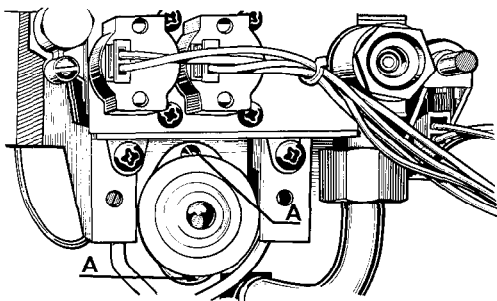
### 8.1



#### Replacing thermocouple

- a) Remove front cover 7.1
- b) Remove combustion chamber cover 7.2
- c) Remove burner 7.3
- d) Release thermocouple from thermocouple bracket removing nuts and bolts securing clamp.
- e) Release at thermoelectric valve by unscrewing nut 10 mm.
- f) Disconnect from overheat thermostat by pulling connections apart.
- g) Replace in reverse order.

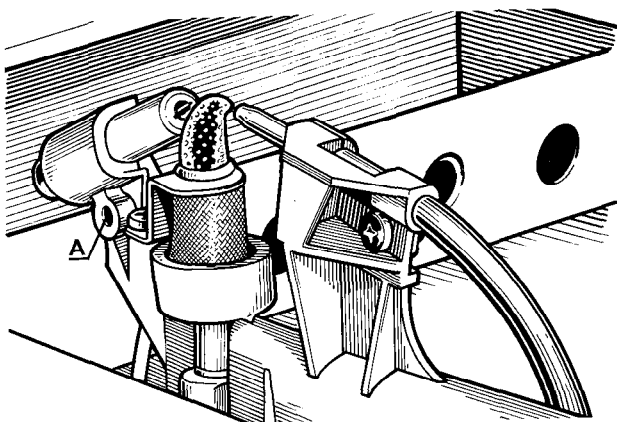
### 8.2



#### Replace high limit thermostat

- a) Remove front cover 7.1 and electrical control box 8.10.
- b) Remove two screws (A) securing overheat assembly.
- c) Disconnect at pin connectors by pulling apart.
- d) Remove sensor from dry pocket first removing split pin.
- e) Replace in reverse order using a heat sink grease on the sensing phial.

### 8.3

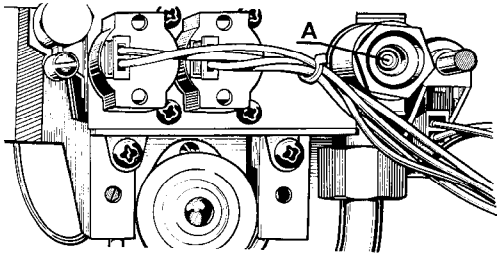


#### Replace electrode and lead

- a) Remove front cover 7.1.
- b) Remove combustion chamber cover 7.2.
- c) Remove burner 7.3.
- d) Remove thermostat knob and six screws from front of electrical control box 8.10.
- e) Remove plugs from rear of electrical controls box.
- f) Slide PCB forward and remove spark lead.
- g) Feed lead out through rear of control box.
- h) Loosen screw (A) securing clip retaining electrode and turn clip through 90°.
- i) Withdraw electrode by sliding to the side.
- j) Replace in reverse order taking care to locate electrode in locating groove.
- n.b. Take care to replace plugs in rear of control box.



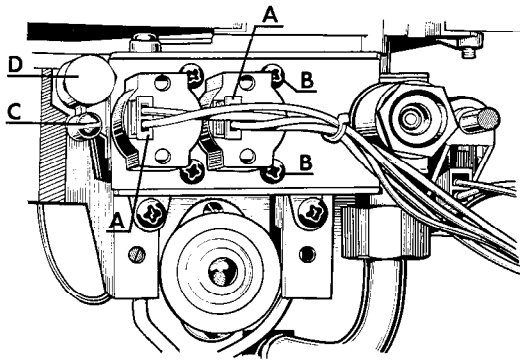
8.4



**To replace thermoelectric valve**

- a) Remove front cover 7.1.
- b) Remove thermocouple connection.
- c) Remove nut (A) securing thermoelectric valve (25 mm).
- d) Withdraw thermoelectric valve.
- e) Replace in reverse order.

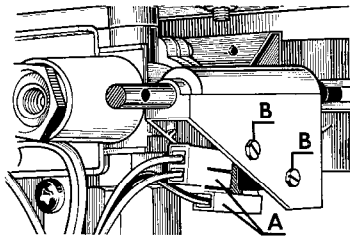
8.5



**To replace solenoid valves**

- a) Remove front cover 7.1.
- b) Remove electrical control box 8.10.
- c) Withdraw plug connection (A) (colour coded from solenoid valves).
- d) Remove four screws (B) securing solenoid valve mounting plate.
- e) Remove mounting plate and solenoids (take care not to misplace springs).
- f) Replace in reverse order.

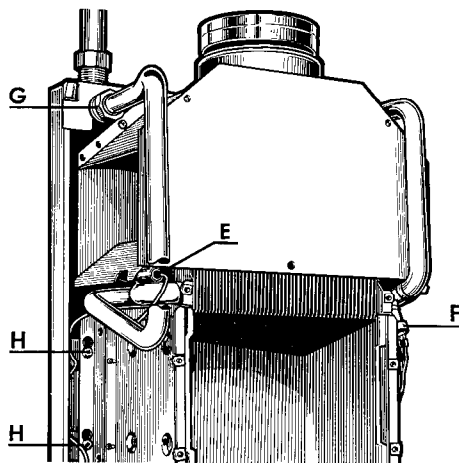
8.6



**To replace microswitch and lead assembly**

- a) Remove front cover 7.1.
- b) Remove electrical control box 8.10.
- c) Remove plug from microswitch.
- d) Remove screws (B) retaining microswitch.
- e) Replace in reverse order.

8.7



**To replace heat exchanger**

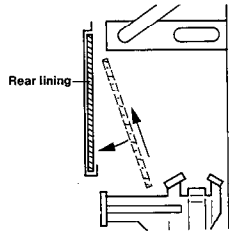
- a) Drain system.
- b) Remove front cover 7.1.
- c) Remove combustion chamber front panel 7.2.
- d) Remove burner manifold and burner 7.3.
- e) Remove high limit thermostat phial - left hand side (E).
- f) Withdraw thermostat phial (right hand side) (F).
- g) Unscrew nuts on flow and return connection (G).
- h) Loosen four screws securing combustion chamber to rear chassis (H).
- i) Drop assembly and withdraw forwards.
- j) Remove two screws from rear of assembly securing heating body to combustion chamber.
- k) Replace in reverse order.

8.8

**To replace pilot injector**

- a) Proceed as for cleaning (page 15 - 7.4).
- b) Replace injector ensuring it is fitted bright side uppermost.

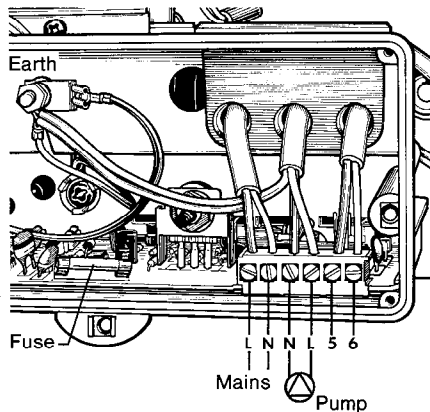
8.9



### Replacing combustion chamber linings

- Remove front cover 6.1.
- Remove front panel combustion chamber 6.2.
- Remove burner 6.3.
- Slide out side linings first followed by rear lining.  
(To remove rear lining ease upwards and withdraw by a downwards and forwards motion).
- Replace in reverse order taking care that front lining is correctly positioned.

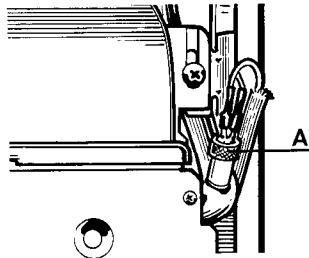
8.10



### Removal of electrical control box

- Remove front cover 6.1.
  - Isolate electrical supply.
  - Remove six screws retaining electrical control box cover.
  - Remove electrical connections from terminal strip and earth.
  - Withdraw plugs from rear of box.
  - Slide PCB forward and disconnect spark lead.
  - Remove 2 screws securing control box to chassis.
  - Replace in reverse order taking care to replace plugs in rear of control box.
- n.b.** Care should be taken to ensure correct location of the ON, OFF and reset buttons.

8.11



### To replace thermostat

- Isolate electrical supply.
- Remove front cover 7.1.
- Unscrew knurled ring (A) retaining thermostat phial and remove phial.
- Unplug from rear of control box.
- Replace in reverse order using heat sink grease on the sensing phial.

8.12

### To replace fuse

- Isolate electrical supply.
- Remove front cover 7.1.
- Remove cover on electrical control box 8.10.
- Remove and replace fuse.
- Reassemble in reverse order.

8.13

### To replace PCB

- Isolate electrical supply.
- Remove front cover 7.1.
- Remove cover on electrical control box 8.10.
- Remove electrical connections from terminal strip and the earth.
- Withdraw plugs from rear of electrical control box.
- Ease PCB forward and remove spark electrode lead and earth lead from the spark generator.
- Slide board forward and remove.
- Replace in reverse order.

# 8.14

## Testing the FFD circuit

### Closed circuit :

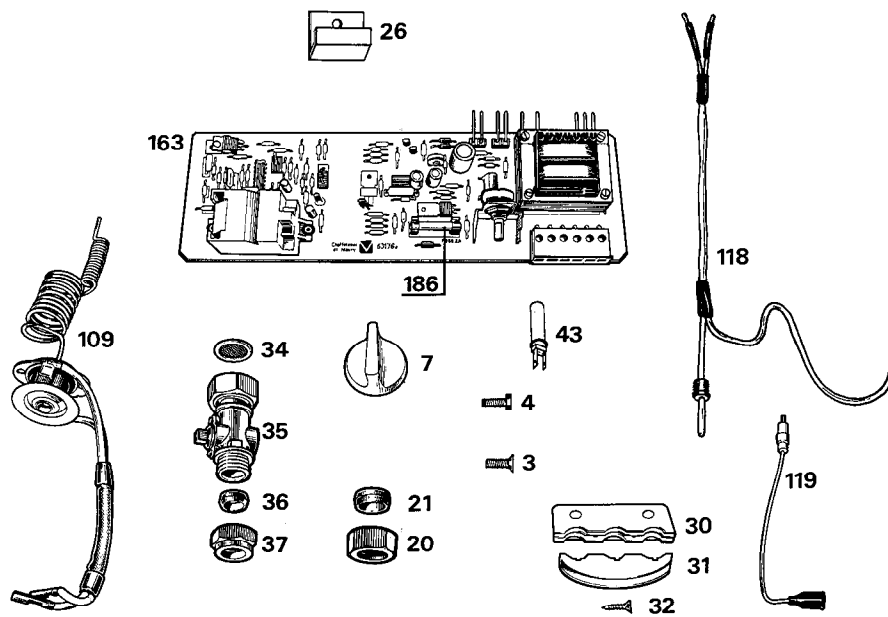
- Slide back insulation at plug in connection and attach millivolt meter using crocodile clip connectors.
- Output should not be less than 3 mv.

### Open circuit :

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

**n.b.** 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
3	Screw front case/electrical box securing .....	366 713	65622/01
4	Screw front case/chassis .....	366 311	39551/03
7	Temperature selector knob .....	366 553	64051
10a	Door assembly 30 OF .....	366 556	64147
10b	Door assembly 50 OF .....	366 625	64148
20	Nut 3/4" BSP .....	366 558	47509
21	Olive (22 mm) .....	366 559	47508
26	Mounting bracket .....	366 257	21720/10
30	Cable clamp bracket .....	366 564	65519
31	Cable clamp .....	366 565	27834
32	Screws cable clamp securing .....	366 714	45654/02
34	Gas filter washer .....	366 545	37309
35	Gas service cock .....	366 566	65960
36	Olive (15 mm) .....	263 800	56489
37	Nut 1/2" BSP .....	366 642	56489
43	Thermistor temperature sensor .....	366 570	64153
109	High limit thermostat .....	366 636	65962
118	Thermocouple .....	366 602	65961
119	Electrode and lead assembly .....	366 593	63404
163	Printed circuit board .....	366 614	63176
186	Fuse .....	264 446	44790

# FAULT FINDING CHART

