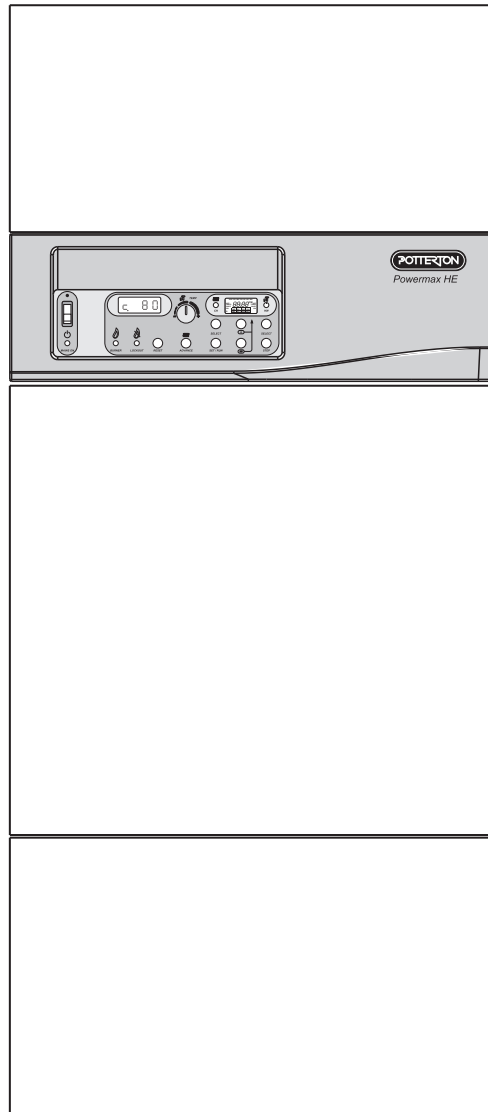




# Installation & Servicing Instructions

## Powermax HE 85, 115 & 150 Litre Condensing Boilers with Integrated Hot Water Storage



### **About the Boiler**

See inside cover for models covered by these instructions.  
This is a Floor Mounted Fan Assisted Balanced Flue Gas Boiler.  
This boiler is for use with Natural Gas (G20) only at 20 mbar and for use in GB/IE only.

### **About Safety**

The Gas Safety (Installation and Use) Regulations.

“ In your own interest, and that of safety, 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.”

Installation must be in accordance with the Installation & Service Instructions and the rules in force.

**Read these Instructions before installing or lighting the boiler**  
**Leave these Instructions and the Benchmark Log Book with the user for use on future calls.**

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The models covered by these instructions are:-

Powermax HE 85 Litre	G.C. No. 41 389 15
Powermax HE 115 Litre	G.C. No. 41 389 16
Powermax HE 150 Litre	G.C. No. 41 389 17

## Important

Refer to Page 8 for **Storage, Unpacking and Handling Instructions.**

## Benchmark Installation, Commissioning and Service Record Log Book



Potterton is a member of the Benchmark initiative and fully supports the aims of the programme. Benchmark has been introduced to improve the standards of installation and commissioning of central heating systems in the UK and to encourage the regular servicing of all central heating systems to ensure safety and efficiency.

**Important** – Failure to install and commission this appliance to manufacturer's instructions may invalidate the warranty. This note does not affect your statutory rights.

## CORGI

All CORGI registered installers carry a CORGI identification card and have a registration number. Both should be recorded in your boiler Log Book.

You can check your installer is registered by telephoning +44 (0) 1256 372300 or writing to:-

CORGI. 1 Elmwood, Chineham Business Park, Crockford Lane, Basingstoke, RG24 8WG.

## Safety, Performance & Quality

Powermax HE boilers have been assessed by a Government appointed Notified Body and shown to meet the 'Essential Requirements' of the European Gas Appliance Directive 90/396/EEC.

The Directive lays down requirements for the safety and efficiency of the appliance, together with its design, construction, and use of materials.

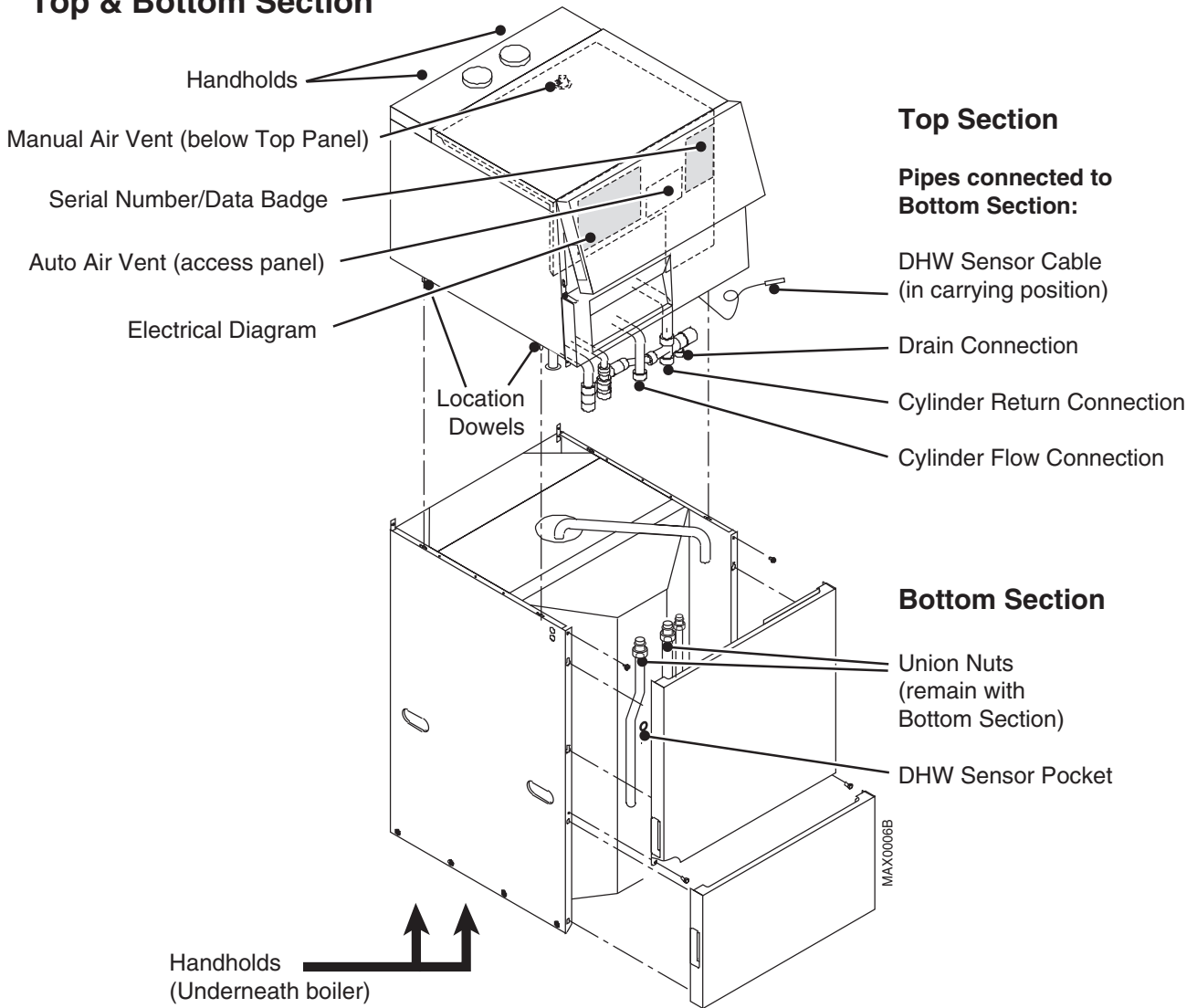
It also requires the production process to be covered by an approved and monitored system of quality assurance.

**Warning** - The addition of anything that may interfere with the normal operation of the appliance without explicit written permission from the manufacturer or his agent could invalidate the appliance warranty. In GB this could also infringe the GAS SAFETY (Installation and Use) REGULATIONS.

# Panel Removal

**Important:** Refer to Page 8 for Storage, Unpacking and Handling Instructions.

## Top & Bottom Section



### Top Section

#### Pipes connected to Bottom Section:

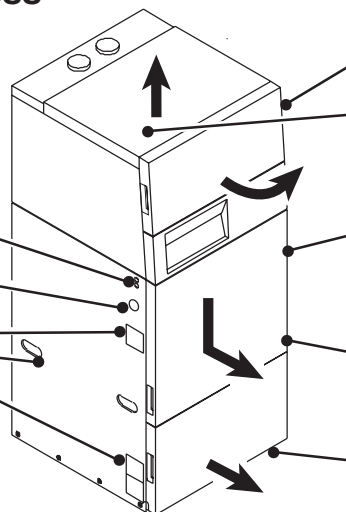
- DHW Sensor Cable (in carrying position)
- Drain Connection
- Cylinder Return Connection
- Cylinder Flow Connection

### Bottom Section

- Union Nuts (remain with Bottom Section)
- DHW Sensor Pocket

## Plumbing Access

- Mains power supply and Immersion Heater cable entry holes
- Condensate outlet hole
- Lifting and plumbing access each side



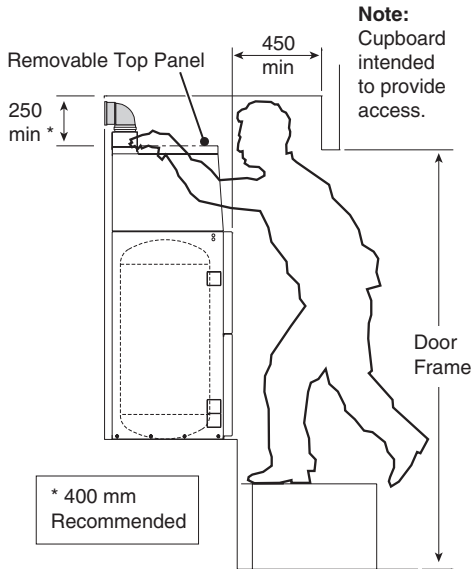
## General Access

- 1 Pull forward Front Panel at the bottom and lift off
- 2 Pull up and away Top Panel
- 4 Unscrew Upper Panel at the bottom and pull away
- Retaining Screws (Upper Panel)
- 3 Pull forward Bottom Panel

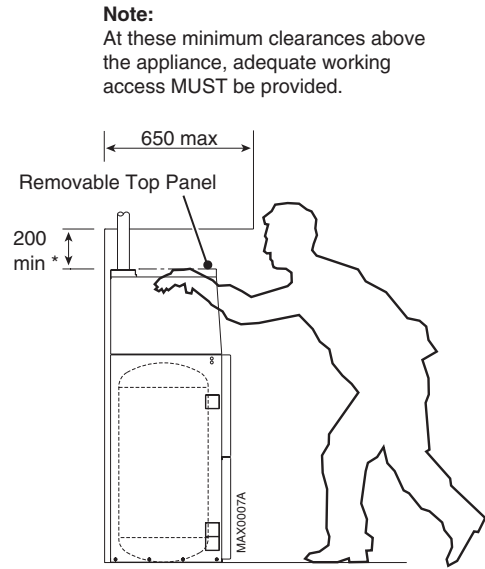
Fig. 1

# Technical Data

Unless indicated, data shown relevant to all models			85 litre	115 litre	150 litre
<b>Classifications</b>	Appliance category Flue Type NOx Class Cylinder Insulation		CAT I <sub>2</sub> H C <sub>13</sub> - C <sub>33</sub> - C <sub>53</sub> (as supplied) 5 (< 70 mg/kWh) CFC, HCFC = 0%		
<b>Input</b> (hot water/central heating) - gross <b>Output to CH</b> (non-condensing) <b>Output to CH</b> (condensing)			7.8 - 25.8 kW 6.7 - 22.6 kW 7.6 - 24.0 kW		
<b>Inlet pressure</b> <b>Gas rate</b> (after 10 mins.)			20 mbar 2.55 m <sup>3</sup> /hr max.		
<b>Gas control differential</b> (offset) <b>CO</b> (average)			0 Pa to - 5 Pa 50 ppm		
<b>Noise</b>			48 DbA (maximum)		
<b>Ventilation Requirements:</b>	High Level Low Level		80 cm <sup>2</sup> to internal space - 40 cm <sup>2</sup> to outside 80 cm <sup>2</sup> to internal space - 40 cm <sup>2</sup> to outside		
<b>Connections</b>	CH Flow & Return DHW Inlet & Outlet Gas Temperature/Press. Relief Valve Condensate Outlet Inlet Control Group  Filling Loop		22 mm compression 22 mm tube end 22 mm compression 22 mm compression from tundish. Flexible Pipe 500 mm long (fits 21.5 mm PP overflow systems) 22 mm compression inlet & outlet Set reduced pressure 2.5 bar, expansion relief valve set 8.0 bar 15 mm /1/2" union (accessible behind lower front panel)		
<b>Secondary Expansion Vessel</b> <b>Automatic bypass</b>			18 litre, pre-charge 2.5 - 2.7 bar (supplied separately) Built in		
<b>Pressure loss warning</b> <b>Built in programmer</b>  <b>External programmer</b> <b>Built-in room thermostat</b> <b>Built in frost protection</b>			Linked to diagnostic display 2-channel, pre-programmed, back lit display, battery back-up Separate times for HW & CH, advance button, CH off selector Optional connectors on user terminal block Dedicated connectors on user terminal block Boiler protected below 5 °C plus external frost 'stat connection		
<b>Optional Immersion Heater</b>			11" Heatrae 'Mega' G1 3/4. 3 kW at 240V, BEAB Approved		
<b>Electricity supply</b> <b>Power Consumption</b> (maximum)			230v ~ 3A fused supply, 166 Watts (Grundfos pump) 156 Watts (Wilco pump)		
<b>Working pressures</b>	Primary DHW Mains Supply Pressure Relief Valve (Primary) Temperature/Press. Relief Valve		0.9 - 2.5 bar 1.0 - 2.5 bar 1.0 - 16.0 bar 3.0 bar Pre-set 95 °C, 10.0 bar opening		
<b>DHW temperature</b> <b>DHW flow rate</b> (Practical maximum assuming suitable mains supply)			45 °C to 65 °C 30 l/m max.	36 l/m max.	48 l/m max.
<b>Weights</b>	Lift Weight Heat Engine Cylinder Full Weight		38 kg 37 kg 166 kg	41 kg 202 kg	49 kg 246 kg

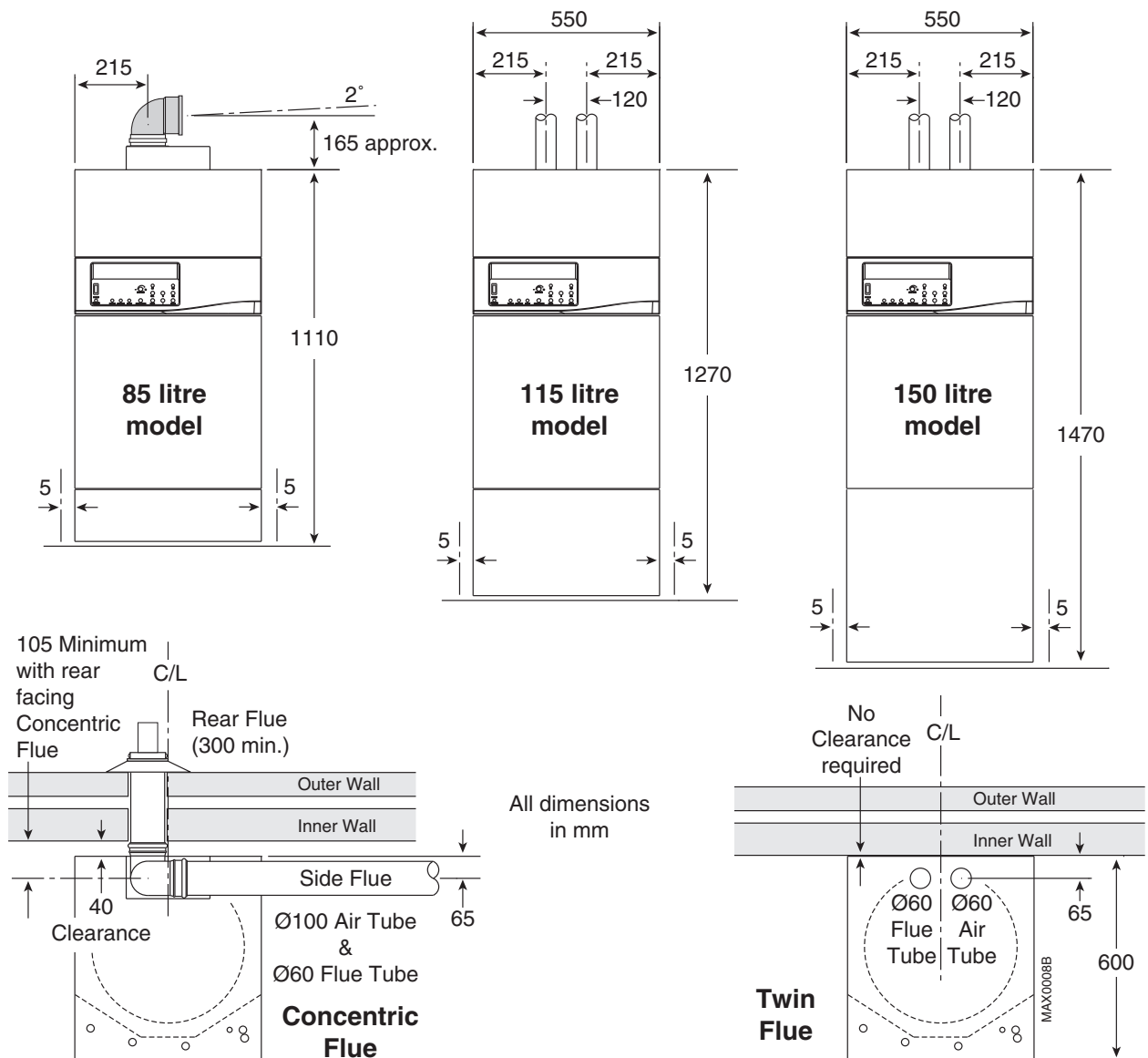


**Typical Bulkhead Installation with rearwards horizontal concentric flue**



**Typical Cupboard Installation with twin vertical air/flue pipes**

Fig. 2



All dimensions in mm

Fig. 3

# Introduction

## Important - Installation, Commissioning, Service & Repair

This appliance must be installed in accordance with the manufacturer's instructions and the regulations in force. Read the instructions fully before installing or using the appliance.

In GB this must be carried out by a competent person as stated in the Gas Safety (Installation & Use) Regulations.

Definition of competence: A person who works for a CORGI registered company and holding current certificates in the relevant ACS modules, or valid ACoP equivalents, is deemed competent.

In IE this must be carried out by a competent person as stated in I.S. 813. "Domestic Gas Installations".

Read the instructions fully before installing or lighting the boiler. See also the separate Installation Instructions for the Powermax HE Flue (Part No. 5106227).

Powermax HE is a floor standing condensing combination boiler which incorporates a hot water store to provide domestic hot water (DHW) and central heating (CH). The DHW temperature is user adjustable (e.g. for summer/winter operation). Operation is automatic and the fully modulating pre-mixed burner ensures that gas is burned cleanly and efficiently within the condensing heat exchanger. An advanced burner control includes flame monitoring, pressure monitoring and other safety features, plus status and diagnostic displays which are large and easy to read.

A small diameter twin pipe flue system has been designed for a length of up to 12.0 metres (including the separate flue and air terminals) through which to draw inlet air and expel exhaust gases. The standard concentric terminal suits a wall thickness of 300 mm to 500 mm.

Installation of this boiler as an unvented hot water system falls within the scope of the Building Regulations 1995 (Part G). These require that installation of an 'unvented' system shall be notified to the local authority Building Control Department; also that the work must be carried out by a competent person as defined in the Approved Document G3. The above requirements do not apply if hot water is obtained via an open vented feed tank.

Samples of the Powermax HE gas boilers have been examined by Advantica Technologies Limited, a United Kingdom Notified Body. The range is certified to comply with the essential requirements of the Gas Appliance Directive 90/396/EEC, the Low Voltage Directive 72/23/EEC and shows compliance with the Electro Magnetic Compatibility Directive 89/336/EEC, the Boiler Efficiency Directive 92/42/EEC and are therefore permitted to carry the CE Mark.

## Operation

The boiler control works on the principle of "hot water priority" so the central heating output may be temporarily delayed if the hot water temperature drops below the selected temperature e.g. after drawing a hot bath. The selected temperature is user adjustable in the range 45° to 65 °C

To suit conventional radiator based central heating systems, the boiler will normally provide a flow temperature of around 80 °C. The boiler control automatically responds to lower central heating loads by reducing the boiler output (which saves wasteful on-off cycling).

This boiler must be installed into a sealed (pressurised) primary system.

Provision is made for fitting both room and frost thermostats if required. **Note:** The boiler has its own in-built frost protection which will seek to prevent the boiler temperature dropping below 5 °C

For summer operation the user can switch off the central heating at the control panel.

## Visible Plumbing

The efficient condensing operation of Powermax HE will naturally cause condensate to form in the flue pipe and plumbing of the condensing gases will be visible during all but the most favourable atmospheric conditions. In installations with long flue runs, some condensate may be discharged from the terminal. The flue terminal must, therefore, be sited to avoid nuisance from either phenomenon.

## Delivery & Kits Available

**Powermax HE** boilers are delivered in three packages (1) the heat engine and unvented accessory kit, (2) the hot water cylinder and (3) the flue kit. The flue kit must be ordered/specified additionally to the boiler.

## Health and Safety Information for the Installer and Service Engineer

Under the Consumer Protection Act 1987 and Section 6 of the Health and Safety at Work Act 1974, we are required to provide information on substances hazardous to health.

This boiler does not contain substances harmful to health; it does not contain asbestos. Small quantities of adhesives and sealants used in the product are cured and present no known hazards.

## Codes of Practice

The appliance is suitable only for installation in GB and IE and should be installed in accordance with the rules in force.

In GB, the installation must be carried out by a CORGI Registered Installer. It must be carried out in accordance with the relevant requirements of the:

- Gas Safety (Installation & Use) Regulations.
- The appropriate Building Regulations either The Building Regulations, The Building Regulations (Scotland), Building Regulations (Northern Ireland).
- The Water Fittings Regulations or Water Byelaws in Scotland.
- The Current I.E.E. Wiring Regulations.

Where no specific instructions are given, reference should be made to the relevant British Standard Codes of Practice.

In IE, the installation must be carried out by a Competent Person and installed in accordance with the current edition of I.S. 813 "Domestic Gas Installations", the current Building Regulations and reference should be made to the current ETCI rules for electrical installation.

In GB the following Codes of Practice apply:

Standard	Scope
BS6891	Specification for low pressure gas pipework in domestic premises.
BS5440 Pt.1	Specification for installation of flues.
BS5440 Pt.2	Specification for installation of ventilation for gas appliances (except that compartment ventilation is amended in section 8 of these instructions).
BS5546	Specification for installation of gas hot water supplies.
BS5449	Specification for forced circulation hot water central heating systems.
BS6798	Specification for installation of gas fired hot water boilers of rated input not exceeding 70kW.

In IE:

I.S. 813 Domestic Gas Installations.

The following BS standards give valuable additional information:

BS6891	Specification for low pressure gas pipework in domestic premises.
BS5546	Specification for installation of gas hot water supplies.
BS5449	Specification for forced circulation hot water central heating systems.

## Schematic Diagram

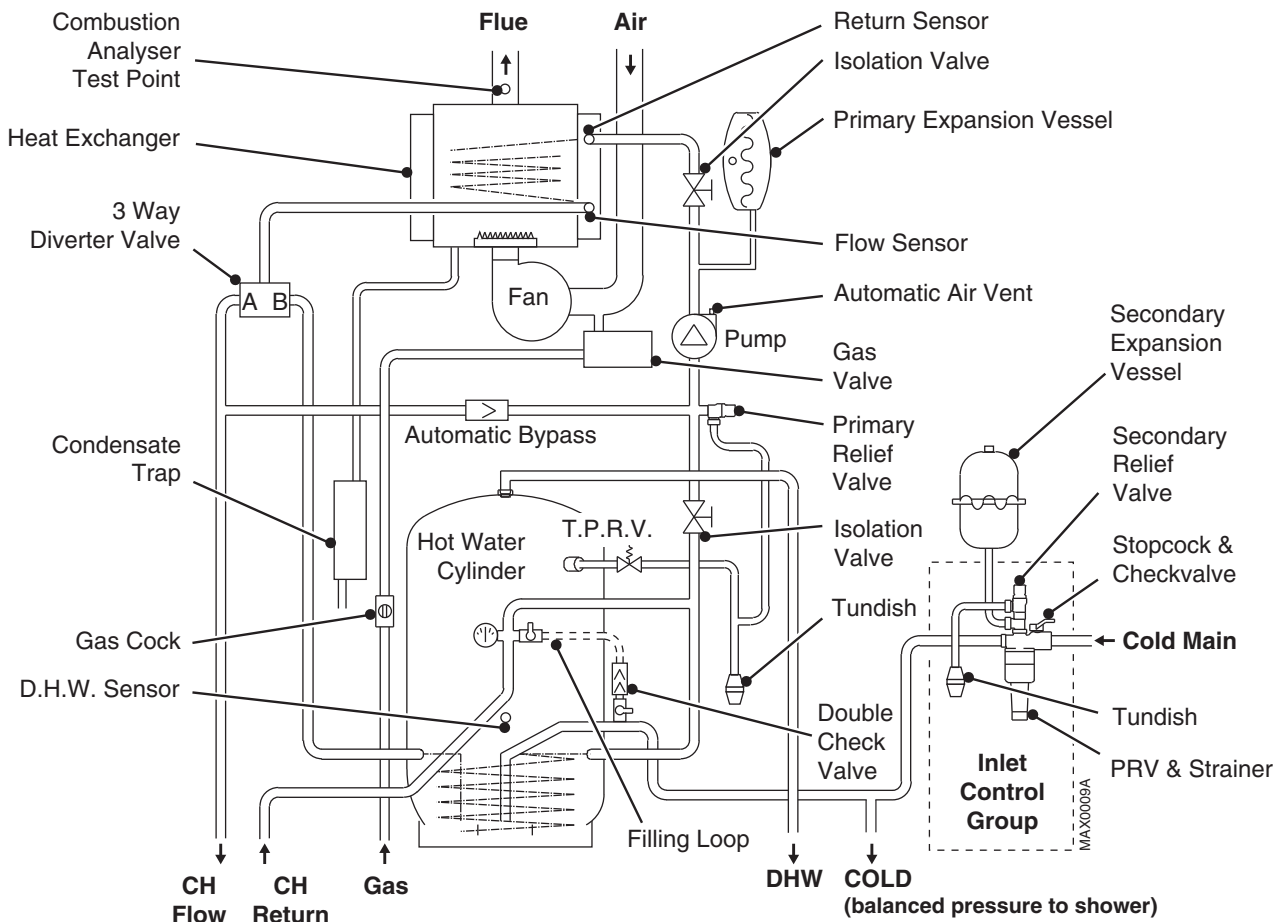


Fig. 4



# 1. Installation Requirements

## Storage, Unpacking & Handling

This boiler is delivered in two sections for safety and ease of handling. Store both the Top (heat engine) and the Bottom (cylinder) under cover in dry conditions.

Remove the Powermax HE unvented Accessory Kit from above the heat engine to reduce lift weight. (The front and top panels can also be removed if required - see Fig. 1 on page 3).

Handholds are provided at the top rear of the heat engine and will assist with removing it from the transport tray. Handholds are provided at both sides and underneath the cylinder.

Use a handling device e.g. sack truck, to manually move either section over long distances. Trucking must be done from the rear. Take particular care to avoid damaging outer panels or programmer.

These items should be lifted and handled by two people. Stooping should be avoided and protective clothing worn when necessary. Carrying and lifting equipment should be used as required for moving Top and Bottom to where they will be assembled and installed..

Determine beforehand whether the Top and Bottom should be assembled to enable the complete unit to be moved into position, or whether to fit the cylinder and then lift the heat engine into position.

The Top has 4 downward facing dowel pins which provide accurate location on to the cylinder. Take care to avoid trapping hands and fingers during assembly.

Take great care when manoeuvring the boiler into its final location and avoid twisting movements of the body. **Do not attempt to carry the complete boiler as the Top is only doweled to the Bottom.**

Dispose of packaging in accordance with environmental guidelines.

### 1.1 Gas Supply

Entry holes are provided in the base and via knockouts in the side panels.

This boiler requires a natural gas supply of 2.6 cubic metres per hour. A 22 mm gas inlet connection is provided at the front and gas supply pipework of not less than 22 mm diameter should be run to the boiler. 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 and must be governed at the meter.

The gas installation should be in accordance with the relevant standards. In GB this is BS 6891. In IE this is the current edition of I.S. 813 "Domestic Gas Installations".

The whole of the gas installation must be checked for soundness and purged in accordance with, in GB, BS 6891 and in IE, I.S. 813 "Domestic Gas Installations".

### 1.2 Electricity Supply

The boiler requires a 230V ~ 50Hz single-phase 3A fused electrical supply. External wiring must be correctly earthed, polarised and in accordance with relevant regulations/rules. In GB this is the current I.E.E. Wiring Regulations. In IE reference should be made to the current edition of the ETCI rules.

Detailed wiring instructions are given in Section 10. Power consumption is approximately 90 - 166 W.

#### **WARNING: THIS BOILER MUST BE EARTHED**

In the event of an electrical fault after installation of the boiler, preliminary electrical systems checks must be carried out i.e. Earth Continuity, Short Circuit, Polarity and Resistance to Earth.

### 1.3 Location of Boiler

The boiler must not be sited outside or in any outhouse where it could be exposed to the weather. Avoid siting the boiler at the highest part of the system.

The boiler must be installed on a flat floor capable of supporting the weight of the unit when full of water – up to 250 kg for the 150 litre model.

It should be sited to minimise the length of flue and to avoid long hot water pipe runs.

The extended flueing capability enables the boiler to be sited well away from an outside wall, thus installation in a first floor cupboard or compartment, basement, utility room or kitchen are all feasible locations.

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



If floor settlement is likely due to the weight of the boiler, ensure that both the flueing and pipework layouts safely provide sufficient flexibility.

If the boiler is to be fitted in a room containing a bath or shower reference must be made to the relevant requirements.

In GB this is the current I.E.E. Wiring Regulations and Building Regulations.

In IE reference should be made to the current edition of I.S. 813 "Domestic Gas Installations" and the current ETCI rules.

## 1.4 Compartment Installation and Ventilation

General guidance for cupboard/compartiment installations, including airing cupboards, is contained in BS 6798. Specific requirements for Powermax are given below.

1. The compartment should be a fixed rigid structure large enough to allow it and the boiler to be inspected and serviced. A minimum width between the door jambs of 560 mm must be provided.
2. Minimum clearances are indicated in Fig.3. A full height compartment door must be at least 15 mm from the front of the boiler and provide 200 mm access height above the boiler.
3. The compartment must be ventilated at high and low level as detailed below.
4. The flue pipe must be protected by the ducting supplied by Potterton or by another no less suitable non-combustible enclosure.
5. With the flue protection duct fitted, additional partitioning is not required. However householders should be discouraged from storing clothes etc. on the boiler itself. A removable shelf at least 75 mm above the boiler is acceptable.
6. The internal surfaces of an understairs cupboard must be lined with non-combustible materials. The door shall have a BS 476 fire resistance of not less than 0.5 hour. Air vents as opposite must be direct to outside air if the building has two or more storeys.

## VENTILATION

1. When the boiler is installed in a room or habitable internal space, there are no specific ventilation requirements.
2. When the boiler is installed in a compartment it is essential that permanent high and low vents are provided for the circulation of cooling air. Purpose made vents must have a non-adjustable free area not less than the minimum specified in the table below.

**Note:** These are approximately 30% of BS 5440:2 recommendations.

Minimum effective area of compartment air vents		
Position of opening	Ventilated to	Area of each vent
High and low level	Room	80 cm <sup>2</sup>
High and low level	Outside	40

## 1.5 Flueing

This is a "room sealed" condensing boiler. Flue systems are supplied in kits, or components can be ordered individually from Potterton. Only Powermax flue components (which are designed for condensing operation) can be used.

### Flue Systems

All boilers are supplied to accept the Powermax 60 mm dia. twin flue system, however several flue system options are available.

Each system is room sealed and offers a choice of flue type and termination method, see Fig. 2.

- Concentric balanced flue with horizontal terminal
- Twin flue with vertical terminal \*
- Twin flue with pitched roof terminal \*
- Twin flue with horizontal mini terminal

Flue kits are available for each of the above options and each kit contains all of the components needed for connection to the boiler and terminal. Flue extension lengths and bends should be purchased separately, as required.

\* These terminals must be ordered/specified separately.

## Flue Protection

When using an extended flue system it is essential to fit protective ducting (such as that supplied in the extended flue kits) in order to prevent direct contact with the hot flue pipe.

## General Requirements for Horizontal Flue Terminations

Detailed recommendations for flueing are given in BS5440: Part 1. The following notes give general guidance. The horizontal balanced flue terminal must be installed so that it is exposed to external air, preferably on a clear expanse of wall. Acceptable positions are indicated in Fig. 3. Avoid positions where the terminal is adjacent to projections; particularly immediately under a balcony, inside a re-entrant position, or immediately adjacent to a drain pipe. If the boiler is fitted under a ventilator or opening window, the terminal must be at least 300 mm from any part of the window or ventilator and in accordance with BS5440: Part 1.

The flue pipe must not be closer than 25 mm to combustible material. Additional clearance must be provided when passing the flue through timber walls. Advice on gas installations in timber framed buildings is contained in IGE technical publication IGE/UP/7 available from the Institution of Gas Engineers, 21 Portland Place, London W1N 3AF.

## Guidance notes for Flue Installation

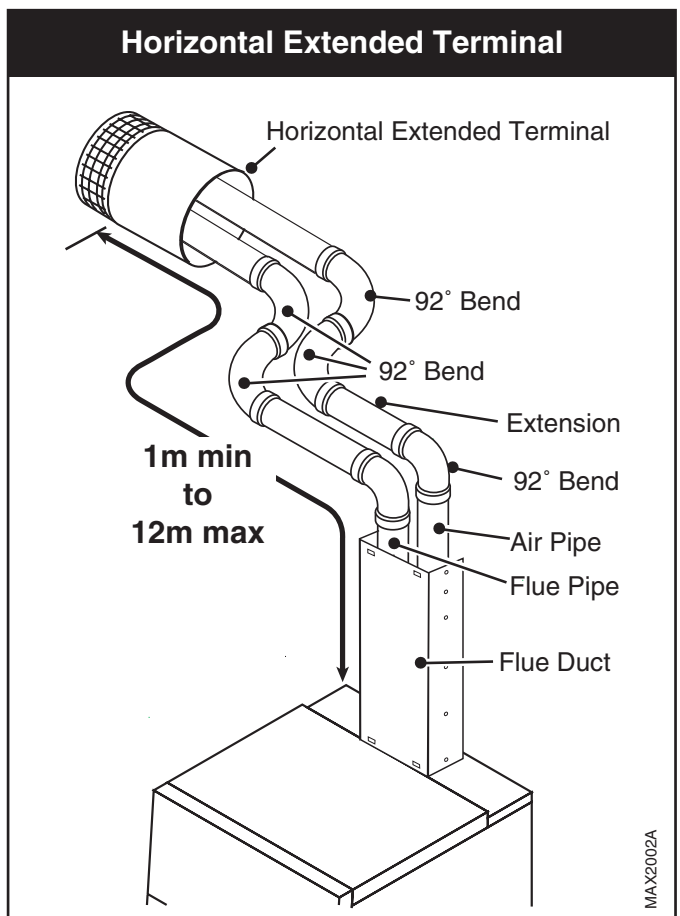
**Read these Installation Instructions before installing the boiler.** Before starting an installation, check that the correct flue kit has been supplied with the boiler.

Detailed recommendations for flue installations are given in BS 5440:1: 2000. The following notes are for general guidance only.

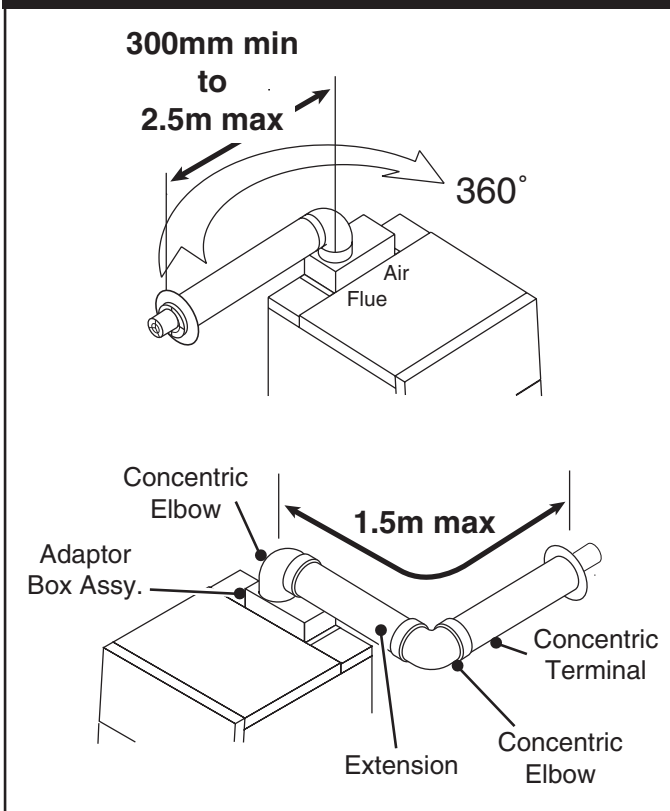
- The flue system must be constructed using only Powermax approved components.
- It is important that the position of the terminal allows free passage of air across it at all times.
- It is **ESSENTIAL TO ENSURE** that products of combustion discharging from the terminal cannot re-enter the building, or any other adjacent building, through ventilators, windows, doors, other sources of natural air infiltration, or forced ventilation / air conditioning.
- The minimum acceptable dimensions from the flue terminal to obstructions and ventilation openings are specified in Figs. 3 & 4 on Page 4 of these instructions.
- If the flue terminal discharges into a pathway or passageway check that combustion products will not

cause nuisance and that the terminal will not obstruct the passageway.

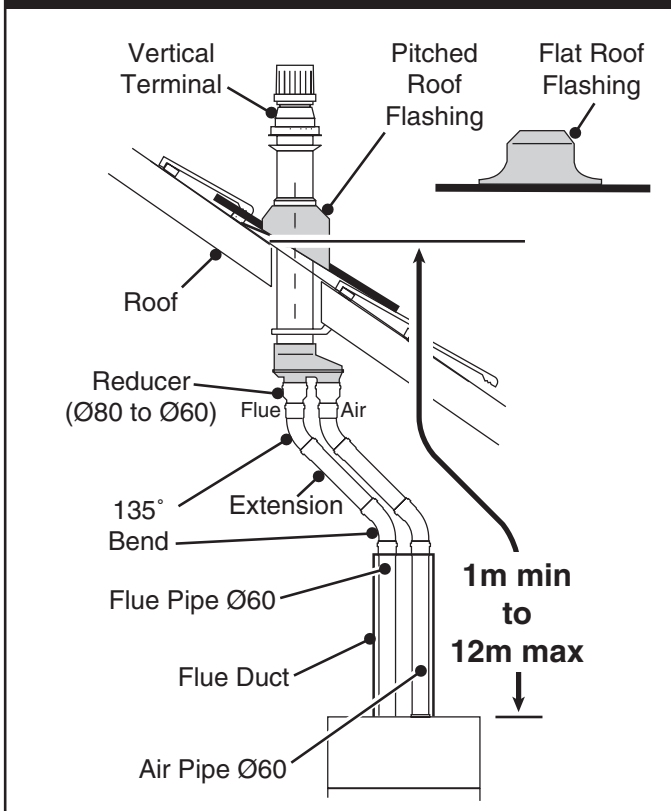
- Where terminals are fitted within 850 mm of a plastic or painted gutter, or 450 mm of painted eaves, an aluminium shield at least 750 mm long must be fitted to the underside of the plastic or painted surface.
- Where installation will be in an unusual location, special procedures may be necessary. BS 6798 gives detailed guidance on this aspect.
- As the Powermax is a condensing boiler the flue duct must have a fall back to the boiler of nominally 2°.
- The efficient condensing operation of the Powermax HE will naturally give rise to condensation in the flue gases and **plumbing will occur in all but the most favourable atmospheric conditions**. Some condensate may also be discharged from the terminal. The terminal must, therefore, be **sited to avoid nuisance from either phenomenon**.
- Where the lowest part of the terminal is less than 2 m above the level of any ground, balcony, flat roof or place to which people have access, the terminal must be protected by a guard of durable material. A Terminal Guard, Part No. P210 is available from Potterton. The guard requires a flat wall surface of approximately 330 mm diameter, concentric with the terminal assembly.



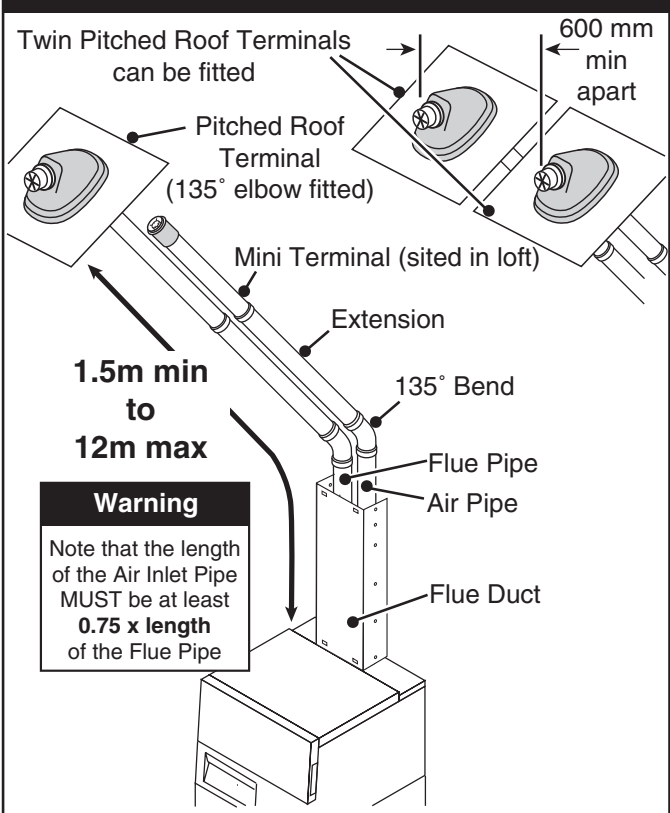
### Concentric Flue Horizontal Terminal



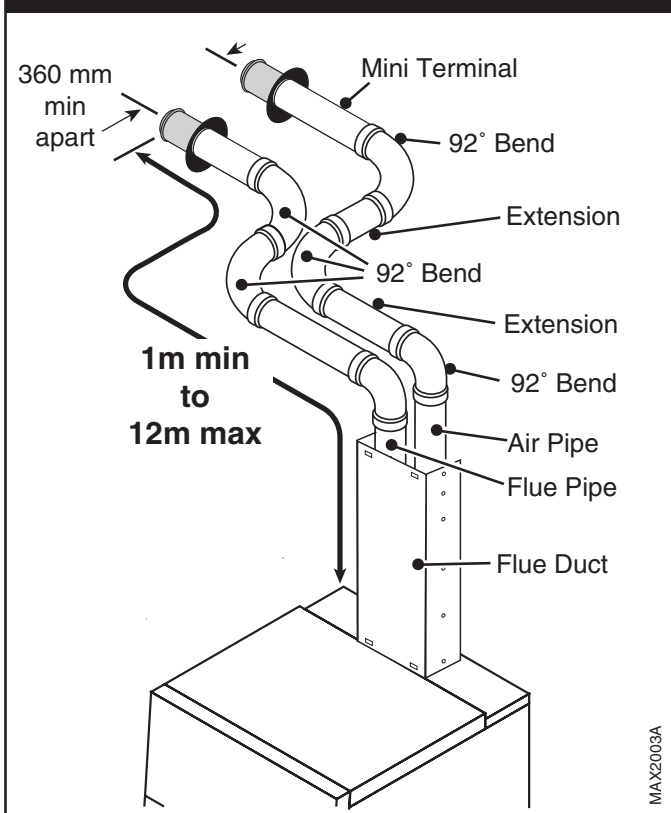
### Twin Flue Vertical Terminal



### Twin Flue Pitched Roof Terminal

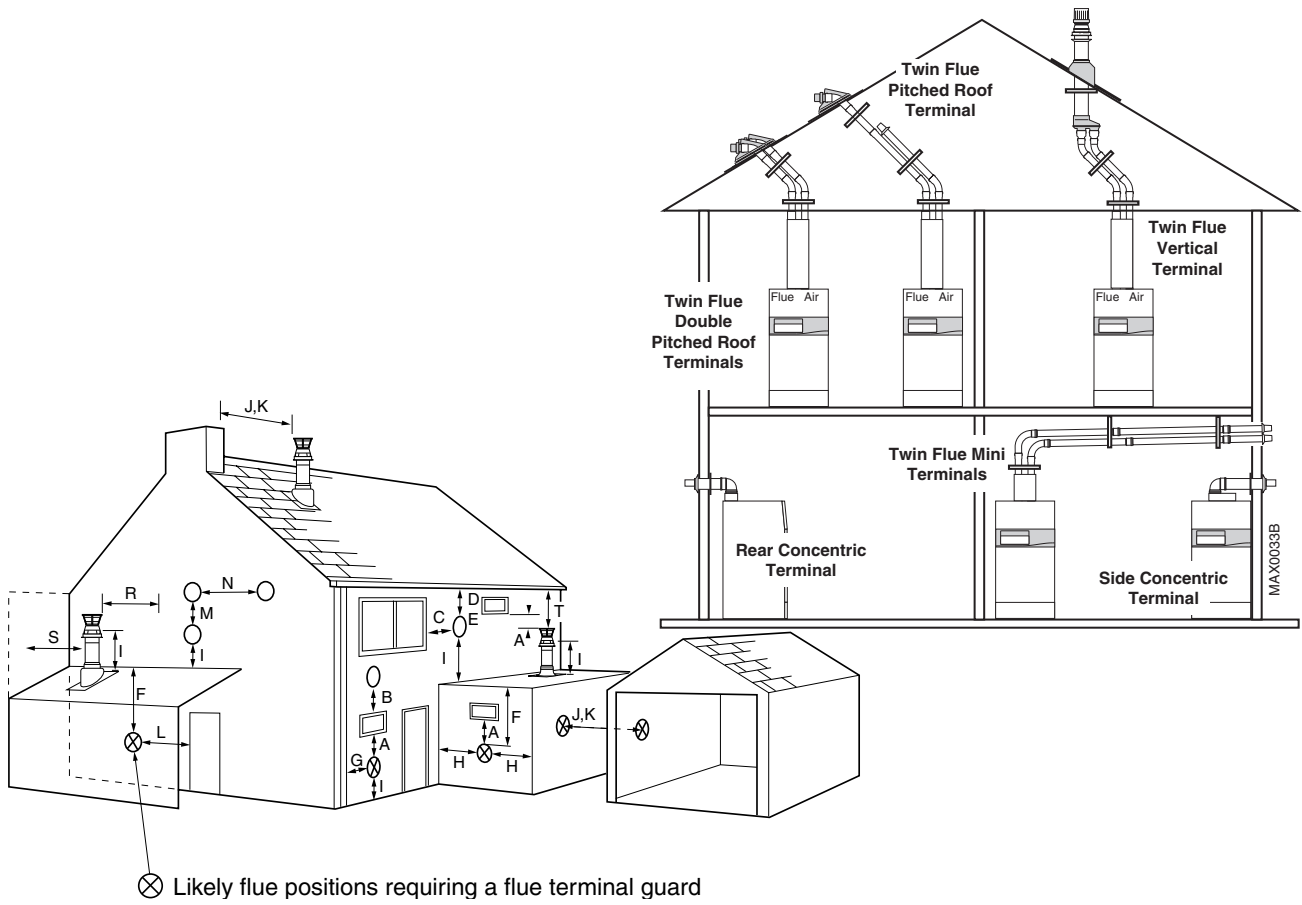


### Twin Flue Mini Horizontal Terminal

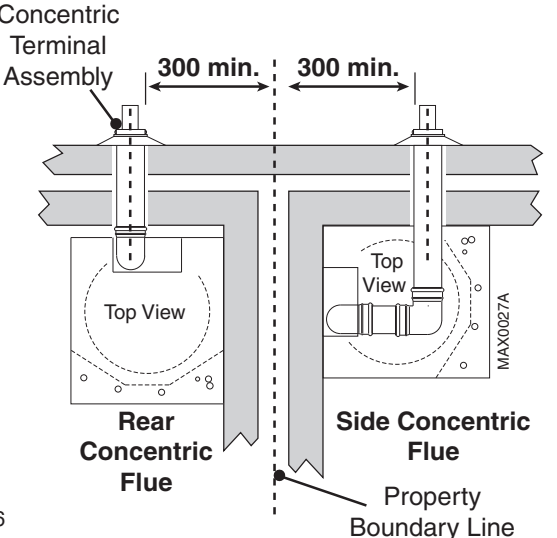
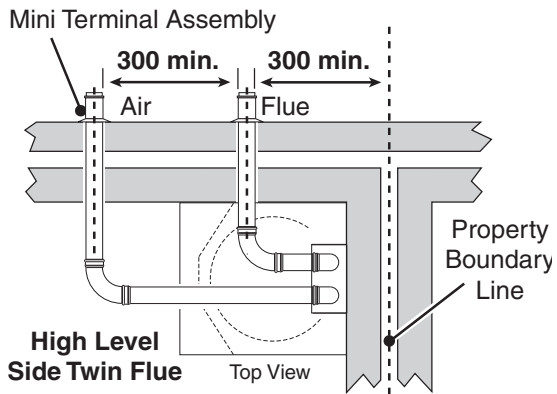


MAX2003A

Fig. 5



⊗ Likely flue positions requiring a flue terminal guard



Terminal Position with Minimum Distance (mm)  
For IE, refer to I.S. 813 "Domestic Gas Installation".

**Fanned Draught Balanced Flue**

<b>A<sup>a</sup></b> Directly below an opening, air brick, opening windows, etc.	300
<b>B<sup>a</sup></b> Above an opening, air brick, opening window, etc.	300
<b>C<sup>a</sup></b> Horizontally to an opening, air brick, opening window, etc.	300
<b>D</b> Below gutters, soil pipes or drain pipes.	75
<b>E</b> Below eaves.	200
<b>F</b> Below balconies or car port roof.	200
<b>G</b> From a vertical drain pipe or soil pipe.	150
<b>H</b> From an internal or external corner.	300
<b>I</b> Above ground, roof or balcony level.	300
<b>J</b> From a surface facing a terminal.	600
<b>K</b> From a terminal facing the terminal.	1200
<b>L</b> From an opening in a <i>carport</i> (e.g. door, window) into the dwelling.	1200
<b>M</b> Vertically from a terminal on the same wall.	1500
<b>N</b> Horizontally from a terminal on the same wall.	300
<b>R</b> From adjacent wall to flue (vertical only).	210
<b>S</b> From internal corner to flue (vertical only).	230
<b>T</b> Below eaves or balcony (vertical only).	600

<sup>a</sup> In addition, the terminal should not be nearer than 150 mm to an opening in the building fabric formed for the purpose of accommodating a built-in element such as a window frame. See BS 5440 Pt. 1.

**Note:** The distance from a fanned draught appliance terminal installed parallel to a boundary may not be less than 300 mm in accordance with the diagram on the left.

Fig. 6

## 1.6 Water Supply

### Mains Supply Requirements

It is essential that the mains supply pressure and flow availability are capable of meeting both the hot and cold water services demand.

Unless consistently high mains pressures are available, it is unlikely that a mains service pipe of less than 22 mm OD (copper) or 25 mm OD (Blue MDPE) will provide an adequate flow rate to the system.

A multi-function Inlet Control Group is supplied with every Powermax HE. To ensure safe and splash free operation, mains water must be supplied to the boiler via the Inlet Control Group as indicated in Fig. 11 on Page 18.

Powermax HE is not recommended for unvented use where the prevailing mains pressure is below 1.0 bar. It is recommended that a 22 mm draw-off is provided from which 15 mm or smaller pipes can then be used to supply hot water services to individual terminations to give a balanced distribution system.

### Terminal Water Fittings

Always tee the cold feed to shower fittings (and other mixer fittings) into the pipe supplying the hot water store i.e. downstream of the Inlet Control Group. This will ensure a balanced pressure supply to the shower(s).

Taps - Ensure that all terminal fittings will withstand mains pressure.

Showers - Thermostatic shower mixers are recommended to optimise performance; these must be suitable for use at mains pressure. The 'Showermax' thermostatic shower kit is recommended for use with this boiler.

**Note:** Shower fittings should comply with the backflow prevention requirements (Para. 15, Schedule 2) of the Water Supply Regulations 1999.

### Use in Hard Water Areas

In the UK., water is drawn from diverse sources some of which have high levels of natural hardness. If not dealt with effectively, the scaling associated with hard waters can adversely affect hot water performance. As a general guide, if the temporary hardness exceeds 200 mg/l, then some form of water treatment device is required. The ultimate solution is an ion-exchange (salt regenerated) water softener. In addition to protecting the Powermax heat exchanger against the effects of limescale, an ion-exchange softener offers users other benefits and should be specified with an appropriate flow rate capacity.

Water "conditioning" devices such as those which dose the incoming water with food grade polyphosphates can be effective in reducing limescale but require correct

siting and regular replenishment to remain operational. They should generally not be fitted where heat could impair their performance. Other types of device can inhibit scale formation but their effectiveness may vary. The manufacturers of any water conditioning device should be consulted regarding its suitability for the application and the particular water supply to the installation address.

Record the type of conditioner being used in "Benchmark" log book.

### Treatment of Water Circulating Systems

All water circulating systems will be subject to corrosion unless an appropriate water treatment is applied. Without treatment the efficiency of the system will deteriorate as corrosion sludge accumulates within the system, risking damage to pump and valves, boiler noise and circulation problems.

For optimum performance after installation this boiler and its associated central heating system must be flushed in accordance with the guidelines given in BS 7593:1992. "Treatment of water in domestic hot water central heating systems". This must involve the use of a proprietary cleanser, such as GE Betz Sentinel X300 or X400, Fernox Superfloc or Salamander System Cleanser. Full instructions are supplied with the products, but for immediate information please contact GE Betz (0044 (0)151 420 9563), Fernox (0044 (0)1799 550 811) or Salamander (0044 (0)121 378 0952) directly.

For long term protection against corrosion and scale, after flushing dose the system with an inhibitor such as GE Betz Sentinel X100, Fernox MB-1 or Copal or Salamander System Inhibitor in accordance with the guidelines given in BS 7593:1992.

**Failure to flush and add inhibitor to the system will invalidate the appliance warranty.**

### Sealed Primary Systems

This boiler must be installed into a sealed primary system. As a general guide systems of up to 7-9 radiators will operate satisfactorily with the 12 litre expansion vessel built into the boiler.

- **Guidance on expansion vessel sizing**

These notes explain how to calculate the total expansion vessel volume required, based on the size and the initial cold fill pressure of the system. If the required volume exceeds that of the vessel fitted to the boiler then an additional vessel should be installed, on the return connection from the heating system. The charge pressure of any additional vessel is assumed to be 1.0 bar, the same as the vessel fitted to the boiler.



If the initial cold fill pressure is 1.0 bar:  
expansion vessel size = 0.11 x system volume

This fill pressure will allow the maximum expansion capacity, though any minor loss of water will result in a rapid pressure drop. An additional expansion vessel is only required if the total system volume exceeds 106 litres.

This includes the 5.5 litre primary circuit volume within the Powermax HE boiler - thus radiator and pipework volume should not exceed 100 litres.

### Pipework above boiler

Air vents must be fitted at the highest positions on flow and return pipes and at any point where air is likely to collect.

### TRV's in System

An automatic bypass valve is built into the boiler to allow thermostatic radiator valves to be fitted. This can be switched into or out of circuit as required.

## 1.7 Discharge Pipework

It is a requirement of Building Regulation G3 that any discharge from an unvented system is conveyed to where it is visible, but will not cause danger to persons in or about the building. The tundish and discharge pipes should be fitted in accordance with the requirements and guidance notes of Building Regulation G3. The G3 Requirements and Guidance section 3.9 are reproduced in the following sections. Information Sheet No. 33 available from the British Board of Agreement gives further advice on discharge pipe installation. For discharge pipe arrangements not covered by G3 Guidance or BBA Info Sheet No.33 advice should be sought from either your local Building Control Officer or Potterton.

**G3 Requirement** "...there shall be precautions ... to ensure that the hot water discharged from safety devices is safely conveyed to where it is visible but will not cause danger to persons in or about the building."

### G3 Guidance SECTION 3.9

The discharge pipe (D1) from the vessel up to and including the tundish is generally supplied by the manufacturer of the hot water storage system. Where otherwise, the installation should include the discharge pipe(s) (D1) from the safety device(s). In either case the tundish should be vertical, located in the same space as the unvented hot water storage system and be fitted as close as possible and within 500 mm of the safety device e.g. the temperature relief valve. **Note:** *The tundish is factory fitted during manufacture of the Powermax HE.* The discharge pipe (D2) from the tundish should terminate in a safe place where there is no risk to persons in the vicinity of the discharge, preferably be of metal and:

a. be at least one pipe size larger than the nominal outlet size of the safety device unless its total equivalent hydraulic resistance exceeds that of a straight pipe 9m long i.e. discharge pipes between 9m and 18m equivalent resistance length should be at least two sizes larger than the nominal Outlet size of the safety device, between 18 and 27m at least 3 sizes larger, and so on. Bends must be taken into account in calculating the flow resistance. Refer to Fig. 7, Table 1 and the worked example.

An alternative approach for sizing discharge pipes would be to follow BS 6700:1987 Specification for design installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Appendix E. section E2 and table 21.

b. have a vertical section of pipe at least 300 mm long, below the tundish before any elbows or bends in the pipework.

c. be installed with a continuous fall.

d. have discharges visible at both the tundish and the final point of discharge, but where this is not possible or practical, there should be clear visibility at one or other of these locations. Examples of acceptable discharge arrangements are:

- i. ideally below a fixed grating and above the water seal in a trapped gully.
- ii. downward discharges at low level; i.e. up to 100mm above external surfaces such as car parks, hard standings, grassed areas etc. are acceptable providing that where children may play or otherwise come into contact with discharges a wire cage or similar guard is positioned to prevent contact, whilst maintaining visibility.
- iii. discharges at high level; e.g. into a metal hopper and metal down pipe with the end of the discharge pipe clearly visible (tundish visible or not) or onto a roof capable of withstanding high temperature discharges of water and 3m from any plastic guttering system that would collect such discharges (tundish visible).
- iv. where a single pipe serves a number of discharges, such as in blocks of flats, the number served should be limited to not more than 6 systems so that any installation discharging can be traced reasonably easily. The single common discharge pipe should be at least one pipe size larger than the largest individual discharge pipe (D2) to be connected. If unvented hot water storage systems are installed where discharges from safety devices may not be apparent i.e. in



dwellings occupied by blind, infirm or disabled people, consideration should be given to the installation of an electronically operated device to warn when discharge takes place.

**Note:** The discharge will consist of scalding water and steam. Asphalt, roofing felt and non-metallic rainwater goods may be damaged by such discharges.

**Worked example of discharge pipe sizing**

The example below is for a G1/2 temperature relief valve with a discharge pipe (D2) having 4 No. elbows and length of 7 m from the tundish to the point of discharge.

From Table 1:

Maximum resistance allowed for a straight length of 22mm copper discharge pipe (D2) from a G1/2 temperature relief valve is 9.0 m.

Subtract the resistance for 4 No. 22 mm elbows at 0.8m each = 3.2 m.

Therefore the permitted length equates to: 5.8 m.

5.8 m is less than the actual length of 7 m therefore calculate the next largest size.

Maximum resistance allowed for a straight length of 28 mm pipe (D2) from a G1/2 temperature relief valves equates to 18 m.

Subtract the resistance of 4 No. 28 mm elbows at 1.0 m each - 4.0 m.

Therefore the maximum permitted length equates to: 14 m.

As the actual length is 7 m, a 28 mm min. (D2) copper pipe will be satisfactory.

**Warnings**

- Under No circumstances should the factory fitted Temperature/Pressure Relief Valve be removed other than by Authorised Potterton personnel. To do so will invalidate any warranty or claim.
- The cold water Inlet Control Group must be fitted to the mains water supply to the Powermax HE when it is operated as an unvented system.
- Control and safety valves MUST NOT be tampered with.
- The discharge pipe MUST NOT be blocked or used for any other purpose.
- The tundish must not be removed but can be sited outside the RH panel using the opening provided.
- Electrical components must not be sited near the tundish.

Valve outlet size	Minimum discharge pipe D1	Minimum discharge pipe D2 from tundish	Maximum resistance allowed, expressed as a length of straight pipe (i.e. no elbows or bends)	Resistance created by each elbow or bend
G1/2	15 mm	22 mm 28 mm 35 mm	up to 9 m up to 18 m up to 27 m	0.8 m 1.0 m 1.4 m
G3/4	22 mm	28 mm 35 mm 42 mm	up to 9 m up to 18 m up to 27 m	1.0 m 1.4 m 1.7 m
G1	28 mm	35 mm 42 mm 54 mm	up to 9 m up to 18 m up to 27 m	1.4 m 1.7 m 2.4 m

Table 1. Sizing of copper discharge pipe (D2) for common temperature relief valve outlet sizes. **Note:** shaded area is reproduced for completeness but does not apply to this boiler.

**Typical Discharge Pipe Arrangement**

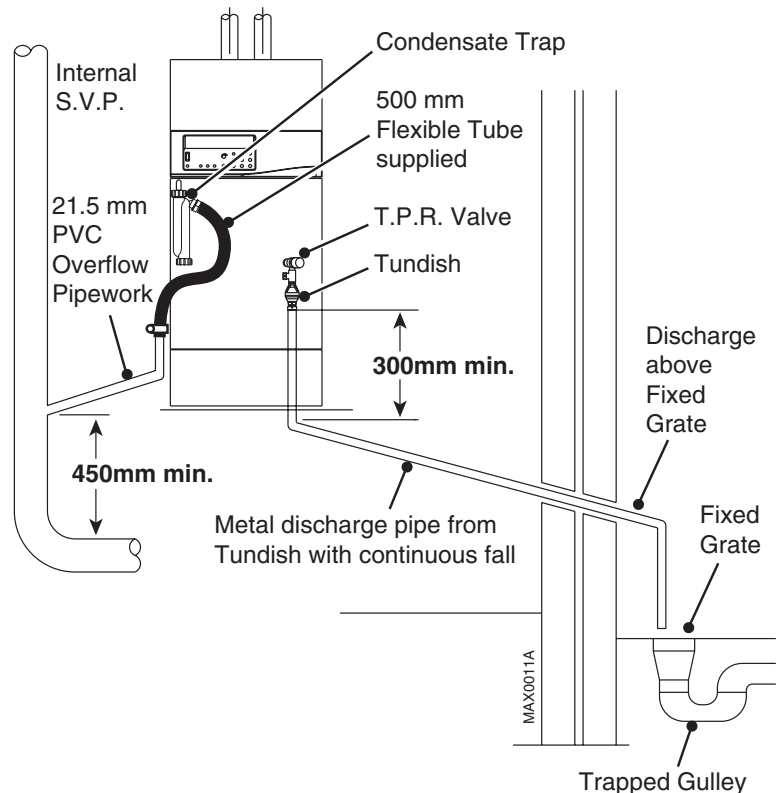


Fig. 7

## 2. Installation

### 2.1 Install the boiler

Before starting an installation, check that the correct flue kit and correct capacity cylinder have been supplied.

**Important: When soldering plumbing fittings, do not allow flame from blowtorch to come into contact with the insulating foam or other non-metallic parts.**

Guidance on where to locate the boiler is given in Sections 1.3 and 1.5. **In some instances it will be advantageous to pre-plumb pipework or to pre-fix terminal, air/flue pipes and duct.**

1. Remove top and front panels (see Page 3) and carefully set aside.
2. Determine boiler final position. The cutaway in the cylinder base allows pipework to be brought up from below floor level. Use the dimensions below or the template on the reverse of the Installation Guide to pre-drill any holes. Pipes must not obstruct service access to the immersion heater (if fitted) or to the condensate trap.
3. Move boiler into position. The need to move as Top and Bottom sections or as a complete assembly will depend on the individual installation. The Top has 4 downward facing dowel pins which provide accurate location on to the cylinder. Take care to avoid trapping hands and fingers during assembly.
4. **Apply sealant to cone faces** of both 22mm Union Nuts (see Fig. 10). Remove cardboard pipework support. Attach the 15mm x 90° branch pipe joining the two relief valves/tundish.

5. Release DHW temperature sensor and un-roll cable. Route cable behind cylinder pipes and push sensor fully home (approx. 310mm - 12") into the pocket in the cylinder.
6. Remove small knock-outs as required either side of casing for plumbing access. The handholds in the side panels can also be used. Further access holes allow the condensate to be routed via the LH panel and the DHW to be plumbed via the RH panel.

### 2.2 Connect the Flue System

1. Unless already fitted, install the flue system as shown in the Installation Instructions supplied with the flue kit.

### 2.3 Connect the Gas Supply

1. Ensure that the gas supply is isolated.
2. The gas connection to the boiler is 22 mm. Refer to Section 1.1 for information on the required gas supply. **Do not turn the gas supply on at this stage.**

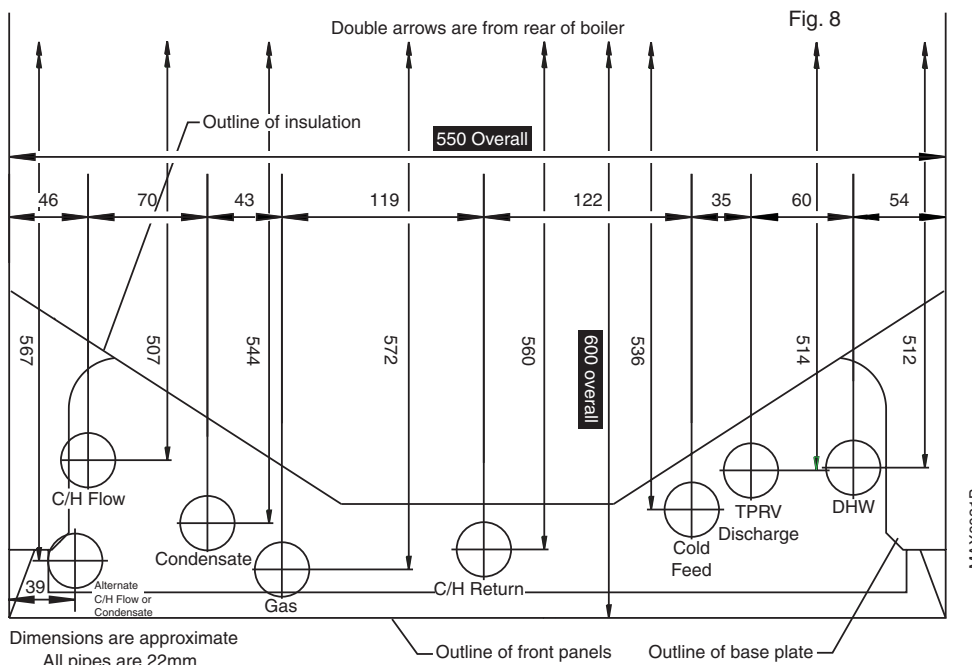
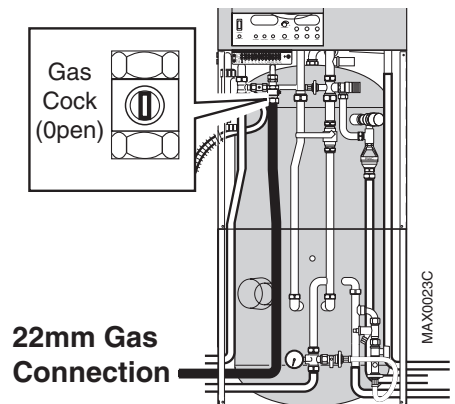


Fig. 9

Fig. 8

### Component & Connection Identification

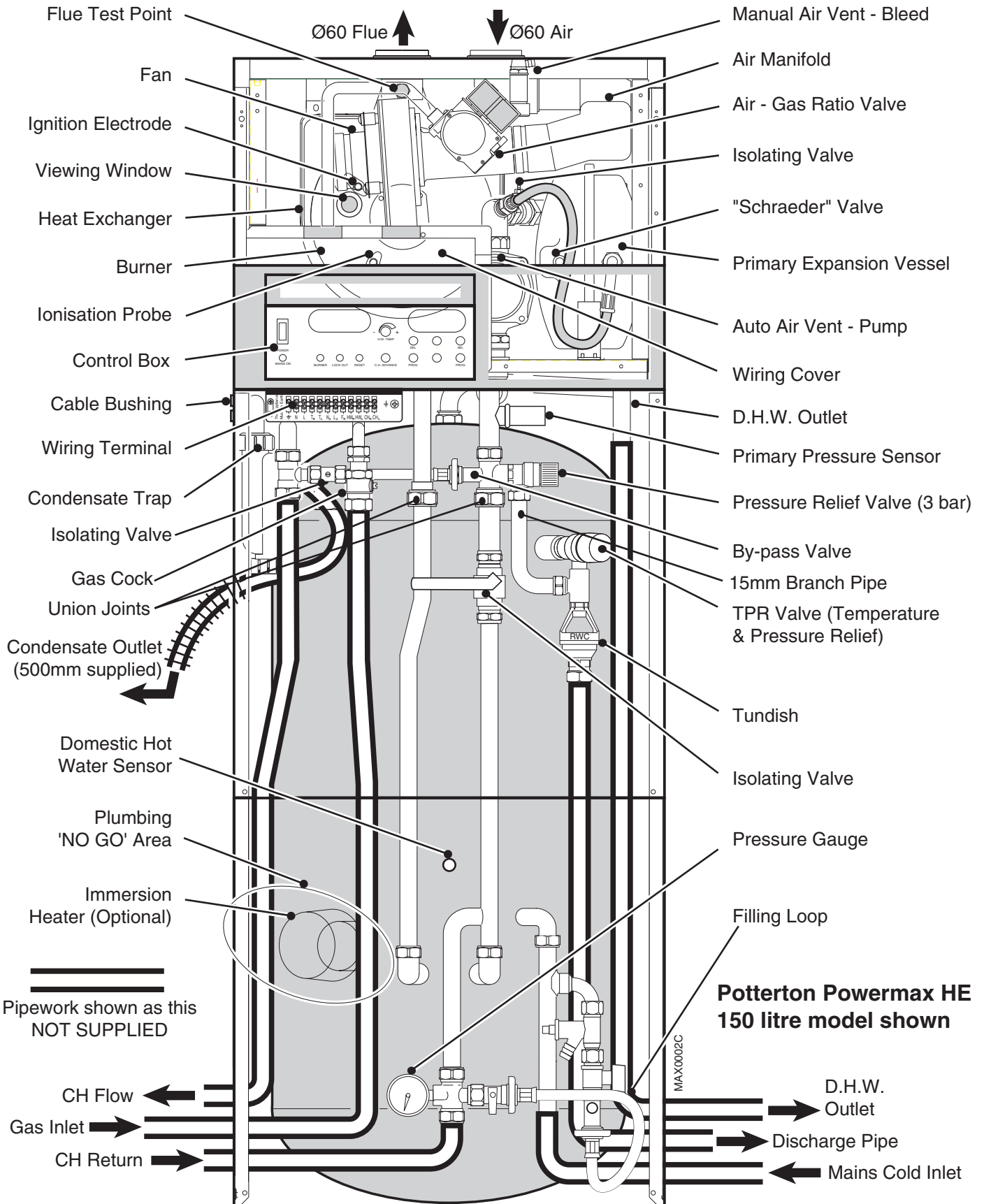


Fig. 10

## 2.4 Connect the Water System

See Figs. 10 and 11. Observe guidance provided in Section 1.6. Always tee the cold feed to shower fittings (and other mixer fittings) into the pipe supplying the hot water store i.e. downstream of the Inlet Control Group. This will ensure a balanced pressure supply to the shower(s).

Future maintenance and servicing operations will be simplified if the Inlet Control Group can be mounted above the DHW store as indicated in Fig. 11. Both the Inlet Control Group and the expansion vessel can be sited away from the boiler e.g. to supply reduced pressure to all the system, but it is essential that no valve is fitted in-line between the store and either of these components.

### Solder Flux

Use water-soluble flux for making soldered capillary joints in the primary circuit. Traditional grease-based flux containing zinc chloride must not be used.

### CH System Connections

The flow connection is on the LH side of the unit as indicated. The return connection is low down at the front centre. Pipework can be run inside the casing but must not prevent the removal of the immersion heater (if fitted) or obstruct access to condensate trap.

### Pressure Relief Valve

A pressure relief valve set at 3.0 bar is fitted to the primary pipework near the top of the tank. See Fig. 10.

### Manual Air Vent

Using the manual air vent, **thoroughly vent air from top of the heat exchanger** when filling the system to save time during the boiler commissioning. **Note:** 1/4" dia. manometer tube fits the manual vent.

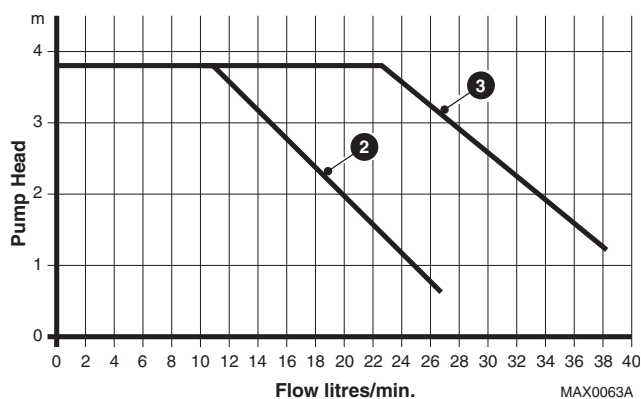
### Central Heating Pump & System By-pass

The central heating pump is factory fitted and an automatic system by-pass is provided. The boiler can be used in systems controlled by thermostatic radiator valves (TRVs) but it is essential that the by-pass isolating valve is fully open.

The circulating pressure and flowrate available for the central heating system is shown opposite with the by-pass in circuit.

For most systems, pump speed 2 will suffice. Using speed 1 will impair domestic hot water recovery. **Speed 3 will be required for high resistance systems** such as those controlled by TRVs and/or utilising plastics minibore pipework.

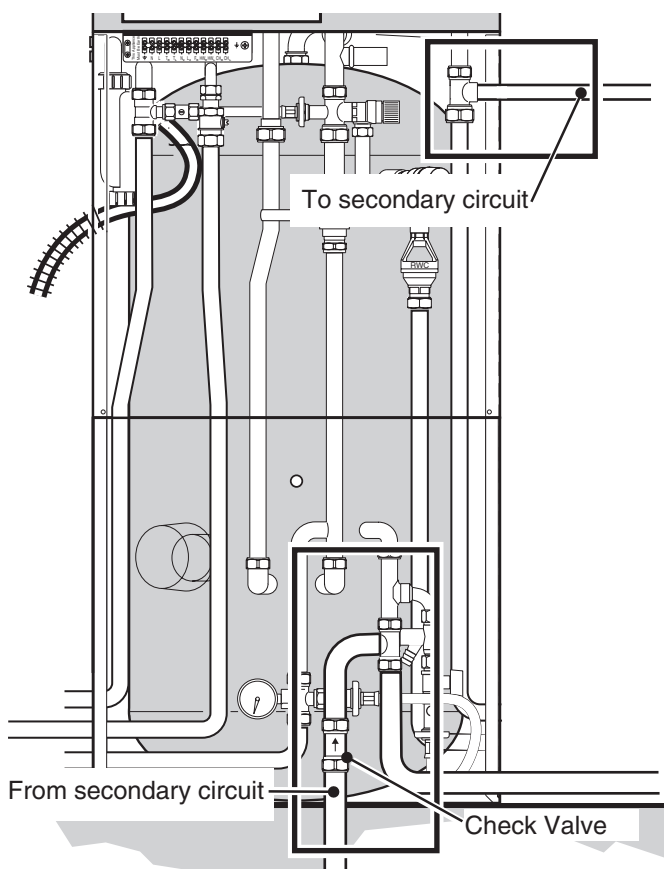
Graph of Central Heating Head vs. Flow



### Secondary Circulation

A pumped secondary circuit, if required, can be connected by teeing into the 22 mm DHW Outlet pipe and the 22 mm Cold Inlet pipe. **Note:** This is not recommended for models having a secondary store of less than 150 litres.

A single check valve (spring loaded type) should be fitted in the return from the secondary circuit. All component parts of a secondary circuit must be suitable for operation at temperatures up to 65 °C and pressures up to 8 bar.



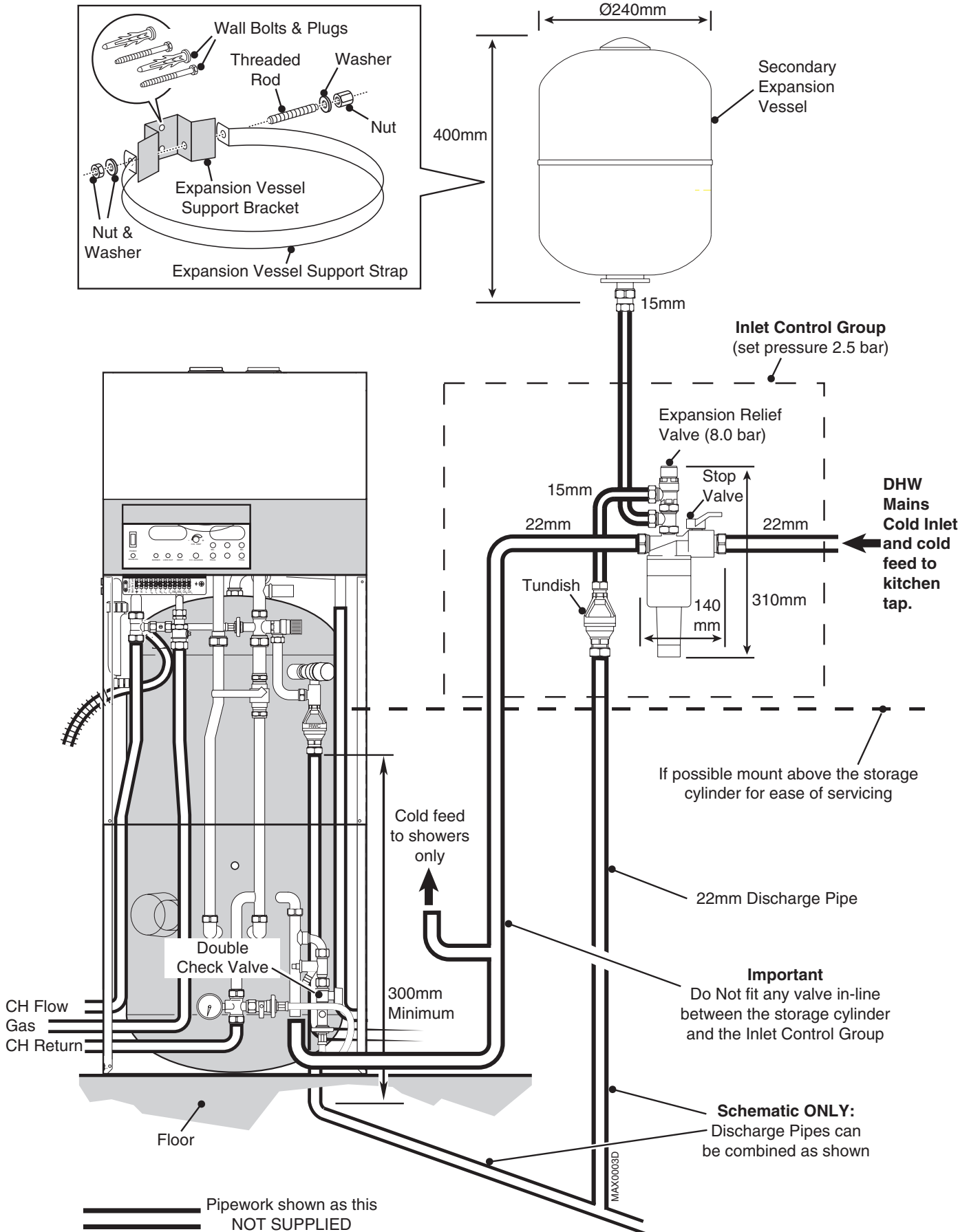


Fig. 11

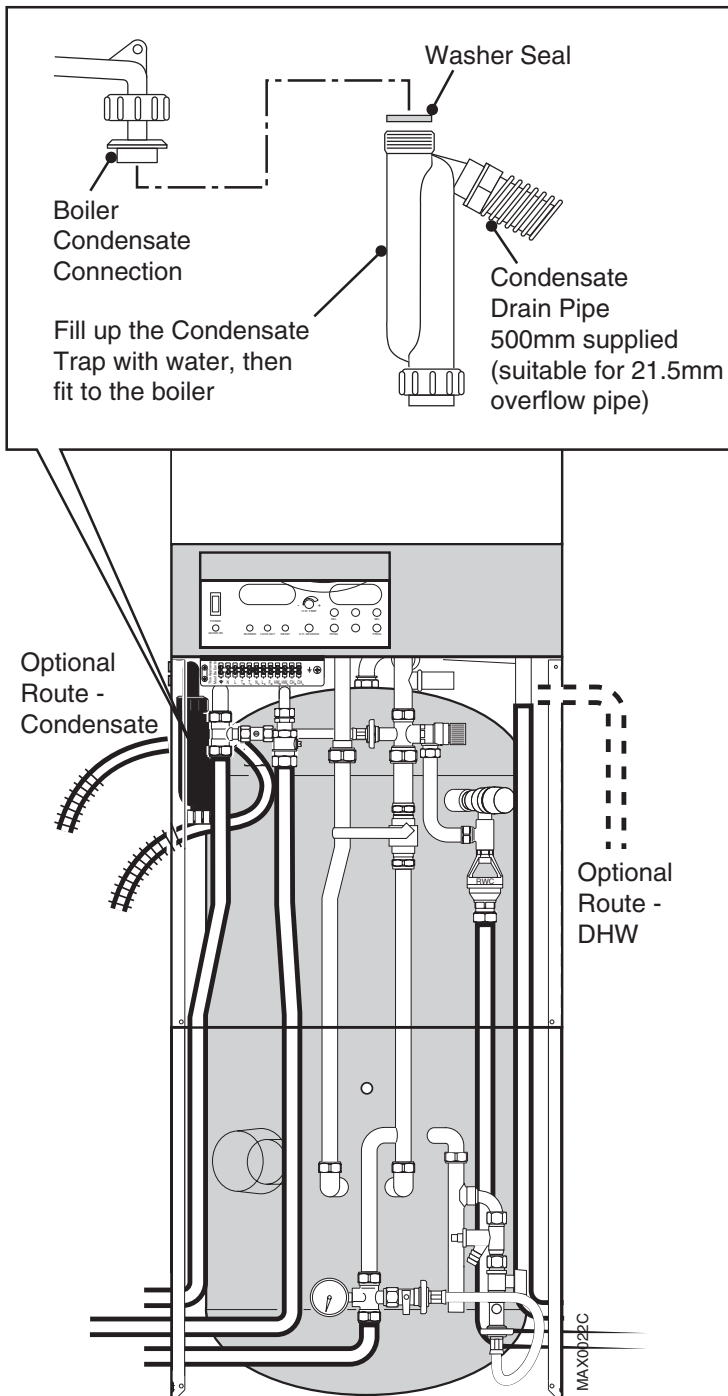


Fig. 12

## 2.5 Condensate Drain Pipe

Before fitting, fill the condensate trap with water.

The condensate pipe should be run in 21.5/22.0 mm diameter plastic material suitable for operation at 60° C. Solvent weld PVC overflow is recommended or a PP system can be used. Copper tube must not be used. Do not use push-fit plastic pipe.

Use the flexible pipe provided to connect to 21.5mm PVC pipe; alternatively a Marley or Plumb Center elbow can be used to direct the condensate pipe through the LH side panel (see Fig. 12). When using the Osma PVC overflow system, a 3/4 -to-22mm adaptor No. 158 may be required.

Internal pipework should have a bore diameter no smaller than 14 mm.

External pipework should be kept to a minimum, and have a bore diameter no smaller than 32 mm. Ideally the condensate pipe should be run internally to the house soil and vent stack or to a waste pipe.

Alternatively, the condensate may be discharged into the rainwater system, or a purpose-built soakaway.

All connecting drainage pipework must have a fall of at least 50 mm per metre run.

It is recommended that the pipe is insulated if run externally to minimise the effects of freezing, and that a plastic insert is fitted that provides a siphon/weir action to encourage the water to flow in intermittent bursts rather than dripping continuously.

Note: Connection of a condensate pipe to a drain may be subject to local building regulations.

See Page 19 for a typical example.

## 2.6 Connect the Power Supply

**WARNING – THIS BOILER MUST BE EARTHED**

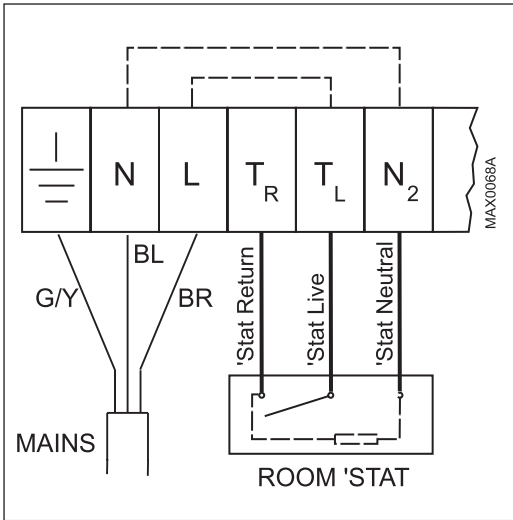
Wiring must comply with the current IEE Wiring Regulations. The supply cable must be 3-core 0.75sq. mm (24/0.2 mm) to BS6500 Table 16.

The supply must be of 230V – 50Hz. A 3A-fused double pole-isolating switch may be used, having a minimum contact separation of 3 mm in both poles, providing it serves only the boiler and its system controls. Alternatively a 3A 3 pin fused plug may be used.

The wiring diagram is shown in Fig. 25, Page 36. Note that the boiler control is fitted with two internal 3.15A “slow blow” fuses (20 mm x 5 mm).



1. Connect the incoming electricity supply cable to the user terminal as shown below ensuring that the green/yellow earth conductor is longer than the blue neutral and brown live conductors. Secure the cable to the anchorage clamp and route via the bushing in the L.H. side panel.
2. Connect the cable from any external control e.g. room thermostat, or frost thermostat and route via lower LH side of unit.

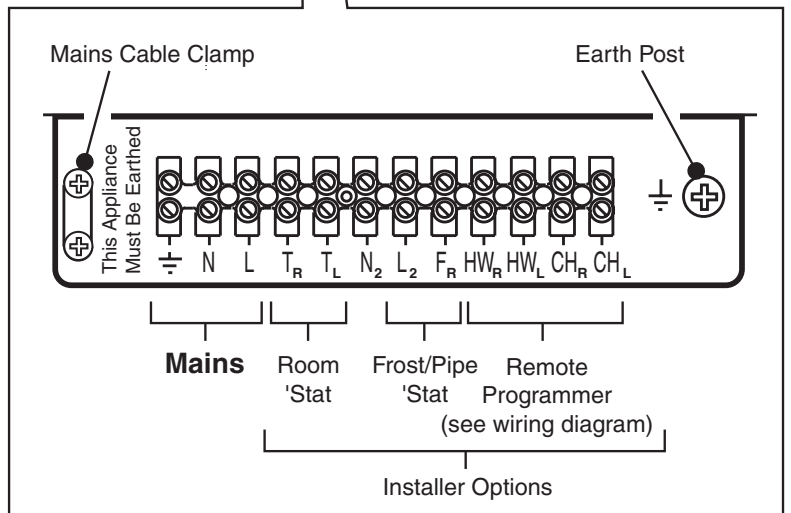
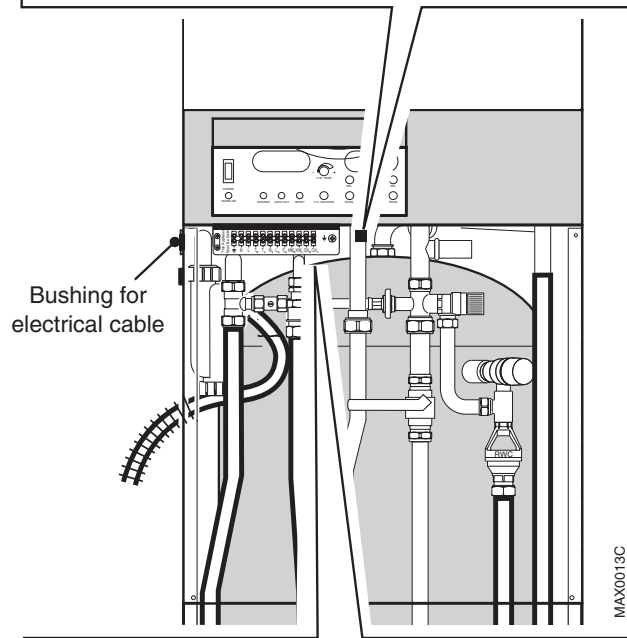
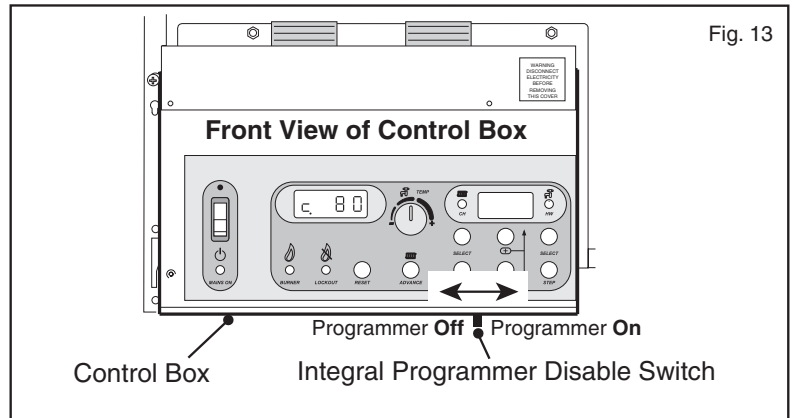


3. The integral programmer can be replaced by one sited away from the boiler if required. It is recommended that it should be of a type having volt free contacts. Wiring connections are indicated in Fig. 25, Page 36. When using an external programmer, the integral programmer must be disabled, see Fig. 13.
4. If a combined clock thermostat is being used to control the central heating, it should be of a type having voltage free contacts. Permanent live and additional neutral connections are available as shown (Fig. 13) for supplying power to the clock.

**Important:** Be certain before switching on for the first time that Earth, Live, Neutral and Thermostat connections are correctly connected and identified.

**Important:** If wired incorrectly, the boiler control may fail when power is applied. This is not covered by the warranty and is replaceable on a chargeable basis.

5. After completing the electrical connections, perform the following electrical system safety checks:
  - A - EARTH CONTINUITY
  - B - POLARITY
  - C - RESISTANCE TO EARTH
  - D - SHORT CIRCUIT



**Important:** If you intend to use an external programmer to control this boiler then the integral programmer must be switched off as shown above

If a frost thermostat is situated in an outhouse or garage, it is advisable to use a pipe 'stat, wired in parallel, to switch off the boiler

Fig. 13

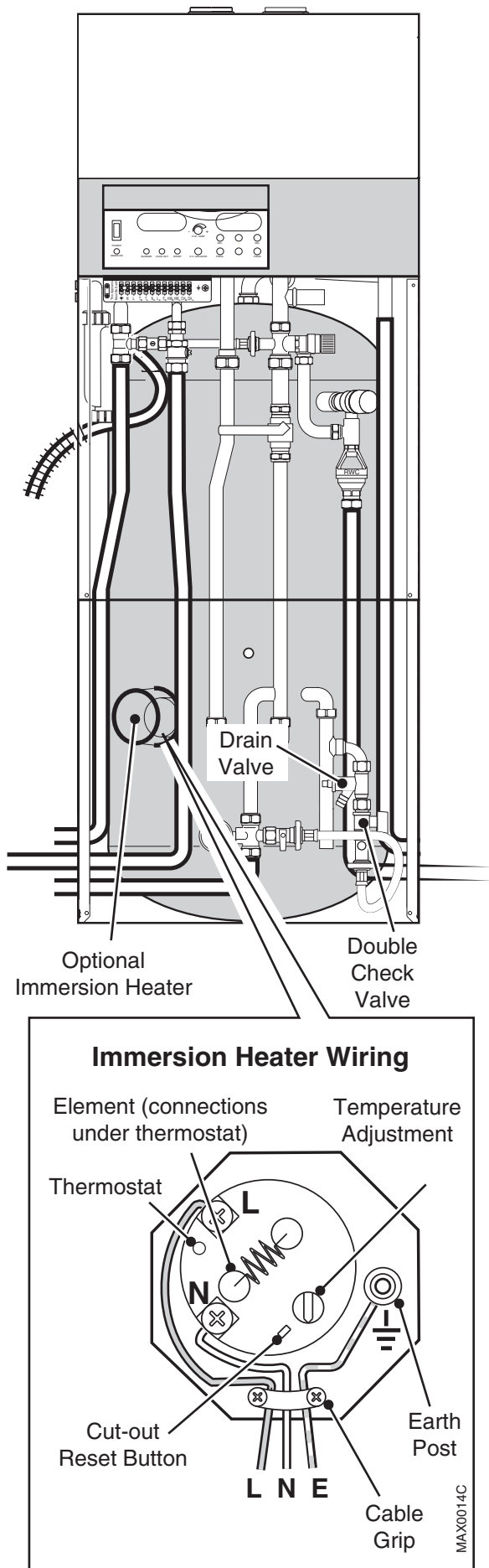


Fig. 14

## 2.7 Optional Immersion Heater

This heater is rated 3 kW at 240 V only and must be wired to a totally separate, suitably rated main supply. THERE MUST BE NO INTERCONNECTION WITH THE WIRING TO THE BOILER.

**Warning: THIS HEATER MUST BE EARTHED.**

It should be installed in accordance with the current IEE wiring regulations and be wired through a double pole isolating switch or a suitable controller. The heater must be fully immersed and not switched on dry. Secure cable grip using only screws provided.

This immersion heater has a special 1 3/4 " BSP thread. It is not interchangeable with standard immersion heaters. Use only the 'O' ring seal provided. The use of any sealant on the 'O' ring is not recommended.

The heater must be wired with 85 °C rubber insulated HOFR sheathed flexible cable 1.5 mm<sup>2</sup> complying with BS 6141 Table 8. The outer sheathing should be secured using the cable grip fitted and routed away from the boiler through one of the bushings provided.

The heater is controlled by the rod type thermostat fitted.

A temperature setting of 65 °C is recommended and is factory pre-set. This should be reduced to 55 °C (No. 3 on dial) in hard water areas.

The thermostat incorporates a thermal cutout which cuts the power to the immersion heater in an overheat situation. Should this operate it can be manually reset by pressing the red button to the side of the temperature adjustment dial.

**Note:** Investigate the cause of the overheating prior to resetting.

Should the immersion heater require replacement, use only the Powermax spare part P3223/5106143.

## 2.8 How to Drain Hot Water Storage Cylinder

Isolate mains water supply at stop valve on Inlet Control Group and close /-turn valve (handle at 90° to valve body) on double check valve - see Fig. 14.

Fit a hosepipe to the tail of the drain valve (secure with "Jubilee" clip), and run open end to a low level where water can be safely drained.

Open nearest tap(s) fully (to allow air to enter cylinder) before opening the drain valve above hose. **Note:** The lower the open end of the hose, the faster will be the draining effect.

When refilling: check that the secondary expansion vessel pre-charge pressure is between 2.5 to 2.7 bar and allow water to flow freely before closing tap(s).

## 2.9 Control Panel, Displays & Diagnostics

The boiler control fitted to Powermax HE has been designed to provide safe, reliable and economical operation of the boiler - see Fig. 15 for a guide to the control panel.

Fault finding, during both commissioning and subsequent maintenance is much simplified by the clear display of lockout and error codes which appear in the 'Status/Error Code Display'. What the codes represent and the remedial actions required are explained on Page 39.

During normal operation, the 'Status/Error Code Display' can be set to show either:

- System pressure e.g. P 1.5 (in bar)
- or The selected temperature of the DHW e.g. U 55 (in °C)
- or The flow temperature to the CH circuit e.g. c 80 (in °C)

by pressing the reset button to scroll from one display to the next.

The 'Programmer Display Window' shows time of day and, when implemented, is used for setting and checking the timed on periods.

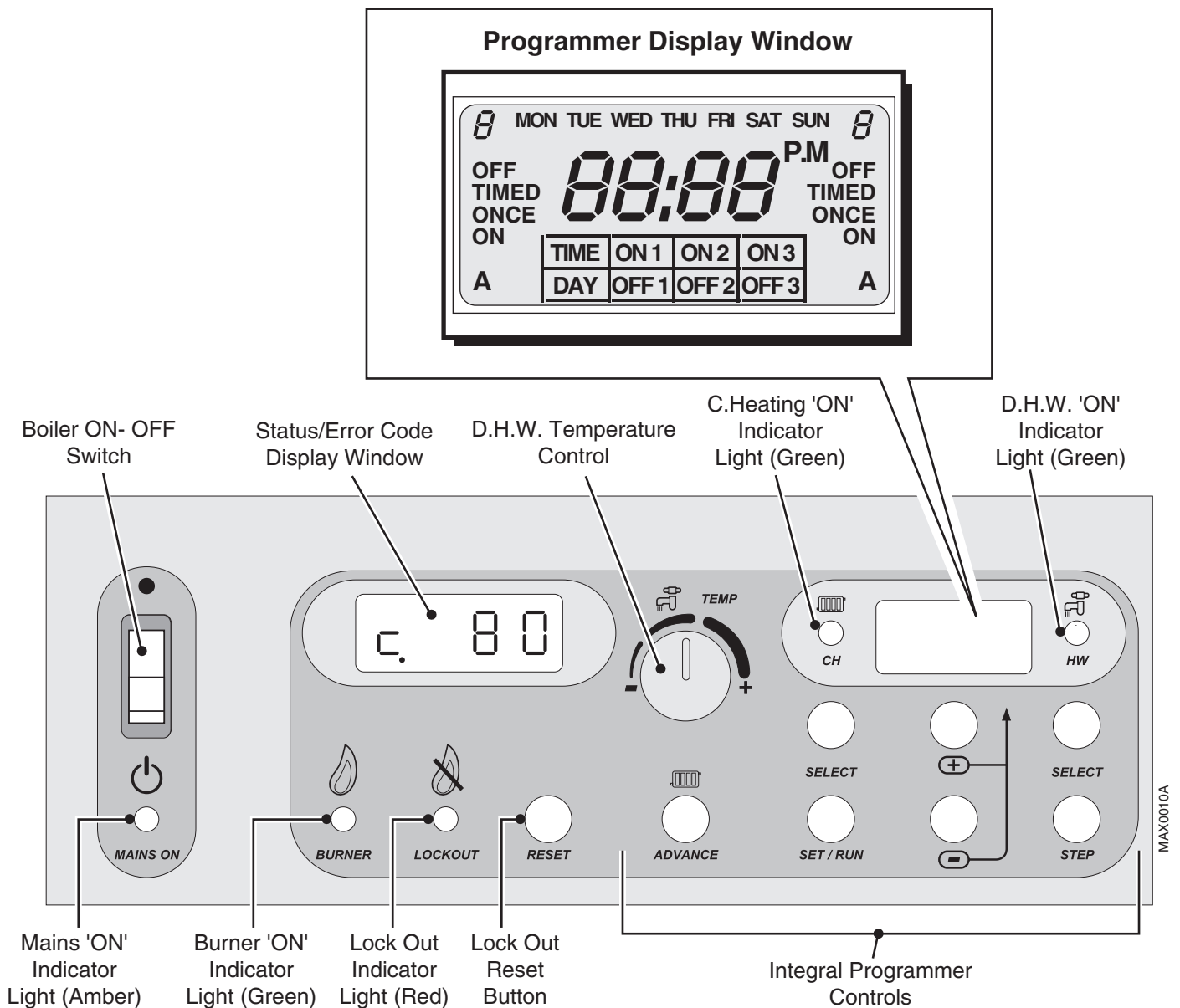


Fig. 15

# 3. Commissioning

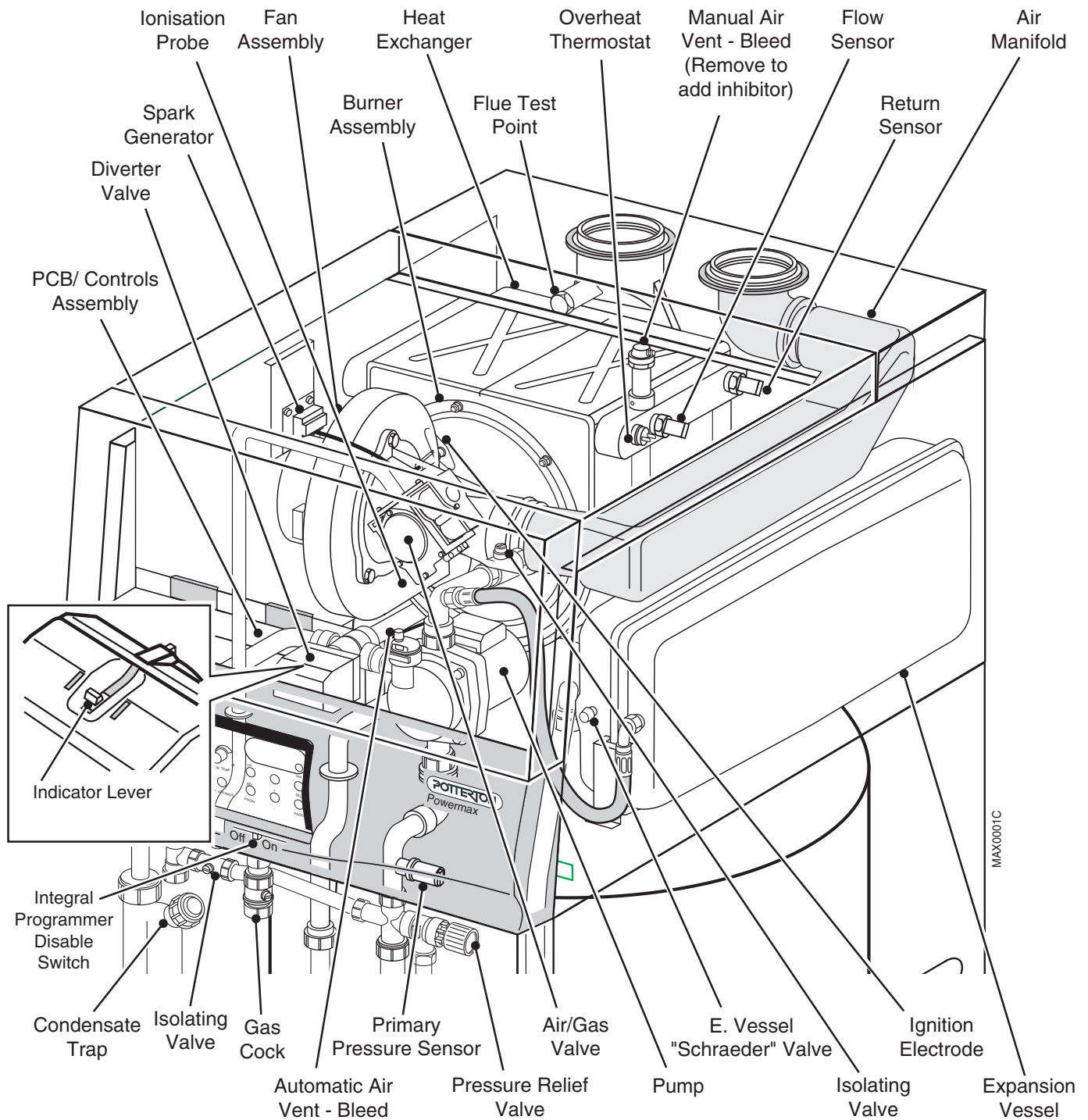


Fig. 16

**Important**

The commissioning and boiler adjustment must only be carried out by a suitably qualified person. Potterton offer this service on a chargeable basis.

**Important**

When checking for gas soundness open all windows and doors in the room. Extinguish all naked lights, cigarettes, pipes, etc.

### 3.1 Commission the Boiler

**Important** - An automatic air vent is built into the pump and the cap on the air bleed valve should be closed after air has been removed from the system.

#### Flush the System

The system must be flushed in accordance with BS 7593 and the flushing agent manufacturers instructions, further guidance can be obtained from BS 5449 Section 5.

Use the manual air vent connection on top of the heat exchanger to add inhibitor - See Fig. 16.

**Warning: Do not attempt to start this boiler unless the primary circuit has been filled with water.**

#### Preliminary Electrical System Checks

These checks must be carried out prior to attempting to start the boiler. They are, Earth Continuity, Short Circuit, Polarity & Resistance to Earth.

#### Sealed Primary System

1. With no water pressure on the system, check and if necessary adjust expansion vessel pressure to approx. 1.0 to 1.2 bar (15 to 16 psi).  
**Note:** Vessel pressure cannot be accurately set with water pressure in system.
2. Attach a length of hose to the outlet of the manual vent so that a copious volume of air water mix can be discharged. Open vent using radiator key.
3. Loosen cap on automatic air vent on pump. Check that filling loop is connected.
4. Open stopvalves (including filling loop) and fill system with water. Allow water to continue flowing from the manual air vent until air is no longer discharged.
5. Close manual vent and, using the gauge on the lower pipework, set the system pressure to approx. 1.5 bar.
6. Open one or more hot water taps to ensure the cylinder is full of water and all air has been expelled.
7. Thoroughly check water connections on boiler and inspect radiator valves, unions, etc. for leaks.
8. Switch on mains electricity supply. Check that integral programmer is switched on and set so that either/both CH and HW channels (and CH thermostat) are calling for heat, (green neons on).  
**Note:** If remote programmer is being used, the integral programmer should be disabled by moving slider switch to left.
9. Check that pump starts immediately (free spindle if it appears to be sticking). Air should be expelled from auto air vent and the control display will warn if system pressure falls below 0.5 bar.

Top up if required. Loosen bleed screw for pump spindle to remove air and re-tighten.

10. Use the programmer CH and HW buttons to alternately select central heating and hot water. Observe that indicator on diverter valve moves forward (hot water) and back (central heating). Check that air is expelled from both circuits.
11. Consult the diagnostic codes on Page 39 to check that control display shows a normal or indicative code, switch off.
12. The whole of the gas installation must be checked for soundness and purged in accordance with, in GB BS 6891 and in IE I.S. 813 "Domestic Gas Installations". Loosen screw in gas valve inlet pressure test point and attach a suitable gauge to monitor inlet gas pressures. Turn on gas supply at meter and turn the service gascock on (indicated by screwdriver slot being in-line – see Fig. 10, Page 18.

#### Unvented Domestic Hot Water System

1. With no water pressure on the system, check and if necessary adjust the secondary expansion vessel pressure to approx. 2.5 to 2.8 bar (36 to 40 psi). **Note:** Vessel pressure can not be accurately set with water pressure in system.
2. Open one or more hot water taps.
3. Turn on mains water supply and observe air free water issuing from tap(s)
4. Close tap(s) and check mains water pipework for leaks
5. Check that all factory-made plumbing connections are tight and leak free (and have not loosened in transit).
6. Manually operate both the Temperature & Pressure Relief Valve and the secondary pressure relief valve and ensure that the discharge from these valves emerges safely. Close them again with a "snap" action.

Guideline times for the initial heat-up and recovery for a nominal 50 °C temperature rise (e.g. 15 °C - 65 °C) within the store are:

Unit	Heat-up	Recovery*
85 Litre	18 min.	15 min.
115 Litre	22 min.	18 min.
150 Litre	30 min.	23 min.

\* From previous draw-off of 70% of volume.

#### Starting (Lighting) the Boiler

1. Switch electricity supply on at the isolating switch and switch the boiler on ('I' position on On/Off switch).
2. Move the boiler on-off switch to the 'I' (on) position. Note that displays are visible in both windows of the control panel.



3. Press the DHW select button to switch hot water on (green neon stays on).
4. Press reset button to scroll through LH window until display shows "p 1.5" to check that system pressure is between 0.9 to 2.5 bar. Adjust as necessary. The fan starts to rotate after a slight delay and a few seconds later the automatic ignition sequence will be initiated. The green burner neon will indicate when the burner lights.
5. If the burner fails to light, the ignition sequence will be automatically repeated until either the burner lights or a safety LOCK-OUT condition is signalled by the red neon. If red neon shows, press the reset button indicated.
6. With the boiler operating check the flame is stable.  
**Note:** After first filling with cold water some noise may occur within the combustion chamber as the flame settles on the burner. This is normal and will soon disappear.
7. Record the "working" inlet gas pressure at inlet pressure test nipple in "Benchmark" logbook.
8. Check gas valve differential (offset) - See Fig. 28, Page 42  
**Note:** This valve has been factory pre-set and adjustment is not normally required.
  - a. Loosen screw in outlet pressure test point and connect to "+" (positive) side of differential micro-manometer.
  - b. Tee the "-" (negative) side of the micro-manometer into the air signal tube as shown in Fig. 28.
  - c. Switch on central heating using CH select button and switch off hot water. The boiler will re-start in CH mode after approx. 1 minute.
  - d. After boiler has been operating in CH mode for several minutes, simultaneously press the "+" and "STEP" buttons and hold down for 5 to 6 seconds. After a minute the boiler will be operating at low input and the differential can be checked.
  - e. Ensure micro-manometer has been zeroed (if in doubt re-zero).
  - f. Check the differential reading. This should be zero to minus 5 Pa (0.00 to - 0.05 mbar). If adjustment is required refer to Page 42.
  - g. Disconnect micro-manometer, **re-instate signal tube between air duct and gas valve**, and test for gas soundness.
9. Turn boiler off, remove gauge, tighten test screws and test for gas soundness.
4. With flow to the CH circuit, bleed every radiator and the pipework high points until all air or air/water mix has been removed.
5. Vent the boiler again if necessary - note that the burner control goes to safety shut-down if the system pressure drops below 0.5 bar.
6. Wait until the central heating circuit has reached its normal temperature of approx. 80 °C before balancing the radiators in the usual way to achieve a temperature drop of 10 °C.
7. Allow system to reach full temperature (all radiators at working temp.) and note "hot system" pressure. Switch boiler off, drain and flush the system.
8. Refill (using a suitable inhibitor) and remove all air and air/water mix. Check the relief valve is not "letting" by observing pipe outlet for several minutes. ("Letting" is usually due to debris on valve seat. Snapping the valve open-shut a few times will normally cure this).
9. Check that the system final pressure equals "hot system" pressure as noted in 7. above. Adjust if necessary.
10. Set the room thermostat or programmer according to the manufacturer's instructions.
11. Disconnect filling loop flexible hose and leave in a secure place for householder.

### Domestic Hot Water System

1. With the cylinder fully heated, check DHW output temperature is approximately 45 to 65 °C (as selected) using nearest tap and a flow rate of approximately 5 l/min. Record inlet and outlet temperatures in "Benchmark" log book.
2. Measure hot water flow rate at bath tap (fully open) and record in "Benchmark" log book.
3. Refit outer covers in reverse order.

### 3.2 Hand Over to the User

1. Explain the boiler controls
2. Give guidance if the system is to be shut down for long periods when freezing is possible
3. Advise the User that for continued efficient and safe operation of the boiler it is important that adequate servicing is carried out.
4. Explain how to re-start boiler if red neon indicates lockout.
5. Hand over the User's Instructions.
6. Carefully read and complete all sections of the "Benchmark" Installation, Commissioning and Service Record Log Book that are relevant to the appliance and installation. The details of the Log Book will be required in the event of any warranty work. The Log Book must be handed to the user for safe keeping and each subsequent regular service visit recorded. For IE, it is necessary to complete a "Declaration of Conformity" to indicate compliance to I.S. 813. An example of this is given in I.S. 813 "Domestic Gas Installations". This is in addition to the "Benchmark" Log Book.

### Central Heating System

1. Press button to select heating (indicated by stable green neon).
2. Check that any connected room thermostat is calling for heat.
3. Note that the 3-way diverter valve does not allow circulation to the CH circuit until the storage cylinder contents have reached the selected temperature. After filling with cold water, this will normally take between 20 to 25 minutes.



## 4. Service & Replacement of Parts

To ensure safe, efficient operation of the boiler, it is necessary to carry out routine servicing at regular intervals. The frequency of servicing will depend upon the particular installation conditions and the use to which the boiler is put.

**Important: Before commencing any servicing or exchange of components, always turn off the gas supply and isolate the electricity supplies (i.e. to boiler and immersion heater).**

An annual inspection is recommended with servicing every other year. After completing any service work always test for gas soundness and **Remember to fill in the Benchmark Log Book.**

To gain access to the boiler for servicing, remove front panel and top cover as described in Section 4.1 on Page 28.

### Annually

**Important:** Any 'O' rings, seals, gaskets or washers disturbed during service or replacement of parts must be visually inspected and replaced if worn or damaged.

1. Remove outer and inner top covers to gain access to heat exchanger etc. Inspect components within compartment, checking that joints are dry etc.
2. Withdraw the ionisation probe and clean the electrode with wire wool or similar abraasive.
3. Partially open vent on top of heat exchanger and release any trapped air. Partially unscrew cap on auto air vent (on top of pump) and release air.
4. Draw hot water from a bath tap if necessary to cause burner to light. Check ignition is smooth and visually inspect flame. Continue to draw water until maximum fan speed is attained. Check combustion, see 'Combustion Testing'.
5. Turn off the mains water supply at the Inlet Control Group and release system pressure by opening a hot tap. Using hexagon key provided, remove the pressure reducing cartridge from the Inlet Control Group. Clean the cartridge and strainer in running cold water (A replacement cartridge/strainer element is available - Part No. 5106018). Re-fit the cartridge ensuring that the strainer is correctly located.
6. With no water pressure in the system, check and if necessary adjust the secondary expansion vessel

pressure to approx. 2.5 to 2.8 bar (36 to 40 psi).

**Note:** Vessel pressure can not be accurately set with water pressure in system.

7. Restore pressure to DHW system. Manually operate, in turn, the expansion relief valve (part of Inlet Control Group) and the temperature & pressure relief valve (Fig. 10). Check that the discharge route(s) is unobstructed and that water flows freely to a safe, visible location. Check that both valves close correctly.
8. Release CH system pressure via relief valve and check primary expansion vessel pre-charge pressure is between 1.0 to 1.2 bar. Adjust if required and top up system to same pressure.
9. Check for gas soundness and re-assemble in reverse order.

### Every Second Year

1. Additionally to the above.

Remove the heat exchanger door complete with burner, see Section 4.7 - Burner. Inspect the burner, combustion chamber and heat exchanger, carefully clean using a vacuum cleaner. Check the tightness of the nuts securing the burner to the heat exchanger door. DO NOT separate the burner from the heat exchanger door. Inspect the electrode condition and check gap which should be 3.5 - 4.0 mm.

### Combustion Testing

A combustion analysis test point is provided on the flue outlet (just above heat exchanger). The test point is tapped / BSP and is sealed by a special screw/'O' ring assembly. For a correctly installed boiler typical values to be expected are:

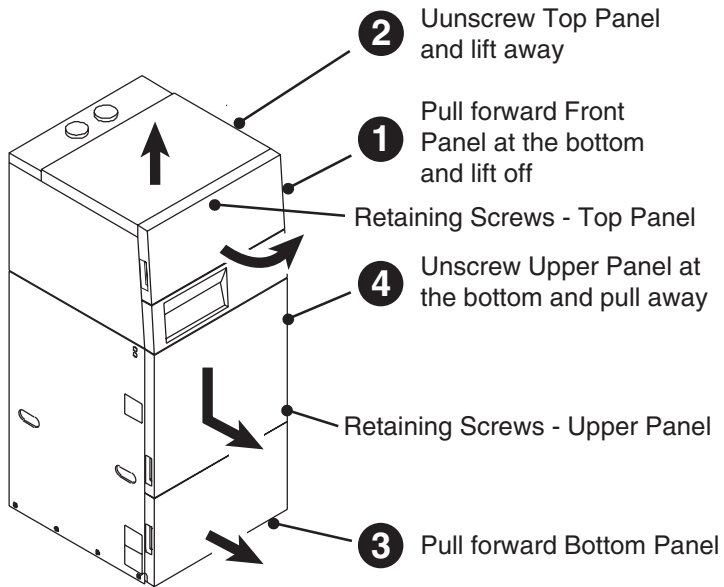
CO <80 ppm CO<sub>2</sub> <9.5 % at maximum input

Levels significantly above these should be investigated and may indicate a defective component or faulty installation. Ensure the test point is FULLY GAS TIGHT. Do not substitute any other screw for the special Powermax screw (Part No. 5106046).

### Electrical Safety Testing

It may be necessary to carry out electrical test work to ensure the safety of the boiler circuits after overhaul or as part of an inspection programme. This should be carried out to latest edition IEE regulations for Class 1 appliances with the flash test set at 1500 volts.

## General Access



## 4.1 General Access

**Warning:** Before attempting to remove any component from the boiler first disconnect the mains electricity supply by removing the plug from the wall socket or by switching off the boiler at the external isolating switch.

**Warning:** The fan operating voltage is 325V d.c. Take appropriate precautions. Allow at least 40 seconds to elapse before handling the PCB within the boiler control assembly.

**Important:** After removal or replacement of any gas carrying component a test for gas soundness must be made and functional check of the controls carried out.

**Important:** Any 'O' rings, seals, gaskets or washers disturbed during replacement of parts must be visually inspected and replaced if worn or damaged.

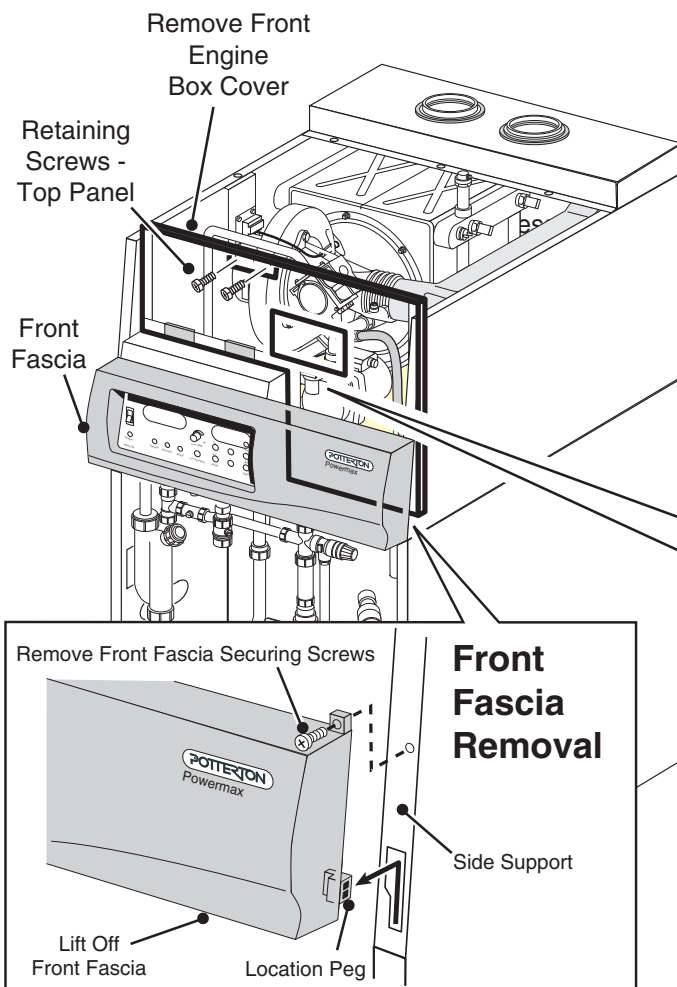
Re-assemble all parts in reverse order.

1. Follow stages 1 - 4 (opposite) to remove the outer panels.

### Internal Access

2. Remove the screws securing the top engine box cover and lift the cover away from the boiler.
3. Remove the screws securing the front engine box cover and lift the cover away from the boiler.

## Internal Access



## 4.2 Automatic Air Vent

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access, remove the access panel rather than the front engine box cover.
2. Pull away the securing clip and lift out the air vent parts as shown.

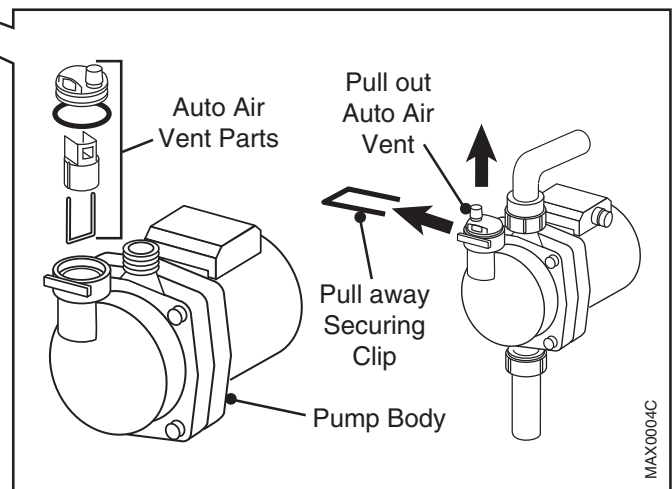


Fig. 17

### 4.3 Expansion Vessel/Pump

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access. Also remove the moulded fascia panel (2 screws).
2. Isolate three valves as shown and open the cap on the auto air vent.
3. Release pressure by opening the pressure relief valve.
4. Remove expansion vessel  
Remove securing screws and support bracket. Disconnect flexible pipe at the vessel. Pull vessel forwards and out of the boiler.

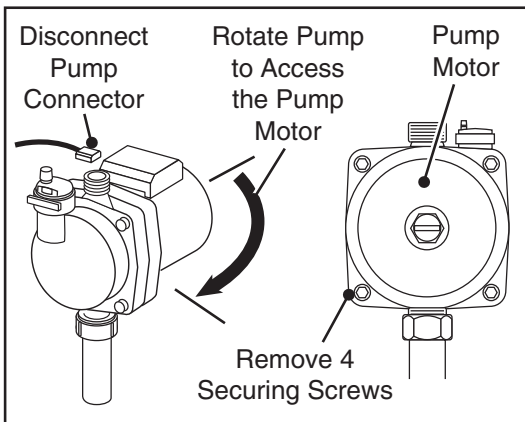
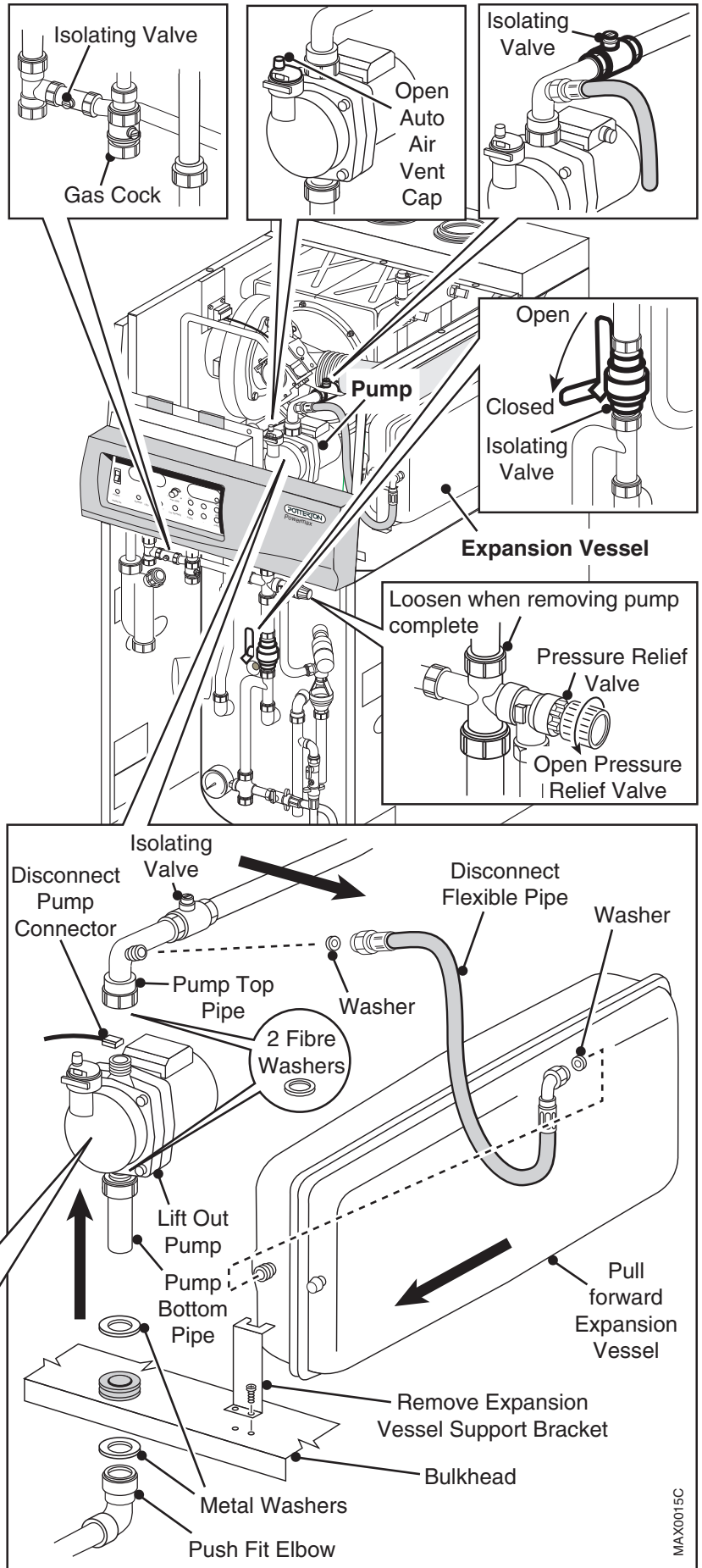
#### 5a. Pump Motor

Loosen the top pipe union nut at the pump.  
Disconnect electrical connector from the pump motor. The pump can now be rotated so the motor retaining screws can be removed

#### 5b. Pump Complete

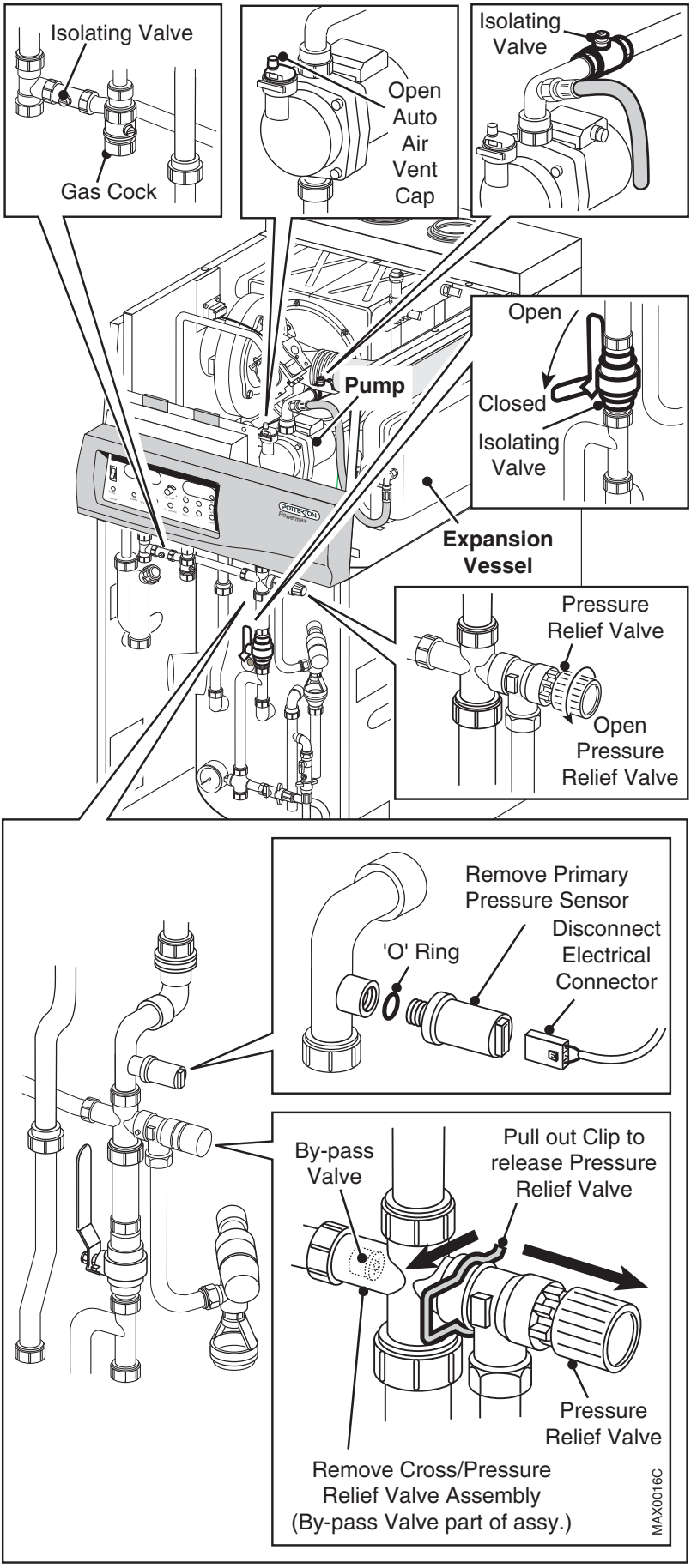
Disconnect the top pipe union nut at the pump. Disconnect electrical connector from the pump motor. Loosen 22 mm compression nut on cross fitting, lift the pump up and it will disconnect (complete with pipe) from the push fit elbow.

**Important:** Ensure that the metal washer is located between the push fit elbow and the bulkhead and also above the rubber washers on top of the bulkhead. This will ensure that the pump can be easily removed in the future.



MAX0015C

Fig. 18



#### 4.4 Pressure Sensor/PRV

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Isolate three valves as shown and open the cap on the auto air vent.
3. Release pressure by opening the pressure relief valve.
4. **Primary Pressure Sensor**  
Disconnect the electrical connector and unscrew the sensor.
4. **Pressure Relief Valve (PRV)**  
Release union nut below the sensor body, remove securing clip and pull valve out from assembly.
4. **By-pass Valve**  
This valve is part of the complete 'cross' unit and cannot be replaced separately. Remove the pressure relief valve as shown above then release the unions and remove the 'cross' unit.

Fig. 19



### 4.5 Air/Gas Valve/Injector/Fan

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Isolate the gas cock.
3. **Air/Gas Valve**

**Important: DO NOT attempt to replace the air/gas valve unless a combustion analyser is available. See Page 42 for setup procedure.**

Remove the screws securing the gas pipe securing plate to the air/gas valve.  
 Remove the screw securing the injector to the venturi body.  
 Disconnect all electrical connections to the valve and the air pressure sensing tube.  
 Pull the air/gas valve complete with injector forward and away from the venturi body.

4. **Injector**

Remove the screws securing the plate to the air/gas valve and pull out the injector. On re-assembly, leave the securing plate slightly loose so the injector can be turned to **allow the flat to line up with the flat on the inside of the venturi body**. Use an 8 mm A/F spanner to 'nip' the screws when in position.

5. **Fan**

Disconnect the electrical connections at the fan.  
 Remove the 3 bolts securing the fan to the venturi and the 4 screws and nuts securing the fan to the burner.  
 Carefully lift the fan out and away from the boiler.  
 Be careful not to lose the large 'O' ring between the fan and venturi.  
 Inspect and if necessary replace gasket behind the fan outlet flange.  
 Transfer large 'O' ring on fan intake to new fan.

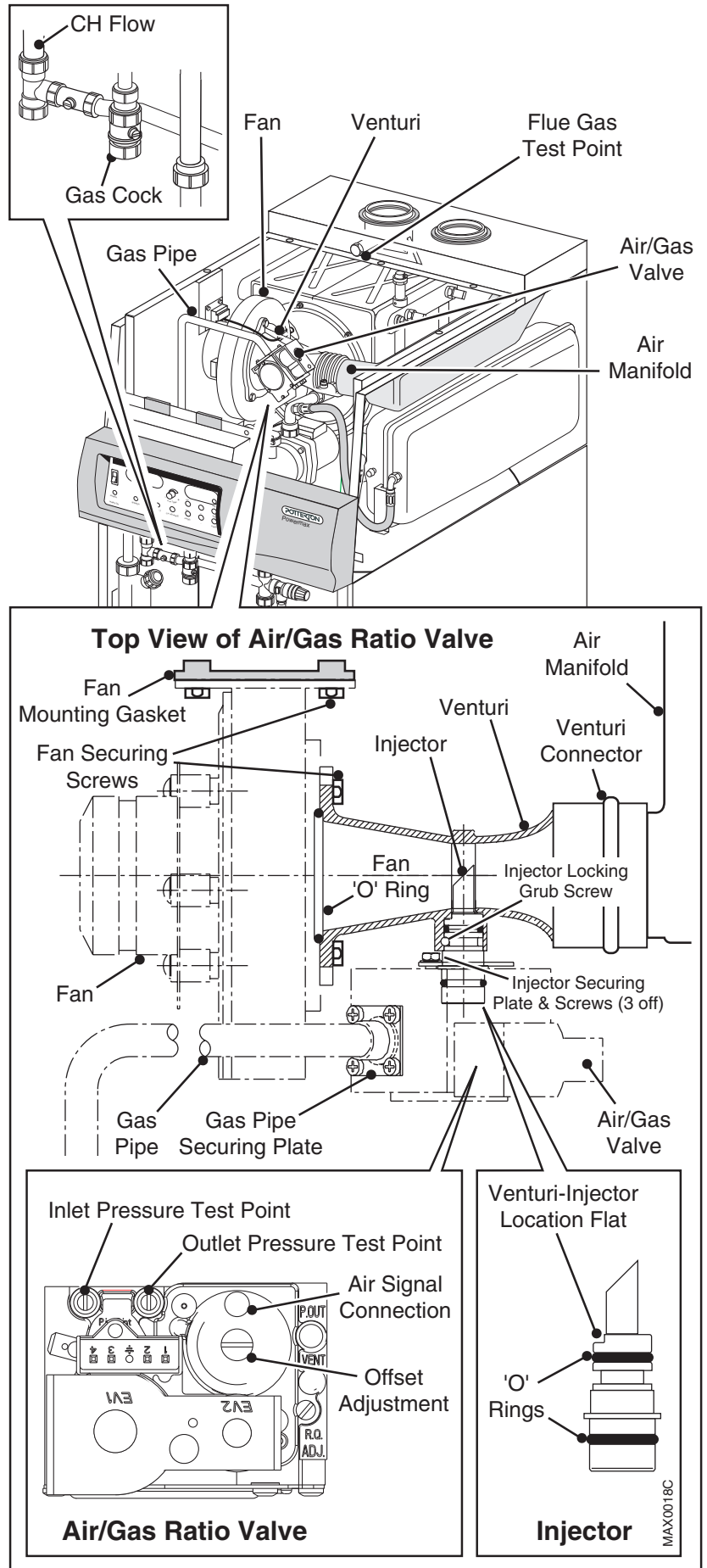


Fig. 20

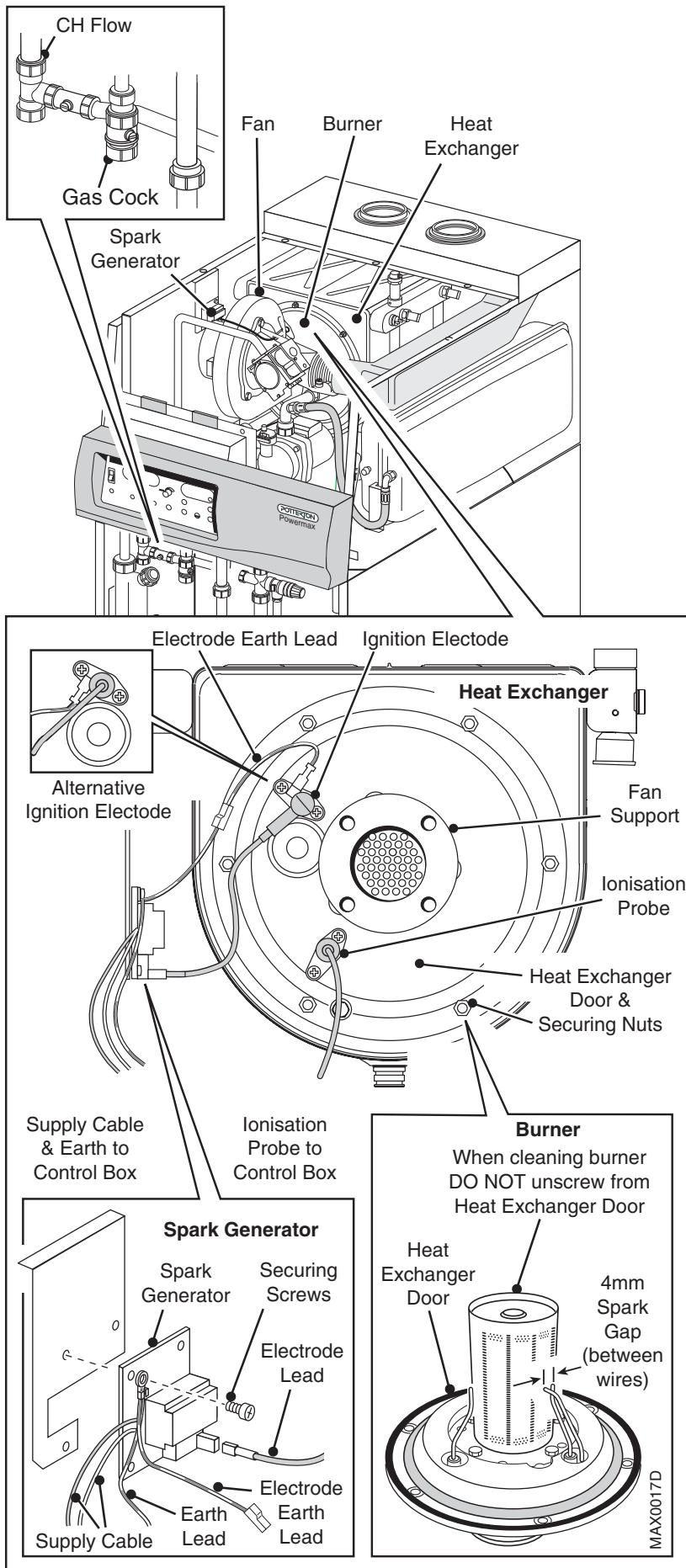


Fig. 21

#### 4.6 Spark Generator/Ignition Electrode

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Isolate the gas cock.

##### 3. Spark Generator

Carefully disconnect the electrode lead from the spark generator.  
Remove supply cable from top of boiler control - see Fig. 22.  
Remove the screws securing the spark generator to its bracket (ensure earth wire is re-connected on re-assembly).

##### 3. Ignition Electrode

Carefully disconnect the earth lead at the electrode.  
Remove the screws securing the electrode to the heat exchanger.  
Carefully remove the electrode from the heat exchanger.  
On re-assembly check that the spark gap between the tips is 3.5 - 4.0 mm.

##### 3. Ionisation Probe

Carefully disconnect the ionisation probe lead at the boiler control.  
Remove the screws securing the probe to the heat exchanger.  
Carefully remove the probe from the heat exchanger.

#### 4.7 Burner

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Isolate the gas cock.
3. Remove the Fan (Section 4.5, Air/Gas Valve/Injector/Fan).
4. Disconnect the ionisation probe, electrode lead and earth lead.
5. Remove the nuts securing the heat exchanger door to the heat exchanger.
6. Carefully remove the door complete with burner from the heat exchanger.

**Important:** Do not separate the burner from the heat exchanger door.



### 4.8 Boiler Control Assembly

**Warning:** The fan operating voltage is 325V d.c. Take appropriate precautions. Allow at least 40 seconds to elapse before handling the PCB within the boiler control assembly.

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Isolate the electricity supply to the boiler.
3. Remove wiring cover plate.
4. Remove securing screws from fascia, note how it fits and with great care, remove it from the boiler.
5. Disconnect all electrical connectors at the control box. On re-assembly, connect as shown on the wiring diagram.
6. Remove the two screws securing the control box to the support plate, note how it fits and **carefully remove** it from the boiler.

**Fuse:** This is located on the control board as shown opposite.

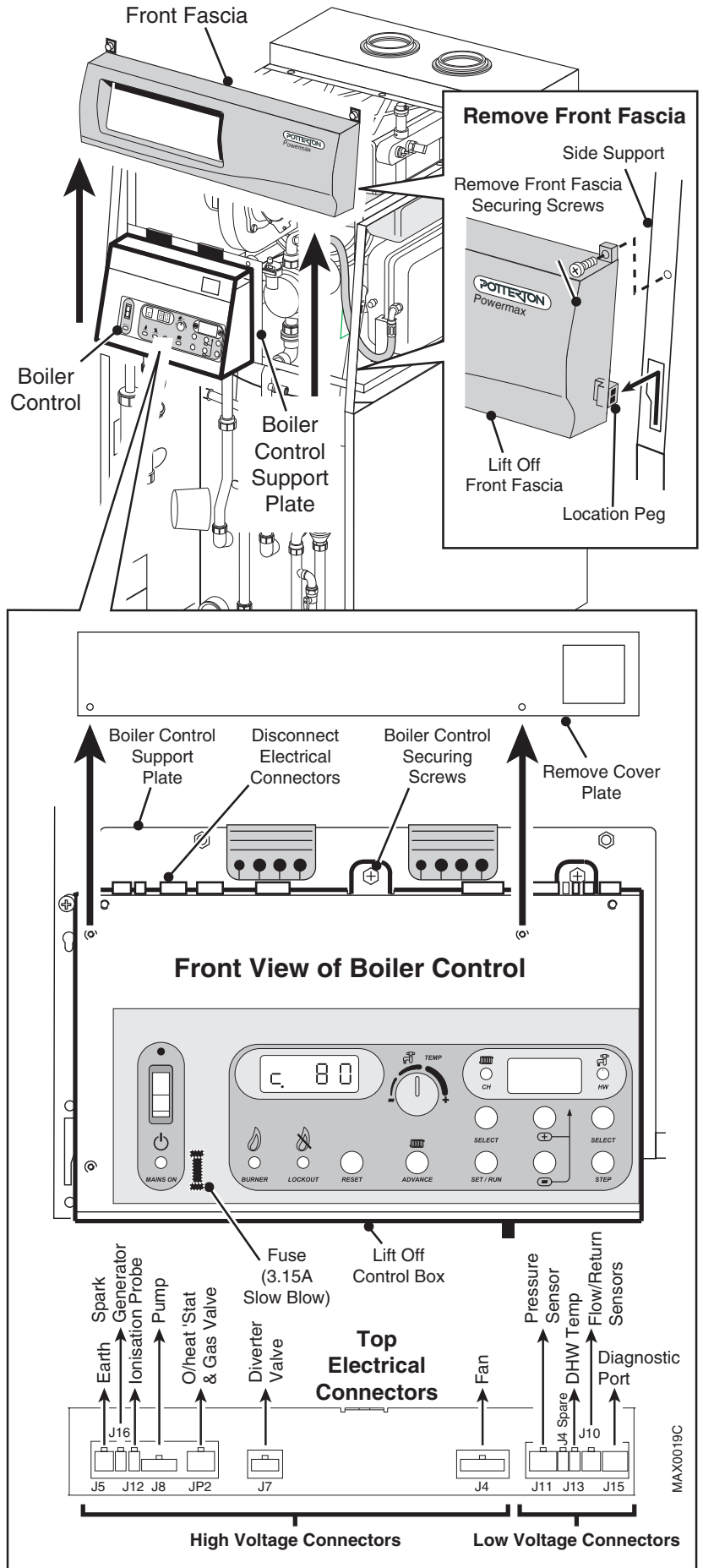
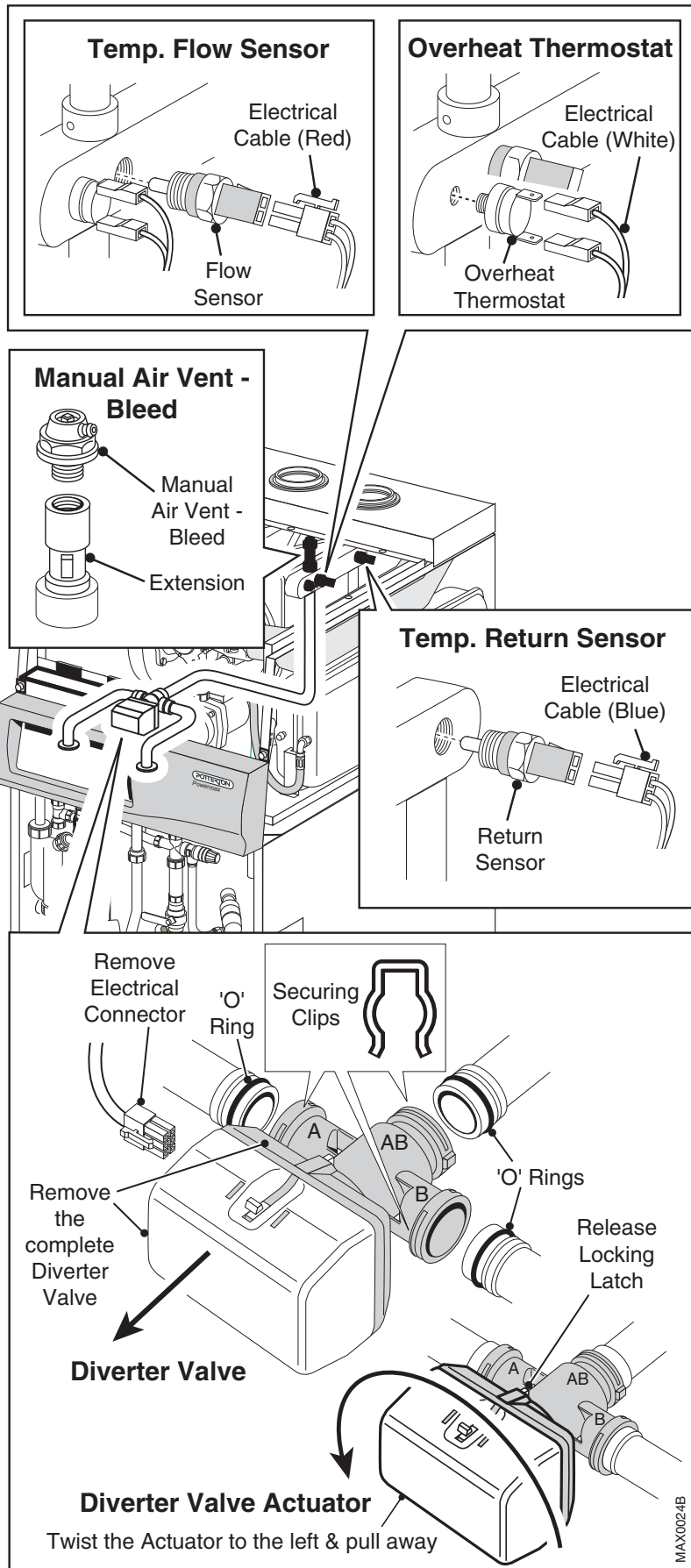


Fig. 22



#### 4.9 Diverter Valve Actuator

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Disconnect the electrical connector at the actuator.
3. Release the locking catch and twist the actuator until it unlocks from the valve and remove from the boiler.

#### 4.10 Overheat Thermostat

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access. Refer to Fig. 24, Page 35.
2. Disconnect electrical connections and unscrew the thermostat. Polarity of the wires is not important.

#### 4.11 Diverter Valve Complete, Manual Air Vent, Temperature Flow & Return Sensors

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Check that the boiler primary system is isolated from mains water supply.
3. Release pressure from primary system and drain down until water level is below the valve.

**Note:** A convenient way to check the water level is to drain all water to the level of the primary expansion relief valve.

#### Diverter Valve Complete

**Note:** The markings on the valve body are an aid to correct installation (See Fig. 23, Page 34).

4. Remove the three spring clips from the connections and remove the valve from the boiler.

#### Manual Air Vent

4. Unscrew vent from its mounting.

#### Temperature Flow & Return Sensors

4. Disconnect the electrical connector and unscrew the sensor. Sensors are interchangeable.
5. See Commissioning Instructions, Page 25 for procedure to re-fill and vent the sealed primary system.

Fig. 23

### 4.12 Heat Exchanger

**Note:** Replacing the heat exchanger involves disconnecting the appliance from the flue and air pipes. It is essential that the flue system is fully reinstated and tested so we recommend that the appropriate replacement flue pipe and fittings be obtained before starting this work. The slip fitting Part No.5106807 will be helpful in reinstating extended twin pipe flue systems.

Re-assemble all parts in reverse order.

1. Perform 4.1 General Access.
2. Check that the boiler primary system is isolated from the mains water supply. Release pressure from the primary system and drain down.
3. Remove expansion vessel, pump, gas valve, fan/venturi, diverter valve and heat exchanger door (complete with burner) all as detailed in previous sections. Remove flow and return pipework from the push-fit connections on RH manifold of heat exchanger. Retain securing clips for re-use.
4. Disengage air inlet duct from elbow on top RH side of boiler and set aside. Unscrew 3 c/sunk screws and remove air inlet elbow.
5. Disconnect wiring from temperature sensors and overheat thermostat. Carefully remove HT lead from spark generator.
6. Disconnect flue pipe. Remove "hidden" M6 nut - see Fig. 24, at RH rear of heat exchanger and remove two M6 flanged set screws securing the LH suspension bracket. Support weight of heat exchanger before removing the clip and saddle beneath.
7. Lift heat exchanger vertically about 19mm (3/4") to disengage condensate spigot from its socket in the base panel; then tilt forward from the bottom to remove.

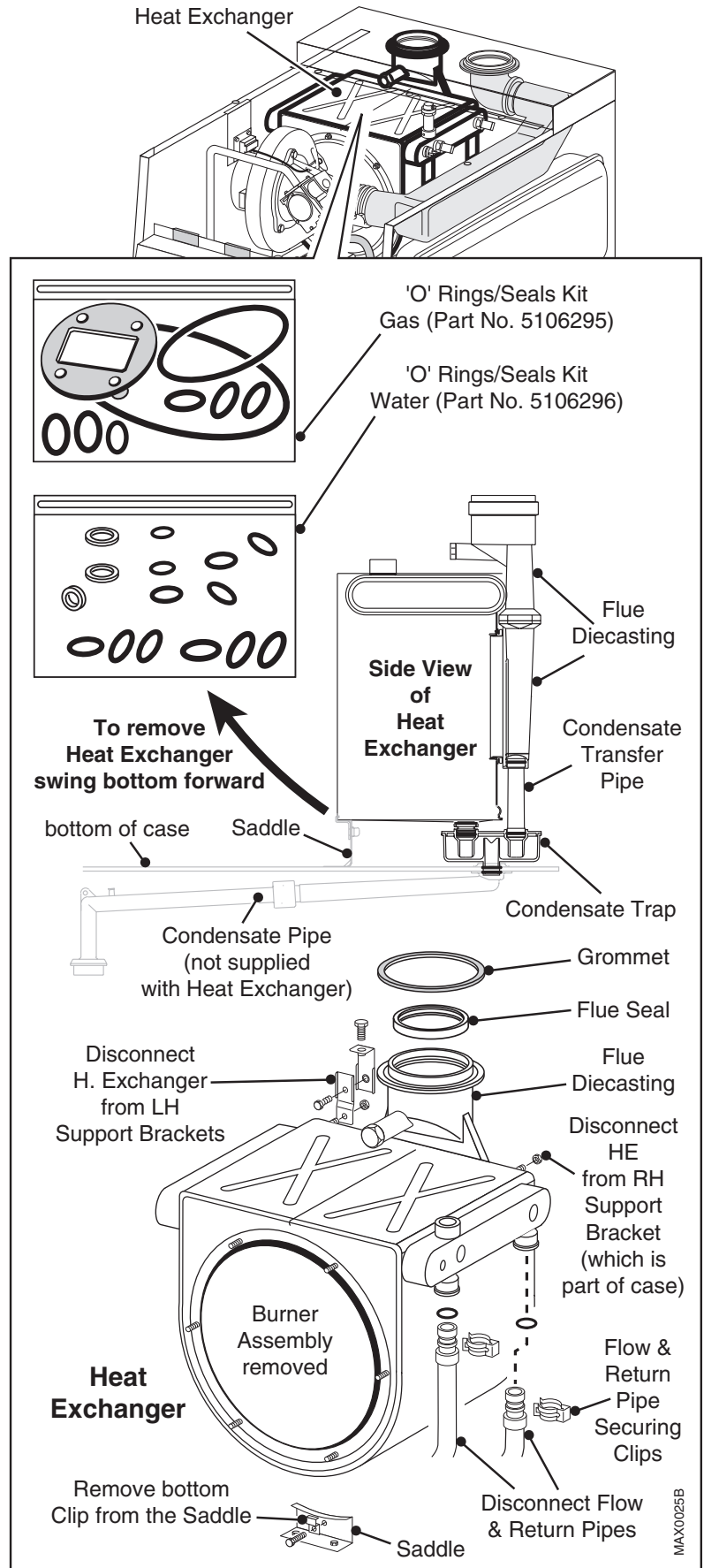


Fig. 24

# 5. Wiring Diagrams

Wiring/Functional Flow Diagram

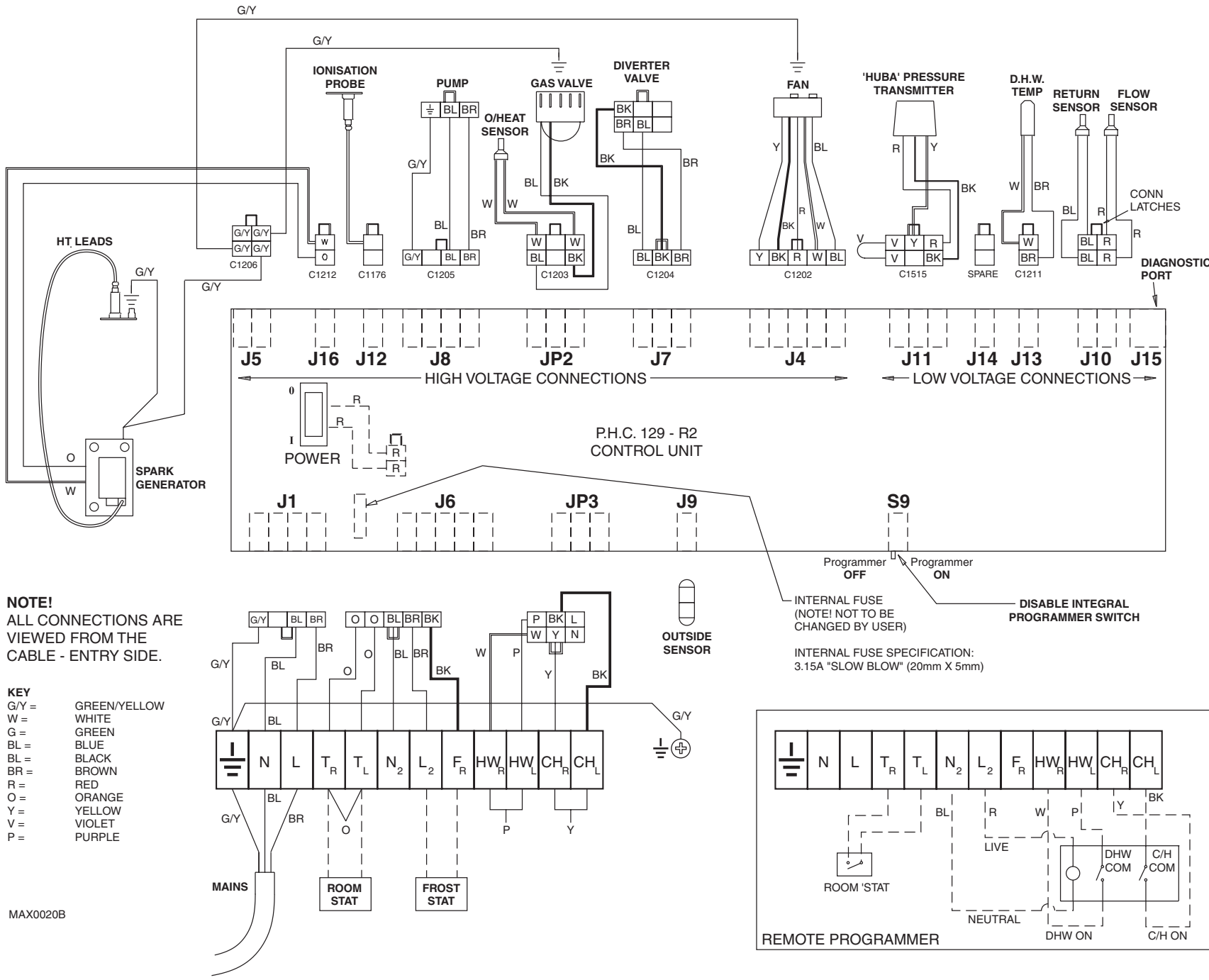
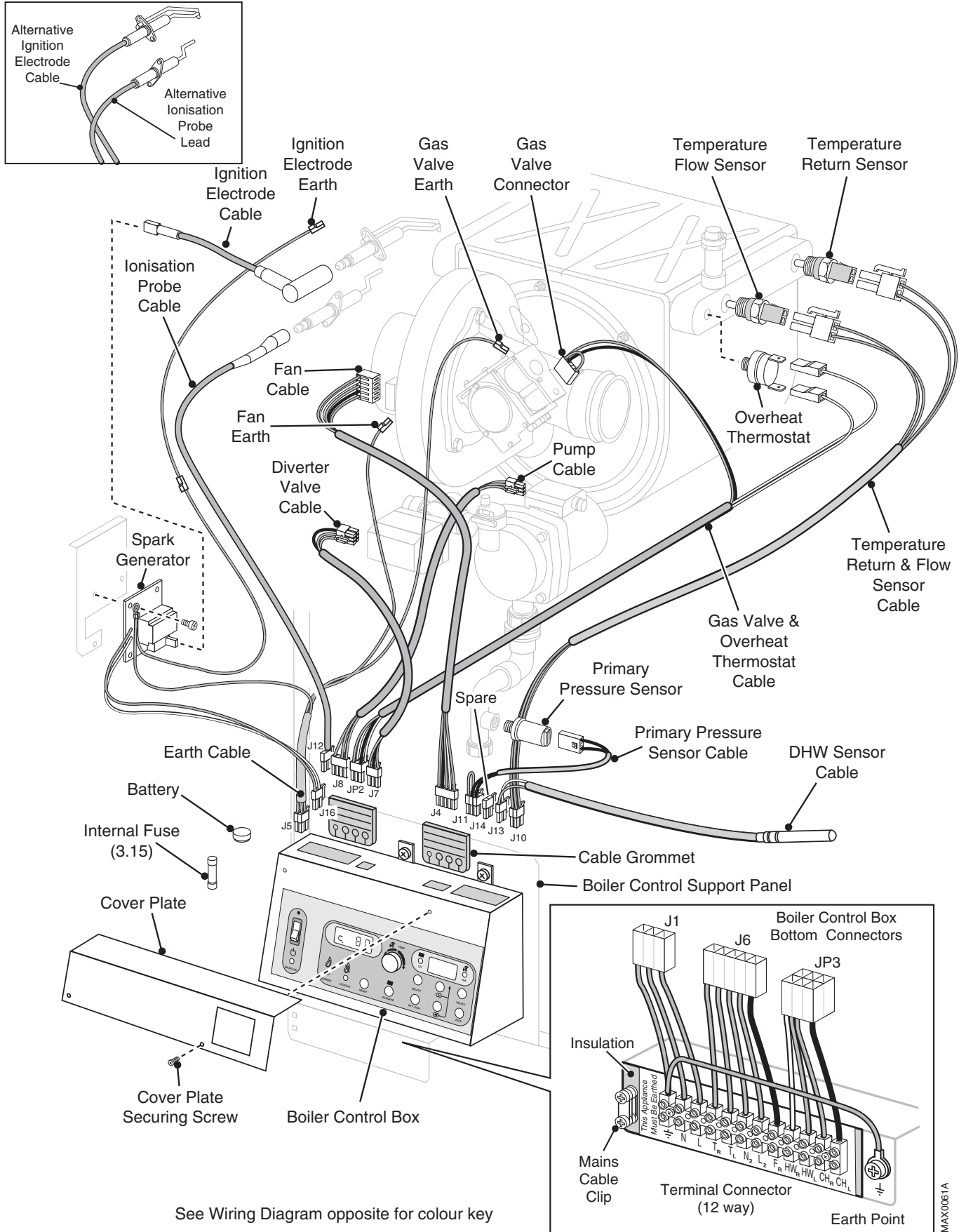


Fig. 25

Wiring Visual Reference



See Wiring Diagram opposite for colour key

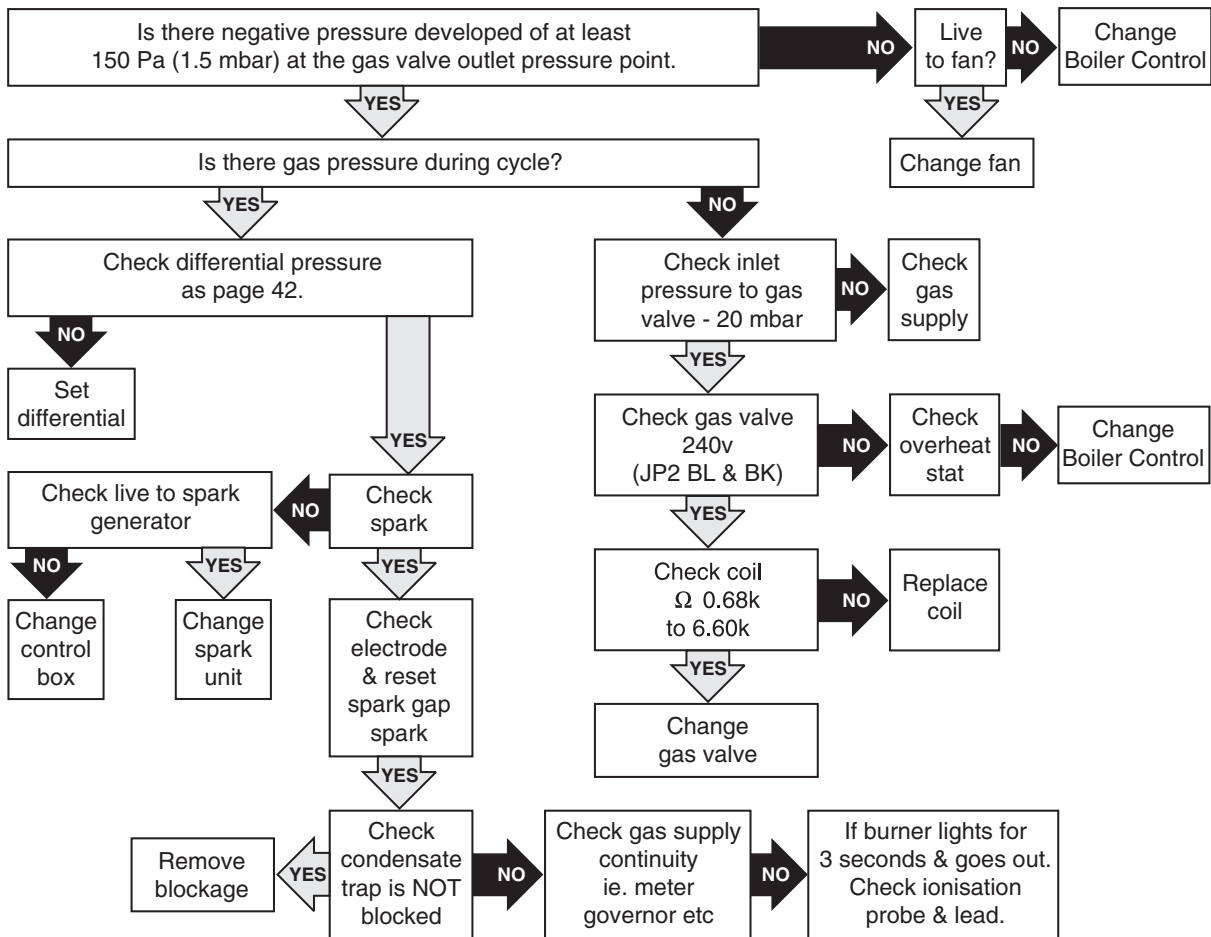
MAX0061A

Fig. 26

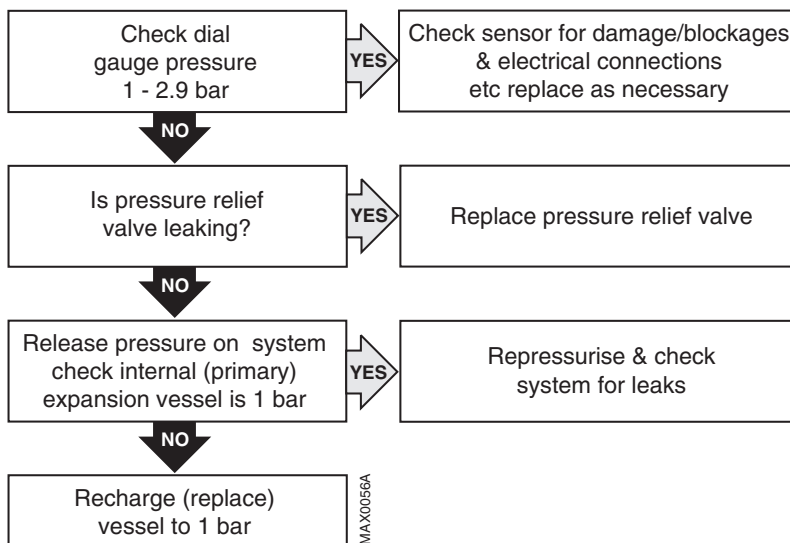
# 6. Fault Finding Guide

## Boiler Fault Finding

Status/Error Code Display **A 01** - Burner fails to light  
 - Lock out light 'ON'  
 - **Reset & check**



Status/Error Code Display **A 15** - **Reset & check**



MAX0056A



DISPLAY CODE	MESSAGE (INFORMATION / FAULT)	ACTION / REMEDY	FURTHER ACTIONS
<b>A 01</b>	Burner failed to light	Check gas supply and gas valve operation Clean or replace ionisation probe & lead	Check fan and spark operation. Check flue for blockage Check condensate outlet not blocked & vent tube is clear
<b>A 03</b>	Over temp. lock-out or circulation failure	Check pump, 3-way valve & CH water pressure	Replenish system & purge air/water via manual vent
<b>A 04</b>	Overheat 'stat open/gas valve failure	Check wires/re-set 'stat. Test valve coils.	Test for 230V and Neutral at PCB & plug on gas valve
<b>A 05</b>	Safety relay failure (in boiler control)	Switch OFF/ON - press RESET	Replace boiler control Part No. 5107535
<b>A 07</b>	Heat exchanger monitoring fault	Check/adjust gas valve differential (page 42) Test combustion at high and low input (page 42)	Clean/replace ionisation probe & lead Part No. 5106941 Check boiler control responds to flow & ret.sensors
<b>A 15</b>	CH pressure loss/pressure sensor faulty.	Check/replenish CH system pressure. Find leaks.	Check/replace pressure transmitter and cable.
<b>A 19</b>	Flame detected after gas valve shut	Relight, check gas valve closes promptly	Check for electric mains problem. Replace gas valve
<b>A 20</b>	Flame detected during ignition cycle	Check gas valve closes fully. Replace	Check ionisation probe & condensate outlet
<b>A 33</b>	Fan speed incorrect	Check fan wiring and connections	Replace fan Part No. 5106068 or boiler control
<b>A 40</b>	System response fault	Check pump operation and speed setting Check by-pass and other water valves open.	Check 3-way valve operation. Purge air from H/E Check boiler control responds to flow & ret.sensors
<b>A 41</b>	System flow fault	Check pump operation and speed setting	Check by-pass isolating valve is open
<b>b 52</b>	°C Indicative cylinder temperature	O.K. Cylinder being re-heated	Press RESET button to scroll display
<b>c 80</b>	°C Indicative flow temperature to CH	O.K. Scroll to pressure display "P"	Press RESET button to scroll display
<b>E 01</b>	Primary pressure too high	Reduce CH system pressure	Check/adjust/replace primary expansion vessel 5106287
<b>E 03</b>	Flow temperature abnormally high	Check pump, 3-way valve & CH system pressure	Replenish system, adjust pump speed & bleed air
<b>E 04</b>	Flow sensor open circuit	Check cable/connections not damaged	Renew sensor/cable. Check connections on control
<b>E 06</b>	Flow sensor short circuit	Check cable/connections not damaged	Renew sensor/cable. Check connections on control
<b>E 07</b>	DHW sensor open circuit	Check cable/connections not damaged	Renew DHW cable /sensor assy. Part No. 5106290
<b>E 08</b>	DHW sensor short circuit	Check cable/connections not damaged	Renew DHW cable /sensor assy. Part No. 5106290
<b>E 20</b>	Flame detected with closed gas valve	Check ionization probe/cable	Check condensate outlet not blocked & vent tube clear
<b>E 21</b>	Live & Neutral supply reversed	Correct the electrical supply	
<b>E 22</b>	Electrical supply not 50Hz	Correct the electrical supply	
<b>E 29</b>	Fault in link on 6-way plug J11	Replace (pressure sensor) cable assy.	Part No. 5107534
<b>E 40</b>	Return sensor open circuit	Check cable/connections not damaged	Renew sensor/cable. Check connections on control
<b>E 41</b>	Return sensor short circuit	Check cable/connections not damaged	Renew sensor/cable. Check connections on control
<b>E 42</b>	Internal control error	Switch OFF/ON at mains isolator	Replace boiler control Part No. 5107535
<b>P 0.1 - 0.4</b>	(bar) Boiler off because pressure too low	Replenish CH system & purge air	Find leak(s) and repair.
<b>P 0.5 - 0.9</b>	(bar) Water pressure in CH system low	Replenish CH system & purge air	Find leak(s) and repair. Compare analogue gauge pressure.
<b>P 1.0 - 2.9</b>	(bar) Normal pressure, system warm/hot	O.K.	
<b>P 3.0 - 3.5</b>	(bar) Primary pressure over 3 bar, boiler off	Reduce CH system pressure	Check/adjust/replace primary expansion vessel
<b>t 80</b>	°C Indicative flow temperature to DHW	O.K. Scroll to pressure display "P"	Press RESET button to scroll display
<b>U 60</b>	°C DHW temperature selected (by knob)	Adjust if required - 55°C recommended	Range: 65°C (winter) - 45°C (summer)

Other codes not listed above indicate a faulty boiler control

# 7. Short List Of Spare Parts

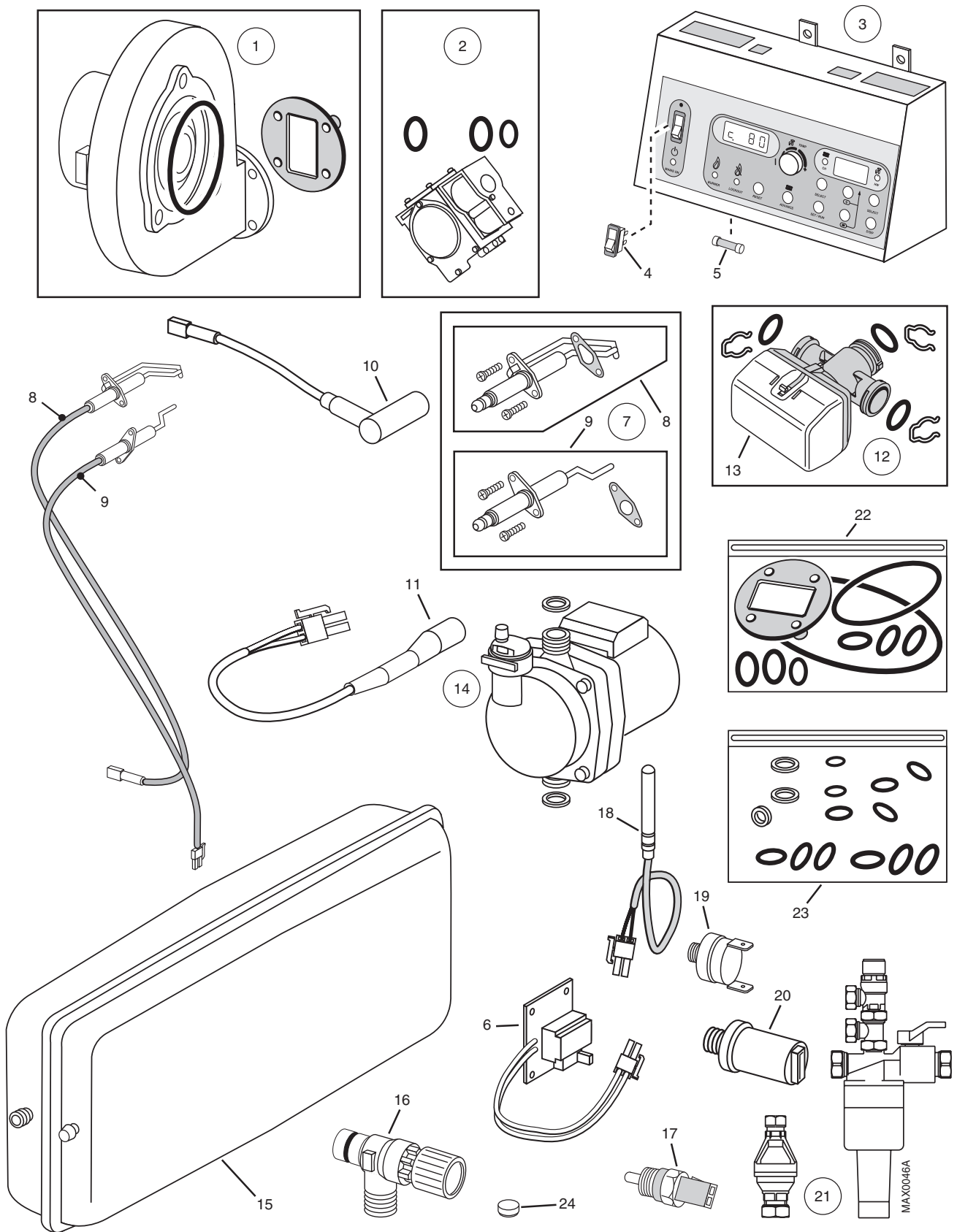


Fig. 27

Drg. No.	G.C. No.	Description	Qty.	Part No.
1	E83 458	Fan Assembly c/w 'O' Ring & Gasket	1	5106279
2	E83 462	Gas Valve Assembly c/w 3 off 'O' Rings	1	5106280
3	E83 465	Boiler Control Assembly (Use with 'Ranco' sensor only)	1	5106281
	H00 266	Boiler Control Assembly (Use with 'Huba' pressure transmitter only)	1	5107535
4	E83 466	Boiler Control On/Off Switch	1	5106229
5	E85 802	Fuse 3.15A "Slow Blow"	1	5106872
6	E83 467	Spark Generator c/w Flying Lead	1	5106282
7	E83 468	Electrode/Ionization Kit Incl. key no's 8 & 9	1	5106283
8	E85 739	Ignition Electrode & leadc/w Gasket & 2 screws	1	5106940
9	E85 740	Ionization Probe & lead c/w Gasket & 2 screws	1	5106941
10	E83 476	HT Lead	1	5106284
11	E83 477	Ionization Lead	1	5106285
12	E85 752	3 Way Valve Assembly (Body, 'O' Rings, Clips & key no. 13)	1	5106931
13	E85 753	Actuator Head	1	5107000
14	E85 761	Pump c/w auto air vent & 2 off washers	1	5106286
	E85 762	Automatic Air Vent	1	5106932
15	E83 481	Expansion Vessel 12 Litre (Primary)	1	5106287
16	E83 482	PRV Assembly	1	5106288
17	E83 483	Immersion NTC Sensors	2	5106289
18	E83 484	DHW NTC Sensor c/w cable 1.25 m	1	5106290
19	E83 485	Overheat Thermostat	1	5106291
20	E83 486	Pressure Sensor 'Ranco' Black	1	5106292
	H00 269	Pressure Transmitter 'Huba' Red	1	5107764
21	E85 901	Unvented Inlet Control Group	1	5106293
22	E83 488	'O' Rings/Seals Kit - Gas Components	1	5106295
23	E83 489	'O' Rings/Seals Kit - Water Components	1	5106296
24	E83 491	Programmer Battery	1	5106294

## Gas/Air Valve Setup Procedure

Procedure to correctly set new Air/Gas Valve using a micro-manometer.

1. Loosen screw in outlet pressure test point and connect to '+' (positive) side of differential micro-manometer.

Tee the '-' (negative) side of the micro-manometer into the air signal tube.

2. Remove special /BSP screw from flue gas outlet (above heat exchanger) and insert probe of combustion analyser approximately 50 mm.

Temporarily seal probe into flue gas test point.

3. Press 'ADVANCE' or central heating 'SELECT' button to obtain ON display in programmer screen. Ensure any connected room thermostat is calling for heat. Observe burner lights and allow boiler to operate in central heating mode for several minutes.
4. Simultaneously press '+' and 'STEP' buttons and hold down for 5 to 6 seconds. After one minute, the boiler will be operating at the correct reduced input rate to enable the differential pressure to be set.
5. Ensure micro-manometer is in Pa or mbar scale and has zeroed correctly. If in doubt, re-zero the instrument.
6. Check differential pressure reading.

This should be zero or a negative (gas relative to signal) value of 0 to - 5 Pa (0.00 to - 0.05 mbar).

Use zero adjustment screw (below central dust cover) to reset differential if necessary.

**Note:** Turning adjustment screw clockwise reduces negative differential; anti-clockwise increases negative differential. A 4 mm hexagon key should be used to make the adjustment.

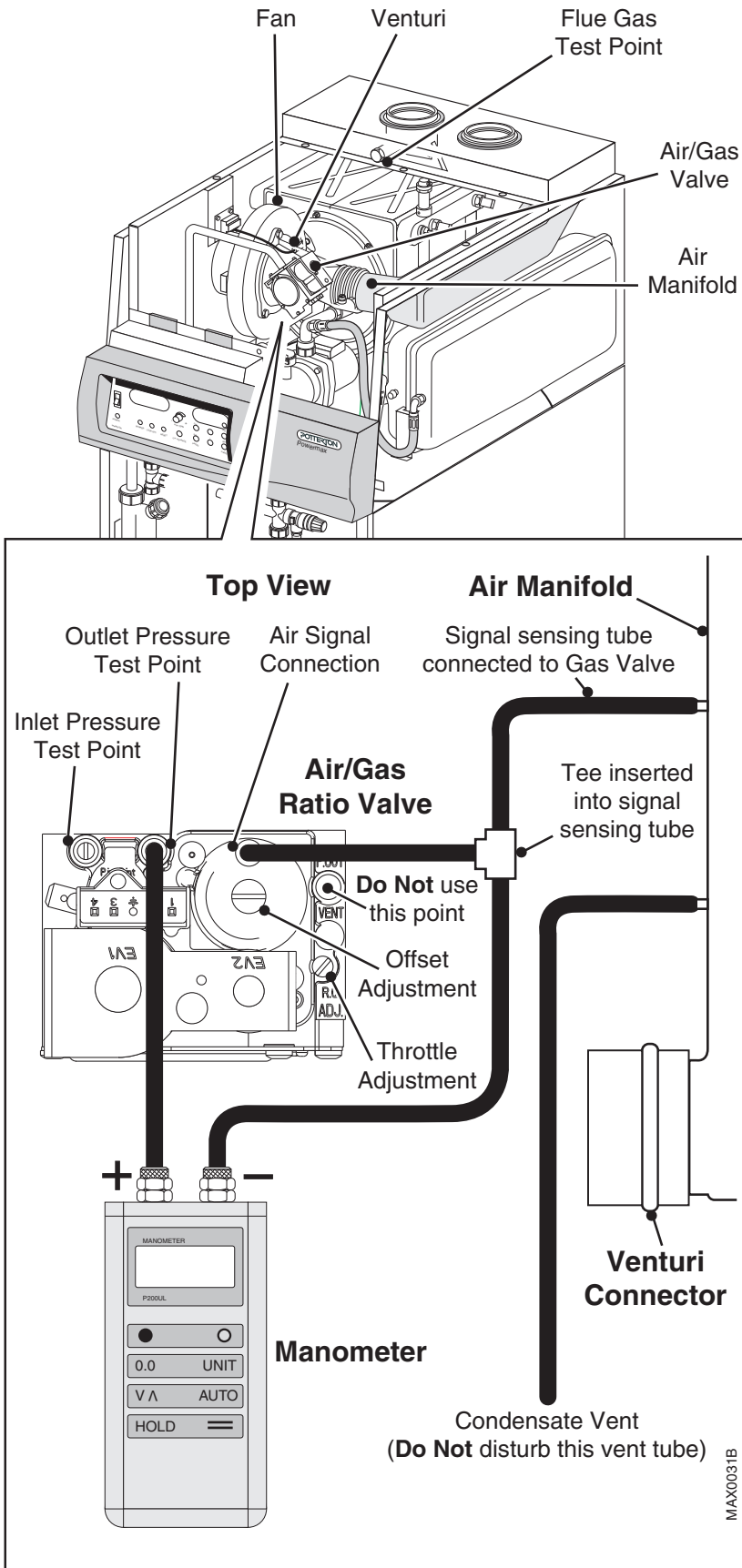


Fig. 28

7. After 2 minutes, the boiler control will return to normal operation. Maintain full central heating demand (or if this is not possible, draw hot water from a bath tap) to cause the fan speed to increase to maximum.
8. Check CO<sub>2</sub> content of the flue gas indicated by combustion analyser.

At maximum fan speed, this should be 9.0 to 9.2% CO<sub>2</sub>.

For values other than this, use throttle adjustment screw to obtain correct setting.

**Note:** Turning screw clockwise reduces CO<sub>2</sub>; anti-clockwise increases CO<sub>2</sub>.

Ensure fan does not modulate by maintaining a CH or DHW demand during the above sequence.

As a double check, the expected CO content should be in the range of 65 to 85 ppm when CO<sub>2</sub> is 9.1%.

Check that gas rate is approximately 2.55 m<sup>3</sup>/hr.

9. Replace dust cover, **re-instate air signal tube between air duct and gas valve**, checking that tube has not physically deteriorated or been damaged e.g. cracked.

Carefully replace special sealing screw in flue gas test point.

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