

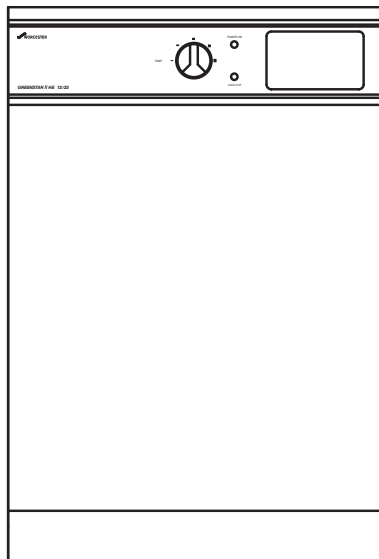


GREENSTAR // HE OIL

12/22

ROOM SEALED BF FLOOR STANDING OIL-FIRED
CONDENSING PRESSURE JET APPLIANCE

INSTALLATION AND SERVICING INSTRUCTIONS



Worcester Bosch supports the
Benchmark code of practice

BOILER OUTPUT

Hot Water and Central Heating

12/22 MINIMUM 12 kW (41,000 Btu/h)
MAXIMUM 22 kW (75,000 Btu/h)

T30.30275.03

THESE INSTRUCTIONS APPLY TO UK MODELS ONLY

THESE INSTRUCTIONS ARE TO BE LEFT WITH THE APPLIANCE

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1. Installation Regulations

1.1 General installation information and advice may be obtained from the Oil Firing Technical Association for the Petroleum Industry (OFTEC). Training courses are also offered by OFTEC, leading to inclusion on their list of registered engineers.

1.2 The appliance should be installed by a competent person. The person installing the appliance should be aware of the Health and Safety at Work Act and take appropriate action to ensure that the regulations are adhered to. In order to give optimum efficiency and trouble free operation the appliance should be commissioned by a qualified engineer. OFTEC recommends the use of registered engineers for the commissioning of oil-fired burners.

1.3 The manufacturers notes must not be taken, in any way, as overriding statutory obligations.

1.4 The compliance with a British Standard does not, of itself, confer immunity from legal obligations. In particular the installation of this appliance must be in accordance with the relevant requirements of the following British Standards and regulations in respect of the safe installation of equipment.

BS 5410: part 1 & 2: Code of practice for Oil Fired Boilers.

BS 799: part 5: Specification for Oil Storage Tanks.

BS 7593: Code of Practice for treatment of water in domestic hot water central heating systems.

BS 5449: part 1: Specification for forced circulation hot water central heating for domestic premises.

BS 5955: part 8: Specification for the installation of thermoplastic pipes and associated fittings for use in domestic hot and cold water services and heating systems.

BS 7291: Thermoplastic pipes and associated fittings for hot and cold water for domestic purposes and heating installations in buildings.

BS 7074: part 1: Application, selection and installation of expansion vessels and ancillary equipment for sealed water systems.

BS 7671: IEE Wiring Regulations, current edition.

The Building Regulations Part J and L1 England and Wales; Part F and Part J Section III Scotland; Part L and Part F Northern Ireland.

Local water company bye-laws.

The Control of Pollution (Oil) Regulations.

1.5 To ensure that the installation will perform to the highest standards, the system and components should conform to those mentioned in the instructions.

2. General Information

2.1 These instructions cover room sealed balanced flue (RS) appliances only.

2.2 The Worcester Greenstar HE Oil appliance covered in these instructions has been designed to serve domestic central heating and hot water requirements ranging from 12 kW to 22 kW.

2.3 This RS balanced flue appliance forms a fully room sealed

system causing the combustion air to be drawn through a duct from outside. The sealed burner cover gives excellent acoustic noise reduction and alleviates the need for an air brick to be located in the boiler room.

Because the balanced flue system does not rely on the cabinet panels to form the room seal, combustion readings can be taken from the test point on the condenser heat exchanger and the cabinet panels can be easily removed during installation thereby preventing any damage.

2.4 The boiler is factory set to the mid-range output and can be altered, if necessary, by adjusting the burner as specified in Table 2. This appliance is only suitable for use with 28 second Kerosene heating oil.

NOTE: It is a mandatory requirement of the building regulations that only 28 second kerosene is used on low level discharge flues.

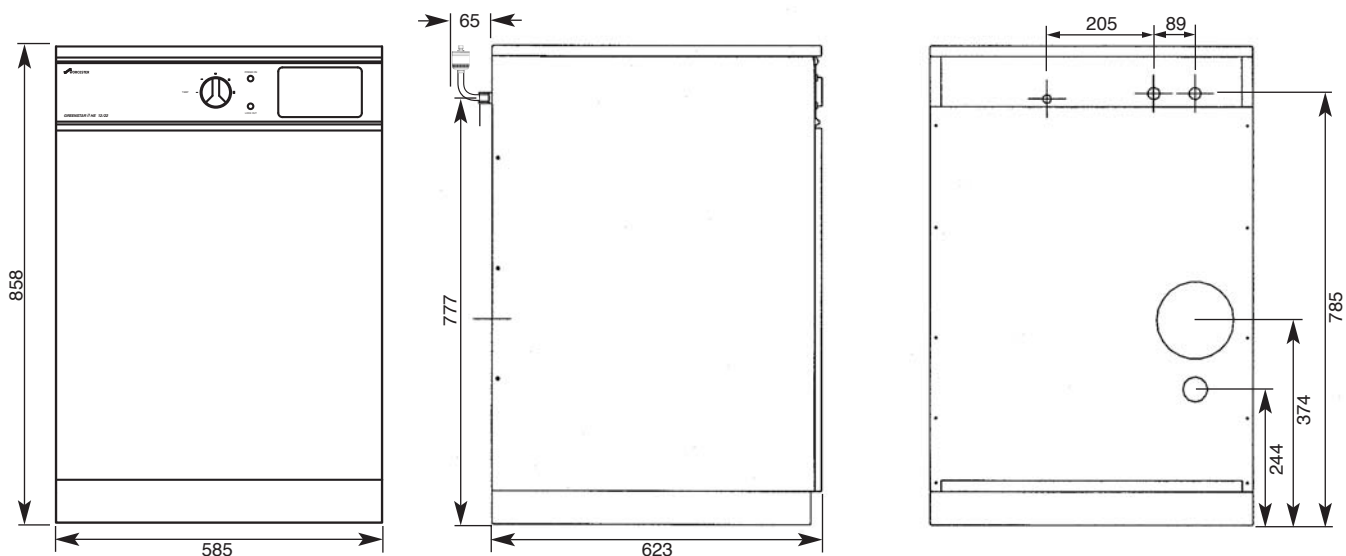
3. Technical Data

Table 1

SPECIFICATIONS	
Model	12/22
POWER SUPPLY	230/240V 50 Hz
HEATING FLOW	22mm
HEATING RETURN	22mm
FUEL LINE	¼" BSP
MINIMUM FLUE REQUIREMENT	Balanced Flue Kit Page 8
HEARTH TEMPERATURE	Below 100°C
MAXIMUM STATIC HEAD	30m (98 ft.)
PRIMARY WATER CAPACITY	20 litres (4.4 gal.)
WEIGHT	121 Kg (267 lbs)
BURNER	Electro Oil Sterling 40
EXIT FLUE GAS MASS FLOW	40 kg/hr
CONTROL THERMOSTAT RANGE	50°C minimum cut in to 80°C maximum cut out
CONTROL THERMOSTAT DIFFERENTIAL	5°C
COMBUSTION PRODUCTS SAFETY THERMOSTAT BREAK POINT	120 + 0/ - 6°C
IP RATING	20
*SEDBUK RATING	90.7% BAND A

* The value is used in the UK Government Standard Assessment Procedure (SAP) for energy ratings for dwellings.

Fig. 1. Principal Dimensions (All Dimensions are millimetres)



12/22 Table 2. Electro Oil Bentone Sterling 40 Burner (See Fig. 27)

RS Balanced Flue Appliance

NOMINAL BOILER RATING AT NORMAL OPERATING TEMPERATURE											
Fuel	Nozzle	Pump Pressure (p.s.i.)	Fuel Flow Rate		Flue Gas Temp. °C	%CO ₂	Approx. Air Setting	Appliance			
			Kg/h	l/h				Input		Output	
								kW	Btu/hr	kW	Btu/hr
28 Sec. Kerosene	0.40 80°EH	150	1.24	1.55	60	10.5-11.0	2	14.7	50,000	14.1	48,000
28 Sec. Kerosene	0.45 80°EH	150	1.46	1.83	70	11.0-11.5	3	17.3	59,000	16.6	57,000
28 Sec. Kerosene	0.50 80°EH	150	1.68	2.10	80	11.5-12.0	5	22.0	75,000	21.1	72,000

Note: These figures are given for guidance only, it is essential therefore that the settings are adjusted to give the correct CO₂ value.

4. Siting the Appliance

4.1 The appliance is not suitable for external installation unless a suitable enclosure is provided.

4.2 The appliance should be positioned on a non-combustible solid base as near to the flue termination point as possible. Care should be taken to ensure that the appliance is level; use packing at the corners where necessary.

4.3 The rear of the appliance must be positioned so that the flue terminal can safely discharge the flue gases as described in Section 7.

4.4 The following clearances must be left to allow access for installation and servicing:

- (a) Above 600mm
- (b) In front - 600mm
- (c) Right and left hand side – sufficient for panel removal and access to pipe connections where required.

5. Removal of the Cabinet

For installation and servicing of the appliance the cabinet should be removed as follows:

5.1 Remove the cabinet top panel by lifting squarely upwards to release the four stud connections.

5.2 Remove the front panel by pulling the upper part of the panel forwards to release the studs and lifting the panel upwards to release it from its supporting ledge.

5.3 Remove electrical cover plate by unscrewing the two screws at the rear of the connector protector plate and hinge up and away.

5.4 The control box can be removed by undoing the two screws in the top access cover, two screws in the front, two ball studs in the top and the screw in the heat exchanger. The thermostat phials should be carefully removed from the phial pocket and the control box placed in a safe place taking care not to kink the thermostat capillary tubes.

6. Air Supply

6.1 The appliance does not require a separate vent for combustion air.

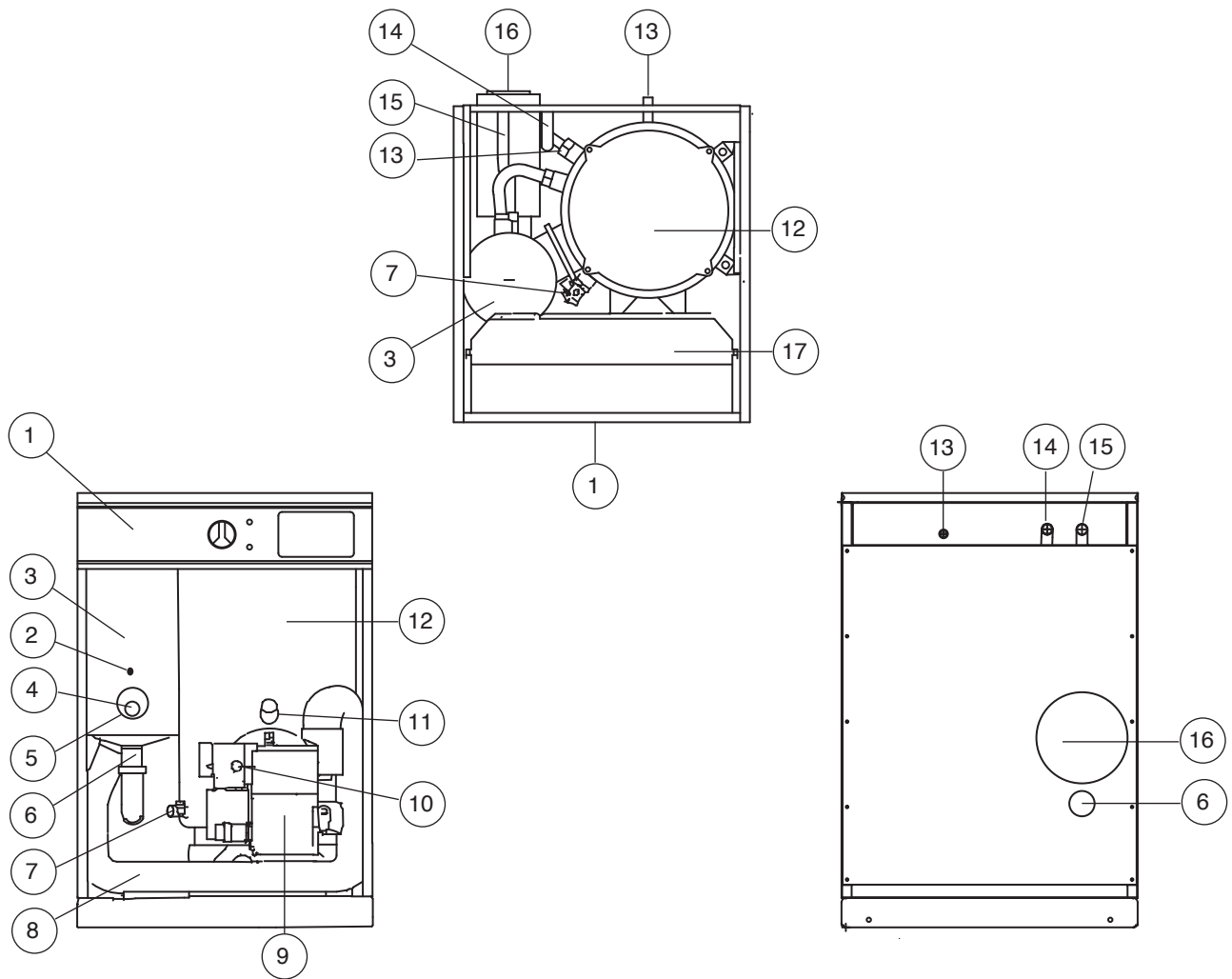
6.2 Installation in cupboards or compartments requires permanent vents for cooling purposes, one at high level and one at low level, either direct to outside air or to a room. Both vents must pass to the same room or be on the same wall to the outside air. The minimum air vent free area is given in Table 3.

6.3 There must be sufficient clearance around the appliance to allow proper circulation of ventilation air. The clearances required for Installation and Servicing will normally be adequate for ventilation. See Section 4.4.

Table 3. Minimum Air Vent Free Area for Room Sealed appliances installed in a compartment.

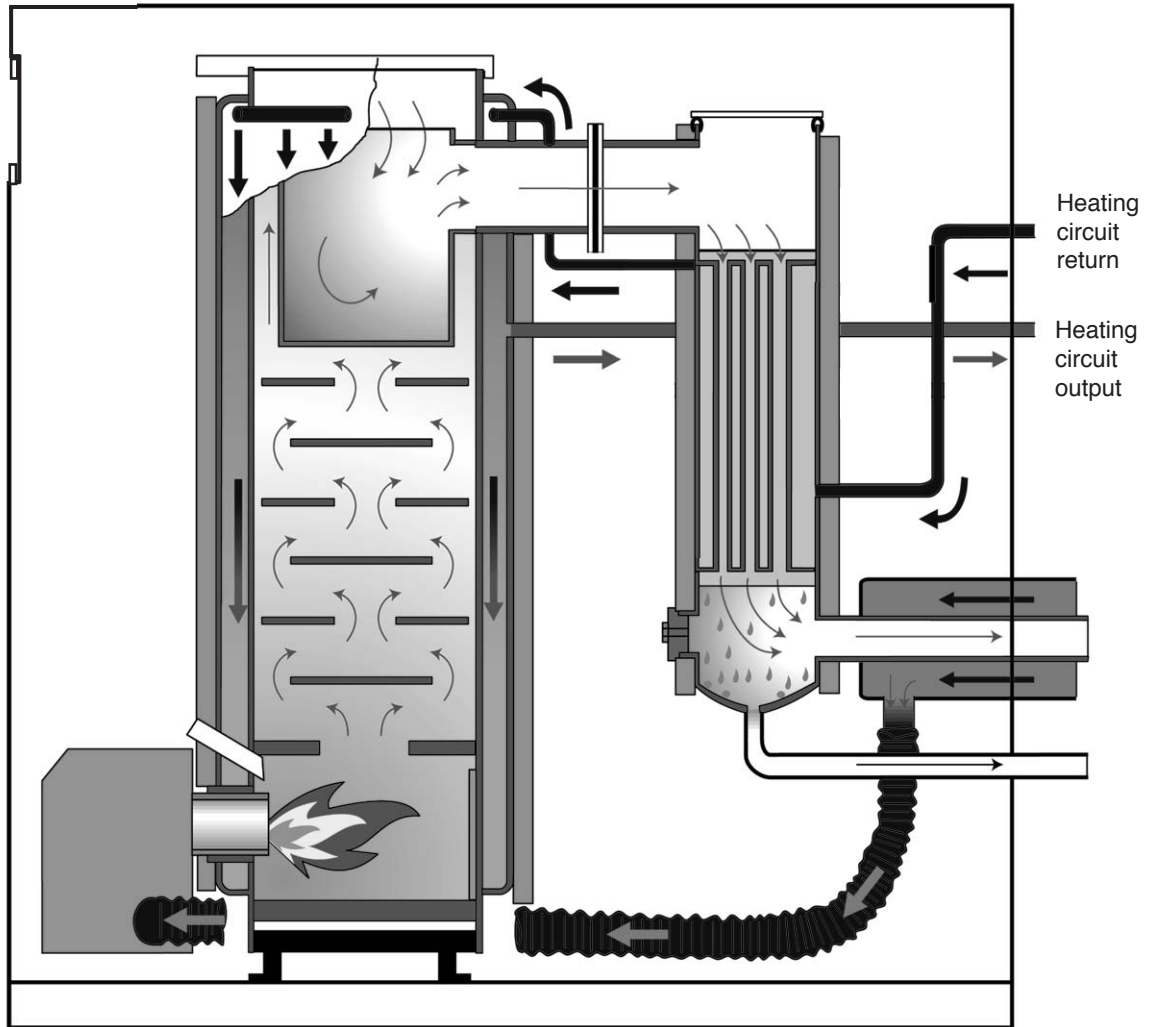
Appliance model	Ventilation to room or internal space		Ventilation to outside	
	High Level	Low Level	High Level	Low Level
12/22	187cm ²	187cm ²	93.5cm ²	93.5cm ²

Fig. 2. Components



- | | |
|--|-----------------------------------|
| 1) Control panel | 13) Auto air vent connection |
| 2) Condenser drain point | 14) Heating flow |
| 3) Secondary heat exchanger | 15) Heating return |
| 4) Combustion product test point | 16) Combustion products flue exit |
| 5) Secondary heat exchanger inspection/cleaning port | 17) Electrical cover plate |
| 6) Condensate drain | |
| 7) Heat exchanger drain point | |
| 8) Burner air inlet pipe | |
| 9) Oil Burner | |
| 10) Lock out reset button | |
| 11) Sight glass | |
| 12) Boiler shell | |

Fig. 3. Principle of Operation



The Greenstar HE Oil 12/22 is a sealed exhaust circuit condensation boiler.

Air is drawn in by the burner's fan from outside the appliance through the hose connected to the air inlet and combustion product evacuation concentric tube.

The boiler shell equipped with a system of removable baffles, is linked to a stainless steel secondary heat exchanger located directly on the heating return.

7. Flue System

A flue system provided by Worcester Bosch, must be fitted in accordance with BS5410:Part 1 and the Building Regulations.

The appliance is supplied ready for installation to a balanced flue system by the simple addition of one of the flue terminal kit options shown in Figs. 4 to 13.

Details of the installation procedure are included in the Flue Terminal Instructions supplied with the terminal kit.

7.1 Siting the flue terminal

1. The flue terminal must be located in a suitable position, as shown in Fig.14, such that the products of combustion can be freely dispersed without the possibility of the gases entering the dwelling or that of a neighbouring dwelling.

2. Discharge of flue gases into car ports or narrow passageways is not recommended.

3. The terminal must not cause an obstruction nor the discharge cause a nuisance as a result of either flue gases or terminal noise.

4. If a terminal is fitted less than 2 metres above a surface to which people have access, a suitable terminal guard must be fitted.

A suitable guard is available from Worcester Heat Systems, Part Number 7 716 190 009, or alternatively a proprietary terminal guard may be used provided it leaves 75mm clearance all around the terminal.

The guard should have suitable corrosion resistance due to the acidic content of the flue gases.

5. The terminal guard must be evenly spaced about the flue terminal and secured using screws so that the terminal guard can be removed for maintenance to the flue terminal.

6. In certain weather conditions. The terminal may steam and siting where this could cause a nuisance should be avoided.

7. Take care to ensure that combustion products do not enter ventilated roof voids.

Fig. 4. Standard Horizontal Flue

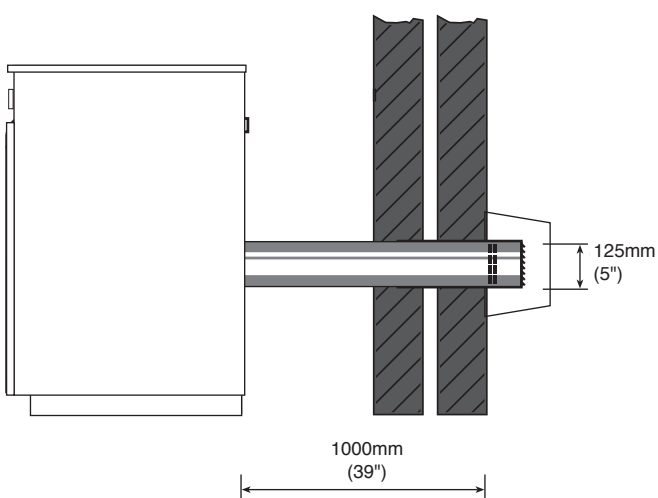


Fig. 5. Extended Horizontal Flue

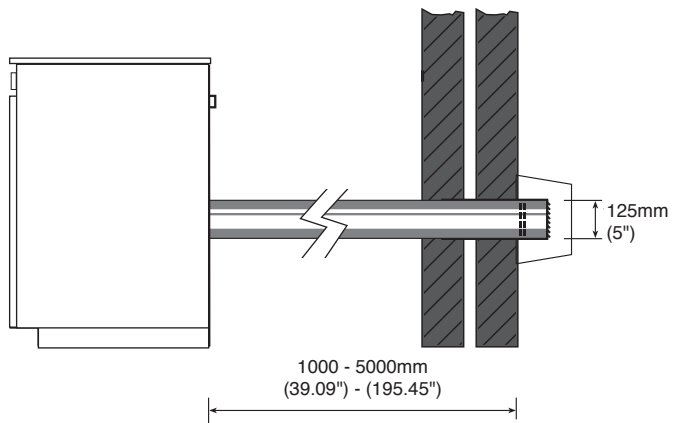


Fig. 6. Horizontal Flue with one 90° Bend

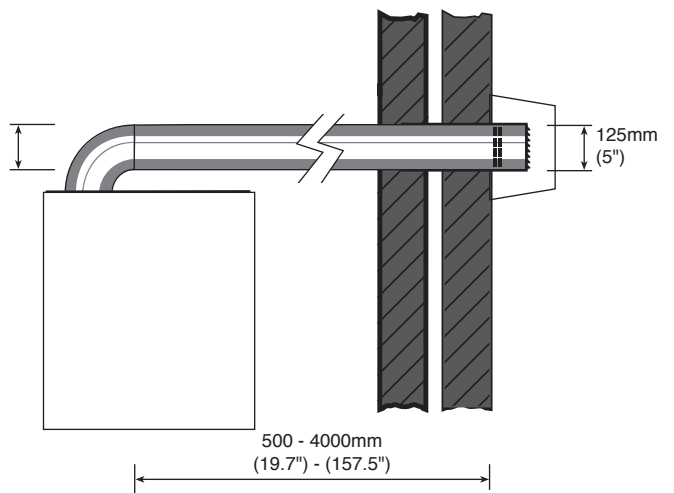


Fig. 7. Horizontal Flue with two 90° Bends

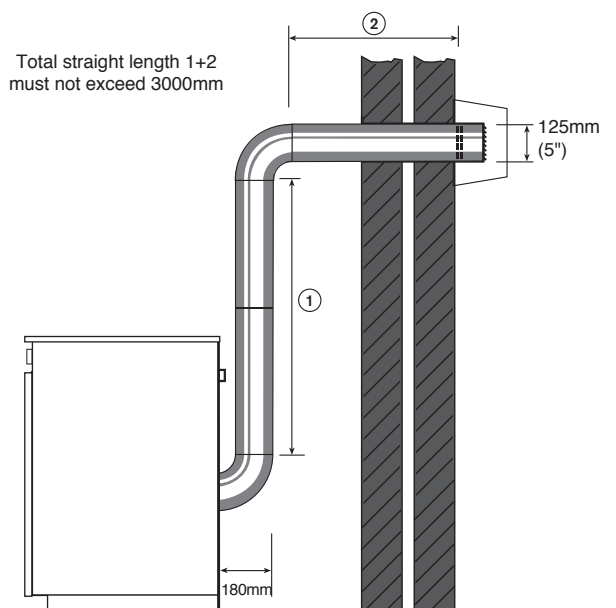


Fig. 8. Flue with one 90° and two 45° Bends

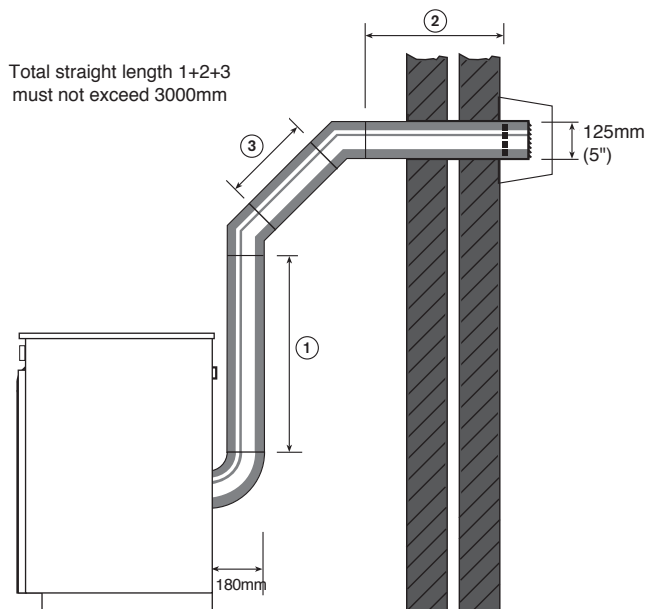


Fig. 9. Flue with two 90° Bends

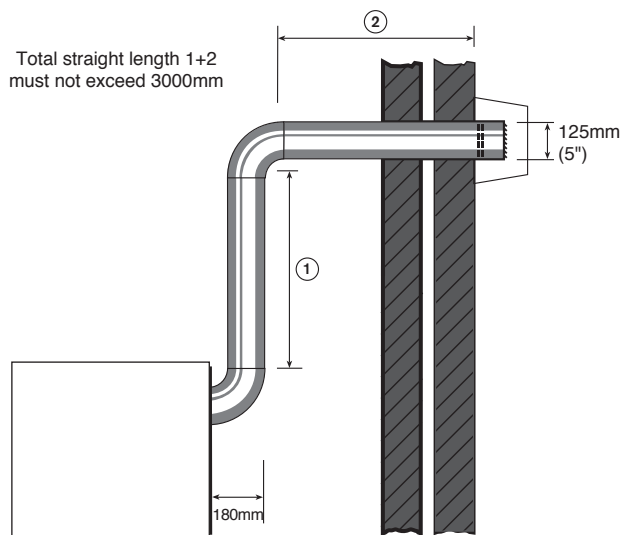


Fig. 10. Flue with one 90° and two 45° Bends

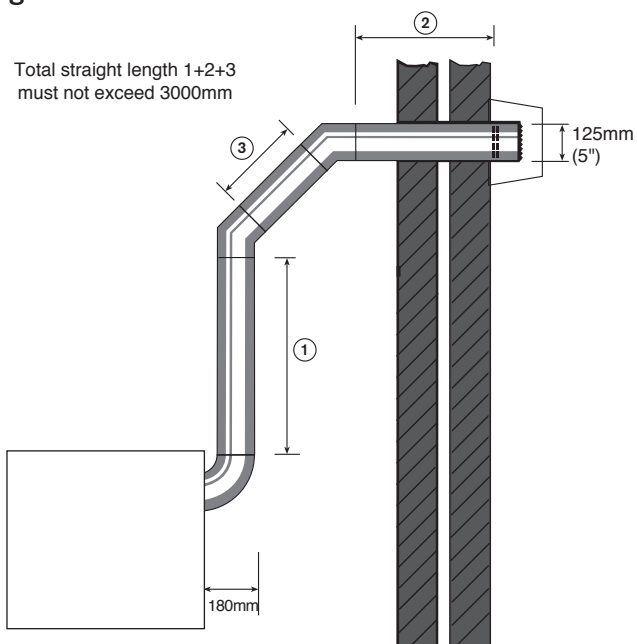


Fig. 11. Vertical Flue

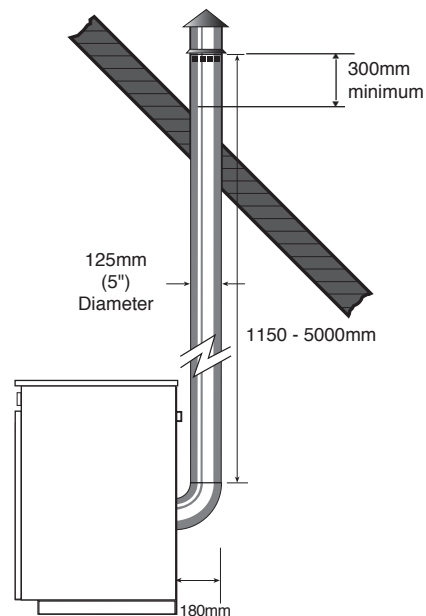


Fig. 12. Vertical Flue with two extra 90° Bends

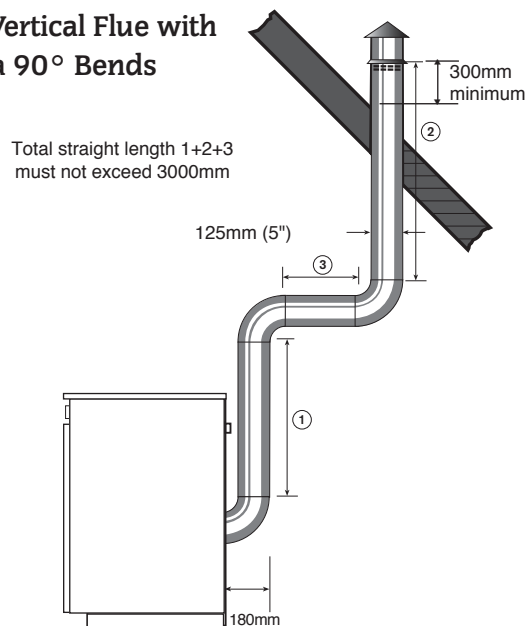


Fig. 13. Vertical Flue with two extra 45° Bends

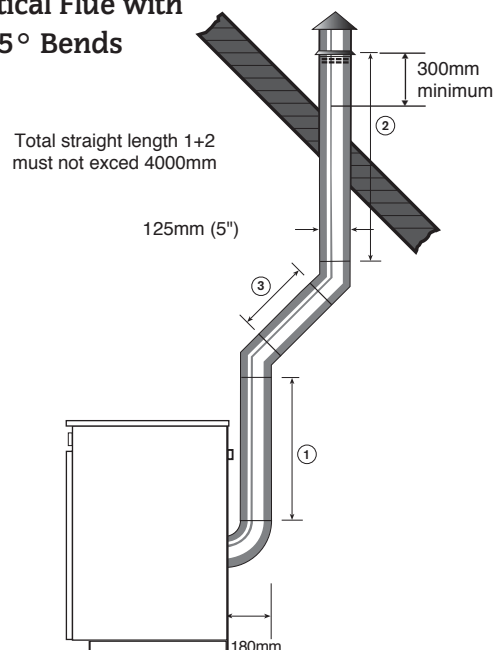
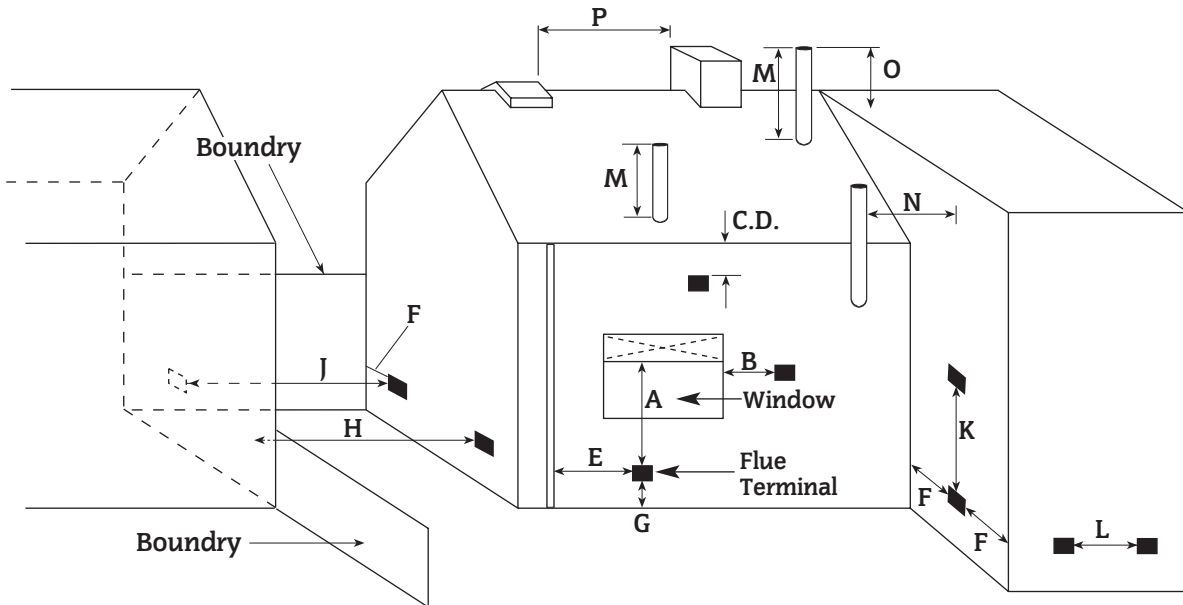


Fig. 14. Flue terminating positions for oil-fired appliances

NOTE: The dimensions given are for general guidance only. Other surrounding buildings or objects may affect the clearance of combustion products. An alternative flue terminal position should be sought when there is any possibility of a nuisance being caused by inadequate dispersal of flue products. Terminals should be positioned so as to avoid products of combustion entering into buildings.



Terminal Position	Minimum Distance (mm)		
	Open Flue	Low-Level Discharge	Vertical Balanced Flue
A Directly below an opening, air brick, window, etc.	Not allowed	600	Not allowed
B Horizontally to an opening, air brick, window, etc.	Not allowed	600	"
C Below a gutter or sanitary pipe if combustible material protected.	Not allowed	75	"
D Below a balcony, eaves, gutter or drainage without protection to combustible material.	Not allowed	600	"
E From vertical sanitary pipework.	Not allowed	300	"
F From an internal or external corner or boundry along side terminal.	Not allowed	300	"
G Above ground or balcony level.	Not allowed	300	"
H From a surface or boundry facing the terminal.	Not allowed	600	"
J From a terminal facing the terminal.	Not allowed	1200	"
K Vertically from a terminal on the same wall.	Not allowed	1500	"
L Horizontally from a terminal on the same wall.	Not allowed	750	"
M Above an intersection with the roof.	600	Not applicable	732
N From a vertical structure on the side of the terminal.	750	Not applicable	750
O Above a vertical structure less than 750mm from the side of the terminal.	600	Not applicable	732
P From a ridge terminal to a vertical structure on the roof.	1500	Not applicable	Not applicable

8. Oil Supply

(See Fig. 16).

8.1 Plastic or steel tanks should be installed to BS5410.

A steel tank should also conform to BS799: part 5 and be arranged with a slope of 1 in 24 away from the outlet valve with a sludge cock at its lower end.

8.2 Do not use galvanised steel tanks or pipework for the oil supply system.

8.3 Do not use soldered joints on the oil supply pipework as this could cause a hazard in the case of a fire.

8.4 The burners on all appliances are supplied so as to be connected to a single pipe gravity feed system. Details of how to convert the burners to a double-pipe sub-gravity feed system are shown in Fig. 15.

8.5 Oil Supply System

(a) Single Pipe System

If a single pipe system is employed then the tank must be positioned such that the oil level does not exceed 4 metres above the level of the burner oil pump and in addition the oil level must be at least 0.3 metres above the level of the oil pump. Should it prove impossible to site the tank below the 4 metres maximum oil level a head breaking device must be installed between the tank and the burner.

(b) Double Pipe System

If a double pipe system is used then the maximum suction height allowable is 3.5 metres.

(c) Single Pipe Suction Lift with De-aerator

If a single pipe suction lift with a de-aerator is used, the oil tank must be positioned below the burner. An inlet and return loop should be created between the de-aerator and oil pump. The oil pump should be connected as for a double pipe system. Details of how to convert to a double pipe system are shown in Fig. 15.

Oil inlet and return flexible hoses should be connected to the oil pump inlet and return ports.

Table 6 is a general guide to determine the maximum allowable pipe run when using a de-aerator.

Table 6 does not override the de-aerators manufacturers instructions and should only be used in conjunction with the manufacturers instructions.

If a non-return valve is not incorporated within the de-aerator unit, a non-return valve should be fitted in the oil line between the oil tank and the de-aerator.

NOTE: If a de-aerator is used it should be fitted externally to the building.

8.6 Oil Supply Pipework

a) The oil supply pipe diameter can be determined using Tables 4, 5 and 6 depending on whether a single or double pipe system or single pipe system with de-aerator is being installed. Selection of the correct pipe diameter will depend on the position of the oil storage tank relative to the burner and the length of the pipe run.

b) The oil supply pipe should be laid as level as possible to avoid air pockets and unnecessary friction losses.

c) The following components should be fitted in the fuel line between the storage tank and burner:

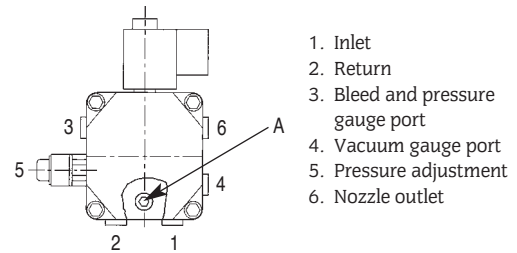
1. A manual isolating valve installed as close to the tank as possible.

2. A fire valve in accordance with BS5410 as shown in Fig. 16. The fire valve should be fitted externally with a fire detection element located within the appliance case. Use of a capillary type valve will allow a neat and simple installation. A suitable valve is the KBB manufactured by Teddington Controls Limited. Alternatively a fusible link or electrical system may be used. Under no circumstances should a combination isolating/fire valve be used as the sole fire protection device.

3. An oil filter should be fitted close to the oil storage tank. If there is doubt about the internal oil line condition, a further filter should be fitted near the boiler.

Fig. 15. Oil Pump.

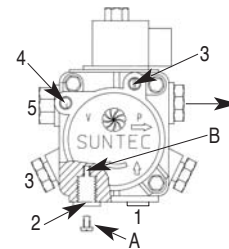
A. Danfoss BFP 11 Oil Pump.



To convert to a double pipe system: Remove the pump front cover, remove the changeover screw (A) nearest to ports 1 and 2, and the horseshoe washer underneath. Replace the changeover screw back into the threaded hole. Connect the flow and return pipes to 1 and 2.

Note: When removing the pump front cover ensure that a suitable receptacle is placed below the pump to catch the oil residue.

B. Suntec AS47C Oil Pump.



To convert to a double pipe system, remove the return port plug (B) and insert the grub screw (A) provided into the threaded hole (B). Connect flow and return pipes to (1) and (2).

TABLE 4 Single Pipe Gravity Feed System

HEAD (metres)	MAXIMUM ALLOWABLE PIPE RUN (metres)	
	8 mm inside dia. pipe (10 mm O.D. copper)	10 mm inside dia. pipe (12 mm O.D. copper)
0.5	12	30
1.0	25	69
1.5	37	91
2.0	49	100
2.5	62	100
3.0	74	100
3.4	87	100
4.0	99	100

TABLE 5 Double Pipe Sub-Gravity Feed System

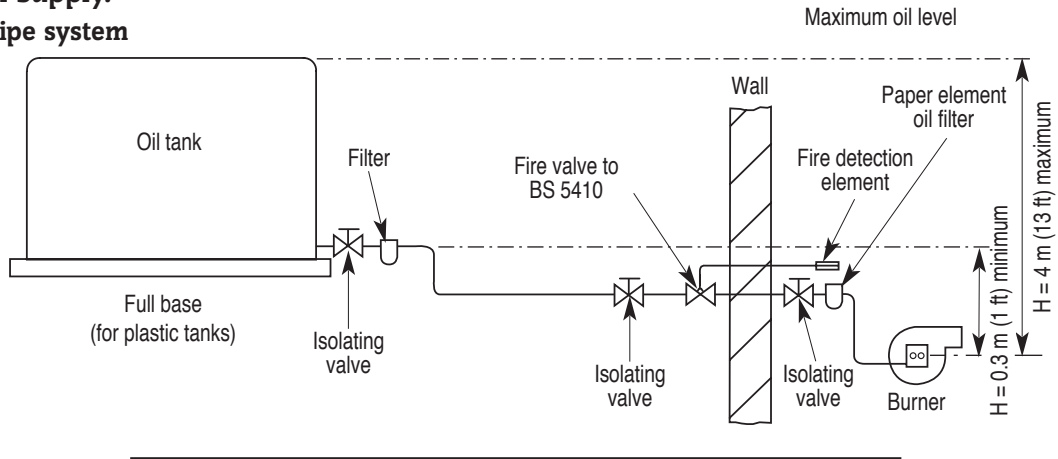
HEAD (metres)	MAXIMUM ALLOWABLE PIPE RUN (metres)	
	8 mm inside dia. pipe (10 mm O.D. copper)	10 mm inside dia. pipe (12 mm O.D. copper)
0	50	100
0.5	44	100
1.0	38	95
1.5	32	80
2.0	26	66
2.5	20	50
3.0	14	37
3.5	8	22

TABLE 6 Single Pipe Suction Lift with De-aerator

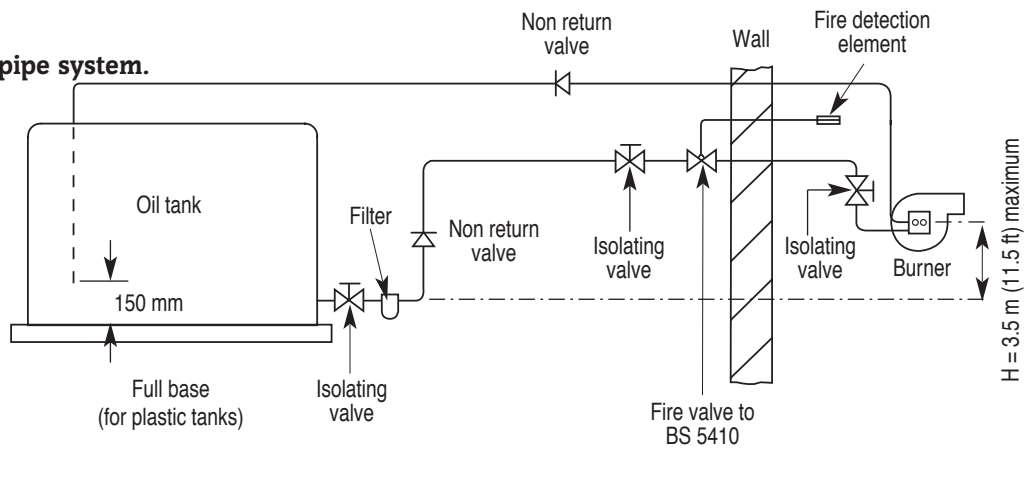
MAXIMUM ALLOWABLE PIPE RUN FROM TANK TO DE-AERATOR (metres)				
Fuel Flowrate	2.5 (kg/h)	5.0 (kg/h)	10.0 (kg/h)	10.0 (kg/h)
HEAD (metres)	6 mm inside dia. pipe (8 mm O.D. copper)			8 mm inside dia. pipe (10 mm O.D. copper)
0	100	55	26	100
0.5	95	45	23	100
1.0	80	40	20	90
1.5	70	35	17	75
2.0	60	30	14	65
2.5	45	25	11	50
3.0	35	15	8	35
3.5	25	10	5	20

Fig. 16. Oil Supply.

(a) Single pipe system



(b) Double pipe system.



(c) Single pipe lift system with de-aerator.

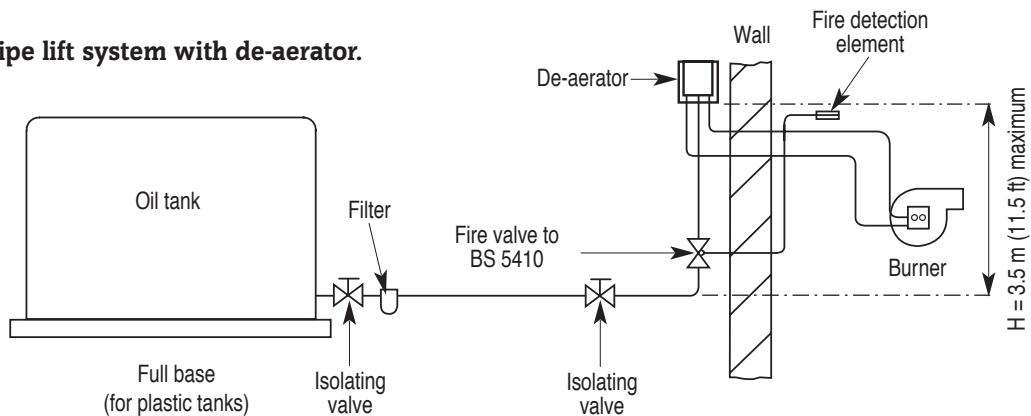


Fig. 17. Typical Open Vent Fully Pumped System (Honeywell 'Y' plan).

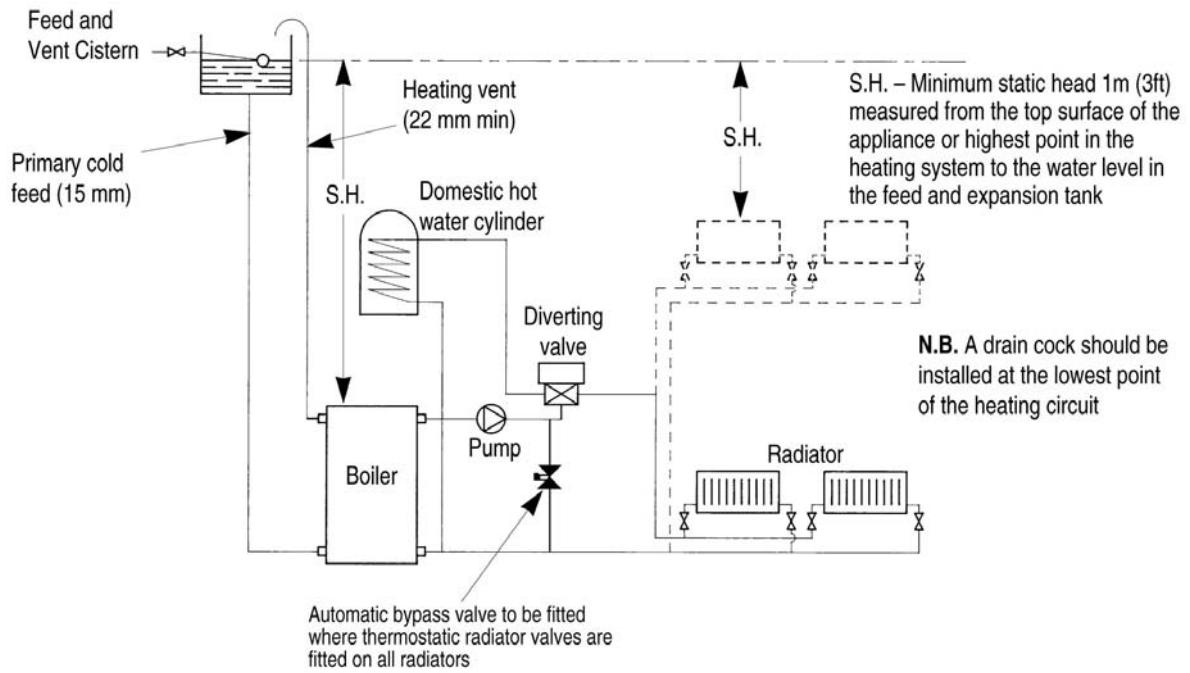


Fig. 18. Typical fully pumped sealed system (Honeywell 'Y' plan).

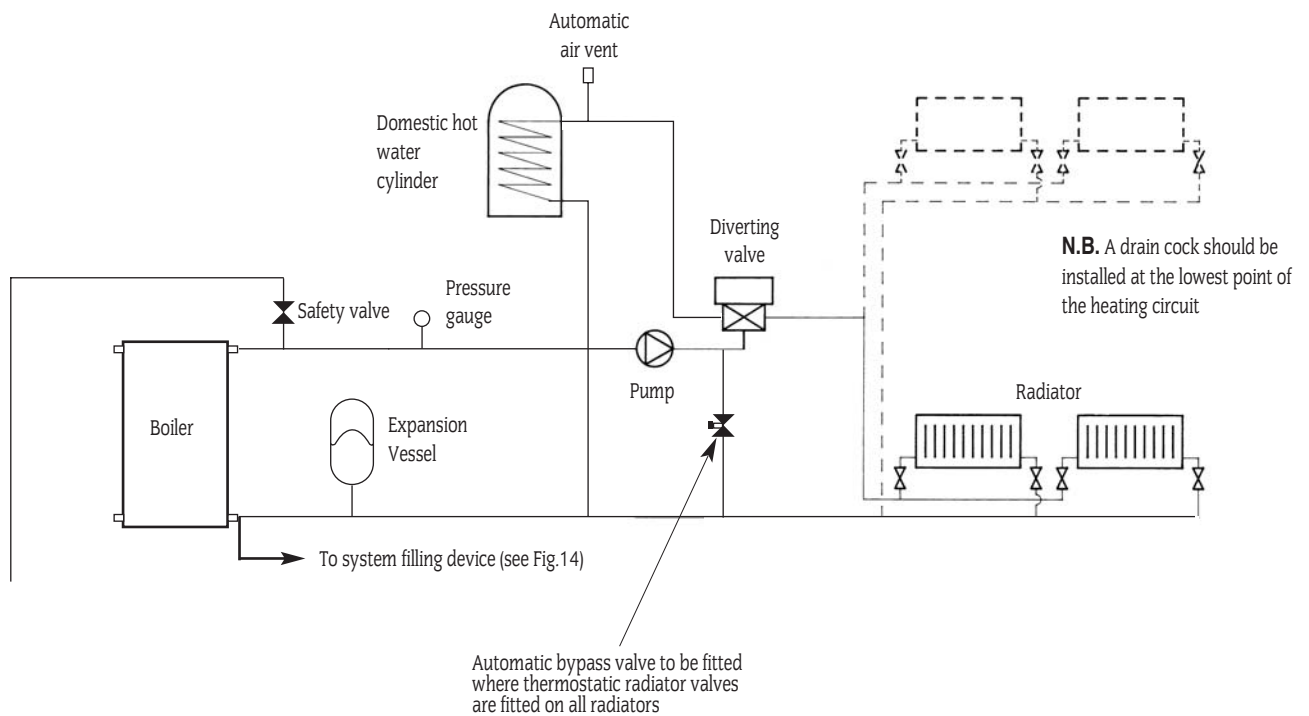
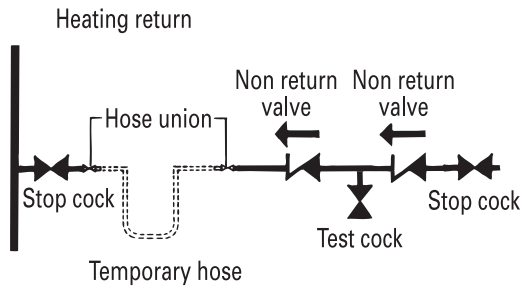
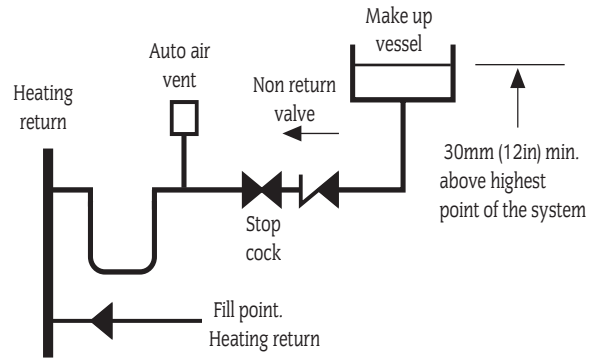


Fig. 19. System filling and make-up



Method 1



Method 2

9. Heating and Hot Water System

9.1 The appliance is suitable for connection to all conventional indirect hot water systems utilising an indirect double feed cylinder.

9.2 The flow and return connections are located at the rear of the appliance.

9.3 There is no requirement for a system bypass.

9.4 The pressure jet burner fitted to the appliance has full automatic control and hence there is no requirement for heat leak radiators.

9.5 The primary system should be flushed and treated in accordance with the recommendations of BS 7593:1992 before the system is handed over to the user.

9.6 The pump should be set in accordance with the heating load requirements to give a flow and return differential temperature of 11°C under full load conditions.

Open Vent Primary System.

(See Fig.17).

The following points are for guidance only. The system installation should be carried out in accordance with BS 5449: Part 1.

1. System Pipework

The first metre of pipework from all appliance connections must be in copper; afterwards copper or plastic pipe can be used. The plastic pipe must be manufactured to BS 7291 and installed to BS 5955 part 8. It is important to protect the system components; the plastic pipe specified must be resistant to the ingress of oxygen.

2. Feed and Expansion System

The feed and expansion pipes must rise continuously from the appliance and must be of the minimum diameter shown in Fig 17. The cistern must be arranged to provide a minimum static head of 1 metre above the top of the highest point in the heating circuit.

3. Filling and Venting

Air in the appliance is expelled through the vent pipe or dissipated into the system. Manual air vents should be fitted at any high points in the system.

There is a connection on the appliance for connecting an auto air vent.

Sealed Primary System

The appliance is supplied with a manual reset thermostat and is suitable for use with a sealed primary system.

General

The system should be installed in compliance with the

requirements of BS5449: Part 1. The boiler must be fitted with a spring loaded safety valve set to operate at 3 bar (45 psi) and the pipe connections made throughout the system must be capable of sustaining a pressure of up to 3 bar.

Copper pipework must be used through out when installing the appliance on a sealed system.

The following is a list of major items which must be fitted to the system:

1. Safety valve – 3 bar
2. Pressure gauge – 0 to 4 bar.
3. Expansion vessel
4. Automatic air vent.

10. Electrical

(See Figs. 20 to 25).

10.1 The wiring between the appliance and the electrical supply shall comply with current IEE Wiring Regulations and any local regulations which apply.

10.2 To gain access to the electrical terminal strip.

1. Isolate the mains electrical supply.
2. Remove the cabinet top panel by pulling squarely upwards.
3. Release the two screws securing the terminal connector protector plate and remove.

10.3 Mains Wiring

Mains supply – 230V AC ~ 50 Hz 5A External Fuse to BS1362.

LIVE - Brown, NEUTRAL - Blue, EARTH - Green/Yellow

Mains Cable: 0.75mm² (24 x 0.20 mm) to BS 6500 Table 16.

The boiler and system controls must be supplied using a single fused supply.

The mains supply cable should be connected into the terminals marked **L** (Live), **N** (Neutral) and **E** (Earth) on the appliance terminal strip and securely held in the cable clamp located in the left-hand side of the electrical tray base. Feed the cable between the side panel and the boiler insulation jacket and route to the connection point avoiding any hot surfaces.

The appliance must be earthed.

10.4 Programmer

(See Fig. 21).

A plug in, colour co-ordinated, 2 channel electronic programmer is available from Worcester Heat Systems Limited. Full instructions covering installation and operation of the programmer are included with the kit. (See Fig. 21a)

The programmer will give fully independent central heating (CH) and hot water (HW) programmes when the switch on the rear of the unit is set to P.

If an external link programmer is to be fitted to the boiler the link plug should be removed from the programmer terminal strip. (See Fig. 21b). The LIVE, NEUTRAL and EARTH wires should be connected to the LIVE, NEUTRAL and EARTH terminals on the main terminal strip and the switched lines connected to terminals 1 and 2.

NOTE: The mains supply cable should not be connected to an external time switch when a frost thermostat is fitted to the Greenstar HE standard wiring block.

NOTE: Under no circumstances should the timer be connected to a separate electrical supply. Safety is assured from a single fused supply to the boiler.

10.5 Safety Check

In the event of an electrical fault after the installation of the appliance, the electrical system shall be checked for short circuits, fuse failure or incorrect polarity of connections.

10.6 Pre-wired Remote “Y” or “S” Plan systems

(See Fig. 22).

If the system is fully pre-wired at a junction box remotely from the boiler it can be connected to the boiler. The diagram shows connection details of two proprietary systems (Honeywell and Invensys).

The WHS fascia mounted programmer can be fitted instead of an external timer to the remote junction box. Remove the link plug (8 to 9) and connect the programmer plug into the time clock connector. Connect terminal 1 from the boiler terminal block to the 'HOT WATER ON' on the remote 10 way junction box.

Connect terminal 2 from the boiler terminal block to the 'HEATING ON' on the remote 10 way junction box..

NOTE: A “Y” Plan requires a live feed from 'HOT WATER OFF' switch position. In order to achieve this, using a WHS programmer, remove the orange wire from terminal 9 and pull back through the tie wraps. Ensure the brown wire is firmly secured in terminal 9. Connect the orange wire to terminal 6 and connect terminal 6 on the boiler terminal block to the 'HOT WATER OFF' connection at the remote 10 way junction box.

10.8 Honeywell “S” Plan

(See Fig. 23).

The “S” plan provides complete control on installations having pumped circulation to both the domestic hot water and radiator circuits.

The domestic hot water and radiator circuits are independently controlled by two motorised valves via a cylinder thermostat and a room thermostat. Both thermostats switch the water circulator and the boiler on and off.

10.9 Honeywell “Y” Plan

(See Fig. 24).

The “Y” Plan provides complete control on installations having pumped circulation to both the domestic hot water cylinder and radiator circuits.

The domestic hot water and radiator circuits are controlled by a 3 port motorised valve via a cylinder thermostat and a room thermostat. Water flow is diverted to either circuit or to both circuits at the same time. Both thermostats switch the water circulator and the boiler on and off.

Note: The “Y” plan requires a live feed from the hot water “off” switch position. In order to achieve this, using a WHS programmer, remove the orange wire from terminal 9 and pull back through the tie wraps. Do not attempt to cut the tie wraps. Ensure that the brown wire is firmly secured in terminal 9. Connect the orange wire to terminal 6.

10.10 Frost Protection

(See Fig. 25).

For full frost protection a single pole double switch thermostat should be fitted so that both the boiler and the circulating pump circuits are energised under frost conditions. Frost protection will be lost if there is no power supply to the boiler.

Fig. 20. Wiring Diagram (Standard).

Mains supply 230V 50Hz

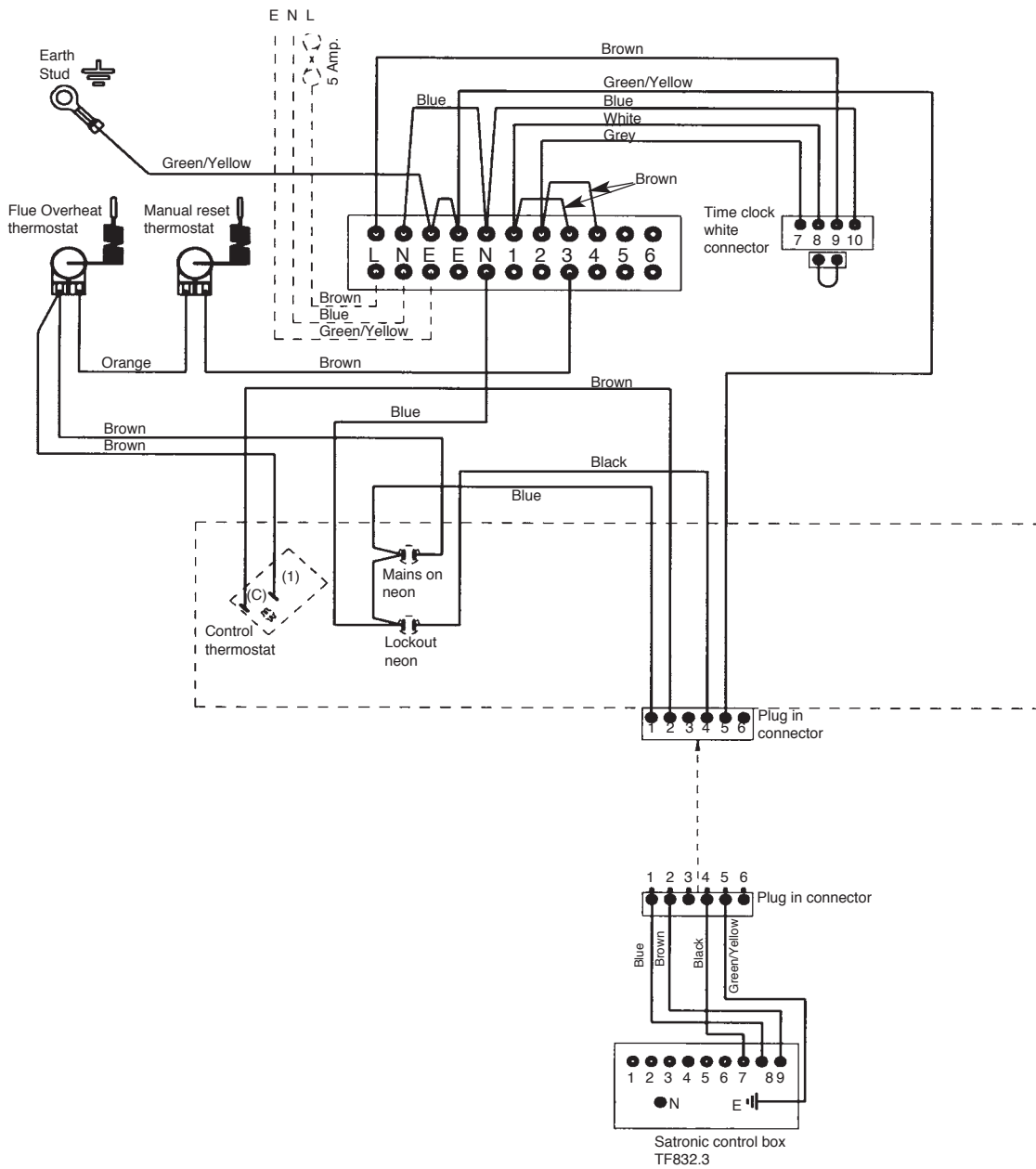
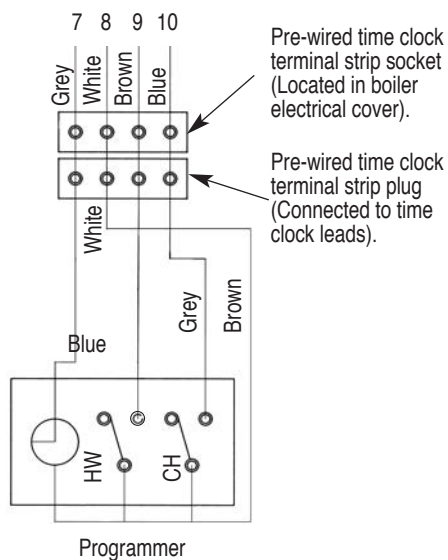
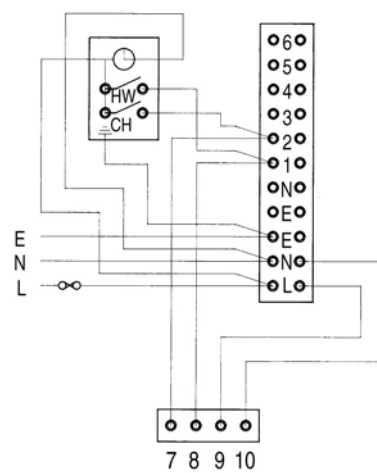


Fig. 21. Programmer Connections

(a) Internal Programmer



(b) External Programmer



Note: Remove link plug 8 & 9.

Fig. 22. Pre-wired Remote 'Y' Plan or 'S' Plan.

NOTE: When using a WHS programmer set the switch on the rear of the programmer to 'P'.
Remove link 1 to 3

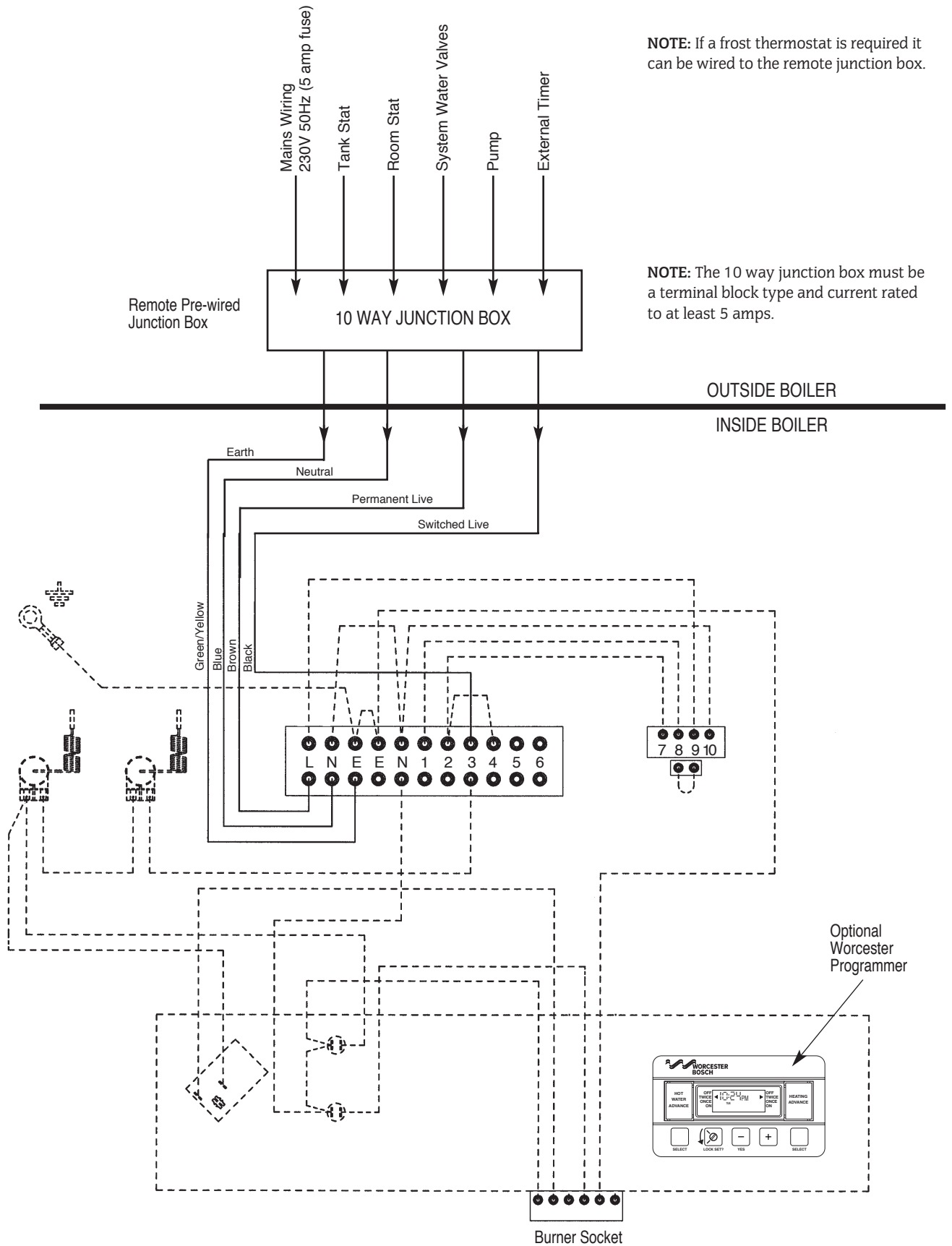


Fig. 23. Honeywell 'S' Plan.

NOTE: When using a WHS programmer set the switch on the rear of the programmer to 'P'. Remove link 1 to 3 and link 2 to 4 and make link 3 to 4

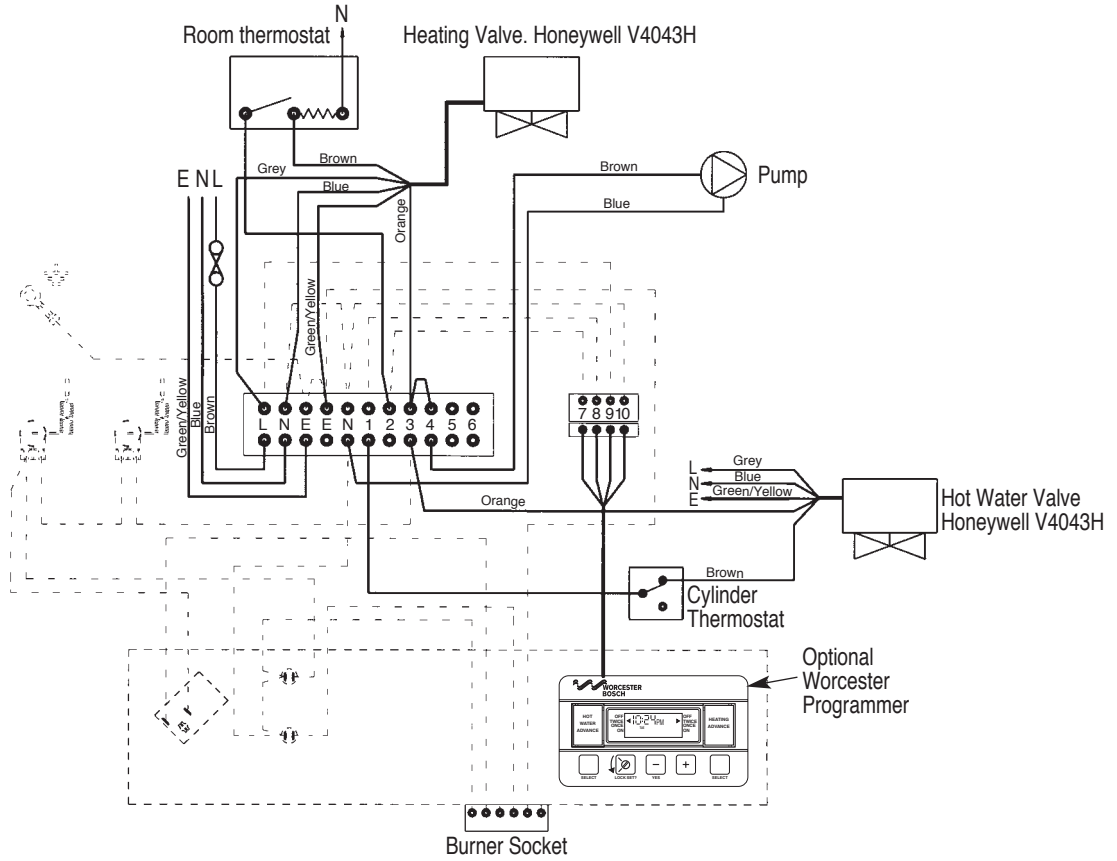


Fig. 24. Honeywell 'Y' Plan.

NOTE: When using a WHS programmer remove the orange wire from terminal 9 and connect to terminal 6. Set the switch on the rear of the programmer to 'P'. Remove link 1 to 3 and link 2 to 4 and make link 3 to 5.

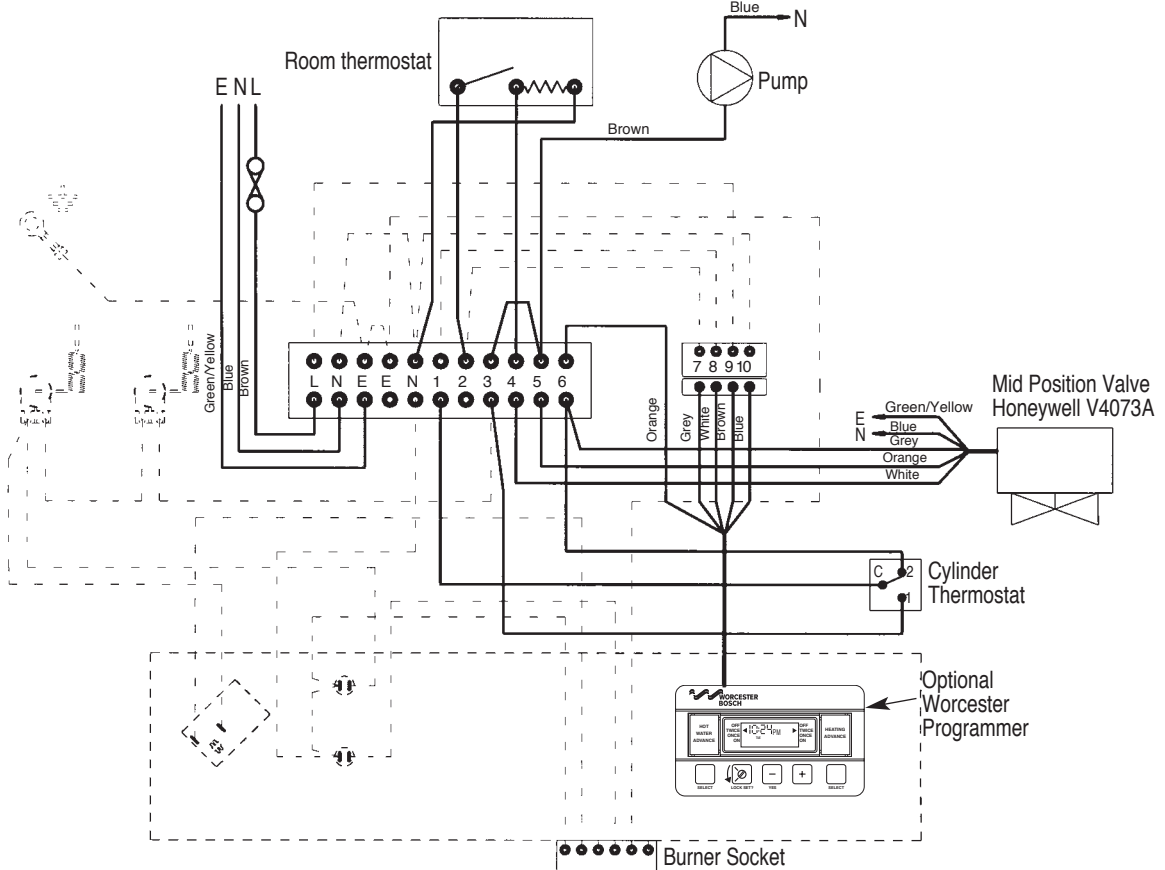
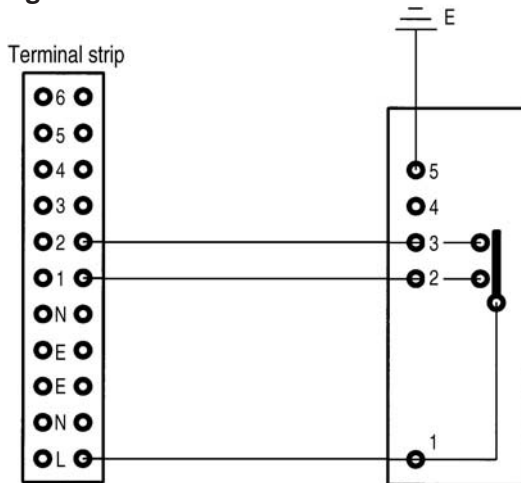


Fig. 25. Frost Protection.



11. Installation

11.1 After unpacking the appliance it is recommended that the top and front cabinet panels are removed, as described in Section 5, and stored in a safe place to avoid damage during installation and allow easy inspection for any leaks after the system has been filled.

11.2 Remove the burner as described below and store in a safe place until the appliance is ready for commissioning.

1. Remove the air tube from the burner by loosening the jubilee clip and pulling the tube up and away.
2. Remove the 13mm nut at the top of the burner and pull the burner out, taking care not to put any tension on the electrical cable.

11.3 Flue system installation.

Install the appliance flue system as described in Section 7.

11.4 Heating system installation.

(benchmark) Before the appliance is fitted to the heating system flush the system and mains water supply.

1. Plumb the boiler into the central heating system.
2. Check that all unused sockets have been plugged.
3. Fit the auto air vent to the boiler.
4. Fill the system and vent all radiators and high points to remove air from the system.
5. Check the boiler and all pipework connections for leaks.

11.5 Oil supply installation.

(See Fig. 16).

NOTE: Never route the oil supply pipe/hose directly below the combustion chamber base.

NOTE: Connection of rigid copper pipe to the oil pump is not recommended. Connection to the oil pump should be made with flexible oil hoses.

(a) Single pipe suction lift with de-aerator.

For connection of single pipe suction lift with de-aerator follow the procedure as for a double pipe system as described below.

(b) Double pipe system oil return pipe.

1. fit the oil return pipe, from the tank, down the left hand side of the boiler along the base. Terminate the end approximately 200mm from the front of the base.
2. Connect a flexible hose, of the same type as the one supplied, to the pipe using a suitable adaptor.
Ensure that the connections are properly sealed.
3. Fit the oil supply pipe as described in the following section.

(c) Single pipe system oil supply pipe.

1. Bend a piece of 10mm or 12mm copper tube (as selected) to the correct profile to allow the pipe to be fed down the side of the appliance. The pipe may be routed along either the right or left hand side of the boiler as required. When using 12mm pipe fit a 12mm to 10mm compression coupling and connect to the valve with a short piece of 10 mm pipe, otherwise connect direct to the valve.

Note: never use soldered joints on oil supply pipes as this could cause a hazard in the case of a fire.

2. Route the pipe back to the oil supply tank ensuring that it is hard against the boiler, to allow installation of the side panel.
3. With the isolating valve in the correct orientation tighten the back-nut.
4. Turn the isolating cock fully clockwise to close the valve.
5. Open the main oil supply valve at the tank and check for any leaks.
6. Place a suitable container below the bulkhead fitting and open the valve.
7. Draw off at least 2.5 litres of oil until a steady flow of clear uncontaminated oil can be seen and turn off the isolating valve.

Note: This method may not be possible on some installations where a sub-gravity system is used. Where this problem arises bleed the system using the oil pump as described in Section 12 and remove and clean the oil pump filter to remove any debris collected as a result of installation.

11.6 Replace the electrical control panel and side panels in reverse order to the removal procedure of Section 5 and connect the electrical supply as described in Section 10.

11.7 Condensate drain connection

When connecting the condensate drain to the waste water drain, it is essential to maintain a downwards slope towards the waste drain.

Note: The maximum production of condensate is 1.5 L/h. This flow rate does not require any specific treatment.

12. Commissioning the Appliance

Ensure that no foreign matter is left in the system as this could cause damage to the appliance.



Benchmark Water Treatment: For optimum performance after installation, this boiler and its associated central heating system should be flushed in accordance with the guidelines given in BS7593:1992 - Treatment of water in domestic hot water systems. Full instructions are supplied with proprietary cleansers sold for this purpose. If an inhibitor is to be used after flushing, it should be used in accordance with the inhibitor manufacturers instructions.

Suitable flushing agents and inhibitors are available from Betz Dearborn Tel: 0151 4209563 and Fernox Tel: 01799 550811. Instructions for use are supplied with these products.

IMPORTANT: Any system cleanser must be flushed from the system before an inhibitor is added.

12.1 Check that the electrical supply to the appliance is switched off.

12.2 When commissioning the appliance after initial installation follow the procedure from 12.3, otherwise remove the burner first as described in Section 14.3.

12.3 Prepare the heating system

1. After initial installation and checking for leaks, as previously described, drain down the system sufficiently to add a flushing agent. Flush the system in accordance with BS 7593:1992.

2. Refill the system.

12.4 Check the Burner

1. Check that the nozzle and electrode settings are correct for the relevant burner. (See Fig. 27).

2. Check that the nozzle lies central with the combustion head hole.

3. Check for any visible defects.

12.5 Replace the burner

1. Connect the flexible oil supply hose and tighten sufficiently to form a good seal. Where a double pipe system is being used connect the oil return flexible hose to the return pipe fitting.

2. Insert the burner into the burner mounting flange and tighten the locking nut using a 13mm spanner.

Note: It is important that a good seal is made between the burner and the boiler to prevent the escape of the flue gases from the combustion chamber.

12.6 Check the installation

1. Check that the appliance is correctly wired as described in Section 10.

2. Check that the baffles are correctly located.

3. Check that the combustion product high limit thermostat phial is correctly located in the thermostat pocket positioned in the top front of the condensing heat exchanger.

4. Check that the water high limit thermostat is located in the pocket on the main heat exchanger.

5. Check that all of the air-ways to the burner are clear of any obstruction.

12.7 Fit a pressure gauge and manifold to the burner pump at the point indicated in Fig. 15.

12.8 Turn on the electricity to the appliance.

12.9 Bleed the burner

Single pipe systems only

Release the fuel bleed port on the manifold and place a suitable receptacle beneath. Turn on the boiler thermostat. Set the programmer to **heating and hot water** and allow the burner to run through to lockout. Wait two minutes and reset the burner control box. Repeat the procedure at least three times or until a steady stream of oil, without air, is exhausted from the bleed

port. Re-lock the bleed port.

Two Pipe System

A two pipe system will automatically vent the air back to the oil tank. Turn on the boiler thermostat and allow the burner to run through to lockout. Wait two minutes and reset the burner control box. Repeat the procedure until the burner fires and runs in a steady state. This may take several attempts depending on the oil pipe length and height.

12.10 Adjust the air shutter and pump pressure to the settings recommended in Table 2. After a pre-ignition period of approximately 15 seconds the burner should ignite. Flame sensing is carried out by means of a photocell mounted in the burner body. Should the boiler fail to establish a normal firing pattern (or should flame failure occur during running), the absence of a flame is sensed and the control box is monitored to a safe lockout condition and the boiler is shut down. The lockout indicator light in the boiler control panel will illuminate indicating that the burner has gone to lockout. In this instance wait two minutes and press the red lockout reset button mounted in the burner control box. Another start sequence is then initiated. Repeat the procedure until a flame is established.

Note: Persistent lockout when running indicates a fault and a Service Engineer should be consulted.

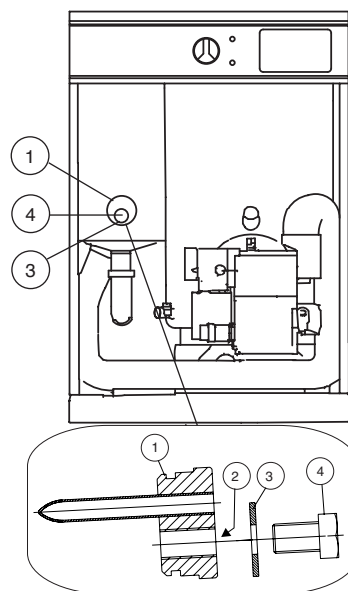
12.11 Run the boiler for approximately 3 minutes and switch off checking that there is no after-spurting from the nozzle. This can be detected by oil saturation on the blast tube. If after-spurting occurs remove the burner from the boiler, unscrew the nozzle, and while holding the burner in a vertical position, fill the nozzle holder with oil. Refit the burner and continue to run the boiler for three minute periods until after-spurting stops.

Note: Use of a "T" piece pressure gauge manifold will increase the oil line volume and hence increase the degree of after-spurting.

12.12 Run the boiler for a further 15 minute period and then finally fine tune the air shutter setting to give the CO₂ level specified in Table 2. During this period some smoke will be emitted due to the burning of the organic binder in the base insulation board. Smoke readings will therefore be inaccurate at this point.

Note: A combustion product sampling point is located on the front of the condensing heat exchanger (see Fig. 26).

Fig. 26. Secondary heat exchanger inspection ports



- 1. Inspection/cleaning port
- 2. Combustion test point
- 3. Washer
- 4. Test point screw

12.13 Check that the smoke reading is in the range 0-1. If this cannot be achieved then check that the burner head is set correctly and the nozzle is in good condition.

12.14 Check that the flue temperature does not exceed the value specified in Table 2. If this is the case then check that the baffles are correctly located. If the baffles are correctly located then reduce the pump pressure since nozzle variations of up to + or - 15% may occur.

12.15 Remove the oil pressure gauge and manifold and check all oil system joints for any signs of leakage.

12.16 Allow the burner to run for a further five minutes and then recheck the CO₂ level and adjust the air setting if required. Check that the smoke number is in the range 0-1. Repeat the fine tuning procedure if found necessary.

12.17 Refit the cabinet top and front panels in the reverse order to that described in Section 5.

12.18 When the heating circuit has reached full operating temperature check the whole system for any leaks.

12.19 Add a suitable proprietary corrosion inhibitor such as Fernox or Sentinel. This will inhibit corrosion, protect the circulating pump and valves reducing the possibility of "kettling" noises resulting from deposits of scale and sludge in the boiler. Refer to the product manufacturers instructions for further information.

13. Instructions to the User

13.1 *(benchmark)* Hand the users instructions and Benchmark Log Book to the user or purchaser for retention and instruct them in the efficient and safe operation of the appliance and the heating/hot water system.

13.2 Advise the user or purchaser of the precautions necessary to prevent damage to the heating/hot water system and to the building in the event of the heating system remaining inoperative during frost conditions.

13.3 Finally advise the user or purchaser that for continued efficient and safe operation of the appliance it is important that adequate servicing is carried out by a qualified engineer at least once per year.

Worcester Heat Systems Limited will be pleased to discuss and offer a comprehensive maintenance contract.

13.4 Set the system controls to the users requirements.

14. Routine Cleaning and Inspection

14.1 The following should be carried out at least once per year to ensure efficient, trouble free operation.

1. Carry out a pre-service check noting any operational faults.
2. Check and clean the burner.
3. Check and clean the air intake tube and the air intake grille at the end of the terminal.
4. Check and clean the baffles.
5. Check and clean the heat exchanger surface.
6. Check the heat shield.
7. Check the combustion chamber base insulation board.
8. Check and clean the secondary heat exchanger and baffles.
9. Check that the flue system is unobstructed and clean as necessary.
10. If the appliance has been installed in a compartment check that the ventilation areas are clear.
11. Clean all oil filters.

Some of the servicing points are covered more fully in the following instructions:-

14.2 Pre-Service Check

1. Remove the cabinet front and top panels as described in section 5.
2. Operate the appliance and system, noting any faults which may need to be corrected during the service.

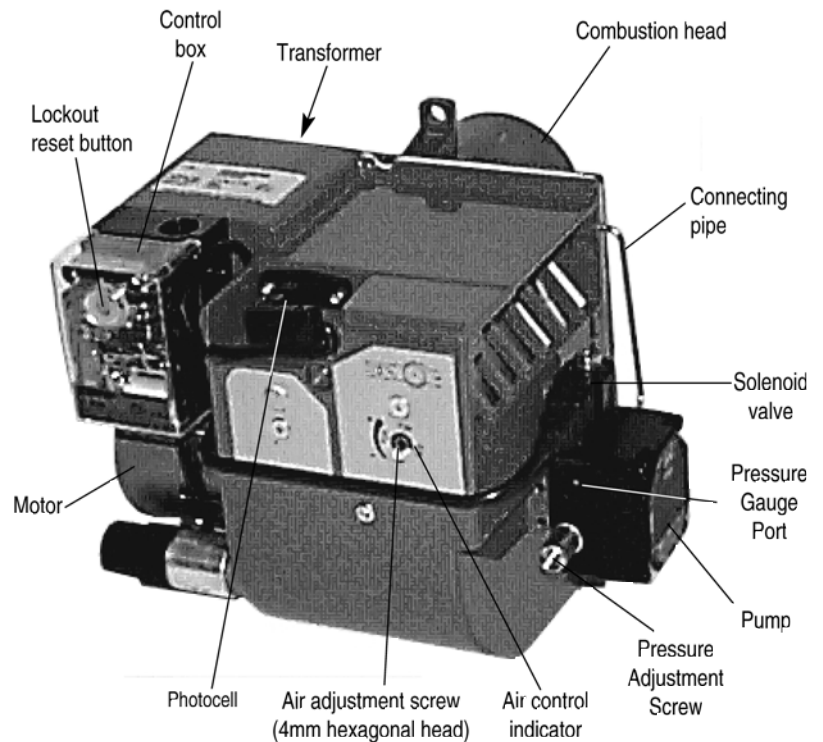
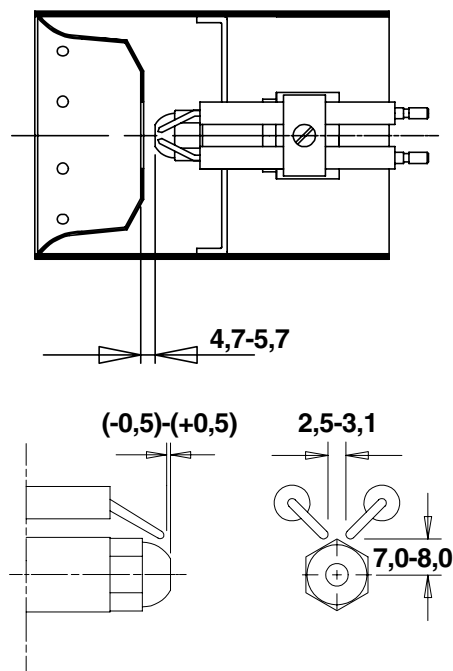
14.3 Cleaning the Burner

IMPORTANT: Disconnect the electrical supply at the mains before commencing any servicing. Turn off the oil at the service cock.

1. Remove the burner.
 - (a) Isolate the oil supply.
 - (b) Remove the 13mm nut at the top of the burner and pull the burner out, taking care not to put any tension on the electrical cable.

Fig. 27. Burner.

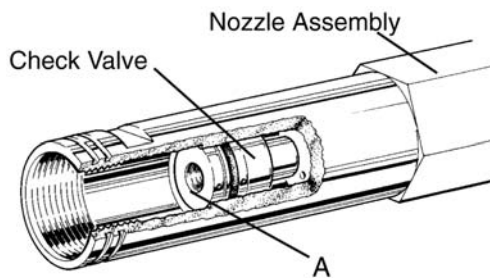
ELECTRO OIL BENTONE STERLING BURNER BURNER HEAD



2. Clean the fan impeller using the following procedure:

- (a) Remove the air adjustment cover.
- (b) Separate the main body of the burner from the burner front by removing the M6 allen screw (located beneath the air adjustment screw), using a 5mm allen key.
- (c) Note the position of the air damper adjustment and check the air damper moves freely.
- (d) Check the air path to the burner head is clear.
- (e) Clean both sides of the fan impeller and remove any debris from the burner housing.
- (f) Check the impeller rotates freely.
- (g) Re-assemble the components.

Fig. 28. Mechanical Shut-off Valve.



4. Inspection of Mechanical Shut-off Valve. (See Fig. 28)

- a) Remove the nozzle.
 - b) Fasten an M5 screw, with a minimum length of 30mm, into the threaded hole (A) and pull the screw to withdraw the check valve.
 - c) Check that the nozzle holder is clear of any debris and clean if necessary.
 - d) Check that the 3 holes in the check valve are clear of any debris. Discard the check valve if the holes cannot be cleared or if the unit is defective and replace with a new one.
 - e) Replace in the reverse order.
5. It is strongly recommended that the oil atomising nozzle is replaced at each service.
6. Check and reset the electrodes, where necessary, as shown in Fig. 27.
7. Replace the combustion head and check that the nozzle lies central to the combustion head and the head settings are as shown in Fig. 27.

8. Withdraw the photocell from its housing and clean.

9. Remove and clean the oil pump internal filter using kerosene or white spirit. The internal filter is accessed by removing the oil pump cover on the Danfoss BFP 11 and Suntec AS47C as indicated in Fig. 15.

10. It is recommended that the standard flexible oil line is replaced at each yearly service to prevent the possibility of a leak due to ageing.

11. Re-assemble the burner components.

12. Check the sponge O-ring seal located around the combustion head and replace if necessary. It is imperative that this seal is in good condition since failure will cause the flue gases to escape.

14.4 Remove the paper element from the external oil filter and replace. If the filter contains a washable element then thoroughly clean in Kerosene or white spirit and re-assemble into the filter.

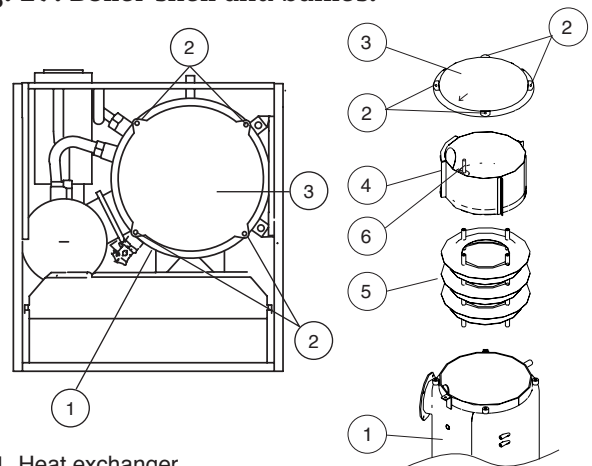
14.5 Clean the air duct tube.

1. Remove the air duct from the burner.
2. Shine a light down the air duct and inspect for any sign of debris and clean where necessary using a flexible hose connected to a vacuum cleaner. A short length of garden hose would be suitable for this purpose.
3. Reconnect the air duct tube.

14.6 Clean the Boiler (See Fig. 29)

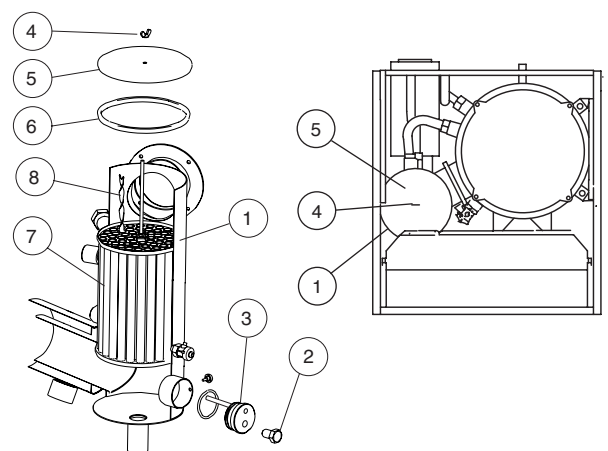
1. Remove the boiler top access plate (3) by releasing the bolts (2) with a 6mm Allen key and check the fibreglass rope seal. Replace the seal if necessary.
2. Remove the flue deflector (4).
3. Remove the main baffle assembly (5), clean and check its condition. Replace if considered to be badly corroded.
4. Thoroughly clean all of the heat exchanger surfaces using a stiff wire brush and vacuum clean all loose debris from the combustion chamber. Take care not to damage the base insulation!
5. Check the heat shield.
6. Check the condition of the combustion chamber base insulation and replace if there is any sign of significant damage.
7. Check and clean the flue.
8. Reassemble all parts and be sure:
 - ▶ not to reverse them
 - ▶ to position the flue deflector with its locating screw towards the front of the boiler.
 - ▶ to position the cast iron plate against marker opposite the locating screw.

Fig. 29. Boiler shell and baffles.



1. Heat exchanger
2. Cover screws
3. Cover
4. Flue deflector
5. Baffle assembly
6. Locator pin

Fig. 30. Secondary heat exchanger.



1. Secondary heat exchanger
2. Combustion products screw
3. Inspection port
4. Wing nut
5. Cover
6. Seal
7. Stainless steel tubes
8. Baffles

14.7 Secondary Heat Exchanger. (See Fig. 30)

Clean the secondary heat exchanger.

Remove the wing nut (4) and heat exchanger cover (5).

Remove each baffle (8), clean and check condition. Use the brush provided to clean each tube in the heat exchanger (7).

Wash any debris away by flushing with water.

Remove inspection plug (3) at base and clean as necessary.

Replace plug.

Replace baffles and cover, securing with wing nut, ensuring a good seal is made.

14.8 Fire Valve.

Check that a fire valve is fitted to the incoming oil line with the body located outside the premises and the detection element located within the appliance case. Test the operation of the fire valve to ensure that the mechanism operates and that the oil supply is completely isolated.

14.9 Recommission the Burner.

1. Connect the flexible oil supply hose to the isolating valve and tighten sufficiently to form a good seal. Where a double pipe system is being used connect the oil return flexible hose to the return pipe fitting.

2. Insert the burner into the burner mounting flange. Push the burner firmly forward to compress the gasket and tighten the locking nut with a 13mm spanner.

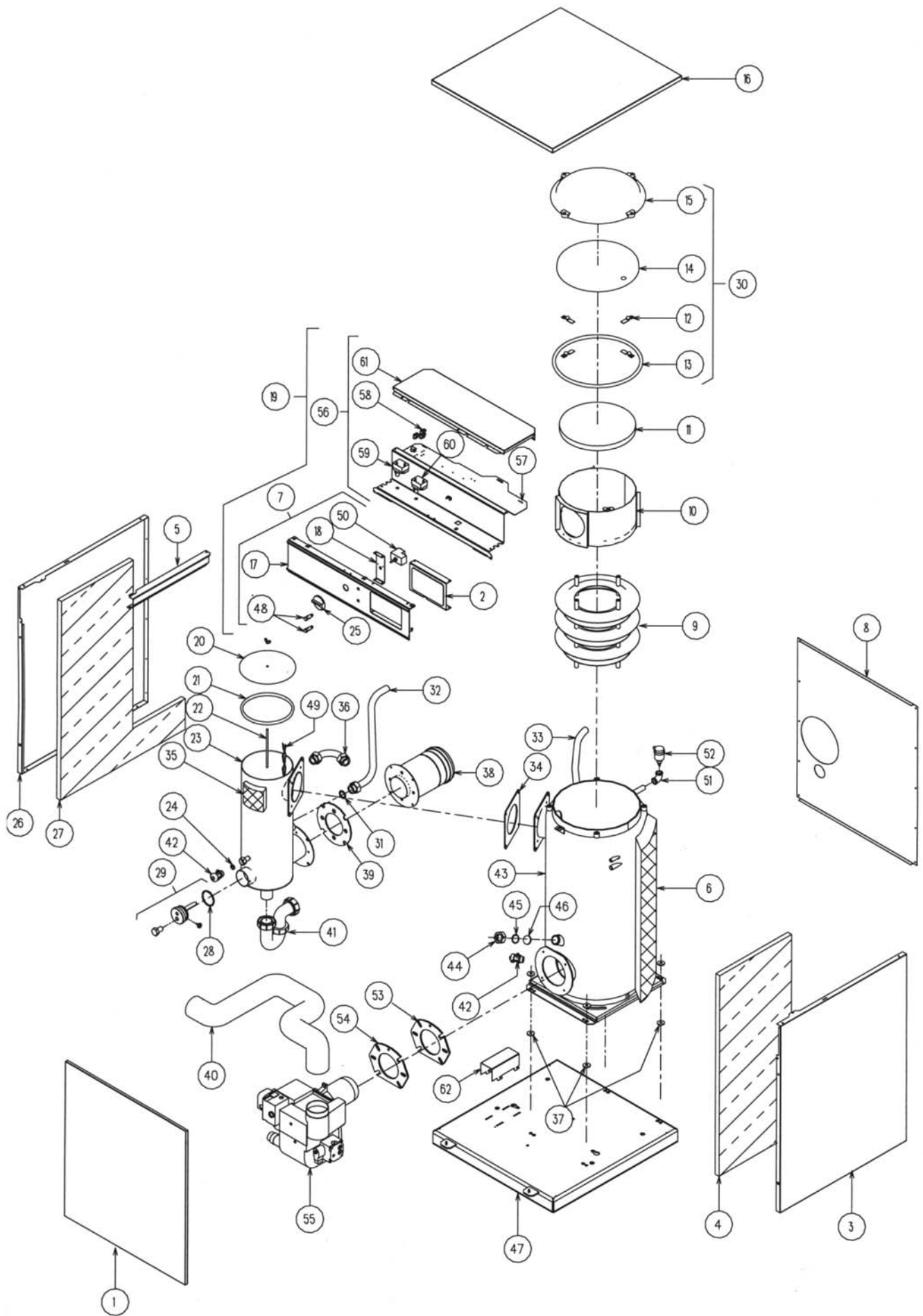
Note: It is important that a good seal is made between the burner and the boiler to prevent the escape of the gases from the combustion chamber.

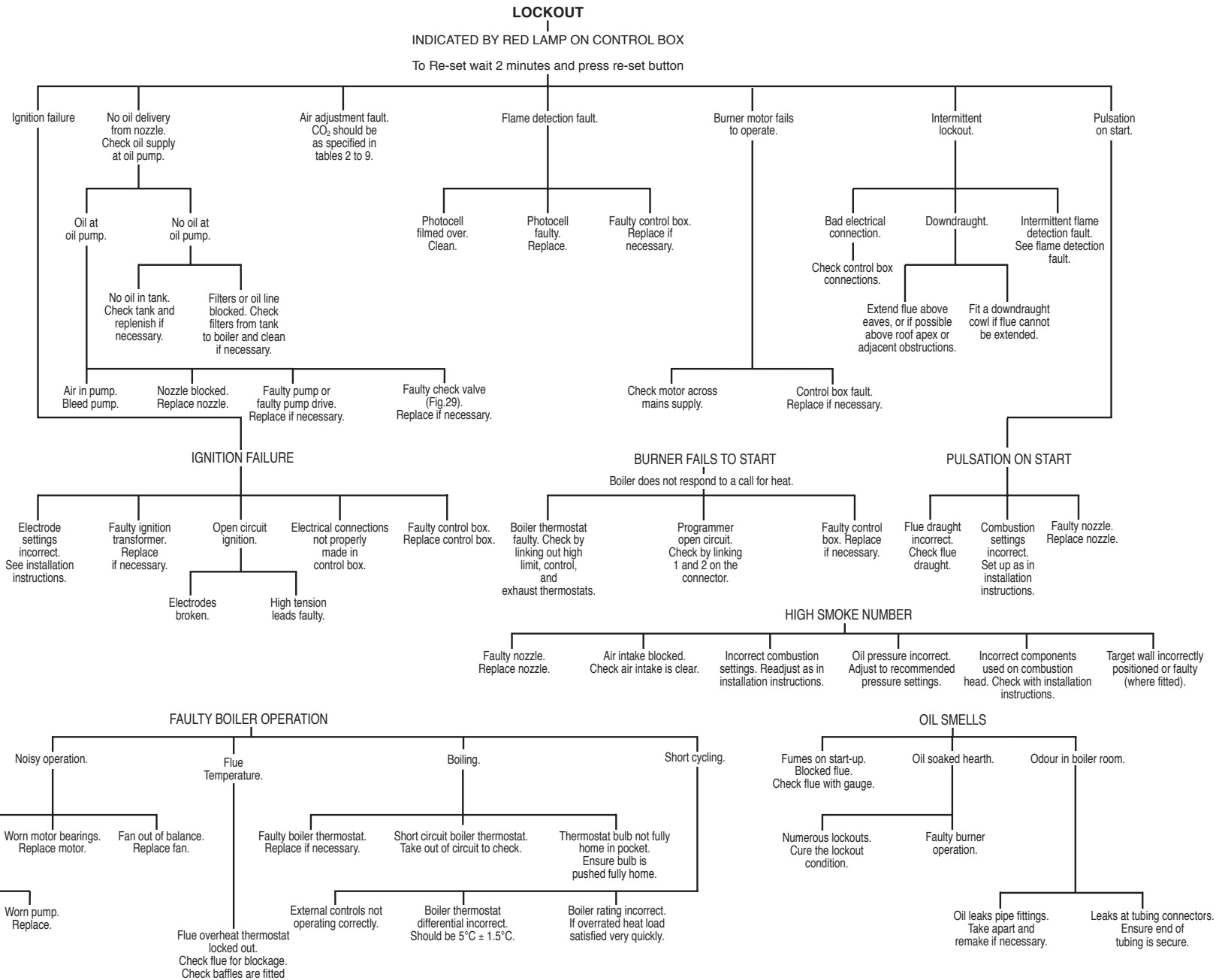
3. Turn on the oil supply at the service cock.

4. Recommission the burner as described in Section 12.

15. Short Parts List

Key No.	Item Ref.	Part	Manufacturer's Reference	WHS Part No.
1	BOILER	Front Panel Equipped FCX Greenstar HE Oil 12/22	Y 72.31765	8 716 105 396 0
2	ELECTRICALBOX	Casing for Clock Housing	W 72.31736	8 716 148 124 0
3	BOILER	Right Panel Equipped FCX Greenstar HE Oil 12/22	Y 72.31770	8 716 105 397 0
4	BOILER	Right Panel Insulation FCX Greenstar HE Oil 12/22	V 72.31770	8 716 105 398 0
5	BOILER	Cable Channel	V 72.31775	8 716 105 399 0
6	BOILER	Insulation for Boiler Shell	F 30.26702	8 716 103 265 0
7	ELECTRICALBOX	Facia Assembly Complete	W72.31779	8 716 105 400 0
8	BOILER	Back White FCX Greenstar HE Oil 12/22	V 72.31776	8 716 105 401 0
9	BOILER	Swirlers	V 72. 08493	8 716 103 268 0
10	BOILER	Combustion Chamber	V 72.08531	8 716 103 269 0
11	BOILER	Mineral Wool 90KG Disk Diameter 262x20	F 30.11048	8 716 103 270 0
12	BOILER	Fastening Angle	V 72.28378	8 716 103 271 0
13	BOILER	Glass Fibre Insulation LG 950- Cast Plate	V 70.09239	8 716 103 272 0
14	BOILER	Glass Fibre Insulation D. 280 x 20 (300°C)	F 20.28379	8 716 103 273 0
15	BOILER	Boiler Shell Cover - Cast Iron	H 00.28364	8 716 103 274 0
16	BOILER	Top Equipped FCX Greenstar HE Oil 12/22	Y 72.31767	8 716 105 402 0
17	ELECTRICALBOX	Facia Panel	130. 31780	8 716 105 403 0
18	ELECTRICALBOX	Stat Bracket	V 72.31716	8 716 102 716 0
19	ELECTRICALBOX	Control Box and Facia Assembly Complete	W72.31778	8 716 105 404 0
20	CONDENSER	Condensing Unit Cover	V 72.08509	8 716 103 279 0
21	CONDENSER	Top Seal for Condensing unit	V 72.09520	8 716 103 280 0
22	CONDENSER	Fastening Flange for Condensing Unit Top Cover	V 72.26826	8 716 103 281 0
23	CONDENSER	Condensing Unit Complete	V 72.30129	8 716 103 282 0
24	BOILER	Seal AMF34 D. 18.6 x 12 2mm Thickness	E 20.06892	8 716 103 283 0
25	ELECTRICALBOX	Control Knob	L71. 31740	8 716 141 087 0
26	BOILER	Panel Left Hand Equipped FCX Greenstar HE Oil 12/22	Y72.31772	8 716 105 405 0
27	BOILER	Left Hand Side Panel Insulation FCX Greenstar HE Oil 12/22	Y72.31773	8 716 105 406 0
28	BOILER	'O' Ring Nitrile 50 x 4 70 Shore	E 00.08776	8 716 103 287 0
29	CONDENSER	Cleaning Cap for Condensing Unit Equipped	V 72.28241	8 716 103 288 0
30	BOILER	Boiler Shell Cover Equipped FCX Greenstar HE Oil 12/22	V 72.28389	8 716 103 289 0
31	BOILER	Sealing AMF34D 30 x 21x 3	E 20.03889	8 716 103 290 0
32	BOILER	Pipe Return FCX Greenstar HE Oil 12/22	U 72.31715	8 716 105 407 0
33	BOILER	Pipe Flow FCX Greenstar HE Oil 12/22	U 72.31714	8 716 105 408 0
34	CONDENSER	Sealing on Condensing Unit Flange	E 20.26827	8 716 103 293 0
35	BOILER	Insulation for Condensing Unit	F 30. 28106	8 716 103 294 0
36	BOILER	Boiler Shell Return	U 72. 26786	8 716 103 295 0
37	BOILER	Mineral Cardboard Washer D. 25 x 8.5 x 3	F 01. 00588	8 716 103 296 0
38	BOILER	Adaptor Air/Flue D. 80/125 FCX Greenstar HE Oil 12/22	V 72. 29545	8 716 103 297 0
39	BOILER	Silicone Seal D. 162 x 85 x 4	E 20.28092	8 716 103 298 0
40	BOILER	Air Hose D. 80 LG1500	U 65.29493	8 716 103 299 0
41	CONDENSER	U-Trap 1-1/2 40mm	A 20. 31685	8 716 105 409 0
42	BOILER	Drain Valve with Cap M1/2 - M 3/4	K 50.11590	8 716 103 301 0
43	BOILER	Boiler Shell Equipped FCX Greenstar HE Oil 12/22	V 72. 31760	8 716 103 307 0
44	BOILER	Nut for Flange 1"	K 20. 03004	8 716 103 303 0
45	BOILER	Stainless Steel washer 30.4 x 25, 5 x 0,3	B 59. 00692	8 716 103 304 0
46	BOILER	Sight Glass Pyrex D. 30 x 5	T 20. 00582	8 716 103 305 0
47	BOILER	White Plinth FCX Greenstar HE Oil 12/22	V 72. 32025	8 716 105 411 0
48	ELECTRICALBOX	Neon Indicator Light	C 90. 03244	8 716 103 321 0
49	BOILER	Condenser Spirals	V 72.12096	8 716 103 308 0
50	ELECTRICALBOX	Control Thermostat	L 71. 31740	8 716 142 309 0
51	BOILER	Cast Iron Bend 90° F3/8 - F3/8	K10. 03620	8 716 104 539 0
52	BOILER	Automatic Air Vent	L 90. 24635	8 716 104 538 0
53	BOILER	Flange seal	L 05. 08845	8 716 140 796 0
54	BOILER	Fixing Flange 11883001	L 05. 29169	8 716 140 014 0
55	BURNER	Bentone Burner ST108-WO	L 05. 30133	8 716 103 406 0
56	ELECTRICALBOX	Electrical Box Assembly	W 72. 31784	8 716 105 413 0
57	ELECTRICALBOX	Control Box Panel	W 72. 31788	8 716 104 414 0
58	ELECTRICALBOX	Cable Grip D = 6.5 mm Black	A 90. 27098	8 716 104 415 0
59	ELECTRICALBOX	Safety Thermostat 110 CAP 1.5M TG400	L 71. 11583	8 716 103 323 0
60	ELECTRICALBOX	Safety Thermostat 120 CAP 1.5M TG400	L 71. 11584	8 716 103 324 0
61	ELECTRICALBOX	Electrical Box Cover White	V 72. 31784	8 716 105 416 0







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