



ECONOCAST II CAST IRON BOILERS

**INSTALLATION, OPERATION & MAINTENANCE
DOCUMENTATION**

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FEB1997

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Brief Boiler Specifications

The Econocast II is a cast iron sectional boiler for pressure jet oil firing or forced draught gas firing and is supplied complete with combustion and control equipment. The boiler is supplied in separate sections for assembly on site.

The Boiler is CE Marked On PIN 87AR80 to:-

Gas Directive, Low Voltage Directive, Electromagnetic Compatibility Directive and conforms to the requirements of PrEN 303 Parts 1 and 3 for Boilers, BSEN 676 Gas burners and BSEN 267 Oil burners.

The boiler is suitable for central heating on open vented and pressurised sealed systems or indirect hot water supplies at working pressure of up to 4.0 bar (60 lb/sqin). The boiler must not be used for direct hot water supply.

The Boiler is provided with a comprehensive control panel containing high fire, low fire, and limit thermostats, on/off switch, "boiler on" high fire and low fire lamps, high temperature lock out lamp and control box lock out lamp. Output signals are available for remote indication. An optional pump over-run timer is available for inclusion in the boiler control panel.

All models are available with Nu-Way or Riello Gas or Oil burners and the Gas combinations are CE marked, and other combinations can be supplied.

Location

The boiler should be located on a level foundation of brick or concrete, capable of supporting the weight of the boiler when filled, 100mm high for models (213-433) and 150mm high for models (489-875).

The boiler is cleaned from the front and top, and should be positioned so that adequate access is provided. It is recommended that at least 450mm (18") clearance be allowed between the boiler and the walls of the boiler house. The clearance at the front should be equivalent to the length of the boiler and 1000mm at the rear and top of the boiler.

Where more than one boiler is installed, the distance between them may be 450mm and need not be doubled.

The dimensions and clearances given are intended to indicate the minimum requirements for the boiler(s) only. They do not take into account the space required to install and maintain flues, pipework, pumps and associated equipment.

Shipping Contents

This boiler is supplied in separate sections, and the burner is supplied either in a carton or shrink-wrapped on a pallet or pallets. The jacket is packed in cartons and the insulation in plastic packing.

Other parts are packed in a tea chest. Cleaning tools and tie bars on the larger boilers are packed separately.

NOx

Typical NOx figures depending on the boiler size and burner combinations are as follows :-

Gas : 45 ppm at 9.5 % CO₂ wet.

65 ppm dry air free at 0% O₂.

116 mg/kWh on net boiler input.

Oil : 75 ppm at 12% CO₂ wet.

107 ppm dry air free at 0% O₂.

192 mg/kWh net boiler input.

Design Considerations General

The installation of the boiler must be in accordance with the following regulations :

National and Local Building Regulations The Building Standards (Scotland) (Consolidation) Regulations.

I.E.E. Regulations 16th Edition Local

Water Bye-laws

Local Gas Service Area Recommendations

Local Authority Recommendations

BS5440 Pt1 1978 Flues

BS5440 Pt2 1976 Air Supply

BS6644 1991 Specification for the installation of gas fired hot water boilers of rated input between 60 kW and 2 MW

CP342 Pt2 1974 Code of practice for centralised hot water supply - buildings other than individual dwellings

British Gas Publications :-

IM/2 Purging procedures

IM/5 Soundness testing

IM/16 Installation of gas pipe work and boosters

IM/11 Flues for commercial boilers

Health and Safety Executive Guidance Note PM5 - Automatically controlled steam and hot water boilers

C.I.B.S.E I.H.V.E Guide Part A, B and C.

Boiler Outputs

Table 1

Weight (kg)

MODEL	LENGTH OF BOILER "A"	X	NUMBER OF SECTION	RATED OUTPUT		WEIGHT EMPTY	WEIGHT FULL
				kW	Btu/h		
213	1190	1400	6	213	727,000	1166	1469
268	1355	1566	7	268	914,000	1332	1685
323	1515	1725	8	323	1,102,000	1497	1900
378	1680	1890	9	378	1,290,000	1663	2117
433	1840	2050	10	433	1,477,000	1828	2333
489	2005	2215	11	489	1,668,000	1995	2550
544	2170	2375	12	544	1,856,000	2160	2766
599	2330	2540	13	599	2,044,000	2325	2980
654	2495	2700	14	654	2,231,000	2492	3198
710	2660	2865	15	710	2,427,000	2658	3416
765	2820	3025	16	765	2,610,000	2823	2631
830	2985	3190	17	830	2,798,000	2989	3847
875	3145	3350	18	875	2,985,000	3156	4065

Dimensions

Table 2

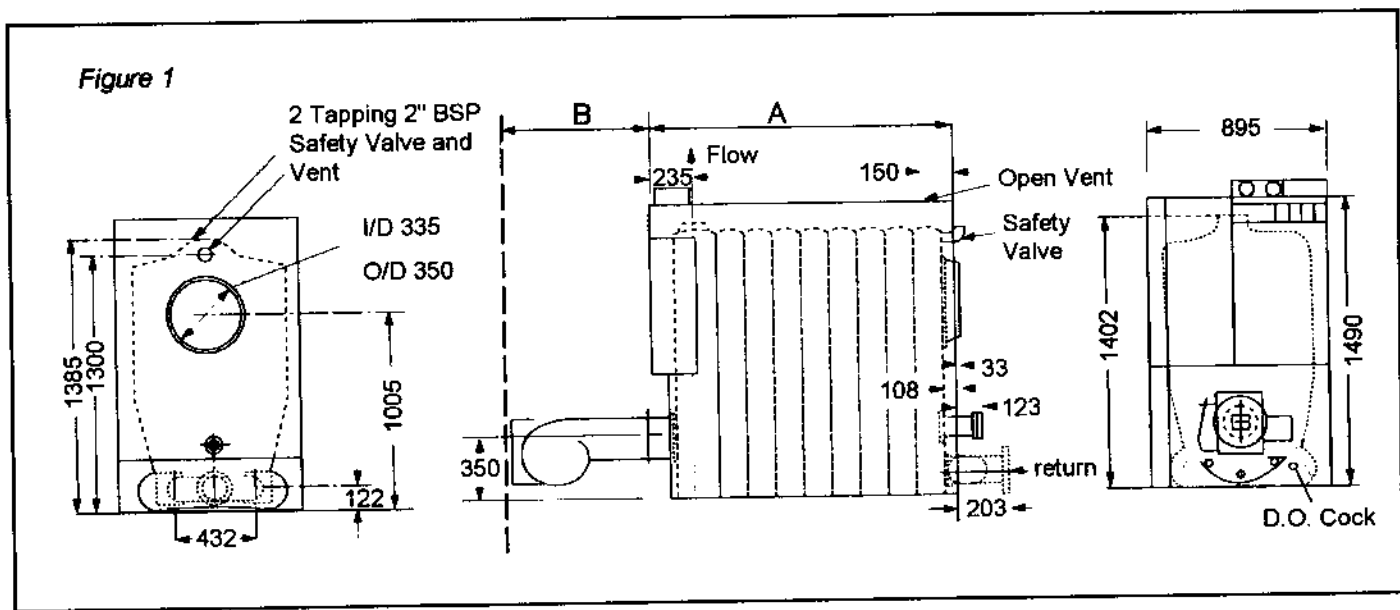
Dimensions (mm)

MODEL	BURNER PROJECTION B mm				NOMINAL FLUE SOCKET SIZE	COMBUSTION CHAMBER RESISTANCE mm.Wg	COMBUSTION CHAMBER DIAMETER mm	COMBUSTION CHAMBER LENGTH mm
	NU WAY		RIELLO					
	OIL	GAS	OIL	GAS				
213	390	580	460	460	300	3.5	500	880
268	390	580	460	460	300	5.6	500	1050
323	390	580	460	460	300	9.0	500	1220
378	580	773	460	460	300	12.0	500	1390
433	580	773	460	460	300	13.5	500	1560
489	580	773	500	840	300	17.5	500	1735
544	580	885	500	840	300	20.2	500	1905
599	560	885	500	840	300	22.5	500	2070
654	560	885	550	840	300	25.0	500	2230
710	542	885	550	840	300	28.0	500	2405
765	686	1180	550	840	300	32.5	500	2570
830	686	1180	550	840	300	38.5	500	2740
875	686	1180	550	840	300	41.0	500	2910

1. Dimension "B" is from the boiler front panel to end of the burner body.

2. The flue socket is nominally 300mm but larger models may require larger flue systems e.g. 875kW may require 400mm flue system.

3. The combustion chamber length measured from front face of front section to the inner face of the back section.



Water Circulation System

The water circulation system should be installed in accordance with the requirements of BS6880.

The flow and return connections are 4" B.S.P. to screwed flanges provided. The flow is from the top of the front section and the return to two connections on the back bottom of the back section. Both of these return connections should be used and a return water header is supplied as shown in figure 1.

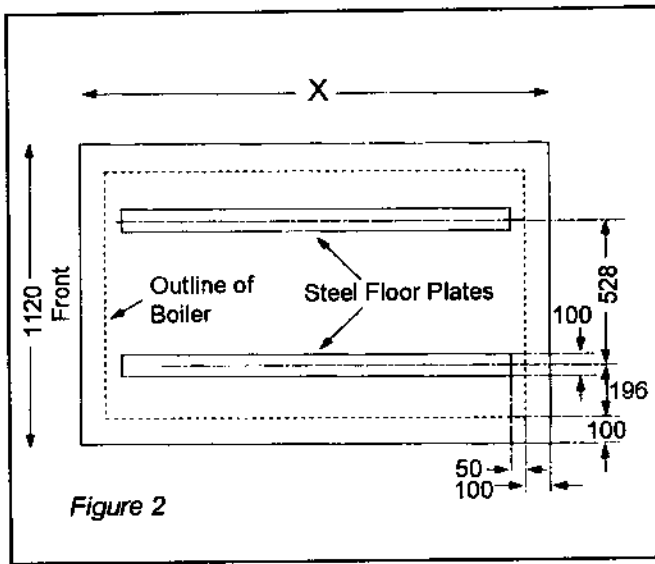
A time delay of approximately 10 minutes should be incorporate between the burner switching off and the cessation of water flow in order to dissipate residual heat and prevent high temperature "lock out". A pump overrun relay is available as an optional extra. If three-way mixing or diverting valves are installed in the system, they should not be of such a type that flow through the boiler is totally interrupted. If fully closing valves are used, a by-pass should be fitted. It is recommended that the minimum flow rate through the boiler is equivalent to a temperature difference between flow and return of 25°K (45°F) at rated output (see table 3).

For satisfactory operation, the pressure including any effect of the circulating pump imposed on the boiler should not be less than 2.0m (6'5") head of water. It is essential when applying the boiler to a system, to avoid by design, a return water temperature falling below 50°C (122°F) which can lead to condensation.

The boiler is supplied with altitude gauge of range 0-4 bar. A 0-1 bar gauge is available and should be specified for low head applications.

The boiler is supplied with thermostats suitable for a maximum flow temperature of 90°C (194°F). The maximum operating temperature is 100°C (212°F) for operation in compliance with the Gas Appliance Directive (120°C for process applications exempt from the Gas Appliance Directive) and thermostats for these applications are available and should be specified, if required.

In all cases it must be remembered that the boiler flow temperature must be at least 17°C (30°F) below the



saturated steam temperature equivalent to the pressure at the highest point of the system.

Boiler water systems should be thoroughly flushed and cleaned before a new boiler is installed and system water should be treated by a reputable specialist and best practice observed. Consideration should be given to the fitting of sludge traps and strainers if site conditions require them.

Oil Supply

The boiler is suitable for 28 Second Kerosene and 35 Second Gas Oil and this should be specified when ordering.

A single pipe oil supply with the oil available at a slight positive pressure is generally required though the burners own oil pumps can provide some lift of the oil depending on the volume flow and the lift required.

For dual fuel burners a two pipe oil supply system is generally recommended unless the burner is fitted with an oil pump clutch. An oil filter and isolating valve should be provided and the burner connected to the oil supply with a flexible oil hose. The hose and filter are generally supplied with the burner.

Gas Supply

The installation must be in accordance with the regulations given under Design Considerations General.

The local gas supply authority should always be contacted at the design stage to ensure an adequate supply is available. An existing service pipe must not be used without prior consultation with the local gas supply authority and the supply must be made through a suitable meter.

The boilers generally require a minimum inlet gas pressure at the boiler gas inlet of 17.5 mbar (7.0 in.wg), though some larger models do require gas boosters (see table 6).

A gas isolating valve and union should be provided.

Flue

The installation must be in accordance with the regulations given under Design Considerations General.

The nominal size should not be less than that of the boiler flue connection socket and the flue must be self supporting as the flue socket is non load bearing. The nominal flue socket is inside diameter of 300mm but larger boilers will require larger flue systems.

The flue gas volumes given in table 5 are quoted at S.T.P (Standard Temperature and Pressure of 15 deg. C and 1013.5 m.bar).

The flue should be designed to give a draught of just balanced (zero) at the boiler flue socket as the burners are designed to overcome all of the combustion chamber resistance.

Ventilation

The installation must be in accordance with the regulations given under Design Considerations General.

For natural ventilation grilles with the minimum free areas as given in table 5 which are based on BS6644 for a single boiler should be provided at low and high level.

For exposed boiler houses grilles should be provided on two or more external walls and care should be taken in siting boilers so that they are not affected by adverse draughts or situated next to powerful fans or other such equipment.

For underground boiler houses or those where communication with the outside is not possible then mechanical ventilation may be used. Volumes of air for mechanical ventilation are given in table 5 for a single boiler and are based on BS6644.

For mechanically ventilated boiler houses it is possible to have mechanical inlet air at low level and natural extract air at high level and all volumes and grilles should be designed on the values given in table 5. It is not allowed to have natural inlet air and mechanical extract. In all cases of mechanical ventilation the fans should be interlocked so that the boiler will not run unless the fans are running.

The figures quoted in tables are based on BS6644 for single boilers and are generally suitable for oil fired boilers.

Table 3

MODEL	MINIMUM RECOMMENDED FLOW AT 25K AT FLOW / RETURN AT RATING		EQUIVALENT TO 20K AT FLOW / RETURN AT RATING		EQUIVALENT TO 11K AT FLOW / RETURN AT RATING		WATER CONTENT	
	AP m.bar	FLOW l/s	AP m.bar	FLOW l/s	AP m.bar	FLOW l/s	Litres	Gallons
213	2	2.1	2.5	2.5	4	4.6	302	66
268	3	2.6	5	3.2	16	5.8	353	78
323	5	3.1	11	3.8	30	7.0	404	89
378	9	3.6	15	4.5	39	8.2	454	100
433	12	4.2	21	5.2	58	9.4	505	111
489	15	4.7	26	5.8	72	10.6	555	122
544	18	5.2	31	6.5	86	11.8	605	133
599	21	5.8	34	7.2	98	12.9	656	144
654	24	6.2	40	7.8	112	14.2	706	155
710	30	6.8	46	8.5	126	15.4	757	167
765	37	7.4	51	9.1	140	16.6	807	178
830	49	7.9	56	9.9	166	17.9	858	189
875	58	8.4	61	10.4	184	18.9	908	200

Heat Inputs And Firing Rates

Table 4a

MODEL	HEAT OUTPUT HIGH FIRE		HEAT INPUT - HIGH FIRE				FIRING RATES - HIGH FIRE			
			OIL*		GAS**		OIL*		GAS**	
	kW	Btu/h	kW	Btu/h	kW	Btu/h	l/h	Imp/GPH	cu.M /h	cu.ft /h
213	213	727,000	260	887,000	269	917,000	24.5	5.40	25.6	904
268	268	914,000	327	1,155,000	338	1,156,000	30.8	6.80	31.6	1115
323	323	1,102,000	394	1,344,000	409	1,429,000	37.2	8.20	38.3	1351
378	378	1,129,000	461	1,573,000	478	1,613,000	43.5	9.60	44.8	1581
433	433	1,477,000	528	1,801,000	548	1,869,000	49.8	10.95	51.2	1807
489	489	1,668,000	596	2,034,000	618	2,111,000	56.2	12.35	57.8	2040
544	544	1,856,000	663	2,263,000	688	2,349,000	62.5	13.75	64.4	2273
599	599	2,044,000	731	2,493,000	757	2,587,000	69.0	15.20	71.0	2506
654	654	2,231,000	798	2,721,000	828	2,824,000	75.3	16.55	77.4	2732
710	710	2,427,000	866	2,960,000	898	3,072,000	81.7	18.00	84.1	2968
765	765	2,610,000	933	3,183,000	967	3,303,000	88.0	19.35	90.5	3194
830	830	2,798,000	1012	3,412,000	1050	3,541,000	95.5	21.00	98.2	3466
875	875	2,985,000	1067	3,640,000	1107	3,778,000	100.7	22.15	103.8	3664

* Class D Oil (Gas Oil) ** Natural Gas

Table 4b

MODEL	HEAT OUTPUT ***LOW FIRE		HEAT INPUT - LOW FIRE				FIRING RATES - LOW FIRE			
			OIL*		GAS**		OIL*		GAS**	
	kW	Btu/h	kW	Btu/h	kW	Btu/h	l/h	Imp/GPH	cu.M /h	cu.ft /h
213	130	437,000	156	532,000	161	550,000	14.7	3.2	15.1	533
268	162	549,000	196	669,000	202	689,000	18.5	4.1	19.0	671
323	196.5	662,000	237	809,000	245	837,000	22.3	4.9	22.9	808
378	230	774,000	277	845,000	286	857,000	26.1	5.7	26.8	946
433	264	887,000	317	1,082,000	329	1,122,000	29.9	6.6	30.7	1084
489	298	1,000,000	357	1,218,000	370	1,262,000	33.7	7.4	34.7	1225
544	331.5	1,112,000	400	1,365,000	412	1,405,000	37.5	8.2	38.6	1363
599	365	1,225,000	438	1,494,000	454	1,552,000	41.4	9.1	42.6	1504
654	399.5	1,337,000	478	1,631,000	497	1,694,000	45.2	9.9	46.6	2000
710	433	1,453,000	520	1,774,000	539	1,838,000	49.0	10.8	50.4	1779
765	465.5	1,566,000	560	1,911,000	580	1,981,000	52.8	11.6	54.3	1917
830	505	1,699,000	607	2,071,000	630	2,149,000	57.3	12.6	58.9	2079
875	534	1,791,000	640	2,184,000	664	2,266,000	60.4	13.3	62.3	2199

* Class D Oil (Gas Oil) ** Natural Gas

***Low fire is typically 60% of high fire.

Flue Gas Volume

Table 5

MODEL	FLUE GAS VOLUME at STP				VENTILATION					
	OIL		GAS		NATURAL		MECHANICAL			
	l/s	Cuft /m	l/s	Cuft /m	LOW LEVEL	HIGH LEVEL	INLET AIR		EXTRACT AIR	
					Squ. cm	Squ. cm	l/s	Cuft /m	l/s	Cuft /m
213	88	186	92	195	1467	734	239	507	160	339
268	110	234	116	246	1778	889	302	640	202	428
323	133	283	141	299	2088	1044	364	771	244	517
378	156	331	165	350	2399	1119	426	903	285	604
433	178	379	189	401	2705	1353	487	1032	326	691
489	201	428	213	453	3020	1510	550	1166	369	782
544	224	525	238	506	3300	1665	612	1297	410	869
599	247	525	262	556	3641	1821	674	1428	452	958
654	270	573	286	610	3951	1976	736	1560	493	1045
710	293	622	315	662	4266	2133	799	1693	535	1134
765	315	670	334	710	4572	2286	861	1825	577	1233
830	342	727	362	771	4941	2471	934	1979	626	1326
875	361	767	383	815	5193	2597	985	2087	660	1399

Burner Electrical Details

Table 6a Nuway Burner Matching

BOILER MODEL	NUWAY GAS BURNER MODEL	NUWAY OIL BURNER MODEL	START CURRENT		RUN (F.L.C) CURRENT				MAIN FUSE		NOISE LEVEL	GAS INLET SIZE
			1 Ph	3 Ph	1 Ph	3 Ph	1 Ph	3 Ph	1 Ph	3 Ph		
			Amp	Amp	Amp	Amp	Amp	Amp	Amp	Amp	dBA	in.BSP
213	NG 9	NOL13	15	3.5	1.75	0.75	10	5	72	1.25"		
268	NG 13	NOL13	15	3.5	1.75	0.75	10	5	72	1.5"		
323	NG 13	NOL20	15 22	3.5 9	1.75 4.5	0.75 1.8	10 15	5 6	72 76	1.5"		
378	NG 15	NOL20	22	11 9	4.8	1.8	15	10 6	76	1.5"		
433	NG 25	NOL25	22	11 9	4.8	1.8	15	10	76	2"		
489	NG 25	NOL25	22	11 9	4.8	1.8	15	10	76	2"		
544	NG 35	NOL25	-	15	15	2.5	-	HRC10	86	2"		
599	NG 35	NOL30	-	15	15	2.5	-	HRC10	86	2"		
654	NG 35	NOL30	-	15	15	2.5	-	HRC10	86	2"		
710	NG 35**	NOL35	-	15	15	2.5	-	HRC10	86	2"		
765	NG 45**	NOL50	-	25	25	4.6	-	HRC10	90	2"		
830	NG 45**	NOL50	-	25	25	4.6	-	HRC10	90	2.5"		
875	NG 45**	NOL50	-	25	25	4.6	-	HRC10	90	2.5"		

* Single phase only available
Single Phase 220-240 V AC

** Large gas burners which require gas booster
3 Phase 380-415 V AC

Table 6b Riello Burner

BOILER MODEL	BURNER MODEL	BURNER MODEL	START CURRENT		RUN (F.L.C) CURRENT		MAIN FUSE		NOISE LEVEL	GAS INLET SIZE
			1Ph	3Ph	1Ph	3Ph	1Ph	3Ph		
			Amp	Amp	Amp	Amp	Amp	Amp		
213	RS28*	RL28	5.0	-	2.1	-	7.5		68	1.5"
268	RS38	RL28	11.5	5.5 N/A	2.9	2.0	15	12 N/A	70	1.5"
323	RS38	RL38	11.0	5.5	2.9	2.0	15	12	70	1.5"
378	RS50	RL50	-	8	-	3	-	12	72	1.5"
433	RS50	RL50	-	8	-	3	-	12	72	2"
489	RS70	RL50	-	25	-	4.8	-	13	75	2"
544	RS70	RL70	-	25	-	4.8	-	13	75	2"
599	RS70	RL70	-	25	-	4.8	-	13	75	2"
654	RS70	RL70	-	25	-	4.8	-	13	77	2"
710	RS100	RL100	-	28	-	5.9	-	20	80	2"
765	RS100	RL100	-	28	-	5.9	-	20	80	2"
830	RS100**	RL100	-	28	-	5.9	-	20	80	2.5"
875	RS100**	RL100	-	28	-	5.9	-	20	80	2.5"

* Single phase only available
Single Phase 220-240 V AC

** Large gas burners which require gas booster
3 Phase 380-415 V AC

Electrical Supply

1. The main electrical supply should be taken from a fused isolator having a minimum contact separation between the poles of 3mm and taken through 16mm electrical conduit to the Live (1), neutral (2) and earth connection in the boiler control panel or burner terminal block and the connectors should be such that in the event of the cable being pulled out the current carrying cables become taught and pull out before the earth conducting wire.

For all 3 phase or 1 phase burners with a run current > 6A fig 4a applies and for all 1 phase burners with run current <6A fig 4b applies.

2. All wire should be suitable for a service temperature of 70°C and a load of 10 Amp and have a minimum cross sectional area of 1.0mm². All electrical installations should be in accordance with I.E.E Regulations.

THIS APPLIANCE MUST BE EARTHED

Electrical Safety Checks

Carry out the following electrical safety checks using a multimeter.

(Do not use a PAT Tester on the pressure jet burners control pack as you could damage the electronics and they give false readings).

Short Circuit Check

1. Appliance must be electrically disconnected from the mains and all appliance switches set to "ON" including the thermostats.
2. Set the meter to the Ohms scale x1 and measure the resistance between the Live (1) and neutral (2) terminals in the boiler control panel. If the meter reads zero then there is a direct short circuit and a fault that should be rectified.
3. Set the meter to the Ohms x100 scale and measure the resistance between the Live terminal (1) and the earth block in the boiler control panel. If the meter reads less than infinity then there is a fault that requires rectifying.

Earth Continuity Check

1. Appliance must be electrically disconnected from the mains.
2. Set the meter to Ohms x1 scale and zero if necessary.
3. Measure resistance between the earth connection point in the boiler control panel and the earth contact point in the supply junction box.
4. If the resistance is greater than 0.1 Ohm check all earth wires and connections for continuity and that they are clean and tight and rectify as necessary.

Resistance to Earth Check

The appliance must be disconnected from the mains supply and all switches including the thermostats set to "ON".

1. Set the meter to the Ohms x100 scale.
2. Measure the resistance between the Live (1) and the earth block. The reading should be infinity and if there is any other reading then there is a fault which should be isolated and rectified.

Burner Electrical Connections

Fig 4a Electrical Installation :

All 3 Phase And 1 Phase Burners With Run Current Above 6 Amp.

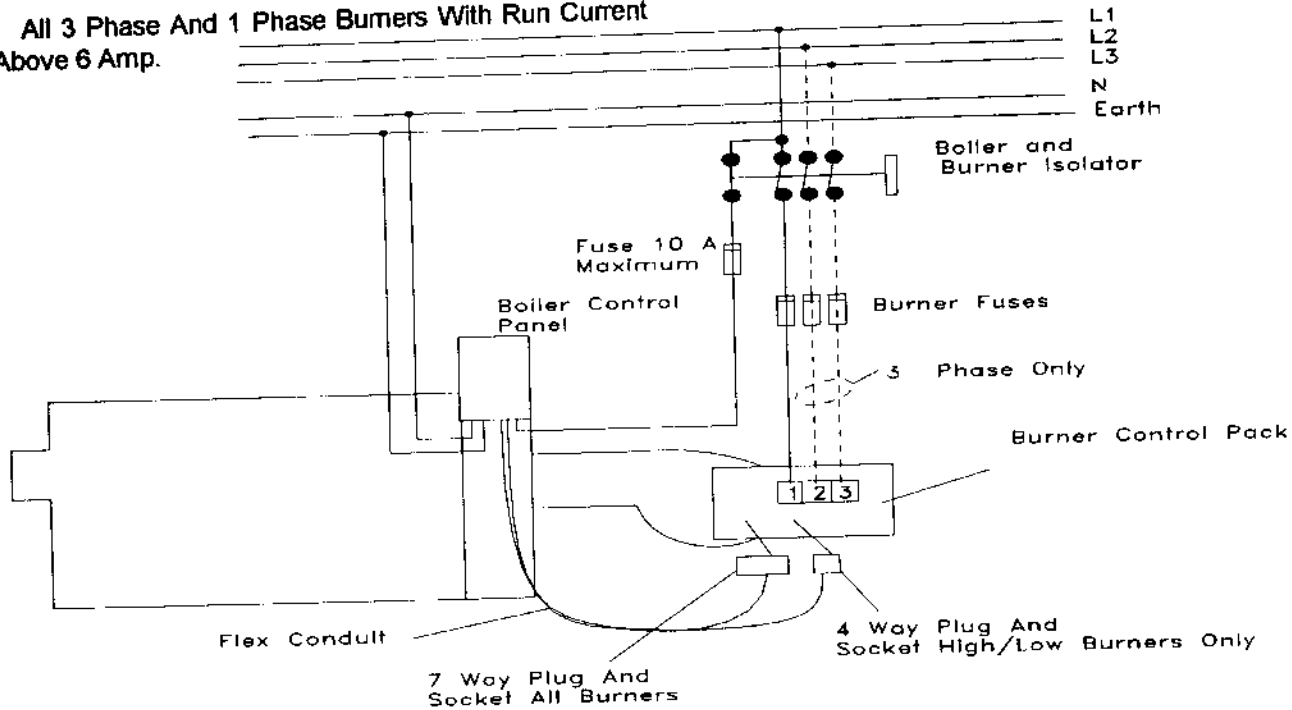
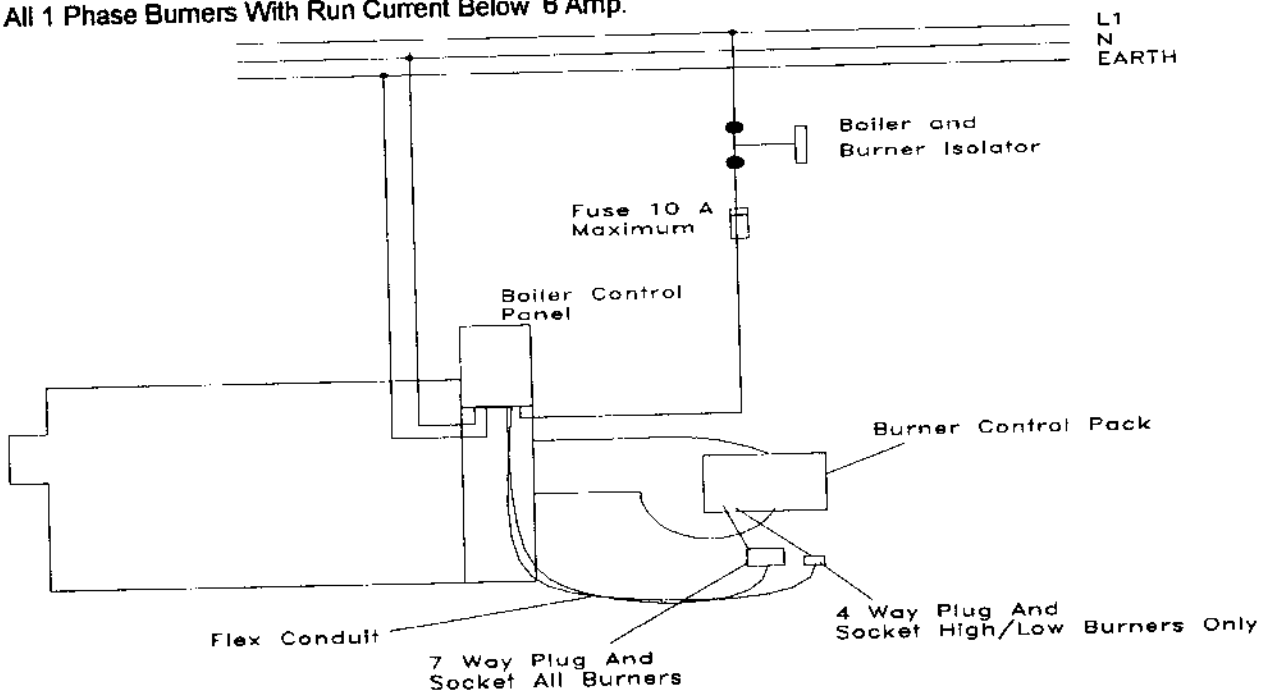


Fig 4b Electrical Installation :

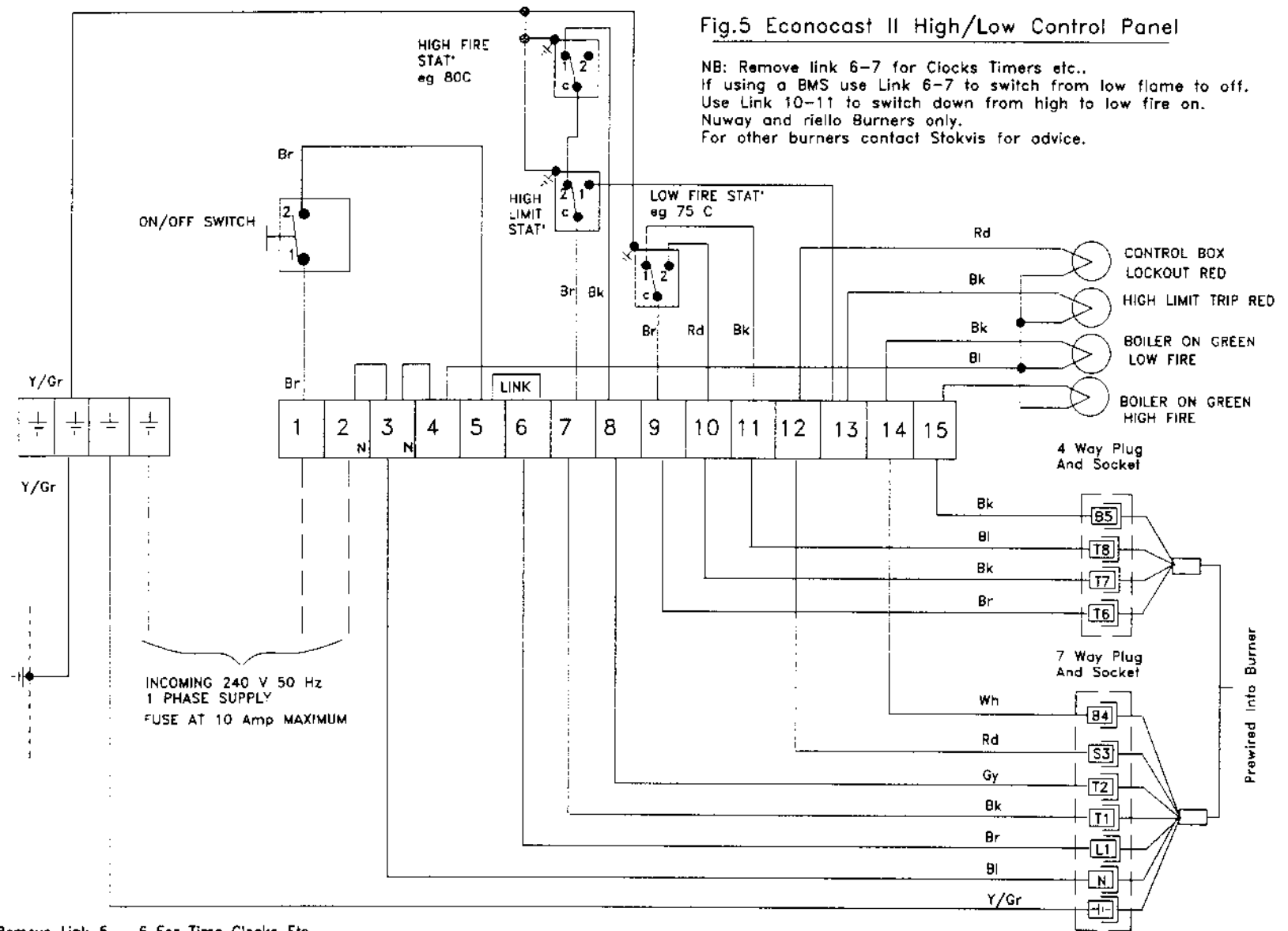
All 1 Phase Burners With Run Current Below 6 Amp.



Polarity Check

Connect the appliance to the mains supply and set the meter to AC volts by 300V scale.

1. Measure the voltage between the Live (1) and Neutral (2) terminals and check that the voltage measures approximately 240V.
2. Measure the voltage between the Live (1) and earth block and check that the voltage measures approximately 240V. When doing this if earth fault detection equipment is installed in the distribution board you may well trip it on some types of multimeter.
3. Measure the voltage between earth and Neutral (2) and check that the voltage measures less than 15V.

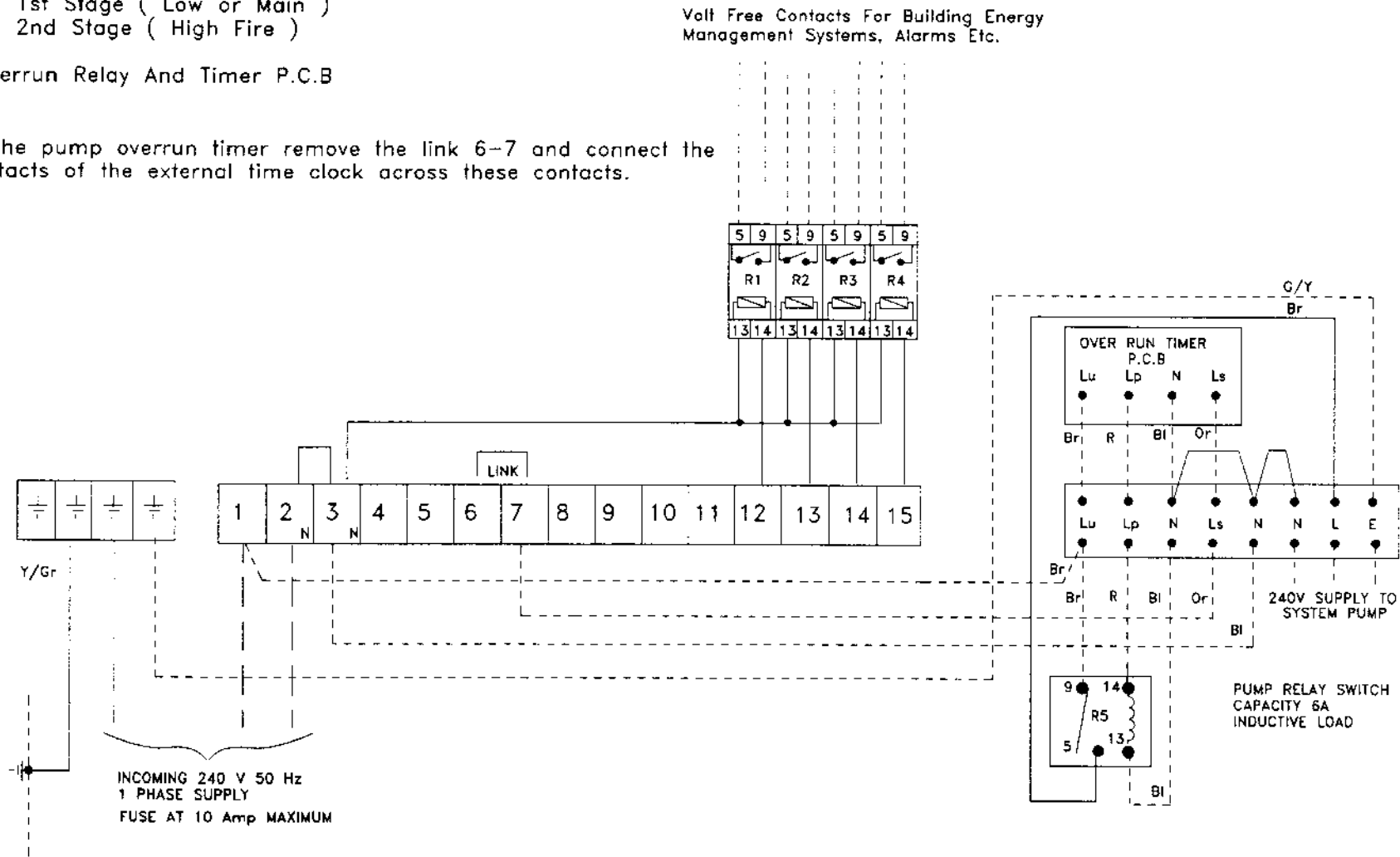


NB: Remove Link 5 - 6 For Time Clocks Etc.

Fig.5 Control Panel Optional Extras

- R1 Burner Control Box Lockout
- R2 High Limit Stat' Trip
- R3 Boiler On 1st Stage (Low or Main)
- R4 Boiler On 2nd Stage (High Fire)
- R5 Pump Overrun Relay And Timer P.C.B

When using the pump overrun timer remove the link 6-7 and connect the volt free contacts of the external time clock across these contacts.



General Assembly of Boiler

Boilers are sent out in separate sections to be assembled on site. Accompanying the sections are packages containing the following:

1. Instrument panel
2. Jacket parts
3. Insulation
4. Nipples, Flue baffles, Etc.
5. Tie rods and casing frame

Foundation

The boiler should be erected on a level foundation of brick and concrete (see figure 2), capable of supporting the weight of the boiler, filled (see table 1). On an existing foundation it may be necessary to provide shims to obtain a level footing.

Water Connections

Flow and Return connections are screwed 4" B.S.P. The flow connection should be made to the top of the front section and the return connection to the bottom rear of the back section into the return header (41). These connections are flanged and counter flanges are provided.

The safety valve and the open vent may be made to the two off 1½" connections on the top of the back section for this purpose, see figure 1.

Boiler Assembly

(Bracketed numbers refer to key numbers in figure 13)

1. The boiler consists of front (1), back (2) and middle (3) sections. All middle sections are identical.
2. If it is found to be more convenient for handling, the flue door (4) on the front section may be removed.
3. Place the floor plates (8) in position on the foundation as indicated in figure 2 at 528mm centres.

Note: On boilers of 10 sections and over, two or three plates are provided for each side.

4. Place the back section (2) in position on the floor plates (8), with the back face of the section in line with the end of the plates. Support the section in the vertical position (figure 5).

5. All nipples and nipple holes should be wiped clean and checked carefully for damage such as bruises before assembling as no responsibility can be accepted for leaks attributed to damaged nipples afterwards.

The nipples are cast iron and they should be lightly coated

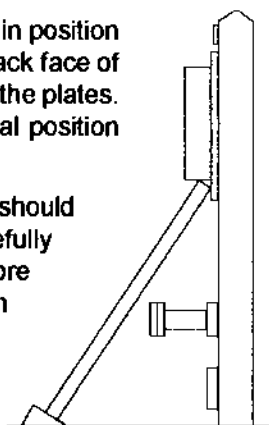
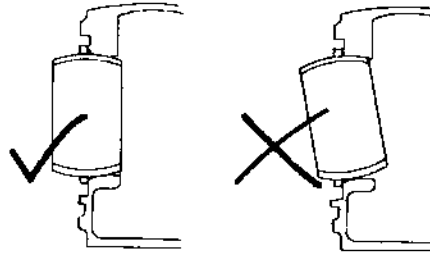


Figure 7

in machine oil (not supplied) to aid assembly but jointing compound is not required.

6. Insert a set of nipples (9) into the nipple holes of the back section and ensure that they are inserted squarely as shown in figure 8.

Figure 8



7. Apply Sealing Strip to the back face of the first middle section. The back face is flush, the front face has raised fins on it. The Seal Strip is supplied on rolls of 2 or 3 strips and the "Use By Date" should be checked. Each strip off a roll is sufficient to make one joint. In cold weather the Seal Strip may not stick sufficiently to cast iron and may be "glued" on with general purpose silicon sealant. Care should be taken not to compress the seal or get dirt on it.

The Seal Strip is applied in 4 areas (figure 7):-

- a) To the sides of the section in the two channels that go all the way around and one of which goes below the bottom nipples. It is important to go all the way up to the top and cut back if necessary after the boiler has been assembled rather than finish short.
- b) The lips of the channels have two small gaps in them down each side to allow crow bars to be inserted if the boiler ever needs stripping. In these gaps the Seal Strip should be applied in a double thickness to ensure a seal.
- c) Two separate strips are run across the top of the top nipple port and it is essential that the top run is continued to come down vertically at the edge of the run down by about 50mm (figure 7).
- d) A run is made in the channel around the tear drop shaped centre flue way and up around the side of the nipple port.

8. Place the middle section (3) on the floor plates (8) with the Sealing Strip facing the back section. Ensure that the Seal Strip remains in position and lift the middle section onto the nipples in the back section with a bar. Care should be taken that the Seal Strip does not become dragged into a nipple hole.

Insert the 4 tie bolts through the lugs with one washer under the head. The bolt should run front to back on the left hand side and back to front on the right hand side. This will make tightening them up easier because the spanner (typically with 20 inch handles) will then be pulled downwards (see figure 8).

Fit the nuts with two washers and use some oil on the threads to help stop binding.

Tighten the nuts evenly so that the four gaps around the nipples remain the same and the section remains plumb as it is pulled up.

The correct position will be achieved when the gap between the sections is 5mm and the distance between the mould lines on the edge of the sections is 165mm. The gap should never be less than 3mm or more than 6mm. A useful technique is to put an M5 screw into the gap at say four places and pull up until the sections grip the screw.

IMPORTANT

In order to assist in the manipulation of the sections, gaps have been introduced into the outer beads at the upper and lower index positions. It is important that a double thickness of sealing strip, about 150mm in length, is applied in these locations to the inner and outer grooves.

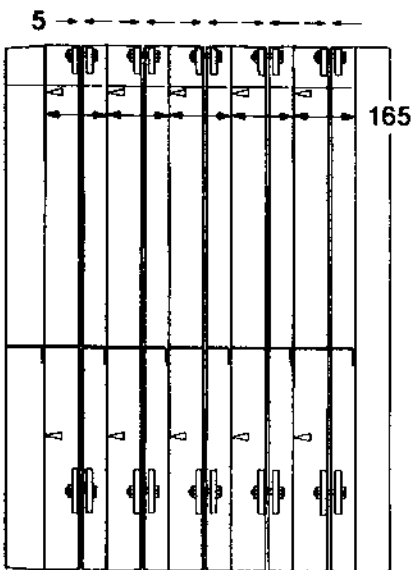


Figure 9

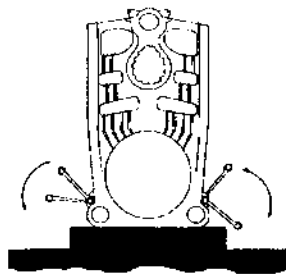


Figure 10

Table 7

Section	Output (kW)	Overall Length of Rod mm	Number of Baffle Plates
6	213	295	3
7	268	1090	3
8	323	1250	4
9	278	1410	4
10	433	1570	5
11	489	1730	5
12	544	1890	6
13 - 18	Flue Baffle Not Fitted		

9. Continue erection of the remaining sections in a similar manner, ensuring that each joint is correctly sealed with the Sealing Strip.

On reaching the front section (1) special care must be taken because of the extra weight and that the nipples are not disturbed as the section lifts onto them (figure 8).

10. When all the sections are assembled the nuts must be slackened off half a turn.

11. After erection of the section the drain cock (13) may be fitted to the bottom left hand tapping of the front section. The flow and returns, vent, safety valve, thermostat and altitude gauge tappings should be plugged and the boiler hydraulically tested. Test pressure should be 1½ times the working pressure.

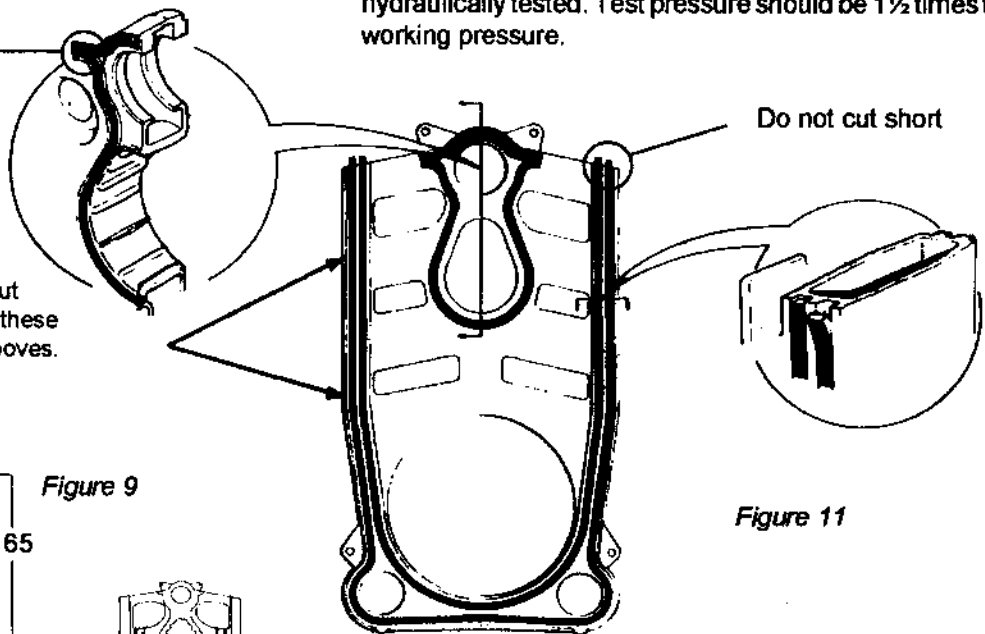


Figure 11

In accordance with good practice, flush the boiler thoroughly after assembly and before connection to the system.

Other Important Safety Precautions

It is extremely important to maintain the stability of a loose section standing in the vertical position. This generally is achieved by the appropriate use of chocks and baulks of timber.

The stability of loose or loosened boiler sections or components is particularly important during the dismantling, partial or otherwise, of an old installation.

Supporting props MUST be used.

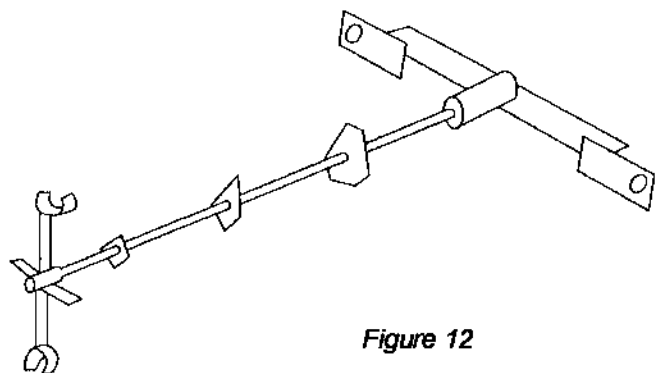


Figure 12

12. On 6/213 to 12/544 boilers, flue baffles are used in the final pass of the boiler.

On such boilers the rear flue baffle support will be pre-fitted into the flue socket (42) (figure 13).

The flue baffle consists of a number of plates welded onto a rod. The largest plate must always be at the back of the boiler and the smallest one at the front end.

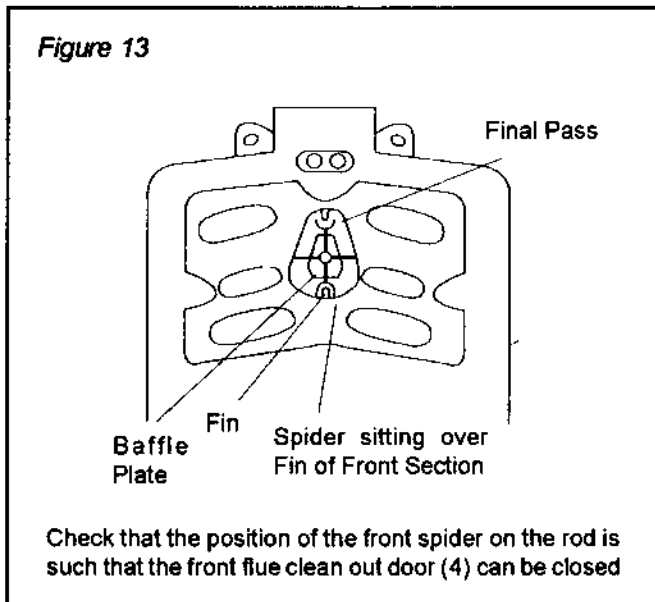
First check with table 8 that the correct baffle has been supplied:-

Take the baffle and add on an M12 nut and washer to the front end (without a point and with the smallest baffle plate).

Add the front support spider and add another M12 nut and washer to grip the spider.

Place the baffle assembly into the final position of the boiler locating the point of the bar into the tube on the rear support.

The front support spider should be adjusted so that it is sitting on the fins of the front section (figure 13).



Platwork and mounting

Fit the top flue covers (14) to the cleaning ports on the shoulders of the boiler. Ensure that each cover is fitted with a gasket (15). The two covers with the short dogs (16) fit in the back cleaning ports (17). Drop the cover into position. Turn the dog (16) or (18) to engage in the recess under the top waterway (19) and tighten the wing nut (43) (figure 12).

Fit the burner mounting plate (21) complete with quarl (22) and gaskets (23) to the front section (1) using M12 hexagon nuts.

Fit the "half-moon" clean-out cover (24) below the burner plate, using M12 wing nuts (25).

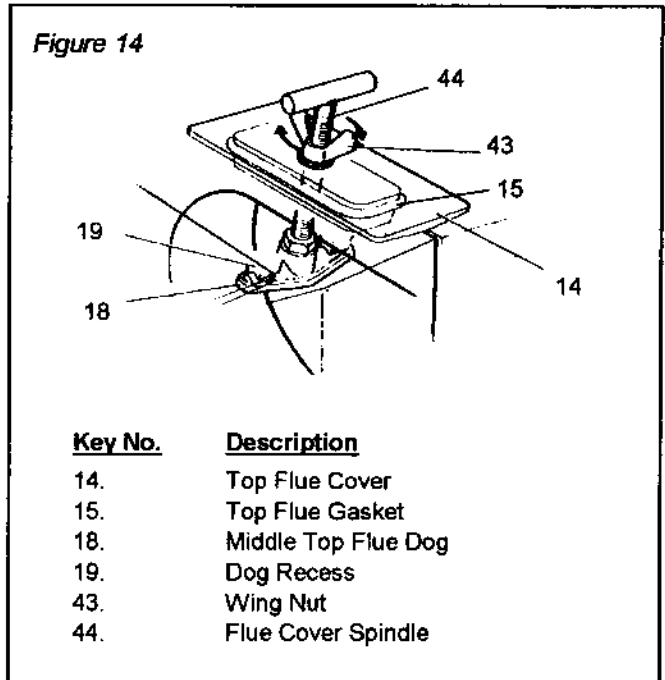
Should the rear cover plate (26) carrying the sight glass (27) be removed from the back section, ensure that the refractory plug (28) is inserted before the cover plate is replaced.

Fit the 2" B.S.P x 215mm pipe (29) in the back of the back section at the top. To this pipe fit the 2" F & F elbow (30) and bush down the outlet of the elbow (31), if necessary, to accept the safety valve (32) using a hexagonal nipple (33).

Fit the 1/4" self isolating valve (35) to the tapping (36) on the left hand top shoulder of the front section (1).

Fit the thermometer pocket (37) in the right hand of the two 1/2" tappings in the front of the front section at the top, and the thermostat pocket (38) in the left hand 1/2" tapping. these fittings are packed in the control panel box.

Fit the flow (39) and return (40) connections making sure that both return connections are utilised. A cast iron return header is supplied for this purpose (41).



Fitting of Insulation

(Bracketed numbers refer to figures 15 and 16)

Fit the four angle plate jacket support brackets (53 and 54) to the sides of the front and back sections using an M8 all thread stud, nuts and two washers. The brackets with the spring clips (55) are the front brackets (53). The front and rear brackets project from the boiler in front of the fixing screw (56).

Position the aluminium faced insulation panels (57) on each side of the boiler, between the jacket brackets, with the support wires to the top.

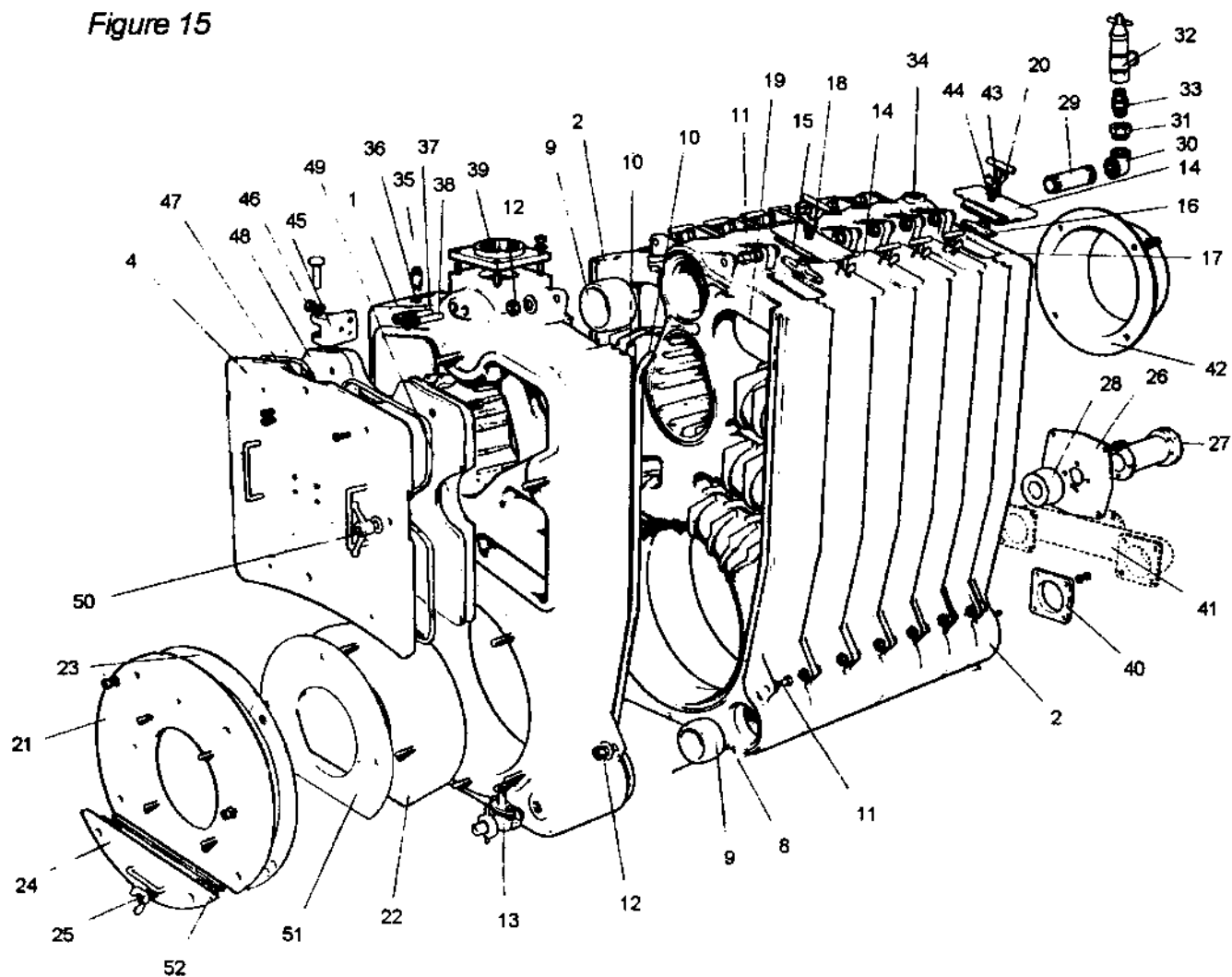
Support the insulation panels clear of the floor and close to the top corner of the section, by joining the support wires together at the top of the boiler. Ensure that the wires are clear of the top flue covers.

Fit the rear insulation panel to the back section.

Stretch two expanding wires (58) along each side, attaching with hooks to the small holes at the top and half way down the jacket brackets (53 and 54). This will retain the insulation close to the boiler. Stretch three expanding wires across the rear insulation panel at convenient positions, attaching with hooks to the outside edge of the rear jacket brackets (53 and 54).

Lay the cloth covered insulation panels (59) along the top of the boiler. The two panels with cut-outs being at the front and rear.

Figure 15



Key Description

1.	Front Section	18.	Middle Top Flue Dog	35.	1/4" B.S.P. Ballofix Valve
2.	Back Section	19.	Dog Recess	36.	Valve Tapping for Ballofix
3.	Middle Section	20.	Top Flue Wing Nut	37.	Thermometer Pocket
4.	Flue Door	21.	Bumer Mounting Plate	38.	Thermostat Pocket
8.	Floor Plates	22.	Quarl	39.	4" B.S.P. Flow Flange
9.	Nipples Top 135mm Bottom 112mm	23.	Quarl Gasket	40.	4" B.S.P. Return Flange
10.	Sealing Strip	24.	Bottom Clean Out Plate	41.	4" B.S.P. 701 Return Header
11.	Bolts M16 x 100	25.	Clean Out Plate Wing Nuts	42.	Flue Socket 300mm (12")
12.	Nuts and Washers	26.	Rear Cover Plate	43.	Wing Nut
13.	D.O. Cock	27.	Sight Glass	44.	Flue Cover Spindle
14.	Top Flue Covers	28.	Refractory Plug	47.	Door Gasket
15.	Top Flue Gaskets	29.	Safety Valve 2" F&F Elbow	48.	Door Back Panel Insulation
16.	Rear Top Flue Dog	31.	Bush	49.	Door Back Panel
17.	Back Flue Port	32.	Safety Valve	50.	Large Wing Nut
		33.	Hex Nipple	51.	Quarl Gasket
		34.	Open Vent Tapping 2" B.S.P.	52.	Bottom Access Door Gasket

Jacket Assembly

Build the jacket support frame by joining the front and back members (61) to the side members (62) with 4 off steel corner brackets and M6 screws. The backs and sides are identical and symmetric.

Fasten the completed frame to the jacket support bracket tops (53 and 54) with 4 off long M6 screws and nuts.

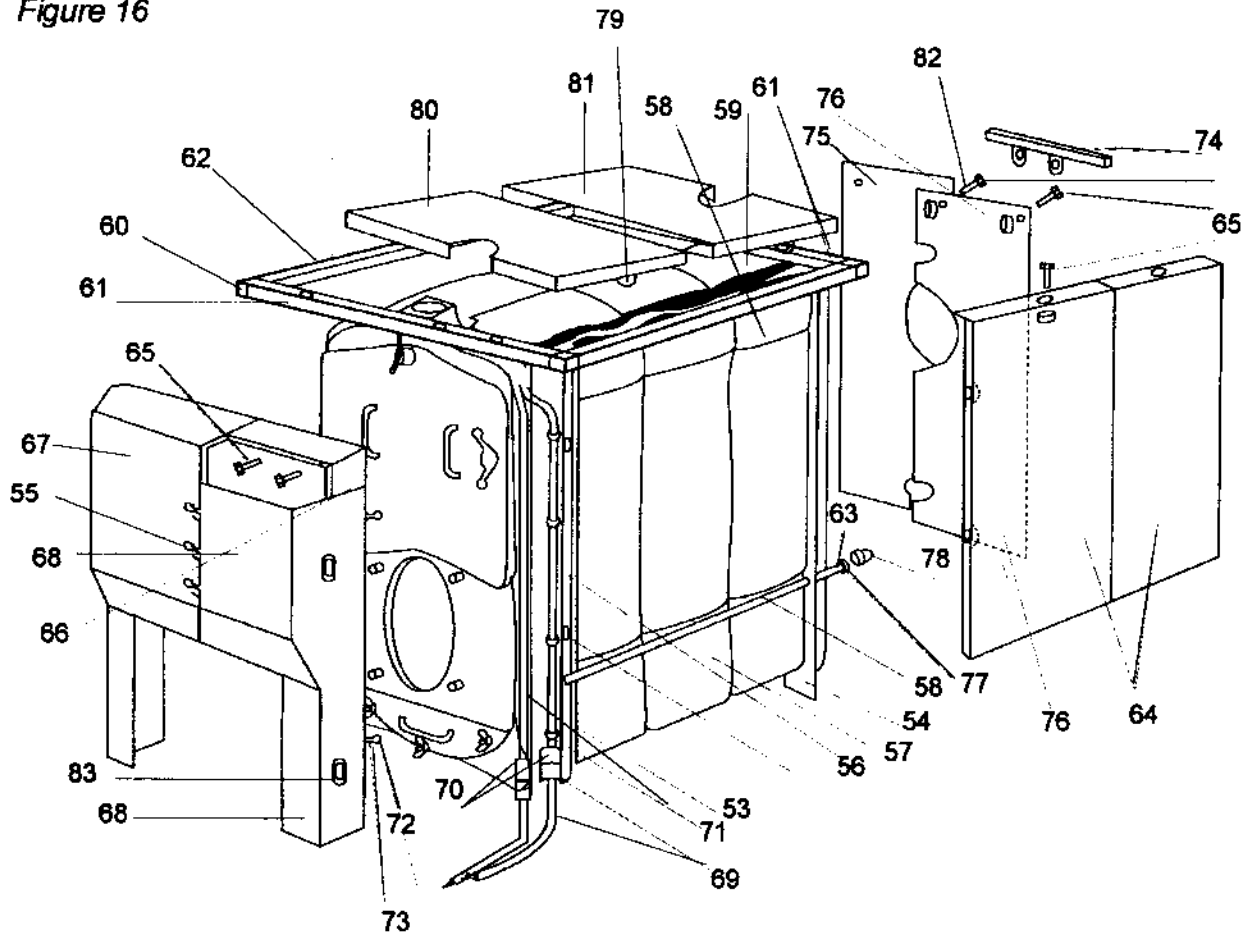
On a 10 to 15 section a frame brace is provided (74) and two off on the 16 to 18 and this should be positioned roughly

in the centre of the boiler or equally spaced to support the side frame members as shown (figure 17).

On larger boilers 2, 4 or 6 coffin shaped jacket spacing brackets should be fitted under the M16 nuts securing the bottom boiler tie bolts. These brackets stop the bottom M8 jacket tie rods from bending in and these tie rods should be threaded through them.

The insulation may require cutting to fit them and they should not clash with the joint between two side panels. They should be equally spaced to support the tie rods evenly.

Figure 16



Key Description

53.	Front Jacket Support Brackets LH and RH	63.	M8 Tie Rod	72.	Ball Stud
54.	Back Jacket Support Brackets LH and RH	64.	Side Panel RH	73.	M5 Screw and Nut
55.	Spring Clips	65.	M6 x 40 Screw and Nut	74.	Jacket Frame Brace
56.	8mm All Thread Stud, Nut and Washer	66.	Top Infill Panel	75.	LH Back Panel
57.	Side Insulation	67.	Front Panel LH	76.	RH Back Panel
58.	Expanding Wire 4 off for Sides	68.	Front Panel RH	77.	M8 Nut and Washer
59.	Cloth Covered Top Insulation	69.	Flying Leads and Wieland Sockets From Burner.	78.	M8 Acorn Nut and Washer
60.	Steel Elbow	70.	Boiler 7 Way and 4 Way Wieland Plugs (Male).	79.	Plastic Foot
61.	Front and Rear Jacket Frame Member	71.	Flex Conduit 16mm.	80.	Top Panel Front
62.	LH and RH Side Jacket Frame Member			81.	Top Panel Rear
				82.	M6 x 10 Screw and Nut
				83.	Plastic Finger Guard

Take a side panel (64) and hang it over the side frame member. There may be between 1 and 4 side panels per side depending on the size of the boiler.

Secure all the side panels to the frame with a long M6 screw and nut, the position of the side panel is determined by these fixing holes.

Take the left hand (25) and right hand (26) back panels and position them on the back of the boiler and fix them together with 3 off M6 screws and nuts (82). Secure the back panels to the rear frame members with 2 off M6 by 40 screws (65).

Take the two M8 tie rods (63) and pass them through the front jacket support bracket, the side panels, the jacket spacers, the rear jacket support bracket and the back panels.

Use an M8 nut and washer (77) to fix the tie rod at the front casing support bracket. Use the acorn nut (78) and washer to fix the tie rod at the back panels and also use an M8 nut and washer as a back nut behind the back panel.

Take the control panel from its packing box and open it up by releasing the two countersunk posidrive screws.

Using 2 off M6 x 10 screws and nuts fix the top infill panel (66) to the back of the control panel.

Using 2 off M6 x 40 screws and nuts fix the control panel to the front frame member on the right hand side. These M6 x 40 screw pass front to back through the frame.

Position the control, high/low and limit thermostat bulb in the thermostat pocket (38) and secure with the fixing clip.

Position the boiler thermometer bulb in the thermometer pocket (37) and secure with the grub screw.

Connect the pressure gauge to the self isolating valve (35). Close the instrument panel and replace the securing screws.

Fit the plastic feet (79) to the top panels. On smaller boilers there is just a front top panel (80) and a rear top panel (81) but on larger models there are intermediate top panels as well. Fit the top panels into position.

Route the Flex Conduit (71) over the right hand front jacket support bracket.

Note: Care should be taken that no extra cable is allowed to run over a hot part of the boiler or chaff against an edge.

Take the left hand front panel (67) and hook it onto the casing front.

Take the right hand front panel (68) and fix the 3 ball studs with M5 x 10 screws to the centre line joint.

Fix the two ball studs with M5 x 10 screws to the right hand edge. These ball studs locate through the front right hand casing panels into the front right hand casing locating bracket.

Because of the extra reach involved an M5 nut should be sandwiched between the ball stud and front casing panel to extend the projection of the ball stud.

Position the front right hand panel by engaging the 5 ball studs.

Put the 2 plastic finger guards (83) into the right hand front panels.

Firing Equipment / Electrical

Fit the burner to the mounting plate (21) on the front section (61).

Connect the 7 Way And The 4 Way Wieland Plugs from the Boiler Control Panel to the Burner 7 Way and 4 Way Wieland Sockets.

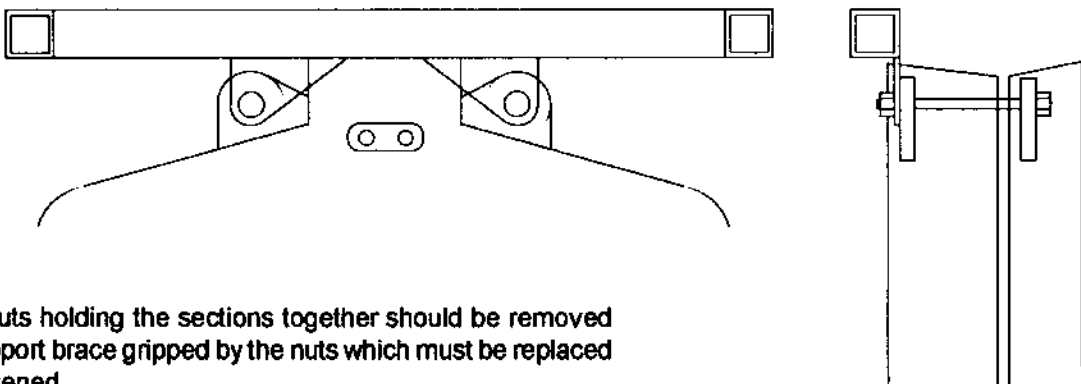
Connect the fuel supply to the burner following the burner manufacturers instruction manual.

When connecting dual fuel burners and oil burners generally check if the burner requires a one or two pipe oil supply and adjust the change over plug in the oil pump if necessary.

Make a 1 phase electrical supply into the boiler control panel and connect the main electrical supply through a suitable isolator adjacent to the boiler according to fig 4a or fig 4b.

All wiring installations must be in accordance with I.E.E. Regulations.

Figure 17



Commissioning Boilers

Electrical:

Before commencing ensure that the electrical supply is turned off and that all electrical connections are correctly made and that the appliance is earthed.

Gas Supply:

Before commencing check that the gas supply is purged of air and that the gas connections are sound and that the boiler gas cock is off. Ensure that the gas supply is turned on at the meter.

Oil Supply:

Before commissioning check that oil is available and that the oil supply has been made through an isolating valve and a suitable filter.

Water:

Before commencing ensure that primary system has been filled and that pumps are operating and that the system pressure is at least 0.2 bar and that any isolating or any other valves on the system are open.

1. Check that the on/off switch on the boiler control panel is off and that the gas or oil service cocks are turned on.

2. Check that the correct oil nozzle is fitted and fit an oil pressure gauge to the oil pump or a manometer to the burner head for gas burners.

3. Commission the oil or gas burner as described in the Burner Manufacturers Manual.

4. Switch OFF the electricity and check that the burner closes down.

5. Test for gas soundness around joints as described in BS6644 and British Gas Publication IM 5. These documents give the correct procedure which is to pressurise the gas pipework system and look for a loss of pressure with a suitable manometer.

Soap solution or ultrasonic leak detectors are not suitable to prove that pipe work is sound, only to find the point of the leak when a pressure test shows there is one.

6. Set the high limit thermostat typically to 95°C, Set the high fire control thermostat to typically 80°C and the low fire thermostat to typically 75°C. And this will bring the burner down from high to low fire when the water temperature reaches 75°C and switch the burner off when the water temperature reaches 80°C. The high limit thermostat should again be typically set to 95°C.

Maintenance of Boiler

WARNING: Before commencing any form of maintenance and cleaning make certain that the electricity supply to the burner is switched off and close fuel supply valves.

Maintenance:

To maintain optimum efficiency the boiler flueways must be cleaned at regular intervals. The period between cleaning will depend on the hours of use, type of fuel and site conditions, but should not be less than once yearly, at the end of the heating season.

The boiler flueways, combustion chamber and chimney system should be kept free from soot and scale. When the boiler is shut down for long periods the front cleaning plate should be removed to allow air to circulate through the boiler.

To avoid the risk of fireside corrosion the minimum return water temperature should be 50°C (120°F).

To Clean Boiler

1. Switch off electricity supply to burner.
2. Cover burner to prevent ingress of dust and grit.
3. Lift off top panels of jacket, starting with the rear-most panel.
4. Lift off insulation mats.

5. Remove top cleanout plates along boiler shoulders.

6. With 1" round flue brush, rod vertically.

7. Open front flue door and if baffle assembly is fitted remove it in one piece. 'Brush Off' the baffle assembly and if it is grossly deteriorated replace it. With the 3" round flue brush rod out horizontally. Replace the baffle.

8. Remove the combustion chamber clean-out plate. To gain easy access it may be necessary to hinge the burner to one side (reference should be made to the burner manufacturers maintenance manual, to follow the correct procedure).

9. With a scraper, rake out deposits.

10. On completion of the internal flueway cleaning, check the flue-door and flue-plates gaskets (replace where necessary). Refit plates and baffles. Close the door, ensuring all wing nuts are tightened evenly and firmly.

11. Replace insulation mats.

12. Replace top panels and jacket.

13. Close burner and secure (where applicable).

14. Switch on electricity supply.

We advise the client to enter into a Service Contract with the Burner Manufacturer to ensure the equipment receives correct and regular maintenance. Should the client wish to maintain the equipment, we recommend they follow the Burner Manufacturers In-Service Manual.

Component Replacement

IMPORTANT:

Before starting to service the boiler turn OFF the electricity supply at the isolator and check that all other incoming feeds e.g. from time clocks are OFF and also turn OFF the gas at the service gas cock provided by others and oil at the oil cock.

CAUTION:

Never open the boiler door unless the burner electrical and fuel systems have been isolated.

Burner and Gas Line

Components should be replaced with reference to the Burner Manufacturers Installation Manual.

Control Panel Component Replacement

Remove the two screws in the sides of the control panel and then hinging up and back.

1. Control or High/Low Thermostat:

Remove the electrical connections noting where they go. Remove the thermostat bulb from the thermostat pocket

after removing the top front jacket panel and thread it back out through the control panel. Remove the knob and the two screws holding the thermostat body and release it from the control panel fascia. Replace as the reverse of the above taking care to replace the spring clip that retains the bulb in the thermostat pocket and to remake the earth connection.

2. High Limit Thermostat:

Remove the electrical connections noting where they go. Remove the thermostat bulb from the thermostat pocket and thread it back through the control panel. Remove the 2 fixing screws under the label.

Replace as the reverse of the above ensuring that the new one is set to the same temperature as the faulty one taking care that the earth connection is remade and that the spring clip retains the bulb in the thermostat pocket.

3. Temperature and Pressure Gauge:

Remove the bulb from the thermostat pocket or the fitting from the self isolating fitting on the boiler and thread it back out through the control panel. Remove the gill clip from the gauge and push it out through the panel. Replace as the reverse of the above.

4. Main On/Off Switch and Lamp:

Remove the electrical connections noting where they go, and the back nut on the lamp and push it out through the panel. Replace as the reverse of the above.

Spare Parts List

<u>ITEM</u>	<u>MAKERS DESCRIPTION</u>	<u>PART NO.</u>
Front Section		BR/F
Rear Section		BR/B
Intermediate Section		BR/M
Flue Cover Gasket		0083
Top Nipple		0621
Bottom Nipple		0619
Control Thermostat (Standard)	Limit TR2 0-90°C	0170
Control Thermostat (High Temperature)	Limit TR2 0-120°C	0935
Limit Thermostat (Standard)	Limit LS 1/3 95-110°C	0172
Limit Thermostat (High Temperature)	Limit LS 1/3 100-130°C	0936
Thermometer (Standard)	Star Instruments 20-120°C	0990
Altitude Gauge (Standard)	Star Instruments 0-4 bar	0988
Altitude Gauge (Low Head)	Star Instruments 0-1 bar	0989
Lamp Green	Arco Electric	LampG
Lamp Red	Arco Electric	LampR
On/Off Switch	Arco Electric	0835

Econocast II Users Guide

To Shut Down the Boiler

1. Switch off the electricity supply and the on/off switch on the boiler control panel.
2. If switching off for an extended period e.g. holidays turn off the gas or oil supplies at the service and isolating gas or oil cock on the burner.

Care of the Boiler

1. Do not shut down the boiler if freezing conditions are expected unless a frost protection thermostat has been incorporated in the boiler house control system.
2. Do not obstruct the air vents, grilles or other air openings in the boiler room and ensure a clear path of combustion and ventilation air to the boiler.
3. Do not store objects on or near the boiler or the flue.

Do not use propellant sprays or chemicals particularly chlorine based chemicals in the vicinity of the boiler.

4. The boiler should be serviced once a year by a C.O.R.G.I registered engineer.
5. If at any time a gas leak is suspected DO NOT use a naked flame to locate the leak or turn on or off any electrical switches.

Turn off the gas supply to the boiler at the Gas Meter and contact the Local Gas Region Office immediately.

The number is in the phone book under GAS, write the number here....

GAS:

To Light the Boiler

1. Turn OFF the on/off switch on the boiler control panel.
2. Check that the gas cock or the oil isolating valve is on.
3. Switch on the electricity supply, time clocks etc. and the on/off switch on the boiler control panel. The green lamp in the on/off switch should light .
4. Turn the Control Thermostat on the control panel to 80°C for on/off boilers and if there are two fitted for high/low boilers set the Low Fire one to 80°C and the High Fire one to 75°C.
5. The burner should now light.

Boiler Fails to Light

1. If the High Limit Thermostat has tripped then the burner will not attempt to start. The red High Limit Thermostat Trip Lamp on the boiler control panel will be ON and the thermostat can be reset by removing the black plastic dust cap on the side of the control panel and pressing the small button beneath it.
2. If the burner itself has detected an internal fault it will Lock Out and will not attempt to light. The red Burner Lockout Lamp on the boiler control panel will be ON and this Lock Out can be reset by pressing the reset button on the burner control pack which may be glowing red.
3. If the burner starts and runs and then locks out check that there is fuel reaching the burner.
If you still cannot light the boiler contact your installer.

R. S. STOKVIS & SONS LTD POOL ROAD WEST MOSELEY SURREY KT8 2HN
TELEPHONE 0181 941 1212 FAX 0181 941 4136

HEALTH AND SAFETY INFORMATION

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

For the type of material and where used in Beeston Heating products refer to the chart attached. Specific Data Sheets are available on request from Beeston Heating for these materials but the following Material Handling and First Aid procedures should in all cases be observed.

PAINTS, SEALANTS AND HEATING FUEL OIL

These materials contain organic solvents and should be used in a well ventilated area away from naked flames.

Do not allow to come into contact with the skin, eyes, inhale or swallow.

Use barrier cream or gloves to protect the skin and goggles to protect the eyes from accidental contact.

Small quantities can be removed from clothes or the skin with a proprietary paint remover or hand cleaning product.

If inhaled remove sufferer to fresh air, if swallowed clean mouth with and drink water but do not induce vomiting.

If in the eye then irrigate the eye for 10 minutes with water and seek medical advice.

THERMAL INSULATION

Avoid contact with the skin, inhaling dust or contact with eyes.

If cutting insulation then do so in a well ventilated area using gloves to protect hands, goggles to protect the eyes and a disposable dust mask.

If a skin reaction or eye or respiratory irritation is experienced then discontinue working with the material and seek medical advice.

SHARP EDGES

Care should be taken when handling sheet metal panels that do not have safety edges.

LIFTING CAST IRON SECTIONS AND BUILDING BOILERS

Care should be taken when lifting cast iron sections as they can weigh up to half a ton and Beeston Heating will confirm the weight of each individual section. When building the boiler the section should always be built onto a level base capable of supporting the full weight of the boiler and sections should always be supported with blocks of wood or props when positioning before final bolting up. An unsupported section should never be left unattended.

NATURAL OR L.P.G GAS

Only a competent qualified person e.g. C.O.R.G.I registered can install, commission or service gas appliances.

THIS APPLIANCE MUST BE EARTHED.

R. S. STOKVIS & SONS LTD POOL ROAD WEST MOSELEY SURREY KT8 2HN
TELEPHONE 0181 941 1212 FAX 0181 941 4136

HEALTH AND SAFETY INFORMATION

CONTROL OF SUBSTANCES HAZARDOUS TO HEALTH

	N/A	ECONOCAST I	ECONOCAST II
PAINTS	* All paints are applied and dried at works and are not applied on site apart from touching up.		
General purpose black undercoat Johnsons Paints.	Boiler body.	n/a	n/a
High temperature black Guard Coatings HT Black Primer	n/a	1 Flue socket 2 Plate work	1 Flue socket 2 Plate work
Green and Grey jackets Trimoco Paints.	1 All jacket parts. 2 Control panel	1 All jacket parts. 2 Control panel	1 All jacket parts. 2 Control panel

INSULATION AND SEALS	* Apart from Rockwool foil faced boiler insulation, all other insulation material is applied at works.		
Rockwool foil faced slabs	1 Boiler body	1 Boiler body	1 Boiler body
Fibre glass rope and tape	1 Burner plate	1 Burner plate 2 Cleaning covers	1 Burner plate 2 Cleaning covers
Ceramic Fibre Board	1 Target wall	n/a	n/a
C.F.C Free Polyurethane spray on foam.	n/a	n/a	n/a
Refractory Brick	n/a	1 Sight glass	1 Sight glass 2 Burner quarl
Asbestos products	Not Used	Not Used	Not Used

SEALANTS	* Generally sealants have to be applied on site on all unassembled boilers.		
Nipple jointing compound. Hawk Red	1 Nipples	1 Nipples	n/a
Extruded Sealing Mastic. Seal Strip Ltd.	n/a	1 Section joints	1 Section joints
Silicone Mastic Black or Clear Websil.	n/a	n/a	n/a
Rust Inhibitor Rocol Rustshield.	1 Boiler nipples 2 Machined ports	1 Boiler nipples 2 Machined ports	1 Boiler nipples 2 Machined ports
Fire Cement in cartridges Pankit of Fortafix.	1 Section joints	1 Glass fibre rope	1 Glass fibre rope
Water Jointing Compound P.T.F.E Tape / Boss White / Hemp	Cast iron plugs Gauges/pockets Drain cocks	Cast iron plugs Gauges/pockets Drain cocks	Cast iron plugs Gauges/pockets Drain cocks
Gas Jointing Compound Plasticol PX10	Burner and gas train.	Burner and gas train.	Burner and gas train.

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