



# POTTERTON DERWENT HE

Installation, Operation &  
Maintenance Manual

October 1995

# INDEX

## SECTION 1

Fig 1.1 - General Data & Dimensions	1.1
Table 1.1 - Boiler Dimensions	1.1
Connections	1.1
Table 1.2A- Technical Data (5 to 12 section)	1.2
Table 1.2B- Technical Data (13 to 22 section)	1.3
Fig 1.2 - Steel Base Strip Details	1.5
Clearances	1.5
Burner Information	1.5
Conversion Table	1.6

## SECTION 2

General Information	2.1
Installation Standards	2.1
Boiler Siting & Base	2.2
LPG Boilers	2.2

## SECTION 3

Electrical Supply	3.1
Fuel Supply (Gas)	3.1
Ventilation - Natural	3.1
Ventilation - Mechanical	3.1
Flues (General)	3.2
Flue Size Considerations	3.3
Natural Draught Systems	3.3
Mechanically Assisted Flues	3.4
Fan Dilution Systems	3.4
Table 3.1 - Flue Losses (8 tables)	3.5
Table 3.2 - Typical Duct Sizes & Fan Volumes	3.6
Water Circulation Systems	3.7
Boiler Protection	3.7
Open Vented Systems	3.8
Cold Feed Supply	3.8
Table 3.3 - Saturated Steam Pressures	3.8
Cistern Sizing	3.8
Table 3.4 - Open Vent Sizes	3.9
Table 3.5 - Cold Feed Pipe Sizes	3.9
Table 3.6 - Safety Valve Sizes	3.9
Sealed Systems	3.10
Noise Level	3.11

## SECTION 4

Installing Fully Assembled Boilers	4.1
Handing Changes: Gas Train	4.1
Control Panel	4.1
Assembly of Flue Hood	4.1
Assembly of Burners	4.1
Fig 4.1 - General Arrangement of Casing	4.2
Assembly of Casing	4.3
Assembly of Gas Train	4.3
Fig 4.2 - Flue Hood Sealing Arrangement	4.4
Fig 4.3 - General Arrangement of	4.4
Thermostat Pocket	4.4

	Connecting Pilot Gas Line	4.5
	Connecting Gas Supply	4.5
	Connecting Water System	4.5
	Connecting Electrical Supply	4.5
Fig 4.4 -	General Arrangement of Boiler Block	4.6
Fig 4.5 -	Landis & Gyr QSZ1 SO2 Pilot Burner Arrangement	4.6
	Boiler Controls	4.7
	Connecting the Flue System	4.7
	Installing Unassembled Boilers	4.7
Fig 4.6 -	Section Assembly	4.8
Fig 4.7 -	Section Assembly	4.8
	Installing Multiple Unassembled Boilers	4.9
Fig 4.8 -	Position of Base Tray	4.10
Fig 4.9 -	Multiple Unassembled Boilers - Clearance	4.10
	Boiler Disassembly	4.11
Fig 4.10 -	Arrangement of Insulation & Rear Sealing	4.11

## SECTION 5

	Boiler Maintenance	5.1
	Boiler Cleaning	5.1
	Commissioning	5.2
	Operation of Ancillary Controls	5.4
	To Light Boiler	5.4
	To Shut Down Boiler	5.4
	Setting Flow Temperature	5.4
Fig.5.1 -	Control Thermostat Expanding Scale	5.5
	Water Flow Switch	5.5
	Fault Finding	5.5
	Component Replacement	5.7
Fig.5.2 -	Furigas Kanthal Rod Burner Arrangement	5.9
Fig.5.3 -	Kanthal Rod Burner Layout	5.9
	Gas Soundness Testing	5.11
Fig 5.4 -	Schematic Gas Train Diagrams	5.13

## SECTION 6

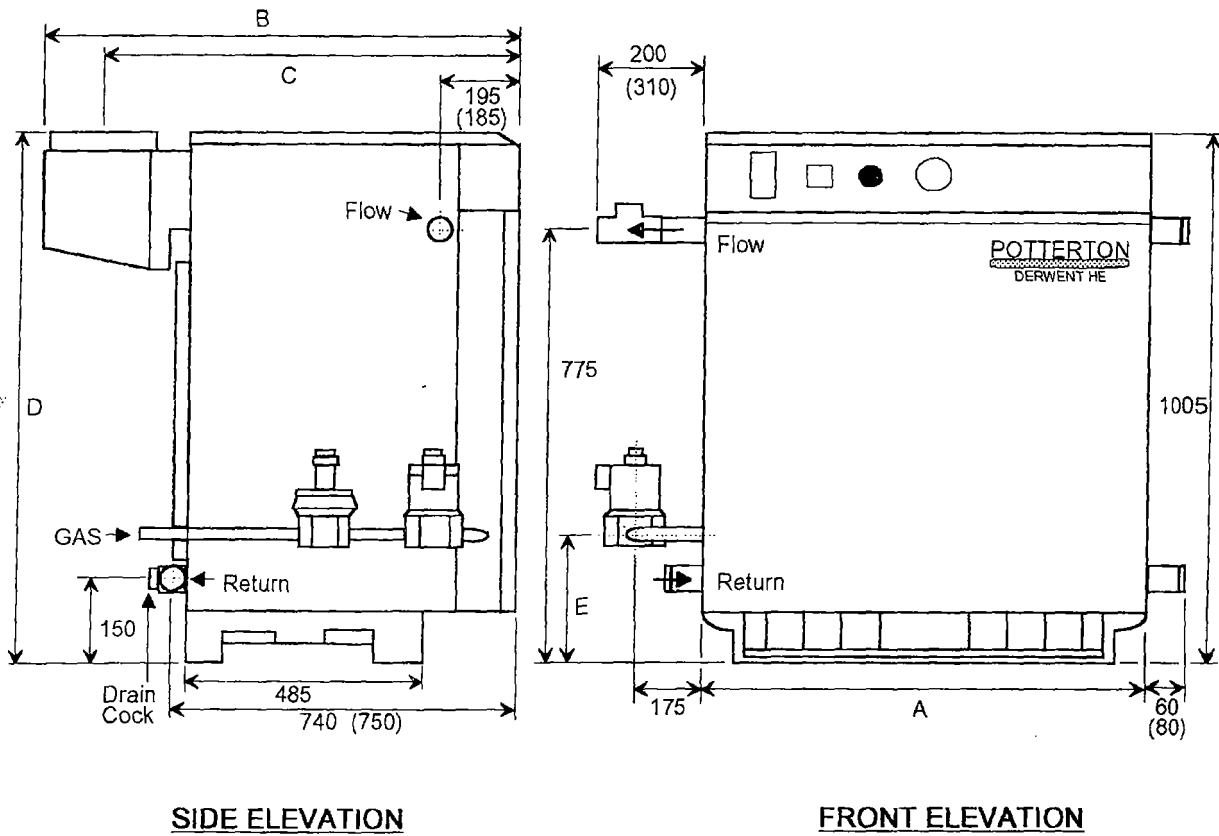
Fig 6.1 -	Control Panel Wiring	6.1
Fig 6.2 -	Pump Overrun Using Changeover Pipe Thermostat	6.2
Fig 6.3 -	Electrical Connections to Plug Cap - Dungs Multiblock Valve ON/OFF Gas Trains Only	6.2

## SECTION 7

	Parts Lists	7.1
--	-------------	-----

**Fig.1.1 - General Data & Dimensions**

Figures in brackets are for the 20 and 22 section boilers.



**Table 1.1 - Boiler Dimensions**

No of Sections	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	22	
A	mm	465	545	625	705	790	870	950	1030	1110	1195	1275	1355	1435	1515	1680	1840
B	mm	980	1000	1050				1100				1150	1200				
C	mm	865	875	900				925				950	975				
D	mm	1005						1015						1175			
E	mm	393															

**Connections**

Water - Flow & Return: 5 to 11 section - 1 1/2" BSP  
 12 to 18 section - 2" BSP  
 20 and 22 section - Flanged, mating flange supplied and screwed 2 1/2" BSP.

Drain: 3/4" BSP - drain cock supplied.

Gas: 5 to 6 section - 1" BSP  
 7 to 11 section - 1 1/2" BSP  
 12 to 22 section - 2" BSP

Refer to section 4 for details on handing options for boiler flow, return and gas connections.

TABLE 1.2A - Technical Data (5 to 12 section)

	Number of Sections		5	6	7	8	9	10	11	12	
	Output	kW	65	81	97	113	129	145	161	178	
1	Fuel Consumption	m <sup>3</sup> /hr	7.46	9.41	11.19	13.05	14.89	16.75	18.73	20.59	
	Input	kW	80	101	120	140	160	180	201	221	
	Maximum Design Pressure	Bar	5								
2	Minimum Operating Pressure	Bar	0.3								
3	Nominal Flue Connection Size	mm	175	200		250			300		
	Internal Diameter of Diverter Socket to BS 835	mm	213	240		290			344		
4	Flue Gas Volume	m <sup>3</sup> /hr	174	217	260	303	315	389	432	477	
	Flue Draught Requirements		1 - 4 mm ALL SIZES								
5	High Level Natural Ventilation to BS 6644	cm <sup>2</sup>	315	363	405	450	495	540	588	633	
5	Low Level Natural Ventilation to BS 6644	cm <sup>2</sup>	630	725	810	900	990	1080	1175	1265	
6	Mechanical Inlet to BS 6644	m <sup>3</sup> /sec	0.089	0.111	0.133	0.154	0.176	0.198	0.22	0.243	
7	Water Connection Size	BSP	1 1/2"								2"
8	Water Flow at 11°C Δ t	lit/sec	1.4	1.8	2.1	2.5	2.8	3.1	3.5	3.9	
	Min Water Flow at 25°C Δ t	lit/sec	0.62	0.77	0.92	1.08	1.23	1.38	1.53	1.7	
8	Hydraulic Resistance at 11°C Δ t	kPa	4.16	5.69	7.61	9.82	12.77	15.76	18.49	22.35	
9	Cold Feed Size to BS 6644 Minimum Bore	mm	25						32		
9	Open Vent Size to BS 6644 Minimum Bore	mm	32						38		
	Safety Valve Size to BS 6644 Nominal Size	mm	19								
2	Maximum Flow Temperature	°C	90°C								
10	Minimum Return Temperature	°C	40°C								
11	Dry Weight	kg	285	330	375	415	470	515	560	610	
	Water Content	kg	29.9	34.6	39.2	43.8	48.5	53.1	57.7	62.4	
	Power Requirements		IP 30 - 240V 50Hz 1Ph - Isolator and 5A fuse required								

For metric to imperial conversions refer to page 1.6

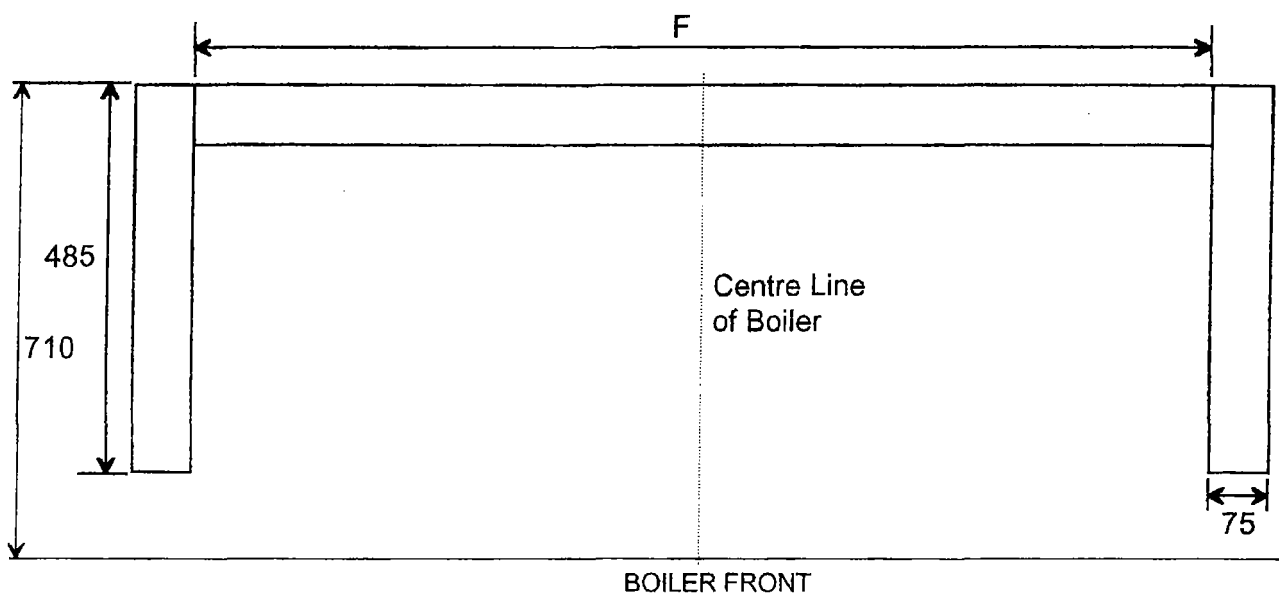
TABLE 1.2B - Technical Data (13 to 22 section)

Number of Sections		13	14	15	16	17	18	20	22	
	Output kW	194	210	226	242	258	274	294	325	
1	Fuel Consumption m <sup>3</sup> /hr	22.43	24.29	26.16	28.02	29.89	31.75	33.98	37.25	
	Input kW	241	261	281	301	321	341	365	403	
	Maximum Design Pressure Bar	5								
2	Minimum Operating Pressure Bar	0.3								
3	Nominal Flue Connection Size mm	300				350		400		
	Internal Diameter of Diverter Socket to BS 835 mm	344				390		440		
4	Flue Gas Volume m <sup>3</sup> /hr	520	563	606	649	692	735	789	872	
	Flue Draught Requirements	1 - 4 mm ALL SIZES								
5	High Level Natural Ventilation to BS 6644 cm <sup>2</sup>	678	722	767	812	857	902	956	1042	
5	Low Level Natural Ventilation to BS 6644 cm <sup>2</sup>	1355	1444	1534	1624	1714	1804	1912	2084	
6	Mechanical Inlet to BS 6644 m <sup>3</sup> /sec	0.265	0.287	0.309	0.331	0.353	0.374	0.402	0.444	
7	Water Connection Size BSP	2"						2 1/2" Flanged		
8	Water Flow at 11°C Δ t lit/sec	4.2	4.6	4.9	5.3	5.6	5.9	6.4	7.1	
	Min Water Flow at 25°C Δ t lit/sec	1.85	2.00	2.15	2.3	2.46	2.61	2.8	3.1	
8	Hydraulic Resistance at 11°C Δ t kPa	25.53	28.75	32.62	36.39	40.8	55.0	38.7	47.6	
9	Cold Feed Size to BS 6644 Minimum Bore mm	32							38	
9	Open Vent Size to BS 6644 Minimum Bore mm	38							50	
	Safety Valve Size to BS 6644 Nominal Size mm	19					25			
2	Maximum Flow Temperature °C	90°C								
10	Minimum Return Temperature °C	40°C								
11	Dry Weight kg	656	703	750	803	841	887	982	1075	
	Water Content kg	67	71.6	76.3	80.9	85.5	90.2	100.5	110.5	
	Power Requirements	IP 30 - 240V 50Hz 1Ph - Isolator and 5A fuse required								

For metric to imperial conversions refer to page 1.6

1. **FUEL CONSUMPTION**  
Gas fuel consumption is based on natural gas with a gross calorific value of 38.6 mj/m<sup>3</sup>, refer to relevant burner data sheet for minimum and maximum fuel pressures. The gas rate should be corrected for the meter supply pressure particularly on high pressure supplies to prevent overfiring.
2. **MINIMUM OPERATING PRESSURE**  
This is the minimum operating pressure of the boiler with pumps operating (NOT static pressure). The requirements of the Health & Safety Executive guidance note PM5 regarding maximum operating temperatures should be observed. See Section 3 for further details.
3. **BOILER FLUE CONNECTION**  
The boilers are provided with a flue adaptor to suit BS 835 flue pipe, see Table 1.2A and 1.2B.
4. **FLUE GAS VOLUME**  
Flue gas volumes are given at STP (standard temperature and pressure [15°C and 1013.25 mbar]). Typical flue gas temperatures for flue sizing are 180°C at 4% CO<sub>2</sub> with 1mm draught at the boiler flue connection.
5. **NATURAL VENTILATION**  
The sizes indicated are free grille areas and are based on a single boiler installation. See section 3 for further details on ventilation.
6. **MECHANICAL VENTILATION**  
The volume given is for a single boiler installation. See section 3 for further details on mechanical ventilation.
7. **WATER CONNECTION SIZES**  
The boiler water connections are screwed BS up to 18 section size and 20 and 22 section sizes are flanged 2 1/2" with screwed counter flanges provided. For further details on water connections see Fig.1.1.  
  
NOTE: Only one flow connection and one return connection can be used on each boiler.
8. **WATER FLOW RATES**  
Water flow rates are given for boiler flow and return temperature differences of 11°C. See section 3 for further details of maximum/minimum flow rates and hydraulic resistances at alternative flow rates.
9. **COLD FEED/OPEN VENT/SAFETY VALVE SIZES**  
Sizes indicated are minimum sizes for single boiler installations. See section 3 for further details.
10. **MINIMUM RETURN TEMPERATURE**  
This is the minimum operating return temperature to prevent condensation within the boiler system. See section 3 for further details on back end protection.
11. **WEIGHT**  
The dry weight is inclusive of the gas train.

Fig.1.2 - Steel Base Strip Details (See Section 2 - Boiler Siting & Base)



No of Sections	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	22
F mm	243	324	405	486	567	648	729	810	891	972	1053	1134	1215	1296	1458	1620

### CLEARANCES

The minimum boiler room clearances for access, erection and maintenance are as follows:-

- REAR - 50mm (2 in) from rear of flue hood.
- SIDES - 500mm (19.7 in) on gas train side, 100mm on the other
- FRONT- 600mm to allow for burner removal.
- TOP - 1000mm to allow for cleaning.

### BURNER INFORMATION

The standard Derwent HE boiler is fitted with Bray atmospheric burners.

CONVERSION TABLE

<u>IMPERIAL TO METRIC</u>	<u>METRIC TO IMPERIAL</u>
<b>HEAT</b> <b>1 Therm = 100,000 Btu/hr</b> 1 Btu/hr    = 0.2931 W 1 Btu       = 1055 J 1 Btu/hr    = 0.252 kcal/hr	1 kW        = 3412 Btu/hr 1 J          = 0.0009478 Btu 1 kcal/hr   = 3.968 Btu/hr
<b>FUEL CONSUMPTION</b> 1 ft <sup>3</sup> = 28.317 dm <sup>3</sup> (litre) 1 Imp. Gall = 4.546 litre 1 Imp. Gall = 1.2 U.S. Gallon	<b>1 dm<sup>3</sup> = 1 LITRE</b> <b>1,000 dm<sup>3</sup> = 1m<sup>3</sup></b> 1 m <sup>3</sup> = 35.3147 ft <sup>3</sup> 1 litre      = 0.2199 Imp. Gallon
<b>PRESSURE</b> <b>1 PSI = 2.307 FT</b> 1 lb/in <sup>2</sup> = 6895 Pa 1 lb/in <sup>2</sup> = 68.95 mbar 1 in.w.g.    = 249.1 Pa 1 in.w.g.    = 2.491 mbar 1 in.w.g.    = 25.4 mm.w.g.	<b>1 kPa = 1000 Pa</b> <b>1 bar = 1000 mbar = 100 kPa</b> 1 bar        = 33.45 ft.w.g. 1 kPa        = 0.3345 ft.w.g. 1 bar        = 14.5 lb/in <sup>2</sup> 1 Pa         = 0.3858 in.w.g. 1 mm.w.g.   = 0.0394 in.w.g. 1 mm.w.g.   = 9.8 Pa
<b>LENGTH</b> 1 inch       = 25.4mm 1 ft         = 0.3048 m 1 yard      = 0.9144 m 1 mile      = 1.609 km	<b>1m = 1000mm</b> 1 mm       = 0.03937 in 1 m         = 3.281 ft 1 m         = 1.094 yard 1 km        = 0.6214 mile
<b>VOLUME</b> 1 ft <sup>3</sup> = 0.02832 m <sup>3</sup> 1 ft <sup>3</sup> = 28.32 litre	1 m <sup>3</sup> = 35.3147 ft <sup>3</sup> 1 litre     = 0.03531 ft <sup>3</sup>
<b>AREA</b> 1 in <sup>2</sup> = 645.2 mm <sup>2</sup> 1 in <sup>2</sup> = 6.452 cm <sup>2</sup> 1 ft <sup>2</sup> = 929 cm <sup>2</sup> 1 ft <sup>2</sup> = 0.0929 m <sup>2</sup>	1 mm <sup>2</sup> = 0.00155 in <sup>2</sup> 1 cm <sup>2</sup> = 0.155 in <sup>2</sup> 1 m <sup>2</sup> = 1550 in <sup>2</sup> 1 m <sup>2</sup> = 10.76 ft <sup>2</sup>
<b>FLOW RATE</b> <b>1 kg/sec = 1 lit/sec @</b> 1 gall/min   = 0.07577 lit/sec 1 ft <sup>3</sup> /min    = 0.4719 lit/sec 1 ft <sup>3</sup> /min    = 0.00047 m <sup>3</sup> /sec	<b>0°C reference temperature</b> 1 lit/sec    = 13.2 gall/min 1 lit/sec    = 2.119 ft <sup>3</sup> /min 1 m <sup>3</sup> /sec    = 2119 ft <sup>3</sup> /min
<b>TEMPERATURE</b> °F to °C    = ("X"°F - 32) x 0.5556	°C to °F    = ("X" °C x 1.8) + 32
<b>TEMPERATURE DIFFERENCE</b> "X"°F x 0.5556 = °C	<b>1°C = 1°K</b> "X" °C x 1.8 = °F
<b>WEIGHT</b> 1 lb         = 0.4536 kg 1 cwt       = 50.8 kg 1 ton        = 1016 kg	1 kg         = 2.205 lb 1 tonne     = 0.9842 ton 1 tonne     = 2204.6 lb



## GENERAL

The Potterton Derwent HE cast iron sectional boiler is available in sixteen sizes with outputs from 65 kw (5 section model) to 325 kw (22 section model). Tables 1.2A and 1.2B give kw outputs and technical data for each model.

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 5 bar (73.5 p.s.i.). Refer to relevant British Standards and Codes of Practice re installation of Derwent HE boilers on sealed systems.

For ease of installation 5 to 10 section boilers are delivered fully assembled, with flue hood, burners, control panel, casing pack and gas train all on one pallet.

The 11 to 16 section boilers are also delivered fully assembled with boiler, burner and flue hood on one pallet and gas train, control panel and casing pack on another pallet.

For sites with restricted access the boiler block, with burner and drain off cock removed, will pass through a 26 inch doorway.

If necessary the boiler block can be easily stripped down into individual sections. Each section weighs approximately 90 lb and the principle dimensions are 800 x 500 x 90 mm.

The 17 to 22 section boilers are delivered unassembled with sections on one pallet and all other components, including flue hood, burner, gas train and casing pack, on another pallet.

All assembled boilers are delivered with the flow and return connections made to the left hand side. For conversion requirements see page 4.5. Boilers are supplied with universal gas trains for use on either right or left hand side of the boiler, see Section 4.

The boiler sections are cast iron with pips to aid heat transfer and they are joined by neoprene 'O' rings to flow and return manifolds.

The fully automatic control system which incorporates full safety features includes control and high limit thermostats, thermometer and on/off switch with lamp. All models have automatic ignition with a sequential control box and an ionisation flame failure device fitted to an interrupted low energy pilot burner.

The gas train assembly must be connected on site and, apart from the incoming supply, all other electrical connections are made by plug and socket.

The boiler sections are insulated by glass fibre insulation ranging in thickness from 30 to 60 mm. The case is finished in a powder coat paint as follows.

Control Panel - Red, Paint Code RAL3020  
Top & Front - Dark Grey, Paint Code RAL7011  
Sides & Rear - Light Grey, Paint Code RAL7004

## 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 Authorities, Gas Undertaking 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:-

Health & Safety at Work Act 1974.

CP331:3 Low Pressure Installation Pipes.

BS 6644: 1991 Installation of Gas Fired Boilers.

BS 779: 1989 Cast Iron Boilers for Central Heating & Indirect Hot Water Supply (Rated Output 44 kw and above).

BS 7074: 1989 Part 2 Application, Selection & Installation of Expansion Vessels & Ancillary Equipment for Sealed Water Systems.

PM5 Health & Safety Executive Guidance Note for Automatically Controlled Steam & Hot Water Boilers.

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

CP342:2 Centralised Hot Water Supply.

Also for gas fired appliances the following British Gas publications:-

Gas Safety (Installation & Use) Regulations 1984.

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' and the Gas Act 1972, Schedule 4, Paragraph 18.

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

### **BOILER SITING AND BASE**

The boiler should be sited in accordance with BS 6644: 1991 with respect to protecting the boiler from damage, air for combustion and ventilation, discharge of products of combustion, clearances for service and access, temperatures, noise levels, the disposal of boiler water and the effects of flooding of the boiler house or seepage from a roof top boiler house. See section 1 for required boiler clearances for service and access.

A level non-combustible floor capable of supporting the weight of the boiler filled with water, see Table 1.2A and 1.2B, 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.

Steel strips should be provided (not supplied by Potterton Commercial) to support the left and right hand section feet and the back feet of the intermediate sections, see Fig.1.2, page 1.4 for details. These strips should typically be 3" wide and 1/8" thick.

It is not recommended to install commercial boilers in kitchens or living areas.

### ELECTRICAL SUPPLY

A 240V 50Hz AC single phase electrical supply is required. The incoming mains supply should be terminated via a double pole fused isolator to the boiler, see Section 6 for wiring details. A 5A fused supply is required for all sizes.

#### Power Requirements

The electrical supply is to feed control circuits and gas valves. Typical loading is 0.22 KVA.

The external supply must be fitted with a 5A fuse.

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

### FUEL SUPPLY

#### NATURAL GAS

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.

The burner gas connection sizes are given in Section 1 and minimum and maximum inlet pressures are 17.5 mbar and 35 mbar respectively.

The gas supply pipe should be sized to allow the minimum operating pressure to be available at the burner inlet under full running conditions. The pipe should be sized to prevent excessive pressure drops under full running conditions.

Where gas boosters are required attention is drawn to the Gas Act 1986, Schedule 5, Part II, paragraph 8 (4). Guidance is given in IM/16 "Guidance Notes on the Installation of Gas Pipework, Boosters and Compressors in Customers Premises" published by British Gas Plc. The gas booster should be electrically interlocked to the burner.

### VENTILATION

Safe, efficient and trouble free operation of conventionally flued 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.

The air supplied for boiler house ventilation shall be such that the maximum temperatures within the boiler house shall not exceed 25°C at floor level, 32°C at mid level (1.5m above floor level) and 40°C at ceiling level (or 100mm below ceiling level). Refer to BS 6644: 1991 for further details.

#### Air Supply by Natural Ventilation

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

A minimum free area of the grilles for a single boiler are given in Table 1.2A and 1.2B. Where plant is likely to be used at or near maximum capacity during the summer months, additional ventilation may be required to prevent excess temperatures.

For boiler houses with multiple boiler installations the minimum ventilation should be sized in accordance with BS 6644 as follows:-

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

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

The above calculated areas are "free" grille areas. Grilles should be designed to minimise high velocity air streams within the boiler house. Typical free area of a standard louvre is approximately 50%.

For boilers installed in a basement boiler house or similar, it is recommended that the inlet air be ducted to low level in ducting not less than equal to the free grille area. Should the inlet duct length be excessive then mechanical ventilation should be used. Position ventilation grilles to avoid accidental obstruction by blockage or flooding.

Further guidance on ventilation for gas appliances is provided by BS 6644: 1991.

#### 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, see Table 1.2A and 1.2B for mechanical inlet ventilation rates for single boiler applications

For multiple boiler installations the ventilation rate is based on a 1.1 m<sup>3</sup>/sec flow rate per 1000 kW total rated input. The design extract rate should be based on 0.45 m<sup>3</sup>/sec flow rate per 1000 kW total rated input.

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

**IMPORTANT:** The use of an extractor fan in the same room as the boiler (or in an adjacent room in communication) can, in certain conditions, adversely affect the safe operation of the boiler and therefore must be avoided.

Tests for spillage of products from the flue system when the extractor fan is running and all doors and windows are shut should be carried out during commissioning. If spillage is detected, the area of permanent ventilation must be increased.

#### 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 gases 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.

Dust contamination in the combustion air may cause blockage of the burner slots or localised overheating of the burner surface leading to premature failure. It is recommended that where there is a likelihood of a contaminated air supply a fanned filtered air supply should be used. A differential pressure switch fitted across the filter should shut the boiler down if the air supply is reduced owing to partial blockage of the filter.

#### 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(s) 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 used should be kept to a minimum and runs of flue pipe less than 45° to the horizontal should be avoided in order to comply with the recommendations made in BS 6644: 1991, 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 and approval obtained where applicable.

The chimney design should avoid the formation of condensate which may be achieved by insulating the flue.

In the case of flue systems which are exposed and have an overall height of 12m or more then consideration should be given to lining the flue.

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 inner skin and the chimney body. Cavities around the liner should be sealed at both top and bottom.

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 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. Flues should not be terminated in areas where down draught may occur.

**IMPORTANT:** 90° square bends must not be used on the flue system, 2 x 45° bends or easy sweep pattern should be used. A minimum of 600mm straight vertical flue should be taken off the boiler flue outlet prior to any fittings.

On multiple boiler installations where a common flue header is utilised, boiler connections to the flue header and connection of the flue header to the chimney stack should utilise 135° swept "T" connections.

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 high temperature polypropylene or stainless steel and positioned so that pipe runs and discharge points are not subject to the effects of frost. Copper pipe is not suitable due to the mildly acidic properties of the condensate.

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.

A draught of 1-4 mm.w.g. (0.04-0.16 in.w.g.) should be provided at the flue socket under full load running conditions. The flue system should be designed to evacuate the products of combustion when all boilers are firing. The Local Authority should be consulted with regard to Clean Air Act approval.

### FLUE SIZE CONSIDERATIONS

Nominal flue connection sizes are given in Table 1.2A and 1.2B, these sizes refer to the boiler flue connection socket, detailed dimensions of the flue adaptor to BS 835 are given in Table 1.2A and 1.2B.

The actual size of the flue system will depend on individual site applications. Detailed below are general considerations on sizing flue systems. These notes are for guidance only and Potterton Commercial Division cannot accept responsibility for any flue system designs.

#### Natural Draught Flue Systems

##### Buoyancy Force

Natural draught flue systems are designed so that the buoyancy force due to the hot flue gases create a draught (suction) that, after overcoming resistance losses, is adequate for the flue draught requirements at the boiler connection spigot given in Table 1.2A and 1.2B. Where the flue draught is inadequate to meet the minimum boiler flue draught requirements or excessive horizontal runs of flue have been utilised that may prevent satisfactory start-up of the boiler and flue system, then mechanical assistance should be considered. The buoyancy force is directly proportional to the flue gas temperature of the exhaust gas. The flue system should be designed, and insulated where necessary, to maintain a temperature drop of less than 17°C between the flue gas entry and flue gas exit.

For flue calculation purposes the mean flue gas temperature is equated from flue gas temperature (nett) + ambient temperature - 17°C/2 (this assumes a maximum temperature drop of 17°C across the flue system and represents the mean temperature). The Derwent HE has a typical nett flue gas temperature of 180°C on high fire. Assuming an ambient temperature of 20°C, a typical mean flue gas temperature for the Derwent HE boiler would be:-

$$180 + 20 - \frac{17}{2} = 191.5^{\circ}\text{C}$$

NOTE: Nett flue gas temperature = gross flue gas temperature - ambient

The buoyancy force available due to the vertical height of the flue can be calculated as follows:-

$$\Delta P = 353 \times H \left[ \frac{1}{t^1 + 273} - \frac{1}{t^2 + 273} \right]$$

where:  $\Delta P$  = Buoyancy force in mm  
H = Stack height in m  
 $t_1$  = Ambient temperature °C  
 $t_2$  = Mean flue gas temperature °C

For a Derwent HE boiler  $\Delta P$  is typically 0.44 mm per metre stack height measured vertically from the flue connection on the boiler to the chimney exit point.

#### Flue System Losses

Losses in flue systems are attributed to friction losses owing to flue gas velocities, plus pressure losses owing to fittings and the chimney exit point. Table 3.1 (page 3.5) gives the pressure loss for each metre of flue pipe and the pressure drop for each flue fitting. The flue system pressure drops should be totalled including all horizontal flue runs and the chimney exit loss.

Subtraction of the total loss from the buoyancy available will give the flue draught available at the boiler flue outlet spigot. The flue system should be sized so that the draught available is within the operating range of the boiler as given on page 3.2.

#### Cold Start Considerations

When the boiler starts up from cold no flue draught is available and therefore the flue design should allow for a continuous rise to the top of the stack to ensure that adequate buoyancy is created as quickly as possible after start up, to prevent spillage from the draught diverter.

Horizontal flue runs only add to the flue resistance without creating any buoyancy and must be avoided. Sloping flue runs should not be less than 45° to the horizontal. Flue resistance should be kept to a minimum but flues should not be oversized as this may lead to cold start spillage.

Where horizontal flue runs are unavoidable owing to building constraints advice should be sought from a flue specialist with a view to installing an induced draught fan. Flue draught should be kept between 1 and 4 mm.w.g., draught conditions in excess of this should be alleviated by the use of a draught stabiliser.

### Common Flue Systems

Where multiple boilers are installed on a common flue system then the flue system should be designed to ensure the correct operation of the flue on varying load conditions. In particular that the appliance flue draught is within the operating parameter under full load and partial load conditions. For safe and reliable operation of the boiler plant it is recommended that the variance in flue draught available at each appliance under full and part load operation is designed to a minimum. (It is recommended that the services of a specialist flue system manufacturer are sought for the design of common flue systems).

For initial flue design a flue size equivalent to the total free area of the boiler flue outlet should be used as a minimum.

### Mechanical Assisted Flue Systems

Where mechanical assisted flue systems are being considered it is recommended that the advice of a flue system specialist is sought to ensure the duty and suitability of the fan. On mechanically assisted flues the boilers must be interlocked to prevent operation unless the fan is operating and air flow is proved.

**THE ABOVE RECOMMENDATIONS ARE FOR GENERAL GUIDANCE ONLY. POTTERTON COMMERCIAL DIVISION CANNOT ACCEPT RESPONSIBILITY FOR FLUE SYSTEM DESIGNS BASED ON THE ABOVE RECOMMENDATIONS.**

### FAN DILUTION SYSTEMS

Potterton Commercial gas fired boilers are suitable for fan dilution systems for low level discharge of products of combustion in accordance with BS 6644.

The fan dilution system should be designed to reduce the CO<sub>2</sub> concentration of the vented combustion products to 1% (volumetric) or less.

The discharge velocity from the fan dilution system should be a minimum of 7.5 m/sec and should be at least 2m above ground level for systems up to 1MW input.

The outlet grille should diffuse the products of combustion upwards and be located so that recirculation of combustion products is avoided, in particular the positioning of fan dilution systems in totally enclosed wells or courtyards should be avoided. The inlet and outlet grilles must be located on the same face of the building.

Fan dilution systems must be interlocked to prevent operation of the boilers unless adequate air flow is proved.

In accordance with BS 6644: 1991 the position of the outlet grille should comply with the following:-

1. The outlet grille shall not be less than 2 x 'U' from any fan assisted intake, where 'U' is the uncorrected chimney height in metres, as defined in the Clean Air Act and is calculated from:-

$$U = 1.3 Q^{0.6}$$

(where 'Q' is the heat input in MW)

2. The outlet shall not be within 2 x 'U' of an openable window or 6 x 'U' from an adjacent building.
3. The fan dilution system should be designed to provide a flue draught at each boiler of 1-2 mm.w.g.

Typical duct sizes, fan volumes and values of 'U' are given in Table 3.2.

It is important that adequate ventilation is provided into the boiler house especially as a proportion of the dilution air is drawn through the draught diverters on atmospheric appliances. Ventilation requirements must take this into account and may require larger louvres.

### EXAMPLE

A Derwent HE 10 section boiler connected to a 250 mm diameter flue 6m high, from the Tables above the flue loss is:-

Flue Exit Loss	0.4674
45° Bend Loss x 2	+ 0.094 x 2
Straight Flue Loss	+ 0.0424 x 6
<b>TOTAL LOSS P<sub>1</sub></b>	<b>= 0.9098 mm</b>

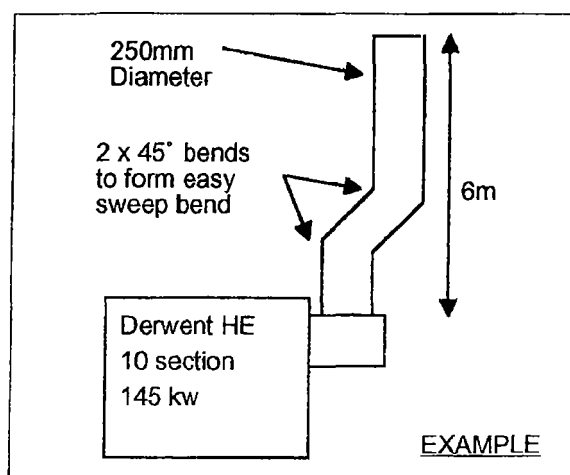
The buoyancy available is 6 x 0.44 mm = 2.64mm

Subtracting the loss from the buoyancy force;

$$\begin{aligned}
 P_2 &= \Delta P - P_1 \\
 &= 2.64 - 0.9098 \\
 &= 1.73 \text{ mm draught}
 \end{aligned}$$

Thus P<sub>2</sub> is an acceptable draught (between 1 and 4 mm.w.g.)

$$\begin{aligned}
 \text{NOTE: } P_2 &= 1.73 \text{ mm draught} \\
 &= -1.73 \text{ pressure at boiler flue exit}
 \end{aligned}$$



Boiler Size	300 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
10/495	0.2261	0.0457	0.0178	2.3379
11/549	0.2769	0.0559	0.0213	2.5920
12/607	0.3378	0.0686	0.0254	2.8631
13/662	0.3988	0.0787	0.0295	3.1172
14/717	0.4674	0.0940	0.0338	3.3714
15/771	0.5461	0.1092	0.0387	3.6424
16/826	0.0248	0.1245	0.0436	3.8965

TABLE 3.1 - Flue Losses

Boiler Size	180 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
5/222	0.3912	0.0782	0.0568	3.0867

Boiler Size	350 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
15/771	0.2946	0.0584	0.0186	2.6761
16/826	0.3378	0.0686	0.0209	2.8628
17/880	0.3835	0.0762	0.0234	3.0495
18/935	0.4318	0.0864	0.0260	3.2362

Boiler Size	200 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
5/222	0.2311	0.0457	0.0302	2.3633
6/276	0.3556	0.0711	0.0441	2.9349
7/331	0.5055	0.1016	0.0602	3.5069

Boiler Size	375 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
17/880	0.2896	0.0584	0.0168	2.6564
18/935	0.3277	0.0660	0.0187	2.8191

Boiler Size	250 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
6/276	0.1448	0.0279	0.0152	1.8785
7/331	0.2083	0.0406	0.0208	2.2445
8/386	0.2794	0.0559	0.0272	2.6103
9/440	0.3073	0.0160	0.0294	2.7323
10/495	0.4674	0.094	0.0424	3.3666
11/549	0.5740	0.1143	0.0507	3.7326
12/607	0.6985	0.1397	0.0604	4.1229

Boiler Size	400 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
17/880	0.2235	0.0457	0.0124	2.3347
18/935	0.2515	0.0508	0.0137	2.4777
20/1003	0.2921	0.0584	0.0156	2.6587
22/1109	0.3581	0.0711	0.0187	2.9446

Boiler Size	450 mm I.D. Flue			
	Flue Exit Losses mm.w.g	45° Bend Loss mm.w.g	Loss/m Straight Flue mm.w.g	Flue Gas Velocity m/sec
20/1003	0.1829	0.0356	0.0089	2.1007
22/1109	0.2235	0.0457	0.0107	2.3266

Table 3.2 - Typical Duct Sizes & Fan Volumes

Boiler Size	* Flue Volume @ 1% CO <sub>2</sub> m <sup>3</sup> /sec	Duct Size (Diameter) mm	Velocity m <sup>3</sup> /sec	** "U" m
5 / 222	0.2175	200	6.924	0.287
6 / 276	0.2711	250	5.522	0.328
7 / 331	0.3246	250	6.613	0.365
8 / 386	0.3782	250	7.704	0.400
9 / 440	0.4317	300	6.107	0.433
10 / 495	0.4853	300	6.865	0.465
11 / 549	0.5388	300	7.622	0.495
12 / 607	0.5957	350	6.191	0.526
13 / 662	0.6492	350	6.748	0.554
14 / 717	0.7028	350	7.305	0.580
15 / 771	0.7563	350	7.861	0.607
16 / 826	0.8099	400	6.445	0.632
17 / 880	0.8634	400	6.871	0.657
18 / 935	0.9170	400	7.297	0.681
20 / 1003	0.9839	400	7.830	0.710
22 / 1109	1.0876	450	6.839	0.754

\* Flue gas volume @ 1013.25 mbar and 15°C. Typical diluted flue gas temperature is 14°C above ambient.

\*\* Uncorrected chimney height from "Clean Air Act".



### WATER CIRCULATION SYSTEMS

The water circulation systems should be indirect and installed in accordance with the relevant parts of British Standards Codes of Practice CP342 and BS 6644: 1991.

The maximum and minimum design temperature differential across the boiler should be 20°C and 10°C and the boiler should be prevented from operating with flow rates giving a temperature difference across the boiler greater than 25°C based on the full boiler output. Boilers operating under constant flow conditions can be more accurately controlled and are not subject to excessive temperature stresses.

On systems with variable flow rates due to flow reducing devices, ie. TRVs, zone valves, etc, or where the minimum heat demand, ie. summer domestic hot water load, does not achieve the minimum boiler flow rate then consideration shall be given to incorporating a primary loop system. For further information see Potterton Publication Technical Bulletin No.1 Issue 2.

The flow rate and hydraulic resistance for an 11°C boiler temperature rise are given in Table 1.4, alternatively, flow rates through boilers can be calculated from:-

$$\text{FLOW (lit/sec)} = \frac{\text{kW (Boiler Output)}}{4.2 \times \text{Boiler Temperature Rise } ^\circ\text{C}}$$

The minimum design flow rate relates to a 20°C boiler temperature rise and should not be misinterpreted as the system design temperature drop particularly where systems have been designed with stand-by capacity.

The hydraulic resistance of the boiler is proportional for flow rates equating to a boiler temperature of between 10°C and 20°C. The hydraulic resistance at 11°C is given in Table 1.4, hydraulic resistance at alternative flow rates can be calculated from:-

$$R_2 = R_1 \times \left(\frac{T_1}{T_2}\right)^2$$

where:-  
 $R_1$  = Boiler Resistance at 11°C  
 $R_2$  = Boiler Resistance at  $T_2$ °C  
 $T_1$  = 11°C  
 $T_2$  = Alternative Boiler Temperature Rise

The maximum and minimum design pressures are 5 bar (170 ft.w.g.) and 0.3 bar (10 ft.w.g.). Care is needed in siting the pump relative to the cold feed and open vent connections. (NOTE: The above are not static pressures).

The boiler flow and return connection sizes are given in Table 1.2A and 1.2B.

It is recommended that the system is designed to give a constant boiler flow rate. For further information on water circulation systems see Potterton Publication Technical Bulletin No.1 Issue 2.

### Boiler Condensation

If the system water content is large, and the start up period before which the water return temperature attains the minimum operating temperature exceeds 20 minutes then consideration should be given to the fitting of a shunt pump or by-pass valve controlled by a pipe thermostat to raise the return water temperature to prevent formation of condensation within the boiler and flue system. It should be noted that shunt pumps should not be used to boost low water flow rates. See Potterton Publication Technical Bulletin No.1 Issue 2 for further information.

### BOILER PROTECTION

The provision of pump overrun by a time delay relay or a thermostat situated in the flow pipe close to the boiler is essential to remove residual heat from the boiler, see Fig.6.2, Section 6.

The boiler and system should be protected by suitable frost thermostats.

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.

### Strainers

Migrating sludge and debris will have a detrimental effect on the life and operation of the boiler and this must not occur. If all debris cannot be removed, strainers and/or other devices should be fitted. Consideration should be given to water treatment and inhibitors to maintain water quality. Migration of system debris or scaling of the waterways will impair the life expectancy of the boiler sections.

### System Filling

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

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

Where the boiler is being installed as a replacement for an existing boiler it is recommended that where possible sections of the removed boiler are cut open and internally examined to determine the presence of scale or system debris to foresee and rectify any potential problems for the new boilers.

The fitting of strainers is strongly recommended.

The system should be checked to ensure that there is no raw water make-up. It is strongly recommended that a suitable water meter is fitted to the cold feed supply of the boiler system to monitor for unregulated water make-up.

The quality of the water in both the heating system and the water supply should be checked to ensure that the hardness (100 ppm) and salinity (TDS) are not excessive. In the case of systems containing aluminium components the pH should be monitored to prevent corrosion.

On systems where unregulated raw water make-up or system debris is known to exist but remedial action cannot be implemented then consideration should be given to installing a heat exchanger to isolate the boiler from the water system to protect the boiler otherwise premature failure may occur.

A specialist water treatment company should be consulted if in doubt.

### Open Vented Systems

#### Maximum Operating Temperature

The maximum operating temperature of a system is dependent on the operating pressure. The minimum design operating pressure (not static) at any point of a system should be sufficient to prevent boiling within any part of the heating system and the boiler control thermostat should be set to provide a 17°C safety margin below the saturated steam absolute pressure given in Table 3.3 corresponding to the minimum design operating pressure.

#### COLD FEED SUPPLY

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 in Table 1.2A and 1.2B 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 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 and sized in accordance with Table 3.5.

Table 3.3 - Saturated Steam Pressures

Temperature °C	110	120	130	140	160
Saturated Steam Absolute Pressure *	1.43 Bar	1.98 Bar	2.7 Bar	3.61 Bar	6.18 Bar

\* NOTE: These are absolute pressures not gauge. For gauge pressure 1 bar must be subtracted.

EXAMPLE: A boiler system with a maximum operating temperature of 93°C and allowing for a safety margin of 17°C the temperature would be 93°C + 17°C = 110°C. From above the minimum gauge pressure within the system should be 1.43 bar - 1 bar = 0.43 bar.

### CISTERN SIZING

The cistern should be sized to accommodate the water expansion in the system from 0°C to the maximum operating temperature. Where the volume of the system is not known then it can be estimated at 12 litres per kw of design load.

For systems with a maximum operating temperatures of up to 100°C the water can expand by 4% (for systems up to 140°C the expansion is 8%). Therefore assuming a system loading of 1000 kw, the approximate system volume is 1000 x 12 litres = 12000 litres and the expansion of water in a system with a maximum design temperature of 100°C is 4% x 12000 = 480 litres. In this instance the cistern should have an expansion capacity between the cold fill level and the overflow pipe of 480 litres (minimum), (overflow should be 80mm above the highest expansion level).

**IMPORTANT:** The water level in the cistern or expansion tank should be minimal on cold charge to allow expansion without discharge from the overflow between cold and hot operating conditions.

TABLE 3.4

Open Vent Pipe Sizes from BS 6644: 1991		
Rated Output	Minimum Bore	Nominal Size (DN <sup>1</sup> )
kw	mm	mm
45 - 60	25	25
61 - 150	32	32
151 - 300	38	40
301 - 600	50	50

<sup>1</sup> Steel pipe sizes complying with medium or heavy quality of BS 1387

For rated outputs above 600 kW the minimum cross sectional area of the venting pipe A (in mm<sup>2</sup>) shall be determined as:- 3.5 x QR where QR is the rated output in kW

Multiple or modular boiler installations shall have an open vent pipe or pipes of the size stated in Table 3.4 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 size for the total rated heat input of the installation (see Table 1.2A and 1.2B for individual boiler open vent sizes). The open vent pipe 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 overflow 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 the boiler is open to atmosphere through the third port and shall incorporate means of indicating the position of the open port. The nominal bore of the valve shall be not 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 may be expected and shall be situated as far as is practicable inside the building to reduce freezing problems.

TABLE 3.5

Cold Feed Pipe Sizes from BS 6644: 1991		
Rated Output	Minimum Bore	Nominal Size (DN <sup>1</sup> )
kw	mm	mm
Below 60	19	20
60 - 150	25	25
150 - 300	32	32
300 - 600	38	40
Over 600	50	50

<sup>1</sup> Steel pipe sizes complying with medium or heavy quality of BS 1387

For further details see BS 6644: 1991.

Boiler Safety Valves

Each boiler, whether in single or multiple installations, shall be fitted with an individual safety valve complying with BS 6759 Part 1.

In the case of modular boiler installations each bank of boilers shall be provided with a common safety valve sized in accordance Table 3.6 to suit the total rated output of the boiler bank. Any boiler in a modular installation that can be isolated from the water supply shall be fitted with an individual safety valve.

The safety valve shall be sized to suit the total rated output of the boiler and shall be located between the boiler and the water isolating valve. See Table 3.6 for safety valve sizes on open vented systems. Refer to notes on sealed systems for safety valve sizes on sealed systems.

TABLE 3.6

Safety Valve sizes to BS 6644 1991 (Open Vented Systems Only)		
Rated Output	Nominal Size	Minimum Area (A)
kw	mm	mm <sup>2</sup>
45 - 264	19	284
265 - 352	25	491
353 - 440	32	802
441 - 528	40	1135
529 - 732	50	2050
733 - 1142	65	3210
1142 - 1640	80	4540

Alternatively:-  
 'A' can be calculated from:-  $A = \frac{R}{0.659 \times P1 \times Kdr}$   
 where R = Boiler Output in kW  
 P1 = 7.6  
 Kdr = The derated coefficient of discharge available from the safety valve manufacturer.  
 A = Flow Area in mm<sup>2</sup>

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

Boiler safety valves shall be of the direct spring loaded type or dead weight type and the maximum setting shall not exceed the following equation:-

$$\text{MAXIMUM VALVE SETTING (IN BAR)} = 0.1 + \text{MAX BOILER DESIGN PRESSURE (IN BAR)}$$

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

On systems containing components with lower maximum operating pressures than the boiler, the rating of the safety valve should be reduced accordingly or additional safety valves provided to protect these items.

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 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 be not less than the nominal size of the valve outlet.

For further guidance on safety valve sizes see BS 6644: 1991.

### SEALED SYSTEMS

#### General

Potterton Commercial boilers are suitable for use on sealed systems designed in accordance with BS 6644: 1991 and BS 6880 Part 2. In addition, reference should be made to the Health & Safety Executive guidance note PM5 "Automatically Controlled Steam & Hot Water Boilers".

#### Expansion Vessels

The sealed system should incorporate an expansion vessel complying with BS 4814 sized to accommodate the volumetric hydraulic expansion of the heating system between 0°C and the temperature setting of the overheat thermostat without exceeding the maximum design pressure of the boiler. The position of the expansion vessel(s) should be such that the manufacturer's maximum operating temperature is not exceeded and the provision of an anti gravity tank may be required for systems operating above 100°C. In addition, the position of the expansion vessel(s) should prevent inadvertent isolation of the boiler system from the expansion vessel, where isolating devices, ie, valves, etc, are incorporated between the boiler(s) and the expansion vessel these should be capable of being locked in the open position during normal operation. See BS 6880 Part 2 for further details.

#### System Filling & Water Make-Up

The sealed system should incorporate suitable means for initial filling, ie. pressure boost pump, which shall comply with the local water authority bye laws and the cold feed supply to the system should incorporate a non-return valve and an isolating valve with the capability of being locked in the open position during normal operation. An automatic air vent should be provided between the isolating valve and the non-return valve and provision should be made within the sealed system to allow automatic replacement of water lost from the system. This may include a pressure boost pump and associated controls or an independent primary feed cistern. However, it is recommended that a suitable device such as a water meter is installed to detect unregulated raw water make-up. See BS 6644: 1991 for further details on provision for filling and make-up on sealed systems.

#### Maximum Operating Temperature

The maximum operating temperature of a sealed system is dependent on the operating pressure. The minimum design operating pressure (not static) at any point of a sealed system should be sufficient to prevent boiling within the any part of the heating system and the boiler control thermostat should be set to provide a 17°C safety margin below the absolute saturated steam pressure given in Table 3.3 corresponding to the minimum design operating pressure.

The boiler overheat thermostat should provide a safety margin of at least 6°C below the absolute saturated steam pressure.

#### Minimum Operating Pressure

The minimum operating pressure (not static) or cold fill pressure should be sufficient to maintain a positive pressure within the heating system to prevent boiling as detailed above. Care should be taken in positioning of the circulating pump(s) relative to the expansion vessel (zero or null point) particularly on systems where a high hydraulic resistance is present to ensure that operation of the pump does not cause a reduction in operating pressure at any point in the system below the minimum operating pressure.

A low water pressure cut off device shall be incorporated to prevent operation of the boiler plant on low water pressure. The pressure cut off device should be set at a pressure to prevent boiling in any part of the heating system while operating at the design working temperature.

Consideration should be given to the positioning of safety valves, low level cut off devices and automatic air vents relative to the minimum operating pressure to ensure that the influence of pump operation does not cause or prevent operation of these devices.

#### Maximum Operating Pressure

The boiler plant should be prevented from operating when the system pressure rises to within 0.35 bar of the safety valve setting.

#### Safety Valves

The safety valve on a sealed system should be sized in accordance with the following equation.

$$A = \frac{R}{2.5 \times Kdr}$$

where R = Boiler output in kW  
Kdr = the derated coefficient of discharge available from the safety valve manufacturer.  
A = flow area in mm

#### NOISE LEVEL

Derwent HE atmospheric boilers are regarded as being commercially quiet, ie. < NR60, under typical operating conditions. Caution should be exercised in siting the boiler in kitchen or living areas.

### INSTALLING FULLY ASSEMBLED BOILERS

NB: For installing unassembled boilers see page 4.7.

Fully assembled boilers are delivered on one pallet for 5 to 10 section boilers and two pallets for 11 to 16 section boilers.

The control panel and gas trains are packed in separate cardboard boxes.

Each package is clearly labelled with the size of the boiler and serial number. The gas train also has a separate serial number.

For all boiler sizes remove the shrink wrap polythene and the cardboard protecting the boiler block. The boiler block is held to the pallet by metal tie straps only.

When moving the boiler block into position the burner assembly should be removed if there is any likelihood of damage occurring. The burner assembly is fixed by two M8 studs, washers and brass lock nuts located on each end section.

Jacks and crow bars should not be used against the flow and return manifolds.

### HANDING CHANGES

#### Gas Trains

Gas trains are universal for left or right hand fitting by rotating the connection on the two unions provided.

**NOTE:** The pilot assembly must be fitted on the same side as the gas train. Ensure that the correct Kanthal bar arrangements are fitted either side of the pilot burner, see page 5.7 under "Main Burner Bar".

To change from left to right hand connection remove the blanking cap from the blanked connection and refit at the opposite end.

#### Control Panel Handing

The boilers are supplied as standard with left hand control connections. The control panel **MUST** be mounted on the gas train side of the boiler.

The control thermostat, limit thermostat and on/off switch are mounted on a plate secured to the front casing panel by six plastic pegs (see Fig.4.1). Remove these pegs by pressing out the centre peg and remove the pin.

Retain all pegs and pins but at this stage do not make any electrical disconnections. Pass the plate through the aperture in the housing panel.

The front casing panel is secured to the front panel housing by two sets of screws and nuts to form a hinge. Remove the front casing panel and turn through 180° so that the control aperture is on the right hand side and replace the set screws and nuts to form the hinge.

The control box, ignition device and terminal strip are mounted on a removable plate secured to the control panel by four screws. Remove this plate and re-fix in position on the right hand side using the four original screws.

Fasten the mounting plate housing the control thermostat, etc in it's new position on the right hand side using the six original plastic pegs.

Reposition the cable glands for the ignition, ionisation, thermostat capillaries and gas valve lead to the right hand side and reposition the cables and capillaries accordingly.

Remove the ignition and ionisation cable clamps from the left hand side and reposition on the right hand side ensuring that the cables are 150mm apart.

#### Assembly of Flue Hood

For 5 to 16 section boilers the flue hood is already fitted before delivery. It should however be removed, particularly where there is difficult access to the back of the rear casing panel. Remove the flue hood by releasing the four wing nuts and clamps as shown in Fig.4.2

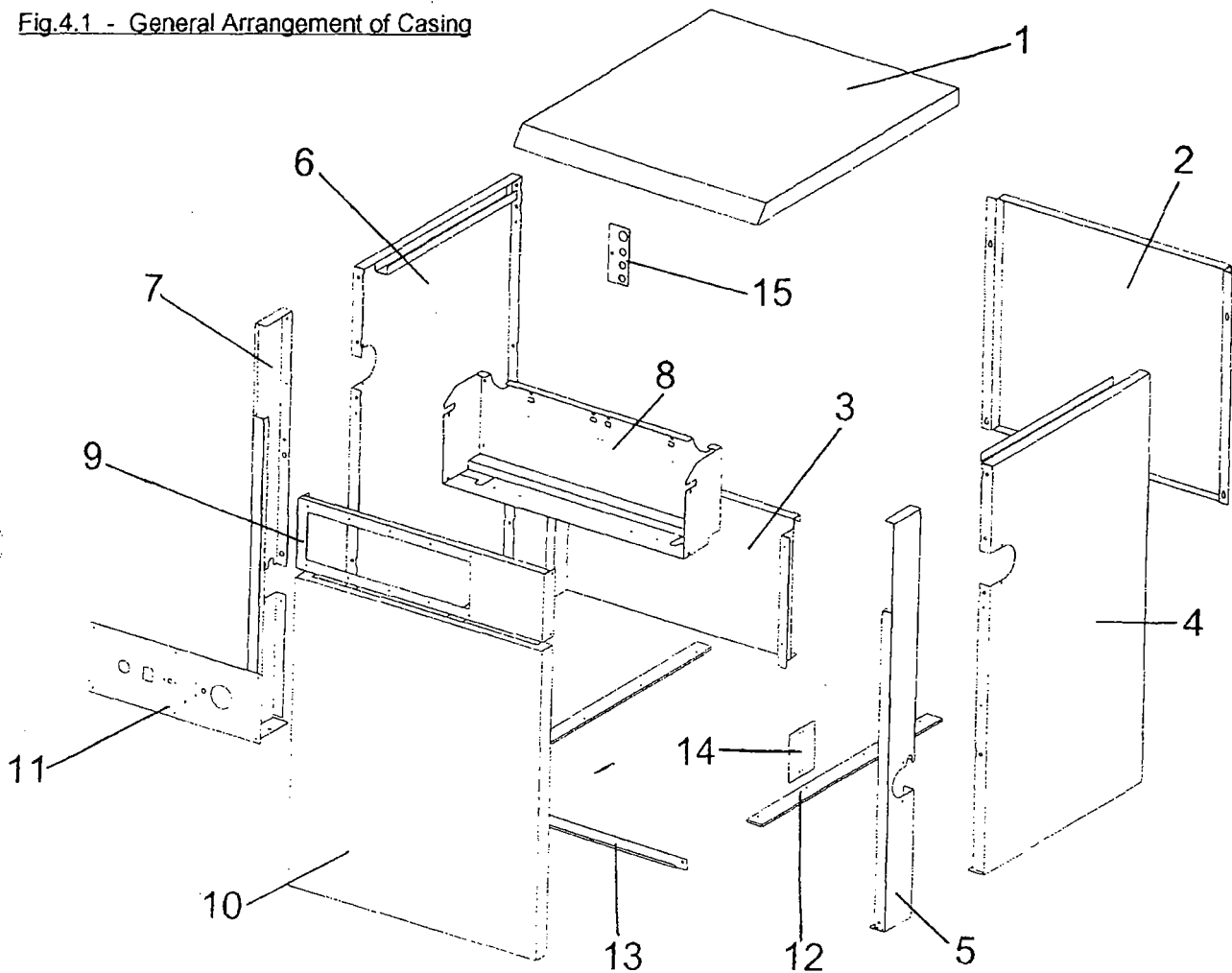
#### Assembly of Burners

For 5 to 16 sections boilers the burners are in position when the boiler is delivered.

When the boiler is sited the burner assembly should be refitted by using the M8 nuts on the studs in the end sections if it has been removed during positioning.

The front combustion chamber panel should be removed by undoing the four M8 nuts and the burner should be inspected and checked with a spirit level to ensure that they are horizontal and remedial action taken if they are not.

Fig.4.1 - General Arrangement of Casing



<u>Item</u>	<u>Description</u>	<u>Part Number (C.I.Ch.)</u>
1.	Top Panel	923314 - 329
2.	Rear Panel	923266 - 281
3.	Combustion Chamber Front Panel	925148 - 163
4.	Side Casing - Right Hand	923536
5.	Side Panel Extension - Right Hand	923554
6.	Side Casing - Left hand	923537
7.	Side Panel Extension - Left Hand	923555
8.	Control Panel Housing	923538 - 553
9.	Control Panel Front Casing	923346 - 361
10.	Removable Front Casing Panel	923330 - 345
11.	Control Panel Fascia: 5 - 7 section	923433
	8 - 22 section	923442
12.	Side Casing Support Bracket	910124
13.	Front Door Locating Strip	923282 - 297
14.	Fillet Piece	923590
15.	Connecting Panel	908353

### Assembly of Casing

See Fig.4.1 for number references.

1. Take one of the side panels (items 4 and 6) which have cut-outs in them to accommodate the flow manifold connections and fit the side casing support brackets (item 12). This should be fitted inside the panel between the lagging and the bottom edge. Make sure that the fixing holes between the support bracket and casing panel align and the support bracket projects 78mm in front of the panel for securing the side panel extension pieces.
2. Secure the casing support bracket to the side casing panel with the wing nuts provided.  
  
AT THIS STAGE DO NOT FULLY TIGHTEN THE WING NUTS.
3. The side panel can now be positioned on the appropriate side of the boiler engaging the wing nuts into the lugs on the end section. Tighten the wing nuts and support the panel.
4. Repeat the above procedure for the other side panel.
5. Take the aluminium front combustion chamber panel (item 3) complete with boiler data plate and secure it between and just behind the front of the two side panels using four self tapping screws provided in the casing pack.
6. Take the rear panel (item 2) and secure it between the two side panels using four self tapping screws provided.
7. Fit the gas train provided to the boiler.
8. With the side panels now securely fitted the extension side panels (items 5 and 7) can be fitted. This is done by fixing the bottom of the panel with wing nuts to the casing support bracket and with two self tapping screws to the side panel already fitted.
9. Remove the control panel from it's box and remove the two securing screws from the ends so that the panel fascia hinges forward.
10. In order to fit the control panel casing the side extension panels have to be eased out to allow the gas train plug and cable to pass through the cut-out provided. The control panel can now be fitted.

11. Secure the control panel with four self tapping screws at top and bottom on both ends of the panel.
12. Fit the two pieces of insulation provided between the control panel and the flue hood.
13. Place the top panel (item 1) in position so that it locates securely on the side panels. Fasten with four self tapping screws, one on each side and one on each side at the rear.
14. At this stage the two thermostat phials, thermometer phials, dummy pieces and sealing strip should be positioned in the thermostat pocket. Ensure that the retaining clip is fitted to keep the phials in place. See Fig.4.3.
15. Place the base tray beneath the burners and secure with two screws.
16. Fit the front door locating strip (item 13) with two self tapping screws into the front of the side casing extension panels.
17. Fit the front door panel into the locating strip.

### Assembling the Gas Train

Remove the gas train from it's box and remove the boiler front cover.

There are four wires coming out of the bottom of the control panel. The short earth wire with large eyelet should be connected to the flow manifold underneath one of the nuts and spring washer.

The remaining earth wire, ignition lead and ionisation probe lead should be fastened to the boiler front panel by the two plastic clips on the panel.

The pilot has been supplied fixed to the burner for the left hand gas train arrangement.

If the gas train is to be fitted on the right hand side, swap the pilot over to the right hand side. The pilot is secured by two studs, washers and nuts. A blanking plate is similarly fastened to the redundant pilot mounting hole and should also be swapped over. See Fig.4.4.

The pilot assembly is also protected with a shield fastened to the front combustion chamber door by two nuts. This shield should be removed before fitting the gas train and replaced afterwards ensuring that the three wires and the pilot bundy pass through it.



Fig.4.2 - Flue Hood Sealing Arrangement

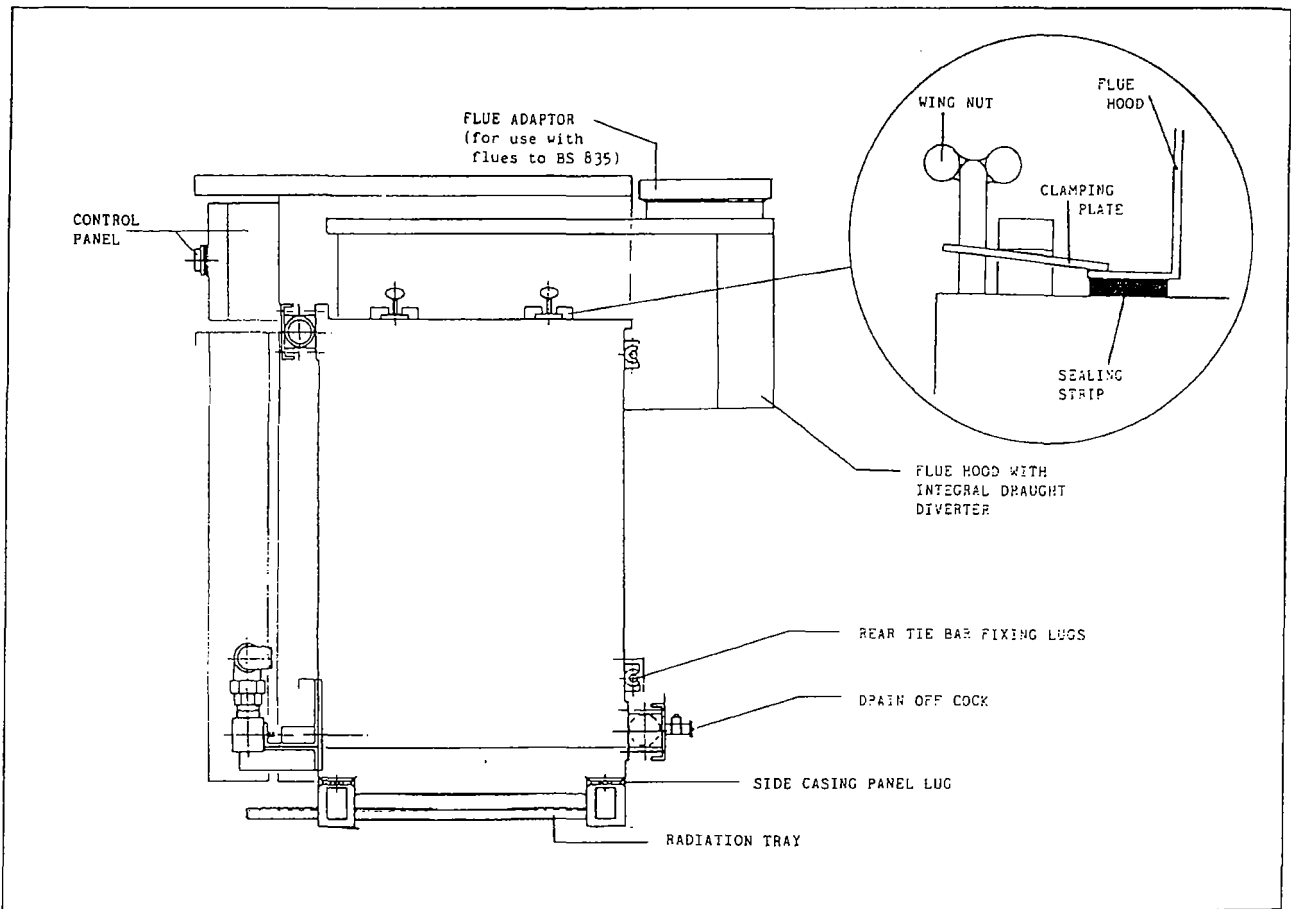
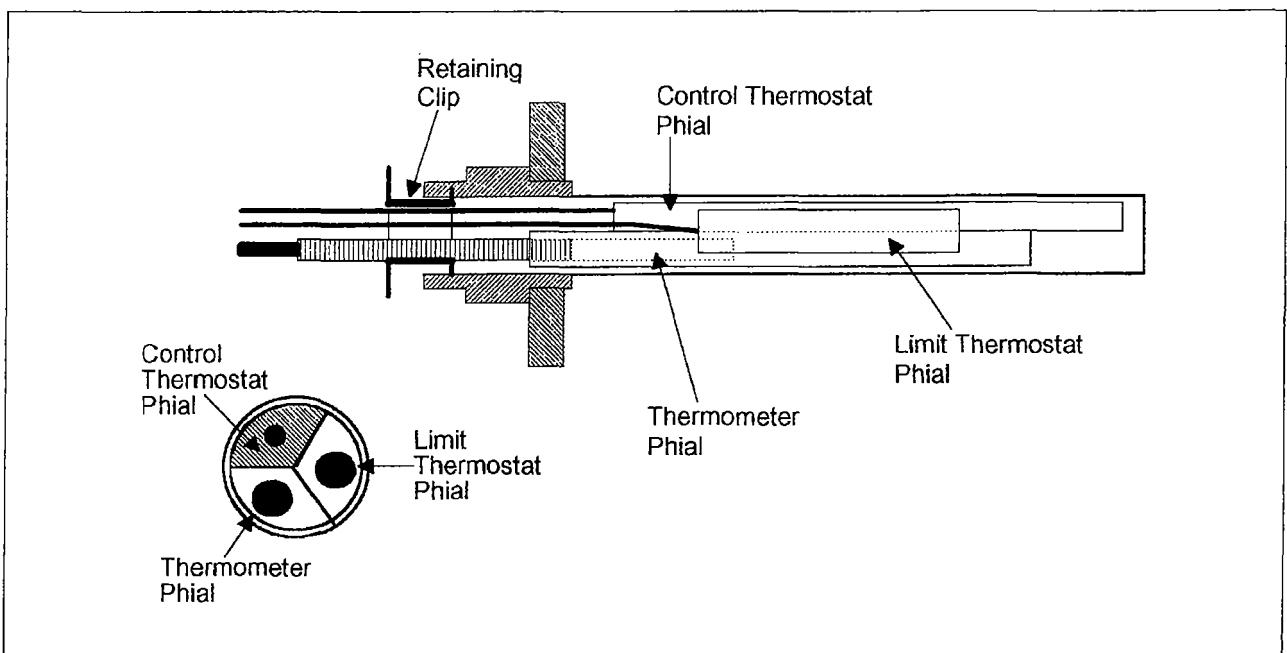


Fig.4.3 - General Arrangement of Thermostat Pocket



Remove the female half of the gas train elbow union from the gas train and fit it to the stub pipe on the burner manifold.

If the gas train is fitted on the right the blanking cap should be changed over from the right to left hand stub pipe first. Make good these joints with the proprietary gas jointing compound provided in the sachet/tube in the gas train box.

Check the gas train and pilot bundy for swarf or ingress of other bodies before continuing.

**NOTE:** The gas train is not self supporting and must be supported with the main gas pipework.

#### Connecting the Pilot Gas Line

The pilot pipe supplied is of sufficient length for the largest model and therefore may require shortening for some boiler models. This should be accomplished by using a pipe cutter ensuring that the pipe is clean of swarf internally and externally before fitting.

A piece of bundy tube is supplied in the gas train box. This is connected to the pilot burner and the pilot line by compression fittings. The nut and olive for the pilot burner is strapped to the pilot burner underneath the pilot shield.

Put the cap nuts on the bundy then the olives and position both pipe ends right into the fittings before tightening.

Tighten the fittings together and do not use pipe jointing compound on these connections.

Finally connect the gas train wiring to the boiler wiring by the plug and socket provided.

Connect the earth eyelet beneath the earth screw and washer on top of the pilot burner.

Plug the ignition lead to the ignition probe and fit the ionisation lead by the eyelet underneath the nut and washer on the ionisation probe, see Fig.4.5.

Fit the pilot burner assembly using the two securing nuts to the front of the burner assembly.

#### Connecting the Gas Supply

The connection should be made to the female connection (size given on page 1.1). A union and isolating valve should be fitted close to the boiler to allow disconnection of the boiler controls for maintenance and repair.

The gas supply should be made through a suitable meter and the Local Gas Undertaking should be consulted to determine the suitability of the meter and gas supply to meet existing and additional demands for gas.

The installation should be made in accordance with the requirements of the Gas Safety (Installation & Use) regulations and all other Regulations and Codes of Practice given on page 2.1.

In particular a manual valve for isolation of the boiler house shall be fitted in an accessible position and readily identifiable.

The gas supply should be supported adequately.

For large single and multiple boiler installations consideration should be given to the installation of additional gas meters to assist in the monitoring of boiler performance.

Attention is drawn to the need for adequately sized pipework according to the maximum gas demand for multiple boiler installations and each boiler shall be provided with an isolating valve so that it is possible to isolate the boiler from a common gas supply for maintenance purposes.

Boosters will not be necessary if a minimum inlet pressure of 7 in.w.g. (17.5 mbar) can be provided at the inlet to each gas train and maintained during full load conditions. If a booster is required the Local Gas Undertaking must be consulted and the booster shall be fitted with a low pressure cut off switch upstream of the booster in the event of reduced pressure and to prevent automatic restart on pressure restoration. The cut off pressure shall be decided by the Local Gas Undertaking.

#### Connecting the Water System

The flow and return connections should be made to the appropriate manifolds.

For 20 and 22 section boilers the connections should be made to the female BSP connections on flanges provided fitted to the manifolds.

The water system should be in accordance with the notes given on page 3.7.

#### Connecting the Electrical Supply

The electrical supply should be 240V 1Ph 50Hz. A 5A fuse and a suitable two 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.

Fig.4.4 - General Arrangement of Boiler Block

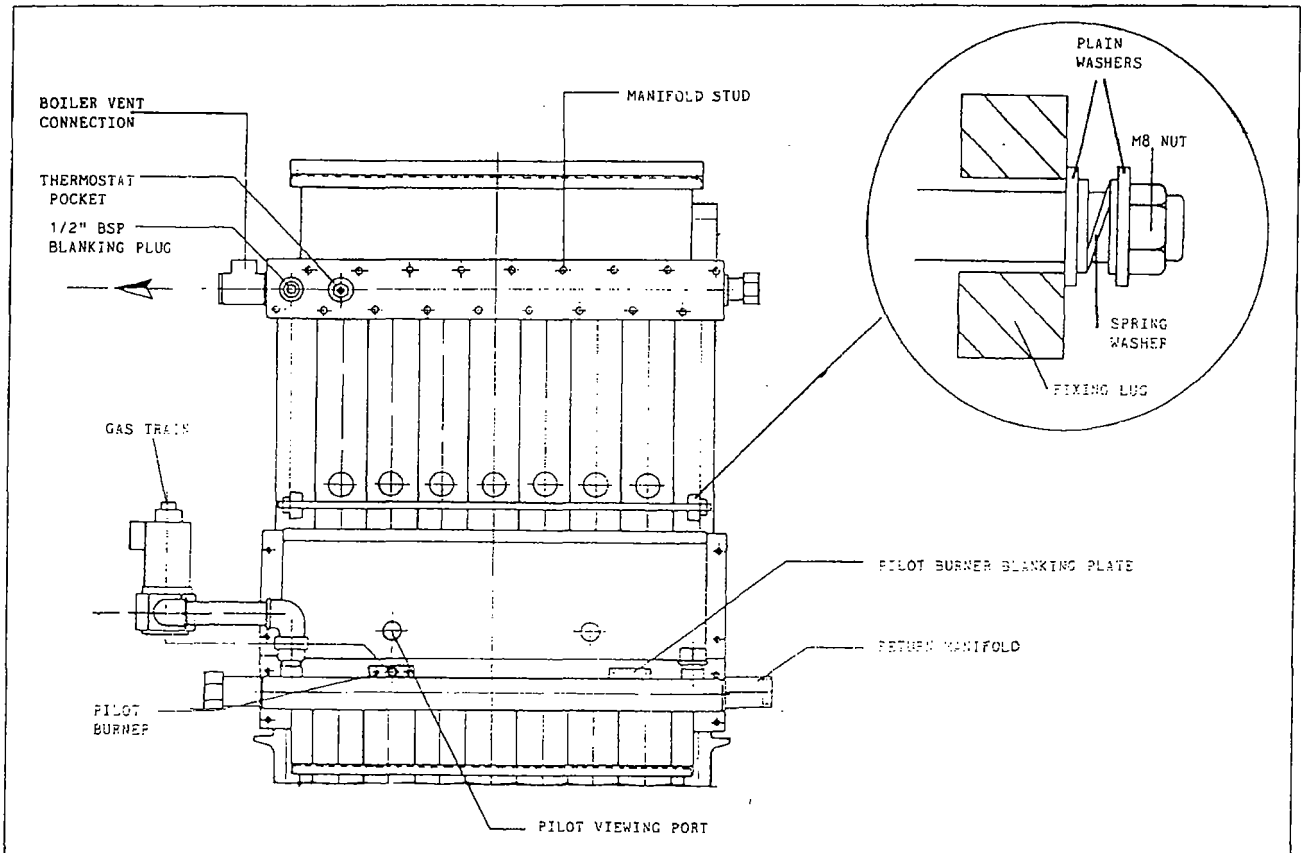
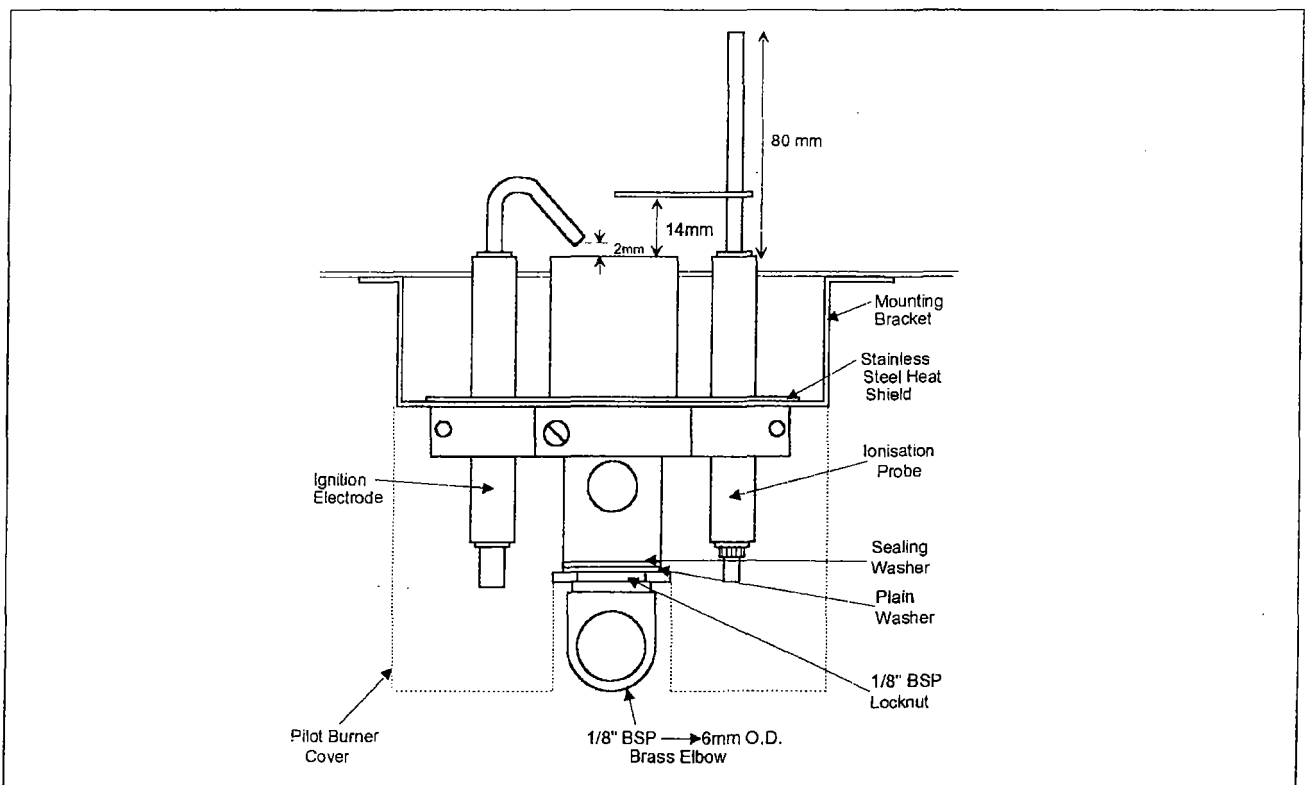


Fig.4.5 - General Arrangement fo Landis & Gyr QSZ1 SO2 Pilot Burner



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

The supply should be made to the left or right hand side of the boiler control panel by flexible conduit.

The entry should be made by a spare bulkhead connector on the control panel. The bulkhead connectors can be switched from one side to the other and blanking caps should be fitted over the unused entry holes. The blanking caps should always be used to cover spare holes.

The live and neutral connections should be made to the control panel terminal block. The earth connection should be made to the earth stud adjacent to the terminal block. 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. The wiring diagram is included in this manual on page 6.1 and also on the front inner panel of the boiler.

For multiple boiler installations each boiler shall have an isolator and fuse as detailed above to protect the boiler and allow for maintenance.

#### Boiler Controls

The operation of the boiler is under the control of it's own control box, 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. The boiler can be controlled by removing links 3-4 and 4-5 and providing volt free contacts across these terminals to switch the boiler.

High limit thermostat trip signal and control box lock out signals can be picked up from terminals 6 and 7 respectively. These are 240V AC single phase signals which can be used to illuminate a lamp or other low current device with a suitable neutral.

#### 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 3.3. 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.

#### INSTALLING UNASSEMBLED BOILERS

17 to 22 section boilers are delivered unassembled. The boiler sections are delivered on one pallet secured by metal straps. The flue hood, gas train, burners, casing and control panel are delivered on another pallet. All pallets are covered over with shrink wrap polythene.

#### Assembly of the Boiler Block

Remove the shrink wrap and metal straps securing the components to the pallets. Identify the bag of fasteners, thermostat pocket and spacers, ceramic rope, glue and Vaseline packed in the casing box.

Clean the O ring ports on the sections with a dry rag, DO NOT use oil or any other compound. Check that the sections are clear of swarf, sand or any other debris.

Fit the M10 studs to the sections, two at the front and two at the back. For 5 to 18 section boilers these studs have an overall length of 82mm and for 20 to 22 section boilers 102mm.

Add the sealing rope to the right hand side of the sections. The rope is pre-cut to two different lengths, one for the front and one for the back, and should be glued with the adhesive provided and trimmed to length if necessary.

**WARNING:** The adhesive gives off a flammable vapour and skin and eye contact should be avoided.

If the adhesive comes into contact with:-

- a) SKIN - then resin removing cream should be used and not a solvent to remove it.
- b) EYES - the eye should be irrigated with water and medical treatment sought.
- c) INHALATION - continued exposure should be prevented and the user should be removed to open air and if necessary medical advice sought.

The adhesive should be used sparingly as it is only used to keep the rope in position until the sections are clamped together.

Stand the left and right hand end sections up and secure to the front manifold using the two small clamping plates provided. See Fig.4.6. The manifold connections should be made to the left or right hand as required.

Fig.4.6 - Installing Unassembled Boilers

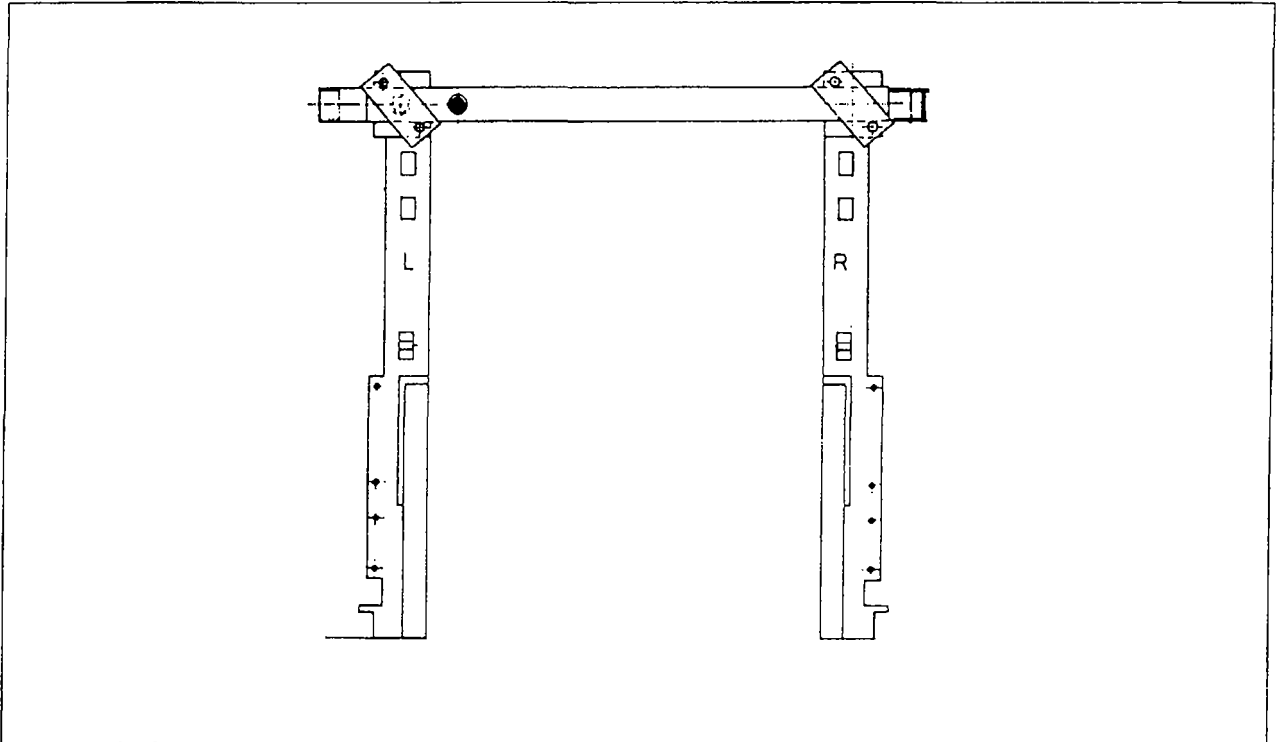
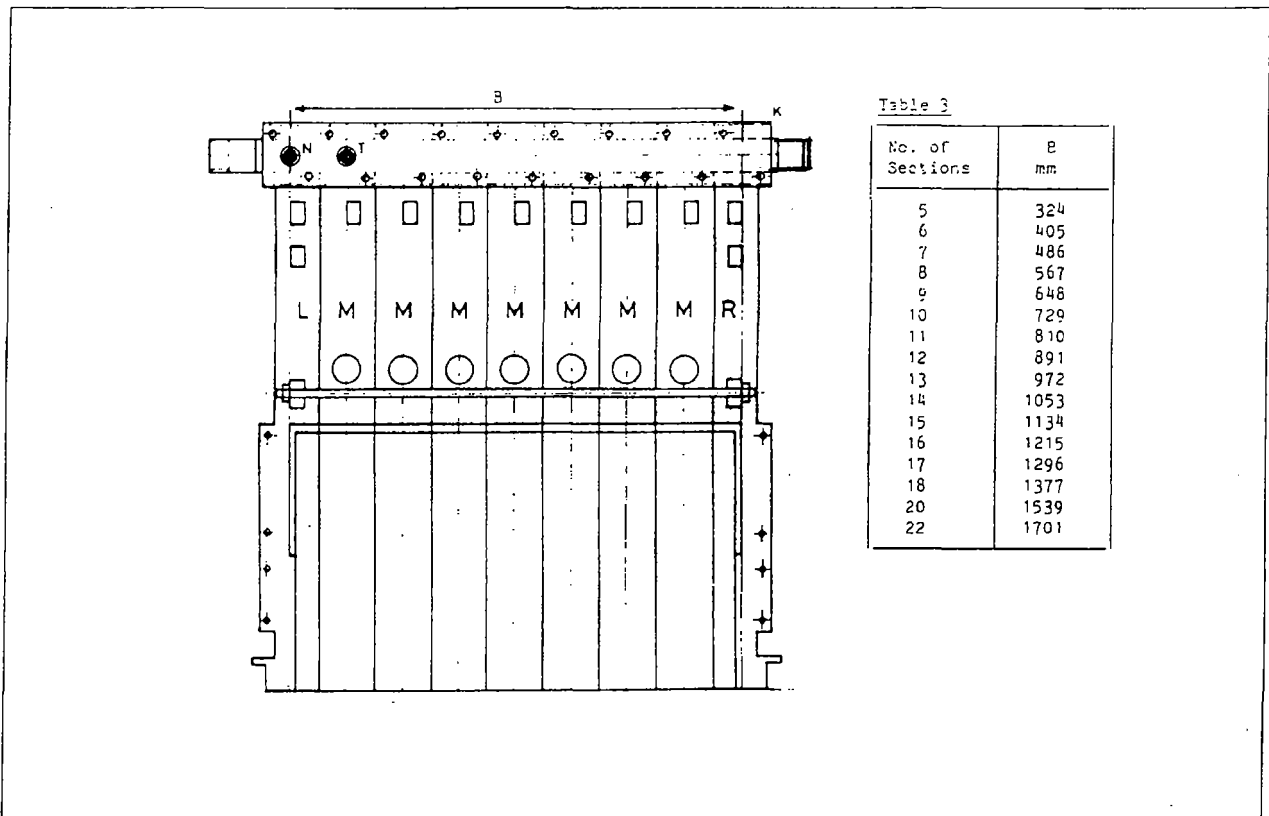


Fig.4.7 - Installing Unassembled Boilers



The front manifold has two BSP tapings, 3/4" and 1/2", while the rear manifold has one 3/4" BSP tapping.

The end sections should be at right angles to the floor and sitting on the steel strips required under the section feet (see Fig.1.2).

The sections should be spaced so that the distance between the centres of the sections are as Dimension B + 2cm given in Fig.4.7, Table 4.1. It is essential that this dimension is maintained at top and bottom otherwise the bottom feet of the end sections may toe in and it will be difficult to fit the base tray..

The boiler should now be sitting in it's final position to avoid further movement when it is fully assembled.

Take an intermediate section and hang it on to the front manifold against the left hand end section taking care not to snag and pull off the sealing rope. Add all of the intermediate sections until the last one is in place.

Loosen the clamping plate holding the right hand end section and push the section up against the intermediate sections.

Add the three tie bars, one at the front and two at the back as shown in Fig.4.2. Loosen the two clamping plates, fit the base tray in position as shown in Fig.4.8 and tighten the tie rods on the boiler up to Dimension B, Fig.4.7, Table 4.1.

Check this dimension carefully and check that the sections are at right angles, sitting on the steel trips and the sealing ropes are still in position. The base tray should be sitting on the lugs on the inside of the end section feet and not on the boiler base.

Fit the return manifold to the back of the boiler with the return connection to the left or right hand as required as follows:-

Fit the O rings to the sections using the Vaseline provided. No other compound should be used on the O rings or in the ports.

Push the manifold up against the O rings, position the U channel capping so that the hole in it lines up with the drain off cock tapping and fasten with the plain washers, spring washers and nuts. There should be one plain washer against the U channel capping, a spring washer above it and then the nut. The nuts should be tightened evenly until the spring washers are nearly flat.

Remove the clamping plates holding the front manifold and pull the manifold back but do not take it off the studs.

Fit the O rings into the sections using the Vaseline provided to hold them in place. Do not use any other type of compound.

Reposition the manifold and fit the U channel capping and secure with the plain washers, spring washers and nuts as for the rear manifold.

The drain off cock, thermostat pocket and the 3/4" BSP blanking plug are fitted to the manifolds before despatch.

The boiler is now ready for hydraulic testing.

#### Hydraulic Test of Boiler

This is to be carried out on boilers assembled on site or where water manifolds have been disturbed.

Fit a hydraulic test pump to the return manifold and fit a valve to vent air from the flow connection.

Fill the boiler with cold water and, in accordance with BS 779, 1976, pressurise up to 1.5 times the design pressure, ie. 7.5 bar maximum, and observe for 30 minutes.

#### INSTALLING MULTIPLE UNASSEMBLED BOILERS

When two boilers are being built side by side with the minimum practical clearance between them and with one flow connection to the left and the other to the right, the end sections should be positioned on the base as shown in Fig.4.9.

#### Assembly of Flue Hood and Burners

Locate the burner assembly on the lower four M8 studs and fasten with the washers and brass nuts provided.

The burners should be checked with a spirit level to ensure that they are horizontal and remedial action taken if they are not.

The flue hood is fitted onto the top of the boiler block and a seal must be made using the ceramic felt provided between the sections and the flue hood.

Fig.4.8 - Position of Base Tray

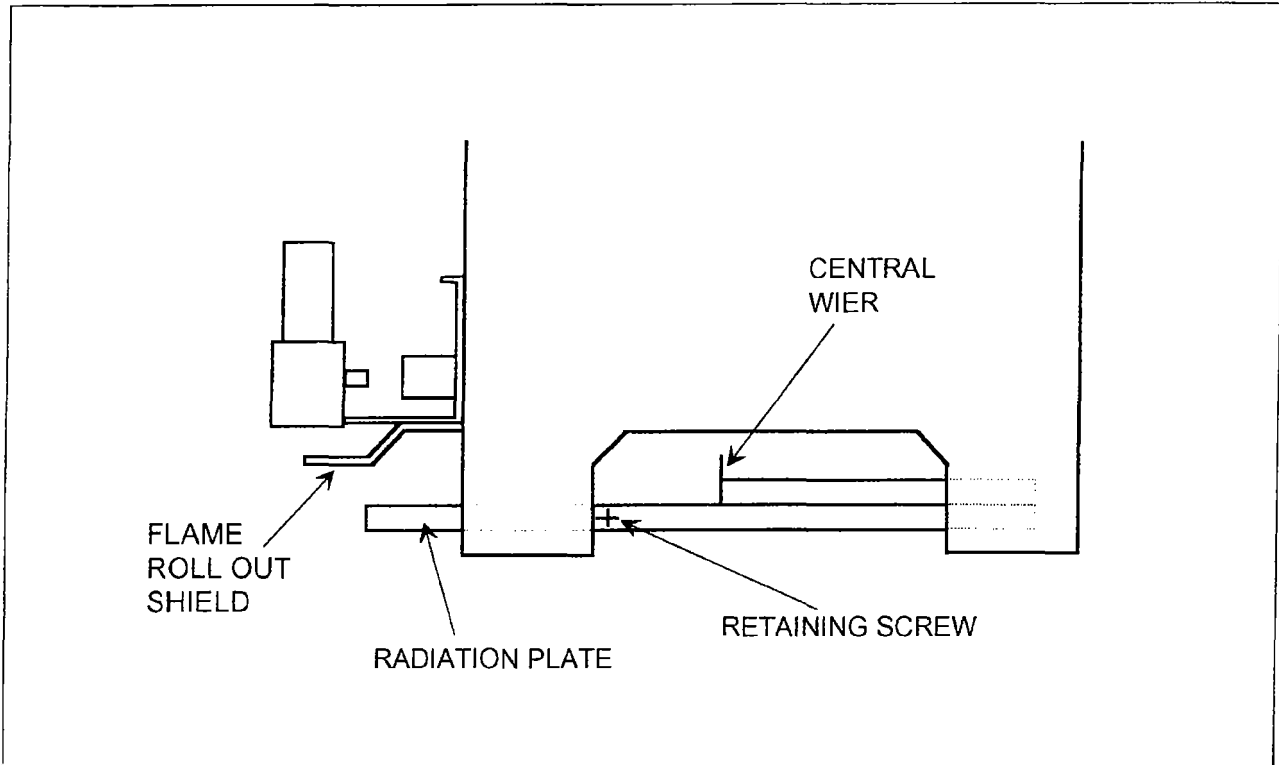
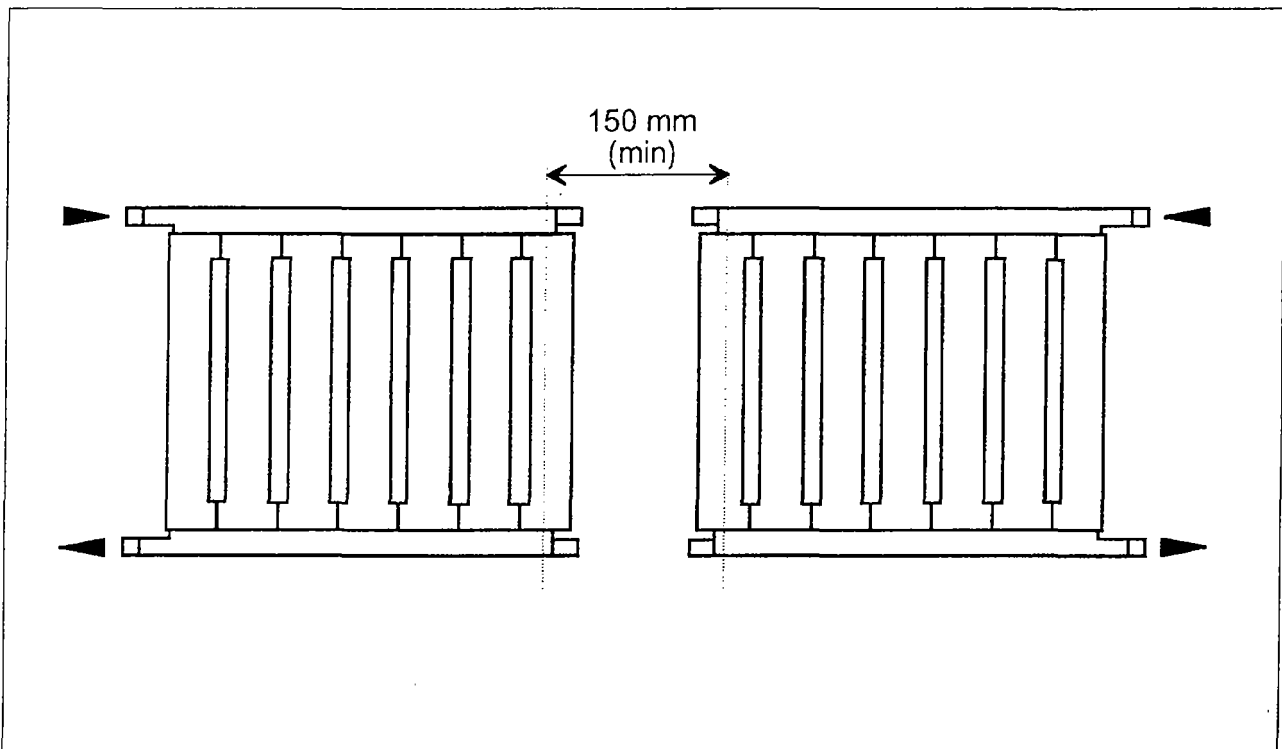


Fig.4.9 - Installing Multiple Unassembled Boilers



Take the roll of ceramic felt packed with the boiler and cut a strip and glue it across the front end of the sections. Next cut two pieces of sealing strip to form the side seal on top of each end section. See Fig.4.2 for the position of the flue hood sealing strip.

Finally add the rear sealing strip. This sealing strip does not sit on top of the end sections but underneath the lip at the back of each section. See Fig.4.9 for the position of the rear flue hood sealing strip.

Fit the flue hood taking care that the seal is correctly made as shown in Fig.4.2 and Fig.4.4 and secure the flue hood with the four clamps and butterfly screws as shown in Fig.4.2.

Adding Casing, Insulation, Control Panel & Gas Trains to Unassembled Boilers

These should be added as for assembled boilers.

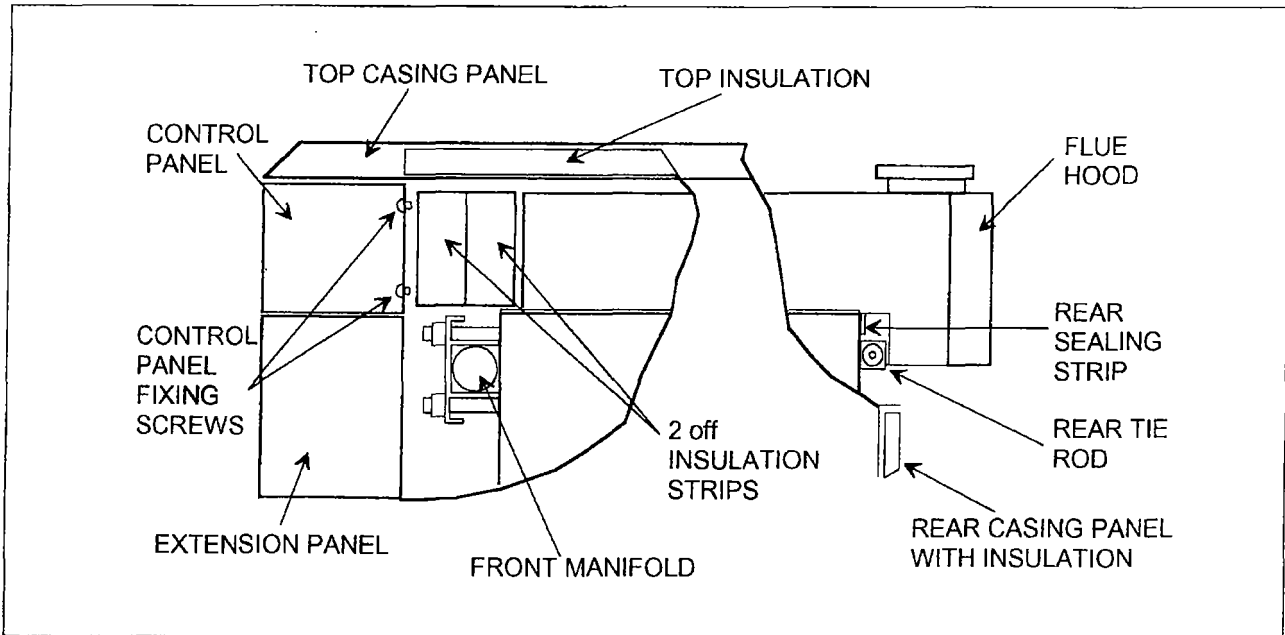
Gas, Water & Electrical Connections for Unassembled Boilers

These should be made as for assembled boilers.

BOILER DISASSEMBLY

If the boiler has to be disassembled it should be noted that the sections are not self supporting. Remove the return manifold only, then remove the sections individually from the flow manifold.

Fig.4.10 - Arrangement of Insulation & Rear Sealing





### **BOILER MAINTENANCE**

It is essential for efficient and trouble free operation that the boiler plant is regularly maintained. This must be carried out by qualified and experienced engineers and in the case of gas fired appliances attention is drawn to the mandatory requirement of CORGI (Confederation of Registered Gas Installers) registration of personnel undertaking work on these appliances. This facility is available from Potterton Commercial Division, details are available from regional offices listed on the back page back of this manual.

Boilers should be serviced and re-commissioned as a minimum on an annual basis but frequency may depend on usage and application of the boiler.

It is strongly advised that a maintenance contract be entered into with Potterton Commercial Division to ensure that the boiler/burner unit is correctly and properly maintained.

**WARNING** Isolate the electrical and fuel supplies before attempting any maintenance work.

Following completion of maintenance on the boiler the boiler should be re-commissioned as detailed on page 5.2 of this section.

### **BOILER CLEANING**

At every service visit the boiler should be cleaned as detailed below and the soundness of the gas control assembly must be checked as described on page 5.8. The boiler should be fully recommissioned as described on page 5.2 with 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 system 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 low pressure switch on a booster system, if fitted, is operating correctly.
5. That the water flow switch, if fitted, is operating correctly.

To clean the boiler it will be necessary to remove the boiler flue hood cover and burner assembly as detailed below.

1. Remove the boiler door by lifting forward and upwards.
2. Disconnect the burner manifold from the gas train union.
3. Disconnect the ignition and flame detection leads from the pilot burner. This will require removal of the pilot burner cover.
4. Disconnect the pilot burner bundy pipe from the pilot burner.
5. Release the four M8 nuts securing the front combustion chamber cover mounted above the burner assembly and remove the panel.
6. Release the four M8 nuts securing the burner assembly to the boiler and remove the burner assembly.
7. Remove the front and rear boiler top panels.
8. Remove the screws securing the flueway clean out cover and remove the cover.
9. With the flue brushes provided clean the flueways of the cast iron heat exchanger.

Following completion remove the debris from the bottom of the boiler.

10. Following completion of the above the boiler should be reassembled. The integrity of the gaskets and insulation should be checked and replaced if necessary during reassembly.
11. Clean the burner bars and ensure that the holes/slots are clear. If necessary blow the slots and internals clear with compressed air or soft brush and vacuum. On no account should the burners be wire brushed.
12. After reassembly test for gas soundness as detailed under Commissioning and check the burner manifold union and pilot burner union for gas leaks.

### COMMISSIONING

**IMPORTANT:** The boiler must be commissioned following completion of installation. Operation of an uncommissioned appliance may cause injury to personnel and damage to the boiler/burner unit and could invalidate the manufacturers warranties.

Commissioning should only be carried out by personnel approved and competent to do so. This facility is available from Potterton Commercial Service Offices at the addresses as listed on the back page of this manual.

Before commencing to commission ensure that any cling film is removed from the casing panels and 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 and is correct supply voltage and polarity.
3. Gas supply is tested for soundness and purged of air. Ensure that the burner is suitable for connected gas supply and pressure.
4. Test for gas soundness of gas trains as described on page 5.8.
5. Appliance gas cocks are all turned off.
6. Gas supply is turned on at the meter.
7. Boiler and system are filled with water and operating pressure is within appliance range..
8. Flow and return valves are open.
9. Any external controls and the on/off switch are in the "ON" position.
10. The circulating pumps are operational. Check that the pump is scheduled to run and not on pump overrun if the boiler has previously been fired. Check that any flow proving interlocks are functional.
11. Check that the high limit thermostat has not tripped by pressing the green reset button on the control panel fascia, on earlier models, the reset button underneath the hexagon cap nut on the fascia. The high limit thermostat has been set by the manufacturer to 98°C and no attempt should be made to recalibrate it on site.

12. Ventilation is adequate and, in the case of mechanical ventilation systems, operation of the boiler is inhibited unless the ventilation fan is proved.
13. On mechanically assisted flue systems the operation of the boiler plant should be inhibited unless the mechanical flue system is operational and flow proved.
14. The safety valve should be checked to ensure that it is of the correct size and pressure. See Section 3 for further details.
15. The cold feed and open vent sizes should be checked. See Section 3 for further details.

Following completion of the above checks the burner should be commissioned. Typical combustion figures are detailed below. The combustion figures, etc. should be completed on the commissioning form provided at the back of this manual and returned to Potterton Commercial at the address on the back page.

Commissioning figures should be taken at a boiler flow temperature of 80°C. The combustion measurements should be taken in the secondary flue at a minimum of 600mm above the draught diverter.

<u>GAS</u>	CO <sub>2</sub>	-	4 - 5%
	CO	-	0 - 50 ppm
	Flue Gas Temp	-	120 - 160°C

**IMPORTANT:** The boiler/burner units are supplied in accordance with Potterton Commercial Quality Assurance plan registered to meet the requirements of BS 5750 Part 2. A condition of the supply of the appliance for compliance with this Quality Assurance plan is the return of the appliance commissioning report.

Following/during commissioning of the burner unit the following additional checks should be carried out.

1. Operation of the control, high/low and high limit thermostats should be checked for correct operation.
2. The flue draught available at the appliance flue outlet should be checked under all operating conditions (hot and cold) and should be within the boiler operating parameters, see Table 1.2A and 1.2B.

3. The fuel supply to the appliance should be isolated and the burner operated to ensure safety shut down and lockout of the burner on flame failure.
4. Shut down of the boiler plant by external controls does not cause a hazardous condition and pump overrun is provided to remove residual heat from the boiler.
5. Following commissioning the boiler overheat and control thermostats should be set to the required operating setting. See Section 3 for maximum operating temperature
6. Following completion of commissioning the soundness of all automatic fuel valves should be checked for leakage.

#### Additional Checks

Where possible the system should be checked to ensure that following purging of air there is no raw water make-up. In particular, when the system is operated in the hot condition, there should be no discharge of water from the safety valve, open vent or cold feed tank overflow that would otherwise lead to unregulated raw water make-up when the system cools down.

#### Pre-Lighting

Before attempting to light the boiler start the circulating pump and check that it is scheduled to run and not on pump overrun if the boiler has been fired previously.

Check that the main and pilot gas cocks and electrical supply are turned off.

Set the boiler control thermostat to the required position and the time clock to an "ON" position. Check that the high limit thermostat has not tripped by pressing the green button on the control panel fascia. With early boilers this is done by removing the hexagon cap nut and pressing the button beneath it.

Start the boiler by switching on the main isolator and the on/off switch on the boiler control panel fascia and the boiler will attempt to light. After a delay of approximately 15 seconds the ignition spark should be heard and after 5 seconds the control box should lock out.

If the ignition spark is not detected or the control box does not lockout see Fault Finding on page 5.6.

#### Commissioning Live Run

After one minute turn the pilot gas cock on (ensure that the main gas cock is turned off).

Turn on the electricity supply at the main isolator and at the on/off switch on the control panel fascia (ensuring that time clocks and any other external controls are made or are in the "ON" position).

Approximately 15 seconds after switching on the ignition spark should appear followed by ignition of the pilot burner. If pilot flame is not established the control box will lockout in approximately 5 seconds. This may initially occur due to air in the pilot line.

The control box may be reset after a delay of one minute by pressing the red button on the control panel and the red light will go out. When the flame is established on the pilot burner, turn off the pilot gas cock and check that the pilot shuts down. An ignition spark should start followed after 5 seconds by lockout.

Connect a pressure gauge to a pilot test point on the inlet to the pilot solenoid valve called TP6, see Fig.5.2 on page 5.11. Open the main and pilot gas cocks and reset the lockout button after a delay of one minute. The pilot burner will relight followed 10-15 seconds later by the main burners. Check the pilot gas pressure of 16 mbar (6.3 in.w.g.) and adjust if necessary.

Test the gas connection between the safety shut off valve and the pilot burner for soundness with a soap solution or other approved method and seal any leakages. Switch off the electrical supply and check that the burner is extinguished. Remove the pressure gauge from the pilot test point and replace the sealing screw.

Fit a pressure test gauge to the test point on the burner manifold. Switch on the electrical supply. When all burners are operating check the pressure. If the burner is not approximately 16 mbar (6.3 in.w.g.) then it should be adjusted. The burner pressure should be checked again after approximately 30 minutes and adjusted again.

During this period test for soundness between the last burner safety shut off valve and the burner injectors with a soap solution or any other approved method and seal any leakages.

Turn off the main isolating valve to the boiler and the main burner and pilot burner should close down. The ignition spark should start followed after 5 seconds by lockout.

Also check the gas consumption by meter if possible and adjust as necessary to obtain the correct gas rate as given in Table 1.2A and 1.2B. Remove the pressure gauge and replace the sealing screws.

Switch the boiler off at it's on/off switch and at the main isolator. Open the control panel fascia and connect a microammeter into the test link between terminals 11 and 12 on the main terminal block. Remove the two nuts securing the pilot burner cover and disconnect the ionisation lead from it's ionisation probe. Close the control panel fascia taking care not to trap the wires to the microammeter. Switch on the main isolator and the on/off switch and after 15 seconds the ignition spark should be heard followed after 15 seconds by lockout of the control box.

Switch off the main isolator and the on/off switch and re-make the ionisation lead connection to the ionisation probe and replace the pilot burner cover with the two nuts. Switch on the main isolator and the on/off switch and after 15 seconds the ignition spark should be heard followed by lighting of the pilot burner. The microammeter should read approximately 7 $\mu$ A.

Switch off the main isolator and the on/off switch, open the control panel fascia, remove the microammeter connections and replace the link between terminals 11 and 12 on the main terminal block. Close the control panel fascia and fasten with the two screws.

With the boiler hot and cold check for spillage of combustion products with a smoke bomb or smoke wand. Check that air is moving onto the front of the boiler and that combustion products are not spilling out of the draught diverter at the back. The flue draught should be checked with a draught gauge and a draught of 1 mm.w.g. (0.04 in.w.g.) is required 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 in Section 3.

For boiler houses with mechanical ventilation, the suitability of the ventilation and extract system should be checked against the notes given on Mechanical Ventilation in Section 3.

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.

### OPERATION OF ANCILLARY CONTROLS

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

### TO LIGHT BOILER - NORMAL OPERATION

1. Turn green on/off switch so that the lamp is not lit.
2. Check that both gas cocks on the gas train on the side of the boiler are on and the service gas cock at the meter.
3. Check that all ancillary controls, eg. time clocks, are turned on.
4. Check that the electricity supply is turned on.
5. Switch on the green on/off switch so that the lamp lights.
6. Check that the control box lockout lamp is not lit and, if so, reset by pressing it.
7. Turn the boiler thermostat to the required setting.
8. The boiler will now light.
9. Replace the front casing panel.

**WARNING:** If the pilot burner fails to establish or the boiler closed down after it has established, or, if the boiler closes down after the main flame has been established, no attempt should be made to relight the boiler for a period of one minute.

### TO SHUT DOWN BOILER

1. Temporarily - Switch the green on/off switch with lamp "OFF" so that the lamp is not lit. Switch off the electrical supply.
2. Long Periods - As above but in addition turn off both gas cocks on the gas train at the side of the boiler.

### SETTING THE FLOW TEMPERATURE

The required flow setting should be set by the control thermostat against the expanding scale. The temperatures which correspond to the positions on this scale are given Fig.5.1. The boiler thermometer should be used to check and adjust the setting as necessary.

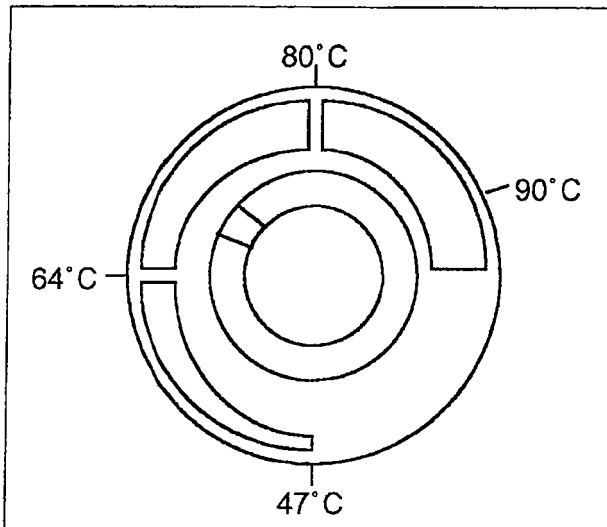


Fig.5.1 - Control Thermostat Expanding Scale

#### 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.

#### FAULT FINDING

Set out below are general guidance notes on system fault finding.

##### Overheat Operation

Operation of the boiler overheat thermostat is associated with a reduction in boiler water flow. Where overheat operation is reported the following should be checked.

- a) The boiler/system pump has not tripped.
- b) Pump overrun is operational to dissipate residual heat from the boiler on system shut down.
- c) System valves are open.
- d) The boiler is operating at the correct rate and is not overfired.

To reset the overheat thermostat allow the boiler to cool down, remove the overheat thermostat knob and press the reset button.

The use of a primary loop system is highly recommended to provide a constant boiler flow rate under all operating conditions. For further information refer to Potterton Publication Technical Bulletin No.1 Issue 2.

##### Burner Lockout

The boilers have an integral safety system to allow the safe and reliable operation of the burner. Failure of the burner to operate correctly will cause the burner control box to "lockout" and the lockout button on the burner will illuminate to indicate this.

The lockout condition can be manually reset by pushing the reset button and the control box should restart its control sequence in an attempt to light the burner. If the control box lockout will not reset or goes to lockout after being reset then the services of a boiler repair/maintenance company should be sought. This service is available from Potterton Commercial Division service offices at the addresses on the back page of this manual.

**WARNING: The lockout reset button should not be repeatedly operated otherwise a hazardous situation may occur.**

Should the boiler go to lockout, check the following before attempting to relight the burner.

1. Fuel is available at the burner.
2. The electrical supply to the appliance is of the correct voltage and polarity.

The Derwent HE boiler is fitted with a Satronic TFI 812.1B Mod.5 control box with a 5 second safety time. The control box controls the safe start up of the burner in sequence. See fault finding table on page 5.6 for details of control box lockout conditions.

<p><u>Stage 1</u></p> <p>Boiler does not attempt to light. Control box does not lockout.</p>	<ul style="list-style-type: none"> <li>a) Check electricity supply is available to boiler and on/off switch is illuminated. The boiler has an integral fuse.</li> <li>b) Check the boiler is being called to operate. Thermostat calling lamp should be lit unless internal thermostat is satisfied or external control circuit is broken.</li> <li>c) Check overheat cut off device has not operated.</li> <li>d) Check power supply is available to control box (see wiring diagram). Replace box if faulty.</li> </ul>
<p><u>Stage 2</u></p> <p>No ignition spark. Pilot does not light. Control box goes to lockout.</p>	<ul style="list-style-type: none"> <li>a) Check ignition electrode continuity for earth fault.</li> <li>b) Check power supply is available to electronic ignitor during ignition period.</li> <li>c) Check operation of ignitor. Replace if necessary.</li> </ul>
<p><u>Stage 3</u></p> <p>Ignition sparks. Pilot burner does not light. Control box locks out.</p>	<ul style="list-style-type: none"> <li>a) Check gas supply is available at the pilot burner at the correct pressure.</li> <li>b) Check gas supply is purged of air.</li> <li>c) Check pilot solenoid.</li> <li>d) Check ignition electrode position.</li> </ul>
<p><u>Stage 4</u></p> <p>Pilot burner lights. Control box goes to lockout after 5 seconds.</p>	<ul style="list-style-type: none"> <li>a) Check electrical supply polarity.</li> <li>b) Check earth continuity to pilot burner.</li> <li>c) Check pilot burner pressure is correct.</li> <li>d) Check there is no earth leakage on ionisation probe circuit.</li> <li>e) Check ionisation probe circuit for correct flame current. This is achieved by removing the test link between <b>11</b> and <b>12</b> of the boiler control panel and connecting a DC microammeter in series. A reading of at least 7µA DC should be obtained. If this is obtained and the control box continues to lock out then replace the control box.</li> </ul>
<p><u>Stage 5</u></p> <p>Pilot burner lights. Main burner does not light. Control box does not lockout.</p>	<ul style="list-style-type: none"> <li>a) Check main burner gas cock is open.</li> <li>b) Check electrical continuity to main gas valves.</li> <li>c) Check operation of gas valve and replace if necessary.</li> <li>d) Check control box. Replace if necessary.</li> </ul>
<p><u>Stage 6</u></p> <p>Pilot burner lights. Main burner lights. Control box locks out.</p>	<ul style="list-style-type: none"> <li>a) Check ignition of main flame is smooth and reliable.</li> </ul> <p><b>Note:</b> The main gas valve has a slow opening function. This should be set at the minimum. There is a time delay of approximately 20 seconds between energising the main gas valve and starting the open.</p> <ul style="list-style-type: none"> <li>b) Check voltage supply for interference.</li> </ul>

### COMPONENT REPLACEMENT

Before commencing any component replacement, isolate the electrical and gas supplies to the boiler. After every service visit the soundness of the gas control assembly must be checked as described on page 5.11.

#### Main Burner Bar

1. Remove the main burner assembly as described under "Cleaning the Boiler" on page 5.1.
2. Release the M4 nut and paint cutting washer securing the end of the burner to the fixing strip.
3. Release the two M6 brass nuts and washers securing the burner bar to the burner manifold and slide the burner bar out.
4. Refitting the burners is the reverse of the above procedure.

#### Pilot Burner & Electrodes

1. Remove the main burner assembly as described.
2. Release the pilot burner and pilot burner cover by undoing the two brass nuts and washers securing the pilot burner to the mounting studs.
3. Release the clamping plates and screws and fit new electrodes if necessary.
4. Fit the pilot burner and check the electrode position as shown in Fig.4.5.
5. A new olive should be used when connecting the pilot burner bundy tube to a new pilot burner.
6. Replace the main burner assembly as the reverse of the above procedure.

#### High Temperature Thermostat

1. Remove the two screws securing the control panel front fascia and hinge it down. This will require the removal of the boiler door.
2. Remove the thermostat phial from the thermostat pocket and thread it through the bulkhead grommet into the control panel.
3. Remove the electrical connections to the thermostat which are made by push on female connectors.

4. Remove the two screws securing the thermostat to the control panel fascia. For the control thermostat the screws are located beneath the thermostat knob which can be pulled off.
5. Fitting the new thermostat is the reversal of the above procedure. The thermostat phial should be positioned as shown in Fig.4.3 and secured in position with the retaining clip.

#### Thermometer

1. Remove the two screws securing the control panel front fascia and hinge it down. This will require removal of the boiler door.
2. Remove the thermometer phial from the thermometer pocket and thread it through the bulkhead grommet into the control panel.
3. Remove the two knurled nuts and clamping pieces securing the thermometer body.
4. Fit the new thermometer as the reversal of the above procedure. The thermometer phial should be positioned as shown in Fig.4.3 and secured with the retaining clip.

#### On/Off Switch & Lamp

1. Remove the two screws securing the control panel fascia and hinge it forward. This will require removal of the boiler door.
2. Remove the electrical connections which are made by female push on connectors.
3. Push the switch out through the control panel fascia.
4. Fit the new switch as the reverse of the above procedure.

#### Control Box & Spark Generator

1. Remove the two screws securing the control panel fascia and hinge it down. This will require removal of the boiler door.
2. Remove the screw through the middle of the control box securing its base and then remove the control box.
3. If the control box only is to be replaced fit the new box as a reverse of the above procedure.

4. To change the spark generator disconnect the spark generator connections from the control box base.
5. Remove the four screws securing the control box back plate to the control panel.
6. Remove the two screws, nuts and washers securing the control box base and spark generator to the back plate.
7. Replace the spark generator as a reversal of the above procedure.
8. Recommission the boiler as described on page 5.2 to check the operation of the control box.

#### Pilot Line Components

1. Disconnect the electrical connection to the pilot solenoid valve by removing the screw which secures the plug-in connector, or, remove the circlip on the pilot solenoid valve and release the coil.
2. Remove the two screws securing the pilot line support bracket.
3. Release the pilot line union.
4. Replace the pilot line components as necessary and refit the pilot line to the main line and then refit the complete assembly as the reversal of the above procedure.
5. After replacing the gas train test for gas soundness as described on page 5.11.

#### Main Gas Line Components

1. Unplug the electrical connection to the gas train.
2. Release the burner manifold union and the pilot line connection to the pilot burner.
3. Disconnect the gas train rear union upstream and lift away the gas train complete.
4. Remove the complete gas assembly and pilot line as described for "Pilot Line Components" above.
5. Remove the screw securing the electrical connection socket, or, remove the cover plates and disconnect the electrical connections to the valves if necessary.

6. Change the valves or governor as necessary.
7. Remake the electrical connections and replace the pilot line and main gas line.
8. After replacing the complete gas train check for gas soundness as described on page 5.11.

#### TO TEST FOR GAS SOUNDNESS OF CONTROL ASSEMBLY & SAFETY SHUT OFF VALVES.

To be read in conjunction with the schematic gas train diagrams on page 5.13.

#### To Test for Gas Soundness of ALL Pilot Solenoid Valves

1. Ensure electricity supply and pilot and main gas cocks are switched off.
2. Fit pressure gauge to TP6, pressure test point just upstream of the pilot solenoid valve, ensuring a gas tight connection.
3. Turn on pilot gas cock and pressurise up to seat of the pilot solenoid valve.
4. Turn off the pilot gas cock and observe the pressure gauge for a period of two minutes.
5. If any pressure loss is observed, repressurise by opening and closing the pilot gas cock and test for leaks with a soap solution.
6. If no external leaks are detected and loss of pressure occurs, this is the result of let-by by the pilot solenoid valve and it should be replaced.
7. Remove the test gauge and refit the test point sealing screw.

#### To Test Gas Soundness of Main Line on Option A - Dungs Multiblocks - 5 to 11 Section Boilers

1. Ensure electricity supply and pilot and main gas cocks are turned off.
2. Connect a pressure test gauge to test point TP1, inlet to the governor and first valve. Remove pressure test point TP3 sealing screw which is situated on the side of the valve block.
3. Open and close the main manual gas cock to pressurise up to the seat of the first valve.



4. Observe the pressure gauge for a period of two minutes.
5. If any loss of pressure is observed open and close the main gas cock to repressurise and check for leaks with a soap solution.
6. If no external leaks are detected and a loss of pressure is observed, this is caused by let-by of the first valve seat and the valve assembly should be replaced.

If the first valve has been tested successfully, continue to test the second valve seat as follows.

7. Connect pressure test points TP1 and TP3 to a pressure gauge with a tee piece.
8. Open and close the main gas cock to pressurise up to the second valve seat via the connection made.
9. Observe the pressure gauge for a period of two minutes.
10. If any loss of pressure is observed this is due to let-by of the second valve seat and the valve unit should be replaced.
11. Remove the pressure test gauge and replace the pressure test point sealing screws.

To Test Gas Soundness of Main Line on:-

Option A - Dungs MVDLE & Landis & Gyr SKP20 - 17 to 22 Section Boilers

Option B - Interlabion AHMVKL & Landis & Gyr SKP20 - 17 to 22 Section Boilers

1. Ensure electricity supply and pilot and main gas cocks are turned off.
2. Connect a pressure test gauge to test point TP1, inlet to the governor and first valve. Remove pressure test point TP3 sealing screw which is situated on the side of the valve block.
3. Open and close the main manual gas cock to pressurise up to the seat of the first valve.
4. Observe the pressure gauge for a period of two minutes.
5. If any loss of pressure is observed open and close the main gas cock to repressurise and check for leaks with a soap solution.

6. If no external leaks are detected and a loss of pressure is observed, this is caused by let-by of the first valve seat and the valve assembly should be replaced.

If the first valve has been tested successfully, continue to test the second valve seat as follows.

7. Connect pressure test points TP1 and TP3 to a pressure gauge with a tee piece.
8. Open and close the main gas cock to pressurise up to the second valve seat via the connection made.
9. Observe the pressure gauge for a period of two minutes.
10. If any loss of pressure is observed open and close the main gas cock to repressurise and check for leaks with a soap solution.
11. If no external leaks are detected and a loss of pressure is observed this is due to let-by of the second valve seat and the valve unit should be replaced.
12. If the valve is successfully tested, remove the pressure test gauge and replace the pressure test point sealing screws.

To Test Gas Soundness of Main Line on:-

Option A - Dungs MVD & MVDLE & Jeavons Governor - 12 to 18 Section Boilers

Option B - Interlabion AHMVS & AHMVKL & Jeavons Governor - 5 to 16 Section Boilers

1. Ensure electricity supply and pilot and main gas cocks are turned off.
2. Connect a pressure test gauge to test point TP2. Remove pressure test point TP3 sealing screw.
3. Open and close the main manual gas cock to pressurise up to the seat of the first valve.
4. Observe the pressure gauge for a period of two minutes.
5. If any loss of pressure is observed open and close the main gas cock to repressurise and check for leaks with a soap solution.

6. If no external leaks are detected and a loss of pressure is observed, this is caused by let-by of the first valve seat and the valve assembly should be replaced.

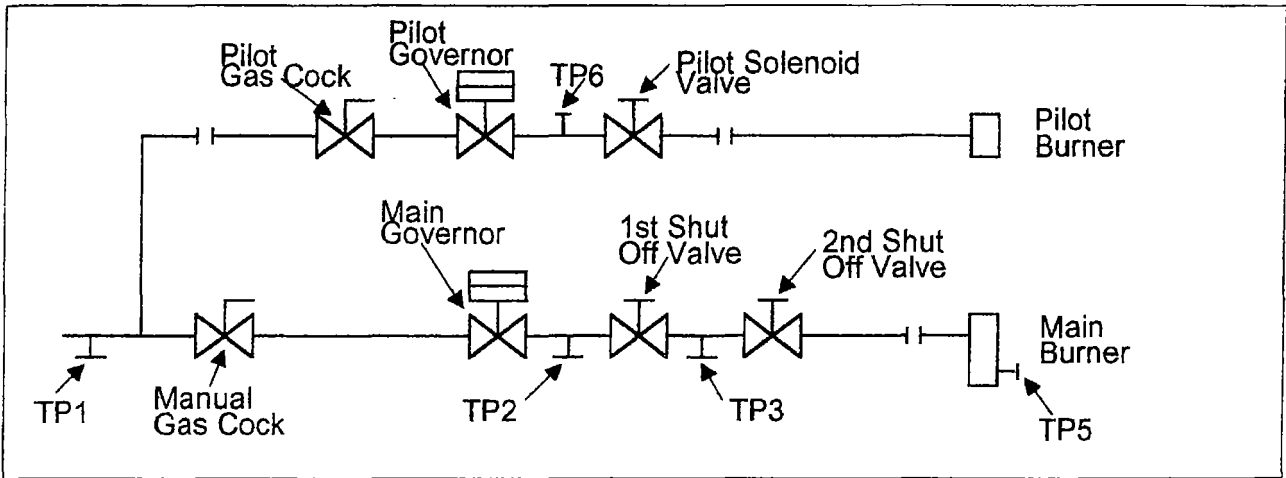
If the first valve has been tested successfully, continue to test the second valve seat as follows.

7. Connect pressure test points TP2 and TP3 to a pressure gauge with a tee piece.
8. Open and close the main gas cock to pressurise up to the second valve seat via the connection made.
9. Observe the pressure gauge for a period of two minutes.
10. If no external leaks are detected and a loss of pressure is observed this is due to let-by of the second valve seat and the valve unit should be replaced.
11. If the second valve is successfully tested, remove the pressure test gauge and replace the pressure test point sealing screws.

**IMPORTANT:** THE INITIAL LIFT AND RATE OF OPENING OF THE SLOW OPENING VALVE AND THE MULTIBLOCK VALVES HAVE BEEN PRESET BY THE MANUFACTURER AND ONLY THE GOVERNOR SHOULD BE ADJUSTED ON SITE.

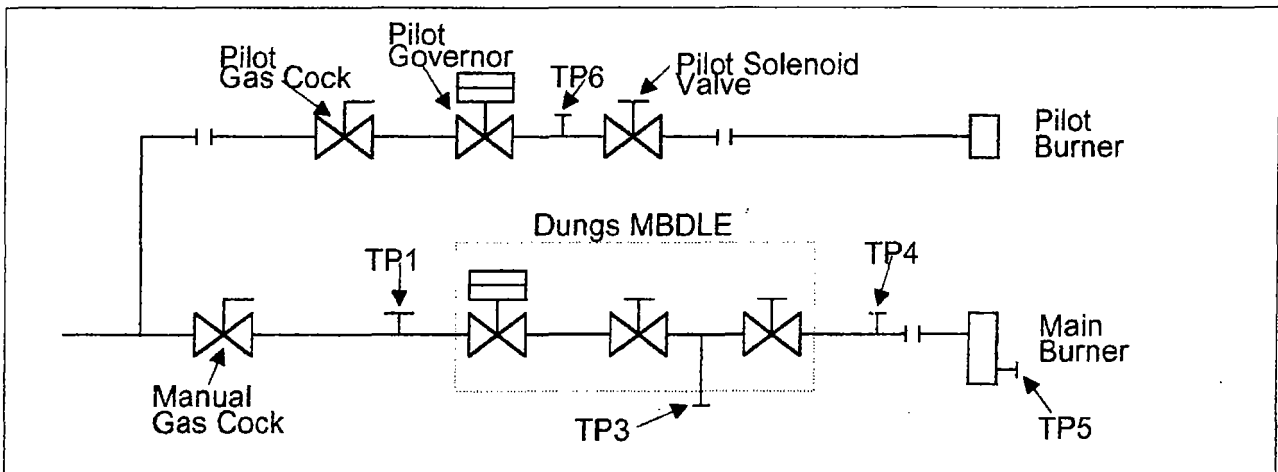
Fig.5.2 - Schematic Gas Train Diagrams

OPTION A - Dungs MBDLE Multiblock - 5 to 12 Section Boilers



OPTION A - Dungs MVD & MVDLE Valves with Jeavons Governor - 13 to 18 Section Boilers

OPTION B - Interlabion AHMVKL & AHMVS Valves with Jeavons Governor - 5 to 16 Section Boilers



OPTION A - Dungs MVDLE with Landis & Gyr SKP20 Valves - 20 to 22 Section Boilers

OPTION B - Interlabion AHMVKL with Landis & Gyr SKP20 Valves - 17 to 22 Section Boilers

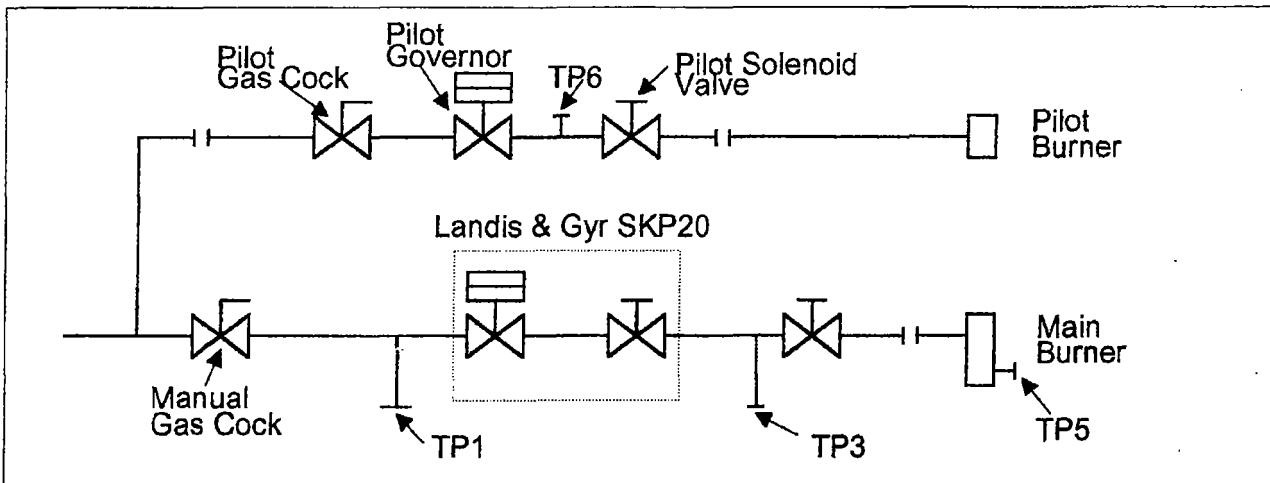
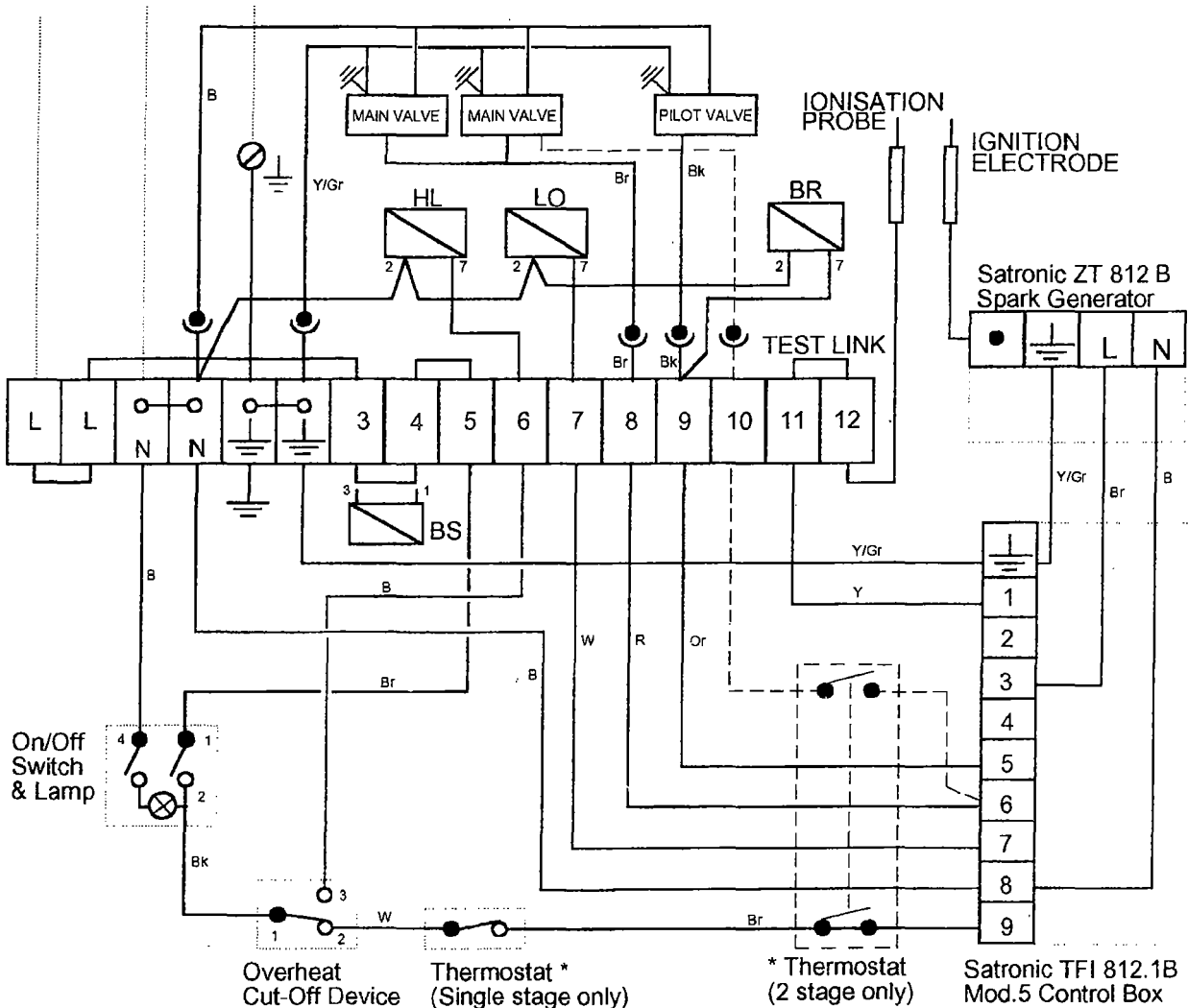


Fig.6.1 - Control Panel Wiring

5A FUSE AND ISOLATOR TO BE PROVIDED BY INSTALLER  
INCOMING MAINS SUPPLY SINGLE PHASE 240V 50 Hz AC



Gas train connections are made by plug and socket arrangement already pre-wired and denoted by ●

Two stage wiring denoted by - - - -

\* Single stage thermostat replaced by two stage on high/low version

**Volt Free Contacts:** HL - High Limit Indication  
LO - Lockout Indication  
BR - Boiler Run / Boiler Enabled  
BS - Boiler Switch / Boiler Enable (specified volatge)

**Relay Configuration:** 2, 7 - Coil      1 - common, 4 - NC, 3 - NO      8 - common, 5 - NC, 6 - NO

Time clocks, sequence controls, etc should be connected by removing links 3-4 or 4-5 and wiring to voltage free contacts in the boiler house control panel.

Link 11-12 should be disconnected to test flame detection ionisation current.

**IMPORTANT:** THE BOILER AND BOILER HOUSE CONTROL PANEL SHOULD BE ISOLATED BY THE SAME ISOLATOR.

Fig.6.2 - Pump Overrun Using Changeover Pipe Thermostat

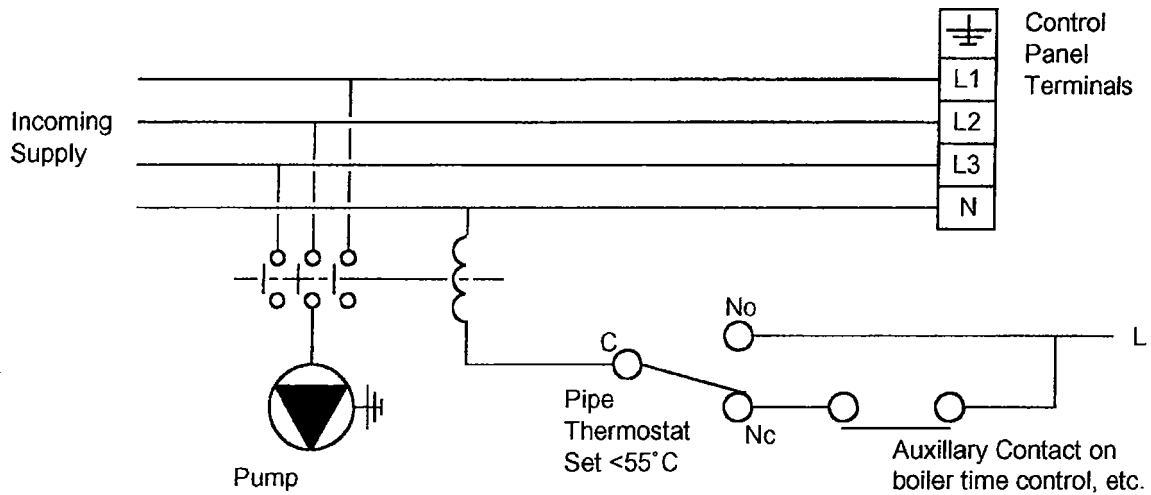
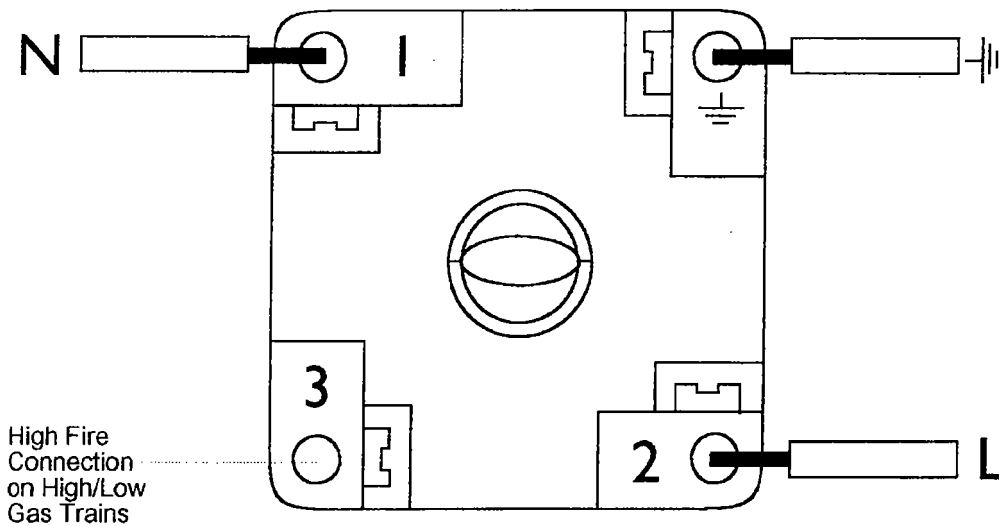


Fig.6.3 - Electrical Connections to Plug Cap Used on Dungs Multiblock Valves and SCEM Pilot Solenoid Valve (ON/OFF GAS TRAINS ONLY)



DERWENT HE SHORT PARTS LIST

<u>Item</u>	<u>Description</u>	<u>Potterton Part Number</u>
1	Right Hand End Section	357621 ✓
2	Left Hand End Section	357622 ✓
3	Intermediate Section	357623 ✓
4	'O' Ring	357825 ✓
5	Manifold Stud (later models) - M10 x 82 mm (all sizes)	357626 ✓
6	Manifold Stud (early models) - M10 x 82 mm (5 to 18 section)	357626 ✓
	Manifold Stud (early models) - M10 x 102 mm (20 to 22 section)	357672 ✓
7	Ceramic Rope for Section Sealing	65063601 ✓
8	Flue Hood Sealing Strip	357324 ✓
9	Main Burner Injector (3.45 mm)	357826 ✓
10	Landis & Gyr QSZ1 SO2 Pilot Burner Complete	357317 ✓
11	Landis & Gyr Pilot Burner Injector - 0.75 mm	357318 ✓
14	Pilot Burner Ignition Electrode	357320 ✓
15	Pilot Burner Ionisation Probe	357319 ✓
16	Flame Detection (Ionisation) Lead	<del>64485</del> 357312
17	Satronic ZT812 Spark Generator and Lead (TRANSFORMER)	357311 ✓
18	Satronic TFI 812.1B Mod.5 Control Box	40816501 *
19	Satronic S701 Control Box Base	905609 ✓
20	Boiler Control Thermostat - Emmerson 718R (42-90°C) - ON/OFF	357300 ✓
21	Boiler High/Low Thermostat - Emmerson Type 722 RU1	358522
22	High Limit Thermostat - Landis & Gyr RAK 21.4/2926 (set at 98°C)	359154 ✓
23	On/Off Switch and Lamp	357307 ✓
24	Thermometer	357303 ✓
25	Flow & Return Manifold Gasket (20 to 22 section boilers only)	357925
26	Flue Brush	359174 ✓
27	Mounting Studs - M8 x 27 mm	<del>357626</del> 200342
28	* LPG Main Burner Injector (2.1 mm Ø)	359600
29	* LPG Pilot Burner Injector (0.5 mm Ø)	359601

72.44

\* USE DERWENT PREMIER LPG KIT  
AS ALTERNATIVE.

IGNITION CAP 357945

\* 40816501 = CONTROL BOX OKG 972 + RESET EXT  
408165 = SIMPL CONTROL BOX OKG 972

Short Parts List for Derwent HE Gas Train - Dungs (Option A)  
(ON/OFF GAS TRAINS ONLY)

<u>Boiler Size</u>	<u>DESCRIPTION</u>	<u>POTTERTON</u> <u>PART No.</u>
5 to 6 Section	1st Main Valve - Dungs MBDLE 407 B01 3/4"	357047
	2nd Main Valve - Dungs MBDLE 407 B01 3/4"	357047
	Main Governor - Dungs MBDLE 407 B01 3/4"	357047
	Main Gas Cock - Giacomi R750 3/4"	357051
	Pilot Gas Cock - Giacomi R750 1/4"	357058
	Pilot Governor - Concentric ED2 1/4"	357065
	Pilot Solenoid - SCEM VE 131.4G 1.4"	357062 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
7 to 8 Section	1st Main Valve - Dungs MBDLE 410 B01 1"	357085 ✓
	2nd Main Valve - Dungs MBDLE 410 B01 1"	357085 ✓
	Main Governor - Dungs MBDLE 410 B01 1"	357085 ✓
	Main Gas Cock - Giacomi R750 1"	357087
	Pilot Gas Cock - Giacomi R750 1/4"	357058
	Pilot Governor - Concentric ED2 1/4"	357065
	Pilot Solenoid - SCEM VE 131.4G 1.4"	357062 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
9 to 12 Section	1st Main Valve - Dungs MBDLE 412 B01 1 1/2"	357432 ✓
	2nd Main Valve - Dungs MBDLE 412 B01 1 1/2"	357432 ✓
	Main Governor - Dungs MBDLE 412 B01 1 1/2"	357432 ✓
	Main Gas Cock - Giacomi R750 1 1/2"	357120
	Pilot Gas Cock - Giacomi R750 1/4"	357058
	Pilot Governor - Concentric ED2 1/4"	357065
	Pilot Solenoid - SCEM VE 131.4G 1.4"	357062 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
13 to 14 Section	1st Main Valve - Dungs MVDLE 1 1/2"	357114
	2nd Main Valve - Dungs MVD 1 1/2"	359157
	Main Governor - Jeavons J48 2"	357185 ✓
	Main Gas Cock - Giacomi R750 1 1/2"	357120
	Pilot Gas Cock - Giacomi R750 1/4"	357058
	Pilot Governor - Concentric ED2 1/4"	357065
	Pilot Solenoid - SCEM VE 131.4G 1/4"	357062 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
15 to 18 Section	1st Main Valve - Dungs MVDLE 2"	357422 ✓
	2nd Main Valve - Dungs MVD 2"	359156
	Main Governor - Jeavons J48 2"	357185 ✓
	Main Gas Cock - Giacomi R750 2"	357425
	Pilot Gas Cock - Giacomi R750 1/4"	357058
	Pilot Governor - Concentric ED2 1/4"	357065
	Pilot Solenoid - SCEM VE 131.4G 1/4"	357062 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
20 to 22 Section	1st Main Valve - Landis & Gyr SKP20 2"	357401 ✓
	2nd Main Valve - Landis & Gyr SKP20 2"	357401 ✓
	Main Governor - Dungs MVDLE 2"	357422 ✓
	Main Gas Cock - Giacomi R750 2"	357425
	Pilot Gas Cock - Giacomi R750 1/4"	357058
	Pilot Governor - Concentric ED2 1/4"	357065
	Pilot Solenoid - SCEM VE 131.4G 1/4"	357062 ✓

5102870

Short Parts List for Derwent HE Gas Train - Interbion (Option B)  
(ON/OFF GAS TRAINS ONLY)

<u>Boiler Size</u>	<u>DESCRIPTION</u>	<u>POTTERTON PART No.</u>
5 to 6 Section	Main Governor - Jeavons J48 1"	
	1st Main Valve - Interbion AHMV 32S 1" / 32	357162
	2nd Main Valve - Interbion AHMV 32KL 1" / 32	357161 ✓
	Main Gas Cock - Interbion 45 1" (Long Handle)	357412 ✓
	Pilot Gas Cock - Interbion 45 1/4" (Short Handle)	357142 ✓
	Pilot Governor - Jeavons 60 DJ 1/4"	357143 ✓
	Pilot Solenoid - Interbion Ref.1025104 (1/4")	357144 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
7 to 9 Section	Main Governor - Jeavons J48 1 1/2"	357136 ✓
	1st Main Valve - Interbion AHMV 32S 1 1/2" / 32	357162 ✓
	2nd Main Valve - Interbion AHMV 32KL 1 1/2" / 32	357161 ✓
	Main Gas Cock - Interbion 45 1" (Long Handle)	<del>357136</del> 357412
	Pilot Gas Cock - Interbion 45 1/4" (Short Handle)	357142 ✓
	Pilot Governor - Jeavons 60 DJ 1/4"	357143 ✓
	Pilot Solenoid - Interbion Ref.1025104 (1/4")	357144 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
10 to 11 Section	Main Governor - Jeavons J48 1 1/2"	357136 ✓
	1st Main Valve - Interbion AHMV 50S 1 1/2" / 40	357135 ✓
	2nd Main Valve - Interbion AHMV 50KL 1 1/2" / 40	357133 ✓
	Main Gas Cock - Interbion 45 1 1/2" (Long Handle)	357138 ✓
	Pilot Gas Cock - Interbion 45 1/4" (Short Handle)	357142 ✓
	Pilot Governor - Jeavons 60 DJ 1/4"	357143 ✓
	Pilot Solenoid - Interbion Ref.1025104 (1/4")	357144 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
12 to 16 Section	Main Governor - Jeavons J48 2"	357185 ✓
	1st Main Valve - Interbion AHMV 50S 2" / 50	357184 ✓
	2nd Main Valve - Interbion AHMV 50KL 2" / 32	357182 ✓
	Main Gas Cock - Interbion 45 2" (Long Handle)	357186 ✓
	Pilot Gas Cock - Interbion 45 1/4" (Short Handle)	357142 ✓
	Pilot Governor - Jeavons 60 DJ 1/4"	357143 ✓
	Pilot Solenoid - Interbion Ref.1025104 (1/4")	357144 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓
17 to 22 Section	Main Governor - Landis & Gyr SKP 20 2"	357401 ✓
	2nd Main Valve - Interbion AHMV 50KL 2" / 50	357182 ✓
	Main Gas Cock - Interbion 45 2" (Long Handle)	357186 ✓
	Pilot Gas Cock - Interbion 45 1/4" (Short Handle)	357142 ✓
	Pilot Governor - Jeavons 60 DJ 1/4"	357143 ✓
	Pilot Solenoid - Interbion Ref.1025104 (1/4")	357144 ✓
	6mm Aluminium Pilot Bundy Tube (1.2m length)	700705 ✓





PORTOBELLO WORKS, EMSCOTE ROAD  
WARWICK CV34 5QU  
Tel: 01926 493420 Fax: 01926 410523

REPORT SENT TO INSTALLER:  
Date: .....  
Signature: .....

REPORT NO: .....  
SITE ADDRESS: .....  
.....  
.....

INSTALLER NAME & ADDRESS: .....  
.....  
.....  
DATE OF COMMISSIONING: .....

1.0	<b>BOILER</b>				
1.1	Type				
1.2	No of Sections				
1.3	Boiler No/Position	RH	LH	Centre	
1.4	Serial No				
1.5	Fuel:	Nat Gas	LPG		

5.0	<b>COMBUSTION</b>				
		Pilot	Low	High	Unit
5.1	Gas rate				m <sup>3</sup> /hr
5.2	Main Burner Pressure				mmwg
5.3	Pilot Burner Pressure				mmwg
5.4*	Ionisation Probe/UV Cell Current				µA
5.5	Air Shutter Position				-
5.6	CO <sub>2</sub> or O <sub>2</sub>				%
5.7	CO				ppm
5.8	Gross Flue Gas Temperature				°C
5.9	Ambient Temperature				°C
5.10	Flue Draught				mmwg
5.11	Inlet Gas Pressure (Main Burner). (If multi boiler installation, inlet gas pressure all boilers high fire).				mmwg

2.0	<b>BURNER</b>				
2.1	Type:	Standard	Modified Low NOx	Ultimate	
2.2	Flame Detection Probe	UV Cell	Thermocouple		
2.3*	Control Box Type				
2.4	Electrical Supply				
2.5	Main Gas Valve Type & Size				
2.6	Pilot Gas Valve Type & Size				
2.7	Gas Train Serial No				

3.0	<b>BURNER SETTINGS</b>				
3.1	Main Burner Injector Size				mm
3.2	Pilot Burner Injector Size				mm
3.3	Are Burners and Injectors Clean?				
3.4	Kanthal Bars Fitted (Modified & Ultimate only)?				
3.5*	Is the Probe of the Correct Type?				
3.6	Electrode Settings as Manual?				

4.0	<b>COMMISSIONING CHECKS (See Note)</b>				
4.1	Gas ventilation as per manual?				
4.2	Electrical supply fused, isolated & earth wire attached?				
4.3	Check external controls allow operation				
4.4	Check boiler/system flooded and pumps operational and any isolation valves open				
4.5	Check gas available at burner				
4.6	Check condensate trap fitted, filled and connected to drain with air break				
4.7	Check gas meter sizing adequate				
4.8	Check flue system clear				

**NOTE:** 5.5 TO 5.9 TO BE MEASURED IN SECONDARY FLUE 600mm UP FROM THE FLUE SOCKET OR AT THE SAMPLING POINT PROVIDED (CONDENSING BOILERS ONLY). THESE MEASUREMENTS ARE INTENDED AS SAFETY CHECKS ONLY. LEVELS ARE DEPENDENT ON FLUE DRAUGHT AND SITE CONDITIONS AND HENCE CANNOT BE USED FOR COMBUSTION EFFICIENCY DETERMINATION.

- \* FULLY ELECTRIC BOILERS ONLY
- † THERMO-ELECTRIC BOILERS ONLY
- ‡ CONDENSING BOILERS ONLY
- § CONVENTIONAL ATMOSPHERIC BOILERS ONLY

**NOTE:** It is the installers responsibility to ensure that the boiler is correctly commissioned by a competent engineer and that this report is completed and kept as a record. A commissioning service is available from Potterton at the address listed on the back page of the boiler manual. When a Potterton engineer commissions, this completed report will be sent to the installer. It is the installers responsibility to action any points arising. Commissioning by Potterton engineers is restricted to equipment of our supply. No responsibility is accepted for the on site assembly or installation of the equipment unless specifically carried out by Potterton. The installer must ensure that the boiler is installed in accordance with the manufacturers instructions and all relevant BS Codes of Practice and Regulations (see manufacturers instructions for full details). Items 4.1 to 4.6 are related to the boiler installation and as such these pre-commissioning checks should be carried out in the presence of the installer.

Potterton is a Member of the Boiler & Radiator Manufacturers Association (BARMA), and the terms of this Commissioning Document follow the generally agreed conditions of the Association. Potterton, in line with it's policy of continuous product development, reserves the right to alter and amend this Document as is deemed necessary at any time.

6.0 OPERATIONAL SAFETY CHECKS	
6.1	Check control stat operation
6.2	Check limit stat operation
6.3	Check thermocouple interrupter operation
6.4	Check thermocouple operation
6.5	Check for gas leaks
6.6	Check for gas leakage past valve assembly
6.7	Check boiler locks out on loss of flame signal
6.8	Check boiler locks out on air pressure switch operation
6.9	Check boiler locks out on all other safety functions
6.10	Check for spillage of flue gas products at draught diverter

8.0 COMMENTS ON ACCESSIBILITY FOR MAINTENANCE	

7.0 BOILER/SYSTEM CHECK LIST	
7.1	Control stat left at °C
7.2	Limit stat left at °C
7.3	Maximum flow temperature recorded °C
7.4	Maximum return temperature recorded °C
7.5	Boiler water pressure
7.6	Are pipework connections as per manual?
7.7	Is safety valve fitted? If so, SIZE _____ PRESSURE RATING _____
7.8	Are water isolating valves fitted?
7.9	Are water flow switches fitted?
7.10	Are return water shut off or diverter valves fitted?
7.11	Is shunt pump fitted?
7.12	Is pump overrun fitted?
7.13	Flue type and diameter of connection to boiler:- TYPE DIAMETER (mm) Where appropriate and for multi boiler installations sketch details of flue system showing length of runs and diameters. Conventional ..... Fan assisted ..... Flue Dilution ..... Approximate overall height ..... m Is the fan interlocked with the boiler YES / NO
7.14	Are flue dampers fitted? YES / NO If so, interlocked? YES / NO
7.15	Fan assisted ventilation? YES / NO If so, interlocked? YES / NO
7.16	Any evidence of condensate formation? YES / NO
7.17	Any evidence of condensate leakage? YES / NO
7.18	Any evidence of water leakage? YES / NO
7.19	Any evidence of flue gas leakage? YES / NO
7.20	Has boiler been built and cased correctly? YES / NO
7.21	Is gas service cock installed? YES / NO If so, accessible? YES / NO

9.0 NOTES & COMMENTS BY COMMISSIONING ENGINEER	

FINDINGS		
	YES	NO
Is the installation safe for use?		
If the answer is NO, has a warning notice been raised?		
Is any remedial work required?		
Have warning labels been fitted?		

Customer Signature: \_\_\_\_\_  
 Print Name: \_\_\_\_\_  
 Date: \_\_\_\_\_

ENGINEER DETAILS	
NAME	_____
COMPANY	_____
SIGNATURE	_____
DATE	_____

- \* FULLY ELECTRIC BOILERS ONLY
- † THERMO-ELECTRIC BOILERS ONLY
- φ CONDENSING BOILERS ONLY
- § CONVENTIONAL ATMOSPHERIC BOILERS ONLY