



*The Boiler People*

**INSTALLATION & SERVICING  
MANUAL FOR**

**70/90  
COMBI BOILER**

**&**

**70/90  
KABIN PAK COMBI**

**LEAVE THESE INSTRUCTIONS WITH THE END USER**





*The Boiler People*

## **COMMISSIONING**

### **\*THIS APPLIANCE MUST BE COMMISSIONED**

\*Failure to commission the boiler will invalidate the warranty

**After commissioning ensure that the pre-paid  
warranty registration card is filled in and  
returned.**

## **SERVICING**

**To ensure continued reliable operation and fuel  
economy it is recommended that the boiler is  
serviced annually by an OFTEC registered  
technician.**

## **N.I. CUSTOMERS ONLY**

**Warmflow Engineering Service division (N.I.)  
provides an excellent back-up service, operating  
a team of OFTEC trained engineers who can  
meet all the servicing, commissioning and  
breakdown requirements for your appliance.**

**Telephone  
0870 240 6532**

**Fax: 028 9262 2827**

**E-mail: [service@warmflow.co.uk](mailto:service@warmflow.co.uk)**

# **BEFORE FITTING THIS BOILER THE INSTALLER MUST CHECK:**

1. What the maximum hot water demand is likely to be placed on the boiler. Not every installation is suitable for a Combi boiler. Systems requiring very high hot water flow rates may be better suited with an unvented cylinder.
2. That the mains are capable of supplying up to 24 litre/min with a minimum dynamic pressure of 1.8 bar at the boiler. This is to ensure that the boiler can achieve its maximum output.
3. The mains water pressure to the boiler must not exceed 5 bar, If the mains pressure exceeds 2 bar then a pressure reducing valve must be fitted.
4. Where the mains water pressure is supplied via a borehole pump and accumulator the pressure variation must not affect the thermostatic mixer valve. (Contact Warmflow for further details).
5. The hardness of the mains water supply. Systems with hard water must be fitted with a suitable chemical scale preventer (eg Fernox Quantomat or Combimate alternatively contact Warmflow for further details).
6. That the flow from any one hot water outlet does not exceed the maximum recommended. This applies particularly to baths which are usually fitted with larger taps and larger bore supply pipes. It may be necessary to restrict the flow to these taps by reducing the bore of the supply pipework or by fitting a restrictor into the pipework.
7. That any outlet when opened does not starve all the other outlets of hot water. If more than one outlet is open at the same time then the total flow from all the outlets should not exceed the maximum flow rate of the boiler.
8. That any showers being supplied hot water by the boiler are compatible with this type of appliance.

**It should be noted that the boiler has been factory fitted with an 18 litre/min flow restrictor.**

**The manufacturers guarantees are void if the appliance is not installed and commissioned in accordance with the recommendations made herein.**

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# 1.0 User Instructions

## 1.0.1 Boiler Control Thermostat

The boiler control thermostat is located on the front of the boiler facia panel and may be adjusted from 52°C to 85°C. The recommended minimum thermostat setting is 65°C. Below this 'cold water corrosion' is likely to occur thus reducing the life of the heat exchanger and is not covered by the manufacturer's warranty. When using hot water only it is recommended that the boiler control thermostat is switched to the off position.

## 1.0.2 Mains Indicator

The green mains light will be lit when there is power to the control panel.

## 1.0.3 H/L Reset

The yellow H/L reset lamp will be lit when the high limit thermostat has tripped at its set temperature of 110°C. This cuts off power to the burner and may indicate that there is a fault in the heating system. The high limit thermostat has a manual reset button located underneath the control panel in line with the control thermostat on the standard Combi and centrally on the front of the control panel on the Kabin Pak Combi. Once the temperature has fallen and the reset button has been pressed the boiler should restart. If the high limit thermostat continues to trip contact your service engineer/technician.

## 1.0.4 Lock Out

The red lock out lamp will be lit when the burner has failed and can be reset by pressing the illuminated red reset button on the burner control box. If there is power and the thermostat is calling for heat and the burner has been reset it will go through its start up cycle. If the burner again fails to fire this would indicate a burner fault or oil supply problem (oil supply problems are not covered by manufacturers warranty).

## 1.0.5 Tank Control Thermostat

Located on the right hand side of the control panel the tank control thermostat controls the temperature in the thermal store. The temperature is factory pre-set to 75°C.

## 1.0.6 Tank Limit Thermostat

Located inside the control panel the tank limit thermostat is a thermal resetting device controlling the on/off operation of the burner in hot water mode.

## 1.0.7 Hot Water and Central Heating On/Off Switch

Both hot water and central heating operations can be controlled via these switches. However it should be noted that when both switches are in the 'on' position hot water will have priority. In addition whenever a timer or programmer is connected to the boiler one or more of these switches may be bypassed.

## 1.0.8 Pressure Gauge

The pressure gauge fitted to the front of the control panel measures system pressure. The pressure should be set at 1 bar when the boiler is cold. As the boiler heats up, the pressure will rise but should not exceed 3 bar.

## 1.0.9 Servicing

It is a requirement of the warranty that the boiler is serviced annually by an OFTEC registered engineer.

## 1.1 Introduction

**Note: All our domestic appliances have been independently tested and accredited as exceeding the minimum SEDBUK efficiency levels required for its type, in compliance with the Building Regulations Approved Document L1 2001 for England and Wales and the Building Standards (Scotland) Regulations 2001 Part J.**

The Warmflow oil fired 'Combi' boiler and Kabin Pak Combi are suitable for sealed central heating systems and can provide at mains pressure domestic hot water without the use of a cylinder.

The Warmflow oil fired combis are designed to burn Class C2 (28 sec redwood) kerosine.

As standard the appliance is fitted with a system expansion vessel, circulating pumps, filling loop, pressure gauge and safety valve. An optional 7-day electronic programmer is also available for use in the internal model only.

The pressure jet oil burner is covered by the manufacturer's parts and labour warranty valid for one year (from the boiler date stamp). The boiler and heat store are covered by a manufacturer's warranty of 5 years (from the boiler date stamp) but does not include burner, labour, handling or shipping. Details of any extended warranties are contained within the installation pack.

Optional extended guarantees, for the appliance covering parts and labour of up to 5 years initially are also available (although not applicable to the Republic of Ireland).

**The manufacturer's guarantees are void if the appliance is not installed and commissioned in accordance with the recommendations made herein.**

## 1.2 General Requirements

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

BS5410 : PART 1 : 1997 Code of practice for oil firing.

BS5449 : PART 1 : 1997 Forced circulation hot water systems.

BS7593 : 1992 Treatment of water in domestic hot water central heating systems.

Current Building Regulations: Part J England and Wales  
Part F Scotland  
Part L Northern Ireland

Current IEE Regulations:

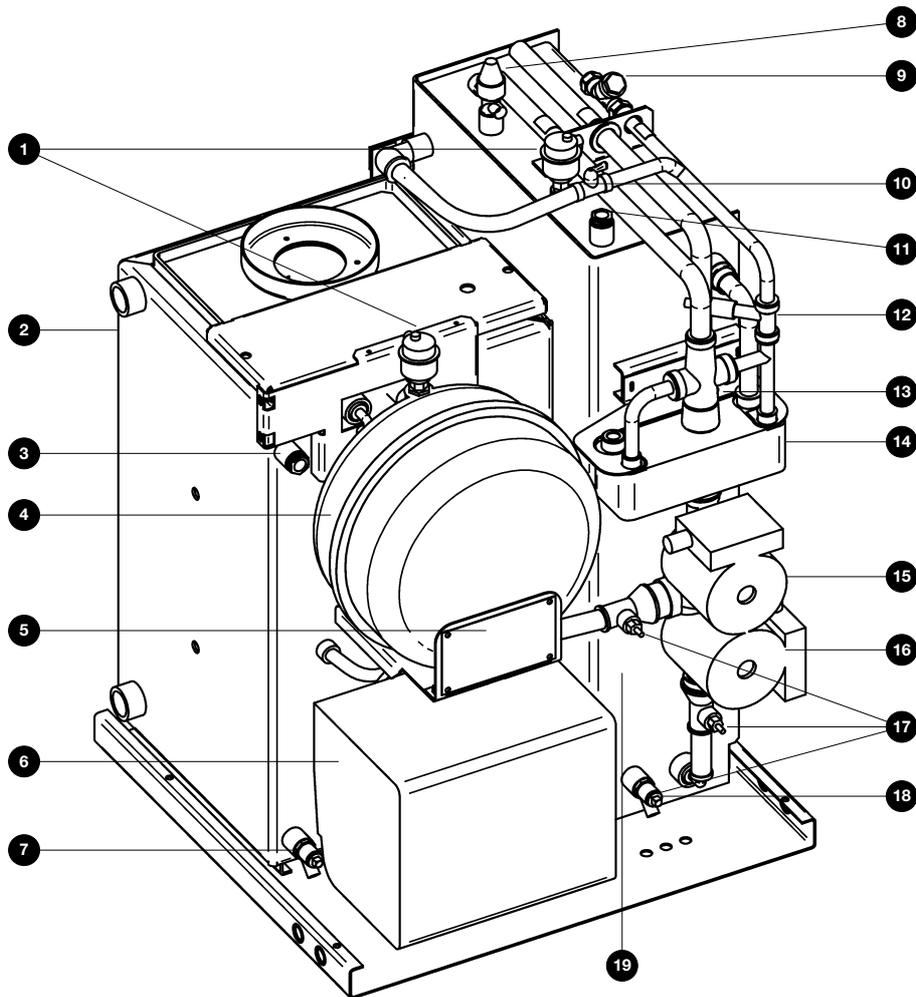
BS7074 : PART 1 : Application Selection & Installation of Expansion Vessels

The heating system should be installed by a competent installer in accordance with the recommendations laid down by HVCA, OFTEC and a sound engineering practice.

**In order to comply with GB building regulations OFTEC forms CD10 for installations and CD11 for commissioning should be left with the customer.**

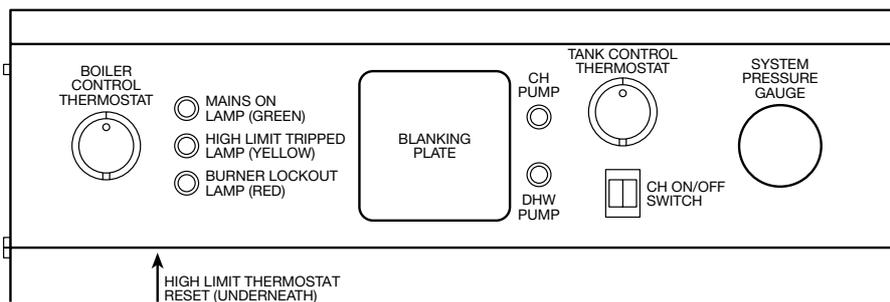
### 1.3 Components

#### 1.3.1 Combi Assembly

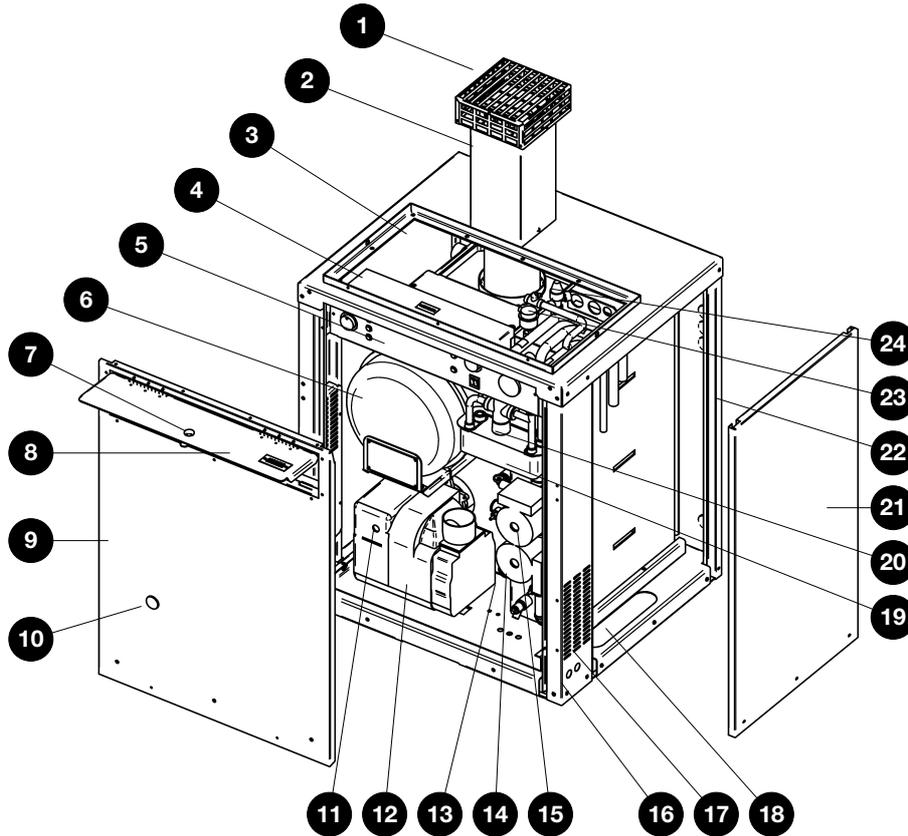


- |                                  |                           |
|----------------------------------|---------------------------|
| 1. Automatic Air Vents           | 11. Tank Limit Stat       |
| 2. Boiler Heat Exchanger         | 12. Flow Switch           |
| 3. Boiler Control and Limit Stat | 13. Mixer Valve           |
| 4. 12 Litre Expansion vessel     | 14. Plate Heat Exchanger  |
| 5. Boiler Data Plate             | 15. CH Pump Head          |
| 6. RDB Burner                    | 16. DHW Pump Head         |
| 7. Boiler Drain Valve            | 17. Pump Gate Valves (x3) |
| 8. Pressure Relief Valve         | 18. Tank Drain Valve      |
| 9. Strainer                      | 19. Tank Control Stat     |
| 10. Filling Loop                 |                           |

#### 1.3.2 Combi Control Panel



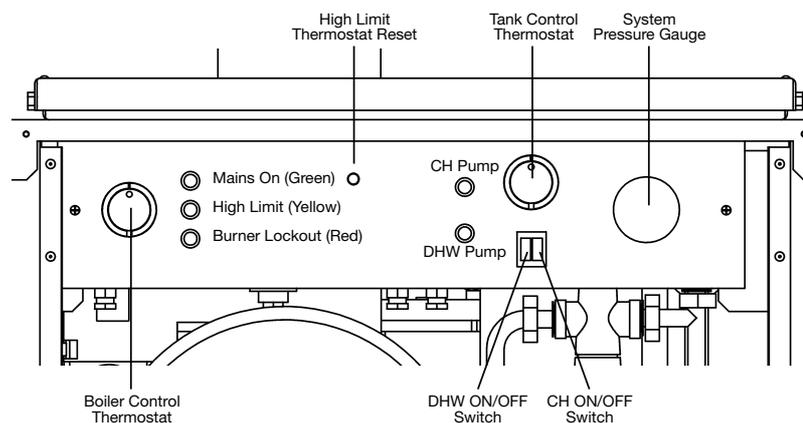
### 1.3.3 Kabin Combi Assembly



- |                            |                                |                           |
|----------------------------|--------------------------------|---------------------------|
| 1. Flue Terminal Guard     | 9. Door Panel                  | 17. Air Intake Grill      |
| 2. Low Level Flue          | 10. Burner Reset               | 18. Pipe Access Hole      |
| 3. Service Access Hatch    | 11. Burner Reset Button        | 19. Plate Heat Exchanger  |
| 4. Control Panel Cover     | 12. Burner                     | 20. Mixing Valve          |
| 5. Controls                | 13. Return Connection          | 21. Side Panel            |
| 6. Pressure Vessel         | 14. DHW Pump                   | 22. Pipe Entry Grommets   |
| 7. Control Panel Flap Lock | 15. CH Pump                    | 23. Auto Air Vent         |
| 8. Control Panel Flap      | 16. Cable on Oil Line Grommets | 24. Pressure Relief Valve |

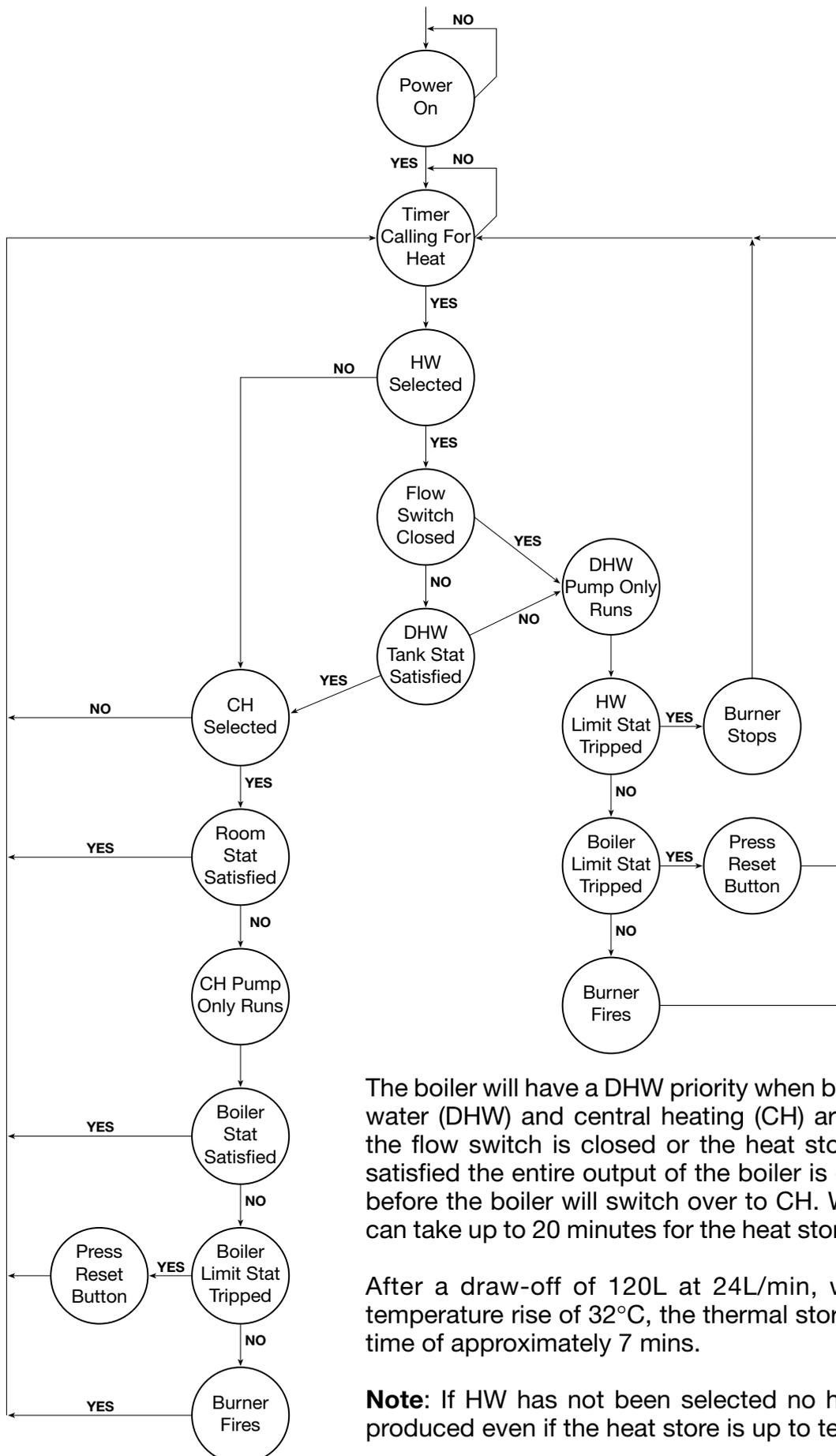
**Note:** To convert the Kabin Pak for use with a conventional flue use the Kabin Pak adaptor (KPA).

### 1.3.4 Kabin Pak Combi Control Panel



## 2.0 Technical Details

### 2.1 Sequence of Operation Flow Chart

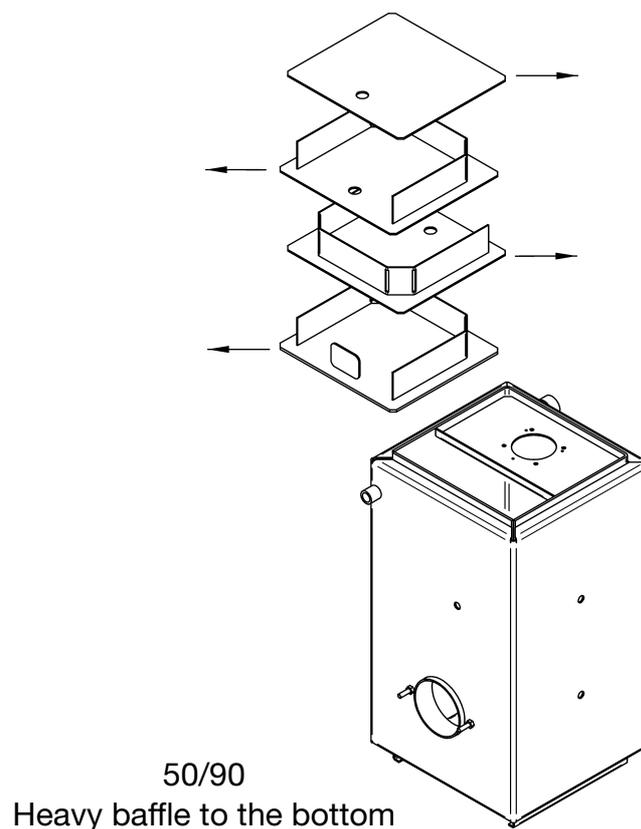


The boiler will have a DHW priority when both domestic hot water (DHW) and central heating (CH) are selected. So if the flow switch is closed or the heat store has not been satisfied the entire output of the boiler is directed to DHW before the boiler will switch over to CH. When fully cold it can take up to 20 minutes for the heat store to be satisfied.

After a draw-off of 120L at 24L/min, with an average temperature rise of 32°C, the thermal store has a recovery time of approximately 7 mins.

**Note:** If HW has not been selected no hot water can be produced even if the heat store is up to temperature.

## 2.2 Baffles



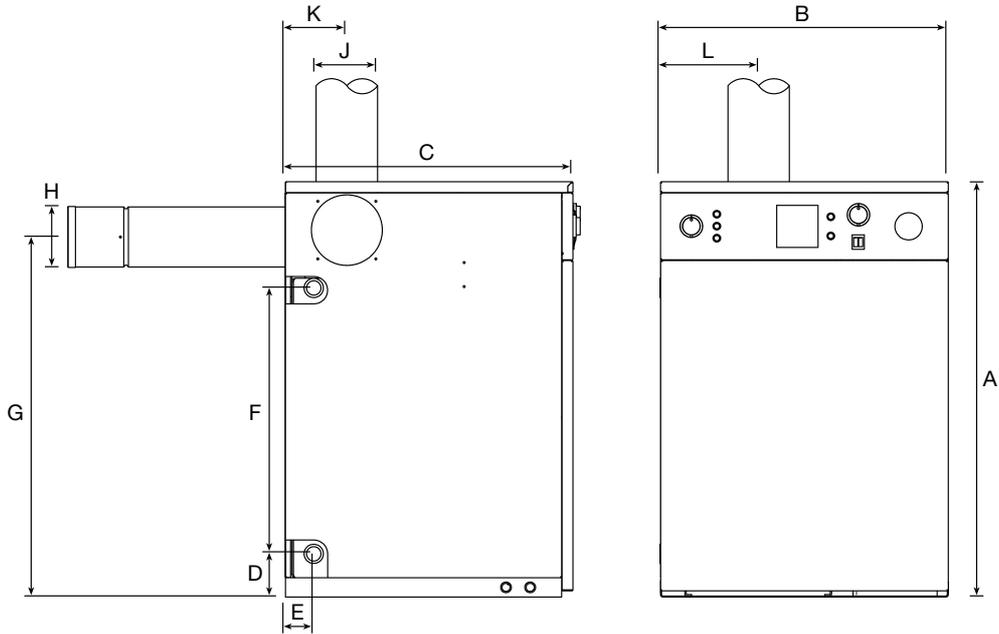
Before firing make sure the baffles and base insulation have not been dislodged in transit. The base insulation should be horizontal and pushed fully down onto the base of the boiler. To achieve maximum efficiency push the baffles in the direction of the arrows as shown.

## 2.3 General Requirements

1. The Warmflow Combi is supplied with all the necessary components for a sealed heating system. However, on some larger systems with a total water content greater than approx 150L, an expansion vessel, in addition to the integral 12L vessel supplied, may be required.
2. The pressure relief discharge shall be positioned away from any electrical components. No other valves should be positioned between the relief valve and the discharge, and the discharge pipe should not be used for any other purposes. The discharge pipe must be plumbed to an external drain in a position where the discharge can be seen but cannot cause any injury or damage.
3. Where there is a catastrophic loss of water from the system the boiler thermostats may fail to operate which would result in serious damage to the appliance. To prevent this it is recommended that a low pressure cut out switch set at 0.2 bar is fitted **to the system** and wired in series with the boiler limit thermostat (see page 16).
4. The boiler should be stored in a dry environment. No heavy objects should be placed on top of the boiler. Where possible the boiler should be moved on its pallet or trucked from its rear. Manhandling the boiler by its casings will result in damage and must be avoided.

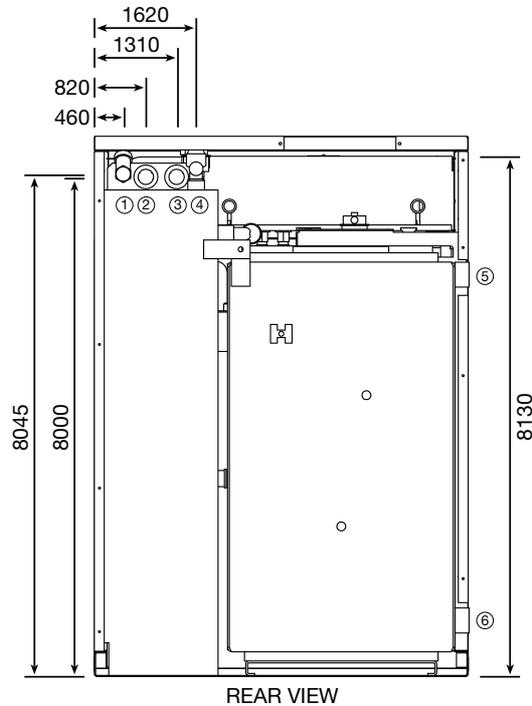
## 2.4 Dimensions

### 2.4.1 Combi Dimensions



MODEL	A	B	C	D	E	F	G	H	J	K	L
70/90	865	595	595	90	59	554	766	125	127	127	203

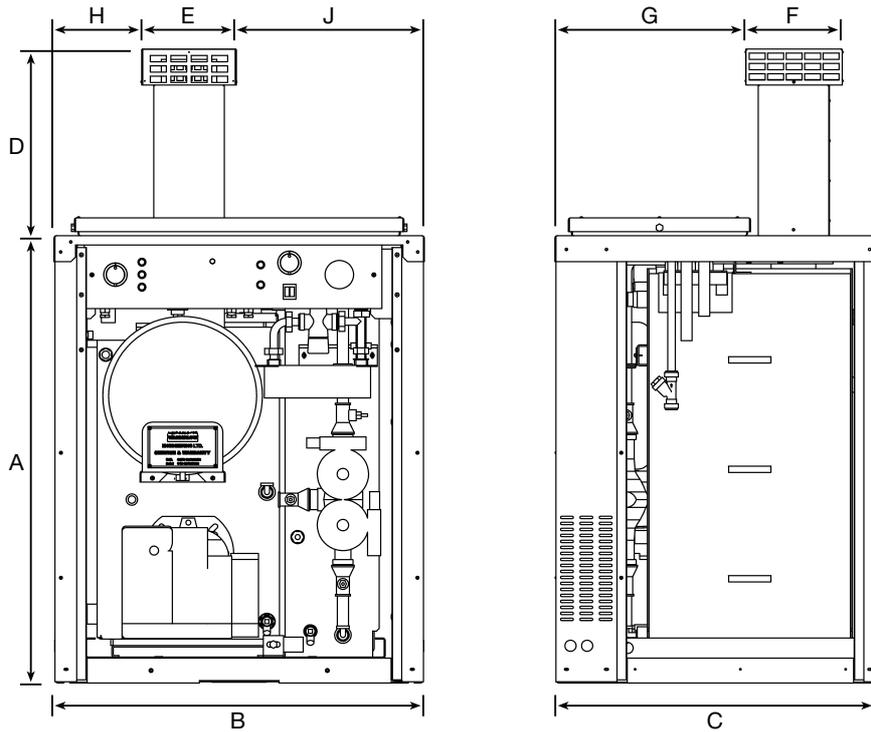
### 2.4.2 Combi Boiler Connections



All dimensions are given in mm.

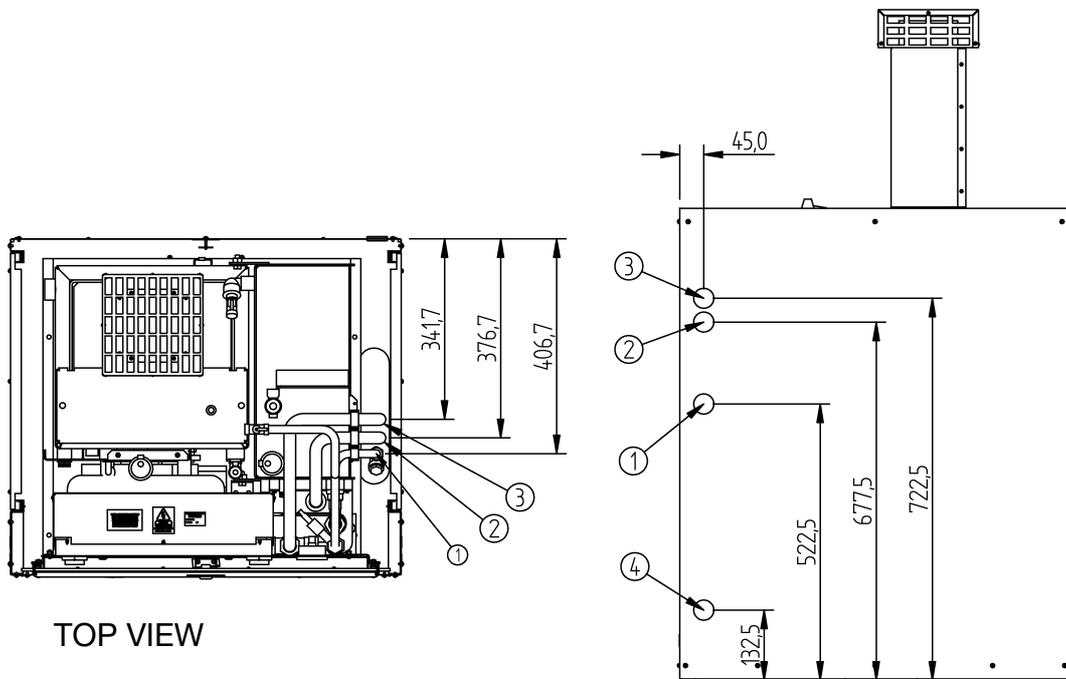
- |                              |                                     |
|------------------------------|-------------------------------------|
| 1. Cold Mains (15mm)         | 4. Pressure Relief Discharge (15mm) |
| 2. Heating Flow (22mm)       | 5. Spare Connection (1" BSP)        |
| 3. Domestic Hot Water (22mm) | 6. Central Heating Return (1" BSP)  |

### 2.4.3 Kabin Pak Combi Dimensions



MODEL	A	B	C	D	E	F	G	H	J
70/90	892	732	636	373	188	191	376	172	371

### 2.4.4 Boiler Connections

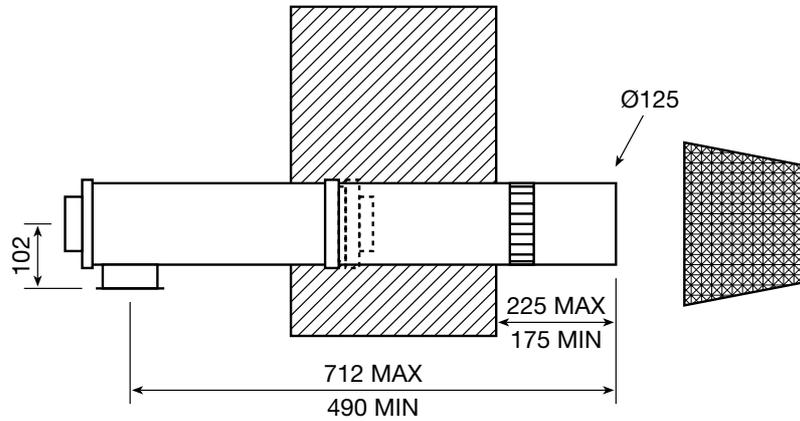


1. Cold Mains (15mm)
2. Heating Flow (22mm)
3. Domestic Hot Water (22mm)
4. Return Connection (22mm)

## 2.5 Combi Flue Options (not applicable to the Kabin Pak Combi)

### 2.5.1 'Easy Fit' Telescopic Low Level Balanced Flue (BF-R)

The horizontal dimension can be increased up to an additional 1200mm using a combination of long extension pieces (E600 = 600mm) and short extension pieces (E300 = 300mm).



**Note:** Low level balanced flue options are rear or left hand outlet only. For right hand flue option use HLBF-R (see page 12).

### 2.5.2 'Easy Fit' High Level Balanced Flue (HLBF) (NI and ROI only)

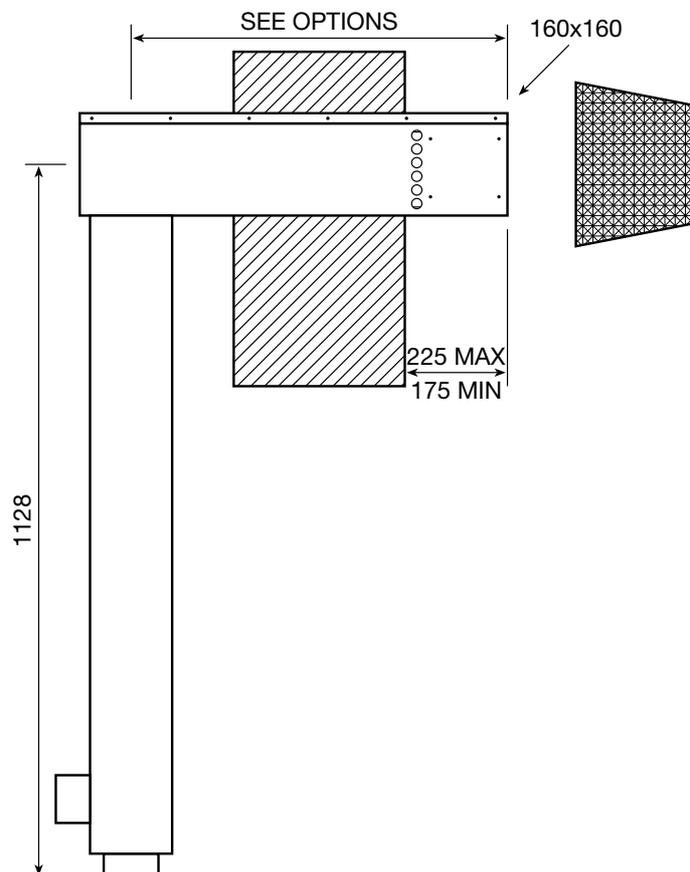
The HLBF is available in 4 fixed horizontal lengths which are:

Option 1 – 455mm

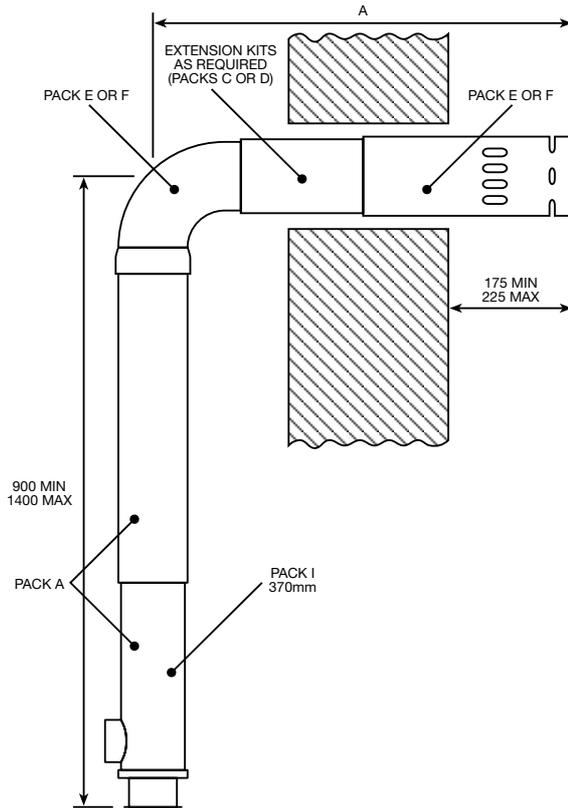
Option 2 – 655mm

Option 3 – 585mm

Option 4 – 785mm



## 2.5.5 Easy Fit Telescopic High Level Balanced Flue (HLBF-R)



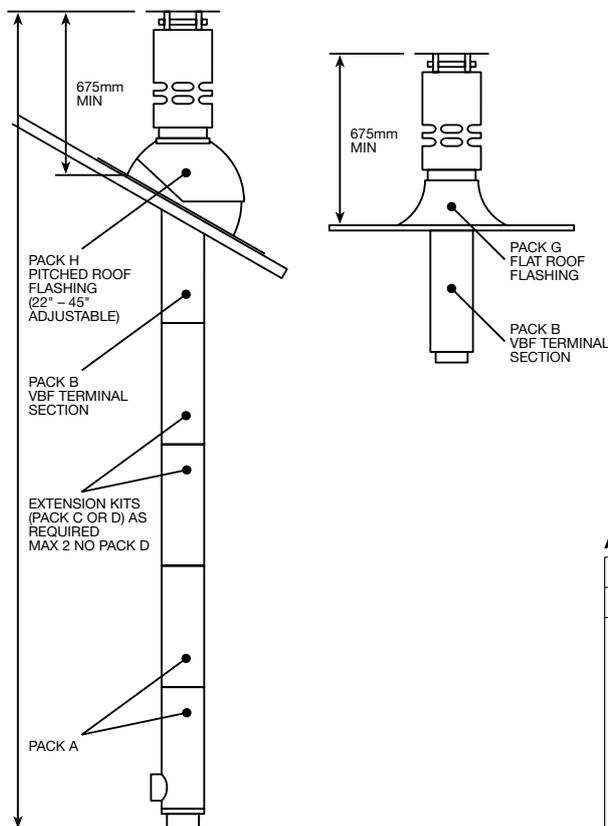
### ALL MODELS

DIM A		FLUE PACKS
MIN	MAX	
435	610	A + E
560	860	A + F
735	910	A + C + E

### 50/70,70/90 & 90/120 MODELS ONLY

DIM A		FLUE PACKS
MIN	MAX	
860	1160	A + C + F
1035	1210	A + C + C + E
1160	1510	A + C + C + F
1385	1560	A + D + E
1510	1860	A + D + F

## 2.5.6 Easy Fit Vertical Balanced Flue (VBF)



### ALL MODELS

FLUE HEIGHT		FLUE PACKS
MIN	MAX	
1340	1840	A + B
1640	2140	A + B + C
1940	2440	A + B + C + C
2290	2740	A + B + D
2590	3040	A + B + D + C
2890	3340	A + B + D + C + C
3240	3740	A + B + D + D

## 2.6 Technical Data

Model		70/90 Combi	70/90 Kabin Pak Combi
Nominal heat	KW	29.3	29.3
Input	Btu/hr	100,000	100,000
Nominal heat	KW	26.4	26.4
Output	Btu/hr	90,000	90,000
Efficiency at max output (net)	%	90	90
Burner		RDB 1	RDB 1
Head		LD3	LD3
Flue	mm	100 or 127	Integral
Size	in	4 or 5	Low Level
Max CO <sub>2</sub>	%	11.5-12.0	11.5-12.0
Smoke		0-1	0-1
FGT at max output	°C	235	235
Water resistance at 20°C ΔT	mbar	12.0	12.0
Approx fuel	l/h	3.15	3.15
Flow rate	gals/h	0.69	0.69
Nozzle (kerosine)	make size	DANFOSS 60°S 0.75	DANFOSS 60°S 0.75
Pump	bar	8	8
Pressure	psi	116	116
Dry weight	kg	155	155
Primary water content	L	70	70
Min inlet dynamic pressure for max hot water flow	bar psi	1.8 26	1.8 26
Max DHW flow rate achievable (refer to page 1)		Unrestricted 24 l/min (5.3 gals/min) recommended	Unrestricted 24 l/min (5.3 gals/min) recommended
Factory set DHW flow rate		18 l/min (4.0 gals/min)	18 l/min (4.0 gals/min)
Min DHW flow rate		2.5 l/min (0.55 gals/min)	2.5 l/min (0.55 gals/min)
DHW temp rise	°C	32°C @ 24 L/min for 120L draw off	32°C @ 24 L/min for 120L draw off
Pressure Relief		3 bar (43.5 psi)	3 bar (43.5 psi)
Heating flow		22 mm	22 mm
Heating return		1" BSP	22 mm Comp.
DHW outlet		22 mm	22 mm
Cold water mains inlet (refer to page 1)		Unrestricted 15 mm bore (minimum)	Unrestricted 15 mm bore (minimum)
Ingress Protection		IPX0	IP45

**Note:** When commissioning the boiler the flue gas temperature as measured at the test point on the boiler may be up to 20% higher than the actual flue gas temperature.

### 3.0 Electricity Supply

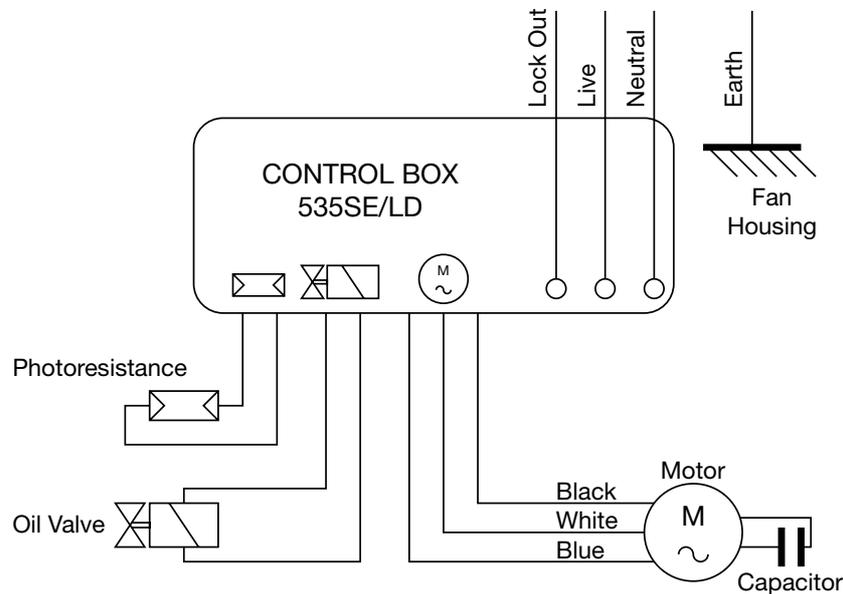
220 - 240V. 1PH, 50 Hz

The boiler/burner and other external electrical equipment should be wired via a fused double pole isolating switch which should be fitted with a 5 amp fuse.

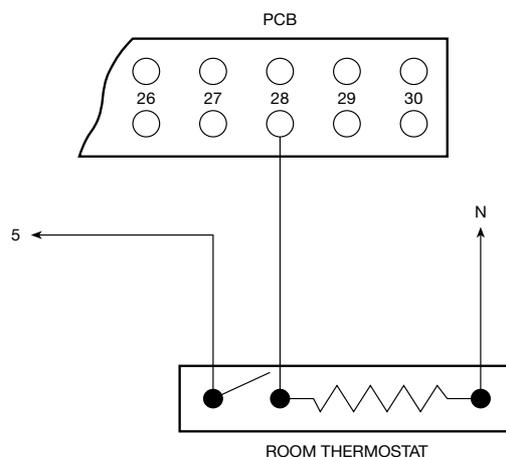
In order to ensure the safety of the Kabin Pak Combi Warmflow recommends that power to the appliance is supplied through a suitable CE approved RCD trip switch.

The appliance must be effectively earthed and all external wiring should comply with current IEE Regulations. It is the responsibility of the installer to ensure that the appliance has been properly earthed.

### 3.1 RDB Burner Control Box



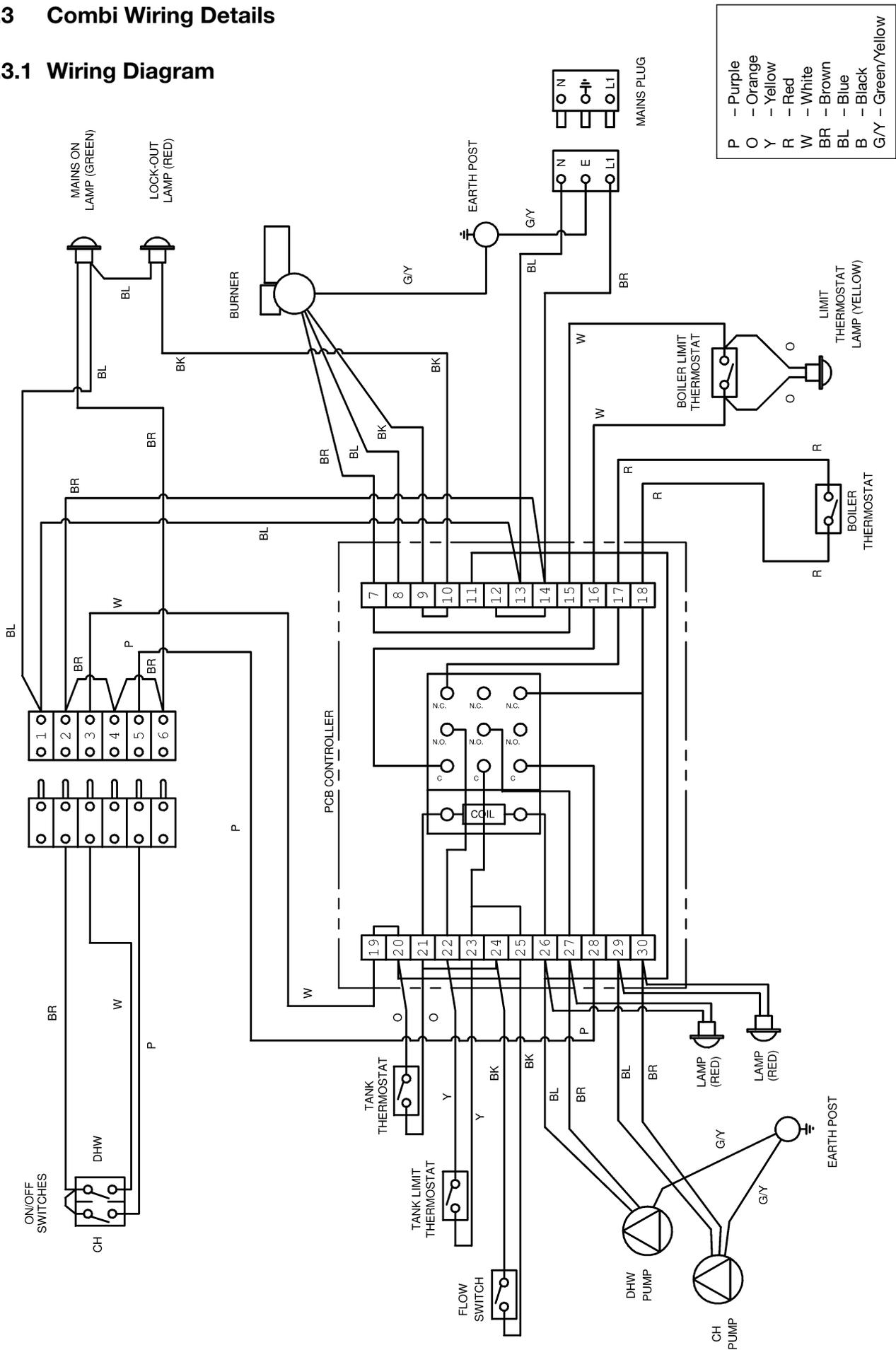
### 3.2 Fitting a Room Thermostat



Remove the purple wire from no 5 and no 28 on the PCB and wire the thermostat as shown. The room thermostat should be located where it is not subjected to extraneous heat gains, direct sunlight or draughts.

### 3.3 Combi Wiring Details

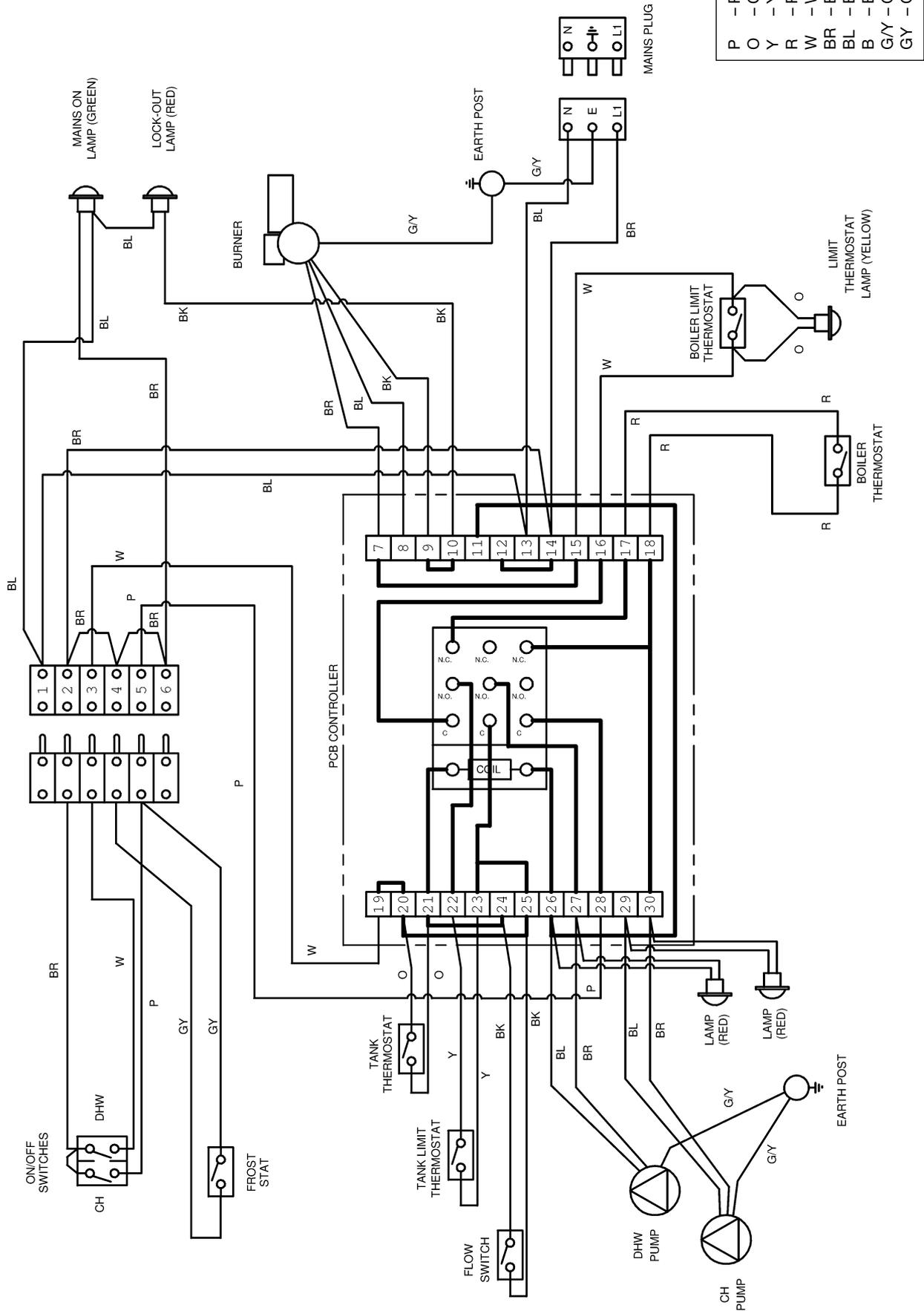
#### 3.3.1 Wiring Diagram



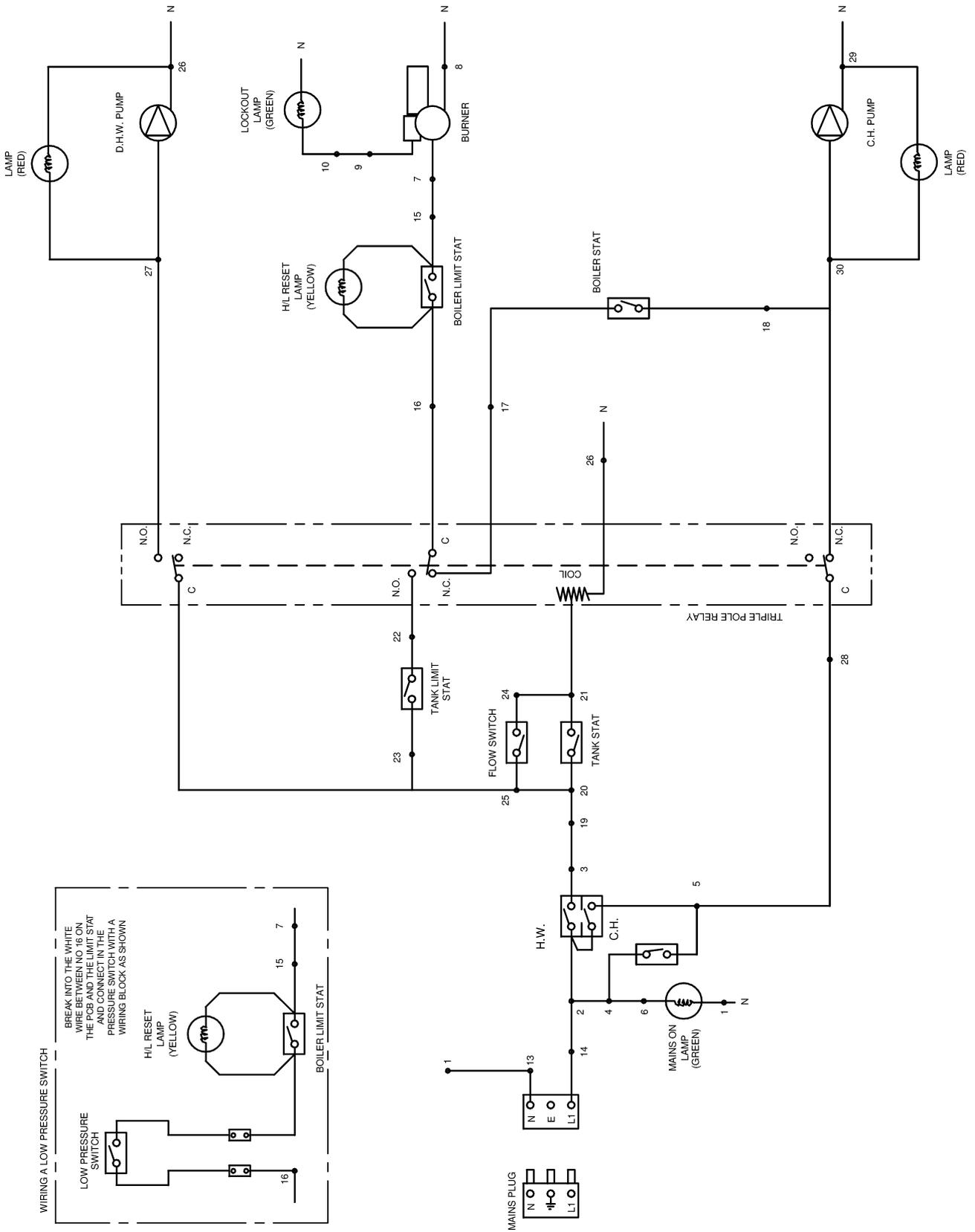


### 3.4 Kabin Pak Combi Wiring Details

#### 3.4.1 Kabin Pak Combi Wiring Diagram



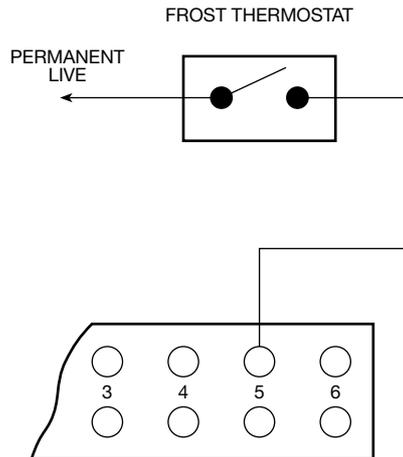
### 3.4.2 Kabin Pak Combi Wiring Schematic



### 3.5 Frost Thermostats

#### 3.5.1 Combi Boilers

The switched live from the frost thermostat (the frost thermostat must be supplied by a permanent live) should be connected to number 5 on the boiler terminal block. In order to protect the fabric of the building as well as the boiler and pipework, the thermostat should be located in the coldest part of the house but where it can respond to any temperature rise.



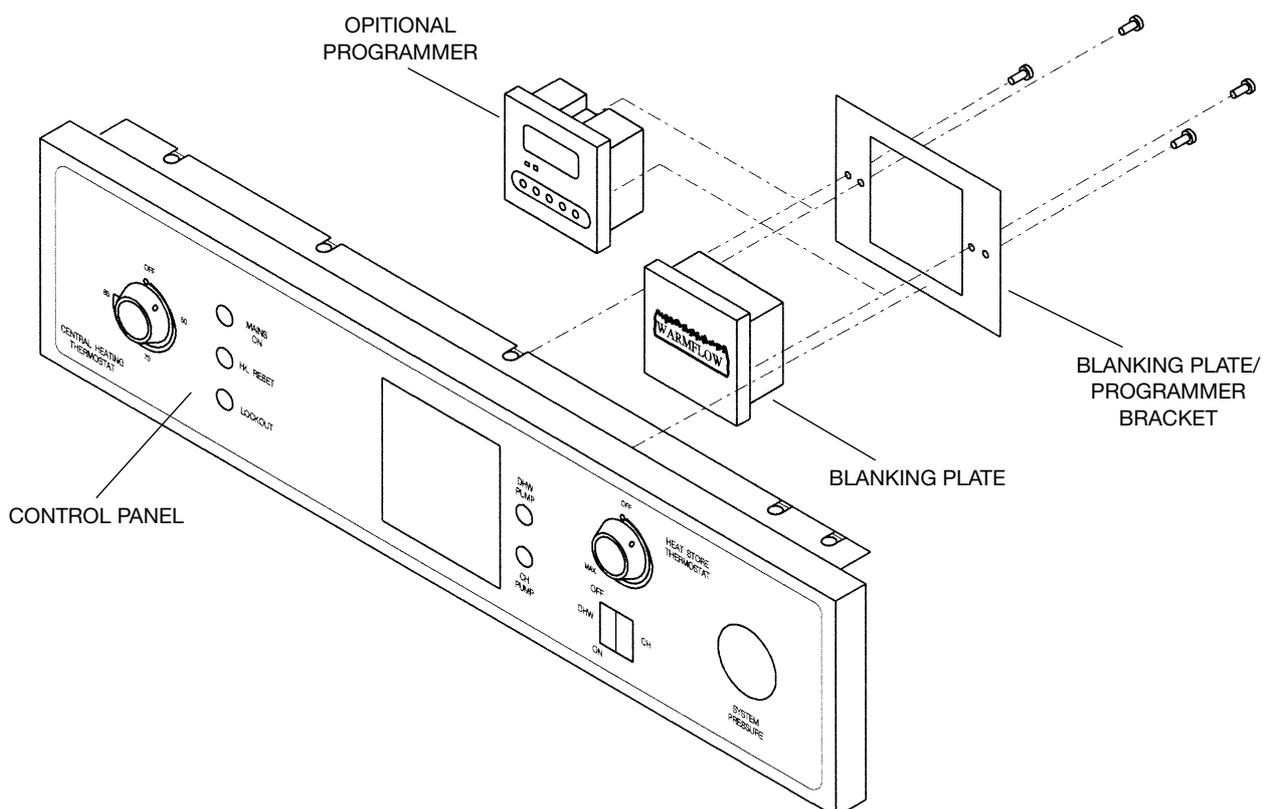
#### 3.5.2 Kabin Pak Combi Boilers

As the boiler is supplied with a factory fitted frost thermostat all that is required is for a permanent live to be supplied to the control panel.



### 3.6.3 Installation of Warmflow Optional Programmer (not applicable to the Kabin Pak Combi)

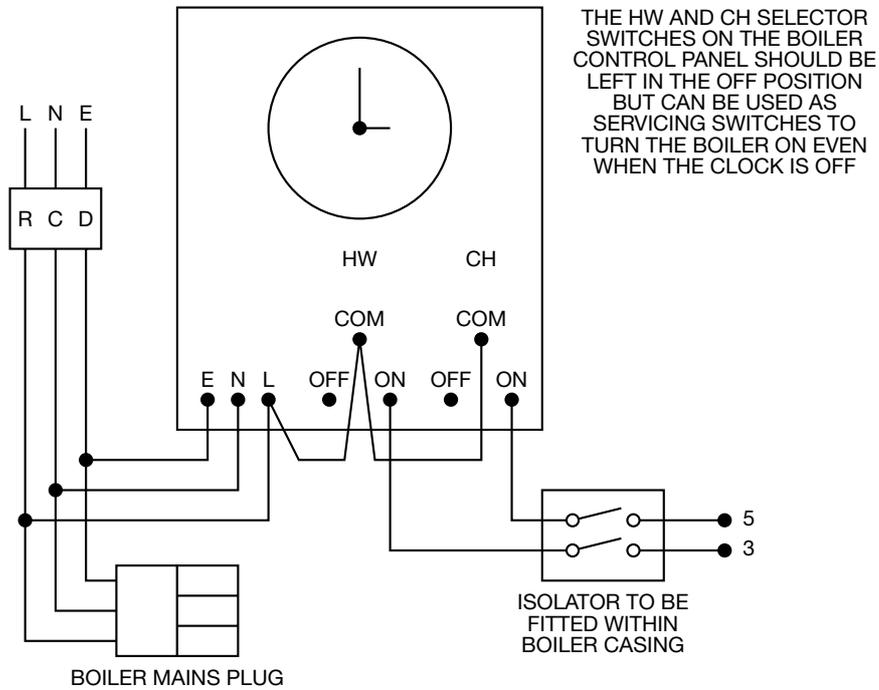
1. Disconnect the electrical supply.
2. Remove top casing (4 studs) and control box cover (1 screw).
3. Remove 2 screws securing blanking plate/programmer bracket. Remove bracket and blanking plate from the control panel.
4. Disconnect the blanking plate from bracket (2 screws).
5. Feed programmer harness through the hole in the bracket. The programmer is secured to the bracket with 2 screws.
6. Disconnect the 6 pin plug from the CH and HW on/off plugs.
7. Connect the programmer 6 pin plug into the socket.
8. Locate the programmer into the hole in the fascia and secure the bracket to the control panel (2 screws).
9. Set the time switch on the rear of the programmer to 'G' or 'P' (see programmer instructions).
10. Replace the control panel cover and reconnect electrical supply.
11. Operational instructions are included in this handbook. (Section 11, Page 27)



### 3.7 Timers for Kabin Pak Combis

**Note: Single channel timers or programmers are not recommended.**

#### 3.7.1 Installation of a Remote Two Channel Programmer



## 4.0 Oil Supply

### 1. Oil Tank

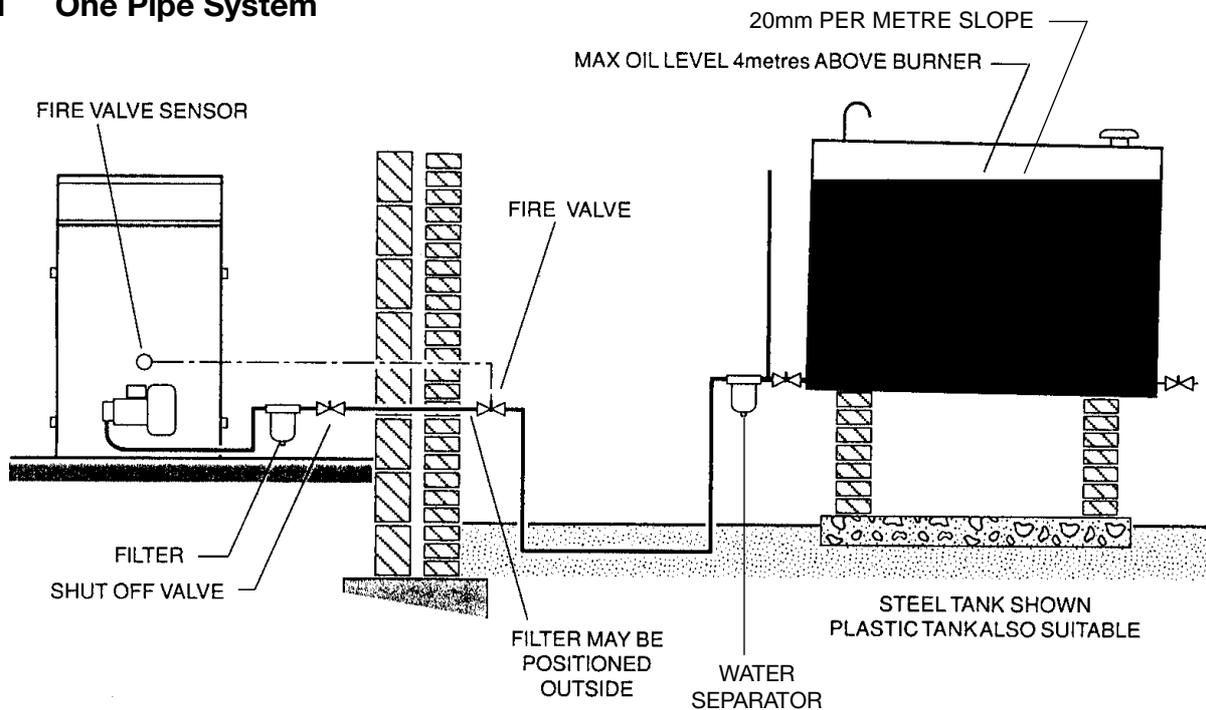
Steel tanks constructed to BS 799 Part 5 1987 should be painted on the outside only and mounted on piers to prevent corrosion. Plastic oil tanks are also available and can be suitable for installation at ground level. However, oil should never be stored in translucent plastic containers.

The tank outlet should be at a height to provide sufficient clearance to allow for proper maintenance of any isolation valve oil filter or water separator fitted.

- The pipe from the oil tank to the burner should be run in copper, steel or aluminium pipework. Galvanised pipe and fittings should not be used. The pipework should terminate close to the boiler and be fitted with an isolating valve and filter. It is also recommended that a remote sensing fire valve should be fitted to the oil line preferably before the oil line enters the building (BS5410 : PART 1). Where a fire valve is fitted to a Kabin Pak Combi the valve body must be situated at least one metre away from this appliance.

Depending on the position of the tank a two pipe system may be required. One and two pipe oil systems are shown below. As an alternative to a two pipe system a Tigerloop or other approved de-aerator. may be used.

### 4.1 One Pipe System

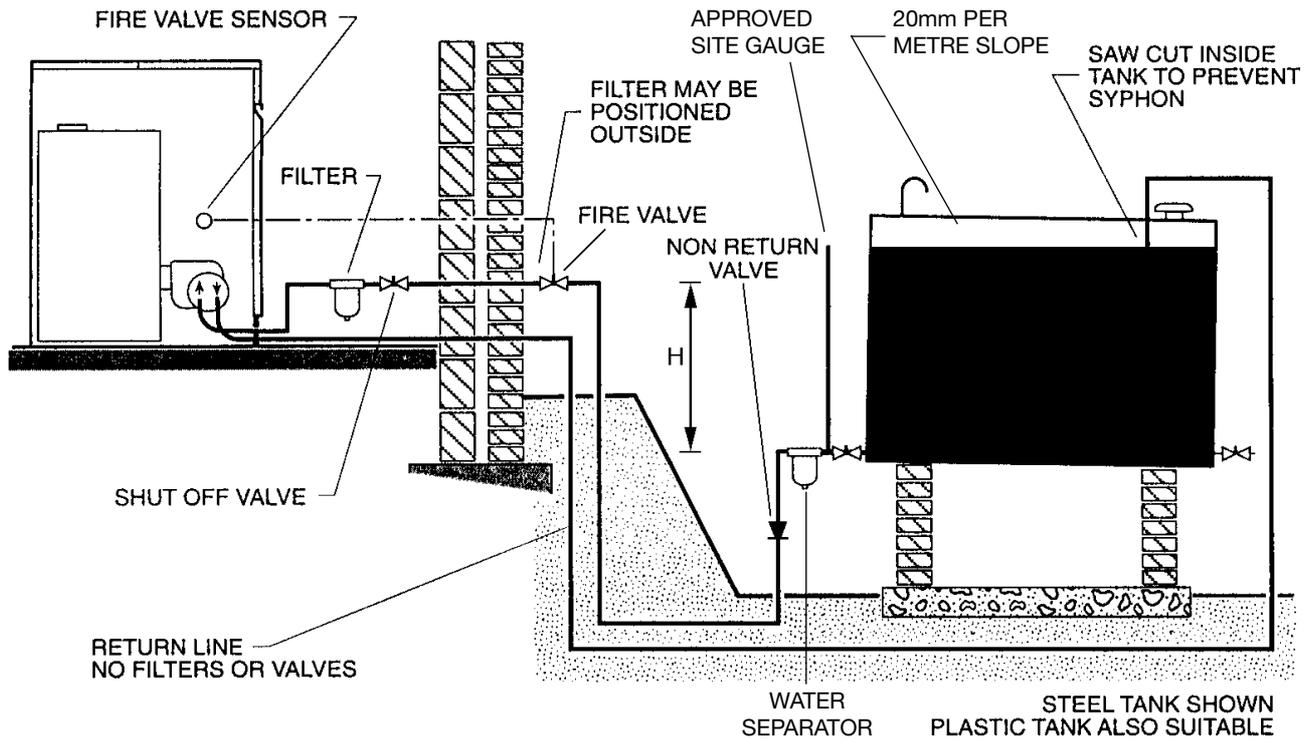


Total Maximum Pipe Length (m)

Head H <sub>(m)</sub>	0.5	1	1.5	2
I.D. 8 mm	10	20	40	60
I.D. 10 mm	20	40	80	100

**Note:** Plastic oil level gauges may shrink when exposed to kerosene thus allowing the ingress of water. Pump failures due to water contamination are not covered under the warranty.

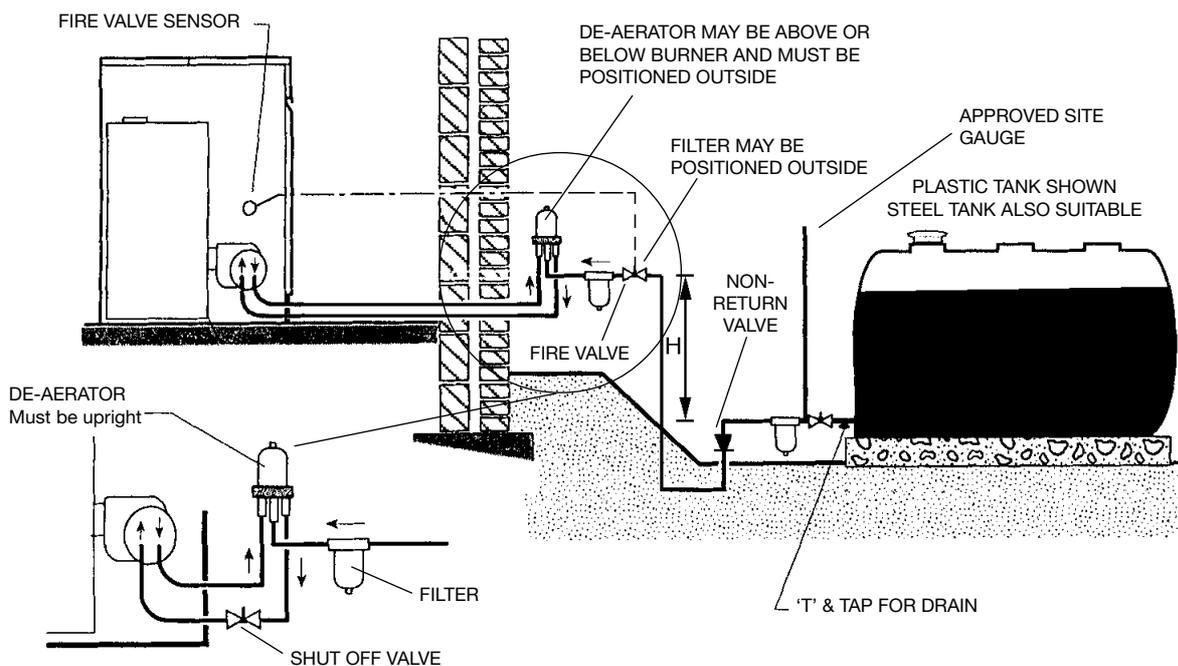
## 4.2 Two Pipe System



**Total Maximum Pipe Length (m)**

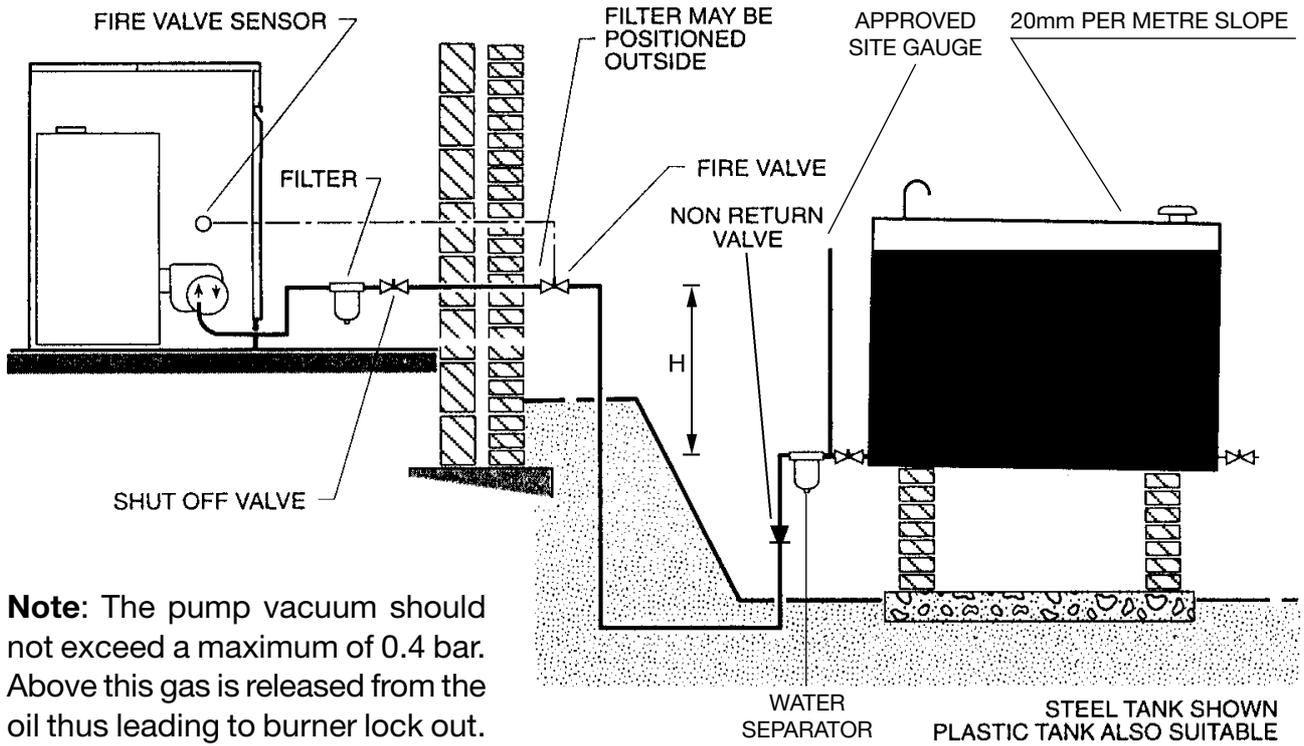
Lift H <sub>(m)</sub>	0.5	0.5	1	1.5	2	3	3.5
I.D. 8 mm	35	30	25	20	15	8	6
I.D. 10 mm	100	100	100	90	70	30	20

## 4.3 De-aerator System



**For maximum pipe length and lift contact de-aerator manufacturer.**

#### 4.4 One Pipe Lift



**Total Maximum Pipe Length (m)**

Lift H <sub>(m)</sub>	0.5	0.5	1	1.5	2	3	3.5
ID 8mm	35	30	25	20	15	8	6
ID 10mm	100	100	100	90	70	30	20

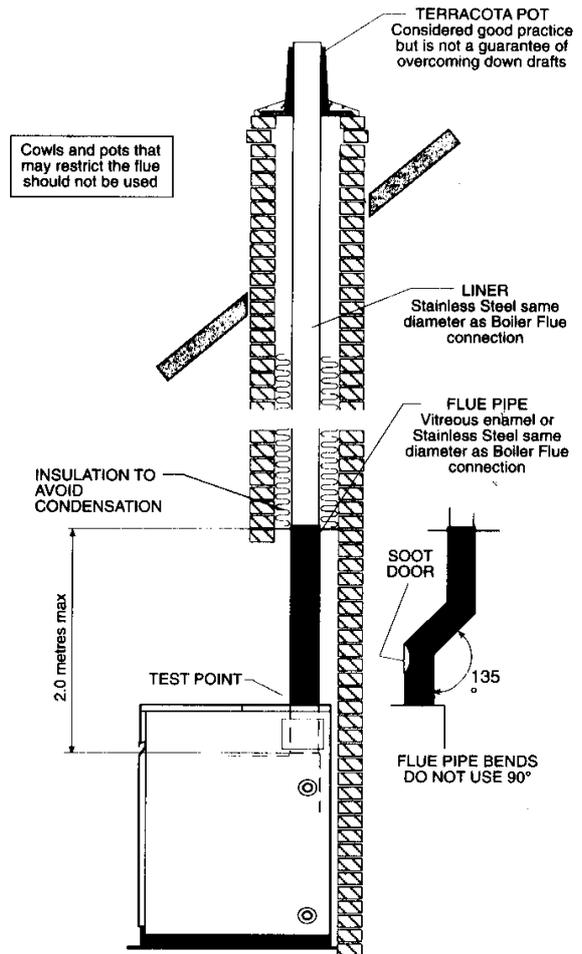
## 5.0 Flues

### 5.1 Conventional Flues

The flue should be designed in accordance with the local bye-laws and the Clean Air Act. Draught stabilisers are not recommended for oil fired boilers. Sharp bends or horizontal runs should be avoided and the flue should terminate 2 feet (600 mm) above the ridge of the dwelling. Terminals which restrict the discharge or allow ingress of water should be avoided.

It is recommended that when connecting to an existing masonry chimney a flexible stainless steel liner of the correct diameter should be used. The annular space must be sealed top and bottom and filled with insulation.

**Note:** Twin wall flue systems must comply to BS4543 Part 3.



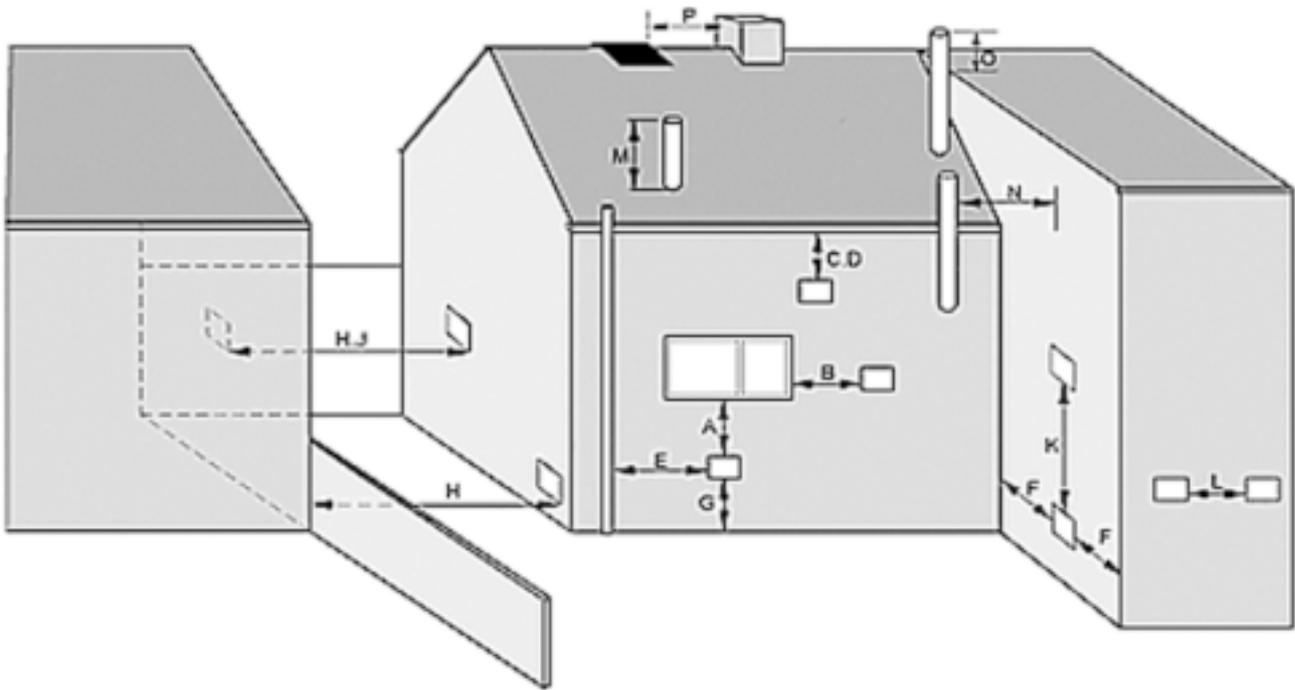
Typical Conventional Flue with Brick Chimney

### 5.2 Low Level Balanced Flues Terminal Positions and Kabin Pak Flues

Attention should be given to the position of the flue discharge; we recommend the following guidelines be adopted.

1. The flue should not discharge beneath opening windows or within 2 metres of other accesses to the building.
2. The flue should not discharge near internal/external corners of the building where turbulent wind conditions could occur.
3. A terminal guard should be fitted at all times.
4. The terminal should not discharge over property boundaries.
5. Discharge into narrow passageways should be avoided.
6. The actual siting of the flue should be determined by the installer after consultation with the householder.
7. In positioning this flue the wind direction should be considered.

**Installation in exposed positions is not recommended.**



**MINIMUM DISTANCES TO TERMINALS IN MILLIMETRES AS MEASURED FROM THE TOP OF THE CHIMNEY OR THE RIM OF A LOW LEVEL DISCHARGE OPENING**

	<b>APPLIANCE BURNER TYPE</b>	<b>GB</b>	<b>NI &amp; ROI</b>
A	Directly below an opening, air brick, opening window etc.	600	600
B	Horizontally to an opening, air brick, opening window etc.	600	600
C	Below a gutter, eaves or balcony with protection.	75	75
D	Below a gutter or a balcony without protection.	600	600
E	From vertical sanitary pipework.	300	300
F	From an internal or external corner or surface or boundary alongside the terminal.	300	600
G	Above ground or balcony level.	300	300
H	From a surface or a boundary facing the terminal.	600	600
J	From a terminal facing the terminal.	1200	1200
K	Vertically from a terminal on the same wall.	1500	1500
L	Horizontally from a terminal on the same wall.	750	750
M	Above the highest point of an intersection with the roof.	600	600
N	From a vertical structure on the side of the terminal.	750	750
O	Above a vertical structure less than 750mm from the side of the terminal.	600	750
P	From a ridge terminal to a vertical structure on the roof.	1500	1500

**These are minimum dimensions and are only quoted as a guideline but they will satisfy the requirements of the Building regulations.**

**Where the flue terminal is within 1 metre (NI & RoI) or 300mm (GB) of any plastic material, such material should be shielded from the effects of the combustion products of the flue.**

**Terminating positions must be at least 1.8 metres distant from an oil storage tank unless a wall with at least 30 min fire resistance and extending higher and wider than the tank is provided between the tank and the terminating position.**

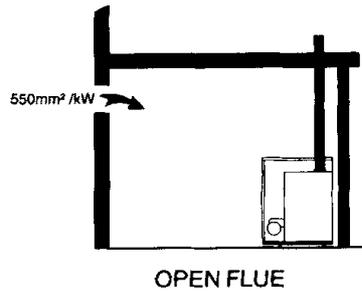
## 6.0 Air Supply for Combustion and Ventilation (see BS 5410)

### 6.1 Open Flue Boilers

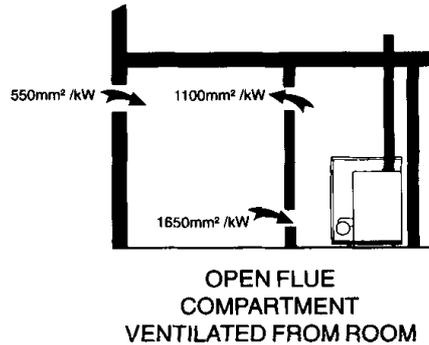
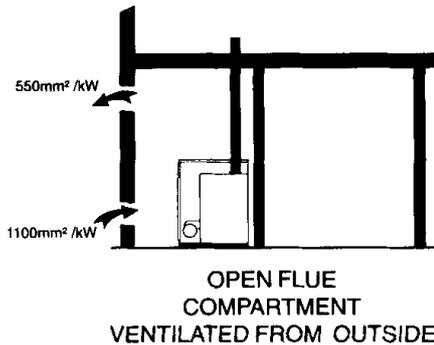
When the boiler is sited in a cellar where the only access for combustion and ventilation air is at high level then the combustion air should be ducted to low level.

#### Combustion Air Supply

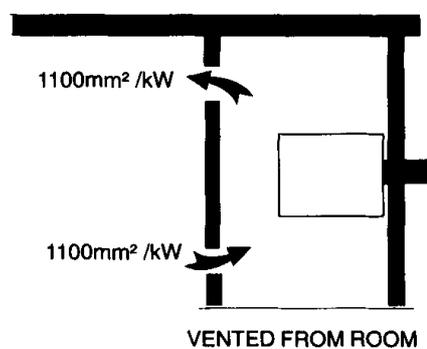
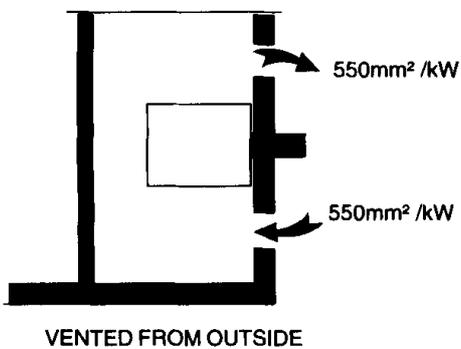
Boiler in Room



Boiler in Compartment

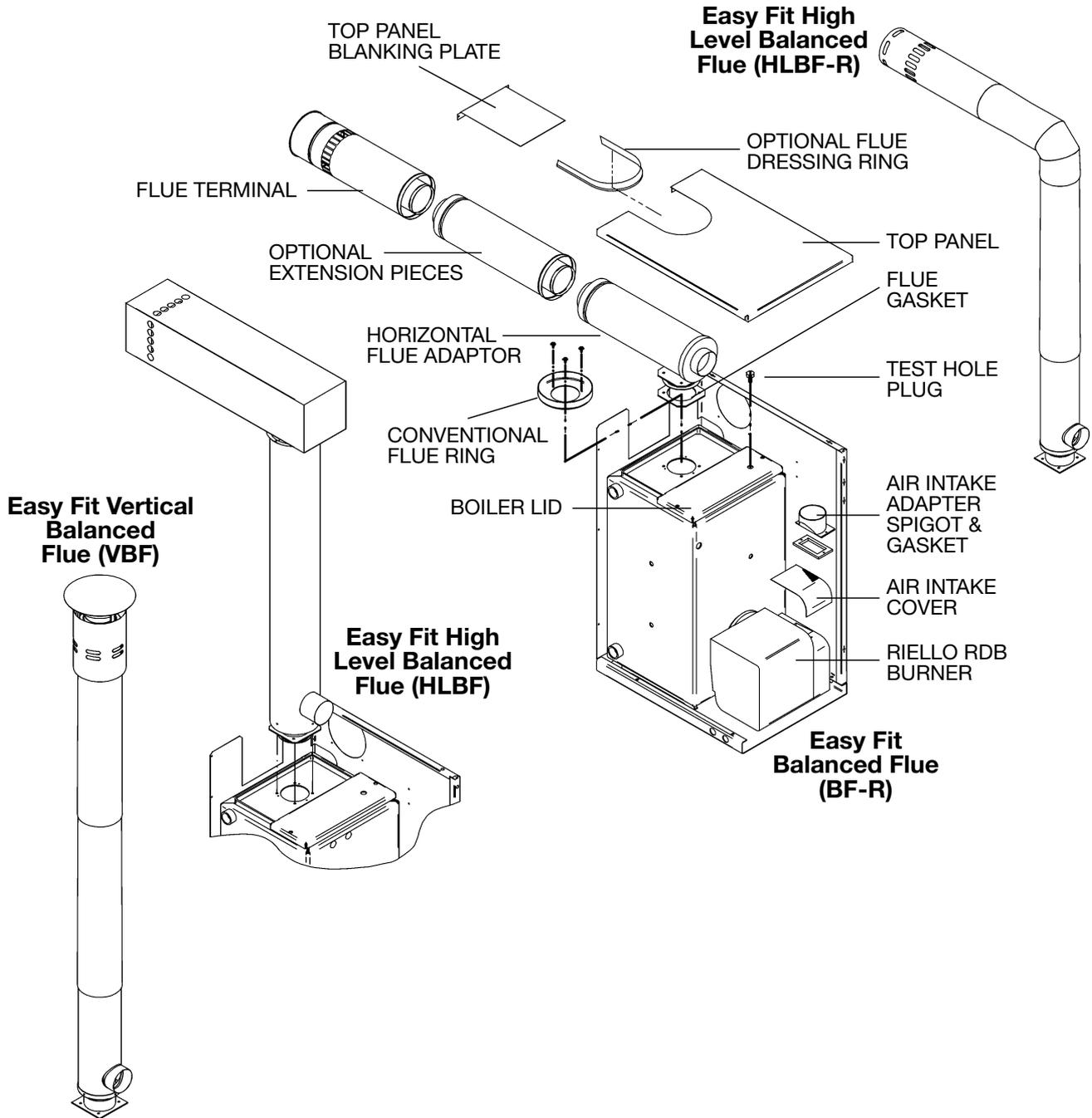


### 6.2 Balanced Flue Boilers in a Compartment



Air Supply for Ventilation  
No Combustion Air Inlet required to Room

### 6.3 Installation of Flues



### 6.3.1 Installation of a Balanced Flue (BF-R, HLBF-R & VBF)

1. Make a suitable sized hole in the wall or ceiling for the flue kit. Add the dimensions given on pages 6 (Dimension G) and 8 (Flue Vertical Dimension). The cavities around the opening must be sealed and protected by a non-combustable sleeve.
2. Remove the top panel (kitchen and utility models) and the combustion chamber lid.
3. Remove the flue ring from the top of the boiler (3 screws) ensuring that any remaining silicone sealant has been cleaned away.
4. Carefully fit the inner and out seals to the flue adaptor.

**Note:** After fitting the seals to the flue smear them with soap or any suitable lubricant which does not react with the silicone rubber.

5. Place the gasket correctly on the boiler and locate the flue adaptor over this, fixing it in position using the nuts and bolts provided. For BF-R side outlet options on white case boilers it will be necessary to manoeuvre the adaptor through the side panel before fixing it to the boiler after the blanking plate has been removed. Push boiler into position against the wall.
6. If fitting extension pieces ensure the seals are correctly fitted and lubricated before pushing through the wall and attaching to the flue adaptor.

**Note:** Any combination of short (300mm) and long (600mm) extension pieces for the BF-R can be used up to a maximum additional length of 1200mm.

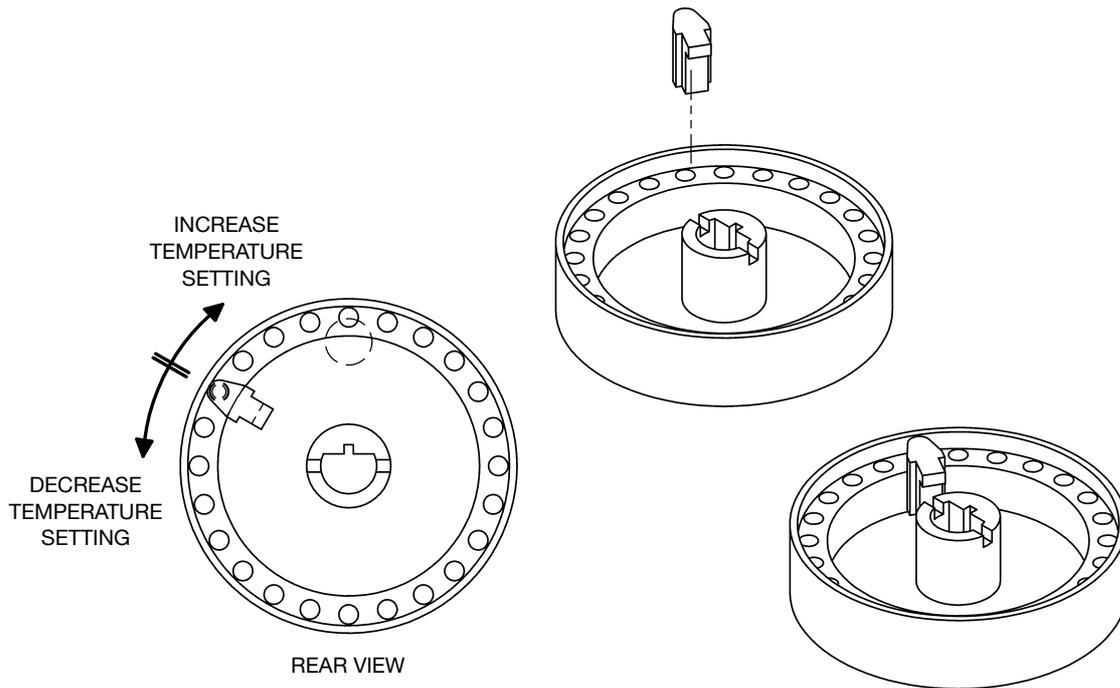
7. Slide the flue terminal into position with a twisting movement ensuring that it protrudes through the wall by a minimum of 175mm and a maximum of 225mm or through the roof by a minimum of 665mm.
8. Seal the gap between the flue and the wall both inside and out after which the protective basket must be fitted to the wall over the flue terminal.
9. After removing the air inlet cover fit the air intake adaptor spigot and gasket to the burner. Connect one end of the air duct to the flue and the other end to the air intake spigot on the burner. Both ends should be securely fastened with the jubilee clips.
10. The boiler is now ready to be connected to the plumbing, oil supply and mains electricity.
11. The baseplate of the Goldbird and Whitebird has been designed to allow the oil pipe and electric cable to pass unnoticed inside the unit from the rear of the installation. Alternatively the grommeted holes either side, towards the front of the baseplate, can be used.
12. A test hole for commissioning purposes has been provided on the boiler lid.

### 6.3.4 Installation of High Level Balanced Flue (HLBF)

Installation instructions as per the balanced flue except there are no seals involved as the flue is not telescopic. There are no extension pieces available for these units.

**Note:** When filling a HLBF to a Combi a new top panel with a larger cut out for the flue is required.

### 7.0 Tank Thermostat Control Knob Peg Setting



## **8.0 Installation**

The boiler installation must be in compliance with BS 5410 Part 1 1997 and the Building Regulations.

### **8.1 Hearth**

The boiler hearth temperature is between 50°C and 85°C and should be stood on a rigid, non-porous, non-combustible base, which is not softened by warmth to comply with the Building Regulations.

### **8.2 Service Access**

#### **8.2.1 Combi**

24" (600 mm) Clearance should be provided above and in front of the boiler to allow for routine servicing. If placed under a worktop ensure that the worktop is easily removed.

#### **8.2.2 Kabin Pak Combi**

The Kabin Pak Combi has been designed to allow fitting into a corner. However a minimum clearance of 600mm should be provided to the front and right hand side of the Kabin Pak to allow access for servicing.

### **8.3 Heating System**

The heating system should be installed to HVCA current codes of practice.

Before installing the boiler the new or existing system should be thoroughly flushed to clear all sludge or other foreign matter such as solder, steel wool and copper fillings. We recommend that the system is cleaned out in accordance with BS 5449 and BS 7593:1992 using a suitable non-corrosive commission cleanser.

It is further recommended that a suitable corrosion inhibitor is added to the heating system, which will not damage the synthetic rubber membrane of the expansion vessel.

#### **8.3.1 Air Vents**

An automatic air vent complete with its own check valve is fitted to the top of the heat store and boiler heat exchanger. However it is recommended that another air vent is fitted at the highest point in the system.

#### **8.3.2 Drain Cock**

Drain cock(s) should be fitted to the lowest points in the system to enable the system to be fully drained. A drain cock has also been fitted to the heat store and boiler heat exchanger.

### 8.3.4 Boiler Connections

All connections to the appliance should be made with compression fittings.

### 8.3.5 Boreholes

Where the mains water supply to the boiler is fed from a borehole via a pump and accumulator arrangement the variable pressure can cause the mixer valve to go to its fail safe settings thus preventing the outlet water temperature from achieving a suitable level.

In order to minimise the pressure variations it is recommended that differential on the borehole pump pressure switch is kept as low as possible without adversely affecting the pump motor. The accumulator must be as large as possible in order to reduce the rate of pressure change and a pressure reducing valve (PRV) must be situated between the pump and accumulator and the boiler. The PRV must be set slightly below the minimum setting of the pressure switch on the pump.

### 8.3.6 Expansion Vessel

A 12 litre expansion vessel charged to 0.5 bar is supplied with the boiler. This can accommodate a maximum combined boiler and system volume of approximately 150 litres. **If this volume is exceeded an additional vessel will be required.** Refer to BS 7074: Part 1 or BS 5449 for details of sizing. The values given in the table are for total system values which includes the primary water capacity. See page 4.

VESSEL VOLUMES													
INITIAL CHARGE	0.5	2.1	4.2	6.3	8.3	10.5	12.5	14.6	16.7	18.7	20.8	22.9	25.0
	1.0	2.7	5.4	8.2	10.9	13.6	16.3	19.1	21.8	24.5	27.2	30.0	32.7
	1.5	3.9	7.8	11.7	15.6	19.5	23.4	27.3	31.2	35.1	39.0	42.9	46.8
TOTAL SYSTEM VOLUME	25	50	75	100	125	150	175	200	225	250	275	300	

The pressure in the vessel(s) should be checked annually during the normal boiler service by fitting a gauge to the shreeder valve on the vessel. Ensure the system pressure is ar zero to ensure on accurate reading.

### 8.3.7 System Filling

As standard, a filling point complete with a filling loop has been included within the appliance. The temporary hose **must** be disconnected after filling. A system pressure when cold of 1 bar is recommended.

Water loss from the system as indicated by a reduction in pressure on the pressure gauge may be made up through the filling loop.

After filling, vent all air from the system. Ensure the caps on the automatic air vents are loose and bleed both circulating pumps.

## 8.4 Domestic Hot Water

The mains water supply pressure must not exceed 5 bar. If the mains water pressure exceeds 2 bar then a pressure reducing valve must be fitted. The final 600 mm of the mains supply pipe to the appliance must be in copper. The flow rate of water from individual taps is dependant on the number of outlets being operated together, as well as the length and size of pipework in the system and the mains supply pressure flow regulators.

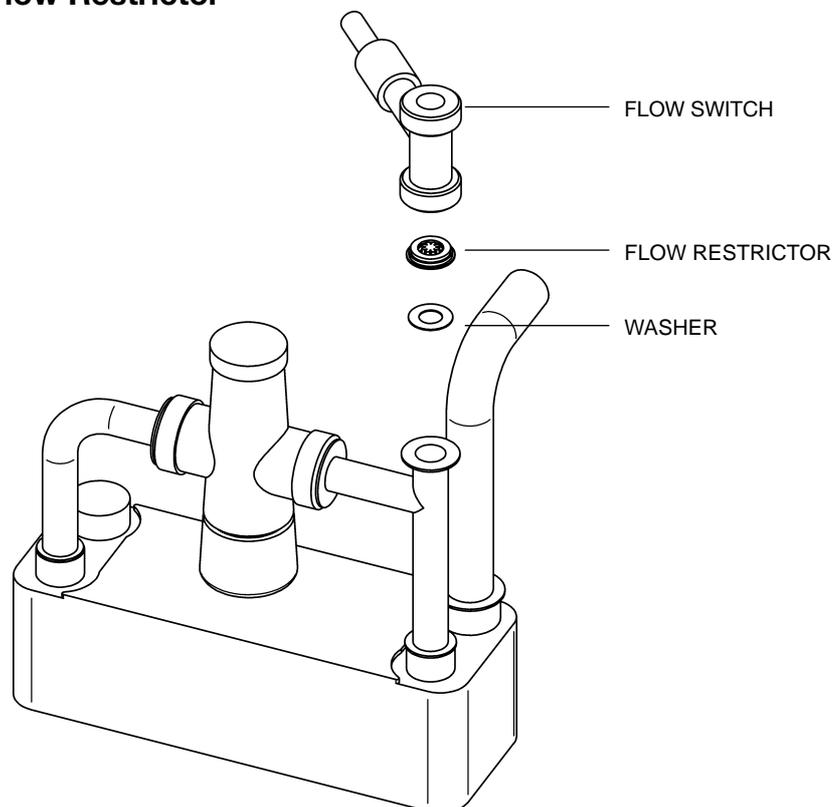
Whenever a pressure reducing valve or any other device containing a non-return valve is fitted to the mains water supply pipe entering the boiler, it is recommended that a mini expansion vessel, suitable for use on potable water, is fitted between the device and the closed tap.

Although many of the DHW components are designed to resist lime scale formation, in areas of hard water it may still be necessary to fit an inline chemical water softener. For further information contact Warmflow and your local water company.

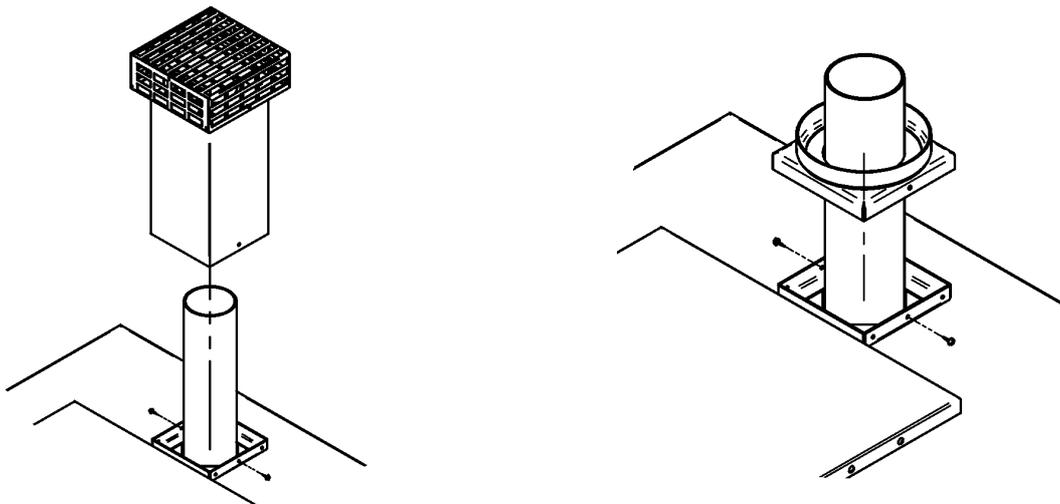
To ensure economic use, the pipe runs between the boiler and the taps should be as short as possible and insulated to reduce heat loss. For boilers that have to be sited remotely from the main point of use, there is likely to be very long pipe runs which can lead to excessive water usage and poor fuel efficiency. It is recommended that a pumped hot water return is used in order to improve HW reaction times. Contact Warmflow for details.

**Note:** An 18L/min flow restrictor has been factory fitted but can be easily removed if required.

## 8.5 Removal of Flow Restrictor



## 8.6 Fitting a Vertical Flue Adaptor



1. Remove the 2 self tappers connecting the flue main body to the Kabin Pak and lift off. It may be necessary to break the seal between the flue main body and the top of the flue pipe.
2. Ensure that the gap between the existing flue pipe and the top of the Kabin Pak is properly sealed with high temperature silicone sealant.
3. Once the flue main body has been removed fit the Kabin Pak adaptor (KPA) into position and secure with the 2 self tapping screws. A 5" conventional flue can now be attached.

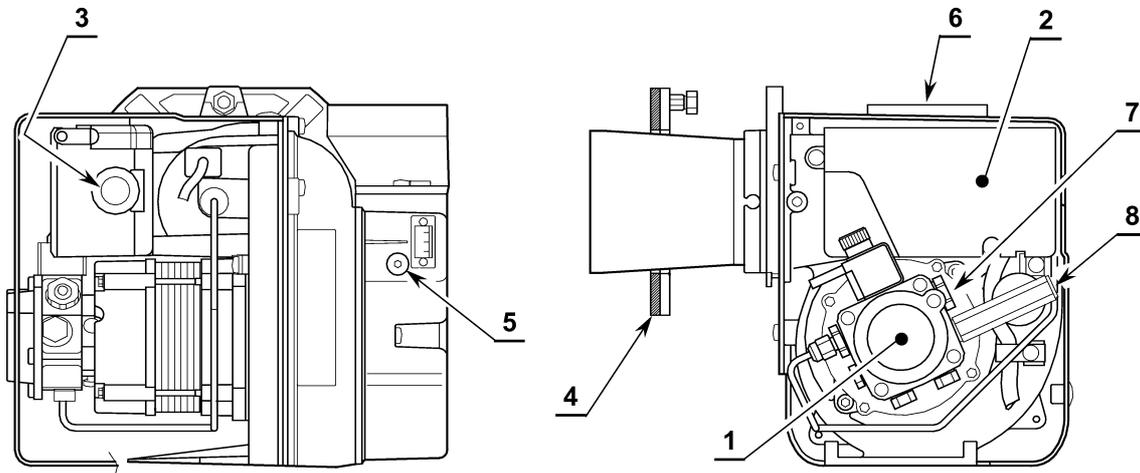
## 8.7 Additional Requirements for a Kabin Pak Combi

1. The Kabin Pak is manufactured from galvanised sheet and powder coated. After installation further painting is not required.
2. When using the Kabin Pak with the integral low level flue only 28 second redwood number 1 (kerosine) may be used in order to comply with building regulations. Suitable flue terminal positions are shown on page 27.
3. The boiler must be provided with a suitable well drained hard standing area to prevent the formation of pools of water in order to eliminate any risk to the service engineer or end user.
4. The boiler must not be serviced or the panels removed where there is a risk of the ingress of water.
5. Although the Kabin Pak has been weatherproofed to IP45 it should not be subjected to a jet of water from a hose or power washer.

## 9.0 Burners

### 9.1 RDB Burner

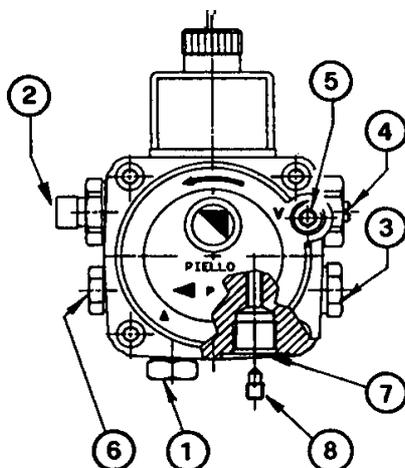
The burner is fitted with the correct nozzle and the pressure set. All that is further required before commissioning, is to connect the oil and electricity supply.



- |                                    |   |
|------------------------------------|---|
| 1. Pump                            | 5. Air damper adjustment screw                |
| 2. Control box                     | 6. Air tube connection (supplied with BF kit) |
| 3. Reset button with lock-out lamp | 7. Pump pressure adjustment screw             |
| 4. Flange with insulating gasket   | 8. Pressure gauge port                        |

### 9.2 Oil Supply

The burner is supplied for use with a one pipe system. For use on a two pipe system, it is necessary to remove the return port plug and fit a small by-pass plug as shown.

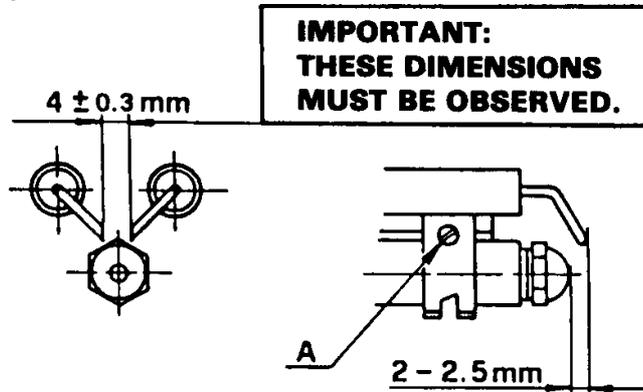


- |                                  |
|----------------------------------|
| 1. Suction port                  |
| 2. To nozzle                     |
| 3. Pressure gauge port/air bleed |
| 4. Pump pressure adjustment      |
| 5. Vacuum port                   |
| 6. To hydraulic ram              |
| 7. Return port                   |
| 8. By-pass plug                  |

### 9.3 Electrical Connections

The boiler control equipment and the burner are provided ex works, it is only necessary to connect a 230V 50Hz supply in accordance with the electrical drawings.

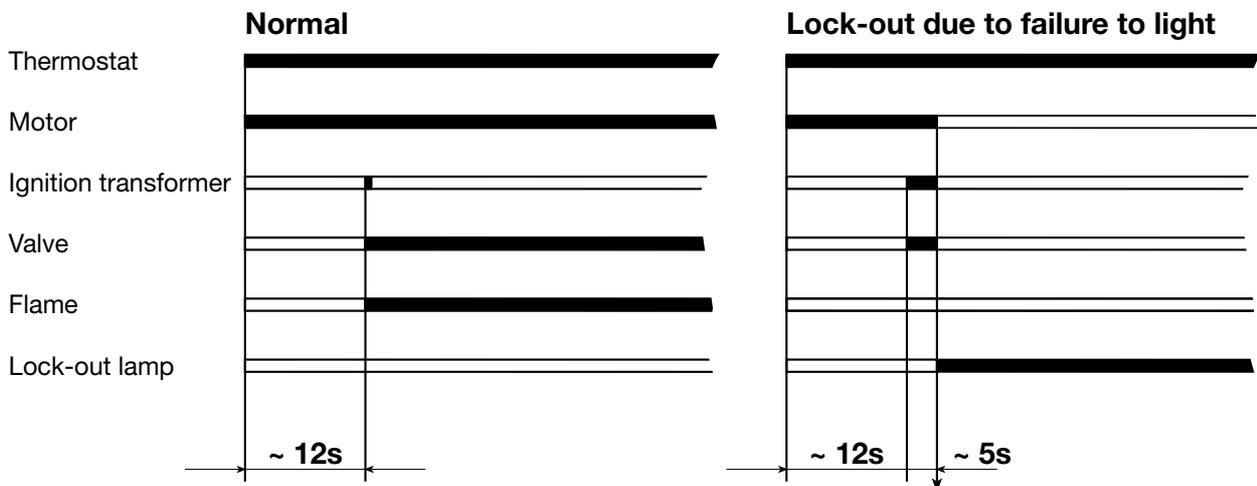
### 9.4 Electrode Setting



#### Attention

Before assembling or removing the nozzle, loosen the screw (A) and move the electrodes away from the nozzle.

### 9.5 Burner Start-up Cycle



## 10.0 Commissioning and Servicing

### 10.1 Commissioning

**Note: IT IS THE RESPONSIBILITY OF THE INSTALLER TO ENSURE THAT THE BOILER IS PROPERLY COMMISSIONED BY AN OFTEC TRAINED AND REGISTERED TECHNICIAN. SEE BS 5410. FAILURE TO DO SO WILL INVALIDATE ALL WARRANTIES.**

Combustion tests must be carried out using a Combustion Analyser. The pump pressure can be checked by fitting a manifold and a pressure gauge to the oil pump.

Before firing ensure that all the baffles are in place as they may have been displaced during transit as shown in on page 8. Set the boiler control to 80°C switch on, ensuring all controls are calling for heat. Typical burner settings and test data are shown in section 2.6.

Check the smoke reading, CO<sub>2</sub> content and flue gas temperature with the boiler up to temperature. Testing while the boiler is still relatively cold gives inaccurate results and leads to incorrect adjustments being made.

Where a balanced flue has been fitted ensure the air duct connecting the flue and burner has been properly connected before commissioning. On the Kabin Pak Combi refit the front door panel before doing a flue gas analysis.

**To comply with GB building regulations OFTEC form CD11 should be completed and a copy left with the householder.**

### 10.2 Servicing

#### 10.2.1 General Requirements

It is recommended that the appliance is serviced annually by an OFTEC registered service technician in accordance with the recommendations laid out in OFTEC's technical information book 2 – 'Pressure Jet Appliances – Commissioning Requirements for Technicians'.

Additionally when servicing special attention should be paid to the condition of the oil nozzle, flexible oil line, fuel filter and lid and base insulation all of which will need to be replaced on a regular basis.

**Note: Second year or other extended warranties will be invalidated if the appliance is not serviced annually by an OFTEC trained and registered technician.**

#### 10.2.2 Kabin Pak Combis

1. The boiler must be provided with a suitable well drained hard standing area to prevent the formation of pools of water in order to eliminate any risk to the service engineer or end user.
2. The boiler must not be serviced or the panels removed where there is a risk of the ingress of water.

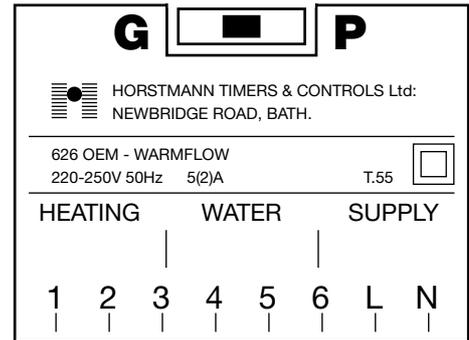
## 11.0 Horstmann 626 Electronic Programmer (not applicable to Kabin Pak Combi)

### User Instructions

**Note: Ensure selection switch on the rear of the programmer is at the correct setting 'G' for HW only or HW and CH. 'P' for independent HW and CH.**

The programmer is factory set at its mid-position.

The 626 Boiler Mounted Programmer is an electronic, 7 day central heating and hot water control; extremely reliable and easy to operate. Properly programmed it will help you save energy and create a comfortable environment in your home.



The 626 Electronic Programmer has the following features:

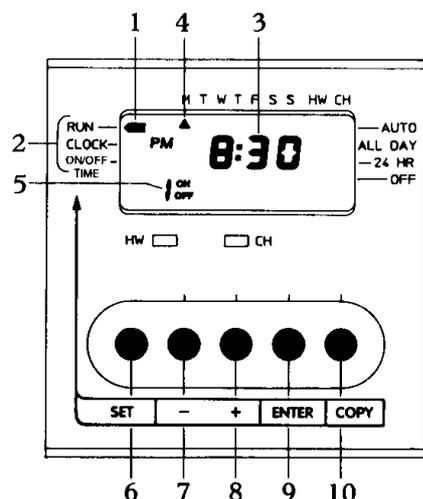
- 3 ON and 3 OFF periods every 24 hours with a choice of different programmes for each day of the week.
- Override programme options of AUTO, ALL DAY, 24 HOUR and OFF.
- A choice of HOT WATER and CENTRAL HEATING.
- A central heating ADVANCE button allowing an instant switch from ON to OFF, or from OFF to ON, without affecting normal settings.

Most of the control buttons on your programmer are dual purpose buttons.

They can be used as SET buttons for inputting time of day, ON/OFF times, etc, or as SELECT buttons for using the advance facility and choosing override programme options.

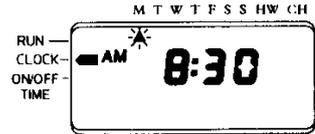
The diagram below can be used to identify the SET buttons, indicators and symbols referred to in the following sections of these instructions.

1. Set indicator.
2. Set positions.
3. Time-of-Day.
4. Day-of-Week indicator.
5. ON/OFF switch period symbol.
6. SET button.
7. Minus(-) adjust button.
8. Plus(+) adjust button.
9. ENTER button.
10. COPY button.



## Setting the Time of Day

Press the SET button so that the SET indicator is pointing to the CLOCK position on the front of the programmer. The DAY OF THE WEEK indicator will now flash.



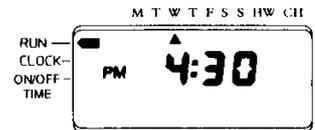
Use the PLUS(+) or MINUS(-) buttons to move the DAY OF THE WEEK Indicator to the current day of the week. Numbers relating to the days of the week are printed along the top of the programmer display, ie, 1 = Monday, 2 = Tuesday, etc.



Press the ENTER button. The TIME OF DAY will now flash.

Now use the (+) or (-) buttons to alter the display to the correct time of day, making sure that the AM/PM SYMBOL is also correct (see figure 4).

**Note:** By pressing and releasing the (+) and (-) buttons you advance or retard the time in 1 minute steps. If you keep the button depressed the display will fast cycle and the time can be changed more rapidly.



Press the ENTER button and then use the SET button to return the SET indicator to the RUN POSITION.

## Setting the 'ON' and 'OFF' Times

**Note:** The minimum ON/OFF time that can be set is TEN MINUTES.

The programmer already has a factory pre-set programme of ON/OFF times in its memory. These are based on the most commonly used settings and are as follows.

Monday to Friday:

Saturday/Sunday:

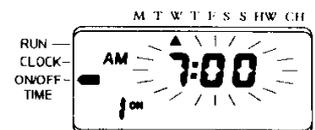
1st ON: 7.00am	1st OFF: 10.00am	1st ON: 7.30am	1st OFF: 11.30am
2nd ON: 12.00pm	2nd OFF: 12.00pm	2nd ON: 12.00pm	2nd OFF: 12.00pm
3rd ON: 5.00pm	3rd OFF: 11.00pm	3rd ON: 5.00pm	3rd OFF: 11.00pm

If these settings do not meet your own requirements then they can be easily changed as follows:

Press the SET button so that the SET indicator is in the position shown. The display will indicate 'DAY' and the DAY OF THE WEEK indicator will now flash.



Use the (+) and (-) buttons to move the indicator to the day of the week you wish to change the times for. Press ENTER.



The display will now show '1 ON' and the first ON time for that day will flash.

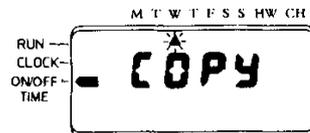
Adjust the flashing time as required by using the (+) AND (-) BUTTONS THEN PRESS ENTER.

The display will now show '1 OFF' and the first programmed OFF time for the day will flash.



This can be altered in the same way as the '1 ON'.

Follow the same procedure for the 2nd and 3rd ON/OFF times remembering to press ENTER after each change to the programme. If you do not wish to alter a particular time then simply press ENTER and the display will move on to the next ON/OFF time leaving the previous one unchanged.



When the 3rd OFF time has been entered the programmer will display the word COPY and the DAY OF THE WEEK indicator will flash (see figure 8).

You can now copy the ON/OFF times you have just input for one day onto any other days that you wish them to apply. This saves you having to separately programme days with identical switching times.

Use the (+) and (-) buttons to mov the DAY OF THE WEEK indicator to the next day that you wish the times to apply and press the COPY button, the display will indicate 'IN'.

Continue in this way until the programme has been copied to all the days that you wish it to apply to.

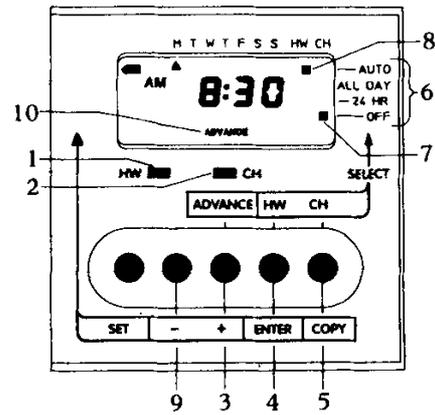
When you have finished copying simply press ENTER. The word COPY will be replaced with 'DAY' and the DAY OF THE WEEK indicator will flash.

You can now programme those days that require different times to the ones that you have just copied by following the same procedure as described at the start of this section, parts (ii) to (v).

**Note:** Your programmer allows you to have up to three ON/OFF periods each day. If you do not want to use all of these, a switch period can be cancelled by programming the ON operation the same time as the OFF operation, eg, 2nd ON at 12.00pm and 2nd OFF at 12.00pm.

The next diagram can be used to identify the SELECT buttons and indicators referred to in the following sections of this leaflet.

1. Hot water ON indicator.
2. Central heating ON indicator.
3. Advance button.
4. Hot water programme select button.
5. Central heating programme select button.
6. Programme positions.
7. Central heating programme indicator.
8. Hot water programme.



## Programme Selection

The following programmes can be selected for either HOT WATER by itself, CENTRAL HEATING by itself or HOT WATER and HEATING together.

### AUTO

When AUTO is selected the programmer will switch ON and OFF according to the switching times held in the memory, ie, up to three ON/OFF periods per day.

### ALL DAY

When ALL DAY is selected the programmer will switch the system on at the 1st ON TIME and OFF at the 3rd OFF TIME.

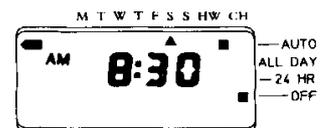
### 24 HOUR

When 24 HOUR is selected the system remains on continuously, ignoring all time settings.

### OFF

When OFF is selected the programmer clock continues to operate but the system remains off.

To select a programme for hot water press the HW PROGRAMME SELECT button until the HW (HOT WATER) PROGRAMME indicator is pointing to the required programme, eg AUTO.

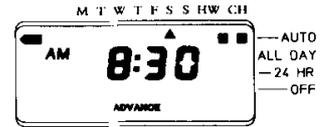


To select a central heating programme follow the same procedure using the CH PROGRAMME SELECT button.

**Note:** When HOT WATER or HEATING is switched to ON the relevant indicator light will be illuminated.

## Using the Advance

The ADVANCE facility allows you to bring forward the next ON or OFF period without having to alter the programmed ON/OFF times.



Press the ADVANCE button once and release. The word ADVANCE will appear in the display.

If the programmer was originally ON it will now switch OFF and stay OFF until the next programmed ON time.

The opposite will apply if the programmer was originally OFF.

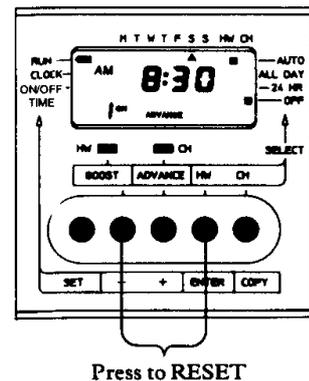
In both cases the unit will then revert to the normal programme times.

If you wish to cancel the advance simply press the ADVANCE button again and the word ADVANCE will disappear from the display.

**Note:** The ADVANCE facility has no effect when the CH PROGRAMME indicator is in either the 24 HOUR or OFF position.

Electronic equipment can, in exceptional circumstances be affected by electrical interference.

If your programmers' display or switching programme becomes frozen or scrambled, or you wish to revert to the factory pre-set programme you can RESET your programmer by pressing the MINUS(-) adjust button and the ENTER/HW SELECT button together.



After using the RESET procedure you will need to re-programme the day and time of day plus any changes you wish to make to the factory pre-set programme.

## Reserve Battery

Your programmer is fitted with a NON-RECHARGEABLE LONG LIFE battery which will maintain the programmed ON/OFF settings for a period in excess of two years.

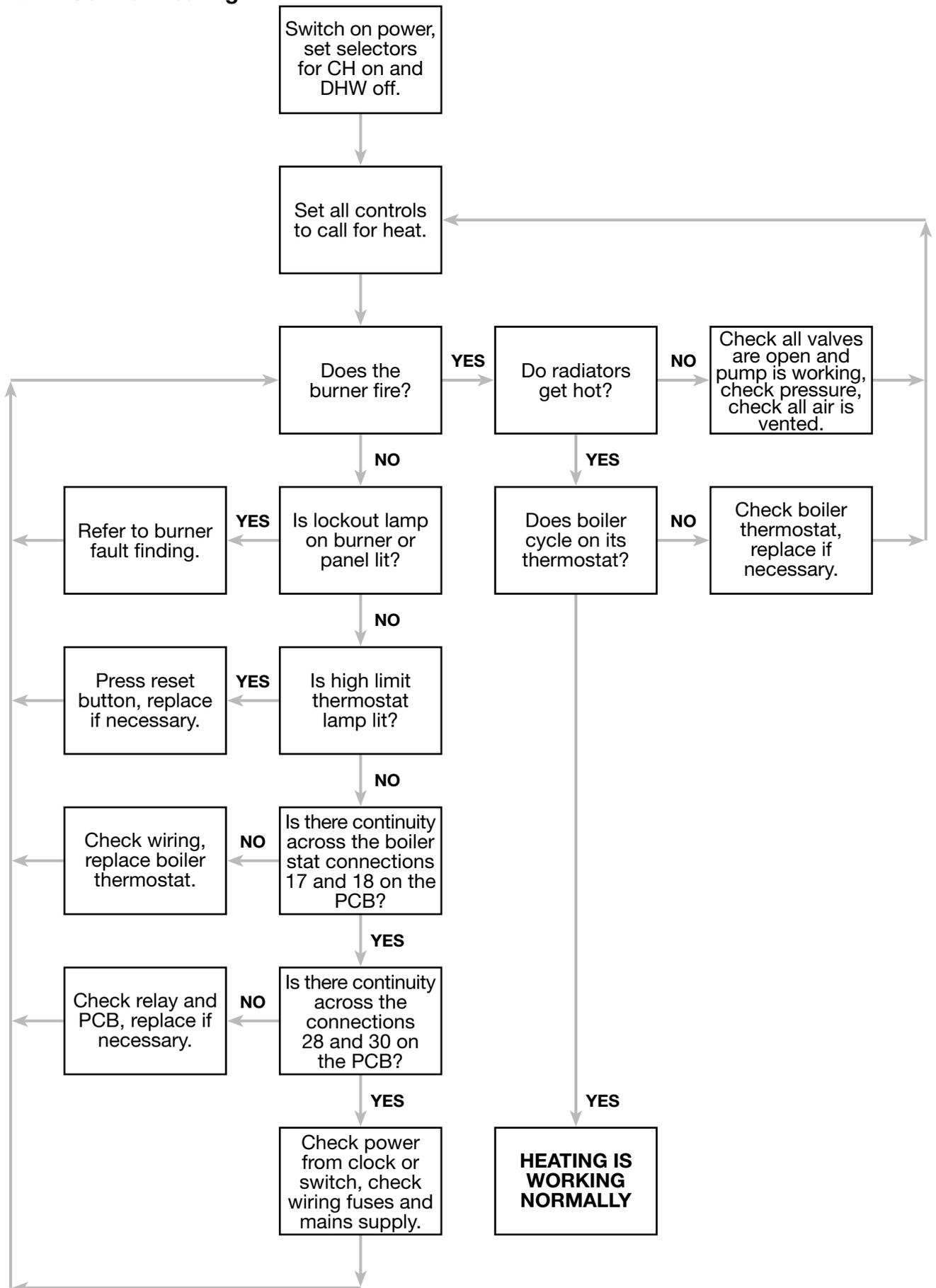
This is more than sufficient to cover all the expected power interruptions during the life of the unit.

## Heating Systems

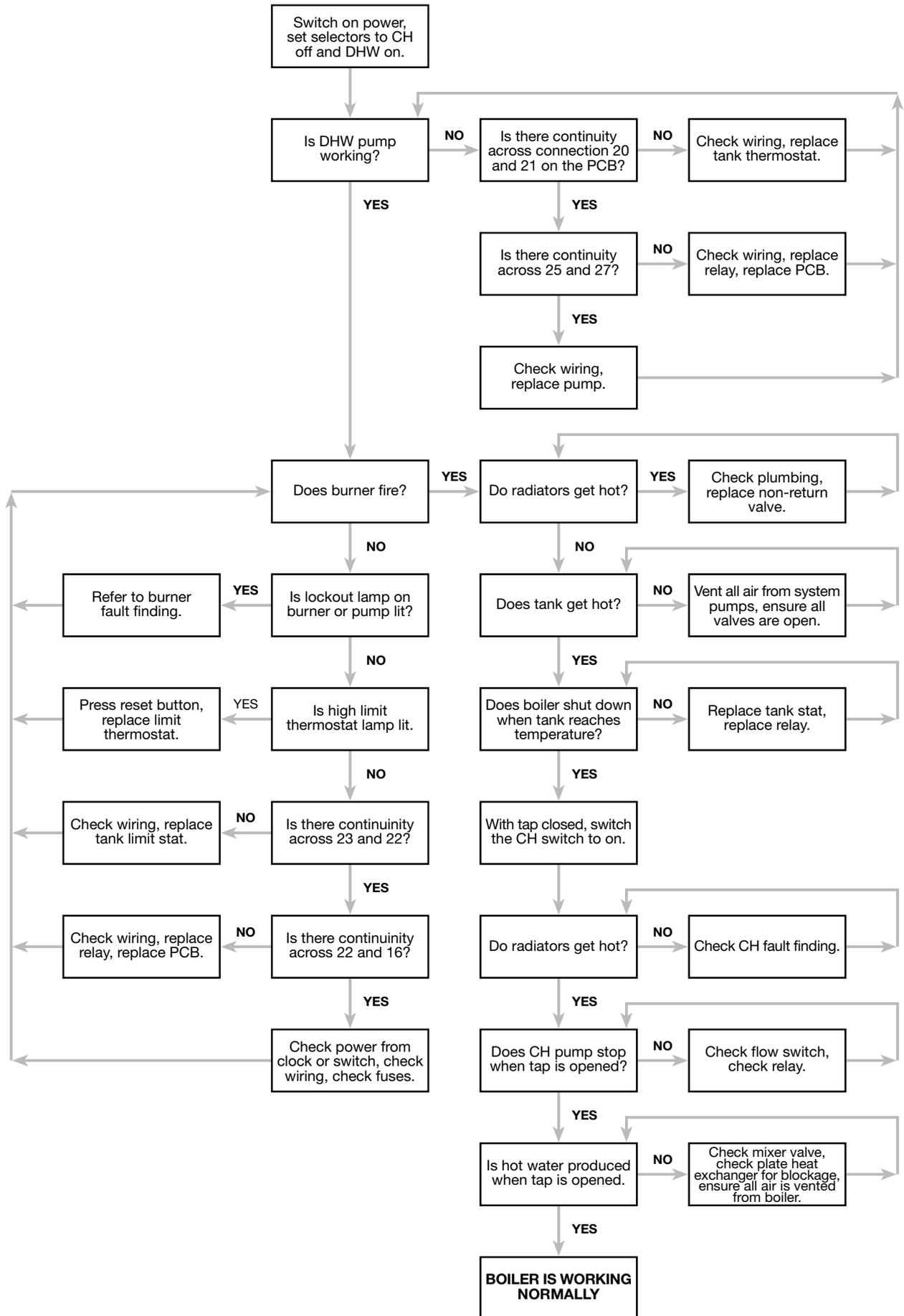
Information for use with various systems is available on request from Warmflow on (028) 9262 1515.

## 12.0 Fault Finding

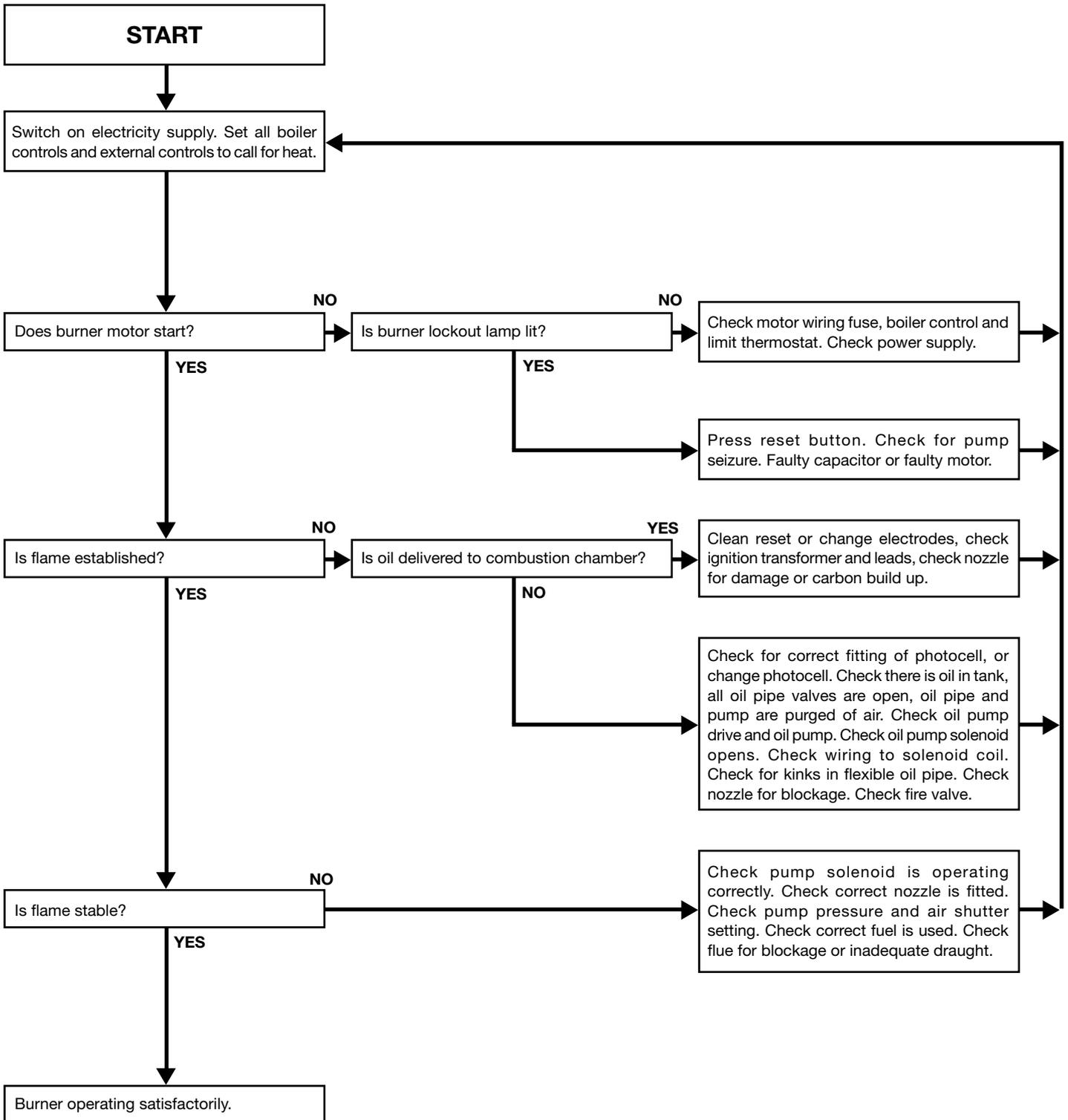
### 12.1 Central Heating



## 12.2 Domestic Hot Water

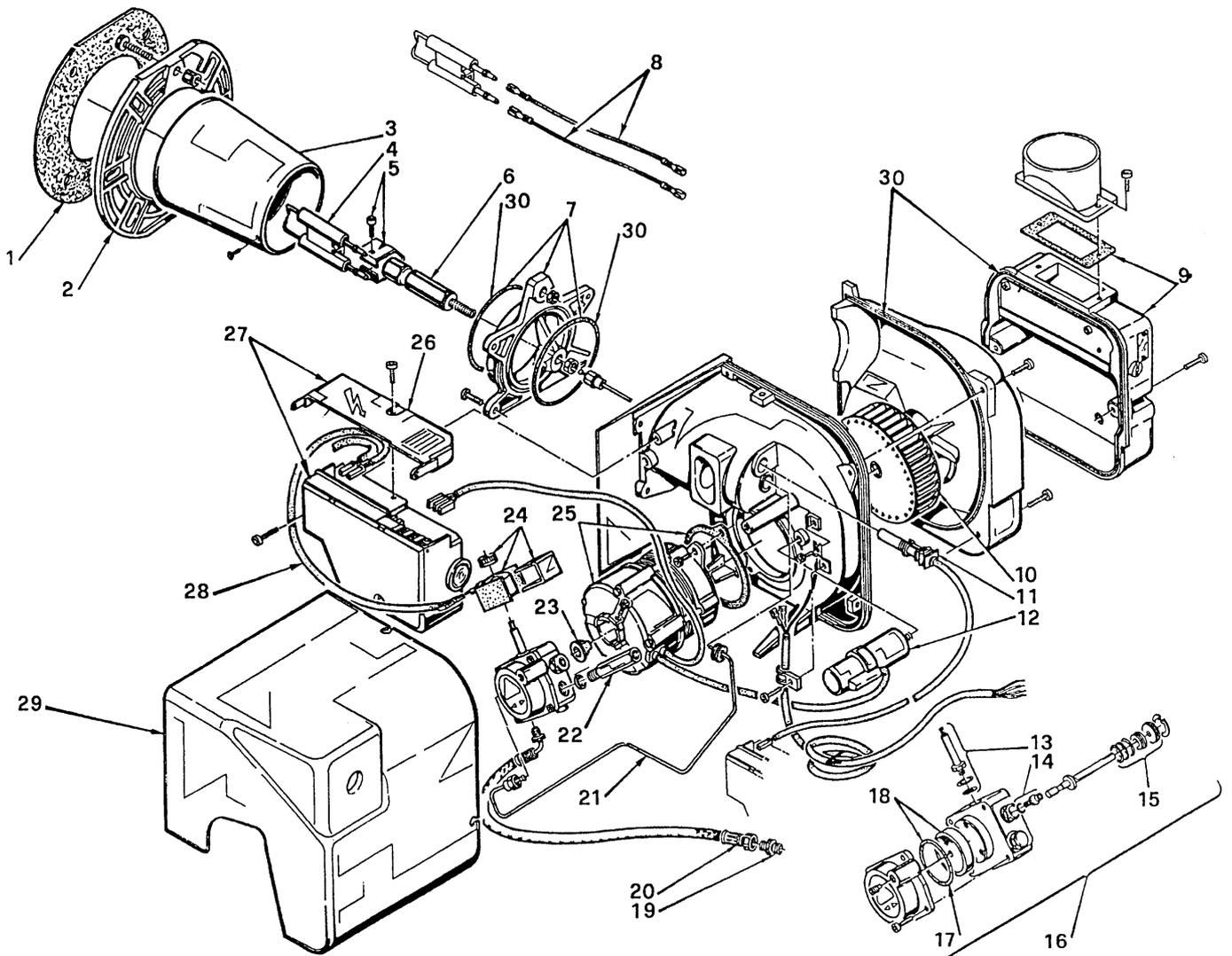


## 12.3 Burner



## 13.0 Spares

### 13.1 Riello RDB Burner

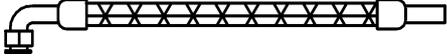
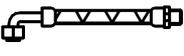
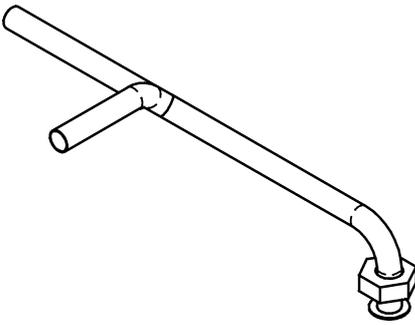
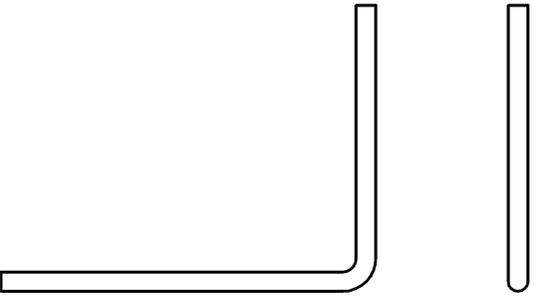
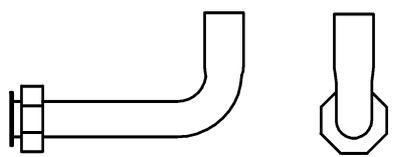
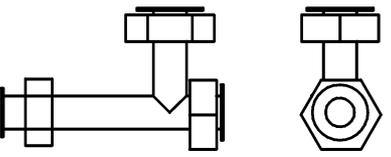
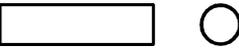
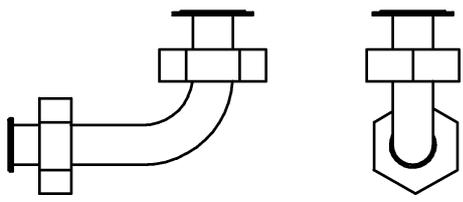
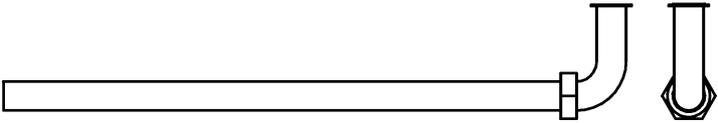
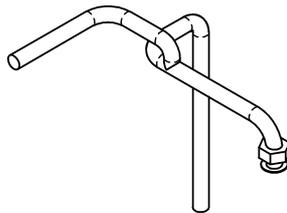
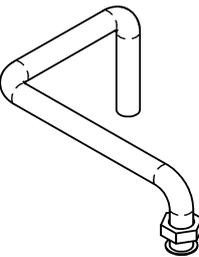


NO	CODE	3748757	DESCRIPTION
1	3005787	•	Gasket
2	3006384	•	Flange
3	3008769	•	Cup-shaped Head
4	3007513	•	Electrode Assembly
5	3006552	•	Electrode Bracket
6	3008642	•	Nozzle Holder
7	3008643	•	Collar
8	3008794	•	High Voltage Lead
9	3008647	•	Air Damper Assembly
10	3008645	•	Fan
11	3008646	•	PE Cell
12	3007479	•	Capacitor 4 $\mu$ F
12	3002837	•	Capacitor 4 $\frac{1}{2}$ $\mu$ F
13	3007582	•	Needle Valve
14	3008651	•	Regulator
15	3000439	•	Pump Seal

NO	CODE	3748757	DESCRIPTION
16	3008654	•	Pump
17	3007162	•	'O' Ring
18	3008653	•	Filter 'O' Ring
19	3003602	•	Connector
20	3005720	•	Flexible
21	3008644	•	Tube
22	3008876	•	Pressure Gauge
23	3000443	•	Joint
24	3008648	•	Coil
25	3008650	•	Motor
25	3002836	•	Motor
26	3008649	•	Protection
27	3008652	•	Control Box 535 RSE/LD
28	3008877	•	Lead Coil
29	3008879	•	Cover
30	3008878	•	Kit Seal

Note: The 4 $\frac{1}{2}$  $\mu$ F capacitor is only suitable for use with the 3002837 motor and the 4 $\mu$ F capacitor is only suitable for use with the 3008650 motor.

## 13.2 Pipe Spares

<p>All Combis</p>  <p>CH Pump to Boiler Flexible Pipe 2056</p>	<p>All Combis</p>  <p>Plate Heat Exchanger to Boiler Flexible Pipe 2057</p>	<p>All Combis</p>  <p>Boiler to Pressure Vessel Flexible Pipe 2056</p>
<p>Std Combis</p>  <p>Flow Switch to Strainer Pipe 1999</p>	<p>Std Combis</p>  <p>From CH Pump Pipe 1996</p>	
<p>All Combis</p>  <p>Plate Heat Exchanger to Boiler Pipe 1997</p>	<p>All Combis</p>  <p>Plate Heat Exchanger to Flow Switch Pipe 1992</p>	<p>All Combis</p>  <p>Hw Pump to Pipe Support Pipe 1993</p>
<p>All Combis</p>  <p>Plate Heat Exchanger to Mixer Valve Pipe 1994</p>	<p>Std Combis</p>  <p>From Mixer Valve Pipe 1995</p>	
<p>Kabin Pak Combis</p>  <p>Flow Switch to Strainer Pipe 2490</p>	<p>Kabin Pak Combis</p>  <p>From Mixer Valve Pipe 2491</p>	<p>Kabin Pak Combis</p>  <p>From CH Pump Pipe 2492</p>

### 13.3 Short Parts List

<b>Part Description</b>	<b>Code</b>
Flow Switch	1476
Tank & Boiler Control Thermostat	2131
Boiler Limit Thermostat	281
Tank Limit Thermostat	2126
Plate Heat Exchanger	599
Twin Head Grundfoss Pump	2130
Grundfoss 15/60 Pump (for replacement head)	602
3 Pole Relay	1827
Auto Air Vent C/W Check Valve	614
Pressure Relief Valve	2132
Filling Loop	2133
Pressure Gauge C/W Capillary	2169
Mixer Valve	1621
Low Pressure Switch	2270
Burner Reset Button Membrane	R7627
PCB Controller MK4	2419
Frost Thermostat	2508
Conventional Flue Adaptor	KPA
Air Intake Duct	AID
12 Litre Pressure Vessel	2128

When ordering replacement casing panels it should be noted that due to the painting process there may be some variation in colour.



*The Boiler People*

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E-mail: sales@warmflow.co.uk

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Fax: (0161) 205 4818  
E-mail: sales@warmflow.co.uk

**Dublin**

Balbriggan Industrial Estate,  
Dublin  
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Fax: (01) 841 6614

## FOR PARTS, SERVICE & WARRANTY CONTACT

**TEL: (028) 9262 1515**

**FAX: (028) 9262 2827**

**service@warmflow.co.uk**

**N IRELAND**

**TEL: (DUBLIN) 8416158**

**FAX: (DUBLIN) 8416614**

**REP OF IRELAND**

**TEL: (0161) 205 4202**

**FAX: (0161) 205 4818**

**ENGLAND,  
SCOTLAND & WALES**

## FOR TECHNICAL ASSISTANCE CONTACT WARMFLOW ON

**TEL: (028) 9262 1515**

**E-MAIL: technical@warmflow.co.uk**

This manual is accurate at the date of printing but will be superseded and should be disregarded if specifications and/or appearances are changed in the interests of continued product improvement.