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BROADSTONE CAST IRON BOILERS

INSTALLATION INSTRUCTIONS

CONTENTS

1. INTRODUCTION AND GENERAL DESCRIPTION

i) The Hamworthy Broadstone Boiler has been introduced to complement the existing range of Hamworthy gas and oil fired modular boilers. The Broadstone boiler is designed to provide an input range between 88 and 214 kW. The boilers have a maximum water pressure rating of 4 bar.g. and are suitable for both open and pressurised systems.

The boilers are constructed from a number of cast iron sections mounted vertically. Connection between sections is made with steel nipples and the assembled boiler is held together with tie rods. The complete assembly forms a compact water cooled combustion chamber and heat exchanger.

The boilers are supplied with matched burners and are suitable for operating with a natural draught flue. Burners are available for firing fuel oil, natural gas or LPG.

The boilers are delivered to site with the cast iron sections fully assembled with a separate casing carton kit matched burner and all the ancillary equipment necessary to complete the boiler.

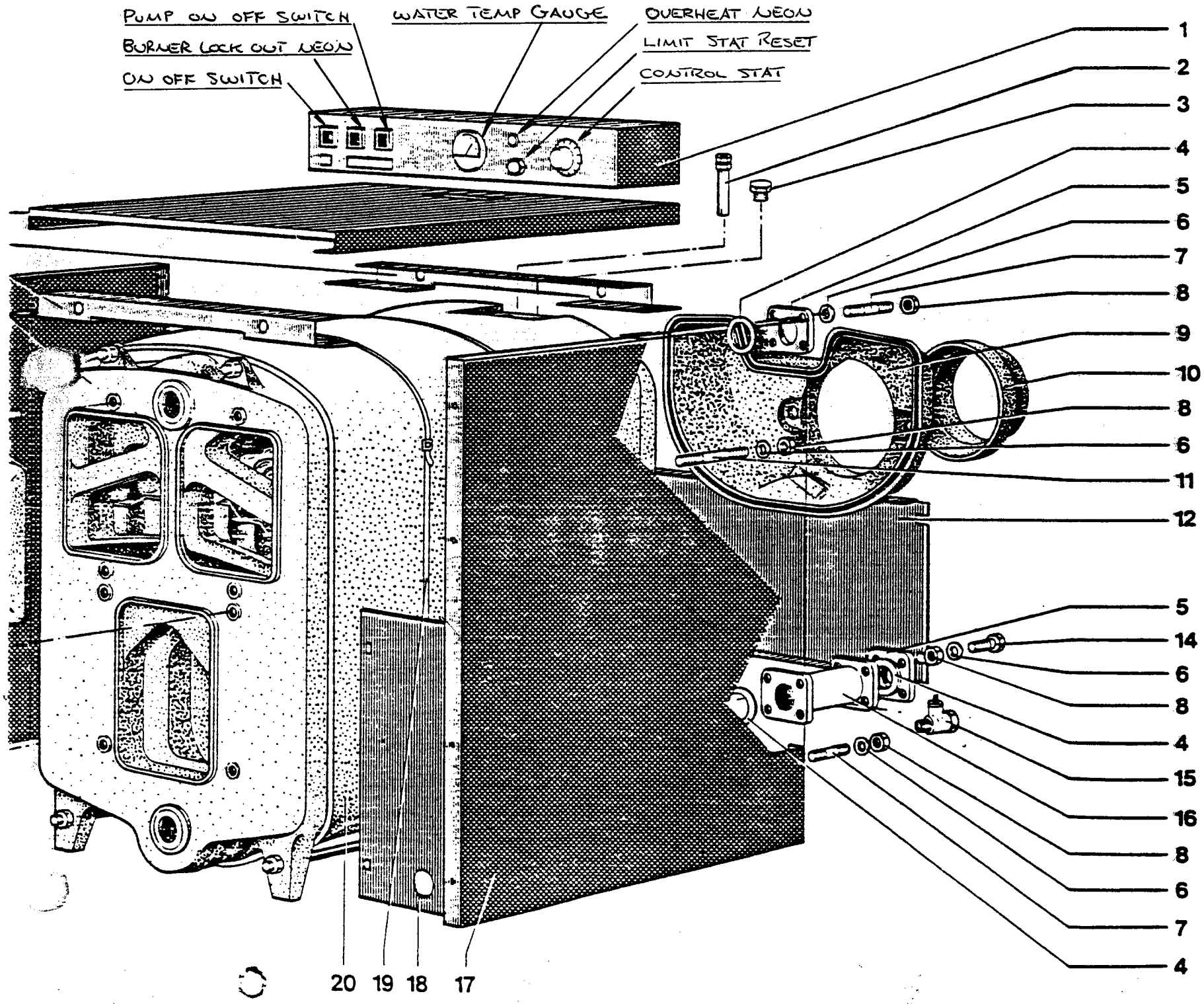
ii) Delivery/Extent of Supply

The boiler is normally supplied as a set of equipment comprising of the:-

i) Cast iron sections ready assembled.
ii) Horizontal outlet smoke box.
iii) Flue cleaning plates.
iv) Burner mounting plate, drilled ready to accept burner.
v) Flow and return flanges, drain cock with key.
vi) Casing panels and insulating blanket.
vii) Control panel (240V, 1 phase, 50 Hz) containing the following:-

- On/Off Switch
- Adjustable Boiler Thermostat
- Water Temperature Gauge
- Manual Reset Overtemp Limit
- Thermostat
- Burner and Boiler Warning Lamps
- Heating Pump Switch
- Wiring (Control Panel - Burner)

viii) Matched Burner : Fuel Oil or Gas


PUMP ON OFF SWITCH
BURNER LOCK OUT NEON
ON OFF SWITCH
WATER TEMP GAUGE
OVERHEAT NEON
LIMIT STAT RESET
CONTROL STAT
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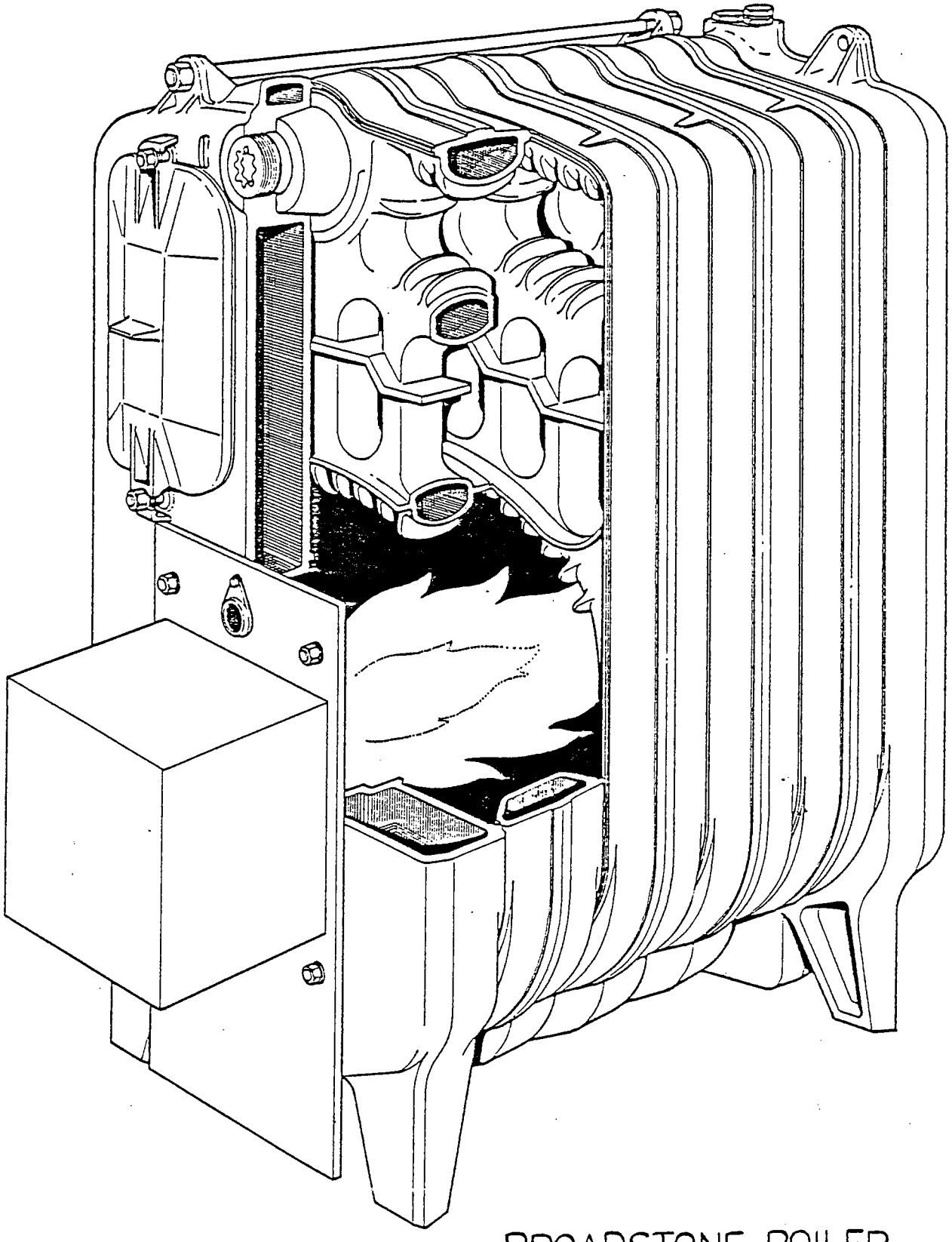


BROADSTONE BOILER

1. GENERAL REQUIREMENTS

i) The boiler should only be installed by a competant person in accordance with the relevant statutory requirements and codes of practice. It is in your own interest and the safety of all concerned that these requirements are complied with.

The installation of the boiler should be in accordance with the requirements of British Standards, Building Regulations, I.E.E. Regulations and the requirement of the local authority and local water undertaking.

If the boiler is gas fired the installation must comply with the requirements of the Gas Safety Regulations and the requirements of the local gas region.

The relevant sections of the following documents must be observed:-

British standards codes of practice:

CP 341.300 - 307	Central heating by low pressure hot water.
CP 342	Centralised hot water supply: Part 1 - Individual dwellings. Part 2 - Buildings other than individual dwellings.
CIBS Guide	Particular reference should be made to sections B7, B11 and B13, and the installation must be in accordance with our recommendations and good practice for our Warranty to apply.

ii) Oil Fired Boilers

The following standards apply to oil fired boilers.

BS 5410	Parts 2 - Oil fired installations of 44 kW and above output capacity for space heating/hot water.

iii) Gas Fired Boilers

The installation should also be in accordance with any relevant requirements of the Local Gas Region and the relevant recommendations of the following documents:-

British Standard Codes of Practice.

CP 331	Installation of pipes and meters for Town Gas. Part 3 - Low pressure installation pipes.
BS6644	Specification for Installation Requirements for Gas Fired Hot Water Boilers or groups of Boilers with Rated Inputs above 60 kW but not greater than 2 MW.

British Gas Publications.

Technical notes for the design of flues for non domestic gas boilers, combustion air and ventilation air, guidance notes for boiler installations in excess of 2,000,000 Btu/h (586 kW) output.

iv) Heating Controls

In order to ensure that the installation operates efficiently the following sections of the Building Regulations should be observed:-

The Building Regulations 1985. Part L Conservation of Fuel and Power

The Requirement Heating System Controls L4

'Space heating or hot water systems in building's shall be provided with automatic controls capable of controlling the operation and output of space heating systems and the temperature of stored water.'

Provisions meeting the performance - Boiler Control 1 - 3.

'Boiler Controls are required to achieve efficient operation where two or more gas or oil fired boilers with a total load of more than 100 kW, supply the same heat demands. Boilers run most efficiently at or near full output and control should be provided in a form which can detect variation in the need for heat in the building and so start, stop, or modulate the boiler as needed (sequence control). Care is needed in hydraulic design to ensure stable control.'

Hamworthy Engineering's Boiler Sequence Controller fully meets the provisions stated above and provision 1.1 (b) for weather compensating control.

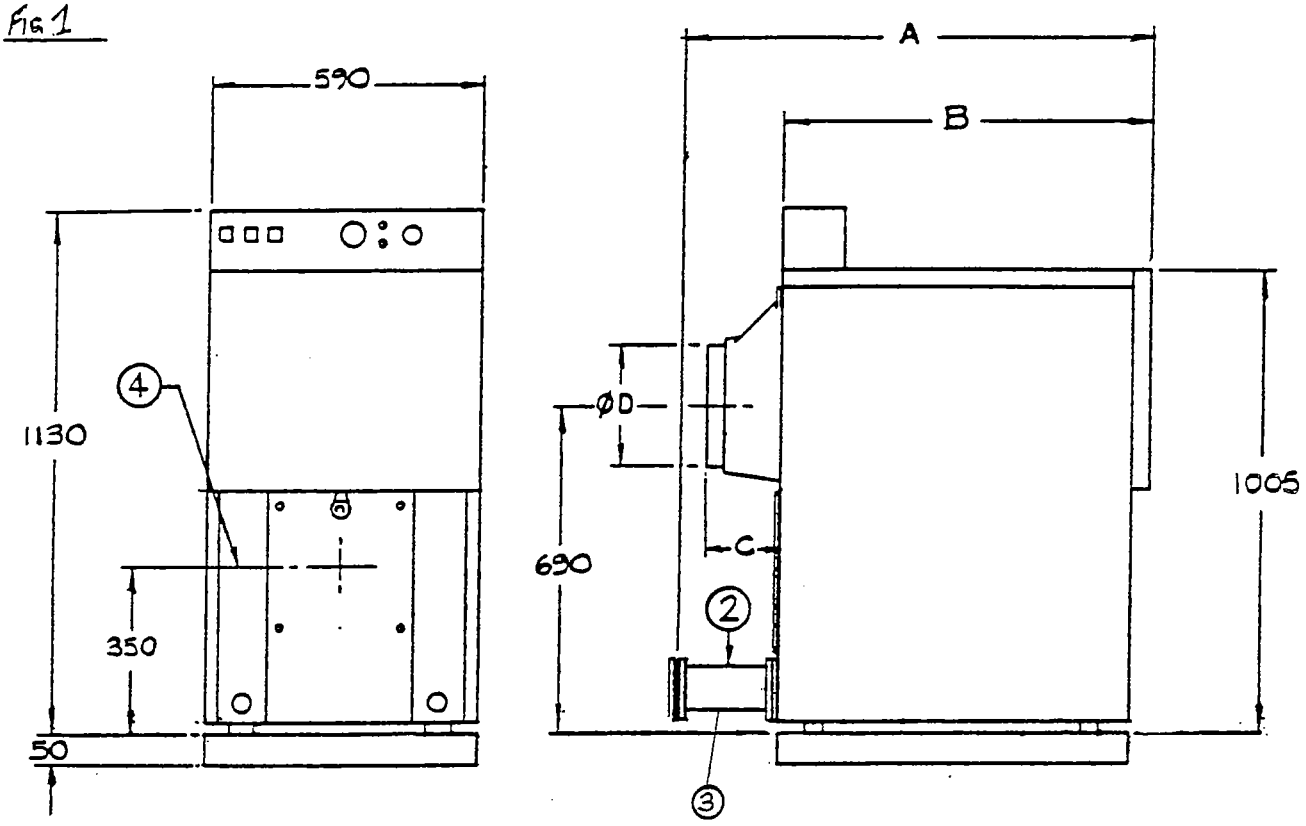
3. TECHNICAL DATA - BROADSTONE BOILERS

TABLE 1

BOILER SIZE		5	6	7	8	9	10
HEAT INPUT TO WATER	Kw	88	111	134	157	186	215
DESIGN WATER FLOW RATE AT 11°C	l/min	115	145	175	205	243	281
MINIMUM WATER FLOW RATE AT 22°C	l/min	57.6	72.5	87.5	102.5	121.5	141
WATERSIDE PRESSURE DROP AT 11°C	m bar	3	3.4	6.5	8.7	12	15.6
MAXIMUM WATER PRESS.	bar g	4	4	4	4	4	4
WATER CONNECTIONS FLOW AND RETURN		FLANGES SUPPLIED WITH BOILER SCREWED 3" BSPT FEMALE					
MAXIMUM WATER FLOW TEMPERATURE	°C	110	110	110	110	110	110
WATER CONTENT	l	72.5	85	87.5	110	122.5	135
INPUT RATE OIL 35 SR1	l/h	10.46	13.2	15.93	18.67	22.11	25.56
APPROX. FLUE GAS VOLUMES (OIL FIRING) (VOLUMES REFERRED TO 0°C & 1013 mbar)	m^3/h	143	180	218	255	302	349
APPROX. FLUE GAS TEMP. (OIL)	°C	255	255	255	255	255	255
INPUT RATE NAT. GAS	m^3/h	10.25	12.93	15.61	18.29	21.67	25.05
APPROX. FLUE GAS VOLUMES (GAS FIRING) (VOLUMES REFERRED TO 0°C & 1013 mbar)	m^3/h	132.2	166.7	201.3	235.9	275.4	323
APPROX. FLUE GAS TEMP. (GAS)	°C	225	225	225	225	225	225
MIN. GAS PRESS. REQUIRED AT GAS TRAIN INLET	m bar	17.5	17.5	17.5	17.5	17.5	17.5
GAS CONNECTIONS	BSPF	1"	1"	1"	1"	1½"	1½"
BOILER GAS SIDE RESISTANCE	m bar	0.3	0.3	0.37	0.40	0.48	0.58
DRAUGHT REQUIRED AT BOILER OUTLET (SUCTION)	m bar	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3	0.0-0.3
FLUE CONNECTION	mm INS.	200 8	200 8	200 8	260 10.5	260 10.5	260 10.5
ELECTRICAL SUPPLY		240V. 1 PHASE. FUSED AND RATED AT 10 AMPS.					

4. BOILER DIMENSIONS

Fig 1

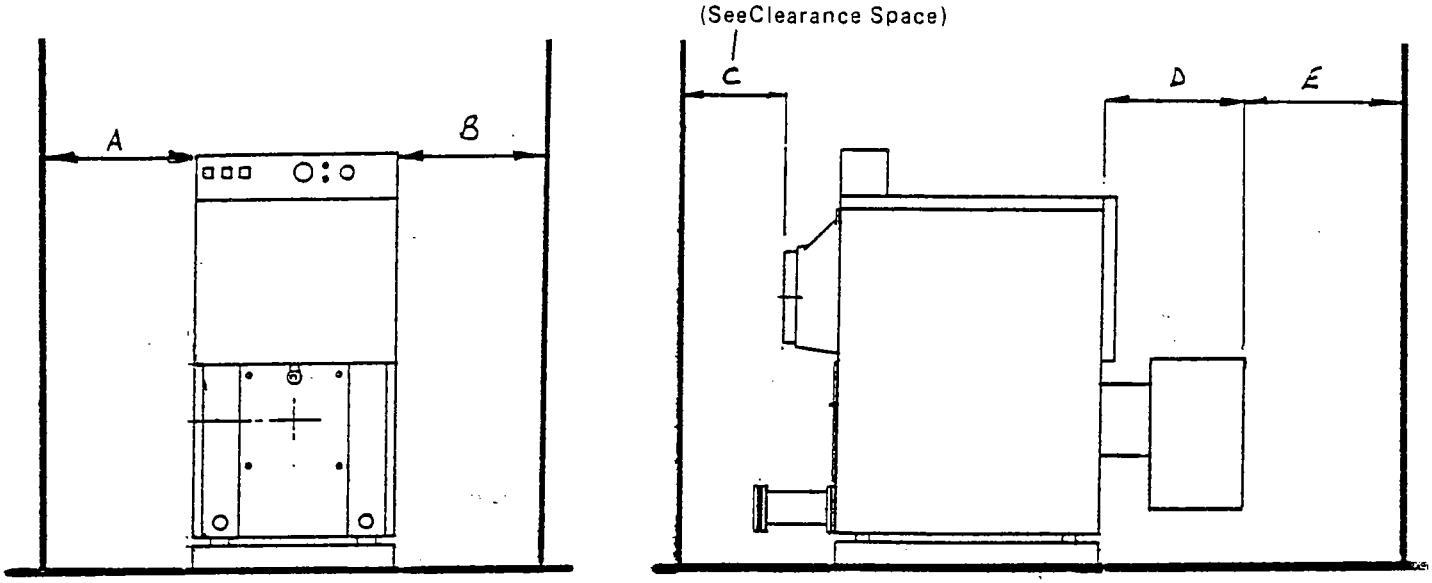


(1), (2) FLOW AND RETURN CONNECTIONS FLANGES SCREWED BSPF
(3) DRAIN COCK
(4) BURNER CENTRE LINE

TABLE 2

BOILER	NO. OF SECTIONS	DIMENSION				SHIPPING WEIGHT (APPROX) kg	WATER CAPACITY LITRES
		A	B	C	ØD		
5	5	840	647	185	200	380	72.5
6	6	960	767	185	200	443	85
7	7	1080	888	185	200	505	97.5
8	8	1200	1008	145	260	565	110
9	9	1320	1129	145	260	627	122.5
10	10	1440	1249	145	260	690	135

BOILER CLEARANCE TABLE 3



MODEL	DIM A	DIM B	DIM C	DIM D		DIM E *	
				OIL FIRING	GAS FIRING	OIL FIRING	GAS FIRING
	MM	MM	MM	MM	MM	MM	MM
5	350	350	450	256	418	300	500
6	350	350	450	290	418	300	500
7	350	350	450	290	418	300	500
8	350	350	450	290	418	300	500
9	350	350	450	290	610	300	700
10	350	350	450	473	610	400	700

* DIMENSION E FOR GUIDANCE ONLY

BOILER ROOM LAYOUT

i) Base

The boilers must be positioned on a level fire proof plinth of concrete or brick. Attention must be paid to the floor loadings (boiler weights are given in the table of dimensions). The plinth should be a minimum of 50 mm high and should end flush with the boiler casing front to prevent interference with the burner, oil pipework, or gas train.

ii) Clearance Space

Dimension C is a minimum recommendation permitting access to the rear of the boiler for maintenance.

It may not be sufficient in many instances for the fitting of flue bends "within" the boiler house and where necessary dimension C must be increased accordingly.

5. AIR SUPPLY AND VENTILATION

i) An adequate supply of air for combustion, dilution of combustion products and ventilation of the boiler house must be provided.

The supply of air for combustion dilution and ventilation must be supplied in accordance with B.S.6644.

The air supply to the boiler house shall be achieved by one of the following methods:-

a) Air supply through a low level opening and discharged through a smaller sized high level opening.

b) Air supplied by a fan to a low level opening and discharged naturally through a high level opening.

c) Air supplied by a fan to a low level opening and discharged by means of a fan at a high level. The fans shall be selected so as not to cause a negative pressure in the boiler house relative to the outside pressure.

ii) Natural Ventilation

Where natural ventilation is used suitable permanent openings connected directly to the outside air shall be provided. The openings should be fitted with grilles that cannot easily be blocked or flooded. The free area of the grilles should be as follows:-

Low Level (Inlet) 540 cm^2 plus 4.5 cm^2 per kW in excess of 60 kW of total rated input.

High Level (Outlet) 270 cm^2 plus 2.25 cm^2 per kW in excess of 60 kW of total rated input.

6. FLUE REQUIREMENTS AND DESIGN PRACTICES

The flue must be designed in accordance with local authority regulations and the recommendations of the Clean Air Act and BS.6644.

The flue system must be designed to suit the flue gas volume at the temperatures at which the gases leave the boiler exit. The flue system should provide a suction of between 0 - 0.3 mbar at the boiler exit.

To aid removal of the products of combustion and to prevent a "tamping effect" when the burner is started it is recommended that the following practices are followed.

Extract from I.H.V.E. Guide Section B13)

(a) Position the boilers as close as possible to the chimney to limit friction and heat losses in the connecting flue system.

(b) Avoid all short radius 90° bends in flue systems.

(c) Avoid abrupt section changes, and use transformation sections with 15° included angles.

(d) Arrange the flue/chimney entry section to slope at 45° or more to the horizontal.

(e) Avoid protrusion of the flues beyond the inner face of the chimney or main flue connection.

(f) Make flues circular or square, and as a design limit avoid aspect ratios greater than 1.5 to 1, width to depth.

(g) Where possible slope flues upwards towards the chimney.

(h) Fit clean-out doors at each bend in the flues, at the chimney base, and adjacent to fans and dampers to aid in the maintenance of a clean flue system.

(i) Avoid long "dead" chimney pockets under the flue entry points which are corrosion zones, and can cause harmonic pulsation problems.

A flue gas sampling point should be provided close to the boiler exit to enable CO_2, temperature CO and smoke number measurements to be made. A draught controller and stabilising device may be fitted if the flue dimensions or external conditions are likely to disturb the draught.

7. FUEL SUPPLY

i) Gas Supply

Service Pipes

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

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

Meters

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

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

Gas Supply Pipes

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

If flexible connections are made between the gas supply and boiler the connections must comply with the following standards:-

B.S.5601 Part 1 and B.S.669 Part 2.

Boosted Supplies

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

ii) Oil Supply

Oil Supply Connections

The oil supply connections between the storage tank and the burner should be run in copper, steel or aluminium pipe. Galvanised pipes and fittings should not be used. All pipework and fittings must be oil tight and screwed joints should be made good with an oil resistant compound.

The supply should terminate close to the burner with a valve and filter, and approximately the last ½m should be run in flexible pipe to facilitate moving the burner away from the appliance during servicing.

The size and arrangement of pipework will depend on the distance and height of the storage tank in relation to the oil pump inlet on the burner.

Burner Fuel Pumps

The fuel pump supplied and fitted to each burner will vary between types and model numbers, refer to the supplement for burner details.

Gravity Feed Supply

Where the delivery connection on the tank is above the level of the pump inlet a single pipe may be used.

The burner oil pump is normally set for this supply arrangement.

Suction Lift Supply

Where the delivery connection on the tank is below the level of the pump inlet a two pipe system MUST BE USED.

Depending on the exact burner model supplied, it may be possible to convert the oil pump for use on this system. REFER to burner supplement for details.

If the suction pipe rises higher than the oil pump inlet at any point on the run it is recommended that a priming point should be provided so that if necessary it can be used to prime the line or check the effectiveness of the non-return valve at the tank end. Otherwise the vacuum gauge port on the pump can be used for this purpose.

8. WATER SUPPLY AND SYSTEM DESIGN

i) In order to ensure reliable operation of the boilers, the water system should be designed to comply with the following conditions:-

i) The minimum water flow rate as stated in Table 1 must be maintained at all times. This will limit the water temperature rise across the boiler to 22°C. The control system, pumps and valves should be designed to ensure this flow at all times.

ii) Where boilers are switched on and off under time switch control, the system must be designed to overun after the last boiler has ceased firing. This will prevent local overheating as a result of zero water flow through the boiler.

iii) When firing the boilers with fuel oil, the return water temperature should not be less than 60°C (140°F). A return water temperature below this may result in acid condensation and corrosion of the boiler heating surfaces.

ii) Feed Water Quality

The use of hard water or the continual replenishment of the system will result in scaling of the boiler. In order to prevent this the following measures should be taken:-

i) Ensure that system leaks are repaired quickly, and draining of the system is kept to an absolute minimum.

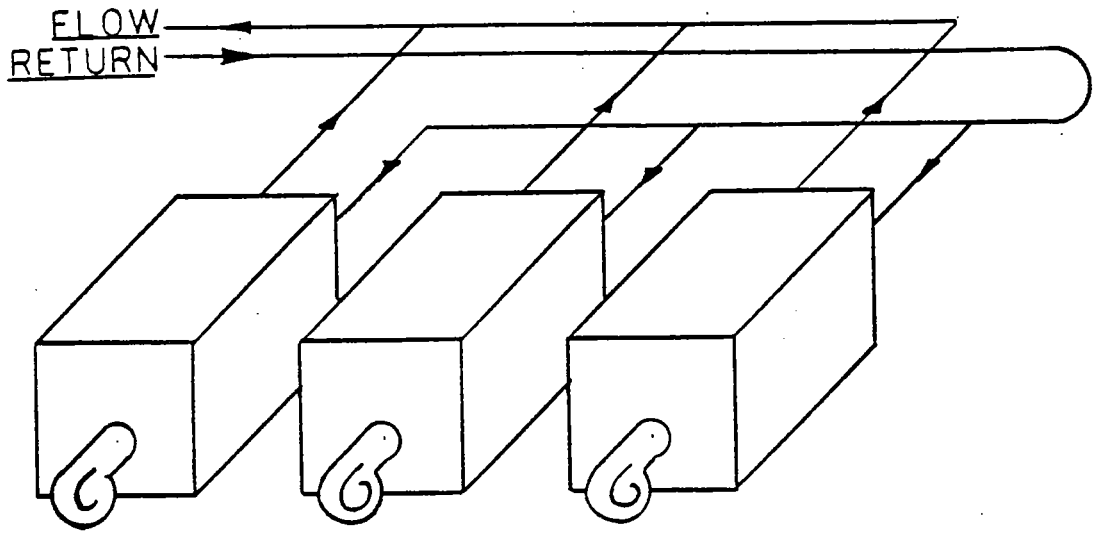
ii) If the water temporary hardness exceeds 250 ppm, the boiler must be filled with softened water. It is recommended that the water be treated to prevent precipitation of scale or sludge in the boiler water passageways.

iii) Old systems should be treated with deflocculating agents and flushed out at least twice. The system should then be filled with softened water. If any doubt still exists about the cleanliness of the system, consideration should be given to the fitting of a coarse filter in the return pipework to the boilers.

iii) Water Flow System

It is important that the system is designed to use the reverse return method of water connections. This is used to ensure an even flow of water through boilers connected in parallel. (See Fig. 2)

Using this method of connection the water pressure loss across any number of boilers will never be greater than that for a single module plus local pipework losses.



REVERSE FLOW RETURN SYSTEM
OF BOILER CONNECTION

FIG2

iv) Boiler Operating Temperatures

a) Control Thermostats

The boilers are supplied with control thermostats which have a maximum setting of 110°C. Where the boilers are to be fitted on high temperature systems a "special to contract" thermostat can be supplied which has adjustment up to 130°C. The upper range of this thermostat can be limited as shown in Appendix I of this document.

b) Limit Thermostat (Overheat Cut-Off Device)

The limit thermostat has a range of 95°C to 130°C. The required limit temperature must be set to suit site requirements during initial commissioning. Adjustment is made by removing the limit thermostat from the control panel and by adjusting the range screw to the required setting.

The maximum operating temperature of the system is limited by the system static water pressure and the maximum temperature of the control and limit thermostats must be set accordingly (see below).

v) Minimum Water System Pressure

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

/Continued.....

v) Minimum Water System Pressure

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

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

e.g. 1.	Required Flow Temperature	= 95°C
	Safety Margin	= 17°C
	Equivalent Saturated Steam Temperature	= 112°C
From Steam Tables - corresponding Gauge Pressure		= 0.52 bar (7.5 psi)
		= 5.3 m (17.3 ft) head of water

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

e.g. 2.	Required Mixed Flow Temperature	= 82°C
	Temperature rise across boilers at minimum flow	= 11°C
	Safety Margin	= 17°C
	Equivalent Saturated Steam Temperature	= 110°C
From Steam Tables - corresponding Gauge Pressure		= 0.41 bar(5.98 psi)
		= 4.18 m (13.7 ft) head of water

/Continued.....

vi) SAFETY VALVES

The most important single safety device fitted to a boiler is its safety valve and each boiler, or in the case of modular installations, each bank of boilers, must be fitted with a pressure relief valve.

Clause 9 of BS6644 provides comprehensive information for the selection and location of safety valves and attention is drawn to the higher capacity requirements of safety valves for pressurised hot water systems (ref - clause 9.1.3.).

vii) Pressure Gauge

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

viii) Drain Valve

The boiler shall be fitted with a drain valve to B.S.2879 operated by means of a removaable key.

9. BOILER ASSEMBLY (SEE FIG. 3)

Check the content of each packing case supplied.

Install the heating body in position and fit, successively:-

The accessories.
The thermal insulation material.
The panels and control unit.
The burner.

Proceed as follows:-

i) Preparation of the Body (Fig. 1) - if Body Site Assembled, Refer to Appendix 2.

On the top of the rear section, blank off one of the 2 orifices with the 15/21 dia. plug (3).

Fit the housing (2) in the other orifice.

Fit the draining cock (13) on the return manifold (16) then fit the latter, with a packing (4), on the return orifice of the rear element.

Fit the backing flanges (5) and packings (4).

Connect the boiler to the heating system and check for leaks.

Fit the flue cleaning plate (29), using studs (30) and wing nuts (28).

Fit the rear protection plate vertically, at the bottom of the hearth.

Fit the burner support plate (21) and it's asbestos packing (23), using the Studs, washers and nuts (24, 25, 26).

Fit and tighten the smoke box securing studs (11) in the rear element. Apply jointing compound on the periphery of the smoke box (9); position and secure the latter with the nuts, tightening evenly and moderately.

If necessary, fit the 200 dia. reducing sleeve (14). The inspection plate is already fitted on the smoke box.

Position the insulating material (20) on the boiler body and secure it with the supplied straps.

ii) Assembly of Panels

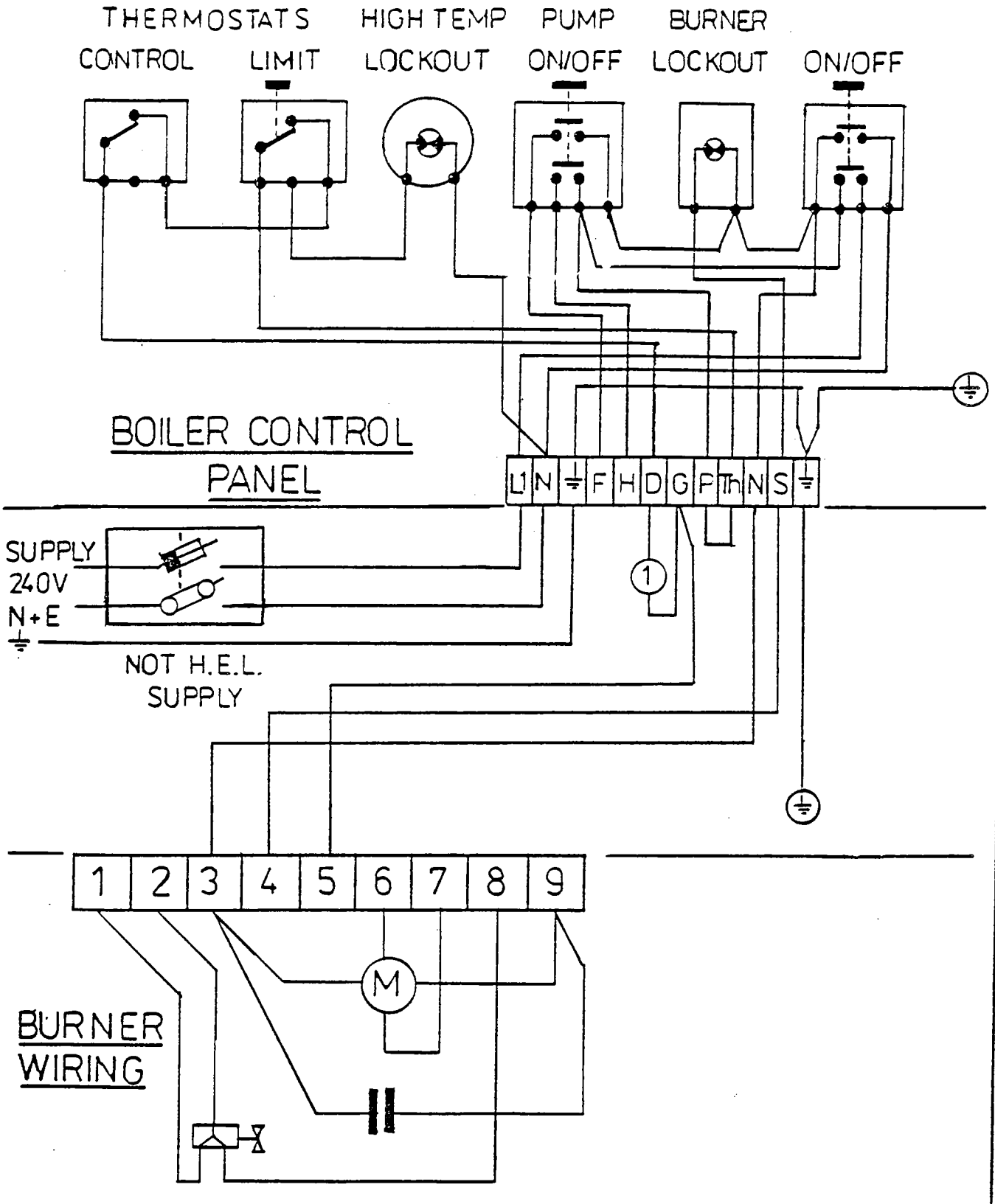
Fit and secure the transverse brackets (32) at the front and rear of the assembly rods, with nuts.

Fit the RH and LH strip panels (18 and 22) to the RH and LH side panels (17), as well as the RAPID studs used to secure the front panel (27).

Offer up the side panels on the brackets, ensuring that the strip panels are located behind the burner support plate (21).

ELECTRICAL WIRING

FIG 5a



RIELLO BURNERS OIL FIRED
MECTRON 10, 15, 20.

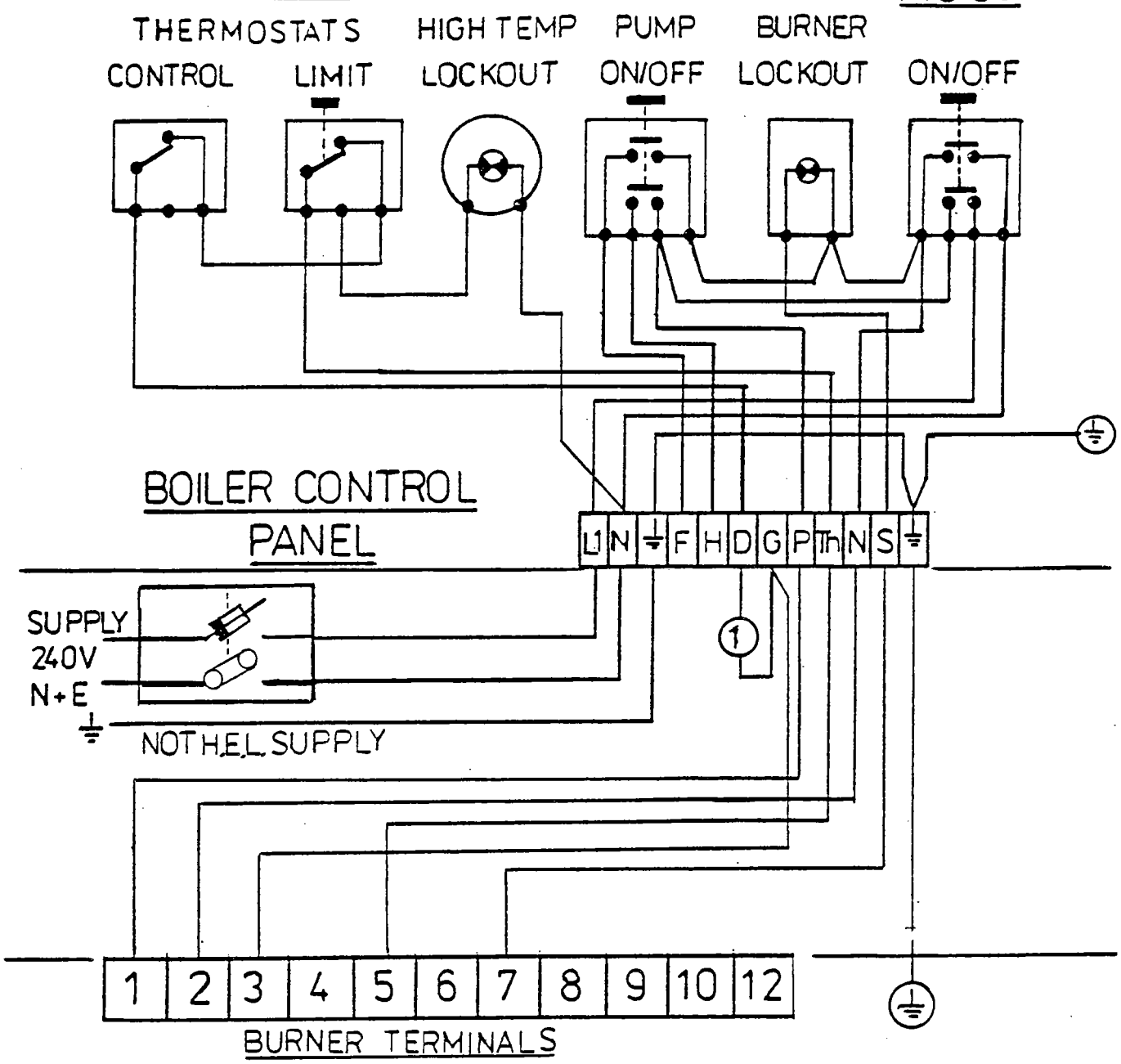
(1) EXTERNAL THERMOSTAT OR LINK

FUSE 6A

issue b 21.8.86

ELECTRICAL WIRING

FIG 5b



RIELLO BURNERS-OIL FIRED

PRESS GBV

① EXTERNAL THERMOSTAT OR LINK

FUSE 6A

issue b 21.8.86

10. ELECTRICAL CONNECTIONS (SEE FIG. 4 & 5)

A 220/240 volt single phase electrical supply is required. This should be supplied from a 10 amp double pole fused switch box located in the boiler room.

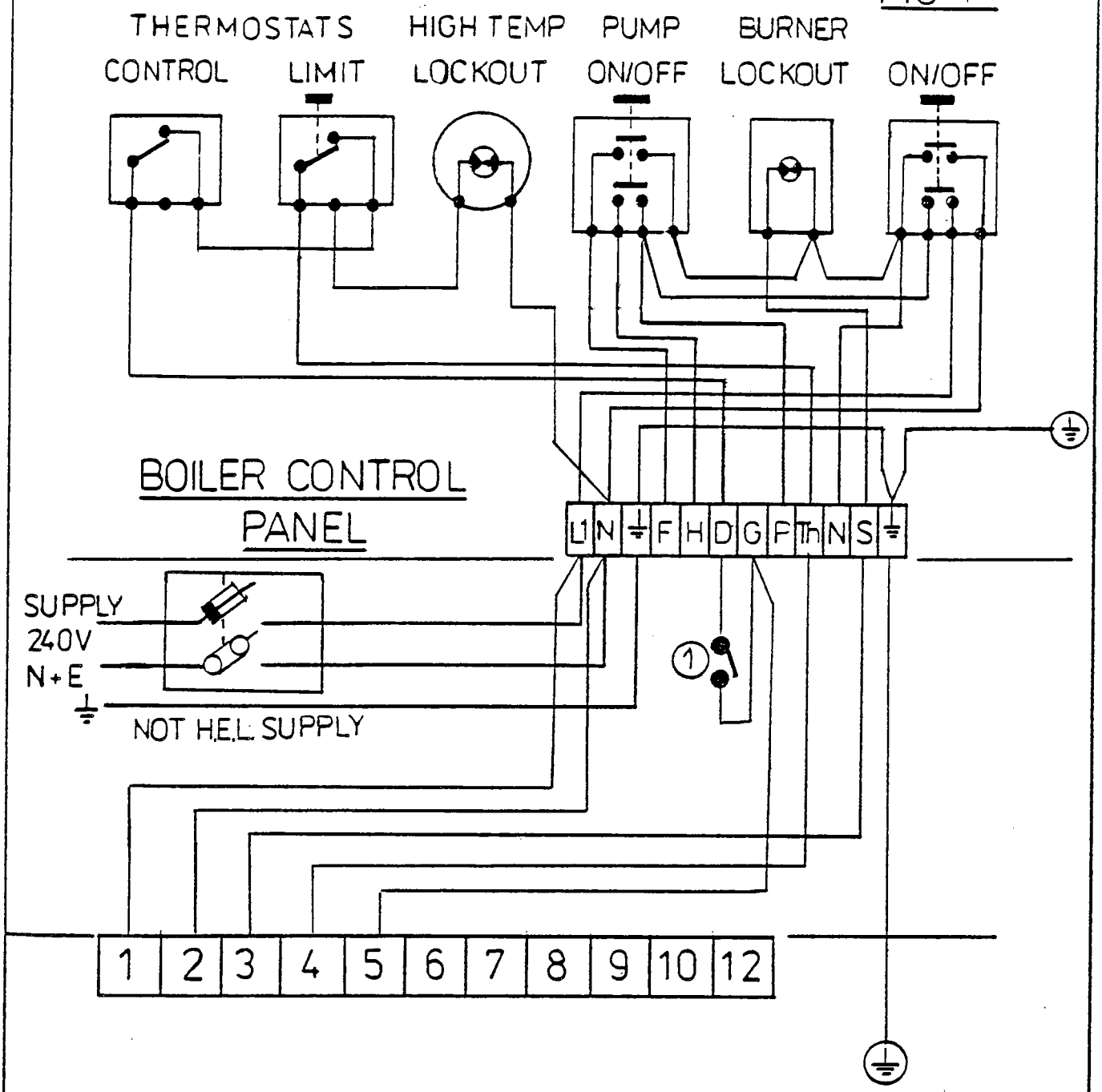
All electric wiring should be in accordance with IEE Regulations, and be carried out in heat resistant PVC insulated cable. Care should be taken to ensure that the cables to the burner will allow it to be removed from the boiler for cleaning.

Consideration should be given to fitting an additional control thermostat for each module positioned in the common flow header, with a differential setting for simple sequence control. The Hamworthy Boiler Sequence Controller is recommended for full sequential control of a number of boilers. Full installation instructions will be supplied with the controller to suit individual applications.

THE APPLIANCE MUST BE EARTHED, AND THE SUPPLY PROTECTED.

ELECTRICAL WIRING

FIG 4



BURNER WIRING

RIELLO GAS BURNERS (GAS 2 & 3)

① LINK OR THERMOSTAT
FUSE 6A

issue b 21.8.86

11. COMMISSIONING AND TESTING

i) Boiler Hydraulic Test

On completion of assembly of the boiler, where a site pressure test is deemed necessary, the following procedure should be followed.

In the case of open vented systems, the hydraulic pressure applied must be equal to one and half times the *maximum operating pressure and be applied for 30 minutes.

In the case of pressurised systems, the hydraulic test pressure shall be twice the *maximum operating pressure and be applied for 30 minutes.

* The maximum operating pressure of the boiler shall be dependent on the system static head, pressurising equipment (where fitted) and the dynamic effects of circulating pumps.

It is the maximum pressure measured in the boiler under normal operating conditions.

ii) Pre Commissioning Checks

The boiler should only be commissioned by a competant person.

Before attempting to commission the boiler ensure that any personnel involved are aware of the action to be taken.

The following checks should be made prior to commissioning:-

a) The boiler should be turned off, the fuel and electricity supplies isolated.
b) Ensure that the installation is complete and there are no leaks of fuel or water.
c) Check that the flueway passages to the chimney are clear. Check that the chimney is clear and all flue terminals or other fittings are correctly installed.
d) Check that the boiler house is adequately ventilated and ventilation grilles are unobstructed.
e) Check that the water circulation system is complete. Any leaks should be repaired prior to commissioning.
f) Check that the water circulation system has been filled and the air vented from the system.
g) Check that the fuel supply is available, if oil fired that oil tanks have been filled and the oil pipework between tank and burner has been primed.
h) If the boiler is gas fired ensure that the gas supply is available and the gas pipework has been tested and is leak free.
i) Ensure that the gas meter is operational and has been checked by the local gas region. Ensure that the gas pipework is fully purged.

/Continued....

j) Check electrical earth continuity between boiler, gas pipework and mains supply.
k) Check that all electrical components are correctly rated and connected.

With the electrical supply switched on the following checks can be made:-

l) The water circulating pumps can be checked to ensure the correct direction of rotation.
m) Check that the water flows are the minimum stated in TABLE 1.
n) Check that any boiler house ventilation fans have the correct direction of rotation and are operating.

The boiler can then be lit. This should be carried out in the following way and in accordance with the burner manufacturers lighting up instructions as described in the burner supplement.

iii) Initial Commissioning Procedure

Oil Fired

a) Set the burner to give the required fuel and air throughputs (See Burner Supplement).
b) Set the control thermostat to its minimum setting. Check that the overheat thermostat is at its required setting.
c) Switch the boiler on and start the burner.
d) The burner controller will pre-purge the boiler, produce an ignition spark and then open the fuel solenoid valve. The flame should then ignite.
e) If the flame fails to ignite it is essential that the boilers be fully purged prior to attempting to light the burner again.
f) With the burner firing check the flue gas for CO_2, CO, flue gas temperature, smoke number and circulating water temperature rise.

The readings obtained should be as follows:-

CO_2	11% - 12%
CO^2	Less than 200 ppm
Flue Gas Exit Temperature	230°C
Smoke No.	2-3
Circulating Water Temperature Rise	Less than 22°C

g) The boiler should then be cycled on and off several times to check for reliable burner light up and satisfactory boiler operation.
h) Set the boiler control thermostat to its required setting and check the operation of all safety cut out devices and heating system controls.

/Continued....

iv) Gas Fired Boilers

a) Set the burner to give the required gas and air throughput (See Burner Supplement).
b) Open main boiler isolating gas valve and check for leaks through the gas train and pipework to burner.
c) Set the control thermostat to its minimum setting and check that the overheat limit thermostat is at its required setting.
d) Close the main boiler isolating gas valve and start the boiler. The boiler fan should start, pre purge the boiler and attempt to light the boiler. The flame should fail to ignite and the boiler go to lockout.
e) Open the main boiler isolating valve, open the pilot gas manual isolating valve and check that main gas manual isolating valve is closed. Restart the burner. The burner should go through a post purge sequence, stop, pre purge the boiler and light the ignition flame. The main flame should fail to light. The burner will continue firing with the pilot flame only. The pilot gas flow rate can be checked and adjusted in this condition. The burner should then be stopped.
f) Open the main gas manual isolating valve and restart the burner. The burner should go through a post purge sequence, stop, pre purge the boiler. The ignition flame should start and then 7 seconds later the main flame should light.
g) With the burner firing the following checks should be made.

Flue Gas CO_2	9% - 10%
Flue Gas CO^2	Less than 200 ppm
Flue Gas Exit Temperature	220°C

Fuel Gas Throughput (This should be checked on the installations primary meter).

The air pressure proving switch should be set according to the burner manufacturers instructions.

h) The boiler should then be cycled on and off several times to check for reliable burner light up and satisfactory boiler operation.
i) Set the boiler control thermostat to its required setting and check the operation of all safety cut out devices and heating system controls.

SHOULD THE BURNER FAIL TO LIGHT THE BOILER MUST BE PRE PURGED PRIOR TO ANY ATTEMPT TO RESTART THE BURNER. IF THE BURNER REPEATEDLY FAILS TO IGNITE FULL INVESTIGATIONS SHOULD BE MADE TO FIND THE CAUSE OF FAILURE.

12. MAINTENANCE AND CLEANING

Ensure that the electrical supply and fuel supply are isolated from the boiler.

1. Ensure that the equipment is maintained dust free and all oil deposits removed promptly.

2. The boiler should be inspected for accumulation of soot or other deposits at least once every 3 months, or at shorter intervals if necessary.

4. The oil filter should be cleaned every 3 months and should immediately be checked if the oil tank has been allowed to reach a low level. Replace the element at the start of each heating season.

5. The photocell and electrodes should be cleaned every 2 weeks, and more if the boiler is in constant operation.

Boiler Cleaning

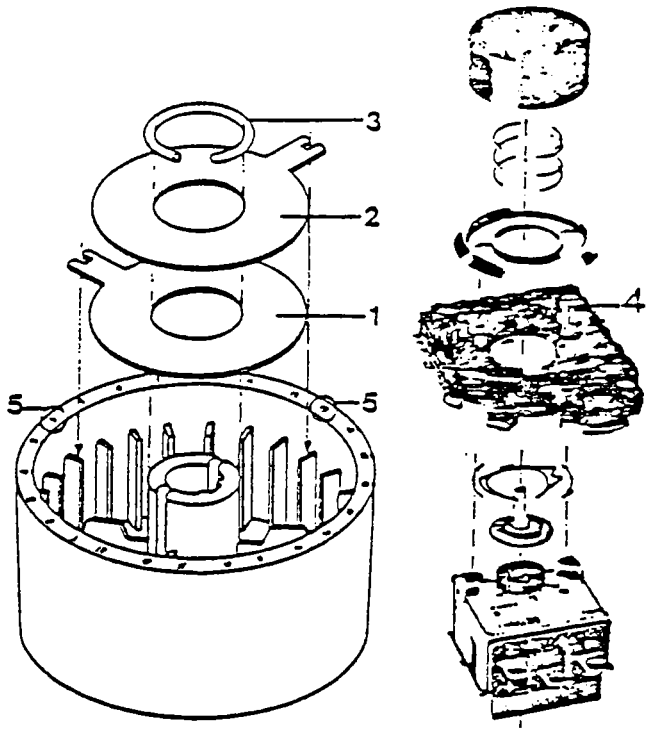
1. The boiler is supplied complete with bolted access doors item 29 on Fig.

   Remove the front cover plate item 27 and access doors item 29 this gives complete access to the flueways for vacuum or brush cleaning with approved chemical cleaner. Should it be necessary, access to the combustion chamber is also available by removing the burner mounting door item 27.

   Access to the rear of boiler flueways can be obtained by removing the rear smoke box item 9.

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

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



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

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

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

APPENDIX 1. CONTROL THERMOSTAT SETTING PROCEDURE

APPENDIX 2.

BROADSTONE BOILER

SITE ASSEMBLY OF HEATING BODY (HEAT EXCHANGER).

Where the heating body is to be site assembled the components are supplied as follows:-
The nipples and sealing mastic in a cardboard box.
The heating body castings and tie bars complete with nuts and washers on a wooden pallet.

			BROADSTONE BOILER NO						
H.E.L. PART NO	DESCRIPTION	CODE REF.	5	6	7	8	9	10	
330896013	SECTION FRONT	17801276	1	1	1	1	1	1	PALLETED
330896021	SECTION FRONT INTERMEDIATE	17805226	1	1	1	1	2	2	
330896039	SECTION INTERMEDIATE	17803256	2	3	4	5	5	6	
330896047	SECTION REAR	17802256	1	1	1	1	1	1	
330502868	NIPPLES 100,9	17809417	8	10	12	14	16	18	BOXED
332012635	TIE RODS 5, Complete	17077520	4						PALLETED
332012643	TIE RODS 6, Complete	17077507		4					
332012650	TIE RODS 7, Complete	17077508			4				
332012668	TIE RODS 8, Complete	17077509				4			
332012676	TIE RODS 9, Complete	17077510					4		
332012684	TIE RODS 10,Complete	17077511						4	
331202468	STAR-HEAD - PLUG 50/60	17868227	2	2	2	2	2	2	
339012042	LUBRICANT Kg. 0.700	17002081	1	1	1	1	1	1	BOXED
339012026	MASTIC Kg. 1.400	17004778	1	1	1	2	2	2	
339012034	MASTIC Kg. 0.325	17004776	2	2	2				

Above is the list of parts which will be found on the pallet or in the cardboard box.

Make sure that all the components listed above are present.

Check the sections with great care, making sure that the orifices have not been damaged during handling operations, as such damage could lead to subsequent leakage. Remove all foreign bodies which may have found their way inside the sections.

Thoroughly clean the nipples and casting bores removing the protective varnish with a proprietary paint stripper, (" Applied 8-70 " manufactured by Applied Chemicals Limited or Equivalent.)

Important:- Comply with Manufacturers Safety Recommendations and Application Procedures.

ASSEMBLY TOOLS.

To assemble the heating body it is necessary to use two set of tools supplied under hire by Hamworthy Engineering Limited.*

Fig. 1 shows one tool assembly comprising:-

A	*1*	*- SPIGOTED FLANGE PLATE*
B	*1*	*- DRILLED FLANGE PLATE*
C	*1*	*- PLAIN FLANGE PLATE*
D	*1*	*- M16 STUD LENGTH*
E	*4*	*- M14 BOLTS*
F	*2*	*- M16 WASHERS*
G	*2*	*- M16 NUTS*
**H*	*1*	*- CHOCK SET*

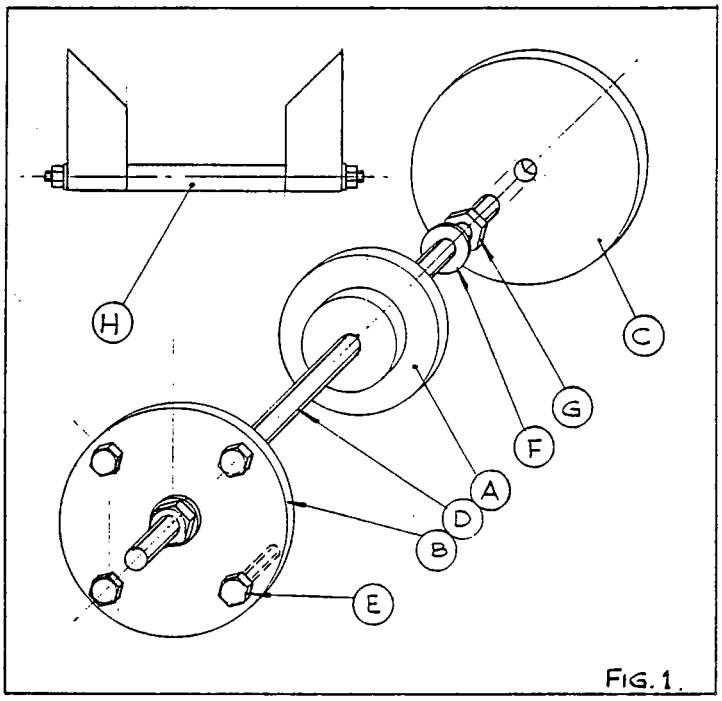


FIG. 1.

** 1 CHOCK SET ONLY REQUIRED.*

ASSEMBLY OF SECTIONS.

a) Remove 2" BSPT plugs from the top and bottom of the front section (the only section that has threaded holes on the nipple centres).

b) Stand the front section upright (in approximately its final position) and support so that the rest of the boiler heating body can be built to it, raising the casting 20 mm by placing a piece of wood under the feet. Remove any debris that falls to the bottom nipple hole.

c) Coat nipple bores and two nipples with light brown lubricant (provided) and top nipples into bores with soft faced mallet (ensure that they are seated squarely). Apply black mastic to the grooves around the casting edge to seal the combustion chamber and flue ways.

d) Select a front intermediate section (large arrow on casting top see Fig. 2) and coat the nipple bores on the side to be located to the front section see Fig. 2 locate the casting on the nipples and chock in position using chock set 'H' Fig. 1. Remove any debris that falls to the bottom nipple hole.

e) Draw the castings together using the assembly tools Fig. 1:-

i) assemble 'G' and 'A' onto studs 'D' so that 300 mm of stud protrudes from 'A'.

ii) pass studs through casting nipples from front section and fit flanges 'C'.

iii) using remaining washers and nuts pull casting together turning each nut one turn at a time.

f) Smooth over the mastic that squeezes from casting joints.

g) Dismantle draw tools and move 'G', 'F' and 'A' further up the stud by the thickness of one casting ready for the next pull.

h) Select the next casting (front intermediate [with large arrow] or normal intermediate section [with small arrow] depending on the boiler being built and repeat c), d), e) and f) moving the chock set along to support the boiler heating body.

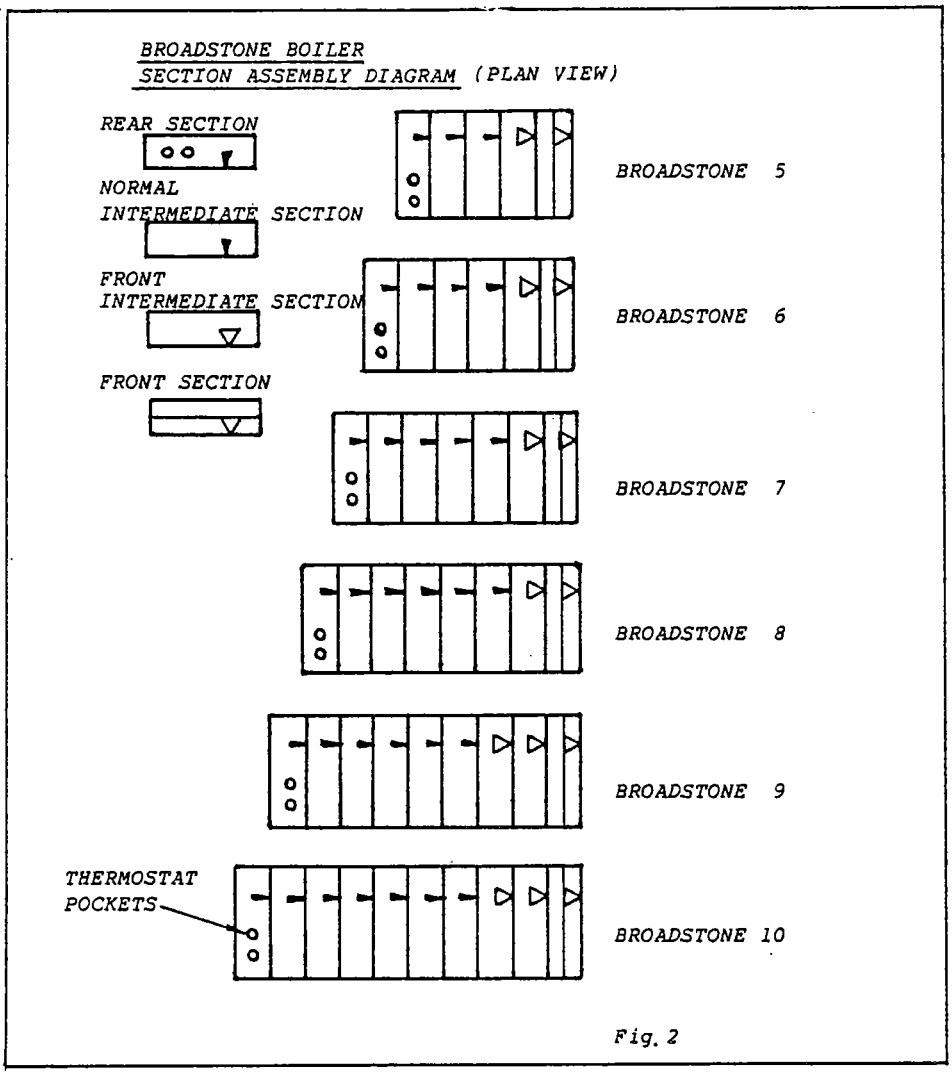


Fig. 2

j) Finally assemble rear section and fit tie bars (4 off) positioning the nuts so that equal amounts of stud protrude from each end of the assembly (for the attachment of casing parts).. Remove chock set and 20 mm thick piece of wood.

k) Due to space considerations and / or boilerhouse layout it may be more convenient to build the heating body starting with the rear section. If this is so, flanges ' B ' should be bolted to the back of the rear casting in line with the nipple bores (with M14 bolts or studs and nuts to be found in the boiler build kit) and the heater body built up following the principles laid out above and to the appropriate assembly diagram in Fig. 2.

BOILER HYDRAULIC TESTING:-

Refer to Page 19 of the Installers Guide CDH 3148.