

C1/sfb

APRIL 1990

**INSTALLATION AND MAINTENANCE  
INSTRUCTIONS FOR THE**

# **DIPLOMAT HE**

**GAS FIRED, ATMOSPHERIC CAST-IRON  
CENTRAL HEATING BOILERS**

THESE BOILERS ARE FOR USE WITH NATURAL GAS ONLY

This boiler is tested and certificated to BS 5978 by British Gas PLC.



**POTTERTON**  
COMMERCIAL PRODUCTS DIVISION

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SECTION 1 - THE BOILER

Fig.1 Diplomat HE 9-14 Sections.

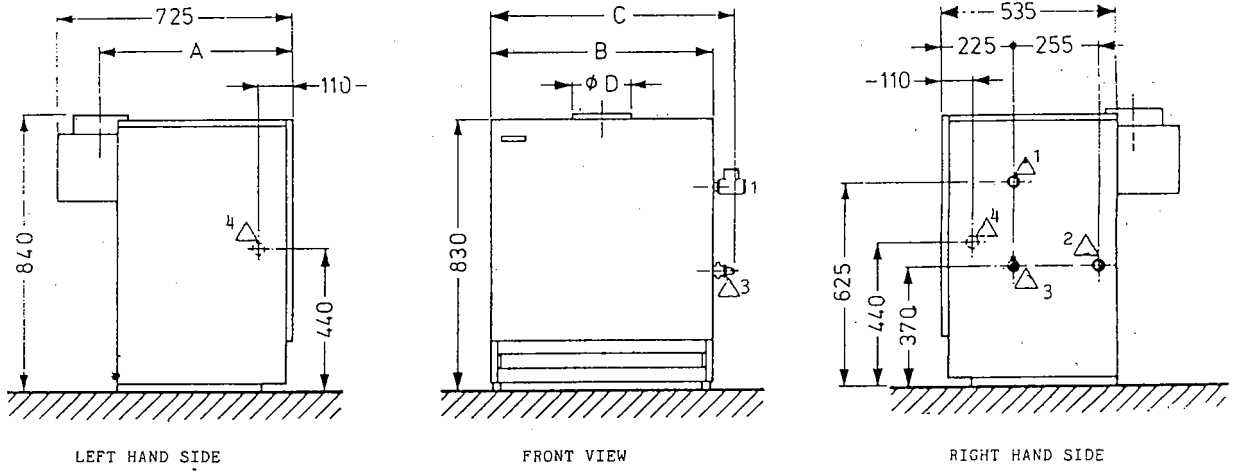
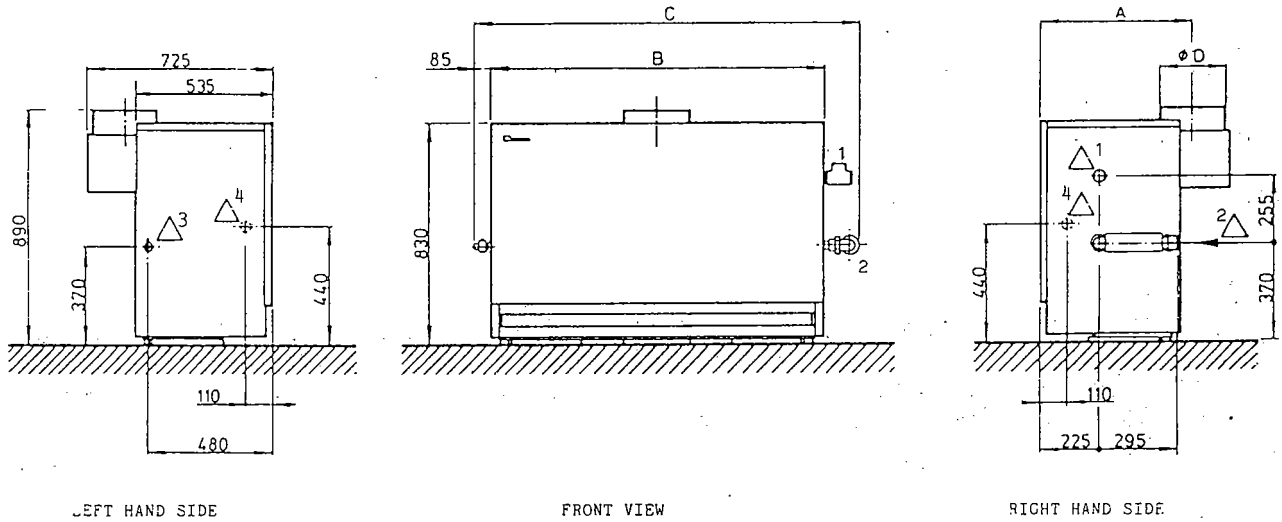


Fig.2 Diplomat HE 16-20 Sections.



- |                      |                         |
|----------------------|-------------------------|
| 1. Flow Connection   | 3. Drain Off Cock       |
| 2. Return Connection | 4. Gas Connection Entry |

Sections	9	10	12	14	16	18	20
A	590	590	600	600	580	580	580
B	634	696	820	944	1054	1176	1298
C	729	791	935	1059	1310	1430	1555

Clearances

- Front - 500mm (to withdraw burner bars)
- Rear - 50mm
- Top - 600mm (to clean flueways)
- Left Hand Side - 130mm (gas supply pipe to be no closer than 100mm to casing panel)
- Right Hand Side - 200mm (to make flow and return connections)

TABLE 1 - PERFORMANCE DETAILS

No. of Sections		9	10	12	14	16	18	20
Boiler Input	KW	53.4	59.6	73.3	84.5	96.9	105.6	115.5
	Btu/hr x 1000	182.0	203.5	250.0	288.5	330.5	360.1	393.8
Boiler Output	KW	43.0	48.0	59.0	68.0	78.0	85.0	93.0
	Btu/hr x 1000	146.5	164.0	201.5	232.0	266.0	289.9	317.1
Gas Rate	m <sup>3</sup> /hr	5.0	5.5	6.8	7.9	9.0	9.8	10.7
	ft <sup>3</sup> /hr	176	197	242	280	320	349	382
Flue Gas Volume *	m <sup>3</sup> /hr	5.0	5.6	6.9	7.9	9.1	9.9	10.6
	ft <sup>3</sup> /hr	141	158	195	233	257	280	305
Main Burner Pressure	mbar	13.8	15.0	15.2	13.1	14.6	14.6	12.8
	in. w.g.	5.5	5.9	6.1	5.2	5.9	5.9	5.0
Main Burner Injector Size	No. off	6	6	7	9	11	12	14
	Ømm	2.30	2.40	2.40	2.40	2.30	2.30	2.30
Pilot Burner Injector Size	No. off	1	1	1	1	1	1	1
	2 Holes Ømm	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Pilot Burner Input	KW	0.21	0.21	0.21	0.21	0.21	0.21	0.21
	Btu/hr	730	730	730	730	730	730	730

\* Volumes are given at STP and are for the secondary flue with dilution assuming a minimum of 1 mm.w.g. (0.04 in.w.g.) negative draught at the boiler socket.

These figures are given as a guide for flue design purposes only and should be used with secondary flue conditions of approximately 4% CO<sub>2</sub> and 180°C gross flue gas temperature.

TABLE 2 - GENERAL DATA

No. of Sections		9	10	12	14	16	18	20	
Flow Tapping	Position	See Fig.1 page 2.				See Fig.2 page 2.			
	Size in BSP	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	
Return Tappings	Position	See Fig.1 page 2.				See Fig.2 page 2.			
	Size in BSP	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	1 $\frac{1}{4}$ "	
Max. Working Water Head	PSI	56	56	56	56	56	56	56	
	Bar	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Gas Inlet Connection	Position	Left or Right Side Casing Panel							
	Size in BSP	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	$\frac{3}{4}$ "	
Minimum Gas Inlet Pressure *	mbar	17.5	17.5	17.5	17.5	17.5	17.5	17.5	
	in. w.g.	7.0	7.0	7.0	7.0	7.0	7.0	7.0	
Electrical Supply		240 V $\sim$ 50 Hz. Isolator & 5 A Fuse Required							
Nominal Flue Size to BS 835	mm	175	175	200	200	250	250	250	
	in.	7	7	8	8	10	10	10	
Diverter Socket Internal Diameter	mm	213	213	238	238	288	288	288	
	in.	8.4	8.4	9.4	9.4	11.3	11.3	11.3	
High Level Ventilation	in <sup>2</sup>	42	42	44	51	55	58	64	
	cm <sup>2</sup>	270	270	300	325	353	373	395	
Low Level Ventilation	in <sup>2</sup>	84	84	88	101	110	116	123	
	cm <sup>2</sup>	540	540	600	650	706	745	790	
Dry Weight	kg	148	162	191	220	248	276	304	
	lb	326	356	420	484	546	607	669	
Water Content	Litre	13.3	14.7	17.5	20.3	23.1	25.9	28.7	
	Gallon	2.9	3.3	3.9	4.5	5.1	5.8	6.4	
Wet Weight	kg	161	177	209	240	271	302	333	
	lb	355	389	459	529	597	665	733	
Water Resistance	t 25°C mbar	27	33	45	59	28	35	38	
	t 20°C mbar	42	51	70	93	44	54	60	
	t 11°C mbar	139	168	231	307	145	178	198	
	t 10°C mbar	168	203	279	371	175	215	239	
Water Flow	t 25°C l/s	0.41	0.46	0.56	0.65	0.74	0.81	0.88	
	t 20°C l/s	0.51	0.57	0.70	0.81	0.93	1.02	1.11	
	t 11°C l/s	0.93	1.04	1.28	1.47	1.69	1.84	2.01	
	t 10°C l/s	1.02	1.14	1.40	1.62	1.86	2.02	2.21	
Maximum Flow Temperature	°C	90	90	90	90	90	90	90	

\* This pressure to be measured at the inlet to the multi-functional valve when the appliance is running under full operating conditions.

## GENERAL

Potterton Diplomat HE gas fired boilers are available in seven sizes with outputs ranging from 43 kW (147,000 Btu/hr) to 93 kW (137,000 Btu/hr). They are approved by British Gas for use on open vented systems, however, they are suitable for use on sealed systems with a maximum operating pressure of 4 bar (56 p.s.i.). Refer to relevant British Standards and Codes of Practice re installation of Diplomat HE boilers on sealed systems.

The Diplomat HE 9 and 10 section boilers are intended for use as commercial appliances and are not tested by British Gas for use in domestic applications.

For ease of installation all boilers are delivered fully assembled with the casing and draught diverter fitted. The boilers are delivered on a single pallet with a frame work of wood around them to protect them and they are shrink wrapped over.

For sites with restricted access a fully assembled boiler will pass through a standard 30" door. With the draught diverter removed the boiler will pass through a 21" gap. If the draught diverter is removed the mastic sealing material may be damaged and this should be inspected and replaced if necessary before the diverter is refitted.

The flow and return connections are made to the right hand side of the boiler casing and the gas supply can be made to the left or right hand side of the casing.

The boiler sections are cast iron with pips to aid heat transfer and the sections are joined by steel nipples and hydraulically assembled.

The control system includes an on/off switch, a multi-functional valve, boiler thermostat, overheat cut out device and permanent pilot.

The boiler sections are insulated with fibre glass insulation and Rockwool. The case is finished in white and covered with a protective film to prevent any minor damage. This protective film should be removed when the boiler is commissioned.

## INSTALLATION

The installation should comply with relevant British Standard Specifications, Codes of Practice and current Building Regulations, together with any special regional requirements of the Local Gas Undertaking, Local Authorities and Insurance Company. All electrical wiring must comply with I.E.E. Regulations for the Electrical Equipment of Buildings.

The installation of the boiler must be in accordance with the relevant requirements of the:-

Gas Safety (Installation and Use) Regulations: 1984

Health & Safety at Work Act 1974.

CP331:3 Low Pressure Installation Pipes.

BS 6644: 1986 Installation of Gas Fired Boilers.

CP341:300-307 Central Heating by Low Pressure Hot Water.

CP342:2 Centralised Hot Water Supply.

Also the following British Gas publications:-

IM/11 Flues for Commercial and Industrial Gas Fired Boilers and Air Heaters.

IM/2 Purging Procedure for Non-Domestic Installations.

IM/5 Soundness Testing for Non-Domestic Installations.

In the event of a gas booster being necessary refer to:-

IM/16 Guidance Notes on the Installation of Gas Pipework, Boosters and Compressors in Customers Premises.

The Gas Act 1972, Schedule 4, Paragraph 18.

Manufacturers notes must not be taken, in any way, as overriding statutory obligations.

## CLEARANCES

The minimum clearance required for access, erection and maintenance are:-

Front - 600mm to allow for burner removal.

Rear - 50mm (rear of flue hood).

Left Hand Side - 130mm (gas supply pipe to be no closer than 100mm to casing panel).

Right Hand Side - 200mm (to make flow and return connections).

Top - 1000mm for cleaning.

If the gas supply pipe runs down the left hand side of the boiler it should run no closer than 4" to the left hand casing panel. This is so that if the casing panel ever has to be removed to replace the overheat cut out device, the casing can be slid along and up to this pipework.

## ELECTRICAL SUPPLY

The electrical supply should be 240V ~ 50 Hz single phase and must be connected to the boiler through a suitable two pole isolator and a 5A fuse.

All on site wiring shall conform to I.E.E. Regulations.

## POWER REQUIREMENTS

Typically 0.22 KVA for all sizes.

## BOILER SITING AND BASE

The boiler should be sited in accordance with BS 6644: 1986 with respect to protecting the boiler from damage, air for combustion and ventilation, access, discharge of products of combustion, clearance, temperature, noise levels, the disposal of boiler water and the effects of flooding of the boiler house or seepage from a roof top boiler house. A level non-combustible floor capable of supporting the weight of the boiler filled with water, see Table 2 page 4, together with any additional weight bearing down on the base from connections, etc must be provided. This will typically be a 50mm concrete plinth with an area equal to that of the plan of the boiler.

## VENTILATION

Safe, efficient and trouble-free operation of conventionally flued gas boilers is vitally dependent on the provision of an adequate supply of fresh air to the room in which the appliance is installed. Account must also be taken of any other fuel burning appliance existing or to be fitted when designing the ventilation and combustion air systems.

## Air Supply by Natural Ventilation

Ventilation by grilles communicating directly with the outside air is required at both high and low levels.

The minimum free area of the grilles for a single boiler are given in Table 2 page 4, and are based on:-

Low Level - 540 cm<sup>2</sup> plus 4.5 cm<sup>2</sup> per kilowatt in excess of 60 kW total rated input.

High Level - 270 cm<sup>2</sup> plus 2.25 cm<sup>2</sup> per kilowatt in excess of 60 kW total rated input.

Position ventilation grilles to avoid accidental obstruction by blockage or flooding.

Further guidance on ventilation is provided in BS 6644: 1986.

#### Air Supply by Mechanical Ventilation

The supply of air to a space housing the boiler by mechanical means should be by mechanical inlet with natural or mechanical extraction. Mechanical ventilation with natural inlet must not be used. Where a mechanical inlet and a mechanical extract system is applied the design extraction rate should be 0.45 m<sup>3</sup>/sec per 1000 kW heat input and the inlet rate should be 1.1 m<sup>3</sup>/sec per 1000 kW heat input.

The requirements for air supply by mechanical ventilation are given in BS 6644: 1986.

For mechanical ventilation systems, an automatic control should be provided to cut off the supply of gas to the boiler(s) in the event of failure of air flow in either inlet or extraction fans.

#### IMPORTANT

The use of an extract fan in the same room as the boiler (or on an adjacent room in communication) can, in certain conditions, adversely effect the safe operation of the boiler. Where such a fan is already fitted (or if it is intended to fit an extractor fan after installation of the appliance) the advice of the Gas Regulator should be obtained.

#### Contaminated Combustion Air

It is essential that fresh and uncontaminated air is introduced to the boiler for combustion.

Air contaminated with chlorine vapours and CFC gasses must not be allowed to enter boiler combustion chambers or formation of chlorine gas and hydrochloric acid will create severe and rapid boiler corrosion. There is also a danger that toxic chlorine gas will be emitted from the boiler flue.

In areas where such products are used, and these include degreasants, dry cleaning fluids, refrigerants and aerosol propellants, steps must be taken to isolate the boiler from the area by situating it in a separate area where fresh air can be introduced. Care should be taken in positioning extract ducts from contaminated areas in relation to boiler house grilles to ensure that cross contamination will not occur.

#### GAS SUPPLY

Where there is an existing primary gas meter, the appropriate gas supplier/undertaking must be consulted to ensure that the service/meter supply capacity is adequate for the proposed installation.

#### FLUE

To ensure safe and satisfactory operation the chimney system, which may be individual or common in the case of modular boiler installations, shall be capable of the complete evacuation of combustion products at all times. The effective height of the chimney terminal(s) above the boiler(s) flue outlet shall ensure sufficient buoyancy to overcome the resistance of the bends, tees and runs of the flue pipe involved and shall terminate in a down draught free zone. The number of bends and lengths of horizontal flue pipe used should be kept to a minimum in order to comply with the recommendations made in BS 6644: 1986, British Gas publication IM/11 "Flues for Commercial and Industrial Gas Fired Boilers and Air Heaters", the third edition of the 1956 Clean Air Act Memorandum and the Building Regulations should be strictly observed where applicable.

A flue system should be no nearer than 50mm to combustible material except where it passes through it enclosed in a sleeve of non-combustible material with an annular (air) space of 25mm. The chimney design should avoid the formation of excessive quantities of condensate and for this reason it is recommended that all chimneys are insulated and lined. In the case of brick or similar structures, a stainless steel rigid or flexible flue liner (Grade 304/316) may be used backed up with a 50mm minimum thick layer of vermiculite or perlite granules between the liner and the inner skin of the chimney body. Liners should be sealed at both top and bottom.

A terminal should be used for flues upto 200mm diameter. For other flues effective protection is necessary to prevent entry of rain, snow, leaves, birds, etc while having minimum resistance to the egress of flue products. The flue termination should be at least 1m above the roof surface and away from any wind pressure areas where the flue products could re-enter the building, eg. near an openable window, mechanical air inlet, etc.

As the Diplomat HE boilers are supplied with an integral draught diverter, no other draught diverter should be fitted in the system. The integral draught diverter is not load bearing and the flue should be supported by other means. Facilities should be included in the flue systems to disconnect the boiler flue hood from the flue should it ever be necessary for maintenance, repair or inspection of the flue system. A flue header which connects into the main flue or chimney should be independently supported and the connection soundly made.

Drainage points positioned at the bottom of all vertical chimney sections should be provided. Drain pipes should be no less than 25mm I.D. and should be manufactured from acid condensate resistant material such as stainless steel and positioned so that pipe runs and discharge points are not subject to the effects of frost. These runs should fall with a gradient of at least 3% and at no point must the drain pipe rise above the level of the drainage point connection.

The dimension of the nominal flue size and boiler flue outlet socket are given in Table 2 page 4. A draught of 1 mm.w.g. (0.04 in.w.g.) should be provided at the flue socket under full load running conditions. The flue should be designed to evacuate the products of combustion when all boilers are firing.

#### WATER CIRCULATION SYSTEMS

The Diplomat HE is suitable for use on fully pumped water systems only.

The water circulation system should be indirect and installed in accordance with the relevant parts of British Standards Code of Practice CP 342 and BS 6644: 1986.

The maximum and minimum temperature differential across the boiler should be 25°C and 10°C. The volume flow and pressure drop across the boiler at 25°, 20°, 11° and 10°C are given in Table 2 page 4.

The maximum and minimum working head are 4 bar (136 ft.w.g.) and 0.1 bar (3 ft.w.g.). Care is needed in siting the pump relative to the cold feed and open vent connections.

The boiler flow and return connection sizes are given in Table 2 page 4 and they are located as in Fig.1 page 2.

If the return water temperature is likely to fall below 55°C under normal running conditions then a shunt pump should be fitted, sized to handle the minimum water flow rate through the boiler, see Table 2 page 4.

The provision of pump overrun by a time delay system or a thermostat situated in the flow pipe close to the boiler is essential to remove residual heat from the boiler, see Fig.12.

It is essential that all systems are thoroughly flushed through to remove all debris and scale prior to fitting the boilers. Cleaning systems with descaling agents is not generally recommended as, if incorrectly used, the scale and deposits may continue to break up after the system has been flushed and the boiler installed.

The fitting of sludge traps and/or strainers is strongly recommended, see page 8.

The system should be checked to ensure that there is no raw water make-up. The raw water hardness must not exceed 100 p.p.m. hardness nor must the TDS (salinity) be excessive. A specialist water treatment company should be consulted if in doubt.

The boiler and system should be protected by suitable frost thermostats and unions and isolating valves should be fitted to the flow and return manifolds so that the boiler can be isolated from the system if the need arises.

#### Water Flow Switch

If the boiler is to be operated at flow settings above 85°C than a water flow switch should be fitted in the return connection to the boiler and wired in series with the control thermostat so that it is not possible to fire the boiler with no water flow.

The water flow switch and pump overrun should be fitted to all boilers operating above 85°C in order that residual heat can be removed from the boiler which could cause nuisance shut down of the overheat thermostat and boiling over of the unit.

#### Safety Valves

Each boiler, whether in single or multiple installations, shall be fitted with an individual safety valve.

In the case of modular boiler installations each bank of boilers shall be fitted with a safety valve in the common flow unless each boiler is fitted with a safety valve.

The safety valve or common safety valve shall be sized to suit the total rated output of the boiler or bank of boilers and shall be located between the boiler or bank of boilers and the water isolating valve. The size of the valve will be based on the following table:-

Safety Valve Sizes		
Rated Output	Minimum Clear Valve Bore	
	Diameter	Area
kW	mm	mm <sup>2</sup>
45 to 264	19	284
264 to 352	25	491
352 to 440	32	802
440 to 528	38	1135
528 to 732	51	2050
732 to 1142	64	3210
1142 to 1640	76	4540
Over 1640	1 x 102 or 2 x 76	8180

The safety valve shall be fitted in the flow pipe work between the boiler and the next valve in line and the safety valve shall not be more than 1m from the boiler measured along the flow pipe.

The safety valve fitted shall have a maximum setting pressure not greater than 4.7 bar (68.15 p.s.i.).

Safety valves shall be of the direct spring loaded type or dead weight type and shall be set according to the following equation:-

$$\text{VALVE SETTING (IN BAR)} = 0.7 + \text{OPERATING PRESSURE (IN BAR)}$$

NB: 1 bar = 33.5 ft head or 14.5 lb/in<sup>2</sup>.

Spring loaded valves are recommended where the static head exceeds 2.5 bar and/or where the boiler may be affected by external vibrations.

The size of the connecting pipe or fitting shall be not less than the nominal size of the valve inlet, or the cross sectional area shall not be less than the aggregate cross sectional area of the valves mounted on it.

The discharge pipe from the safety valve shall terminate in a visible position where discharge will not result in hazard to the user or plant. The size of the discharge pipe shall not be less than the nominal size of the valve outlet.

For further information on safety valves see BS 6644: 1986.

#### Open Vented Systems

A cold feed pipe should be provided and taken directly from a feed and expansion cistern which shall not supply water for any other purpose.

It shall not be smaller than as specified below and shall be connected to the boiler or boiler side of any valve on the return pipe. The cold feed pipe shall be situated within the building and shall be insulated along those parts of its length where freezing conditions or condensation on the pipe may be expected to occur.

For multiple and modular boiler installations the cold feed connection shall be either to the common return pipe upstream of the individual boiler isolating valves or to each individual boiler return pipe downstream of the isolating valve. The cold feed to a multiple or modular boiler installation shall be provided with a lockable isolating valve.



For a single boiler installation an open vent pipe shall be fitted to the flow pipe and sized according to the table below. It shall rise continuously by the shortest practical route to the venting point. The open vent pipe shall discharge into the feed and expansion cistern above the over flow level and for a single boiler installation the pipe shall not be fitted with valves (apart from a 3 way type such that when closed to the common vent pipe the boiler is open to atmosphere through the third port and shall incorporate means of indicating the position of the open port and the nominal bore of the valve shall not be less than that of the open vent pipe in which it is fitted) nor shall there be any obstruction which could prevent safe venting of the boiler. The vent pipe shall be insulated along those parts of its length where freezing conditions may be expected and shall be situated as far as practicable inside buildings to reduce freezing problems.

Multiple boiler installations shall have an open vent pipe or pipes of the size given below as appropriate. Individual open vent pipes shall be either routed independently to the venting point or be connected to a common open vent pipe of appropriate sizes for the total rated heat input of the installation.

For modular boiler installations, each bank of boilers in a module shall be fitted with an open vent pipe on the common flow pipe. This vent pipe shall be sized to suit the total capacity of the bank and shall be connected between the boiler bank and the safety valve. Any individual boiler fitted with a water isolating valve shall be provided with an open vent pipe as for a multiple boiler installation.

For modular boiler installations vent pipes shall be sized on the table below.

Cold Feed Pipe Sizes		
Rated Output	Minimum Bore	Nominal Bore
kW	mm	in*
Below 60	19	$\frac{3}{4}$
60 to 150	25	1
150 to 300	32	1 $\frac{1}{4}$
300 to 600	38	1 $\frac{1}{2}$
Above 600	50	2

\* Steel pipe sizes complying with medium or heavy quality of BS 1387.

A boiler vent pipe connection is provided as an equal tee on the flow manifold.

For further details see BS 6644: 1986.

#### Water Pressure Gauge (Head Gauge)

The boiler shall be fitted with a gauge that indicates the pressure in metres of water or bars. The gauge shall be fitted on the flow pipe and sited so that it can be easily read and can be easily replaced without draining the boiler/system.

#### Sludge Traps and Strainers

When new boilers are connected to old systems the fitting of sludge traps and/or strainers is strongly recommended to protect the boiler from migrating system debris which could have a detrimental effect on the boiler.

#### System Filling

When filling the boiler system with water care should be taken that water does not backwash system debris into the boiler via the flow connection and by-passing any sludge traps and strainers that may have been fitted.

Fig.3 Diplomat HE Casing  
9-14 Sections

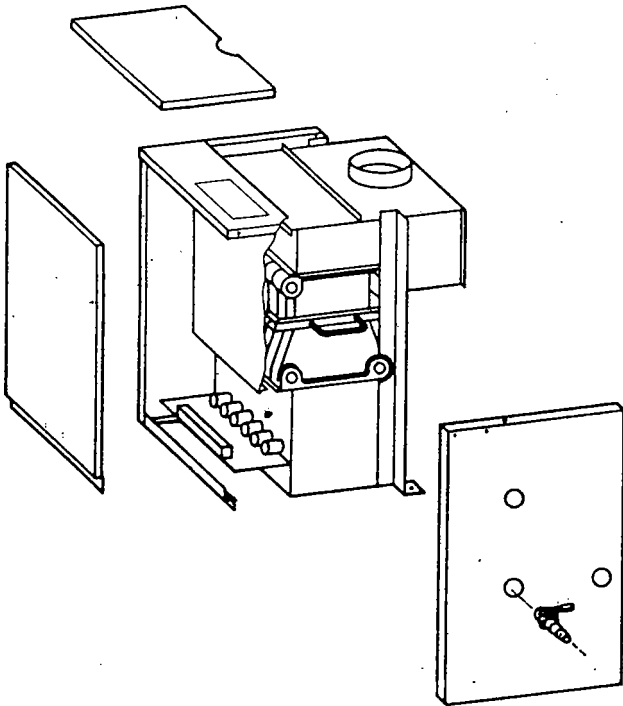


Fig.5 Diplomat HE Feet  
9-14 Sections

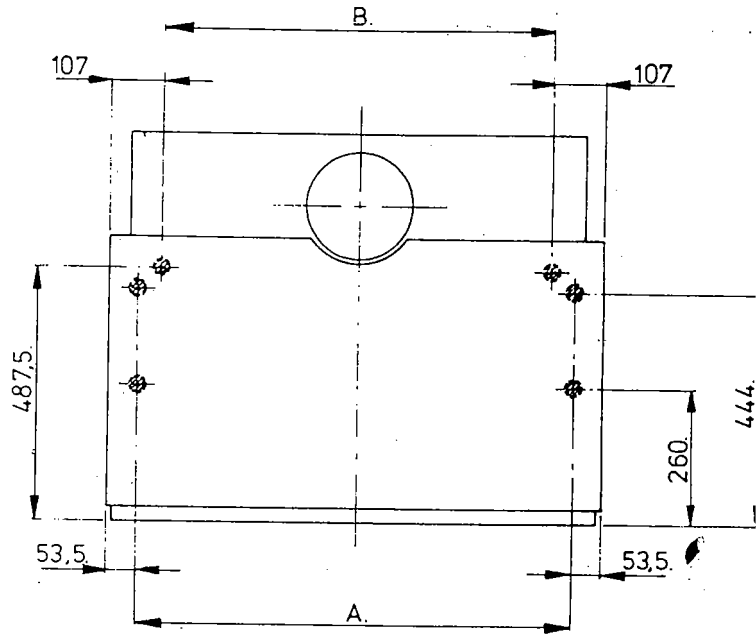


Fig.4 Diplomat HE Casing  
16-20 Sections

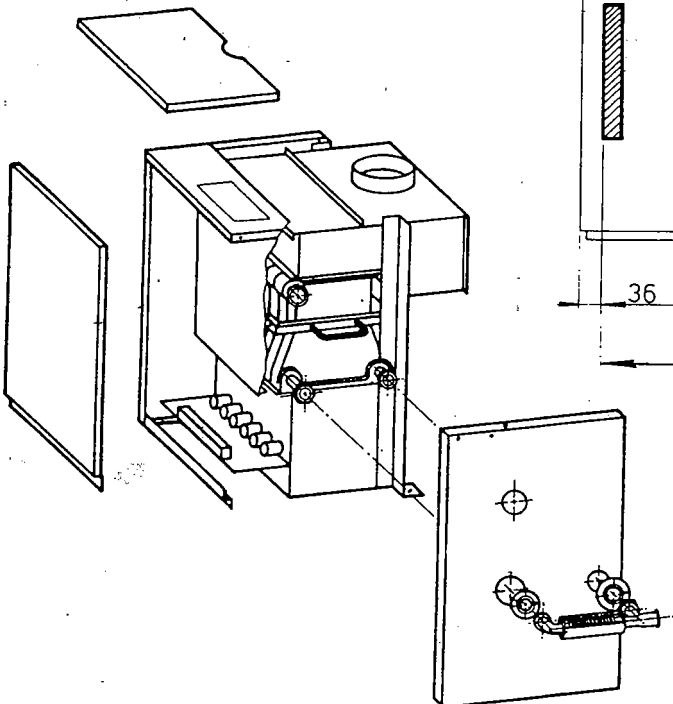
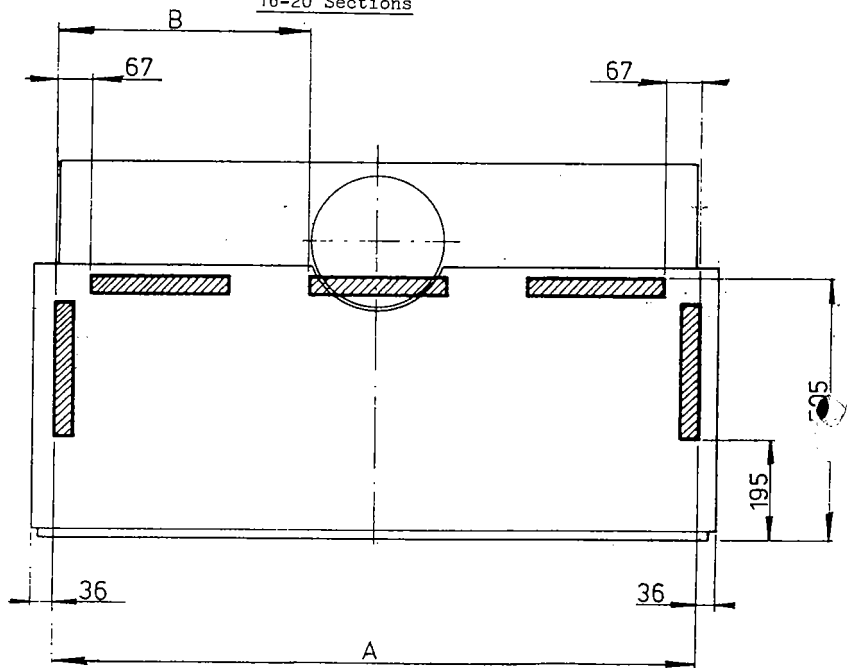


Fig.6 Diplomat HE Feet  
16-20 Sections



SECTIONS	Amm	Bmm
9	527	421
10	589	483
12	713	607
14	837	731
16	982	358
18	1104	420
20	1226	480

## INSTALLATION INSTRUCTIONS

### GENERAL

Please check the installation and clearance requirements given on page 5.

The boiler is delivered fully assembled with the casing fitted. To remove the boiler from its wooden pallet, remove the casing as illustrated in Fig.3 for 9-14 section boilers and Fig.4 for 16-20 section boilers. The drain valve is a  $\frac{1}{2}$ " BSP and is threaded into the sections and the return manifold is connected by unions onto stub pipes into the sections. Once the unions have been released the plastic capping into the casing should be removed with a screwdriver and then the casing panel can be lifted over the male part of the connection.

The boiler is secured to the wooden pallet by 4 screws through brackets on the bottom of the combustion chamber and these should be removed.

The boiler may be lifted by the carrying handles on the cast iron sections to its position.

The boiler is supported on its wooden pallet by 6 plastic feet for the 9-14 section boilers and 5 plastic strips for the 16-20 section boilers. These feet should be positioned as shown in Fig.5 for the 9-14 section boilers and Fig.6 for the 16-20 section boilers, on the boiler base and the boiler positioned on them.

Replace the casing and the ancillaries removed. The casing is protected by shrink wrap plastic and this should be peeled off at the time of commissioning.

### Connecting the Gas Supply

The gas connection should be made into the female elbow fitted by an 'O' ring and screws to the main gas valve.

The elbow should be positioned to the left or right to suit the incoming gas supply. The appropriate knock out in the side casing panel should be removed to allow entry of the gas supply.

The elbow on top of the gas valve can be released to allow withdrawal of the burner assembly and therefore an additional union within the casing for this purpose is not necessary.

An isolating valve should be fitted by the installer to the pipework adjacent to the boiler to allow it to be isolated for maintenance and also to test up to the seat of the gas valve for gas soundness.

A union should also be provided between the gas cock and the boiler.

If the gas supply is made to the left hand side, the gas pipe inner edge should run no closer than 4" to the left hand casing panel. This is to allow the left hand casing panel to be moved away from the side of the boiler to replace the overheat cut off device should it ever be necessary.

The size of the gas supply to the boiler should never be made in a size smaller than the gas connection size, ie.  $\frac{3}{4}$ " BSP, and should be sized for the rate of gas needed, see CP331 Part 3. Always ensure that all dirt and swarf are removed from the gas supply pipe system before connecting.

### Connecting the Water System

The flow and return connections are made to the right hand side of the boiler.

On the 9-14 section boilers the return connection is made into a  $\frac{1}{4}$ " BSP female connection into the piping (see Fig.1 page 2).

The female connection is a socket welded to a sparge pipe which runs into the sections. A sparge pipe is a tube with holes in it which directs the water into the sections. The female socket has a pip on it and after connecting the return connection the socket should be checked to make sure that the pip is pointing directly upwards and this will ensure that the holes in the sparge pipes are pointing in the right direction. If not it should be adjusted, see Fig.8.

The 16-20 section boilers have the two return connections made to the  $\frac{1}{4}$ " BSP female socket in the return manifold. The female socket should be securely held whilst connecting to the return to avoid damaging the internal flexible pipe. These sizes of boiler also have sparge pipes fitted but their positions are pre-set during assembly.

The flow connection is made to a  $\frac{1}{4}$ " BSP tee as shown in Figs.1 and 2, see page 2. No sparge pipe is fitted to this connection.

The unions and isolating valves should be fitted to the flow and returns so that the boiler can be isolated from the water system if required. The drain off cock is supplied loose and should be connected as shown in Figs.1 and 2, page 2.

### Electrical Connections

All electrical wiring must be installed in accordance with I.E.E. Regulations. Care must be taken that all wiring is kept clear of sharp edges and hot surfaces.

A 5 Ampere fuse and a suitable 2 pole isolator having a contact separation of at least 3mm in all poles has to be provided by the installer for isolation of the boiler and should be installed close to the boiler.

The incoming electrical connections should be made through the conduit provided on the left or right hand side of the boiler running from back to front.

The 240 volts  $\sim$  AC single phase supply should be connected to the live and neutral terminals in the junction box and the earth connection should be connected to the earth bar in the junction box via a cable entry gland. The length of the conductors between the cord anchorage and the terminals must be such that the current carrying conductors become taut before the earth conductor if the cable or cord slips out of the cord anchorage. Access to the junction box is made by removing the screws holding the lid in position.

A wiring diagram is fixed inside the lid of the junction box and is also included in this manual.

If the left hand conduit is used the incoming wire should be run across the front of the boiler in the conduit provided.

### Connecting the Flue System

A flue adaptor socket is provided with each boiler for use with flues to BS 835, for flues to BS 715 this flue adaptor socket can be discarded. The flue system should be made in accordance with the notes given on page 6. The flue pipe should be supported so that no weight is transferred to the boiler draught diverter. Facilities for disconnecting the flue system from the boiler should be provided.

### Boiler Controls

The operation of the boiler is under the control of its own boiler thermostat and high limit thermostat.

In addition the boiler should be controlled by a time switch, frost thermostat, pump overrun facility and for multiple boiler installations a boiler sequence controller.

## COMMISSIONING AND OPERATION

Before commencing to commission the boiler ensure that the shrink wrap plastic is removed from the casing panels then check the following:-


1. Electrical supply is switched off. All electrical connections are sound and correctly made.
2. Electrical system and the boiler are correctly earthed.
3. Gas supply is tested for soundness and purged of air.
4. Test for gas soundness of gas trains as described on page 13.
5. Appliance gas cocks are all turned off.
6. Gas supply is turned on at meter.
7. Boiler and system are filled with water.
8. Flow and return valves are open.
9. Any external controls and the on/off switch are in the 'ON' position.
10. The circulation pumps are operational. Check that the pump is scheduled to run and not on pump overrun if the boiler has previously been fired.

For boiler houses with natural ventilation, the area of the grilles should be checked against the notes given on 'Ventilation' on page 6.

For boiler houses with mechanical ventilation, the suitability of the ventilation and extract system should be checked against the notes given under 'Mechanical Ventilation' on page 6.

In addition the installer must check that it is not possible for the boiler to operate if either the ventilation or extract fans are not running.

### 1.0 TO LIGHT THE BOILER

- 1.1 Check that the electricity supply to the boiler is off, the on/off switch is off and that the boiler thermostat is at the 'OFF' position marked with a white dot.
- 1.2 Check that ancillary controls such as time clocks and external thermostats are off or at their lowest settings.
- 1.3 Ensure that the gas supply to the boiler is on.
- 1.4 Press and hold in fully the square button marked "  " on the gas control valve and press the Piezo ignitor two or three times to light the pilot. Keep the button held in for 20 seconds after the pilot has lit; then release the square button.  
  
If the pilot flame goes out, push in and release the button marked '0'. Wait for 3 minutes then repeat from step 1.4.
- 1.5 With the pilot flame established turn on the electricity supply, on/off switch, time switch, external thermostats and turn the boiler thermostat to its required setting.

The boiler will now light.

- 1.6 Refit the boiler front casing.

**WARNING - If the pilot light is extinguished either intentionally or unintentionally, no attempt should be made to re-light it until at least 3 minutes have elapsed.**

### 2.0 TO SHUT DOWN BOILER

- 2.1 Temporarily - turn the boiler thermostat to the 'OFF' position. Turn the on/off switch and the time switch, if fitted, off.

To bring the boiler on again, turn on the time switch and on/off switch and turn the boiler thermostat to the required setting.

- 2.2 Long Periods - turn off the time switch, electricity supply and on/off switch and turn the boiler thermostat to the 'OFF' position.

Push the square OFF button marked '0' on the gas control valve and the pilot will go out. Turn off the gas cock.

### OPERATION OF ANCILLARY CONTROLS

After lighting the boiler the operation of the above mentioned controls, eg. clock and thermostats, should be checked.

### FINAL ADJUSTMENT

#### Main Burner

Fit a pressure test gauge to the outlet pressure test nipple on the valve as shown in Fig.7.

Check that the burner pressure is as given in Table 1, page 3, and if necessary adjust the pressure regulator. The position of the adjuster is shown in Fig.7.

After the burners have stabilised for 30 minutes, check the gas pressure and if needed re-adjust it again and measure the gas rate at the meter. The gas rates are given in Table 1, page 3.

With the boiler hot and cold check for spillage of combustion products with a smoke bomb or smoke wand. Check that air is moving into the front of the boiler, that combustion products are not spilling out of the front or spilling out of the draught diverter at the back. The flue draught should be checked with a draught gauge and should be measured at a suitable test point in the flue above the flue adaptor socket.

For boiler houses with natural ventilation the area of the grilles should be checked against the notes given on ventilation.

For boiler houses with mechanical ventilation, the suitability of the ventilation and extract system should be checked against the notes given under "Mechanical Ventilation". In addition, the installer must check that the flow switches on the ventilators are interlocked with the burner controls so that it is not possible for the boiler to operate if either the ventilation or extract fans are not running.

Whilst the boiler is operating, check for gas soundness in the main gas line and the pilot line downstream of the multi-functional control using a soap solution or other approved method.

Switch the boiler off, remove the pressure gauge and re-tighten the test point sealing screw.

#### Pilot Burner

When correctly set the pilot flame must be sufficient to heat the thermocouple so that the pilot safety device is held in, but must not cause the thermocouple to overheat.

This can be detected by observing the thermocouple tip and the pilot flame as shown in Fig.9.

The pilot flame should be about 20mm long and should cover the thermocouple tip. If the thermocouple is bright red it is too hot and the pilot gas rate should be reduced by use of the adjuster screw as illustrated in Fig.7. Turn the screw clockwise to reduce and anti-clockwise to increase the pilot flame.

The ignition electrode gap should be as illustrated in Fig.9.

The action of the flame failure device should be checked by turning the pilot off and making sure that the flame failure device cuts out. This will be heard as an audible click within 60 seconds.

#### Water Flow Switch

For boilers fitted with a water flow switch, the installer should check that it is not possible for the boiler to fire when there is no water flow. This may be done by checking that the boiler closes down when the pumps are switched off or the water flow is gated off. Always restore the water flow before completing commissioning.

#### SERVICING AND MAINTENANCE

**WARNING** - Always isolate the electrical supply and the gas supply to the boiler before commencing maintenance or component replacement.

Always replace the electrical junction box cover after maintenance.

The frequency of servicing depends upon the usage and application of the boiler. This is likely to be at least once a year.

At every service visit the boiler should be cleaned as detailed below and the soundness of the safety shut off valve within the multi-functional valve checked as described under "Commissioning" and the gas control assembly must be checked for leakage with a soap solution or other approved method. The boiler should be fully re-commissioned as described under "Commissioning" and attention also paid to:-

1. The effectiveness of natural and mechanical ventilation and in particular the safe operation of an air flow switch on a mechanical ventilation system.
2. That the chimney is sound and adequately evacuating the products of combustion and that there is no spillage of flue products.
3. That the burner gas pressure is correct and that the boiler is still on rate.
4. That the water flow switch, if fitted, is operating correctly.
5. That the low pressure switch on a booster system, if fitted, is operating correctly.

#### TO CLEAN THE BOILER

Remove the front casing panel, the large top casing panel which is secured by 4 screws and the bottom front strip secured by 2 screws.

Remove the plastic terminal cover on the main gas valve secured by a screw and disconnect the electrical supply made by push on connections and a screw on spade terminal. Disconnect the overheat cut off device by removing the two push on female connections to it.

Isolate the gas supply at the gas cock and release the gas supply by removing the 4 screws from the elbow on top of the multi-functional valve and breaking the connection. Take care not to lose the 'O' ring or to get foreign matter into the pipe or valve.

Remove the 4 headed screws securing the burner assembly and withdraw it.

Remove the Rockwool covering the flue hood clean out cover and unscrew the screws securing it and remove the cover, paying attention not to damage the seal.

Remove the flueway baffles and clean the flueways from the top and bottom with the brush provided with the boiler and sweep away the debris from the bottom of the combustion chamber.

Replace the flueway baffles and the flue hood cover taking care to position it on the seal and secure it by replacing the screws. Replace the Rockwool insulation cover and refit the large top casing panel with the 4 screws.

While the burner assembly is removed from the boiler check the condition of the burner front plate and insulation and replace if necessary.

Check the condition of the Vermiculite blocks lining the combustion chamber and replace them if necessary.

Lightly brush the burners and remove any fluff which may have accumulated.

Inspect the thermocouple, ignition electrode and pilot burner head. See Fig.9 for the correct position of the thermocouple and ignition electrode.

Remove and clean the main burner injectors in cleaning fluid. When replacing the injectors use an approved thread sealant.

Replace the burner assembly taking care not to damage the Vermiculite lining and the burner front plate insulation and re-fit the 4 Hex head screws.

Re-connect the gas line, thermocouple interrupter and the electrical connection to the multi-functional valve.

Check for gas soundness of the safety shut off valve within the multi-functional valve and check the control assembly for gas leakage with a soap solution or any other approved method as described under "Commissioning".

Re-fit the front casing panel.

## THERMOSTATS

### Boiler Thermostat

This is a Honeywell thermostat range 25-90°C and is graduated in degrees Centigrade and there is an off position marked with a white dot.

The thermostat has been calibrated by the manufacturers and no attempt should be made to re-calibrate it on site.

When the boiler reaches a suitable temperature, turn it to a lower setting to check that the main burner shuts down.

### Overheat Cut Off Device

This is a Landis & Gyr RAK 21.4/2756 which acts as a thermocouple interrupter.

It has been set by the manufacturers to 98°C and no attempt should be made to re-calibrate it on site.

When a temperature of 98°C is reached the device will shut down the pilot. Before re-lighting the pilot, investigate the cause and rectify the reason for overheat condition being reached. Re-set the device by pressing the green button on it and then re-light the pilot 3 minutes after the last attempt to light the pilot.

The operation of the overheat cut off circuit should be checked by disconnecting a female push on connection to the overheat cut off device and checking that the boiler shuts down.

### Location of Thermostat Phials

The boiler thermostat phial is located in the thermostat pocket behind the Honeywell boiler thermostat and the thermostat body is clamped to the thermostat pocket by a single screw.

The overheat cut off device phial is located in a thermostat pocket in the left hand side of the cast iron boiler sections.

### To Test Gas Soundness of the Safety Shut Off Valve Within the Multi-Functional Control

The soundness of the safety shut off valve should be checked at every service visit.

Fit a manometer to the inlet of the multi-functional valve and light the pilot in the normal way and bring on the main burners.

Turn the multi-functional valve off by pressing the square 'OFF' button marked '0'.

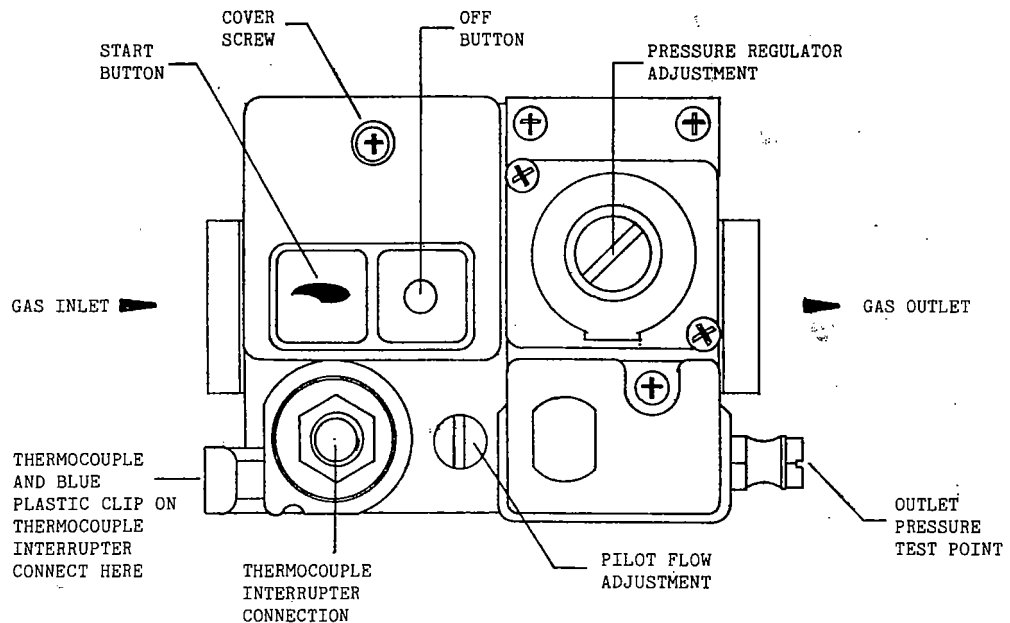
Listen for the click as the safety shut off valve closes and pressurise up to this valve seat by closing the gas cock.

Observe the manometer for a period of 3 minutes. If the valve loses less than 1½ in.w.g. (3.8 mbar) in 3 minutes the valve is satisfactory.

If any loss of pressure is observed then check the assembly and pipework for leaks with a soap solution and rectify if a leak is found.

If no external leaks are found the safety shut off valve seat is letting by and the valve should be replaced.

Fig.7 Multi-Functional Control



## COMPONENT REPLACEMENT

### Overheat Cut Off Device

Remove the front casing panel, the front bottom strip secured by 2 screws and the small top panel secured by 2 screws. Lift these panels away and then lift away the left hand side panel. If the gas connection is made through the left hand side panel, the panel should be slid along the pipe which should have been positioned 4" away from the panel.

Remove the thermostat pocket retaining clip and remove the thermostat phial from its pocket and then the 2 wires connected to the overheat cut off device by female push on connections.

Remove the 2 screws securing the device to its mounting bracket and replace with a new one supplied by the manufacturer and calibrated to 98°C only. Position the new phial fully into the pocket and secure with the retaining clip.

Replace the two wires to terminals 1 and 2 as removed and replace the casing panels.

### Boiler Thermostat Replacement

Remove the front casing panel and unscrew the plastic cover plate on the front of the thermostat body, pull down the plastic lower portion of the thermostat and disconnect the electrical connections. Remove the electrical wire through the cable entry gland and release the screw securing the thermostat body to the head of the thermostat pocket.

Re-fit a complete new unit, secure the thermostat to the thermostat pocket, re-make the electrical connections. Tighten up the cable entry gland and re-fit the plastic cover over the connections.

Check the operation of the thermostat as described under "Commissioning" and re-fit the front casing panel.

### On/Off Switch Replacement

Remove the front casing panel and the front of the junction box which is secured by screws. Disconnect the push on connectors to the on/off switch. Push the body of the switch through the junction box lid and replace with a new one and re-connect the push on connectors. Check that the connectors are made to the correct terminals.

Re-light the boiler and check that the switch closes down the main burner.

### Pilot Assembly/Thermocouple/Ignition Electrode Replacement

Disconnect the high tension ignition lead from the ignition electrode and unscrew the thermocouple from its fitting on the pilot burner assembly. Release the pilot bundy tube from both the multi-functional control valve and the pilot assembly taking care not to lose the injector from the pilot burner.

Remove the 2 screws securing the pilot burner to the burner assembly and replace with new pilot burner assembly if necessary.

To replace the thermocouple, unscrew it from its connection into the side of the multi-functional gas valve and replace with a new one as necessary.

The ignition electrode is secured by 2 self tapping screws into the pilot burner assembly. This is a non-serviceable item and if necessary the complete pilot burner should be replaced.

Replace the pilot assembly and secure with the 2 screws. Care should be taken that the pilot assembly is mounted the correct way up. Looking at the pilot from the front of the boiler, the thermocouple should be on the left hand side and the ignition electrode on the right hand side. See Fig.10.

Re-connect the pilot line taking care to make sure that the pilot injector is included. If the pilot bundy tube does not align this may be because the pilot burner is upside down. See above.

Re-connect the thermocouple to the pilot burner and to the slot on the side of the multi-functional gas valve. Care should be taken that the thermocouple is screwed into this slot which also fixes the wire to the overheat cut off device and that the thermocouple is not screwed directly into the pilot solenoid connection. See Fig.8 and 9. Re-connect the high tension ignition electrode lead to the ignition electrode.

Check the position of the pilot burner, thermocouple and electrode as given in Fig.10.

Replace the burner assembly, check for letby of the safety shut off valve as described under "Commissioning" and check the control assembly for gas leaks with soap solution or other approved method.

Adjust the pilot rate as described under "Commissioning".

Check that the thermocouple is holding in the flame failure device within the multi-functional valve and then turn the pilot to the 'OFF' position and make sure that the flame failure device cuts out with an audible click within 60 seconds.

Check that the overheat cut off circuit is operational by disconnecting one female push on connection to the device and checking that the boiler closes down.

### Main Gas Valve Replacement

Remove the burner assembly as described under "Cleaning".

Release the pilot bundy tube, the thermocouple and the two thermocouple interrupter wires from the multi-functional valve.

Disconnect the high tension ignition lead from the Piezo ignitor.

Release the 8 screws securing the valve to its flanges and replace with a new valve and new 'O' ring seals.

When these 8 screws are released it is possible to remove the Piezo ignitor and its bracket from the old valve.

Re-fit the Piezo ignitor and its bracket to the new valve.

Reassemble the thermocouple, the pilot bundy tube and the 2 overheat cut off device wires into the multi-functional valve. Care should be taken that the thermocouple is screwed into the slot on the side of the multi-functional valve into the overheat cut off device wire and not directly into the pilot solenoid magnet.

Replace the burner assembly. Check for letby of the safety shut off valve within the multi-functional valve as described under "Commissioning" and also check for gas soundness of the control assembly with soap solution or any other approved method.

Re-commission the main burner and pilot as described under "Commissioning".

### Piezo Ignitor

To replace the Piezo ignitor, disconnect the high tension ignition lead from it and unscrew the plastic lock nut on the body of the ignitor and remove it from its bracket.

Replace with a new unit, refit the plastic lock nut and the ignition lead.

### Section Replacement

Each section is joined together on the water side by steel push nipples and strips of Tapperil sealing mastic between the sections to form a gas tight seal.

Tapperil is also used to seal the flue hood to the top of the heat exchanger and fire cement is used to seal the sections to the combustion chamber.

The sections are held to the combustion chamber by 4 Taptite screws passing through lugs at the base of the section into fixing brackets on the combustion chamber.

The flue hood and draught diverter are fixed to the cast iron sections by bolts and washers securing the flue hood to lugs on the top of the sections.

If a section leaks, the boiler must be drained down and the heat exchanger containing the leaking section removed.

To do this the casing must be stripped away, the insulation and the flue hood.

When the heat exchanger is removed check the burners and combustion chamber Vermiculite lining for damage and replace where necessary.

Once the heat exchanger is removed, remove the sparge pipe on the 9-14 sections models and the two sparge pipes on the 14-20 section models.

Remove all plugs and the thermostat pockets if end sections are to be replaced.

Remove the two tie rods holding the sections together. The sections can be split by inserting a sharp chisel between the sections and carefully easing apart.

When re-assembling, use new nipples, clean the nipple port with wire wool and use a proprietary jointing compound. Fit new strips of Tapperil jointing mastic along the edges of the section.

Fit the sections together and pull up so that they come metal to metal around the nipple ports. The sections should be pulled up using a set of pulling up tools available from the Parts Department of Potterton International Ltd. Alternatively, the thermostat pockets and all plugs can be removed and 3 threaded bars passed through the nipple ports in all sections and with a suitable end plate these can be used to pull the sections up together.

Refit the two tie rods and carrying handles and the thermostat pockets and plugs using a proprietary jointing compound.

Pressure test the block of sections to  $1\frac{1}{2}$  times the operating pressure, ie. 6 bar.

After pressure testing refit the sparge pipes. On the 9-14 section boilers the pip on the  $1\frac{1}{4}$ " BSP female socket should point upwards and it will be seen that with the sparge pipe in this position the holes in the pipe direct water up into the legs of the section.

On the 16-20 section models the indent on the sparge pipe fittings should also point upwards so that the holes in the pipe direct water up into the legs of the sections.

Refit the heat exchanger to the combustion chamber using new fire cement and secure with the 4 screws. Refit the flue hood to the heat exchanger using new strips of Tapperil jointing mastic.

Refit the insulation and the casing panels and recommission the boiler.

### IMPORTANT

If a section has failed it may be due to scale and deposits within the boiler. If this is the case then it is generally recommended that the complete bank of sections be replaced as the other sections may also contain scale and deposits and they may have a shortened life.

For this reason it is strongly recommended that sludge traps and strainers be fitted to a system to prevent system debris entering the sections and the Technical Department of Potterton Commercial Products, address given on the back page of this manual, will be pleased to receive and examine any failed sections to help identify the cause.

Fig.8 Sparge Pipe 9-14 Sections

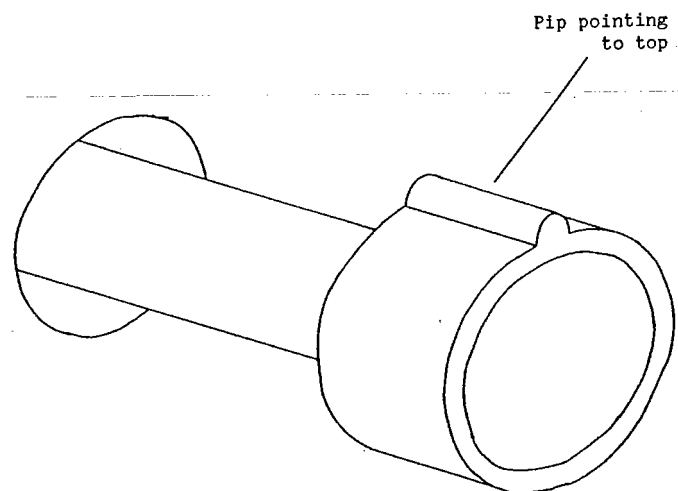




Fig.9 Diplomat HE Pilot Assembly

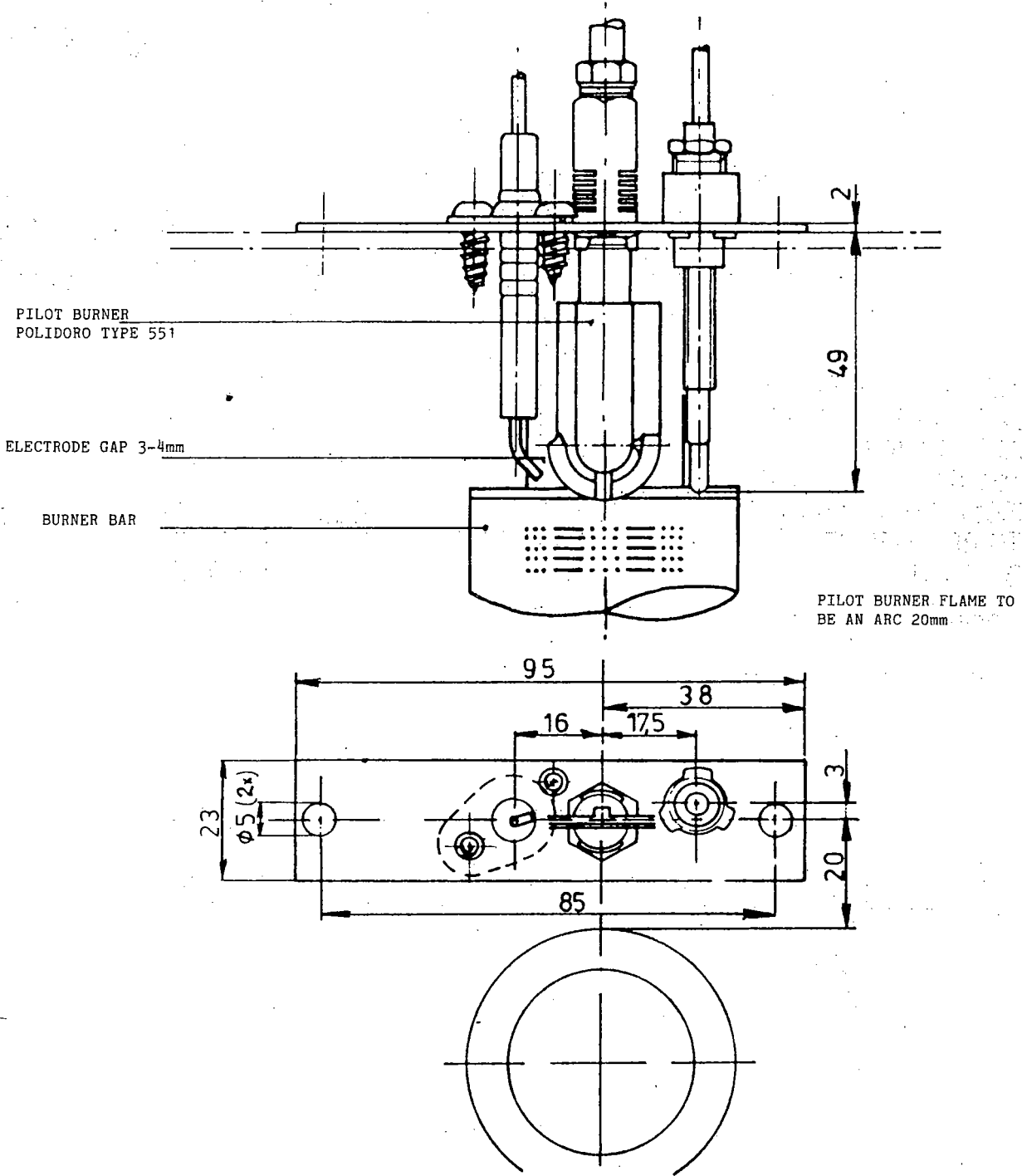


Fig.10 Diplomat HE Wiring Diagram

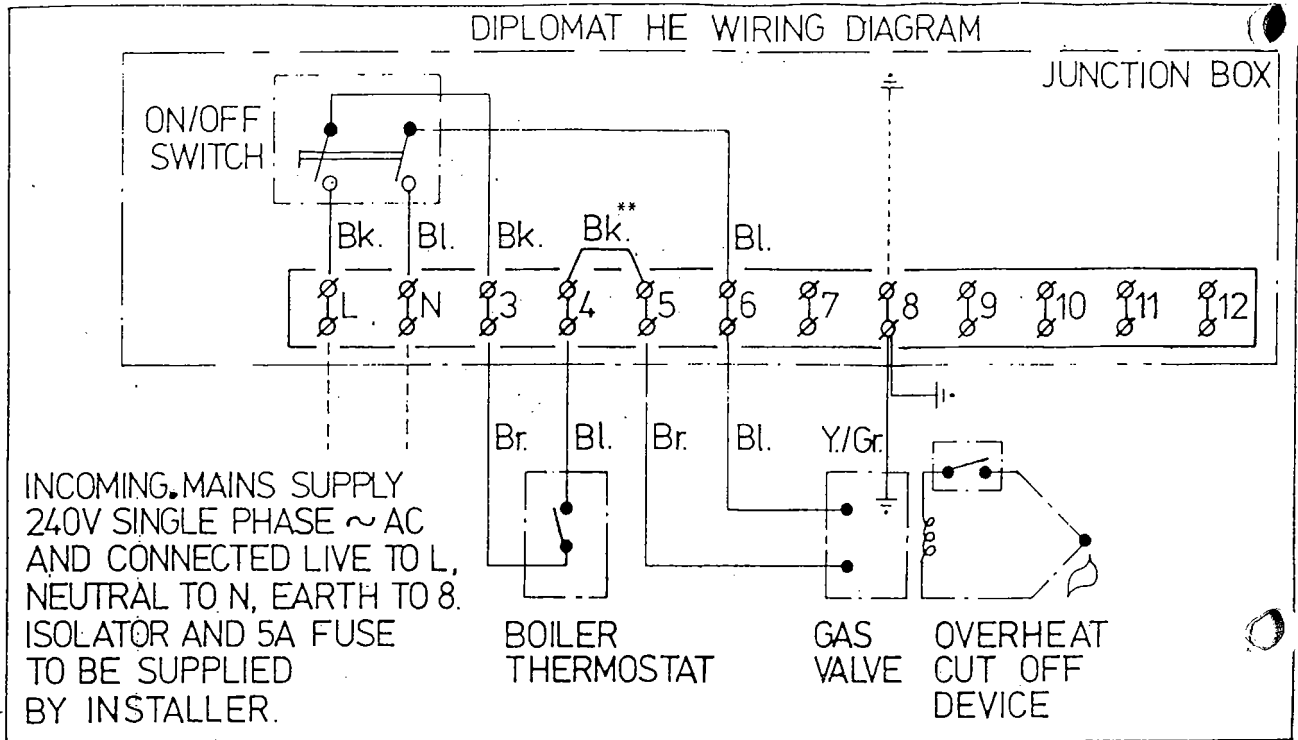


Fig.11 Block Diagram of Gas Control Assembly

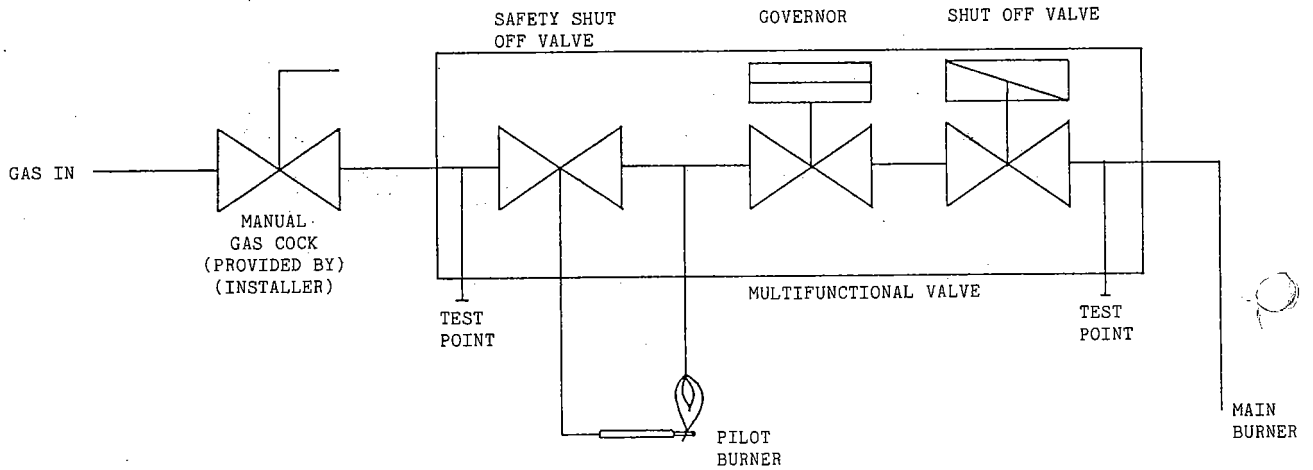
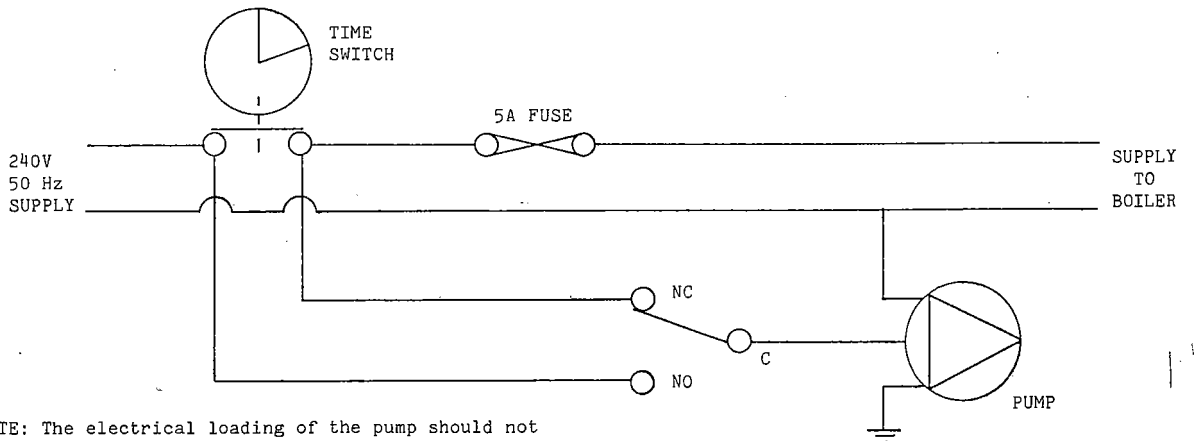


Fig.12 Pump Overrun Using Changeover Pipe Thermostat



FAULT FINDING

Pilot will not light	<ol style="list-style-type: none"> <li>1. Air in gas line.</li> <li>2. Faulty gas control valve.</li> <li>3. No spark at electrode tip.</li> <li>4. Blocked pilot injector.</li> </ol>
Pilot does not remain alight when knob released.	<ol style="list-style-type: none"> <li>1. Over heat cut off device tripped.</li> <li>2. Loose connection on leads to overheat cut off device.</li> <li>3. Loose thermocouple connection.</li> <li>4. Faulty thermocouple.</li> <li>5. Faulty over heat cut off device.</li> <li>6. Faulty gas control valve.</li> <li>7. Pilot partially blocked or needs adjusting.</li> </ol>
Pilot established - main burner does not light.	<ol style="list-style-type: none"> <li>1. No electrical supply to burner.</li> <li>2. On/off switch is in 'OFF' position.</li> <li>3. Boiler thermostat set too low.</li> <li>4. Faulty thermostat or connections.</li> <li>5. Faulty gas control valve.</li> </ol>
Main burner remains alight when thermostat satisfied.	<ol style="list-style-type: none"> <li>1. Faulty thermostat.</li> <li>2. Faulty gas control valve.</li> </ol>
Main burner remains alight when on/off switch in 'OFF' position.	<ol style="list-style-type: none"> <li>1. Faulty on/off switch.</li> <li>2. Faulty main gas valve.</li> <li>3. Incorrect control circuit.</li> </ol>

SHORT PARTS LIST

	<u>Potterton Part Number</u>
1. Honeywell V4400C $\frac{3}{4}$ " gas valve (9-20 sections)	402852
2. Honeywell Q309 thermocouple	40225701
3. Piezo ignitor Honeywell Q635	358024
4. Ignition electrode	358026
5. On/off switch Arco Electric	358023
6. Pilot assembly complete Polydoro 511	358204
7. Pilot injector 2 holes $\emptyset$ 0.29	358027
8. Boiler thermostat Honeywell Aquastat 30-90°C	358020
9. Over heat cut off device Landis & Gyr RAK 21.4 2756	358022
10. Over heat cut off device connection wires	358031
11. Main burner injector $\emptyset$ 2.4mm	358030
12. Main burner injector $\emptyset$ 2.3mm	358240
13. Ignition electrode lead	358046

NB: Early boilers were fitted with a Honeywell LS 8097A over heat cut off device. The Landis & Gyr RAK 21.4/2756 should be used for spares purposes. The Landis & Gyr device is fitted to a mounting bracket (Potterton Part No. 358050) by two M3 x 6 screws (Potterton Part No. 633931). This bracket has a slot in it which fixes under the head of the hex head screw securing the front inner panel to brackets on the block of sections. The bracket also has a 5mm hole in it and a number 6B by 12mm self tapping screw (Potterton Part No. 613434) or one of the original fixing screws should be used to fix the bracket to the hole in the front inner panel used for mounting the original cut off device.

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