# Hamworthy

Installers Guide
for

# WESSEX 50
# MARK IV

HOT WATER BOILER

# WESSEX Mk IV 1 x 50
# 2 x 50
# 3 x 50

HOT WATER BOILERS FOR HEATING AND
DOMESTIC HOT WATER

INSTALLATION AND COMMISSIONING INSTRUCTIONS
FOR USE WITH NATURAL GAS ONLY

# CONTENTS

## 1.0 INTRODUCTION

These instructions are for use with natural gas only. The "Wessex" is a gas fired, fan assisted, open flued central heating/hot water boiler. Each burner/tube bank assembly is termed a module. Up to three boiler modules are arranged in a single casing, the multiple arrangements being termed batteries. Each battery has common flue, water and gas connections.

The technical data for the various arrangements is given in Section 2.

The burner fitted to each module is of the fan assisted pre-mixed type incorporating a separate intermittent gas fired pilot, and rectification principles are used to monitor both the pilot and the main flame and the burner is fitted with a sequence controller complying with the requirements of BS:5885 (Industrial Gas Burners of input rating 60 kW and above.)

Each single boiler/battery is arranged for direct connection to the flue system. The flue outlets from more than one battery may be connected to a single chimney. No draught diverter is fitted to the single boiler/battery nor is a fixed diverter required in the flue system. However, a draught stabiliser is recommended for some installations (see Section 6.1).

The Wessex is floor mounted and is intended for the heating of commercial and industrial premises. It may also be used to supply hot water for those premises via an indirect cylinder.

The module has a low thermal capacity and water flow rates must be maintained at or above the recommended levels shown in Section 8 and Fig. 2.

## 2.0 TECHNICAL DATA

### 2.1 Overall Dimensions

Shown in Fig. 8.

### 2.2 Heat Input/Output

| Boiler | Heat Input (gross) | Heat Output (to water) |
|---|---|---|
| Wessex 1 x 50 | 59.5 kW (203.000 Btu/h) | 50 kW (170.600 Btu/h) |
| Wessex 2 x 50 | 119.0 kW (406.000 Btu/h) | 100 kW (341.200 Btu/h) |
| Wessex 3 x 50 | 178.5 kW (609.000 Btu/h) | 150 kW (511.800 Btu/h) |

### 2.3 Gas Supply

The units are for use with natural gas only. The nominal gas pressure at the single boiler/battery inlet manifold should be 20 m bar (8 in w.g.).

### 2.4 Water Pressure

The units are suitable for a maximum water pressure of 6.0 bar (60m/200ft).

## 3.0 GENERAL REQUIREMENTS

### 3.1 Related Documents. Gas Safety Regulations 1972

It is 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 that this law is complied with. (This paragraph is brought to your notice at the request of British Gas).

The installation of the boiler must be in accordance with the relevant requirements of the Gas Safety Regulations, Building Regulations, I.E.E. Regulations and the byelaws of the local water undertaking.

It should also be in accordance with any relevant requirements of the local gas region and local authority and the relevant recommendations of the following documents:

**British Standard Codes of Practice**

CP 331: Installation of pipes and meters for town gas.
Part 3: Low pressure installation pipes.

CP 332: Slection and installation of town gas space heating.
Part 3: Boilers of more than 150,000 Btu/h (44 kW) and up to 2,000,000 Btu/h (586 kW) output.

CP 341, 300 – 307: Central heating by low pressure hot water.

CP 342: Centralised hot water supply.
Part 1: Individual dwellings.
Part 2: Buildings other than individual dwellings.

**British Gas Publications**

"Flues for Commercial and Industrial gas fired boilers and air heaters".

"Combustion and ventilation air — guidance notes for boiler installations in excess of 2,000,000 Btu/h (586 kW) output".

## 4.0 LOCATION

The location chosen for the boiler must permit the provision of a satisfactory flue system and an adequate air supply. The location must also provide adequate space for servicing and air circulation around each unit.

The boiler must be installed on a level non-combustible surface that is capable of adequately supporting its weight (when filled with water) and any ancillary equipment.

Any combustible material adjacent to the boiler and the flue system must be so placed or shielded as to ensure that its temperature does not exceed 65°C (150°F).

Further details regarding boiler location are given in CP 332:3..

## 5.0 GAS SUPPLY

### 5.1 Service Pipes

The local gas region must be consulted at the installation planning stage in order to establish the availability of an adequate supply of gas.

An existing service pipe must not be used without prior consultation with the local gas region.

### 5.2 Meters

A gas meter will be connected to the service pipe by the local gas region, or a local gas region contractor.

An existing meter should be checked, preferably by the gas region, to ensure that it is adequate to deal with the rate of gas supply required.

### 5.3 Gas Supply Pipes

Supply pipes must be fitted in accordance with CP 331:3. Pipework from the meter to the boiler must be of adequate size. Do not use pipes of a smaller size than the boiler gas connection. The complete installation must be tested for soundness as described in the above Code.

### 5.4 Boosted Supplies

Where it is necessary to employ a gas pressure booster, the controls must include a low pressure cut-off switch at the booster inlet. The local gas region must be consulted before a gas pressure booster is fitted.

## 6.0 FLUE SYSTEM

Detailed recommendations for flue systems are given in the British Gas Publication "Flues for Commercial and Industrial gas fired boilers and air heaters".

Reference should also be made to CP 332:3 where applicable.

The following notes are intended to give general guidance only.

### 6.1 Suction

Each single boiler/battery is arranged for direct connection to the flue system. The flue outlets from more than one battery may be connected to a single chimney. No draught diverter is fitted to the single boiler/battery nor is a fixed diverter required in the flue system. However, a draught stabiliser is recommended for some installations.

The flue system should be designed to maintain atmospheric pressure or a slight suction at the single boiler/battery flue connection at all times. If at any time the suction is likely to exceed 0.1 m bar (0.04 in w.g.) a draught stabiliser is recommended to be fitted to the flue system.

### 6.2 Design Waste Gas, Volume and Temperature

It is recommended that the volume and temperature of the waste gases used for design of the flue system is as shown below:

| Boiler | Exhaust Volume at N.T.P. (0°C – 760mm Kg) $m^3/h$ | $ft^3/h$ | Exhaust Temp. °C | °F |
|---|---|---|---|---|
| Wessex 1 x 50 | 85 | 3000 | 125 | 257 |
| Wessex 2 x 50 | 170 | 6000 | 125 | 257 |
| Wessex 3 x 50 | 255 | 9000 | 125 | 257 |

### 6.3 Flue Condensation

With the high thermal efficiency of the modules, the flue gas temperature is low (approx. 125°C). Condensation in the flue is thus more likely than with lower efficiency units. It is strongly recommended that twin-wall or insulated flue pipe is used on all installations. Care should be taken to ensure that the flue is installed so that any condensation is continuously drained. All flues should have a minimum slope of 2.5° upwards in the direction of exhaust gas flow (no horizontal sections). All joints must be made so that any condensation is directed back down the slope. The drain fitted to the single boiler/battery casing will adequately cope with condensation from 6 m (20 ft) of twin-wall flue, any longer lengths of flue should have separate open drain connections. The drain pipe must be 12.7 mm (½ in) dia. minimum, of non-corrodible material and preferably led to a gulley.

### 6.4 Materials

Materials used for the flue system must be mechanically robust, resistant to internal and external corrosion, non-combustible and durable under the conditions to which they are likely to be subjected.

### 6.5 Disconnection

Facilities must be made for disconnecting the flue pipe from each single boiler/battery for inspection and servicing purposes. Bends with removable covers should be fitted for inspection and cleaning purposes where considered appropriate.

### 6.6 Flue Discharge

The flue system must ensure safe and efficient operation of the boiler to which it is attached, protect the combustion process from wind effects and disperse the products of combustion to the external air.

The flue must terminate in a freely exposed position and be so situated as to prevent the products of combustion entering any opening in a building in such concentration as to be prejudicial to health or a nuisance.

Where the flue diameter is less than 200 mm (8 in) a terminal should be fitted. Where the flue is of a larger size consideration should be given to the fitting of a terminal.

## 7.0 AIR SUPPLY

**Boiler Installations up to 12 Modules — 600 kW Output**

Detailed recommendations for air supply are given in CP 332:3.

**Boiler Installations in Excess of 12 Modules — 600 kW Output**

Detailed recommendations for air supply are given in the British Gas Publication "Guidance Notes for Boiler Installations in Excess of 2,000,000 Btu/h (586 kW) Output".

The following notes are intended to give general guidance. In all cases there must be provision for an adequate supply of air for both combustion and general ventilation.

### 7.1 Air Supply by Natural Ventilation

The purpose provided space housing the boiler must have, or be provided with, permanent air vents communicating directly with the outside air, at high level and at low level. Where communication with the outside air is only possible by means of high level air vents, ducting down to floor level for the lower vents should be used. For an exposed boiler house, air vents should be fitted preferably on all four sides, but at least on two sides. Air vents should have negligible resistance and must not be sited in any position where they are likely to be easily blocked or flooded or in any position adjacent to an extraction system which is carrying flammable vapour. Grilles or louvres must be so designed that high velocity air streams do not occur within the space housing the boiler.

The air supply requirements stated below are equivalent to those specified in CP 332:3 and the British Gas Guidance Notes as mentioned above.

| NUMBER OF MODULES INSTALLED | POSITION OF AIR VENT(S) | AIR VENT AREAS (Air direct from outside) |
|---|---|---|
| Up to 12 modules (Up to 600 kW output) | High Level | 270 $cm^2$ per module (42 $in^2$ per module) |
| | Low Level | 540 $cm^2$ per module (84 $in^2$ per module) |
| 12 to 22 modules (600 to 1100 kW output) | High Level | 3300 $cm^2$ (500 $in^2$) |
| | Low Level | 6600 $cm^2$ (1000 $in^2$) |

7.2 **Air Supply by Mechanical Ventilation**

The supply of air to a space housing the boiler by mechanical means should be by mechanical inlet with natural or mechanical extraction. Mechanical extract ventilation with natural inlet must not be used. Where a mechanical inlet and a mechanical extract system is applied, the design extraction rate must not exceed one third of the design inlet rate.

The requirements for air supply by mechanical ventilation are given in CP 332:3 and the British Gas Guidance Notes mentioned above.

*NOTE: For mechanical ventilation systems an automatic control should be provided to cut off the gas supply to the boiler, in the event of failure of air flow in either inlet or extract fans.*

## 8.0 WATER CIRCULATION SYSTEM

8.1 **General**

The boiler has a low water content and the requirements of minimum water flow are given in Figure 2. Recommendations for the water circulation system are given in CP 332:3 and CP 342.

In a combined central heating and hot water system, the hot water storage vessel must be of the indirect cylinder or calorifier type. The hot water storage vessel should be insulated, preferably, with not less than 75 mm (3 in) thick mineral fibre, or its thermal equivalent.

Circulating pipework not forming part of the useful heating surface should be insulated to help prevent heat loss and possible freezing, particularly where pipes are run through roof spaces and ventilated cavities. Cisterns situated in areas which may be exposed to freezing conditions, must also be insulated,

Insulation exposed to the weather should be rendered waterproof.

Draining taps must be located in accessible positions which permit the draining of the whole system, including the boiler and hot water storage vessel.

8.2 **Pressure Relief Valve**

A pressure relief valve must be fitted to the water system between the single boiler/battery and the first isolating valve in the water system. The size of this relief valve should be as shown below.

| Boiler | Relief Valve Size | Free Area of Relief Valve |
|---|---|---|
| Wessex 1 x 50 | 20 mm (¾ in) | 284 mm² (0.44 in²) |
| Wessex 2 x 50 | 20 mm (¾ in) | 284 mm² (0.44 in²) |
| Wessex 3 x 50 | 20 mm (¾ in) | 284 mm² (0.44 in²) |

For further details see CP 332:3.

### 8.3 Open Vent Pipe and Cold Feed Pipe

A vent pipe and cold feed pipe must be fitted to the water system between the single boiler/battery and the first isolating valve in the water system. The sizes of these pipes are shown below.

| Boiler | Open Vent Size | Cold Feed Size |
|---|---|---|
| Wessex 1 x 50 | 25 mm (1 in) | 20 mm (¾ in) |
| Wessex 2 x 50 | 32 mm (1¼ in) | 25 mm (1 in) |
| Wessex 3 x 50 | 38 mm (1½ in) | 32 mm (1¼ in) |

### 8.4 Altitude Gauge (Water Pressure Gauge)

Each single boiler/battery should be provided with a gauge complete with isolating cock.

### 8.5 Thermometer

A thermometer complete with pocket should be fitted in the pipework to indicate water flow temperature.

### 8.6 Drain Taps

Each single boiler/battery must have a ½ in n.b. drain tap fitted to drain the single boiler/battery only. The heating system in total should have drain taps as recommended by CP 332:3.

### 8.7 Circulating Pump

One or more pumps will be required to circulate the water around the boiler and heating system. Fig. 2 shows the hydraulic resistance of the single boiler/battery. The pump should be sited to facilitate servicing. It is important to note that when Wessex boilers are used to replace boilers on an existing system, the pumps should be checked for performance against the new boiler waterside pressure drop to ensure that an adequate flow rate can be obtained. It is also important that the existing system be flushed through to remove any loose matter which may have accumulated. If in any doubt regarding the cleanliness of the system, consideration should be given to the fitting of a coarse filter in the return pipework to the boilers.

*NOTE: If the boilers are time clock controlled, a pump overrun (not Hamworthy supply) should be fitted, which must run for a minimum of 1 minute on shut down of the boiler.*

### 8.8 Minimum Water Flow Rates

The minimum water flow rates are shown in Fig. 2. These flow rates must be maintained through each single boiler/battery at all times when the burner is firing. If the water flow rate is allowed to fall below the minimum then the waterways of the boiler might be subject to premature failure due to scale formation. Particular attention must be paid to a reduction of flow rates during periods of low lead demand.

## 8.9 Waterside Pressure Drop

The water side pressure drop is shown in Fig. 2.

## 8.10 Control Schemes

### 8.10.1 Temperature Controls

The adjustable control thermostat fitted to each module, is set to operate within the range 50 – 90°C as standard, however, the thermostat has an upper limit of 110°C and if a higher setting is required refer to the temperature adjustment procedure detailed in Appendix 17.

For high temperature applications, a ''special to contract'' controls thermostat is available with adjustment within the range 80 – 130°C and it should be noted that on boilers applied to systems having flow temperatures in excess of 100°C, additional insulation should be applied to the front heat exchanger tube plates (apply to Hamworthy Engineering for this special insulation kit).

An adjustable overheat cut-off device (hand re-set limit thermostat) is also fitted to each module and this is capable of adjustment between the ranges 95 and 130°C. This thermostat will be set to 95°C as standard but may be adjusted to suit the specific flow temperature requirements.

### 8.10.2. Water Flow Controls

Any external mixing valves or similar controls must always ensure that the minimum water flow rate shown in Fig. 2 is maintained. It is strongly recommended that a water flow switch is fitted to the system. The switch should be connected so that the single boiler/battery cannot fire unless the water flow is proved.

### 8.10.3 Frost Protection

Consideration should be given to fitting a frost thermostat set at approximately 4°C (39°F).

## 8.11 Minimum Water System Pressure

To comply with Guidance Note PM5 from the Health and Safety Executive the minimum static water pressure at the highest point in the circulating system must be calculated as follows:-

If the boilers are to be installed as single units the minimum pressure must be equal to the gauge pressure equivalent to the saturated steam temperature obtained by adding 17°C to the required boiler flow temperature but never less than 2 m (6.5 ft).

| | | | |
|---|---|---|---|
| e.g. 1. | Required Flow Temperature | = | 95°C |
| | Safety Margin | = | 17°C |
| | Equivalent Saturated Steam Temperature | = | 112°C |
| From Steam Tables — corresponding Gauge Pressure | | = | 0.5 bar (7.3 psi) |
| | | = | 5 m (16.8 ft) head of water |

If the boilers are to be installed in a modular formation the minimum pressure must be equal to the gauge pressure equivalent to the saturated steam temperature obtained by adding 17°C to the sum of the required mixed flow temperature and the temperature rise across the boilers.

| | | | |
|---|---|---|---|
| e.g. 2. | Required mixed flow temperature | = | 82°C |
| | Temperature rise across boilers | = | 11°C |
| | Safety margin | = | 17°C |
| | Equivalent Saturated Steam Temperature | = | 110°C |

| | | | |
|---|---|---|---|
| From Steam Tables — corresponding Gauge Pressure | | = | 0.42 bar (6.1 psi) |
| | | = | 4.3 m (14 ft) head of water |
| e.g. 3. | Required mixed flow temperature | = | 82°C |
| | Temperature rise across boilers at minimum flow | = | 13°C |
| | Safety margin | = | 17°C |
| | Equivalent Saturated Steam Temperature | = | 112°C |
| From Steam Tables — corresponding Gauge Pressure | | = | 0.57 bar (8.3 psi) |
| | | = | 5.8 m (19.1 ft) head of water |

## 9.0 ELECTRICAL SUPPLY

**WARNING: THIS APPLIANCE MUST BE EARTHED.**

Wiring external to the boiler must be installed in accordance with the I.E.E. Regulations and any local regulations which apply. Wiring must be completed in heat resistant 3 core cable. (Size 1.0 square mm. C.S.A.). Boilers are normally supplied for 230/250 volts, 50 Hz. Internal fuse rating of each module is 2 amp. External fuses should be 5 amp. for all single boiler/battery sizes.

The method of connection to the mains electricity supply must facilitate complete electrical isolation of the single boiler/battery with a contact separation of at least 3 mm in all poles.

A mains isolator should be provided adjacent to the boiler in a readily accessible position. The supply should only serve the boiler. Further details regarding connection to the electricity supply are given in CP 323:3.

### 9.1 Mains Cable Connection

The path of the mains cable is shown in Fig. 3 — use heat resistant 3 core cable size 1.0 square mm C.S.A.

### 9.2 Module Wiring Diagram

The module wiring diagram is shown in Fig. 4. This wiring diagram is also fitted inside each module cover.

## 10.0 INSTALLATION OF BOILERS

### 10.1 General

Each boiler/battery is normally despatched to site as a pre-piped unit for floor mounting. All units should be stored in a weatherproof place before installation.

The single boiler/battery should be positioned to allow a minimum of 150 mm (6 in) from adjacent walls or equipment to facilitate inspection.

Other installation dimensions are given in Fig. 8. The outer insulated casing should be fitted in accordance with the packed instructions after completing the gas and water pipework connections, but prior to connecting the boilers to the flue system. Care must be taken to prevent damage to the casings prior to Contract completion.

### 10.2 Connection of Boilers to the Flue System

Notes on the recommendation for design of the flue system are given in Section 6.

Each single boiler/battery is arranged for direct connection to the flue system. The flue outlets from more than one battery may be connected to a single chimney. No draught diverter is fitted to the single boiler/battery nor is a fixed diverter required in the flue system.

A flue socket is provided suitable for accepting twin-wall flue pipe. Sealing of the flue to the socket should be made using a suitable caulking string and cold caulking compound.

Suitable means should be incorporated in the flue system adjacent to the boiler for removal of the boiler casing without the need to dismantle the whole flue system.

### 10.3 Gas Connections

For design see Section 5.

Size and position of gas connections are shown in Fig. 8. A filter mesh is fitted inside the gas cock at the union end. Each module has an individual gas cock fitted. The installer must fit a suitable isolation valve on the supply to each boiler/battery as shown in Fig. 1. A union should be fitted between the isolation valve and the boiler/battery manifold for ease of battery removal.

## 11.0 COMMISSIONING AND TESTING

### 11.1 Electrical Installation

For design see Section 9.

Checks to ensure electrical safety must be carried out by a competent person.

### 11.2 Gas Installation

For design see Section 5.

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

### 11.3 Water Circulation System

For design see Section 8.

*Note: If a boiler is to be fitted into an old or existing pipework system, it is advisable that this is chemically clean and thoroughly flushed prior to plant commissioning. When flushing the system ensure that all valves are open and all unreasonable restrictions removed (circulating pumps etc.).*

*After flushing, the system should be re-instated, filled and vented. Before proceeding to initial commissioning, the total water system should be checked for soundness.*

### 11.4 Lighting the Boiler (Initial Commissioning)

Prior to delivery, all Wessex boilers are subject to a full sequence check and pressure switches are adjusted to design settings. (See following text for values.) The intent therefore of the following initial commissioning procedure, is to check the correct functioning of the sequence system up to and including the establishment of the pilot flame, *with the gas supply to the main burner isolated.*

**Initial Commissioning Procedure**

a) Ensure that the gas supply to each module is turned off.

b) Isolate the electrical supply to the boiler (plant switch).

c) Remove the boiler front cover.

d) Turn each boiler switch to off and adjust the boiler control thermostat to minimum setting.

e) Disconnect the main gas solenoid valve by removing the electrical commissioning loop between terminals 2 and 3 on the incoming supply terminal block. (See wiring diagram.)

f) Establish water flow through the boiler modules (circulating pumps.)

g) Switch the boiler ON/OFF switch to ON after which the controller should commence an automatic sequence of events. If when the switch is turned to ON it is observed that the lock-out lamp on the sequence step controller is illuminated, the controller should be re-set by depressing the illuminated button.

h) With the controller re-set from lock-out, the cam timer will motor to its normal start position and the fan will commence a boiler pre-purge of approximately 30 seconds.

i) Following this pre-purge period, an ignition spark will be generated and the pilot gas solenoid valve will lift to supply gas to the pilot burner.

j) After a few seconds, the spark will be removed and a short pilot flame monitoring period will start.

k) On completion of the pilot proving period, the green normal firing lamp will be seen to illuminate but since the main gas solenoid valve is disconnected, the boiler sequencer will go to lock-out after approximately 4 seconds. The lock-out lamp on the controller will then illuminate and the green normal firing lamp will be extinguished.

l) When the commissioning engineer is satisfied that he has a stable reliable pilot flame, the module should be electrically isolated at the plant switch and the commissioning loop reconnected. (Terminals 2 and 3 on the incoming supply terminal block.)

**Main Burner Commissioning**

m) Having established a satisfactory pilot flame and reconnected the supply to the main gas solenoid valve, the sequence described above will, after switching the boiler on, be repeated but instead of the boiler going to lock-out at the end of the pilot proving period, the main gas valve will open and after approximately 4 seconds of green lamp illumination, the pilot valve will be de-energised and the main flame should remain established under the control of the flame monitoring system.

### 11.5.1 Gas Pressure Adjustment and Gas System Leak Check

Although the boiler receives a gas leak check prior to leaving the factory, transport and installation may cause disturbance to unions and fittings and during commissioning a further test for soundness should be carried out on the boiler gas pipework taking great care not to allow soapy water on or near any electrical parts or connections.

After approximately 30 minutes of normal firing, the gas pressure differential across the gas orifice (reference Figure ) should be checked by connecting a differential manometer to test points A & B. The pressure drop for Natural Gas should be 2.5 mbar (1 in. w.g.) and minor adjustments to the appliance governor may be necessary to correct for site gas pressure conditions.

For reference, the gas pressure switch setting (factory adjusted) is 10 mbar (4 in. w.g.) to "make" and the air pressure switch (factory adjusted) is 0.46 mbar (0.18 in. w.g.) to "break".

### 11.5.2 Combustion Checks

A flue gas sampling point is provided in the front boiler casing (see Fig. ). To check combustion take a flue gas sample from each module test point and for reference North Sea Natural Gas $CO_2$ measurements should be between 9 and 10%, or 3.5 to 5% when the basis of measurement is oxygen. Normal CO levels should not exceed 200 ppm or 0.02% (by volume).

*Note: All the above measurements refer to dry gas samples.*

### 11.6.1 Limit Thermostat (Overheat Cut-off Device) Adjustments

The limit thermostat is supplied factory set to 95°C and this is normally satisfactory for low pressure hot water systems. However, it is capable of adjustment up to 130°C on high

temperature applications and adjustment may be made by removing the limit thermostat from the controls bracket (lock-nut accessible from the front) and by adjusting the range screw to the required setting.

*NOTE: For high temperature applications, it is essential that the water system static head, or in the case of pressurised systems, the system pressure, is suitable for operation at elevated temperatures and attention is drawn to the specific requirements of CP:332 and the Health and Safety Executive Guidance Note PM5 (Automatically Controlled Steam and Hot Water Boilers).*

### 11.6.2 Control Thermostat Adjustment

Control thermostats are factory set to limit their adjustment to 90°C, however the thermostat has an upper limit of 110°C and a "special to contract" limit thermostat is available for adjustment up to 130°C. Where a control thermostat setting in excess of 90°C is required to suit high temperature applications, the extended range may be achieved by adjusting the angle of rotation as shown in Appendix 1 of this document.

## 11.7 USERS INSTRUCTIONS

Upon satisfactory completion of commissioning and testing, the commissioning engineer should hand the Users Instructions to the user or purchaser and explain the method of economic and efficient operation of the system. Ensure that the user or purchaser is fully conversant with lighting, shut-down and general operational procedures.

## 12.0 FAULT FINDING

The controller fitted to the Wessex 50 kW boiler incorporates a rotating coloured disc fixed to the cam timer which provides information with regard to the position that has been achieved at any point in the sequence. This disc with the relevant sequence information is shown in Fig.7 and in general the fault can be located by observing the position at which the disc stopped rotating and the functions controlled to that point.

### BOILER SEQUENCE CONTROLLER, OPERATION AND FAULT FINDING

### 12.1 Summary of Safety Features

1. Flame failure during a run, results in burner shut-down and lockout within 1 second.
2. Failure to establish and detect flame during the light-up sequence, results in burner shut-down and lockout within 2 – 5 seconds from the initial release of fuel.
3. Air supply failure at any time, results in burner shut-down and immediate lockout.
4. The air pressure proving switch, is checked in both the "no air" and "air supply proved" positions.
   From the initial start up of the burner fan motor, a period of 5 seconds is allowed by the control box for the pressure switch to detect a combustion air supply.
5. Restoration of the power supply after an interruption, results in a full light-up sequence to safely restart the burner. Power failure after a lockout, will not interfere with this condition when the supply has been restored.
6. False flame signals at the start point and during pre-purge result in burner shut-down and lockout.
7. The light-up sequence can only commence providing the cam switches and relay contacts within the control box are at their correct relative positions, and continuity of the lockout relay circuit is proved.

### 12.2 Fault Finding

1. Burner will not start.
   Coloured programme indicator stopped on blue line in white sector.
   a) Check electrical supply is switched on.

b) Check that thermostat circuit is ''calling for heat'' and timeswitch circuit (if fitted) is made.
A supply on terminal 9 will determine this.

c) Check that the start circuit loop across terminals 9 and 1 is made and the gas pressure switch contacts are closed.

2. Burner will not start.
Synchronous motor runs, coloured programme indicator rotates but burner does not start.
Check air pressure proving switch is in correct state i.e. ''no air'' position.

3. Burner starts but goes to lockout.
Programme indicator stopped on red line in blue sector.
a) Check air pressure proving switch.
b) Check that a load, e.g. start gas valve is connected to terminal C.
c) Check continuity of start gas coil winding.
d) The start gas valve has coil with half-wave rectification, check that negative side is connected to terminal C.
e) Check for flame simulation or false flame signal.

4. Burner starts but goes to lockout.
Coloured programme indicator stopped in blue sector.
a) Check for combustion air supply failure.
b) Check for flame simulation, if necessary, change control box.
c) Check for continuity of start gas valve coil circuit.

5. Burner starts, flame established but control box goes to lockout.
Coloured programme indicator stopped at end of yellow sector/start of red sector.
a) Check that flame detection probe is in contact with flame.
b) Check that flame probe insulator is not cracked. A cracked insulator will be sufficient to give rise to an a.c. leakage current.
c) Check that flame probe is not in contact with other metallic parts of the burner.

6. Burner starts, flame established but control box goes to lockout.
Coloured programme indicator stopped in red sector.
Check that when main gas valve has been switched on, the change in combustion or flame characteristics has not caused the flame to ''lift off'' the combustion head and hence allow the flame probe to lose contact with the flame.

7. Burner starts, runs but subsequently goes to lockout.
Coloured programme indicator stopped at end of green/start of white sector.
a) Check for interruption in gas supply.
b) Check for failure of combustion air supply failure.
c) Check flame probe position for proper contact with flame.
d) Check flame probe insulator for soundness.
e) If necessary, change control box.
*Note: If the control box goes to lockout, it is generally performing the function it is designed for.*

## 12.3 Causes of Lockout

1. No Ignition.
2. Ignition not in correct place, check electrode settings and ceramic insulator for cracks or damage.
3. No gas supply.
4. Gas valves not opening.
5. Failure of combustion air supply.
6. Incorrectly positioned flame probe, poor earth contact with flame, interference to flame signal from ignition spark.
7. Faulty control box.

# 13.0 SERVICING INSTRUCTIONS

## 13.1 General

Regular periodic servicing is recommended, preferably by a Hamworthy appointed person.

**WARNING:**
**ISOLATE THE ELECTRICAL SUPPLY TO THE SINGLE BOILER/BATTERY BEFORE ANY SERVICING OR COMPONENT EXCHANGE PROCEDURE, AND TURN OFF THE GAS SERVICE COCK TO THE MODULE BEING SERVICED.**

## 13.2 Annual Service

13.2.1 Remove module cover by unscrewing the central pozi-drive retaining screw and withdrawing cover from the two corner locating pins.

13.2.2 Remove fan/mixing chamber and control assembly complete using the following steps:

a) Disconnect mains cable at terminal block and earthing post, loosen cable clamp and withdraw cable from assembly.

b) Disconnect leads to spark electrode and flame probe.

c) Release pilot bundy tube from solenoid valve body.

d) Release ½ in. union nut connecting gas service cock to module.

e) Release gas pipework "U" bolt located just above service cock by slackening the two M6 nuts and removing the M10 nut securing the plate to the module casting stud. Swing pipe clamp plate away from stud.

f) Remove wire retaining clip from thermostat pocket and withdraw thermostat bulbs.

g) Remove air pressure switch cover plate, disconnect wiring and remove switch from module by releasing bundy tube nuts at top of switch and underside of fan case.

h) Unscrew the four M5 socket headed screws securing the complete assembly to the front header casting, and withdraw assembly from the module.

i) The burner can now also be withdrawn from the module by first tapping lightly on the flange to loosen. The centre cone can be gripped with pliers to facilitate withdrawal.

j) Release pilot burner assembly by removing the two screws securing it to the header casting, and withdrawing unit.

13.2.3 Clean the burner by gently brushing inner and outer surfaces and tap firmly, flange downwards, on a wooden block to eject particles of dust and debris. Check circular cork gasket for soundness and renew if necessary. Replace burner in module. (Closed end of burner must locate in recess in module rear tube plate). This will be indicated when the flanged end of the burner is flush and square with the front header casting. The burner seam, marked top on the flange, must be at 45° clockwise to the vertical centre line of the heat exchanger (22½° before the pilot position).

13.2.4 The fan/mixing chamber, controls assembly and pilot assembly may now be removed to bench for inspection and cleaning.

a) Release the screw retaining the sequence controller and pull the top clear of the base plate to expose the wiring terminal rail. Disconnect and remove the two black fan motor leads from terminals 4 and 8.
Release the fan motor earth lead (green/yellow) from the boiler earthing post.

b) Remove red plastis cap securing solenoid coil enclosure on main electromagnetic gas valve and withdraw solenoid and enclosure etc.

c) Remove clip securing pilot valve coil and lift coil from body.

d) Release screw securing gas pressure cover and lift off cover. Disconnect wiring.

e) Remove the three "pozi-drive" screws securing fan motor plate and thermostat/indication lamp bracket, to fan casing. Remove bracket and wiring loom complete with solenoid enclosures. Gently withdraw fan taking care not to damage rubber gasket. The fan motor bearings are sealed for life and do not require lubrication.

f) Gently brush fan blades if necessary to remove any dust accumulation.

g) Gently brush both sides of the swirler — (located between fan discharge flange and extension duct) — to remove any dust accumulation.

*NOTE: Exercise extreme caution at this stage as the swirler must not be damaged or altered in any way. Do not attempt to remove swirler from its location.*

h) Remove bundy tubes from air pressure switch and blow them and their respective couplings through to ensure they are clear. Remove couplings from air switch and blow through. (Do not attempt to blow through whilst fitted to switch — to prevent damage to switch diaphragm.)

i) Re-assemble fan/mixing chamber etc., by reversing the above procedure.

13.2.5 Gently lift filter gauze from gas cock and lightly brush off or blow away any dust and debris — replace immediately.

13.2.6 Check spark electrode assembly. If electrode shows signs of oxidization or is distorted it must be renewed. Check that spark gap is set at 3 mm.

13.2.7 Check flame probe for signs of oxidization or distortion — renew if required. Length of metal rod should be 56 mm.

13.2.8 Remove pilot bundy tube from elbow connection at main gas train. Remove elbow connection from pipework to reveal pilot gas filter (Sintered bronze) clean filter and re-assemble using suitable jointing compound at elbow connection.

13.2.9 Re-assemble fan/mixing chamber and controls assembly to module in reverse procedure to that given in paragraph 13.2.2. Check rectangular cork gasket for serviceability and renew if required. Use colour code given on wiring diagram (inside controls casing and Fig. of the guide) to facilitate reconnection of electrical leads.

13.2.10 Replace module cover and tighten retaining screw.

13.2.11 Recommission boilers, ref section 11.4.

13.3 **Two Year Service**

13.3.1 Repeat annual service as previously described in paragraphs 13.2.1 to 13.2.8 inclusive but do not re-assemble any items to the boiler modules. If boiler is a 2 x 50 or 3 x 50 battery either a) turn off main gas supply to boiler, undo 1 in gas union and remove gas manifold or b) temporarily support gas manifold.

13.3.2 a) Isolate the single boiler/battery from the flow and return water pipes and drain down. Each module holds approximately 4 litres (0.9 gall) of water.

b) Undo and remove the four M8 bolts and nuts securing the modules flow and return flanges to respective headers and break the seal. If boiler is a 2 x 50 or 3 x 50 battery, undo flange bolts holding flow and return headers to respective pipework and remove headers.

c) Undo the four M10 nuts/studs securing the module to the battery casing and withdraw the module by sliding it out on the internal runners.

*NOTE: Each module weighs approximately 45 kg (100 lb).*

d) Take module to bench and stretch off stainless coil spring baffle retainers.

e) The 16 stainless steel baffle plates can now be removed to expose the finned tube bank. Wire brush both sides of baffles to remove any deposit.

f) Thoroughly wire brush finned tubes until clean.

13.3.3 Re-assemble modules generally in reverse procedure to above. Clean flanges and renew flange gaskets. Renew ceramic fibre rope seal — (Module casing). To re-assemble baffles, stretch coil spring retainer over tube bank then slip in baffles one at a time. Two baffles have pressed locating dimples — ensure these baffles are positioned opposite one another around the tube bank to locate the retainers. When all baffles are in position, stretch the second retainer over the assembly and locate between dimples.

When module is re-assembled in casing, re-fit other items, ie. ignition/pilot assembly, filter mesh, fan/mixing chamber and controls etc., in accordance with procedure for annual service. Continue with final items of annual service viz. 13.2.10 and 13.2.11.

13.4 **Four Year Service** (and every subsequent four years)

13.4.1 Repeat two year service procedure as described in paragraphs 13.3.1 and 13.3.2.

13.4.2 With module on bench:-

a) Remove the 12 x M10 bolts securing the inner cover plate to the inner tube plate and separate plates.

b) Remove the 12 x M10 bolts securing the front header plate to the outer tube plate and separate the plates.

c) Clean and descale the tubes through and also the waterways in the tube plates and covers. Chemical descaling is preferred for the tube bank assembly. Recommended solutions include "Gamlen XD" blended with Gamlen C.U.O. inhibitor.

Follow chemical manufacturers instructions for solution strength, method of application, safety and handling precautions.

13.4.3 Clean up mating surfaces and re-assemble covers to tube plates with new gaskets, lightly greased, before assembly. Torque M10 bolts down evenly to 5.5 kg.m. (40 lb.ft).

13.4.4 Continue with re-assembly according to paragraph 13.3.3., concluding with final items of annual service viz. 13.2.10 and 13.2.11.

13.4.5 When the module is firing the gas pressure must be checked in accordance with paragraph 11.5. (Commissioning and Testing section).

## 14.0 REPLACEMENT OF FAILED COMPONENTS

**WARNING:**
**Isolate the electrical supply to the single boiler/battery and turn off the gas supply before removing burner cover and commencing any servicing or component exchange procedure.**

14.1 **Spark Electrode Renewal** (Hamworthy Part No. 333801341)

a) Pull off H.T. cap and disconnect probe wire. Release nuts securing bundy tube between pilot solenoid valve and assembly and remove. Remove two screws securing pilot assembly to header casing and withdraw assembly.

b) Release electrode by removing screw securing its flange to the assembly.

c) Check spark gap is set at 3 mm before re-fitting assembly to boiler.

14.2 **Flame Probe Renewal** (Hamworthy Part No. 333801333)

a) Repeat Step 14.1 a) above.

b) Release probe by removing screw securing its flange to the assembly.

c) Check rod of new probe for straightness and length (see 13.2.7.) before re-fitting to assembly.

14.3 **Sight Glass Renewal** (Hamworthy Part No. 339907043)

Remove spark electrode and flame probe. Lift out clamp-ring and remove sight glass disc from igniter block. Replace in reverse order with particular attention to 14.1 c).

14.4 **Fan Motor Renewal** (Hamworthy Part No. 399011085)

Release the screw retaining the sequence controller and pull the top clear of the baseplate to expose the wiring terminal rail. The two fan leads (both black) are interchangeable, one of which is wired into terminal No. 4, the other to the neutral (terminal No. 8).

Withdraw the wires from the controller, then release and remove the motor earthing cable (yellow/green) from the earthing post on the burner control bracket. Remove the three Pozi-head screws holding the fan motor plate and thermostat/indicator lamp facia etc., to the fan casing. Place the facia to one side ensuring no excessive strain is put on any wiring connections or thermostat capillary. Withdraw the fan gently taking care not to damage rubber gasket. Slacken the impellor retaining grubscrew and remove the impellor from the motor shaft. Undo the four nuts exposed by the impellor removal and take off the motor mounting plate. This together with the impellor can now be fitted to the new motor. Position the impellor to give a 6 mm clearance between motor plate and impellor back-plate. Reverse the remainder of the procedure for re-assembly.

14.5 **Main Solenoid Valve Renewal** (Hamworthy Part No. 747445333)

It is likely that the main cause of gas valve failure will be due to coil winding failure, either open or short circuit. If this is the case, it is possible to replace the coil only. Disconnect coil wires (both black) from the 4 way terminal block at main cable entry position; terminals 2 and 3. Release and remove the coil earth lead (green/yellow) from the earthing post on the burner control bracket, and withdraw from cable grommet in the control bracket. Remove the red plastic cap securing the solenoid enclosure on the gas valve and withdraw solenoid coil, enclosure and yoke assembly etc., taking care to note the order for re-assembly.

Trim the leads on the new coil to a length identical to the old coil (allow for stripping) and place the new coil into the original yoke using the existing location bushes. Thread the two black wires into the solenoid enclosure then replace the enclosure and yoke assembly onto the gas valve. Refit the red plastic cap. Feed the wires through the rubber grommet in the control bracket. The black leads are interchangeable, but ensure that one is wired to terminal 3 and the other to terminal of the incoming mains terminal block (4 way). Re-make the solenoid earth connection to the boiler earthing post.

14.6 **Pilot Solenoid Valve Coil Renewal** (Hamworthy Part No 747445499)

Release the screw retaining the sequence controller and pull clear of the base-plate to expose the wiring terminal rails. Release and remove the brown wire from terminal 8, blue wire from terminal "C" and green/yellow wire from "E". Using a pair of pliers, close together small lugs of clip at top of solenoid coil and lift off clip. Pull off coil.

*NOTE: This coil is half wave rectified.*

When re-wiring new coil to sequence controller ensure that the negative (blue) wire is connected to terminal "C". Failure to comply with this would result in non-operation of the sequence controller.

14.7 **Air Pressure Switch Renewal** (Hamworthy Part No. 747146295)

Remove cover plate by releasing Pozi-head screw. Disconnect and remove wires from terminals. Release bundy tube nuts at switch. Remove fittings and refit to new switch.

*NOTE: When fittings are removed from switch ensure that holes are clear of any obstruction and jointing compound before re-fitting to new switch.*

Refit new switch and connect wiring as indicated:

a) White/Red wire to terminal marked "N.O."
b) White wire to terminal marked "C".
c) Green/Yellow wire to earthing point on body.

Replace cover plate. (This switch will have been FACTORY SET).

14.8 **Gas Pressure Switch Renewal** (Hamworthy Part No. 339009477)

Remove cover-plate by releasing Pozi-head screw. Disconnect and remove wires from terminals. Using suitable spanners, unscrew switch from fitting at pilot solenoid valve body. When fitting

new switch ensure that suitable joining compound is applied to the male thread of the adaptor.

Turn on gas cock and test for gas soundness. Turn off gas cock and connect wiring as indicated:-

a) Orange/Black wire to terminal marked "N.O."
b) Mauve wire to terminal marked "C".
c) Green/Yellow wire to earthing point on body.

Replace cover plate. (This switch will have been FACTORY SET)

14.9 **Control Thermostat Renewal**
(See Appendix)

Remove thermostat capillary retaining clip at pocket and withdraw the bulb from the pocket in the flow header. Remove the spaded yellow and pink leads at the "push-on" terminals on the thermostat body. Pull off the control knob and remove the spring and silver bezel. The termostat is retained to the support bracket by two M3 screws, one of which is a pillar type and forms the control knob stop. Take care to note the relative position of the two screws before removing them, together with the thermostat body.

Re-assemble the new thermostat in reverse procedure ensuring that the YELLOW and PINK leads connect the thermostat in the normally closed position. (Identified as contacts 1 and 2 on the thermostat body.)

*NOTE: For adjustment of thermostat operating range refer to Section 11.7.*

14.10 **Overhead Cut-Off Device Renewal** (See Appendix 1)
(Limit Thermostat)

Remove thermostat capillary retaining clip at pocket and withdraw the bulb from the pocket in the flow header. Remove the spaded pink and mauve leads at the "push-on" terminals on the device body. Undo the bulkhead nut and withdraw the device.

Fit the new overheat cut-off device (limit thermostat) in reverse procedure ensuring that the PINK and MAUVE leads connect the device in the normally closed position. (Identified as contacts 1 and 2 on the device body).

*NOTE: For adjustment of over-heat cut-off device (limit thermostat) operating range, refer to section 8.10.1.*

14.11 **Sequence Controller Renewal** (Hamworthy Part No. 747246236)

Release the screw retaining the sequence controller and pull the top clear of the base-plate to expose the terminal rails. Re-fit the new controller top onto the existing base-plate and tighten the retaining screw.

To check the correct operation of the new controller, commission the appliance according to the notes detailed in Section 11.4.

14.12 **Ignition Transformer Renewal** (Hamworthy Part No. 747217120)

Release the screw retaining the sequence controller and pull the top clear of the base-plate to expose the terminal rails. Pull off H.T. cap from ignition electrode and unscrew cap from lead. Disconnect wiring from base-plate at terminals A, 8 and E. Release two screws securing base-plate and transformer to controls bracket, remove transformer.

Reassemble components in reverse order making sure that the transformer is earthed at the earthing terminal.

14.13 **Neons and ON/OFF Switch Renewal.**

| | | |
|---|---|---|
| GREEN NEON | = | Hamworthy Part No. 747436456 |
| RED NEON | = | Hamworthy Part No. 747436449 |
| ON/OFF SWITCH | = | Hamworthy Part No. 339006648 |

Pull off electrical leads to the appropriate item. Release switch or lamp from mounting fascia by pressing in the plastic retaining lugs at the top and bottom.

Pull switch or lamp out frontwards. Push in new item until lug locks in position and reconnect leads.

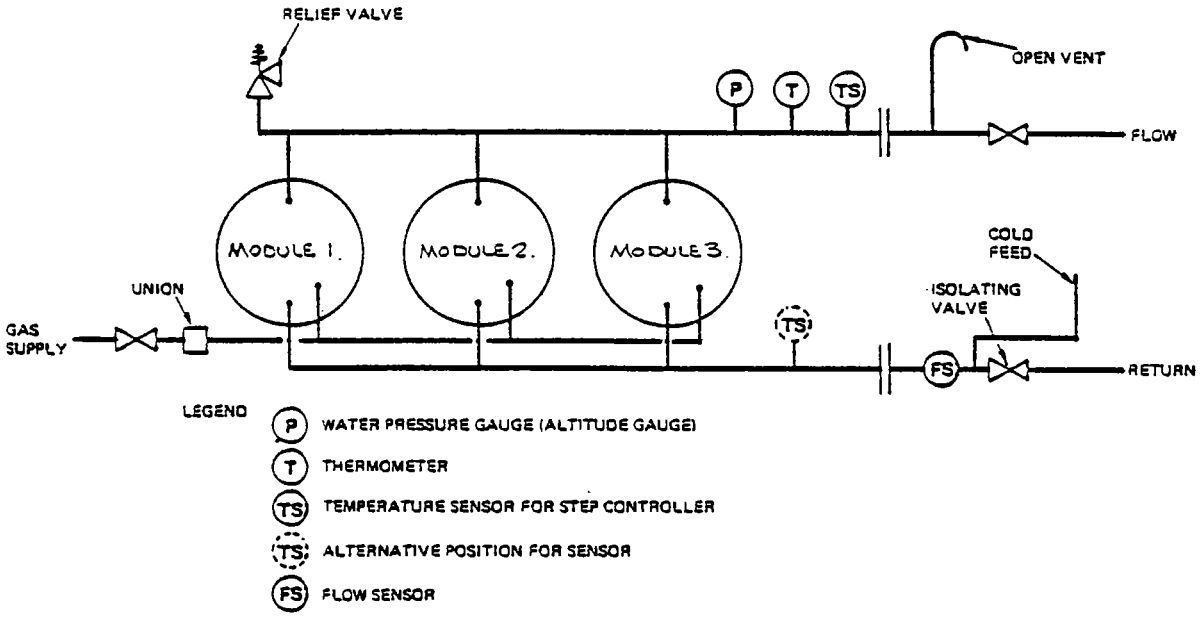



**Fig. 1. Schematic Arrangement of Water and Gas Pipework**

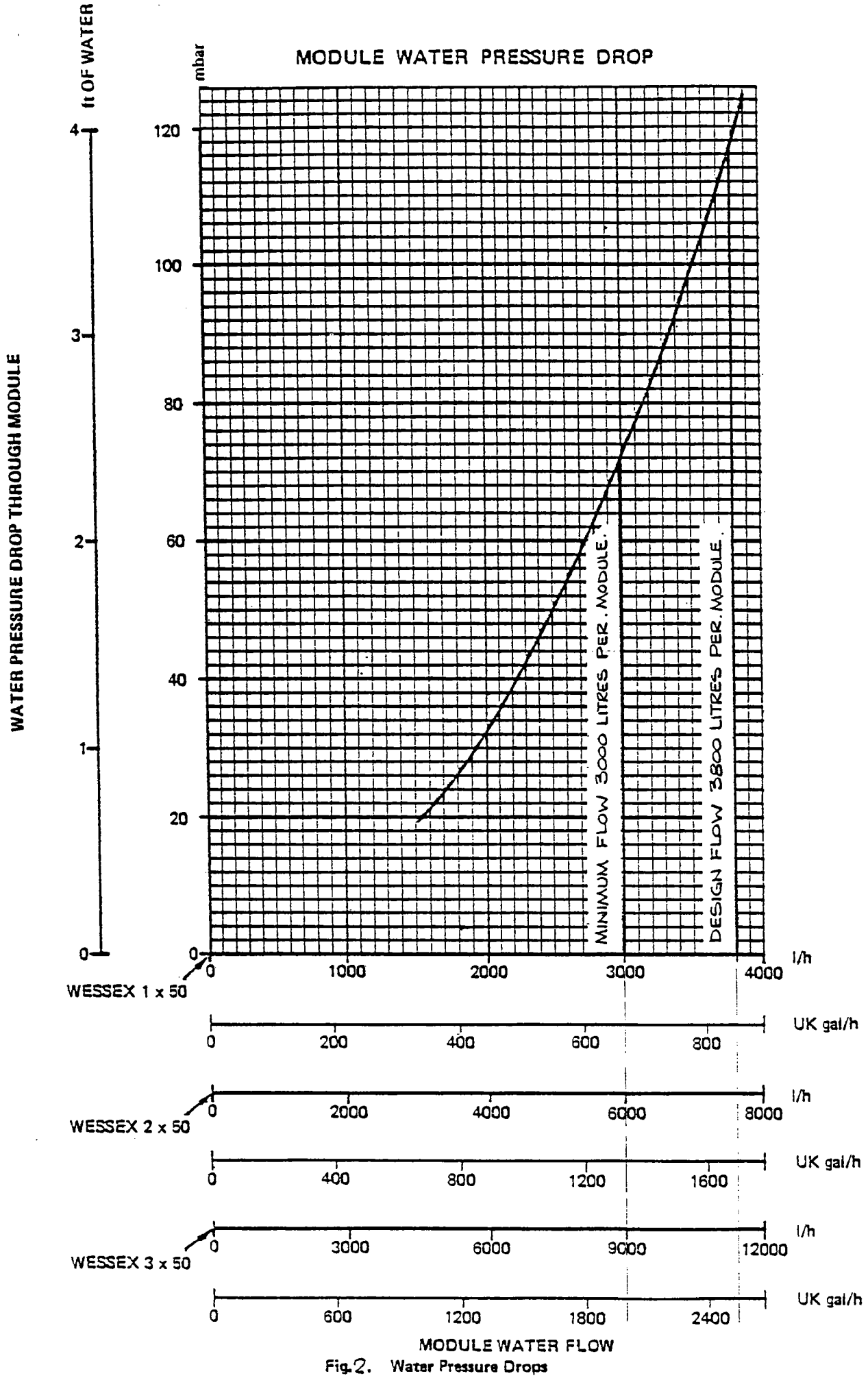



Fig.2. Water Pressure Drops

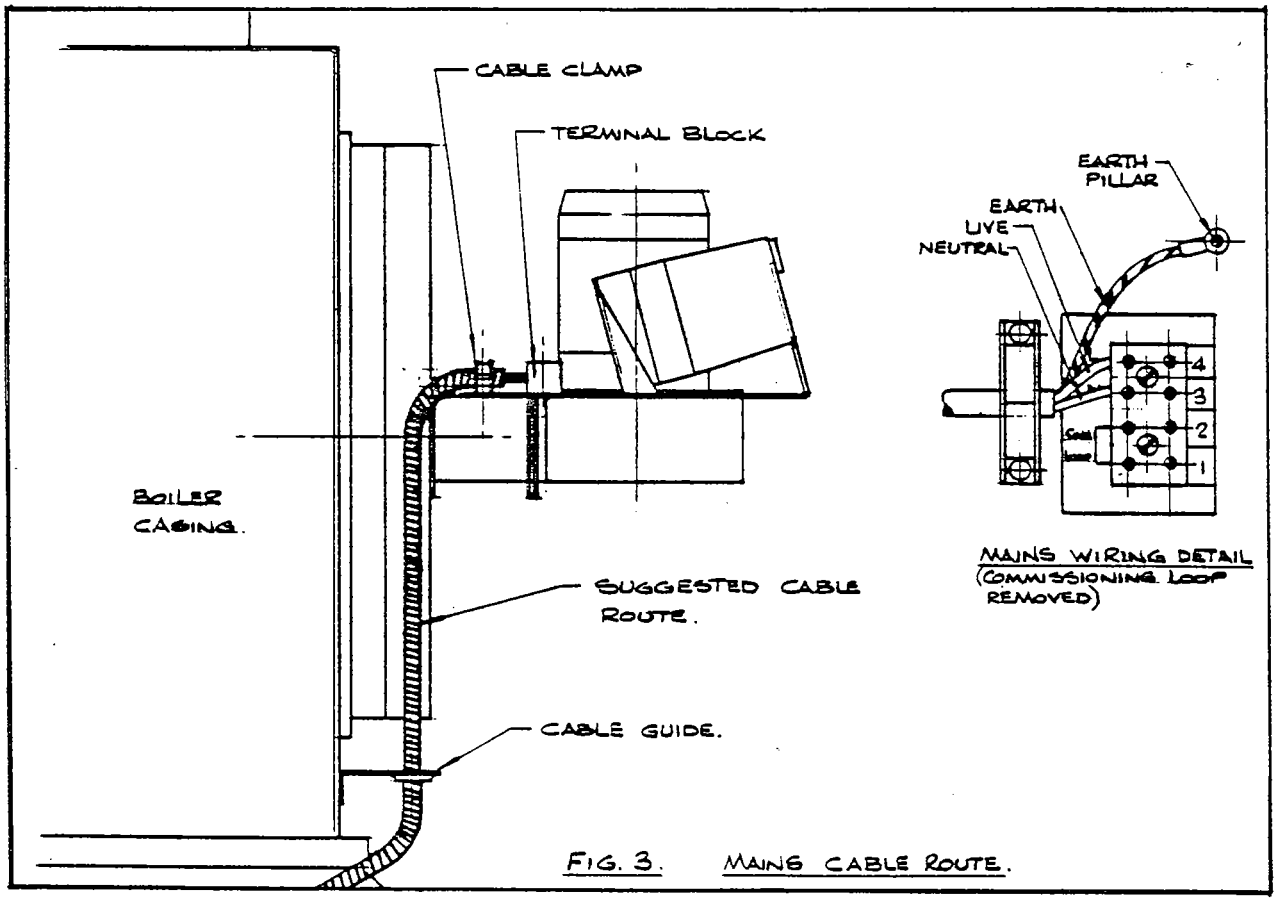
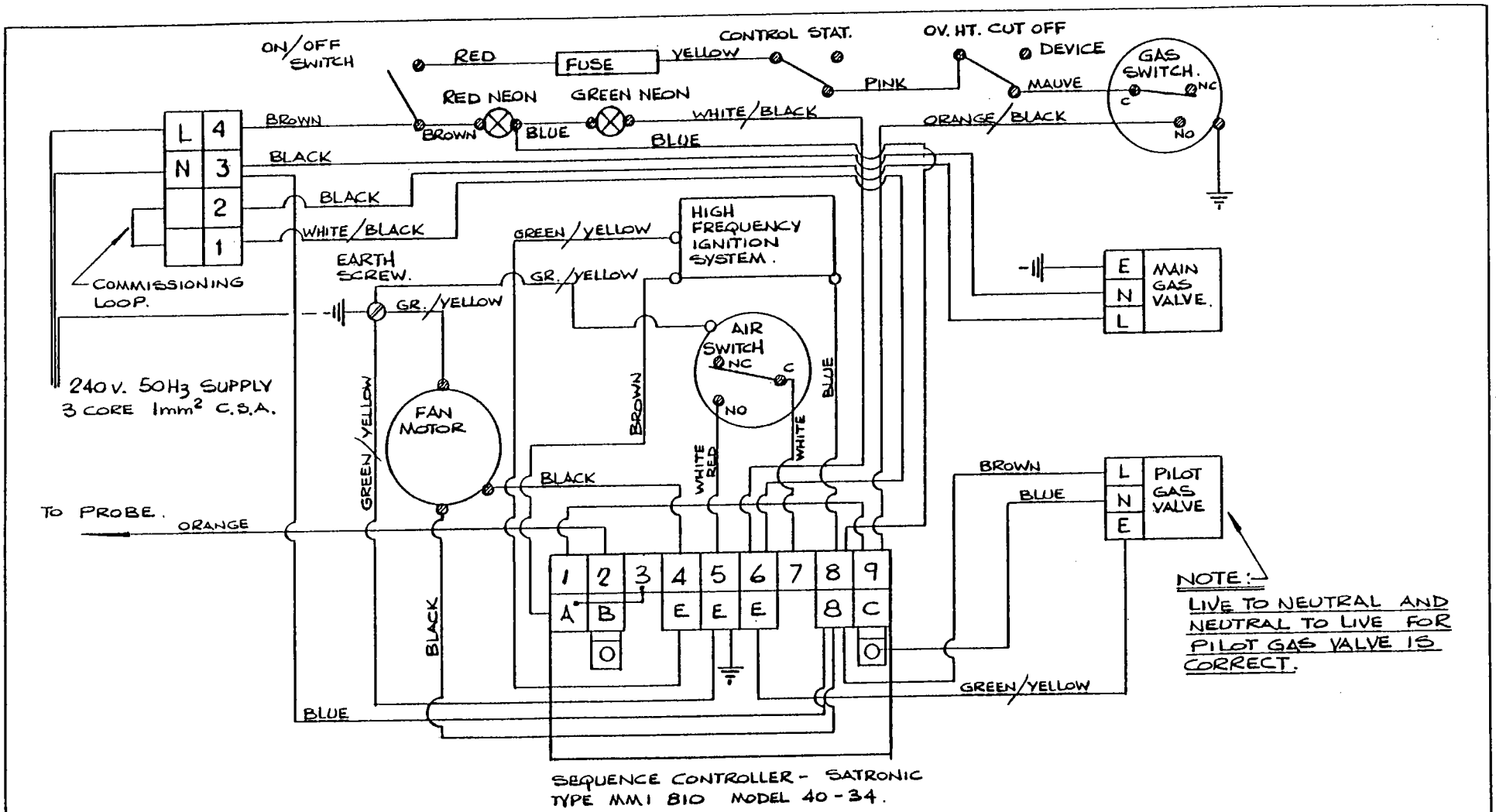



FIG. 3. MAINS CABLE ROUTE.




WIRING DIAGRAM FIG. 4.

330351639

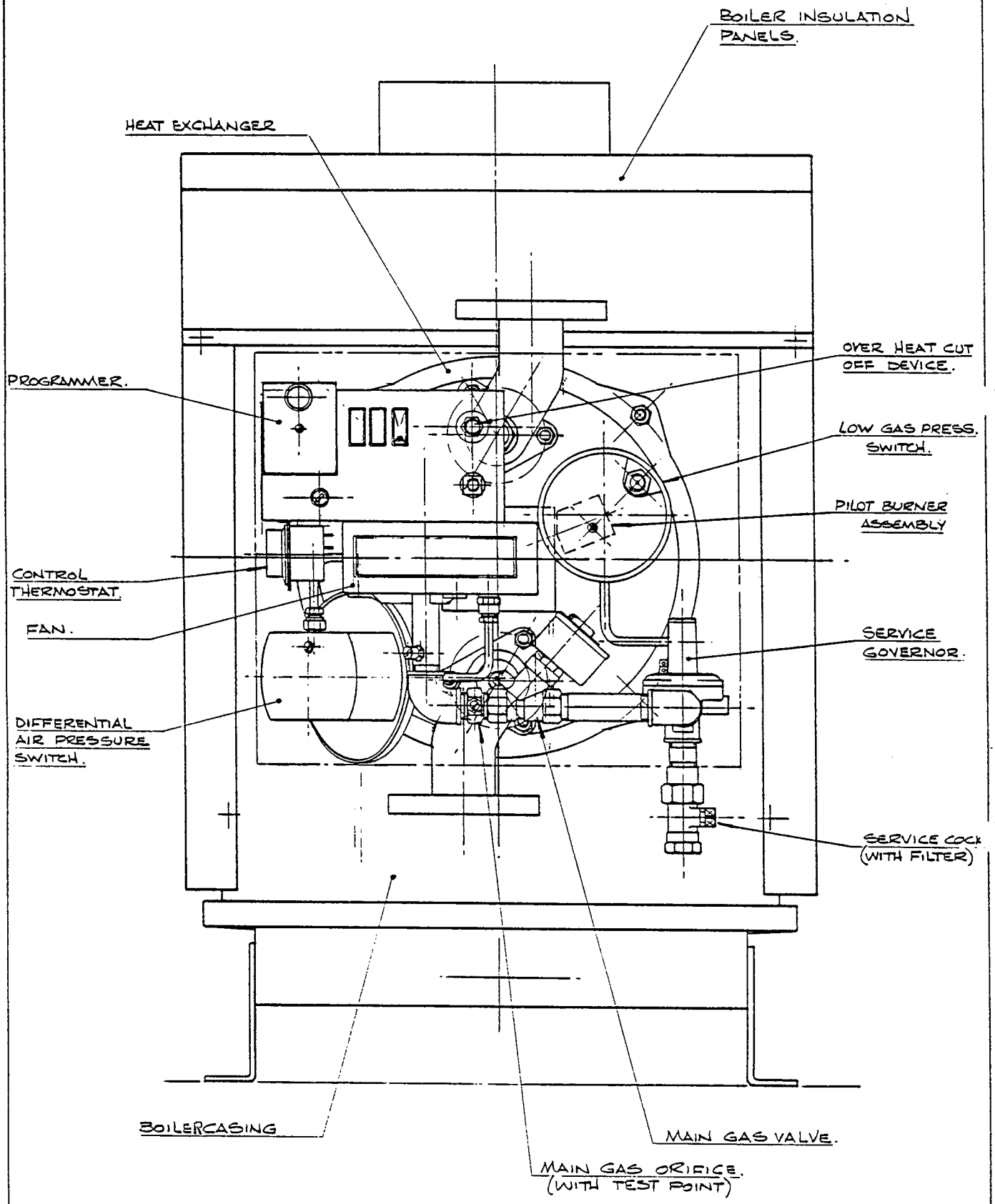
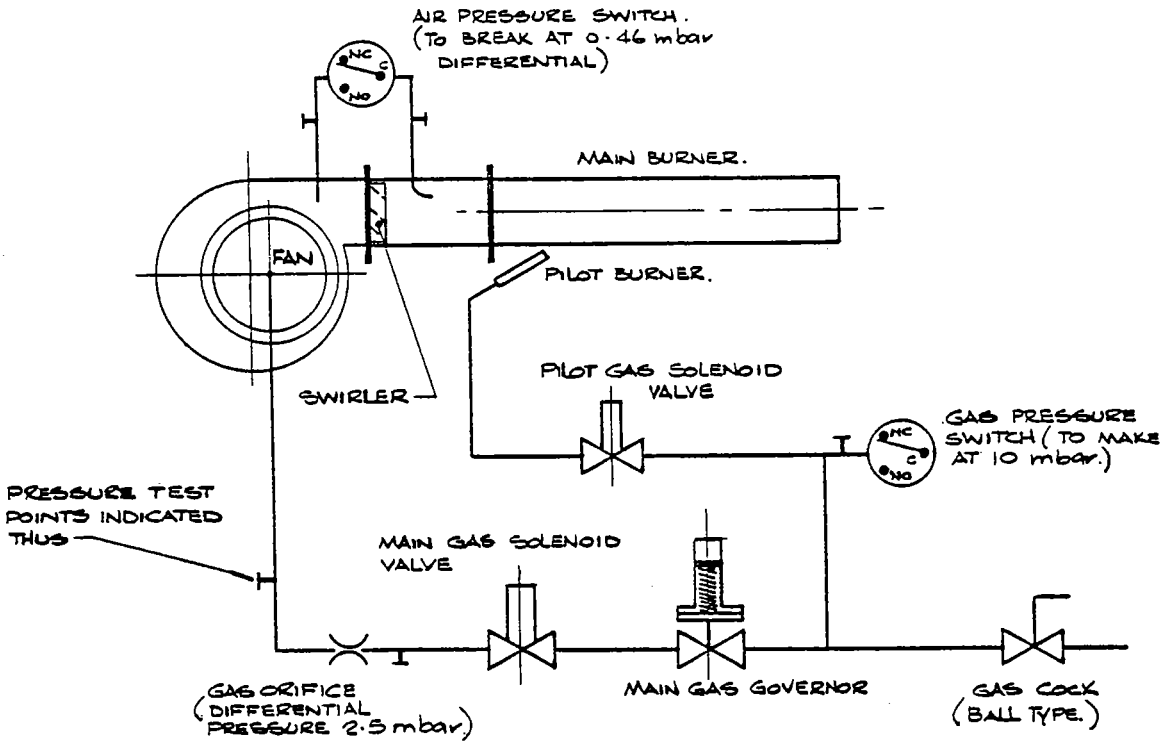



FIG. 5 WESSEX 50 KW MK IV BOILER FRONT ARRANGEMENT.




WESSEX 50 KW MK IV BURNER SYSTEM SCHEMATIC.

FIG. 6

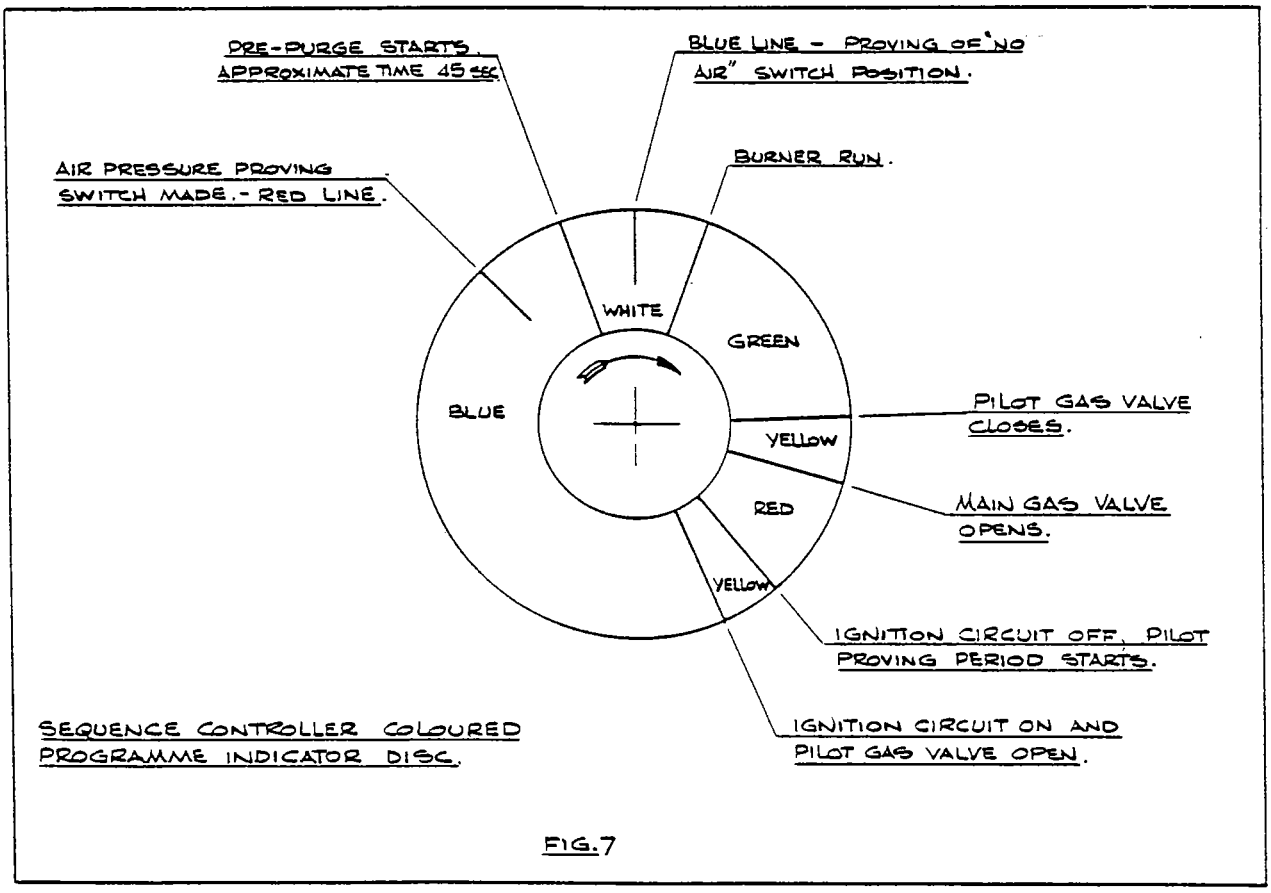
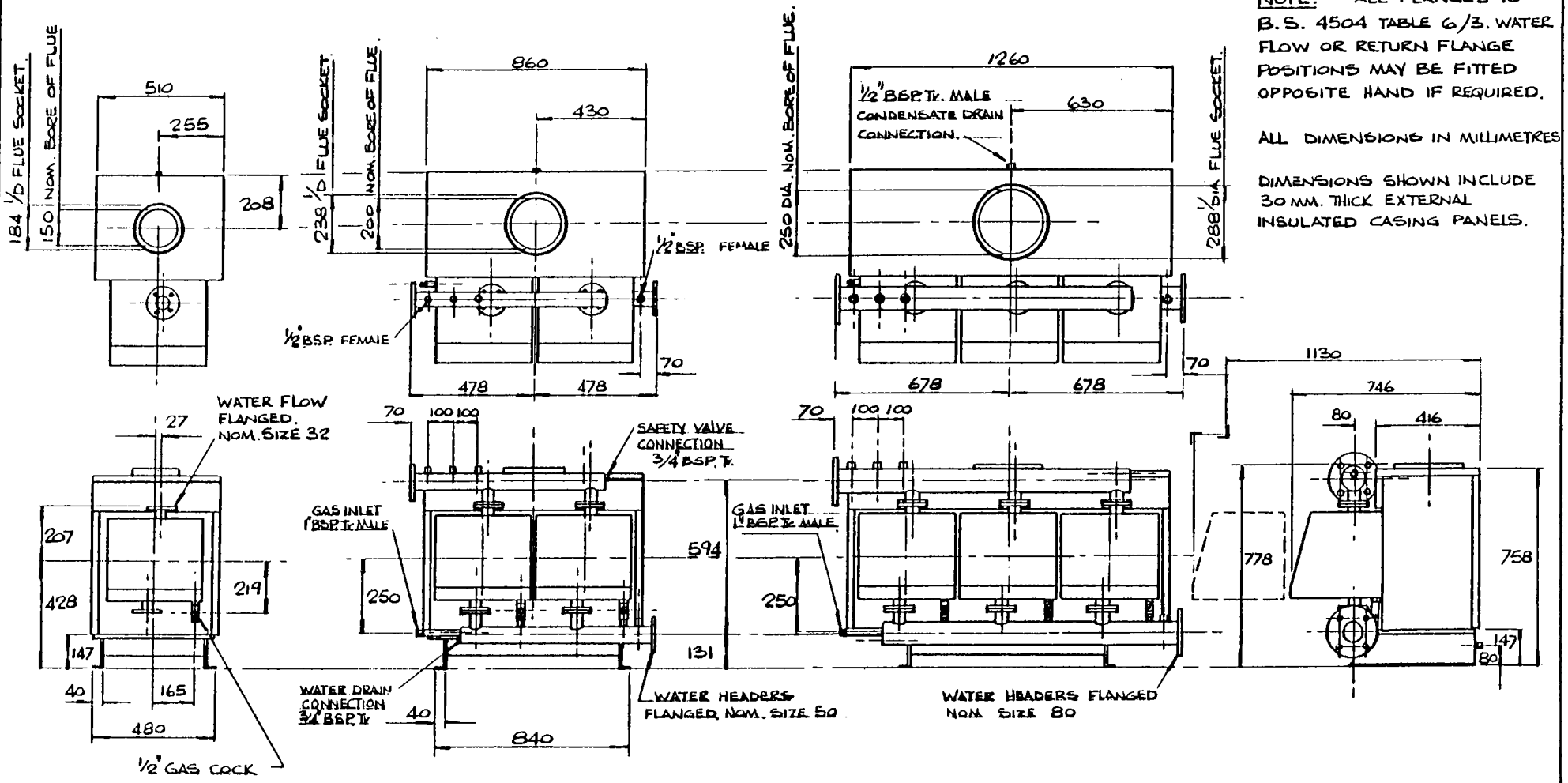



FIG. 7

| WESSEX MK IV 1 x 50. | WESSEX MK IV 2 x 50. | WESSEX MK IV 3 x 50. |
|---|---|---|
| WEIGHT EMPTY 85 Kg. | WEIGHT EMPTY 165 Kg. | WEIGHT EMPTY 240 Kg. |
| FULL 90 Kg. | FULL 175 Kg. | FULL 255 Kg. |

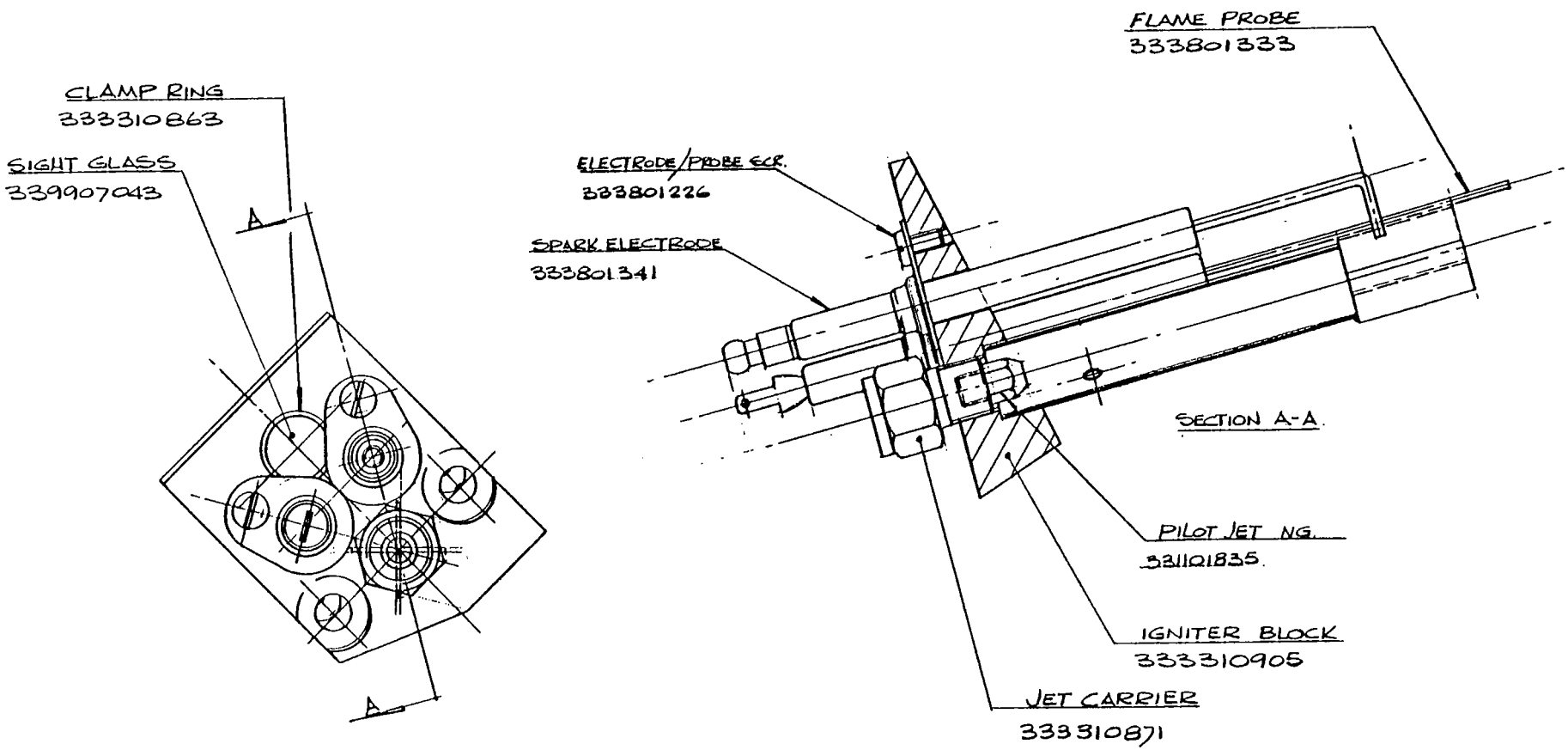



NOTE. ALL FLANGES TO B.S. 4504 TABLE 6/3. WATER FLOW OR RETURN FLANGE POSITIONS MAY BE FITTED OPPOSITE HAND IF REQUIRED.

ALL DIMENSIONS IN MILLIMETRES

DIMENSIONS SHOWN INCLUDE 30 MM. THICK EXTERNAL INSULATED CASING PANELS.

FIG. 8.

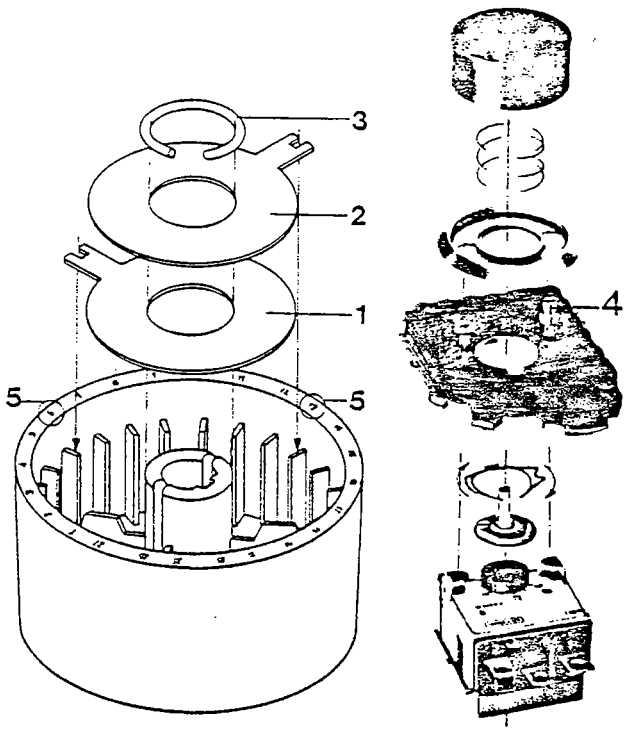



WESSEX 50 KW MK IV PILOT BURNER ASSEMBLY

FIG. 9.

**Adjusting the limitation of angle of rotation**
Only for thermostats with drum type setting knobs

1. Pull the setting knob off the thermostat spindle.
2. Remove the spring clip (3) and limit stop discs (1) and (2) from inside the setting knob.
3. Insert limit stop disc (1) in to the setting knob so that its stop arm locks on to that rib having the guide number (5) which corresponds to the start value of the desired setting range.
4. Insert limit stop disc (2) in the same manner, but this time choosing the rib and guide number which corresponds to the end value of the desired setting range.
5. Replace spring clip (3), thus securing the limit stop discs.
6. Push the setting knob back on to the thermostat spindle so that the stop screw (4) is located within the selected setting range.
7. Rotate the setting knob to the limit stops of both ends of the scale to check the adjusted range against the setting scale.




A Desired start value of the new setting range in °C. Corresponding guide number for limit stop disc (1).

B Desired end value of the new setting range in °C. Corresponding guide number for limit stop disc (2).

| Setting range °C | Limit stop disc Nr. | | Guide Nr. (5) 1 | 3 | 5 | 7 | 9 | 11 | 13 | 15 | 17 | 19 | 21 | 23 | 25 | 27 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50...110 | 1 | A | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 | — |
| | 2 | B | — | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 105 | 110 |
| 80...130 | 1 | A | — | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | — | — |
| | 2 | B | — | — | 80 | 85 | 90 | 95 | 100 | 105 | 110 | 115 | 120 | 125 | 130 | — |

## APPENDIX 1. CONTROL THERMOSTAT SETTING PROCEDURE

HAMWORTHY ENGINEERING LTD. - COMBUSTION DIVISION - SPARES DEPARTMENT

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RECOMMENDED SPARES FOR WESSEX 50 MK IV

| QUANTITY | DESCRIPTION | PART NO. |
|---|---|---|
| 1 | SPARK ELECTRODE | 333801341 |
| 1 | FLAME PROBE | 333801333 |
| 1 | SIGHT GLASS | 339907043 |
| 1 | FAN (MOTOR ONLY) | 399011085 |
| 1 | FAN/MOTOR ASSEMBLY | 339011069 |
| 1 | MAIN SOLENOID VALVE ASSEMBLY | 363914923 |
| 1 | MAIN SOLENOID VALVE | 747441761 |
| 1 | MAIN SOLENOID COIL | 747445333 |
| 1 | PILOT SOLENOID VALVE | 747442413 |
| 1 | PILOT SOLENOID VALVE ASSEMBLY | 363914931 |
| 1 | AIR PRESSURE SWITCH | 747146295 |
| 1 | GAS PRESSURE SWITCH | 339009477 |
| 1 | CONTROL THERMOSTAT | 339009345 |
| 1 | OVERHEAT CUT OFF (LIMIT STAT) | 339011044 |
| 1 | SEQUENCE CONTROLLER | 747246236 |
| 1 | IGNITION TRANSFORMER | 747217120 |
| 1 | GREEN NEON | 747436456 |
| 1 | RED NEON | 747436449 |
| 1 | ON/OFF SWITCH | 339006648 |
| 1 | PILOT BURNER ASSEMBLY (IGNITER) | 363310387 |
| 1 | BURNER ASSEMBLY | 363309025 |

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**SCOTLAND**

**McDOWALL MODULAR SERVICES,**
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