November, 1983

IDEAL Concord Super 50 ~ 300 Series 2 Modular Gas Fired Boiler Installation & Servicing

B.G.C. Appliance No.'s			
Concord Super	50	Series 2	41 407 27
Concord Super	100	Series 2	41 407 28
Concord Super	150	Series 2	41 407 29
Concord Super	200	Series 2	41 407 30
Concord Super	250	Series 2	41 407 31
Concord Super	300	Series 2	41 407 32

STELRAD GROUP

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INTRODUCTION

The CONCORD SUPER range of boilers is suitable for connection to open vented, or pressurised, central heating, indirect domestic hot water and combined systems – in Commercial and Industrial premises. The maximum design operating pressure is 4.5 bar (65 lb/in^2).

The maximum design operating head is 45.7m (150ft).
The maximum design operating temperature is 82°C (180°F).

Electrical power consumption, per module, is 50W.

The basic unit is the heat exchange module (refer Fig. 1) which has a heat output of 50kW (170 600 Btu/h).

A boiler may consist of up to twelve modules.

Boilers embodying one to six modules are located, side by side, in a boiler casing.

The configuration may be vertical and/or horizontal.

This publication is restricted to information relating to vertical boilers of up to 300kW (1 023 600 Btu/h).

Information peculiar to boilers of greater output, and other configurations, is available under a separate cover. The latter combinations have NOT been submitted for approval.

Each boiler consists of:

(a) The insulated, stainless steel, boiler casing.
(b) The heat exchanger module(s).
(c) The flow and return water headers – (Multi-Module Boilers ONLY).
(d) The gas header, complete with individual module gas service taps and module governors.

The boiler MUST be used on an open flue system, without a draught diverter, and is for use with Natural Gas ONLY.

IMPORTANT

This appliance range is approved by the British Gas Corporation for safety and performance. It is, therefore, important that no external control devices – e.g. flue dampers, economisers, etc., be directly connected to this appliance unless covered by these 'Installation and Servicing' instructions or otherwise recommended by Stelrad Group Ltd., in writing. If in doubt please enquire.

Any direct connection of a control device not approved by Stelrad Group Ltd., could invalidate the B.G.C. approval and the normal appliance warranty and could also infringe the Gas Safety Regulations.

GENERAL DESCRIPTION

The modules are fitted on slide rails, within an insulated, stainless steel, boiler casing, into which the exhaust gases discharge, after transferring heat to the water flowing through the modules.

The water flows through the boiler from the return header, through the module, to the flow header. The modules are connected, in parallel, across the two headers.

During normal operation, the water flows through all modules at all times, Each module has a control thermostat and a limit thermostat. As the return water temperature rises, the control thermostat switches off the upper module first, then the middle module(s), and lastly, the lower module. As the water temperature falls, the reverse procedure operates, i.e. the lowest module switches on first, then the middle, and lastly, the upper.

When the upper modules are not firing, the water content is kept hot by the combustion products of the lower modules.

A control system, operated by temperature measurement of the mixed flow or return from the boiler, can be incorporated. The boiler can then be programmed for extra requirements.

HEAT EXCHANGER – Refer Fig. 1

The heat exchanger consists, basically of twenty four finned tubes (17), the ends of which are expanded into tube plates (16 & 21). A top cover plate (14), gasket (15), bottom cover plate (19), and gasket (20), are bolted to the tube plates to form a sealed unit. The front end of the heat exchanger is secured to the boiler casing by four studs and nuts.

The periphery of the unit is enclosed by a gas distribution screen (22), which controls the flow of the products of combustion over the finned tubes.

COMBUSTION AIR SUPPLY – Refer Fig. 2

Air is supplied to each module by a fan impellor (38). The fan motor is cooled by a cooling impellor (55), and is protected by a thermal cut-out.

Note:

Care has been taken to route all wiring and thermostat capillaries, to avoid obstructing the cooling impellor.
The fan entry is fitted with a gas distribution plate, which ensures efficient mixing of the air and gas before discharge into the gas burner.

It is IMPORTANT that Item (36) is correctly positioned as illustrated.

GAS SUPPLY – Refer Fig. 3

Gas is supplied to each module from the gas header. The gas pressure is controlled via individual module governors.

GAS SIDE OF THE HEAT EXCHANGER

The hot combustion products flow outwards, around the finned tubes, transferring heat to the water flowing through the tubes. The exhaust gases are then discharged into the boiler casing (refer Fig. 3).

The burner is supplied with a mixture of gas and air, in the correct proportions for good combustion, by the fan, via the fan ducting (Fig. 2 – Items (37) and (38)). Gas, at a constant rate, is supplied to the fan inlet through a gas injector (Fig. 4 – Item (56)).

MODULE CONTROL SYSTEM

Each module has separate controls. These may be conveniently divided into gas and electrical controls.

GAS CONTROL – Refer Fig. 4

Gas is admitted to the boiler through the gas header. The flow, to each module, is through the gas inlet cock, the gas governor, the double solenoid valves (59), the proportionator (58), to the gas injector (56).

Gas pressure test points are provided at Items (61), (63) and (64).

ELECTRICAL CONTROL – Refer Figs. 1 and 2

The start sequence control box (49), the limit thermostat (47), the control thermostat (52), the ON/OFF switch (43), and the indicator lights (40), (41) and (42) are mounted on a chassis, bolted to the top of the fan. The igniter assembly (11), and the ionisation probe (25), are secured, by integral lugs, to the front plate. The limit thermostat phial is located in a pocket (3), and the control thermostat phial in a pocket (33). If a boiler sequence control is used, regulating a mixed flow or return temperature, – it is mounted independently.

MODULE OPERATION

Before any module is set into operation:

1. Ensure that water is flowing through the boiler.
2. Switch ON the mains electricity supply.
3. Turn ON the module gas service tap.
4. Press down the ON/OFF switch. The green light will come on, indicating that power is on that module. If heat is required, the following sequence will take place:
5. The amber light will come on, indicating that the thermostat is not satisfied.
6. The red light will come on, indicating that the starting sequence has begun.

1. Fan and Control Assembly
2. M6 x 16 Hex Hd Screw and Washer
3. Limit Thermostat Pocket
4. Square Cork Gasket & Multi-hole Plate
5. M8 Nut
6. Square to Round Casting
7. Round Cork Gasket
8. Flow Pipe
9. M8 x 55 Bolt and Washer
10. Triangular Gasket
11. Igniter Assembly
12. M8 Studs
13. M8 x 40 Bolt and Washer
14. Top Cover Plate
15. Top Cover Gasket
16. Top Tube Plate
17. Finned Copper Tubes
18. M8 x 40 Bolt and Washer
19. Bottom Cover Plate
20. Bottom Cover Gasket
21. Bottom Tube Plate
22. Gas Distribution Screen
23. Gas Train Support
24. Gas Train Support
25. Ionisation Probe
26. Burner
27. Test Point Assembly — Suction Pipe
28. Triangular Gasket
29. Return Pipe
30. M8 x 20 Bolt and Washer
31. Gas Train Support Saddle
32. Gas Train Assembly
33. Control Thermostat Pocket
34. Gas Injector Straps and M4 x 6 Pozi Pan Hd Screws
35. Gas Train Support Saddle
36. Fan Pressure Sensing Pipe
37. Pressure Test Point Assembly

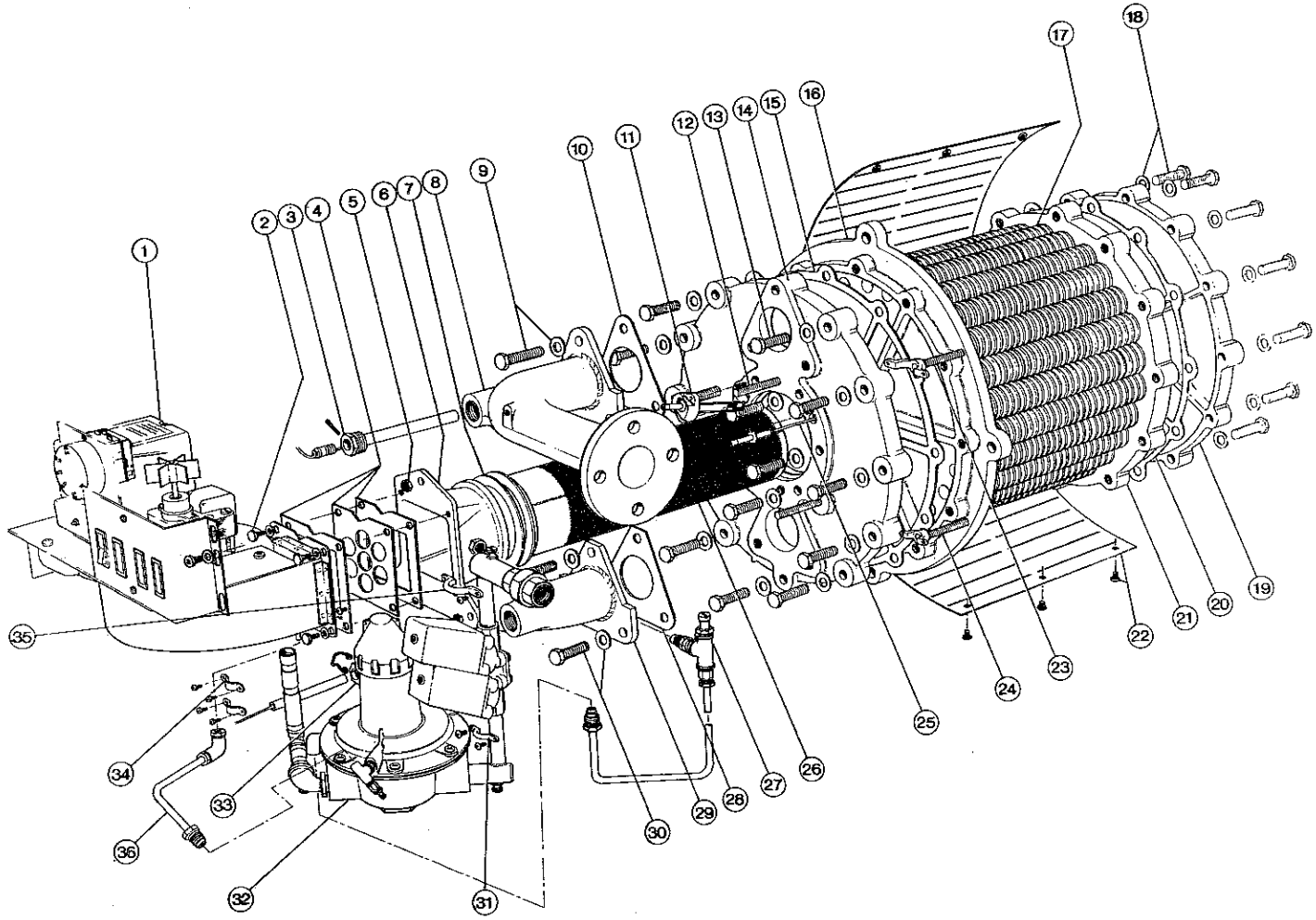
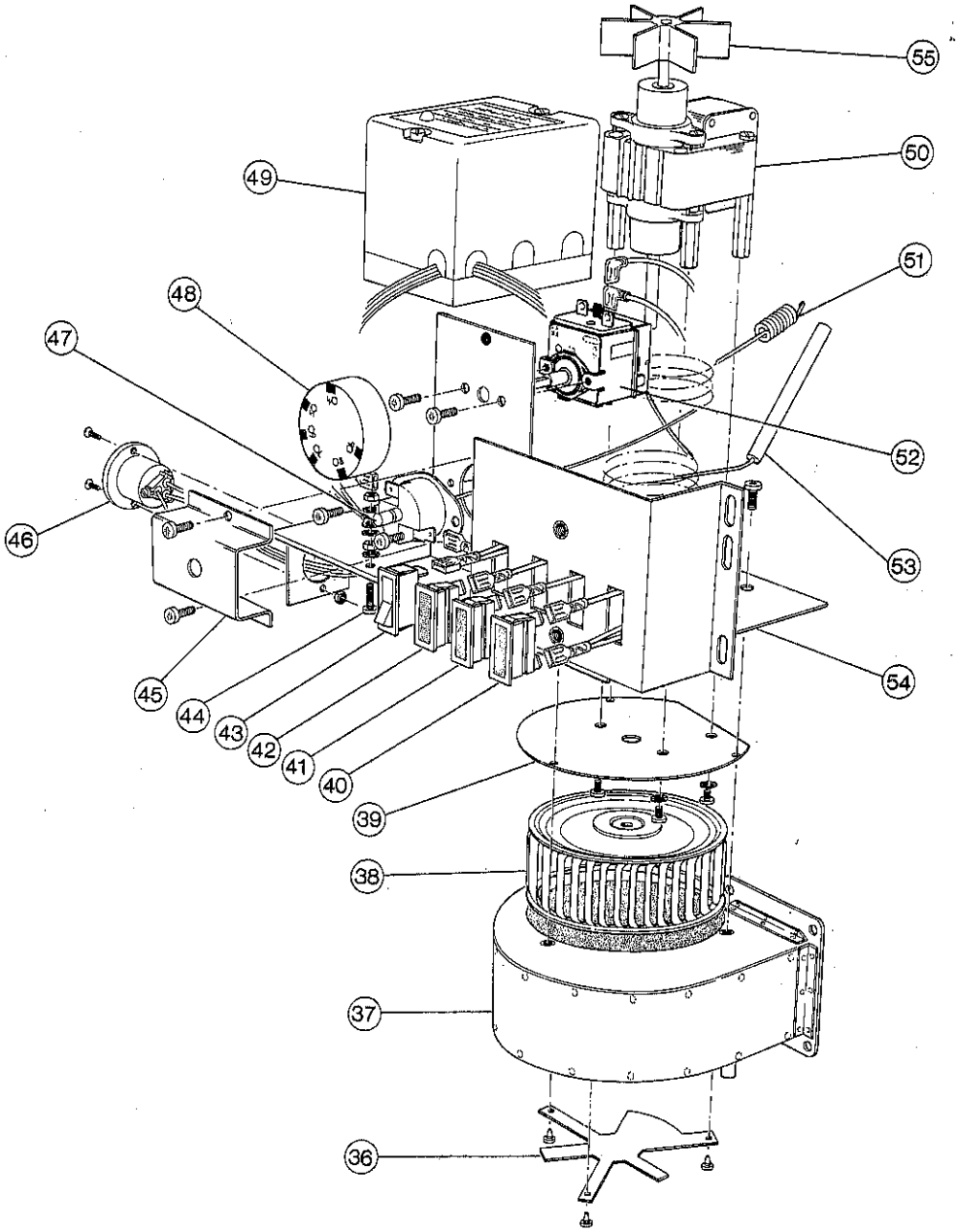


Fig. 1

MODULE EXPLODED VIEW

Note:
* Item 36 PERMANENTLY fixed to Item 37

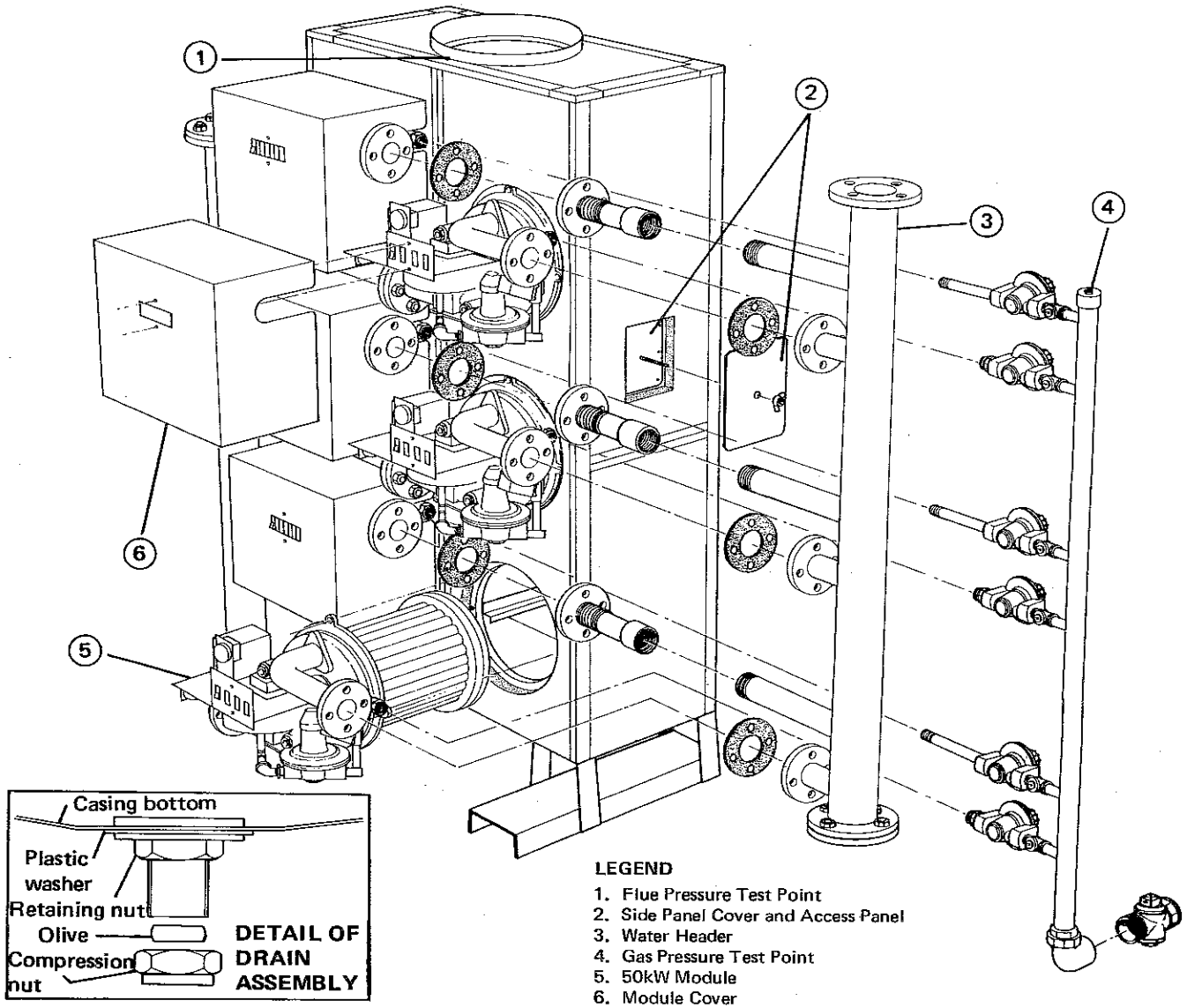


CONTROL/FAN ASSEMBLY

* 36.	Gas Distribution Plate	46.	Mains Plug
* 37.	Fan Ducting	47.	Limit Thermostat
38.	Fan Impellor	48.	Control Thermostat Knob
39.	Motor Mounting Plate	49.	Control Box
40.	RED Indication Lamp	50.	Fan Motor
41.	AMBER Indication Lamp	51.	Limit Thermostat Phial
42.	GREEN Indication Lamp	52.	Control Thermostat
43.	ON/OFF Switch	53.	Control Thermostat Phial
44.	Earth Screw	54.	Controls Bracket
45.	Limit Thermostat Cover	55.	Fan Cooling Impellor

Fig. 2

ELECTRICAL CONTROLS EXPLODED VIEW

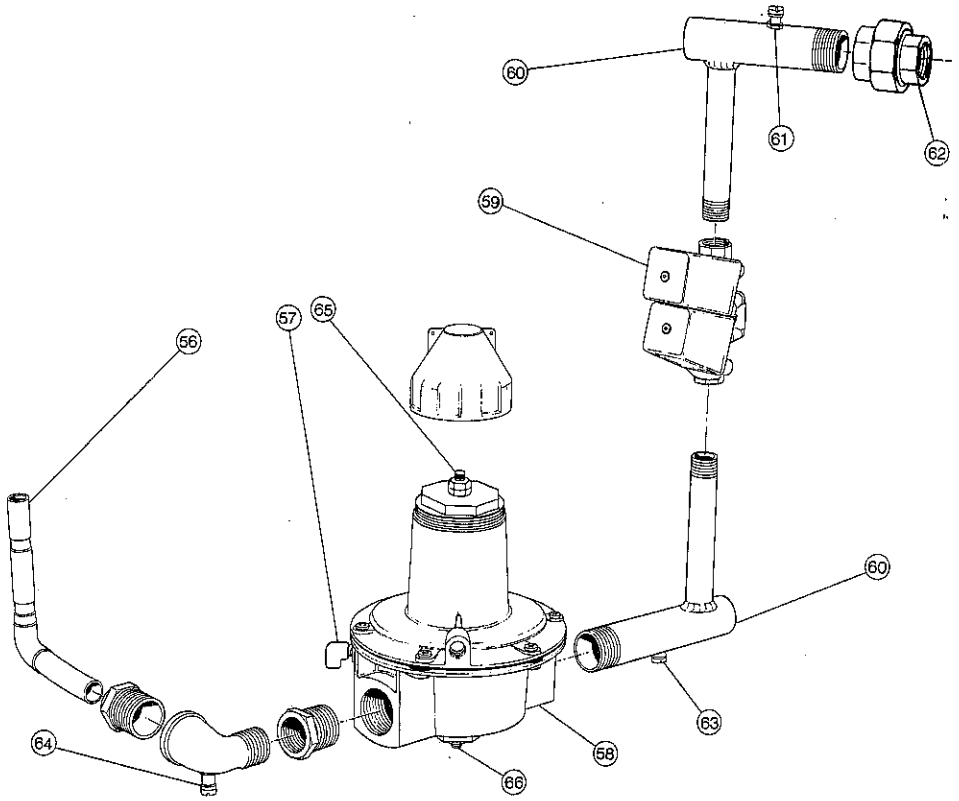


LEGEND

1. Flue Pressure Test Point
2. Side Panel Cover and Access Panel
3. Water Header
4. Gas Pressure Test Point
5. 50kW Module
6. Module Cover

Fig. 3

300 kW VERTICAL BOILER EXPLODED VIEW



GAS TRAIN ASSEMBLY

56.	Gas Injector	61.	Pressure Test Nipple
57.	Square to Round Casting Suction Pipe	62.	Straight Union
58.	Proportionator	63.	Pressure Test Nipple
59.	3/8" Double Solenoid Valve (SPERRYN)	64.	Pressure Test Nipple
60.	Gas Pipe	65.	Locknuts
		66.	Gas rate Limiter

Fig. 4 **MODULE GAS CONTROL LINE EXPLODED VIEW**

7. The fan will start, and run for 15 seconds, to purge the combustion chamber.
8. A spark will be initiated at the electrode, and run for a maximum of 4 seconds. The red light goes off.
9. The gas solenoid valve will be open during this period.
10. The gas burner will light.
11. A flame will be sensed by the probe.
12. The spark will be shut off.

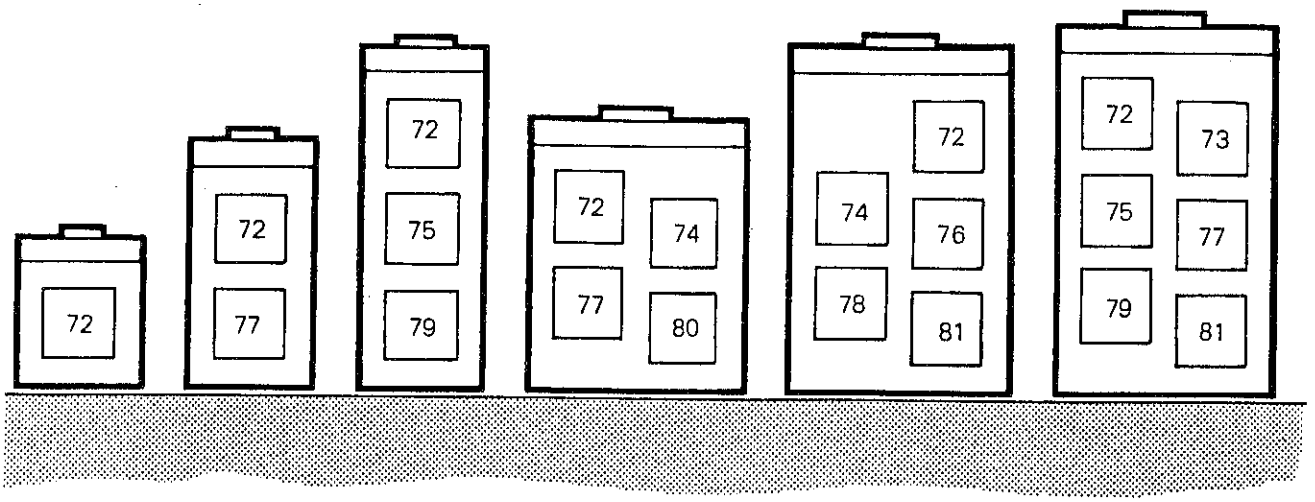
The burner will continue to fire until the thermostat is satisfied. The gas supply will then be cut off by the solenoid valve, and the fan will stop. The amber light will go off and the green light will stay on.

Note:

If the boiler should malfunction, the red light will come on to indicate burner Lockout, and the fan will continue to run.

BOILER CONTROL

At designed full load, all modules will be in operation, and a green and an amber light will show on each module cover. It is IMPORTANT that the modules should operate in sequence in response to changes in load, this is shown in Fig. 5.



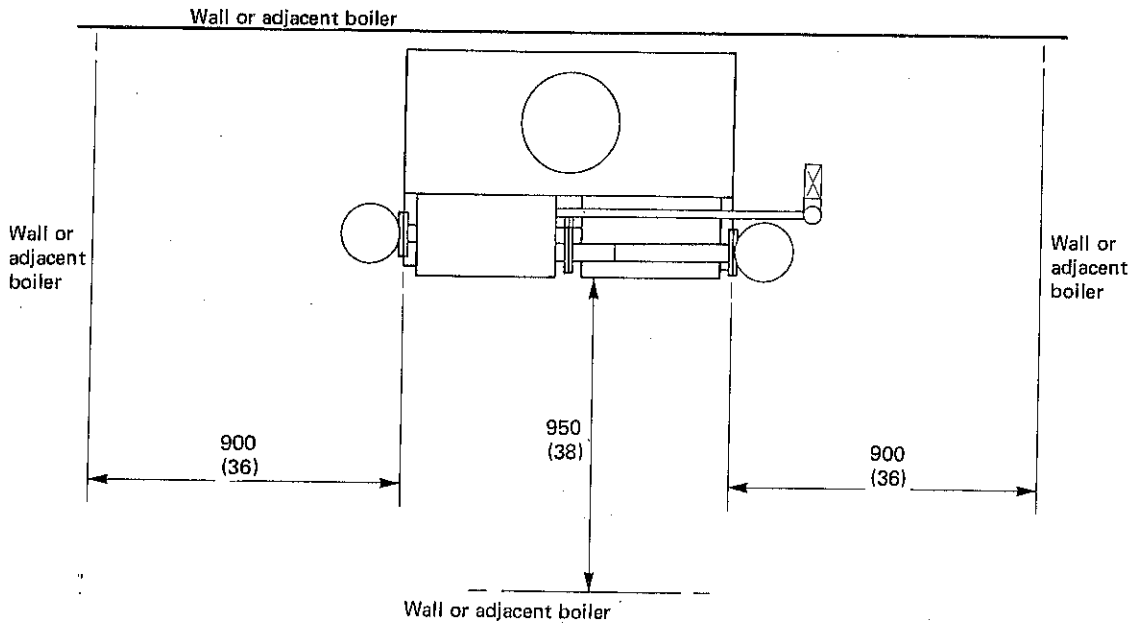
Approximate settings of control thermostats to give a mean mixed flow temperature of 82°C (180°F). These settings apply only if water is flowing through the boiler at the designed rate.

Note:

Although approximate Control Thermostat settings are shown for boilers up to 300kW, sequence control is recommended for boilers above 150kW – refer page 15.

Fig. 5 **BOILER THERMOSTAT SEQUENCE SETTINGS**

All dimensions in millimetres (inches)



RECOMMENDED BOILERHOUSE CLEARANCES – for comfortable servicing access

GENERAL TECHNICAL DATA

Table 1

VERTICAL BOILERS OF ONE TO SIX MODULES

Boiler Size			50	100	150	200	250	300
Number of Modules			1	2	3	4	5	6
Heat Output		kW	50	100	150	200	250	300
		Btu/h	170 600	341 200	511 800	682 400	853 000	1 023 600
Heat Input		kW	57.7	115.3	173.0	230.7	288.4	346.0
		Btu/h	196 770	393 540	590 310	787 080	983 850	1 180 620
Flue Gas Volume @ 135°C		l/s	28	56	84	112	140	168
@ 275°F		ft^3/min	59	118	177	236	295	354
Gas Rate *		m^3/h	5.4	10.8	16.2	21.6	27.0	32.4
		ft^3/h	191	381	572	763	953	1144
Boiler Height	Overall	mm	724	1375	1855	1485	1965	1965
		in	28½	54 1/8	73 1/32	58 29/64	77 23/64	77 23/64
Boiler Width	Overall	mm	475	930	942	1412	1425	1425
		in	18 11/16	36 35/64	37 5/64	55 37/64	56 3/32	56 3/32
Boiler Depth	Overall	mm	← 640 →					
		in	← 25 3/16 →					
Weights:	Casing/Insulation	kg	29.07	47.73	61.47	76.56	106.56	98.88
		lb	64.10	105.24	135.54	168.81	234.96	218.03
	Module	kg	50	100	150	200	250	300
		lb	110	220	330	440	550	660
	Gas/Water Headers	kg	–	25.38	39.50	51.21	70.10	72.74
		lb	–	55.96	87.10	112.92	154.57	160.39
Water Content – Boiler		litre	4.5	11.9	20.7	26.2	37.7	44.5
		gal	1.0	2.6	4.6	5.9	8.3	9.8
Flow and Return Connection +		mm	40	50	← 65 →		← 80 →	
		in	1½	2	← 2½ →		← 3 →	
Gas Connection		Rc	¾	1	← 1¼ →		← 1½ →	
		in.BSP	¾	1	← 1¼ →		← 1½ →	
Flue Pipe Size ++		mm	127	178	203	← 254 →		305
(Nominal Bore)		in	5	7	8	← 10 →		12

Notes:

Constants:

* CV – 38.4 MJ/m^3 (1 031 Btu/ft^3) at 15°C (60°F) and 760mm (30in.) Hg.

The gas rate, at calorific values different to this, may be calculated by direct proportion.

CO_2 is calculated at the rate of 9.0%

Gas pressure at inlet to solenoid is 14.0 mbar (5.6in.w.g.)

Electrical supply is 240v, Single Phase, 50 Hz.

Water content of a heat exchanger only is 3.7 litres (0.81 gals.).

\+ Flange size – Refer Table 'D' in BS.10

++ Flue pipe size – **N.B.** For 250kW Model only, a flue adapter is supplied as standard.

Table 2

REQUIRED WATER FLOW through the boiler at all times when operating, irrespective of the number of modules firing.

Number of Modules		1	2	3	4	5	6
Litres/sec.	± 10%	1.07	2.14	3.21	4.28	5.35	6.42
Gals/min.	± 10%	14.1	28.2	42.3	56.4	70.5	84.6

All dimensions in millimetres

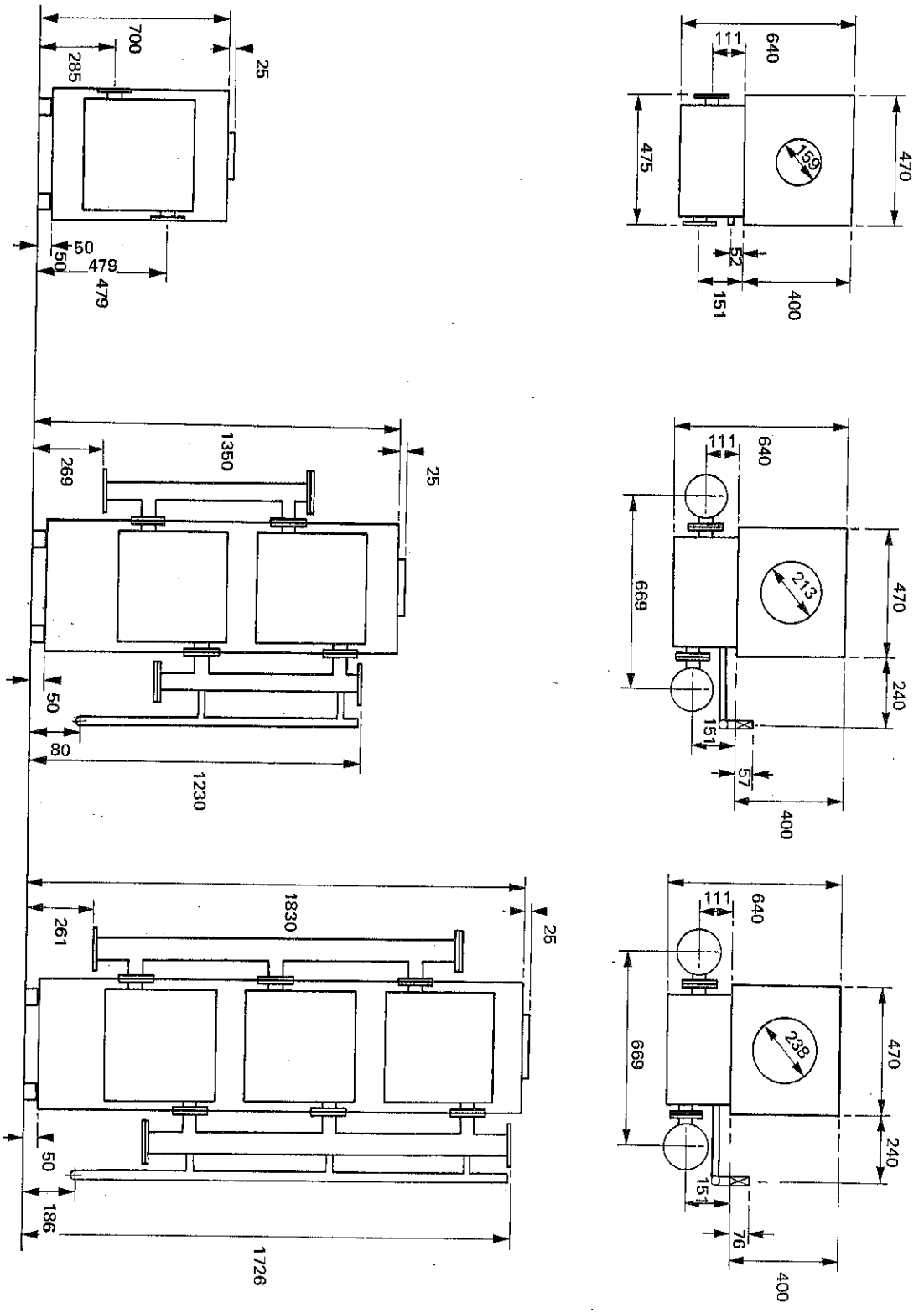
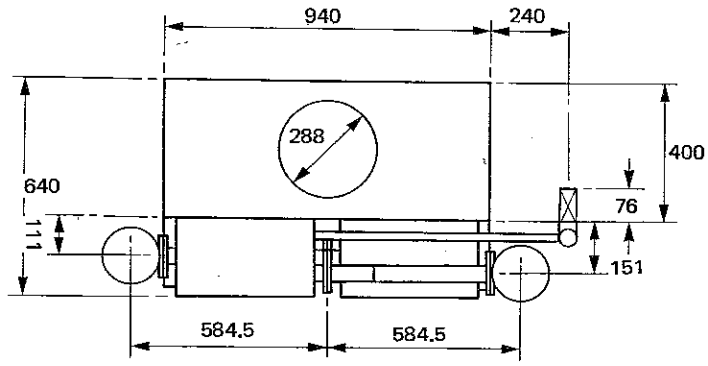
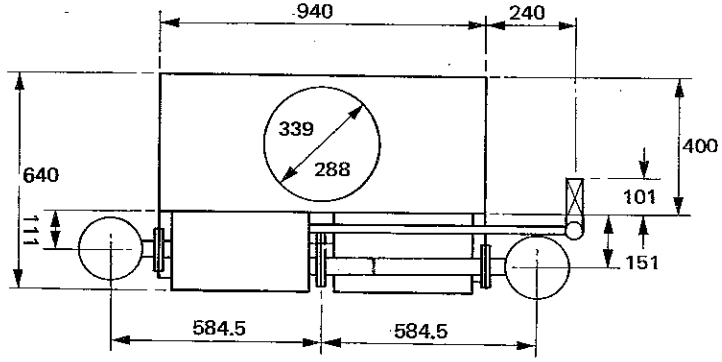


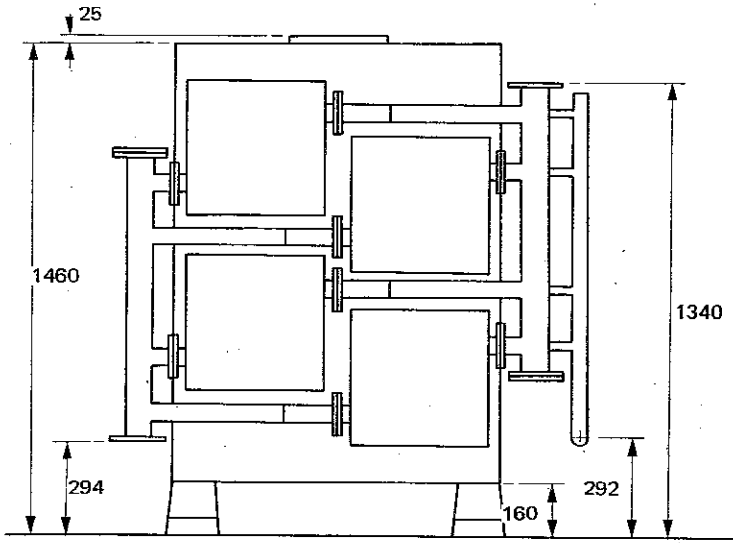
Fig. 6

BOILER DIMENSIONS
50kW–150kW MODELS

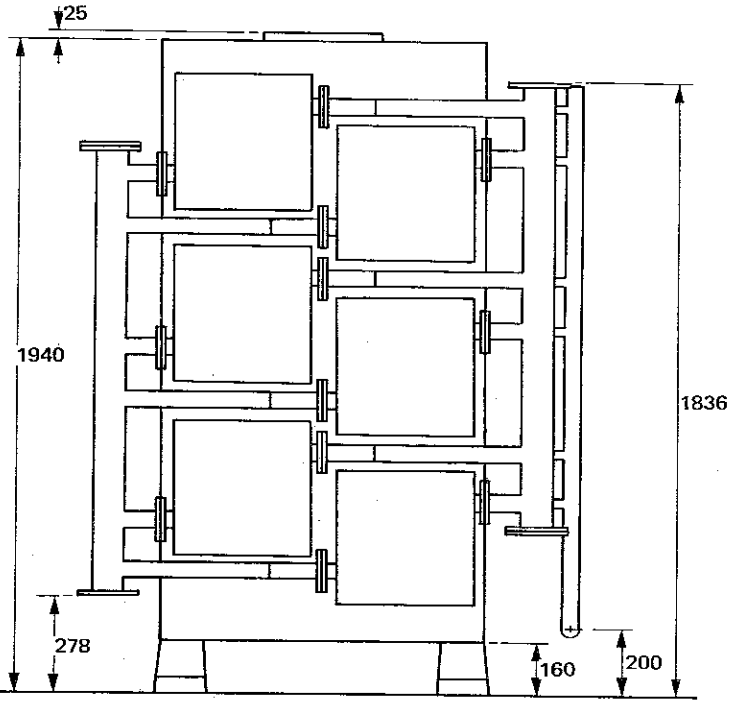
All dimensions in millimetres







200kW



250 & 300kW

Fig. 7

BOILER DIMENSIONS
200kW–300kW MODELS

Continuation -

SINGLE MODULE

INSTALLATION REQUIREMENTS

fan fail. A stabiliser is required in the boiler primary flue, exactly as described under 'Open Flue System Design Requirements'.

(b) In practice, this means that the induced draught fan system will include a stabiliser. Above the stabiliser will be an air pressure switch, on the intake side of the fan, as shown in Fig. 8.

Fan dilution systems will include the stabiliser, as above, in the primary flue below the entry into the fresh air duct – as shown in Fig. 8.

(c) Draught setting for the stabiliser, above the boiler flue outlet, is as required for open flued systems. The fan dilution, or induced draught fan, air pressure switch, MUST be set to shut down the boiler, if the volume flow of products falls by more than 15% of the design rate.

(d) ALL flue systems MUST be insulated.

This also applies to induced draught, and fan diluted, flue systems – to avoid excessive condensation forming, and possible icing of the discharge from dilution systems, due to freezing outside temperature conditions.

Where an induced draught fan is used, it is permissible to reduce the cross-sectional area of the flue pipe, or liner, on the DISCHARGE side of the fan ONLY, to below that of the boiler flue outlet. The flue velocity, AFTER the fan, should NOT exceed 6.1 m/s (20ft/s).

Due allowance must be made for flue resistance when assessing the fan duty.

AIR SUPPLY

Detailed recommendations for air supply are in BS.5440:2.

The room in which the boiler is installed MUST be provided with a permanent air vent. The vent must be either, direct to the outside air, or to an adjacent room, which has, itself, a permanent vent of, at least, the same size, direct to the outside air.

The minimum effective area of the vent, based upon the input of the boiler, is : 230cm^2 (34.5in^2) per module.

If the appliance is to be installed in a cupboard, or compartment, air vents are required at both high and low level. They may communicate with an adjoining room or, preferably, with the outside air.

The minimum effective area of the cupboard/compartment air vents, based on the input of the boiler, is:

AIR DIRECT FROM THE OUTSIDE – PER MODULE			
At High Level		At Low Level	
cm^2	in^2	cm^2	in^2
260	40	520	80

AIR FROM AN ADJOINING ROOM – PER MODULE			
At High Level		At Low Level	
cm^2	in^2	cm^2	in^2
520	80	1040	160

Note:

Both vents MUST communicate with the same room, or be on the same outside wall.

Combustion, ventilation and dilution air supply MUST NOT be contaminated by combustion products, airborne grit, dust, etc.

WATER CIRCULATION SYSTEM

The central heating system should be in accordance with the relevant provisions of BS.5376:2 and the B.G.C. Publication – 'Material and Installation Specifications for Domestic Heating and Hot Water'.

The domestic hot water system, where applicable, should be in accordance with the relevant provisions of CP.342:1 or 2, and the above B.G.C. Publication.

Water circulation systems MUST incorporate a pump, as the boiler is NOT suitable for natural circulation. The water flow, through a single module boiler MUST be 1.07 l/s (14.1 gal/min) $\pm$ 10%.

We recommend that a water flow switch is fitted in the system, to guard against pump failure.

ELECTRICAL SUPPLY

External wiring MUST be in accordance with I.E.E. Regulations.

This is a Class 1 Appliance, suitable for connection to a 240V, Single Phase, 50Hz, AC Supply.

Refer page 20 – 'Electrical Connections' for wiring instructions.

This Appliance MUST BE EARTHED

INSTALLATION REQUIREMENTS ~ MULTI-MODULE

The information in the preceding section – 'Installation Requirements – Single Module', applies also to the requirements for the installation of multi-module boilers.

Additional information, peculiar to the requirements for the installation of multi-module boilers, is contained in this section.

FLUING

Detailed recommendations for fluing are given in the B.G.C. Publication – 'Flues for Commercial and Industrial Gas Fired Boilers and Air Heaters' (IM11) and BS.5854 'Flues and Flue Structures in Buildings'. However, these publications must NOT be taken to over-ride any of the requirements stated in this literature. Any queries should be taken up with STELRAD GROUP Ltd.

AIR SUPPLY

Detailed information is in CP.332:3, and in the British Gas Publication (Combustion and Ventilation Air) – 'Guidance Notes for Boiler Installations in Excess of 586kW'.

AIR SUPPLY BY NATURAL VENTILATION

There should be suitable openings, at high and low level, communicating directly with the outside air. Where the only feasible openings are at high level, ducting down to floor level should be provided.

Exposed boiler-houses should be provided with openings on all four sides where this is possible, but, at least, on two sides.

Grilles and louvres should be designed, and sited, to avoid high speed air streams inside the boilerhouse. The minimum effective areas, for single module boilers, are quoted in the preceding section.

AIR SUPPLY BY MECHANICAL VENTILATION

Mechanically ventilated boiler-houses MUST be by forced inlet, and natural, or mechanical extraction.

Mechanical extraction, with natural inlet, is NOT permitted.

Where a wholly mechanical system is used, the extraction rate should NOT exceed one third of the inlet rate.

Note:

An automatic control is necessary to cut off the gas supply in case of inlet or extraction fan failure.

WATER CIRCULATION SYSTEM

The following general guidance is intended to ensure that a boiler, or boilers, will function efficiently, without problems arising associated with nucleate boiling within the heat exchanger, or nuisance, trip out of limit thermostats.

Basic considerations when applying the CONCORD SUPER to a system are as follows:

(a) Notwithstanding the type of system being considered, a water flow of 1.07 l/s (14.1 gal/min) ± 10%, per module, MUST pass through the boilers at all times, irrespective of the number of modules firing.

(b) The boiler(s) MUST be protected against boiler circulating pump failure, using either duplicate pumps, with automatic changeover facility, and/or a water flow switch, wired, in series, with the electrical supply to all modules.

(c) Any system designed to operate at a flow rate of less than 1.07 l/s (14.1 gal/min) ± 10%, times the total number of modules, will require a primary pump for each boiler, or a single pump for all boilers, sized at the above rating, against a pressure drop of 125 mbar (50 in.w.g.), and the shunt circuit resistance.

(d) When more than one boiler is to be used, the sequencing of modules may result in the complete shutdown of one boiler before another.

Provided the boiler is controlled by a sequencing unit, and the SYSTEM design is such that the volume of water circulating through it is reduced with load, it is in order to keep standing losses to a minimum, by switching off the boiler primary pump, serving a complete shutdown boiler, after the last (bottom) module has switched off.

The boiler will not refire if a water flow switch is fitted, until the sequence controller restarts the primary pump, when the supply to the modules will be remade through the switch.

The boilers' individual primary pumps may NOT be switched off:

1. Whenever a module is firing.
2. When the circulation requirements of the system zones would exceed the total flow of the individual boiler primary pumps.

(e) Very high turn-down ratios are possible using the CONCORD SUPER, but it is recommended that, when more than three modules are to be used, a sequence controller, interlocked with a water temperature sensor, be used.

It is practical to utilise the thermostats supplied, one on each module, as described in 'Commissioning and Testing', up to a maximum of three modules (150kW), refer Fig. 5.

A compensator may be used in conjunction with a sequence controller or, in conjunction with system controls – such as a three-port mixing valve, provided basic flow rate requirements through the boiler modules are met.

Figures 10, 11, 12, 13 and 14, give guidance, and recommended layouts, for boiler application up to 300kW.

A multi-zone system, as shown in Fig.12, may require sudden changes in load, to be effected by the operation of timers and/or system controls.

In order to avoid a rapid rate of temperature rise, brought about by such changes, it is strongly recommended that, whenever practically possible, the sequence controller, (if used), be of a type which will allow all modules to recycle from the OFF position, whenever a large reduction in load takes place, thus matching the new load.

Alternatively, avoidance of a rapid rate of temperature rise may be effected by the external live supply to those modules providing boiler power, over and above that required, being interrupted simultaneously by the zone timer(s). This will not affect water flow through the modules out of use. The modules still firing will be capable of providing adequate boiler power to satisfy the remaining load, whilst the rate of temperature rise will be reduced to an acceptable level.

When the plant is shut down completely, the main primary pump(s) should be over-run for a minimum of 30 seconds.

For example, a 200kW (4–module) boiler, connected to a three–zone system, comprising:

1. DHW (load 45kW), with independent pump, controlled by a cylinder thermostat.
2. Constant temperature heating zone (45kW), with pump, and (3) – a variable temperature heating zone (90kW), with three-way mixing valve and pump –

would be operated as follows:

During Winter operation, it may be necessary to switch off the variable temperature heating zone, leaving a reduced load of 45kW for heating, whilst, at that time,

the DHW thermostat is not calling for heat. If, at shut-down, three or four modules were firing, the heat input to the system would be 150kW–200kW, against a sudden reduction in load from, around, 130kW to 45kW. By interlocking the DHW thermostat, and timer, with the supply to one of the modules, the constant temperature timer to a second module, and the variable temperature circuit timer to the remaining two modules, it would be possible to achieve the following situation:

Under the above condition, at shut-down the DHW thermostat is not calling for heat and therefore, only three modules would be firing, providing 150kW to satisfy a 135kW load. When the constant temperature heating circuit is switched off, a second module will be switched off simultaneously, leaving 100kW to cope with a 90kW maximum load.,

When the DHW thermostat calls for heat, the system pump, and module serving it, will run – providing 150kW for a maximum load of 135kW.

(f) As each module is an individual 'basic electric' unit, the use of sequence control is straightforward, with the step controller switching modules as required.

When more than one boiler is to be used, (say 2 x 300 kW units), then the user has a choice of maximum turndown ratio of 12:1, which may involve isolating one boiler, as described under (d), or reducing the turndown ratio to 6:1, by switching two modules at a time, one on each boiler.

(g) To avoid excessive pressure drop in the gas line, serving multi-module boilers, when all modules are firing under cold start conditions, it is recommended that an external switching device be used to ignite modules in sequence, with a minimum delay time of 15 seconds.

Note:

1. Single module boiler requirements are as for multi-module boilers.
2. Hydraulic resistance for all boilers is 125 mbar (50in.w.g.), at a flow rate of 1.07 l/s (14.1 gal/min), at a temperature difference of 11°C (20°F) per module.
3. Minimum tank height dimensions shown may have to be increased to comply with pump manufacturer's requirements to avoid cavitation.

LEGEND

1. Cold feed) Sizes MUST comply
2. Open vent) with B.S.
3. Safety valve
4. Water flow switch
5. Dual primary pumps
6. Boiler flow header) Supplied by
7. Boiler return header) STELRAD
8. Feed/expansion tank

Dimensions in millimetres (inches)

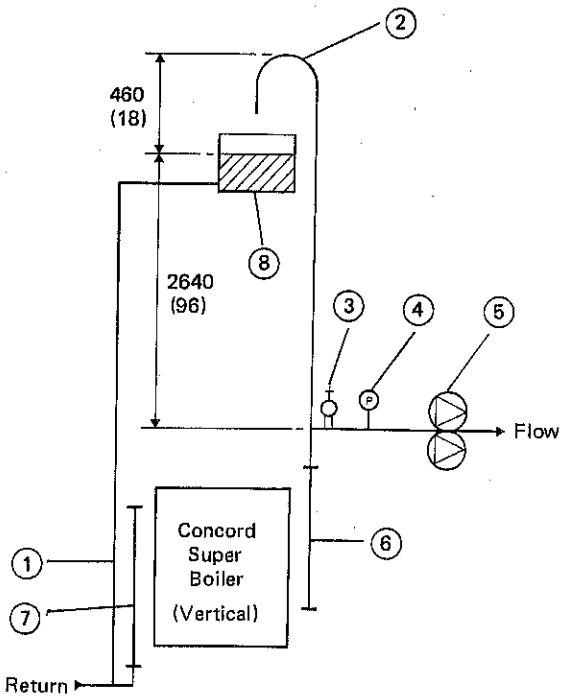


Fig. 10

GUIDE TO MINIMUM REQUIREMENTS FEED/EXPANSION TANK HEIGHT

Operation at constant volume flow rate with 11°C (20°F) temperature difference across boiler and system

LEGEND

1. Cold feed
2. Open vent
3. Safety valve
4. Water flow switch
5. Dual system pumps (30 second over-run time required on system shutdown)
6. Feed/expansion tank

A,B – Diverter valve bypasses, balanced to ensure constant volume flow when diverter valves 'D' are open to bypass.

C – Cylinder thermostat controls diverter valve

T – Timers for D.H.W.and heating.

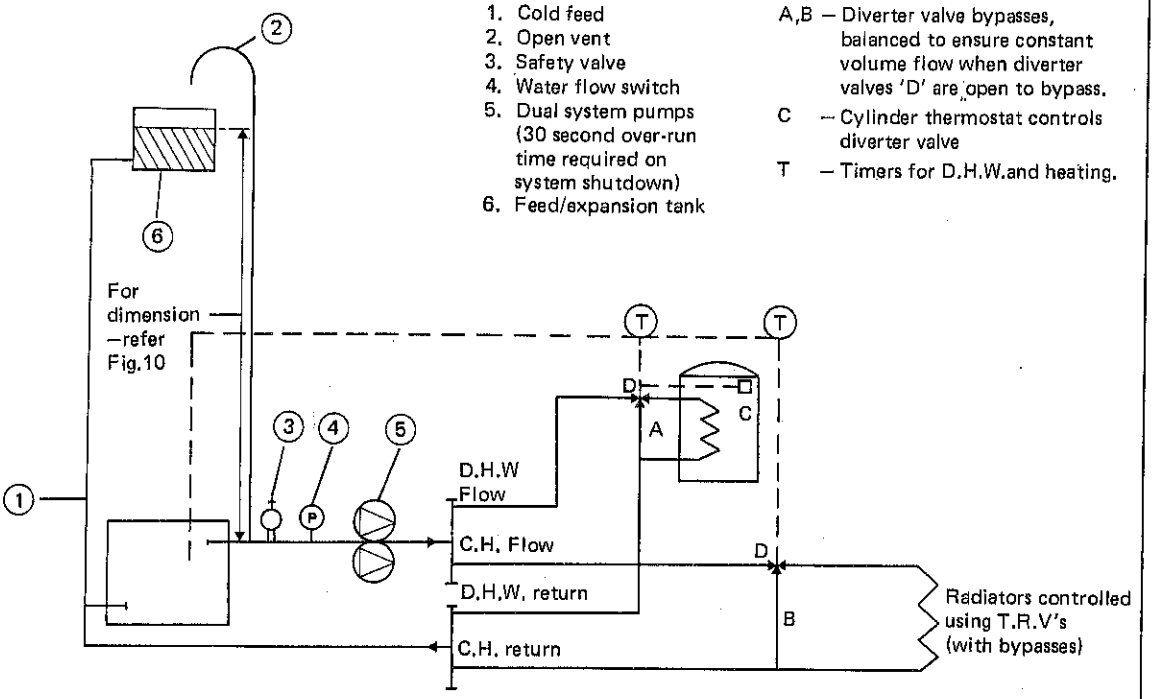


Fig. 11

SIMPLE COMBINED HEATING AND DHW SYSTEM SINGLE MODULE BOILER (50kW)

Note:

The sequence controller would switch modules M1 to M4 in order by sensing flow or return temperature (gradual reduction in load).

Module M1 would be electrically interlocked with the DHW thermostat and timer, so that it fires only when heat to the calorifier is called for.

Similarly, module M2 would be interlocked with the constant temperature heating circuit, and modules M3 and M4 – with the mixing circuit (refer text).

C – Cylinder thermostat controls pump
E – Air temperature sensors
T – Timers

* Primary pump duty – 1.07 l/s x 4 modules
– 4.28 l/s (56.6 gal/min) against 125 mbar (50in.w.g.) plus pipework resistance.

LEGEND

1. Cold feed
2. Open vent
3. Safety valve
4. Water flow switch
5. Dual primary pumps *
6. Mixing header
7. Feed/expansion tank
8. Sequence control sensor on flow or return (if fitted)
9. Compensator

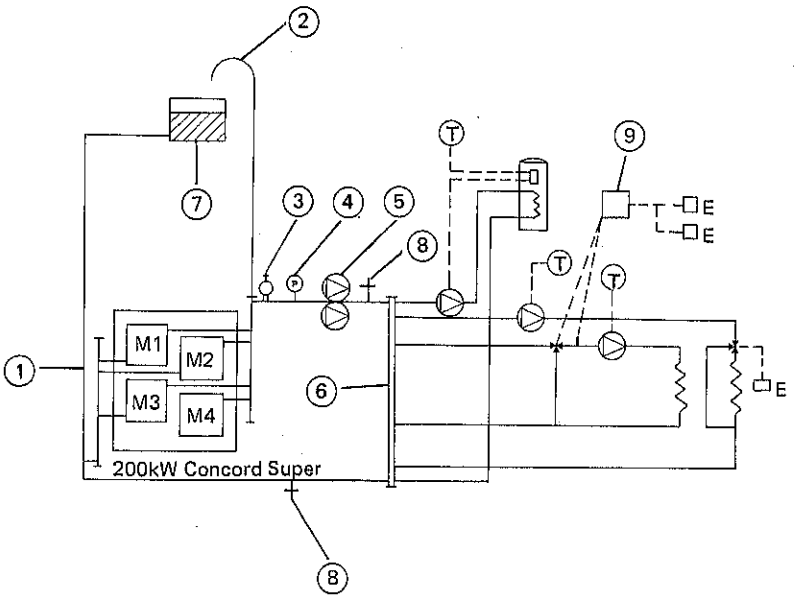


Fig. 12

EXAMPLE OF MULTIZONE HEATING AND DHW SYSTEM CONNECTED TO MULTI-MODULE BOILER

Application with independent boiler primary pumps

Note:

It is not necessary to have more than two modules in operation, when zones 1 or 3 are in operation alone, or more than three modules when zones 2 or 4 are operating alone.

Modules may be switched to provide an 8:1 turndown ratio, provided sequence controller sensor is positioned on flow,in which case, when boiler No.1 has shut down ALL modules (the primary pump serving a particular boiler MUST run whenever there are modules firing on that boiler), its primary pump may stop, providing the zones pumps are not taking more than 4.28 l/s (56.4 gal/min) from the mixing header. Alternatively, modules may be switched one at each boiler simultaneously to provide a 4:1 turndown boiler ratio, i.e. (M1 + M5), (M2 + M6), M3 + M7) and (M4 + M8). (refer Fig.14).

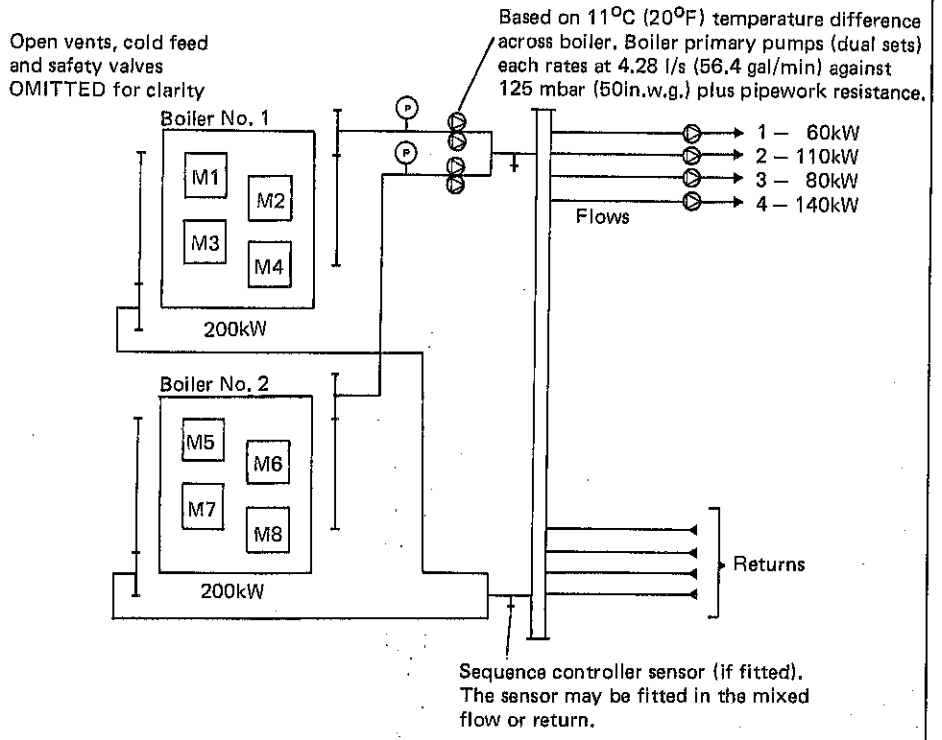


Fig. 13 EXAMPLE OF MULTIZONE HEATING AND DHW SYSTEM CONNECTED TO TWO MULTI-MODULE BOILERS

Note:

On COMPLETE shutdown of plant, a 30 second (minimum) primary pump over-run time is required.

Application with a single boiler primary pump

Note:

Modules should be switched, one on each boiler, simultaneously, to provide a 4:1 turndown ratio, i.e. (M1 + M5), (M2 + M6), (M3 + M7) and (M4 + M8).

The boiler primary pump MUST run at all times, irrespective of the number of modules firing on either boiler. On COMPLETE shutdown of plant, a 30 second (minimum) primary pump over-run time is required.

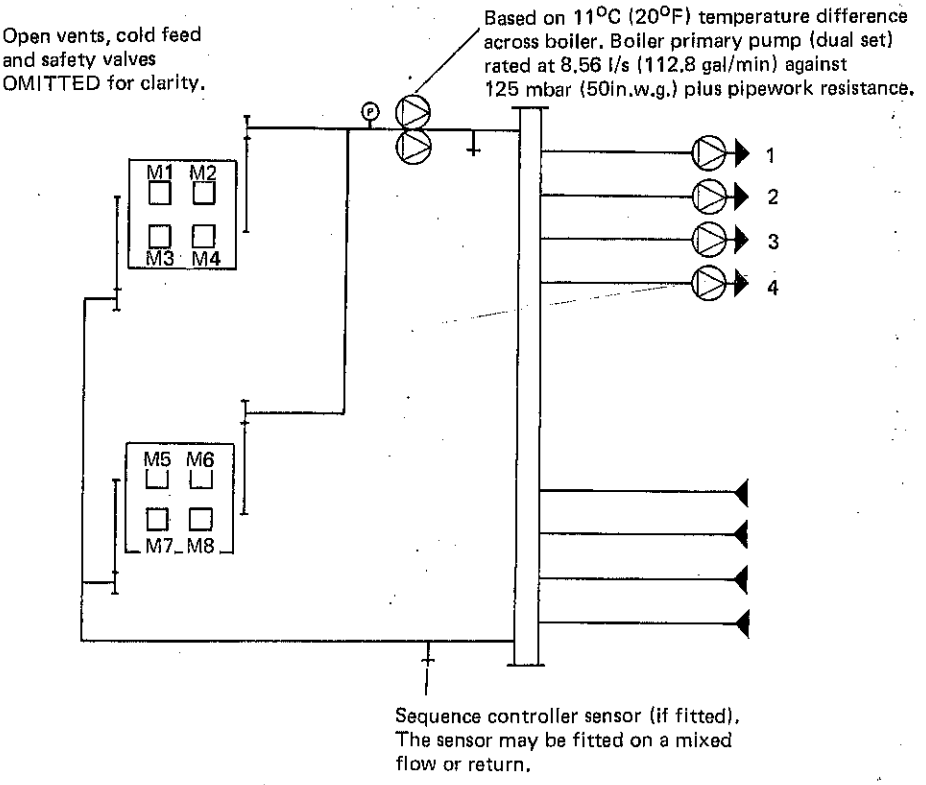


Fig. 14 EXAMPLE OF MULTIZONE HEATING AND DHW SYSTEM CONNECTED TO TWO MULTI-MODULE BOILERS

INSTALLATION INSTRUCTIONS - GENERAL

The boilers are normally despatched to site as:

1. Single module package.
2. Boiler casing and header package.

GUIDANCE ON APPLICATIONS

Figures 10, 11, 12, 13 and 14 are intended to provide BASIC information ONLY on the application of the CONCORD SUPER. B.G.C. approval has NOT been sought in the matter.

Further advice, if required, can be obtained from STELRAD GROUP Ltd.

Both constant temperature, and variable, temperature circuits are shown in Figures 12, 13 and 14.

Compensating controls may be used in conjunction with variable temperature circuits, operating a mixing valve, or over-riding a sequence controller, to directly affect mixed flow temperature on larger heating systems, not requiring to maintain constant flow temperature.

Irrespective of the type of system(s) being considered, a volume flow rate of 1.07 l/s (14.1 gal/min), times the TOTAL number of modules FITTED to a particular boiler, (NOT the number in use at a particular time), MUST be maintained whenever the plant is in operation.

The mixing header MUST be sized, at least, one pipe size larger than the boiler flow manifold flow/return size, in order to avoid hydraulic interference between the boiler primary pump and the system zone pumps.

Fig. 10 is intended as a guide ONLY, and cannot take into account instantaneous changes in head, brought about by ancillary equipment switching.

Due allowance MUST be made if surging is liable to occur.

Note:

The following assumptions, and conditions, apply to Fig. 10:

1. Open vent and cold feed connections are made to boiler flow/return manifolds respectively.
2. The boiler is assumed to be the HIGHEST point of the system.
3. The pump is positioned on the flow and, the vertical distance between the pump and the feed/expansion tank, complies with the pump Manufacturer's minimum requirements – to avoid cavitation.

   If not, INCREASE tank height ABOVE the minimum requirements of STELRAD GROUP.
4. The water velocity is assumed to be below 1.5 m/s (5ft/s), and the volume flow rate to be 1.07 l/s (14.1 gal/min) per boiler module.

FOUNDATION

An insulated foundation is NOT necessary, as the bottom of the boiler casing will not exceed a temperature of 80°C (176°F).

The foundation MUST be flat and level, fireproof, dustfree, and capable of supporting the weight of the WET boiler.

CASING FEET AND DRAIN CONNECTION

Attach the feet to the bottom of the boiler casing, using the M.10 x 20mm Lg Hex Hd screws provided. A drain fitting, suitable for connection to 22mm dia. pipe, is supplied in the Hardware Pack.

This MUST be assembled to the bottom of the casing, and the connection made, prior to the casing being placed in position – for details of assembly, refer Fig. 3.

Note:

Condensation will only occur on warming up, when the return water temperature is below 55°C (131°F) – the Water Dew Point.

The boiler casing can now be placed in position.

N.B.

EXTREME CARE **MUST** BE TAKEN WHEN HANDLING THE CASING, WHICH IS FITTED WITH AN ALUMINIUM-FACED, INSULATING CLADDING. THIS CLADDING CAN BE KEPT CLEAN BY WIPING WITH A DAMP CLOTH.

ASSEMBLING THE MODULE AND HEADERS TO THE BOILER CASING (Refer Fig. 3)

WARNING:

Cracking may occur if the flow and return module castings are over-stressed.

The following procedure is to be adopted:

1. With the module cover removed, fit the module(s) to the casing, but do NOT tighten the four fixing nuts.
2. For boilers over 150kW ONLY:

   Screw the flanged bellows unit to the longer branches of the water headers, using a wrench on the iron socket, at the end of the bellows, to tighten in position. When tight, the flange on the bellows should finish approximately 470mm (18½in) away from the fixed flanges, with the flange holes in a vertical, and horizontal attitude – refer Fig. 3.

   UNDER NO CIRCUMSTANCES MUST THE FLANGE, OR BELLOWS, BE USED FOR TIGHTENING.
3. Secure the flow and return water headers to the modules, rigid flanges first, using the gaskets and screws provided, taking adequate precaution to support the headers during assembly.

Note:

Care should be taken to avoid damage to the bellows units, whilst tightening the screws securing the bellows flanges.

4. For 100kW–150kW boilers ONLY:
   (Refer Figs. 4 and 6).

   Remove the union half of the straight union on the module, and screw it into the branch projecting from the gas header assembly. Repeat for each module, ensuring that the dimensions, between header and the end faces of the straight union halves, are the same. Place the gas header in position so that the straight unions can be reconnected to the modules, taking care to adequately support the gas header during assembly.

   For boilers over 150kW (Refer Figs. 4 and 7):

   A short branch is fitted to the gas header for connection to the Right Hand modules, and a long branch for connection to the Left Hand modules.

   (Right and Left as viewed facing the modules).

   Remove the union halves of the straight unions on the modules, and screw on to the projecting short and long branches.

NOTE:

When tight, the dimension between the end faces of the straight unions, on the long and short branches, should be 470mm (18½in.).

Place the gas header in position so that the straight unions can be reconnected to the modules, taking care to adequately support the gas header during assembly.

5. The four module fixing nuts (para 1) may now be tightened.

WATER CONNECTIONS AND PRESSURES

(Refer Installation Requirements – Multi-Module, also Fig. 3)

All service pipework, linking the flow and return headers, should be adequately supported, taking care that no strain is imposed upon them.

Allowance must be made for any additional service pipework expansion. Provision for draining the boiler should be made at the lowest point in the system.

A safety valve MUST be fitted.

The valve should be set at 0.7 bar (10 lb/in^2) ABOVE the available static head of water over the boiler, or the design operating pressure of the system, whichever applies.

If isolating valves are fitted in the flow and return pipes to the boiler, then a safety valve, set as above, MUST be fitted either side of them.

The maximum safety valve setting is 0.7 bar (10 lb/in^2) above the maximum design operating head, or pressure of the boiler – 4.5 bar (65 lb/in^2).

The heat output of each module needs a water flow of 1.07 l/s (14.1 gal/min) $\pm$ 10%.

The water pressure drop, through each module, is 124.5 mbar (50 in.w.g.), at the designed flow rate. As the modules are connected in parallel, the pressure drop remains constant, whatever the boiler size.

CONNECTING BOILERS TO THE FLUE SYSTEM

Details of the flue design are in pages 12, 14 and 15. Boiler socket and flue pipe sizes are indicated by Table 1, page 9.

Also refer Fig. 15, for general fluing guidance.

GAS CONNECTION

Sizes of the various boiler gas connections are given in Table 1, page 9.

Ensure the gas supply is compatible with boiler requirements. A dynamic gas pressure of, at least, 17.5 mbar (7in.w.g.) MUST be available at the inlet to the appliance.

The gas supply pipe must be adequately supported, so that a strain is not imposed on the boiler gas headers.

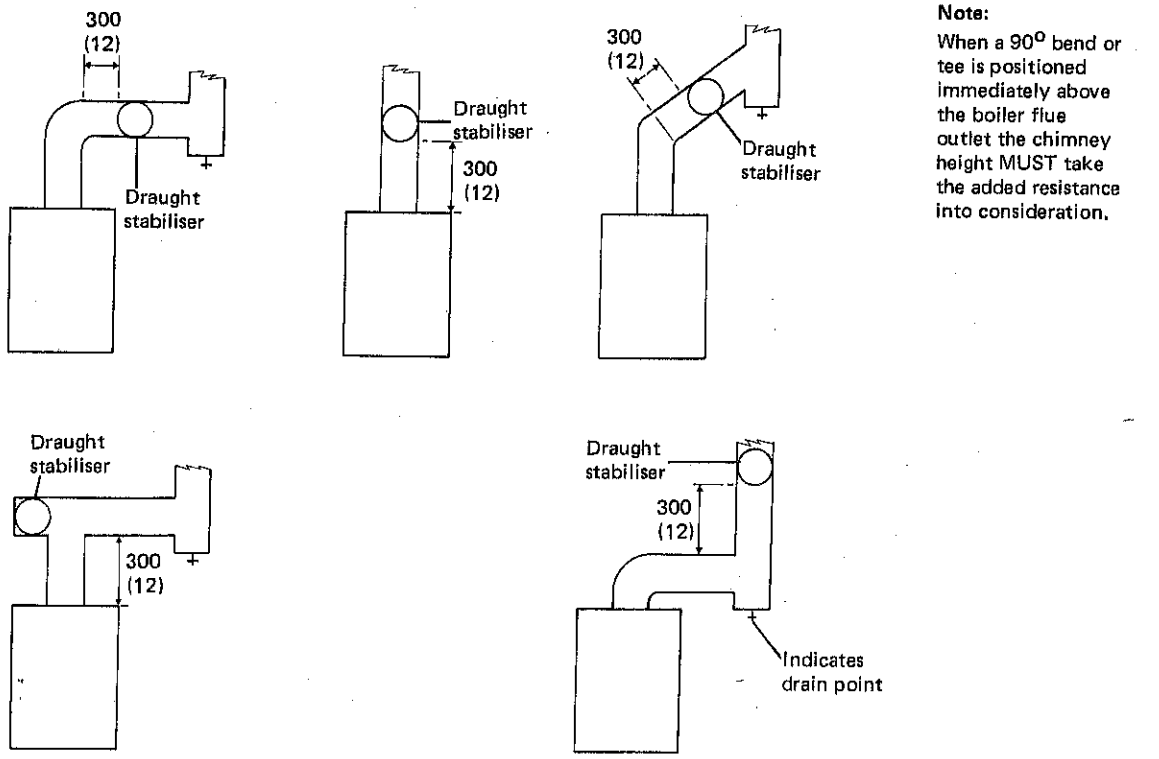
ELECTRICAL CONNECTION

A three-pin plug is fitted to the control chassis of each module. The corresponding socket is provided with the module. A flexible lead, (24/0.2mm, 0.75mm^2 to BS6500) of suitable length, should be wired to the socket – refer Fig. 16, Item (P).

The electrical load, taken by each module, is 50 watts.

The electrical supply MUST be fused at 5 amps.

All dimensions in millimetres (inches)

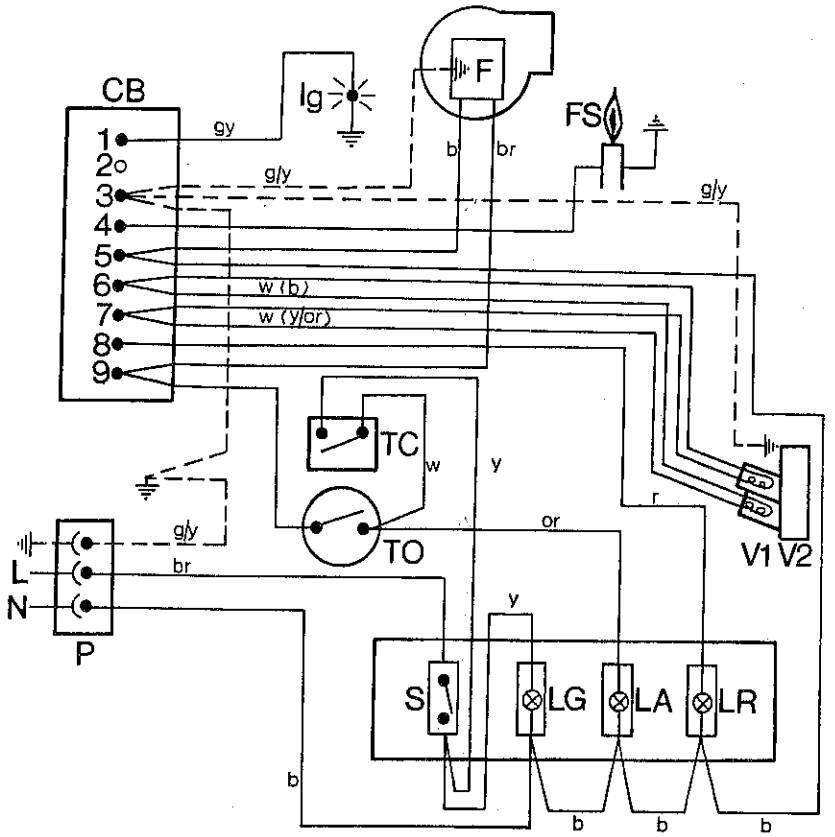


Note:
When a 90° bend or tee is positioned immediately above the boiler flue outlet the chimney height MUST take the added resistance into consideration.

Fig. 15

FLUING – GENERAL GUIDANCE

CSS.04.B
Control Box



Legend:

b	—	blue
br	—	brown
gy	—	grey
or	—	orange
g/y	—	green/yellow
r	—	red
y	—	yellow
w	—	white

CB	—	Control box
F	—	Fan
FS	—	Flame sensor
Ig	—	Igniter
LG	—	Green lamp
LA	—	Amber lamp
LR	—	Red lamp
P	—	Plug/socket
S	—	Switch
TC	—	Control thermostat
TO	—	Overheat thermostat
V1 V2	—	Solenoid valves

Fig. 16

WIRING DIAGRAM

COMMISSIONING AND TESTING

The CONCORD SUPER boiler should be commissioned, and tested, by a qualified gas/heating engineer.

Turn the electrical supply to the boiler OFF, and isolate the modules, by withdrawing the electrical sockets from the control chassis.

FILLING THE BOILER WITH WATER

Fill the boiler by admitting water to the return header. By this method, air is forced from the tubes in the heat exchanger.

WATER CIRCULATION

Switch ON the pump motor, and check that water is circulating. If a water flow switch is fitted in the system, check that it switches OFF the electrical supply to the boiler when there is no water flow.

The design flow rate MUST be 1.07 l/s (14.1 gal/min), ± 10%, at a temperature difference of 11°C (20°F), for each module, irrespective of the number of modules firing.

HEADER GAS TIGHTNESS

Turn the top module gas service tap ON. Connect a manometer to the tapping point (4) at the top of the gas header (refer Fig. 3), turn ON the mains inlet gas tap — at the inlet to the appliance. Slacken the nut on the ¾" union, connecting the top module to the gas header, (refer Fig. 4, Item 62), and purge the gas header. Retighten the union connection. Turn OFF to top module gas service tap, and ensure that all other module gas service taps are in the OFF position. Take note of the manometer reading, and turn OFF the mains inlet gas tap. A subsequent fall in pressure indicates a leak between the mains inlet gas tap and individual module gas service taps, which MUST be made good.

When the pressure remains constant, the main gas service tap may be turned ON again.

CONTROL LINE GAS TIGHTNESS

Carry out the following test, on each module, in turn:

1. Connect a manometer to the tapping point, at the inlet to the solenoid valve — Fig. 4, Item (61).
2. Turn ON the module gas service tap, and screw down the regulator on the module governor, until a pressure of 17.5 mbar (7in.w.g.) is indicated on the manometer.
3. Turn OFF the module gas service tap and observe the

manometer pressure. This pressure should not fall more than 2.5 mbar (1in.w.g.) in one minute.

If this rate of fall is exceeded, leakage past the solenoid valve seat, or leakage from joints in this section of gas line, MUST be investigated.

PRE-FIRING CHECK
(Refer Figs. 1, 2 & 4)

Each module should be checked, separately, in the following manner:

1. Ensure that the electrical supply to the boiler is OFF.
2. Switch the module ON/OFF switch – Fig. 2, Item (43) – to OFF.
3. Turn the module gas service tap to OFF.

Note:

EXTREME CARE SHOULD BE TAKEN WHEN THE MODULE IS RUN WITHOUT A COVER.

4. Turn the control thermostat knob – Fig. 2, Item (48) – to the OFF position.
5. Plug in the electrical socket.
6. Switch the electrical supply to the boiler to ON.
7. Switch the module ON/OFF switch – Fig. 2, Item (43) to ON.
8. The GREEN light – Fig. 2, Item (42) – will be illuminated, indicating that power is ON to the module under test.
9. Turn the control thermostat to the ON position.

The following sequence of events will occur:

(a) The AMBER light, and the RED light, will be illuminated.

(b) The fan will start, and run for a 15 second pre-purge period, before:

(c) The ignition spark commences, continues for approximately 4 seconds, and then ceases.

This operation can be HEARD inside the module.

(d) The AMBER and RED lights will remain illuminated, and the fan will continue to run.

(e) Turn the ON/OFF switch to the OFF position.

The lights will go out, and the fan will cease to run.

FIRING

The individual module governors perform best with the maximum available dynamic inlet pressure – up to 25 mbar (10in.w.g.). The minimum pressure, at the mains inlet gas tap, should NOT be less than 17.5 mbar (7in.w.g.), and the supply should be capable of maintaining this pressure, with all modules firing, – refer 'Installation Requirements – Single Module' – 'Connection to the Gas Supply'.

Note:

The stabiliser should be set to control between neutral and 0.2 mbar (0.8in.w.g.) suction, with one, or all, module(s) firing. A test point is provided, in the top of the boiler casing, adjacent to the flue outlet socket.

Turn ON the mains inlet gas tap.

Carry out the following Firing Check, commencing with the top module, and finishing with the bottom:

1. Turn ON the module gas service tap.
2. Switch the module ON/OFF switch to ON.

The following sequence of events will now take place:

(a) The GREEN, RED and AMBER lights will be illuminated.

(b) The fan will start and run.

After a 15 second pre-purge period, ignition will commence, lasting for 4 seconds.

(c) The gas valves will open, to coincide with the ignition period, and the burner will light.

(d) The RED light will be extinguished, the GREEN and AMBER lights remaining illuminated.

With the module firing, and with both impulse lines connected, use an inclinded gauge to measure the fan pressure, (pressure point on the tube connecting to the top of the proportionator), and then the suction in the Square to Round casting – test point on adjacent tee assembly.

The fan pressure, added to the suction in the Square to Round casting, should give a total operating force of NOT less than 1.1 mbar (0.45in.w.g.).

If lower, the fan performance should be checked, also the tightness of connections.

Adjust the module governor to give an inlet to solenoid pressure of 14.0 mbar (5.6in.w.g.), measured at the test point – Fig. 4, Item (61).

Note:

The governor will NOT control properly if screwed hard down.

The base of the proportionator is fitted with a gas rate limiting device – release the locknut and turn the screw anti-clockwise to maximum adjustment.

Remove the screw cap, on the top of the proportionator, and adjust the nuts to give a pressure drop of 5.3 mbar (2.1in.w.g.), when measured across the test points provided – Fig. 4, Items (63) and (64).

Check that the inlet to solenoid pressure, and the proportionate pressure drop requirement, are achieved together.

Screw in the gas rate limiter, Fig. 4, Item (66) until the pressure drop is clearly, and positively, increased. Having found the adjustment point, withdraw the screw beyond range, and then screw it in again, until the proportionator pressure drop is seen to increase from 5.3 mbar (2.1in.w.g.) to 5.5 mbar (2.2in.w.g.). Tighten the locknut on the limiting device, and also the locking nut on the top of the proportionator, Fig. 4, Item (65) observing the manometer, to ensure that the pressure drop is not altered.

FAULT CONDITION

If the burner does not fire, the following sequence of events will occur, after (c) in the preceding paragraph:

(d) The gas valves will stay open for 4 seconds, and ignition will continue for the same length of time.

(e) The gas valves will close, and ignition ceases.

(f) The RED, AMBER and GREEN lights remain illuminated.

Another attempt to light can now be made, by turning the ON/OFF switch, first to OFF, and then, – to ON again.

The sequence, described in 'Firing Check', paragraphs (a) to (d), will then recur.

SHOULD ANY MODULE STILL NOT FIRE – REFER TO THE TROUBLE SHOOTING INSTRUCTIONS ON PAGE 25.

SAFETY CHECKS

The following safety checks should be made:

COMBUSTION

Fire each module, on its own, blanking off the fan air inlets of all the non-firing modules, using the sheet of self-adhesive paper – supplied in the module Hardware Pack.

Measure CO/CO_2, on each module,– a sampling point is provided in the top of the boiler casing, adjacent to the flue outlet socket.

For Draeger tests, note the following:

(1) The sampling line, however short, should ALWAYS be purged.

(2) CO_2 tubes are marked in per cent divisions, and ONE pump ONLY is required.

CO_2 tubes are also marked by divisions indicating parts per million (p.p.m.).

(3) The % CO/CO_2 calculation result should NOT exceed 0.001.

(4) For convenient reference, Table 3, below, completes the above calculation, and relates CO_2 per cent, as read direct from the tube, to maximum allowable CO in p.p.m., also as read.

Low CO_2 levels are included, to cover dilution due to casing and flue volume on the larger boilers.

Remove the fan air blanking material from all modules.

Fire all modules together, and measure the pressure at the inlet to a solenoid valve. If it is less than 14.0 mbar (5.6in. w.g.), check that the pressure, at the appliance inlet, has NOT fallen below 17.5 mbar (7in.w.g.), as specified in 'Connection to the Gas Supply', and 'Gas Connection' – pages 12 and 20 respectively.

Measure CO, and CO_2, under the FULL output firing condition, and refer to the maximum allowable CO content – Table 3.

FLAME SENSING PROBE

(a) Re-establish the flame, as detailed in 'Firing Check', described in the preceding page.

(b) Remove the lead from the flame sensing probe. The burner should stop firing within one second.

(c) A single attempt will be made to relight, and the burner will then go to Lockout. The RED light will remain illuminated, as will the GREEN and AMBER lights.

(d) If the check is satisfactory, replace the lead to the flame sensing probe. If it is not – the control box should be replaced.

CONTROL THERMOSTAT

When the water temperature satisfies the thermostat, it should turn the module OFF – the AMBER light goes out, leaving the GREEN light illuminated.

CONTROL OF BOILER WATER TEMPERATURE

The bulbs of the control thermostats are in the return pipe to each module. The design temperature rise, across each module, is 11°C (20°F), if the water flow is correct.

Operational temperature settings are marked on the thermostat dial.

The thermostat should be adjusted so that the LOWEST module is the LAST to stop firing.

Fig. 5 shows the approximate settings to obtain a mean mixed flow temperature of 82°C (180°F), if the water flow is correct. An increased water flow calls for increased settings.

LIMIT THERMOSTAT

The limit thermostat is located in the flow pipe of each module, and has a fixed setting of 98°C (208°F). If this temperature is exceeded, the thermostat will trip out, the GREEN button will pop out, and the burner will stop firing.

This is the only true indication of limit thermostat Lockout.

The thermostat is reset by pushing the GREEN button.

With the correct flow rate and the control thermostats, or sequence controller, set to operate all modules at their individual flow temperatures (refer Fig. 5), the limit thermostats should not operate through the whole sequencing operation, brought about by reducing the load gradually from maximum to minimum.

Tripping may occur if there is a reduced water flow rate, or if limit thermostats are defective.

In the former case, the boiler should NOT be operated until the correct flow rate has been established – refer Table 2.

In the latter case, turn OFF the gas and electrical supplies to the affected modules until replacement thermostats are fitted.

The module covers should be fitted after the boiler water temperature has stabilised.

Table 3

MAXIMUM ALLOWABLE CO CONTENT

CO_2 % (As Read)	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5
Maximum Allowable CO p.p.m. (As Read)	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105

Annual, and biennial, servicing are recommended.

The procedures are given below:

BEFORE CARRYING OUT ANY SERVICING PROCEDURE –

1. Isolate the boiler electrical supply.
2. Turn OFF the gas service tap on the module being serviced.

Withdraw the electrical socket from the module, unscrew the two 6mm retaining screws, and remove the module cover.

Note:

Visual inspection of the module heat exchanger(s) can be made, at any time, by removing the inspection panel(s) at the side(s) of the boiler.

Unfasten the wing nut, holding the outer plate against the insulation panel.

Remove the six screws, securing the inner plate to the casing, and remove the plate.

The heat exchanger(s) will then be visible for inspection.

REMOVING THE FAN ASSEMBLY AND CONTROL CHASSIS

1. Disconnect the lead to the spark electrode.
2. Disconnect the lead to the flame sensing probe.
3. Disconnect the two Live leads, and the two Neutral leads, from terminals 6 and 7 on the control box. Also disconnect the Earth lead – refer Fig. 16.
4. Undo the fan pressure pipe, at the point where it enters the tee on the proportionator.
5. Undo the Square to Round casting suction pipe – at the proportionator end.
6. Remove the three M8 nuts, securing the fan/controls assembly to the module.
7. Remove the single Pozi Pan Hd screw, securing the switch bracket to the cast iron flow pipe.
8. Withdraw the control thermostat, and limit thermostat, phials from their respective pockets.
9. Withdraw the fan/controls assembly and then, the burner, from the module.

CLEANING THE BURNER

Note:

The following procedure involves replacing three split pins (1/16in. dia. x ¼in. long).

These should be obtained before the burner is dismantled.

1. Unclinch and remove the three split pins at the back end of the burner so that the air distribution cone can be withdrawn from the burner.
2. Carefully brush the inside and outside of the burner and the surface of the air distribution cone.
3. Replace the air distribution cone and lock in position with new split pins.
4. Replace the burner in the module, unless it shows signs of deterioration in which case it should be replaced.

CLEANING THE FAN

Disconnect the fan Live, Neutral and Earth leads from terminals 9, 5 and 3, respectively, on the control box – refer Fig. 16. Note the routing of the leads. Remove the fan assembly from the control chassis by unscrewing the three M4 x 10mm Lg Pozi Pan Hd screws and shakeproof washers.

Note the relative position of the fan motor.

Inspect the fan blades, the inside of both the fan scroll, and the Square to Round casing, paying particular attention to the area around the multi-hole plate. Brush off any accumulation of dirt in these areas, using a SOFT brush.

Refit the fan assembly, ensuring that the fan motor is refitted in its original position. Replace the leads to the control box, ensuring that they are routed as previously.

CLEANING THE MODULE COVER FILTER

The module cover is fitted with a polyurethene foam filter, which forms the bottom panel of the cover. This filter is retained by four spring steel edge clips.

To remove the filter, prize open each clip, (as shown in Fig.17),and release the wire frame of the filter from the clip.

Wash the filter in lukewarm, soapy water. It should then be thoroughly rinsed and allowed to dry.

Refitting is the reversal of the removal procedure.

SERVICING THE SPARK ELECTRODE ASSEMBLY

1. Unscrew the two 4mm nuts, which secure the spark assembly in position.
2. Withdraw the spark assembly and inspect it. If the electrode is reduced in diameter, the assembly should be replaced.
3. Check that the spark gas is set to 4mm (3/32in.).
4. Refit the assembly to the module. Replace, and tighten the two 4mm nuts.

SERVICING THE FLAME SENSING PROBE

1. Undo the 4mm screw, which secures the probe in position, withdraw the probe and inspect it.
2. If the probe is reduced in diameter, or is not straight, it should be replaced.
3. Replace the probe in position, and retighten the 4mm nut.

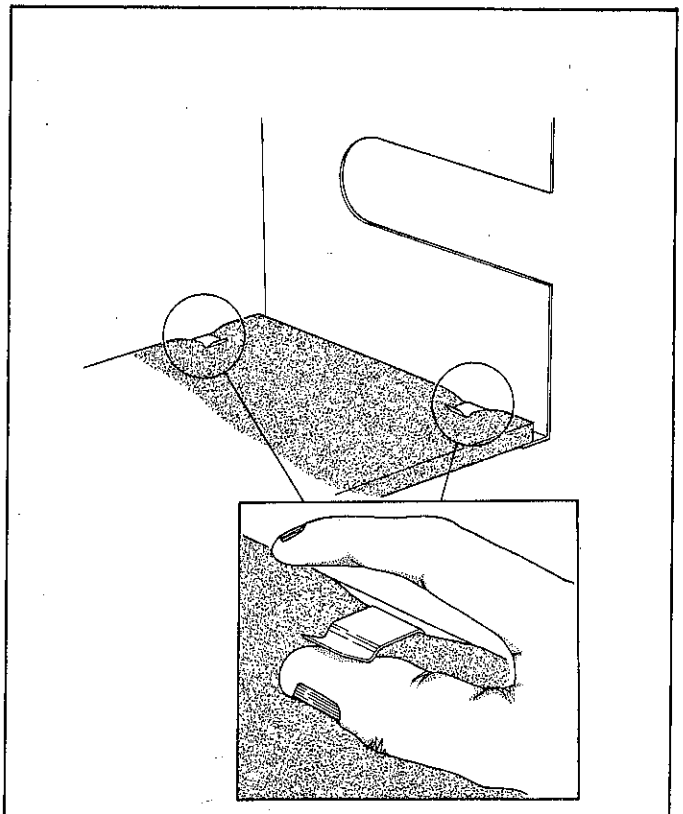


Fig. 17 REMOVAL OF MODULE COVER FILTER

CLEANING THE FAN PRESSURE PIPE AND SQUARE TO ROUND CASTING SUCTION PIPE

Both sensing pipes should be blown through, to ensure that they are clear.

REFITTING THE FAN ASSEMBLY AND CONTROL CHASSIS

The fan assembly, and control chassis, should be fitted back to the module, in the reverse order to that detailed in 'Removing the Fan Assembly and Control Chassis'. If the cork gasket, which seals the fan assembly to the burner, is damaged, it MUST be replaced. Do NOT overtighten the 8mm nuts, or damage to the casing may result.

SERVICING INSTRUCTIONS ~ BIENNIAL

Repeat the annual service – refer previous page, and above.

CLEANING THE HEAT TRANSFER SURFACES

1. Isolate the boiler from the flow, and return, water pipes.
2. Drain the boiler – refer page 20 – 'Water Connections and Pressures'.
3. Uncouple the flanges, connecting the modules to the flow and return headers.
4. Release the Rc¾ (¾in.) union nuts, connecting the gas inlet manifold to the modules.
5. Remove the four 10mm nuts, securing the module to the casing. Pull out the module, and place it on the bench.
6. Remove the screws, holding the gas distribution screen over the finned tubes. Remove the screen.
7. Brush the finned tubes thoroughly, until they are clean.

REASSEMBLY OF THE MODULE

The reverse procedure to that detailed above, should be adopted for reassembly. The gas distribution screen slots MUST be in line with the OUTERMOST points of the finned tubes, and held tightly against the finned tubes, when tightening the screws.

It will usually be more convenient to complete the module assembly on the bench, before it is replaced in the casing.

CLEANING THE MODULE WATERWAYS (Refer Fig. 1)

This will be necessary only, if a lot of makeup water has been used in the system. The most used module should be checked first, to ascertain the degree of lime buildup.

1. Remove the module from the casing.
2. Remove the gas controls assembly, by releasing the pipe clips holding the solenoid valves, and the proportionator, in position.
3. Remove the twelve 8mm bolts, and the centre 8mm bolt, which hold the bottom cover plate in the bottom tube plate.

   The plates can now be separated.
4. The waterways can now be examined.

   If the tubes are scaled, or partially blocked, the top cover plate MUST be removed, by unscrewing the twelve 8mm bolts, disposed around the periphery, and the six 8mm bolts, around the centre.
5. The water passages, in the tube plates, and in the tubes, can now be cleaned.

REASSEMBLY OF THE MODULE AFTER WATER TUBE CLEANING

Take CARE that:

1. The triangular lugs on the cover plate are in register with the corresponding lugs on the header castings.
2. New gaskets should be used between mating flanges.

   The gaskets should be lightly greased before use.
3. Tighten the securing bolts EVENLY.

   A torque of 27.1 N/m (20ft/lbf) should NOT be exceeded.

Re-assembly can then be continued as detailed above.

TROUBLE SHOOTING

Diagnosis, and rectification, of faults, is given in the following paragraphs.

The module covers should be removed by qualified persons ONLY. Extreme CARE MUST BE TAKEN if the boiler is run without covers.

ELECTRICAL SUPPLY

The lamps on each module give an indication of malfunctioning.

If the GREEN light does not show, when the module ON/OFF switch is at ON, check that:

1. The time clock (if fitted) is 'Calling for Heat'.
2. The mains electricity supply is satisfactory, and the fuse is not blown.
3. The plug, and socket, on each module, are making a good connection.

If the above are satisfactory, either the module ON/OFF switch, or the GREEN light, is faulty. Replace as necessary.

THE BURNER DOES NOT ATTEMPT TO START

The correct sequence of operation of the burner is detailed in pages 3 and 7 – Module Operation'.

If the GREEN light is illuminated, and the control thermostat is 'Calling for Heat', both the RED and AMBER lights should become illuminated, and the starting sequence commence.

CONTROL THERMOSTAT

If the AMBER light does not come on, either:

1. The return water temperature is above the set point of the control thermostat.

   If this is not so, then:
2. The control thermostat has failed.

   Isolate the mains. .

   Remove the push-on connectors from the thermostat, and check across the terminal for continuity.

   If an open circuit is apparent, the thermostat should be changed.

LIMIT THERMOSTAT

If, during the start sequence, the AMBER light becomes illuminated, and the RED one does not, it signifies that the

limit thermostat has tripped, because, either:

1. The control thermostat is faulty, and is not switching the module at the set temperature.
2. The water flow, through the module, is insufficient, causing temperature overshoot.
3. The non-adjustable limit thermostat is out of calibration, and requires changing.

The limit thermostat can be reset by pressing the GREEN button, which protrudes from the thermostat cover plate.

CONTROL BOX

If, during the start sequence, the RED light does not become illuminated, after the thermostats have been checked out, there is either:

1. A loose connection at terminal 9, or —
2. The control box is faulty.

Before changing the control box, check that there is voltage between terminals 9 and 5, with the control box unplugged.

Check that the contacts, between the control box and its base, are satisfactory.

FAN

When the GREEN, AMBER and RED lights become illuminated, indicating the start of the sequence, the fan should be HEARD to start.

Should the fan not be heard to start, the fault may be:

1. A faulty connection between the fan and the control box base. Check terminals 9 and 5.
2. A fan motor failure.
3. Impellor jammed.

Remove the fan assembly, and control chassis, from the module. Note the routing of the leads.

Detach the control chassis, and withdraw the motor, complete with impellor, from the fan housing. Undo the Allen screw, and remove the impellor from the motor shaft. A new motor can now be fitted.

Re-assembly is in the reverse order of the above instructions.

NOTE:

ENSURE that the electical leads are routed as previously.

IGNITION TRANSFORMER

After the pre-purge period of 15 seconds, the ignition spark should be HEARD from within the module, for a maximum period of 4 seconds.

If a spark does not occur:

1. Turn the gas tap OFF. Remove the igniter lead from the plug, and test the transformer, by holding the end of the lead 4mm from an Earth. Sparking should occur after the pre-purge period.
2. If there is no spark, check the connection to terminal 1. If this is satisfactory, it means that the transformer has failed.
3. The control box (which contains the transformer) MUST be replaced.

IGNITER

Assuming a satisfactory spark has been obtained from the ignition lead, which is reconnected to the plug:

1. Remove the igniter assembly from the module, and place it on an Earth.
2. Restart the sequence. Sparking should occur, between the electrode and the earth probe.
3. If the spark is tracking to earth elsewhere, the igniter assembly MUST be either replaced or reset.

RESUME

It is now established that the electricity supply, the thermostats, the fan and the ignition are all satisfactory.

If the burner still does not fire, the gas supply must be checked. Ensure the gas tap is ON.

GAS PRESSURE AND INDIVIDUAL MODULE GOVERNORS

A pressure of 16 mbar to 25 mbar (6.5in.w.g. to 10.0in.w.g.) should be available, measured at the manifold, with none, or all, of the modules firing.

The individual module governor, immediately downstream of the service gas tap, should be set to give 14 mbar (5.6in. w.g.), when the solenoid valves open, measured at test point (61), Fig. 4.

For 'Trouble Shooting purposes, this governor may be screwed hard down, to ensure adequate pressure for tests, but MUST be backed off several turns to a true governing position, on final setting up.

SOLENOID VALVES
(Refer Fig. 4)

1. A manometer should be connected to test point (63), Fig. 4. At the end of the start sequence, a pressure of approximately 7.5 mbar (3in.w.g.) should be indicated.

   If no pressure is registered, the gas valves have not opened.
2. Check the output from the control box. Remove the solenoid valve leads from terminals 6 and 7, in the control box, and replace them with the test leads of a voltmeter. The output is rectified 240v, AC, i.e. (half-wave DC). Take a reading, (on the DC scale), as the ignition spark occurs.

   If no voltage reading shows, change the control box.

   If a voltage reading is obtained, but there is no gas pressure at the test point, it indicates that the solenoid valves are failing to open, and MUST be replaced.

PROPORTIONATOR
(Refer Fig. 4)

1. Connect a manometer across the test points (63) and (64), Fig. 4. The pressure difference should be approximately 5.5 mbar (2.2in.w.g.), when the gas pressure, at the inlet to the solenoid, is 14 mbar (5.6in.w.g.).
2. A higher figure indicates insufficient gas going to the burner, and a lower figure indicates too much gas going to it.
3. The flow of gas can be rectified by adjusting the proportionator, as indicated by the 'Firing' instructions in page 22.
4. If the proportionator cannot be adjusted to give the requisite pressure, then it MUST be replaced.

FLAME SENSING PROBE

1. If the burner lights, but the flame is not established by the end of the sequence, the RED light will still be illuminated and the burner will Lockout.
2. The fault may lie with the flame sensing probe, or, the detection circuit in the control box.

   To prove this, remove the lead from the probe and connect a DC micro-ammeter between them.

   The reading should be 6 to 8 micro-amps.
3. If, during the brief flame period, the reading is satisfactory and the burner goes to Lockout, the control box has failed and MUST be replaced.
4. If the reading is not satisfactory, the flame sensing probe must be removed and examined.

   If damaged, or deteriorated, it should be replaced.