

Grant Vortex Eco

External Wall Hung Condensing Oil Boiler Range

Installation & Servicing Instructions



Commissioning Report

For use with Kerosene only.

After installing the boiler leave these instructions with the User.

This appliance is deemed a controlled service and specific regional statutory requirements may be applicable.

Date: _____

Commissioning engineer: _____ Tel. No: _____

Boiler model/output: _____ kW

Fuel type: Kerosene

Nozzle size: _____ Pump pressure: _____

Air setting: _____ Flue gas % CO₂: _____

Net flue gas temp: _____ Smoke No: _____

Contents

1	Introduction	4	7	Sealed Systems	21
1.1	How a condensing boiler works	4	7.1	Sealed system installation	21
1.2	Boiler Description	4	7.2	Fill the sealed system	23
1.3	Boiler Components	5	8	Electrical	24
2	Technical Data	6	8.1	Connecting the power supply	24
2.1	Boiler technical data – Vortex Eco external wall-hung boilers	6	8.2	Frost protection	24
2.2	Sealed system data – External models	6	8.3	Control system wiring diagrams	24
2.3	Vortex boilers using Class C2 kerosene	7	8.4	Boiler control panel wiring diagrams	26
2.4	Flue gas analysis	7	9	Flue System & Air Supply	27
2.5	Boiler panel assembly	8	9.1	Air supply	27
3	Oil Storage & Supply System	9	9.2	Conventional flue system	27
3.1	Fuel supply	9	9.3	Hybrid system green to orange	27
3.2	Burner oil connection	11	9.4	Connecting a conventional flue	28
4	Boiler Installation Information	13	10	Commissioning	30
4.1	Introduction	13	10.1	Before switching on	30
4.2	Boiler location	13	10.2	Switching on	30
4.3	Preparation for installation	13	10.3	Running the boiler	31
4.4	Dismantling the boiler	13	10.4	Balancing the system	31
4.5	Installing the boiler	15	10.5	Completion	31
4.6	Regulations compliance	16	11	Boiler Servicing	32
4.7	Completion	17	11.1	Checking before servicing	32
4.8	Before you commission	17	11.2	Dismantling prior to servicing	32
4.9	Heating system design considerations	17	11.3	Cleaning the boiler	32
4.10	Underfloor heating systems	17	11.4	Cleaning the burner	33
4.11	Pipework materials	17	12	Fault Finding	34
4.12	Sealed systems	17	12.1	Burner fault finding	34
4.13	Underfloor systems	17	12.2	Boiler fault finding	37
5	Pipe Connections	18	13	Spare Parts	38
5.1	Water connections	18	14	Health & Safety Information	40
5.2	Water connections – System models	18	14.1	Insulation materials	40
6	Condensate Disposal	19	14.2	Kerosene and gas oil fuels (mineral oils)	40
6.1	General requirements	19	15	EC Declaration of Conformity	41
6.2	Connections	19	16	Notes	42
6.3	Pipework	19			
6.4	External pipework	19			
6.5	Condensate soakaway	19			
6.6	Condensate trap	20			
6.7	Condensate disposal pipework	20			
6.8	Inspection and cleaning of trap	20			

1 Introduction

This manual is intended to guide engineers in the installation and maintenance of Grant VORTEX Eco External Wall Hung boilers. A separate manual is available to guide users in the operation of these boilers.

The following special text formats are used in this manual for the purposes listed below:



Warning of possible human injury as a consequence of not following the instructions in the warning.



Caution concerning likely damage to equipment or tools as a consequence of not following the instructions in the caution.



Note text. Used for emphasis or information not directly concerned with the surrounding text but of importance to the reader.

1.1 How a Condensing Boiler Works

During the combustion process, hydrogen and oxygen combine to produce heat and water vapour. The water vapour produced is in the form of superheated steam in the heat exchanger. This superheated steam contains sensible heat (available heat) and latent heat (heat locked up in the flue gas). A conventional boiler cannot recover any of the latent heat and this energy is lost to the atmosphere through the flue.

The Grant VORTEX Eco External Wall Hung condensing boiler contains an extra heat exchanger which is designed to recover the latent heat normally lost by a conventional boiler. It does this by cooling the flue gases to below 90°C, thus extracting more sensible heat and some of the latent heat. This is achieved by cooling the flue gases to their dew point (approximately 55°C).

To ensure maximum efficiency, the boiler return temperature should be 55°C or less, this will enable the latent heat to be condensed out of the flue gases.

The boiler will achieve net thermal efficiencies of 100%.

To achieve maximum performance from the Grant VORTEX Eco External Wall Hung boiler, it is recommended that the heating system is designed so that a temperature differential of 20°C between the flow and return is maintained. The use of modulating circulating pumps (now widely available) and effective control systems should be considered.

The Grant Vortex boiler will however still operate at extremely high efficiencies even when it is not in condensing mode and therefore is suitable for fitting to an existing heating system without alteration to the radiator sizes. The boiler is capable of a maximum flow temperature of 75°C.

1.2 Boiler Description

The Vortex Eco External Modules have an insulated weatherproof enclosure made of galvanised steel with a powder coated finish, and are designed for external installation, Mounted on a suitable external wall.

The Grant VORTEX Eco External modules are part of the Grant range of automatic pressure jet oil boilers, and have been designed for use with a fully pumped central heating system with indirect domestic hot water cylinder. They are not suitable for use with either a direct cylinder or a 'primatic' cylinder or gravity hot water.

The boilers are suitable for use on open vented or sealed central heating systems. All models are supplied with the control panel and burner factory fitted.

The boilers can be connected to either a conventional flue system or a balanced flue system, as required.

An external conventional flue (Green) system is available from Grant Engineering (UK) Ltd. Refer to Chapter 9 for further details including the list of available components of this system.

A hybrid flue (Green/Orange) system is also available which allows the External module to utilize an existing chimney stack. Refer to Chapter 9 for further detail including the list of available components of this system.



The flue system materials and construction must be suitable for use with oil-fired condensing boilers. Failure to fit a suitable conventional flue may invalidate the warranty on the boiler.

1.3 Boiler Components

All burners are pre-set for use with kerosene and are supplied ready to connect to a two pipe fuel supply system with two flexible fuel lines and $\frac{3}{8}$ " to $\frac{1}{4}$ " BSP male adaptor supplied with the boiler.

The temperature of the water leaving the boiler to heat the radiators and hot water cylinder is User adjustable.

The boiler is fitted with an overheat thermostat (which allows it to be used on a sealed central heating system) which will automatically switch off the boiler if the heat exchanger exceeds a pre-set temperature of $111^{\circ}\text{C} \pm 3^{\circ}\text{C}$.

The control panel is fitted with an ON/OFF switch, boiler thermostat control knob and the manual reset button for the overheat thermostat.

To access the controls, pull open the front panel by turning the knob at the base, pulling it out from the base and sliding it from under the lip at the top, as shown in Figure 1-1.

The controls are shown in Figure 1-3.



Figure 1-1: Front panel showing access knob at base and overlap at top



Figure 1-3: Boiler controls



Figure 1-2: Boiler front panel removed

2 Technical Data

2.1 Boiler Technical Data – Vortex Eco External Wall-hung Boilers

Model		External		External System	
		12/16	16/21	12/16	16/21
Water content	Litres	11	11	11	11
	Gal	2.4	2.4	2.4	2.4
Weight - complete boiler (dry)	kg	85.7	92.2	85.7	92.2
	lbs	189	203	189	203
Weight - boiler shell only (dry)*	kg	56.0	56.0	56.0	56.0
	lbs	123	123	123	123
Max heat input (kerosene)	kW	17.0	21.0	17.0	21.0
	Btu/h	58,000	71,650	58,000	71,650
Flow connection		22mm - push-fit Tectite connector (supplied fitted)			
Return connection		22mm - push-fit Tectite connector (supplied fitted)			
Min. flow rate $\Delta T=10^{\circ}\text{C}$	l/h	1420	1740	1420	1740
Min. flow rate $\Delta T=20^{\circ}\text{C}$	l/h	710	870	710	870
Condense connection		Accepts 21.5mm Ø polypropylene overflow pipe			
Flue diameter (conventional flue)	mm	100mm			
Waterside resistance $\Delta T=10^{\circ}\text{C}$	mbar	28.5			
Waterside resistance $\Delta T=20^{\circ}\text{C}$	mbar	10			
Maximum static head	m	28			
Minimum circulating head	m	1			
Boiler thermostat range	$^{\circ}\text{C}$	65 to 75			
Limit (safety) stat cut-off temperature	$^{\circ}\text{C}$	111 \pm 3			
Max casing temperature	$^{\circ}\text{C}$	less than 50			
Electricity supply		230V ~ 50Hz Fused at 5 Amp			
Motor power	Watts	75			
Starting current	Amps	2.25			
Running current	Amps	0.85			
Oil connections		1/4" Male BSP			
Conventional flue draught	N/m ²	Min - 8.7			
	in.wg	Max - 37			
Max operating press - sealed system	bar	2.5			
Max operating pressure - open system	bar	2.5			

* Weight of shell - without baffles & clean-out door 45.7kg

2.2 Sealed System Data – External Models

	12/16 & 16/21
Heating system pressure (cold)	0.5 bar Min - 1.0 bar Max
Pressure relief valve operating pressure	2.5 bar
Expansion vessel size	8 litres
Max heating system volume (including boiler)*	85 litres
Cold mains connection (for filling loop)	15mm compression (provided)
Pressure relief valve discharge connection	15mm compression (provided)

* Based on vessel charge and system pressure cold fill pressure of 0.5 bar

2.3 Vortex Boilers using Class C2 Kerosene

Model	Heat Input		Heat output		SEDBUK	Nozzle	Oil pressure	Smoke	Burner head	Fuel flow	Flue gas	CO ₂
	kW	Btu/h	kW	Btu/h	efficiency		bar	rate No.	temp type	kg/h	°C	%
12/16	13.0	44,350	12.7	43,300	94.9	0.35 80°EH	7	0	No.1 Fixed	1.09	60 - 65	11 - 12
	14.5	49,470	*14.0	47,770	94.9	0.40 80°EH	10	0	No.1 Fixed	1.21	65 - 69	11 - 12
	17.0	58,000	16.5	56,300	94.9	0.50 80°EH	7	0	No.1 Fixed	1.43	65 - 69	11 - 12
16/21	17.0	58,000	16.5	56,300	93.8	0.50 80°EH	7	0	No.1 Fixed	1.43	65 - 69	11 - 12
	19.3	65,850	*18.7	63,800	93.8	0.50 80°EH	10	0	No.1 Fixed	1.61	70 - 75	11 - 12
	21.0	71,650	20.3	69,270	93.8	0.60 80°EH	8	0	No.1 Fixed	1.82	75 - 79	11 - 12

Notes:

1. Data given is approximate only.
2. The above settings may have to be adjusted on site for correct operation of burner.
3. Gas oil is not suitable for use with the Grant VORTEX Eco Wall Hung boiler range.
4. The net flue gas temperatures given above are $\pm 10\%$.
5. When commissioning the air damper must be adjusted to obtain correct CO₂ level.
6. * Factory settings: 12/16 - 14kW 16/21 - 18.7kW
7. Combustion door test point may be used for CO₂ and smoke readings only. Do not use this test point for temperature or efficiency readings.
8. The installer must amend the boiler data label if the output is changed.

2.4 Flue Gas Analysis

To allow the boiler to be commissioned and serviced, the boiler is supplied with a combustion test point on the front cleaning door. When this test point is used please note that the test point is for CO₂ and smoke readings only.

Insert combustion probe in to the end of the flue terminal to measure the CO₂ level.



NOTE

Do not use the test point in the cleaning door.

To obtain the correct CO₂ level the final flue gas reading must be taken with all the casing panels fitted.

2.5 External Boiler
Panel Assembly

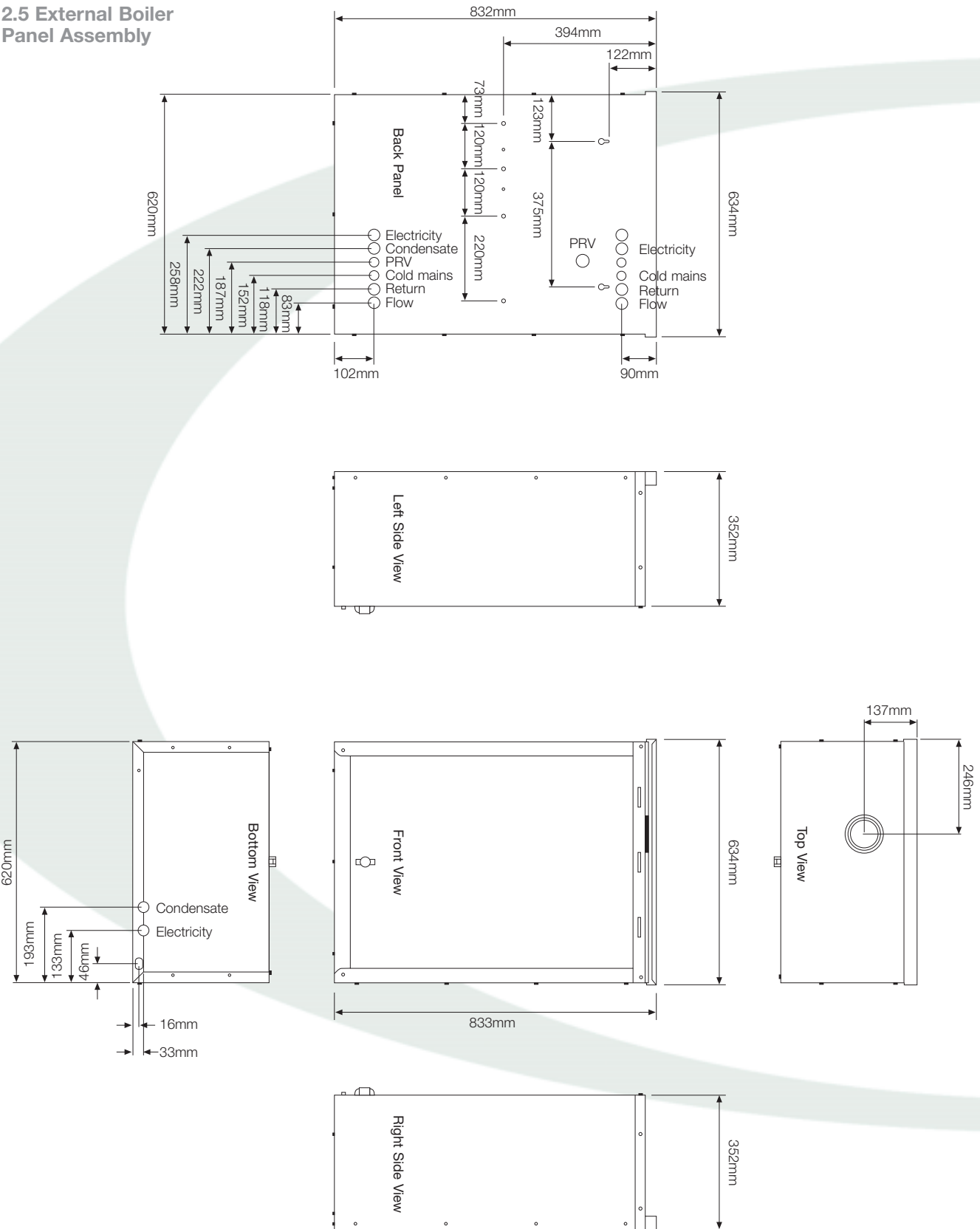


Figure 2-1: Grant VORTEX Eco External Wall Hung boiler panel assembly

3 Oil Storage & Supply System

3.1 Fuel Supply

Fuel Storage

The tank should be positioned in accordance with the recommendations given in BS 5410:1:1997, which gives details of filling, maintenance and protection from fire.

A steel tank may be used and must be constructed to BS 799:5:1987 and OFS T200.



CAUTION

A galvanized tank must not be used.

A plastic tank may be used and must comply with OFS T100.



NOTE

Plastic tanks should be adequately and uniformly supported on a smooth level surface, across their entire load bearing base area, that is, the area in contact with the ground.

Fuel Pipes

Fuel supply pipes should be of copper tubing with an external diameter of at least 10mm.

Galvanised pipe **must not** be used.

All pipe connections should preferably use flared fittings. Soldered connections **must not** be used on oil pipes.



CAUTION

Flexible pipes must not be used outside the boiler case.

A remote sensing fire valve must be installed in the fuel supply line, with the sensing head located above the burner.

Recommendations are given in BS 5410:1:1997.

A metal bowl type filter with a replaceable micronic filter must be fitted in the fuel supply line adjacent to the boiler. A shut-off valve should be fitted before the filter, to allow the filter to be serviced.

Two flexible fuel lines, adaptor and 1/4" BSP isolation valve are supplied loose with the boiler for the final connection to the burner, with a two pipe system or 'Tiger Loop' type de-aerator.

Metal braided flexible pipes should be replaced annually when the boiler is serviced. Long life flexible pipes should be inspected annually and replaced at least every 60 months.

Two Pipe System - (See Figure 3-1)

With the storage tank outlet below the burner, a two pipe system should be used. The pipe runs should be as shown in Fig. 3-1. The return pipe should be at the same level in the tank as the supply pipe, both being 75 to 100mm above the base of the tank. The pipe ends should be a sufficient distance apart so as to prevent any sediment disturbed by the return entering the supply pipe.

Avoid the bottom of the tank being more than 3m below the burner.

A non-return valve should be fitted in the supply pipe together with the filter and fire valve. A non-return valve should be fitted in the return pipe if the top of the tank is above the burner.

The pump vacuum should not exceed 0.4 bar.

Beyond this limit gas is released from the oil.

For guidance on installation of top outlet fuel tanks and suction oil supply sizing, see OFTEC booklet T1/139.

Available at www.oftec.org.uk.

H (m)	Pipe Length (m)		
	ø 6mm	ø 8mm	ø 10mm
0.5	19	60	100
1	21	66	100
1.5	23	72	100
2	25	79	100
2.5	27	85	100
3	29	91	100
3.5	31	98	100

Tiger Loop System - (See Figures 3-2 and 3-3)

When The storage tank is below the burner, an alternative to a two pipe system can be achieved using a 'Tiger Loop' type oil deaerator. This effectively removes the air from the oil supply on a single pipe lift.

The de-aerator is connected close to the boiler as a two pipe system (omitting the non-return valve) as shown in Figure 3-2. Refer to the manufacturers instructions supplied with the de-aerator.

The de-aerator **must** be mounted vertically, as shown in Figure 3-2.



WARNING

To prevent any possibility of fuel fumes entering the building, the de-aerator **must** be fitted outside.

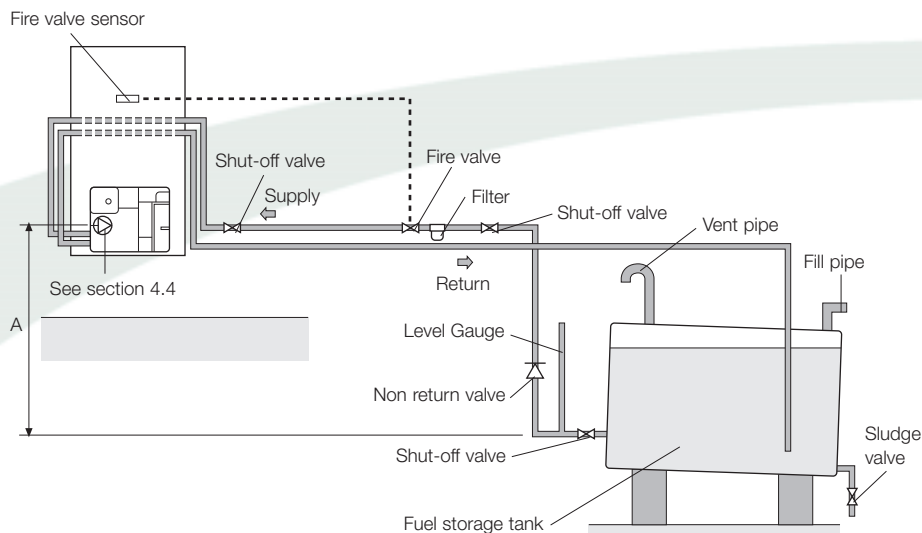


Figure 3-1: Two pipe system

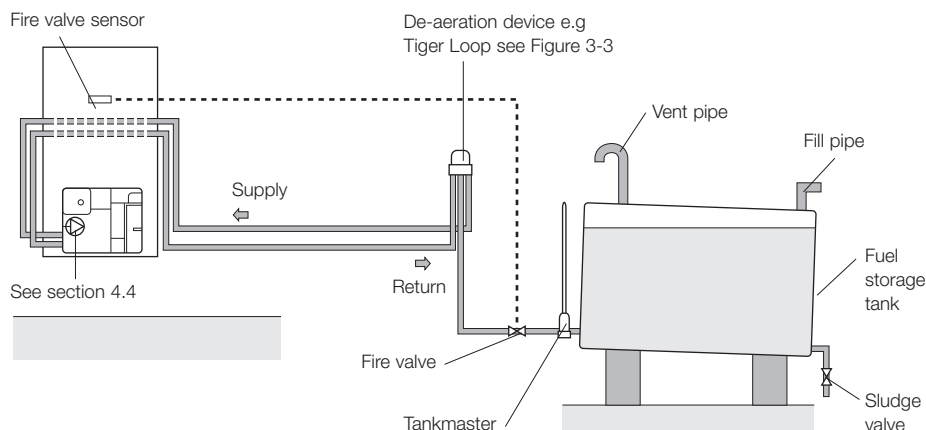


Figure 3-2: De-aeration device system

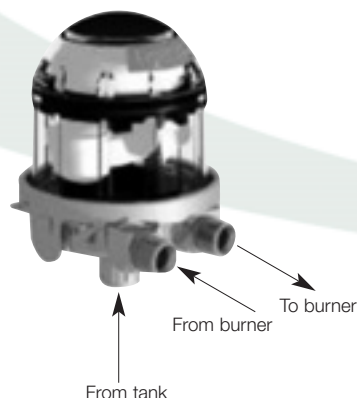


Figure 3-3: Tiger loop de-aeration device

3.2 Burner Oil Connection

The burner fuel pump is supplied for use with a two-pipe fuel supply system. (For use on a single pipe system, it is necessary to fit the washer (see Figure 3-4) into the tapping in the pump.)

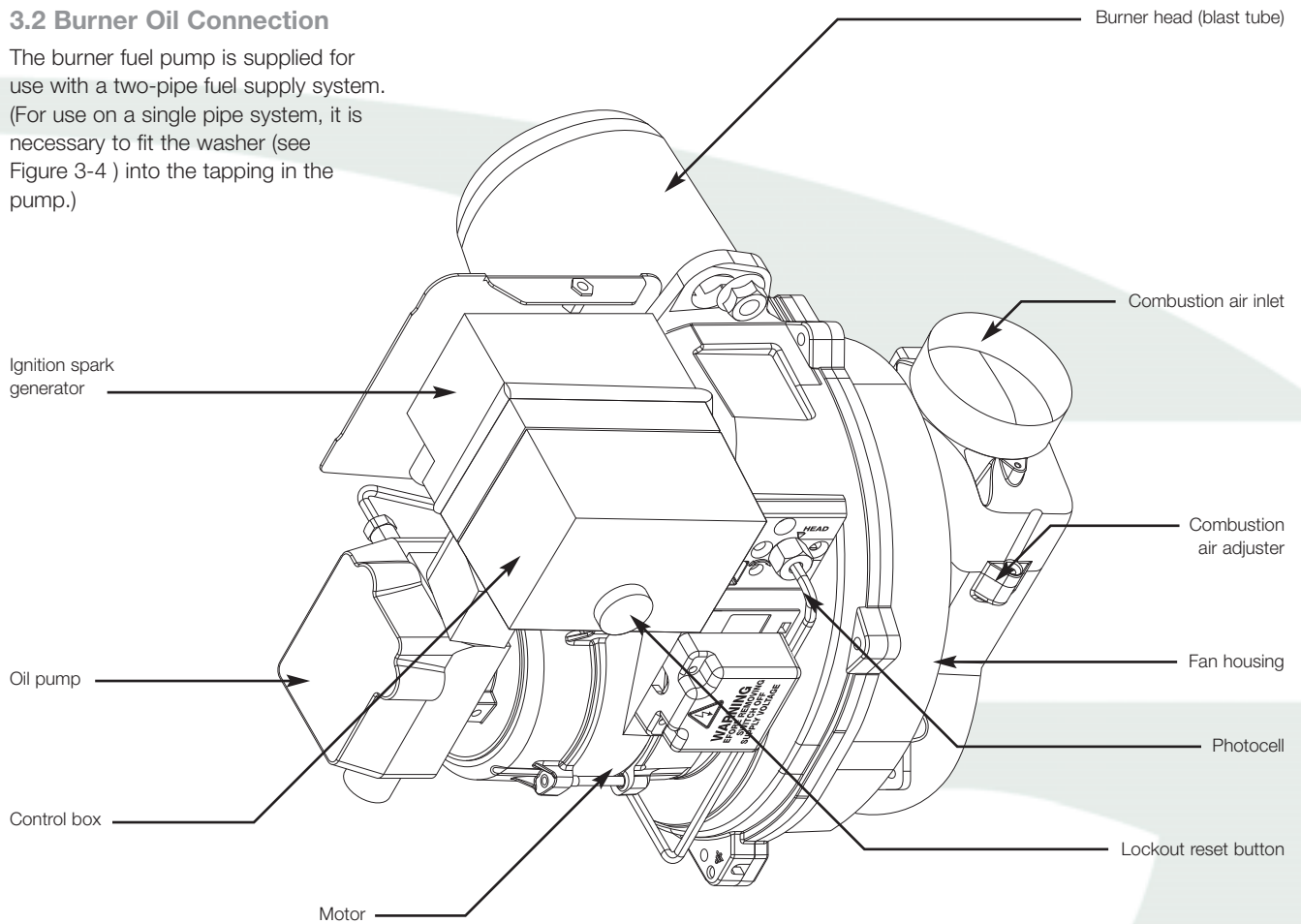


Figure 3-4: Burner components

Main Burner Components

Remove the control panel (secured by two screws). To gain access to the burner. It may be necessary to remove the burner from the boiler to access connections in the fuel pump.

To do this, unscrew the single nut at the top of the burner (using a 13mm spanner) and rotate the burner clockwise and withdraw the burner from the boiler as shown in Figure 3-5.

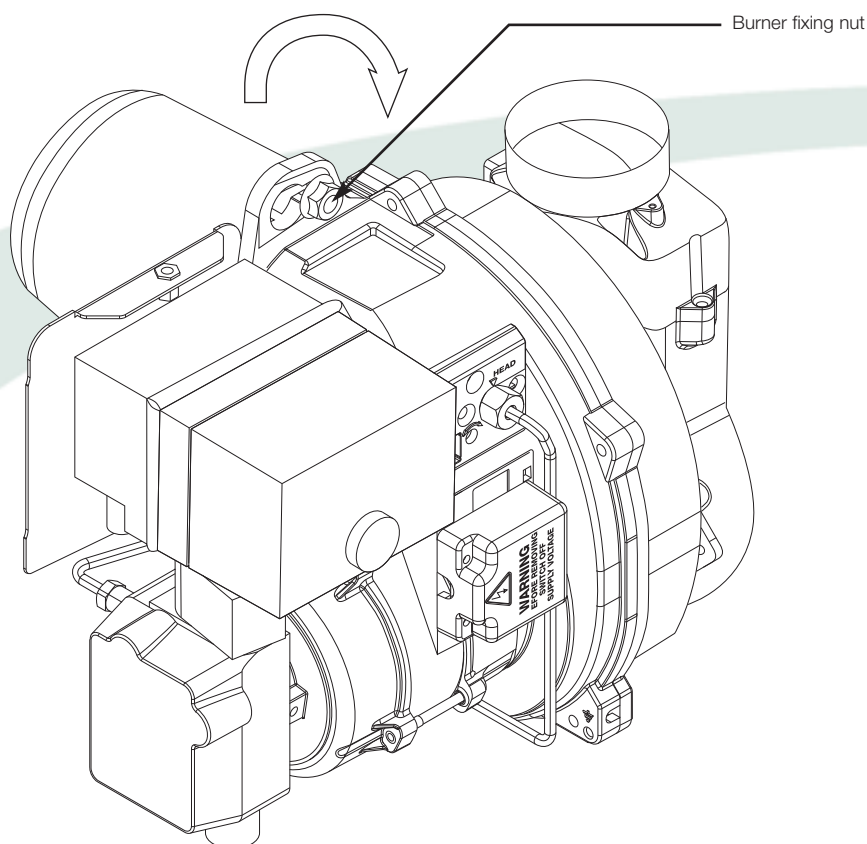


Figure 3-5: Burner removal

Burner Removal

The procedure then is:

1. Remove and discard the blanking plugs from the suction (inlet) and return connections of the pump.
2. Connect the suction and return oil flexible fuel lines to the pump.
3. Connect the $\frac{3}{8}$ " to $\frac{1}{4}$ " BSP adaptor to the flexible fuel line using the adaptor supplied. The supply enters through one of the holes in the casing.

Item	Description
01	Inlet
02	Return
03	Bleed and pressure gauge port
04	Vacuum gauge port
05	Pressure adjustment
06	Nozzle outlet

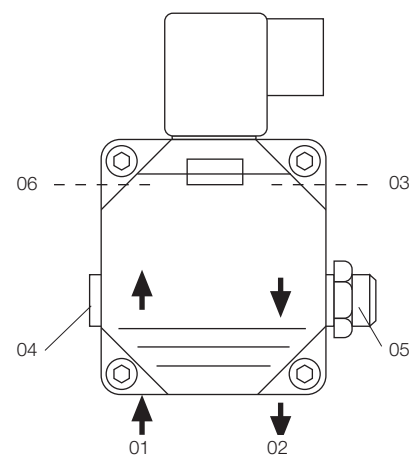


Figure 3-5: Danfoss BFP11 R3 oil pump

4 Boiler Installation Information

4.1 Introduction

The boiler is supplied already fully assembled in a carton which is carefully packed with packing materials. As the boiler is wall mounted all of the content of the boiler casing must be removed with the packaging before installation can begin, to give access to the rear fixing panel. The installation procedure therefore begins with unpacking and uninstalling of the packed boiler.

4.2 Boiler Location

The Module must be installed against the building fixed to an outdoor wall that is firm, flat and vertical. It does not require any special base provisions as the temperature of the boiler casing is less than 50° C.

The Module must be positioned such that the required clearances from the low level flue outlet, as shown in Figure 9-3, are achieved.

Adequate clearance must be left around and in front of the Module for servicing. The Eco external wall mounted boiler must be installed with the flue terminal terminating at least two metres above ground level. (Refer to standard BS5410 part 1). No terminal guard can be fitted if termination is less than two metres above ground level. In this situation use the Green flue system to achieve the minimum height. See Section 9.

The flue terminal must be a minimum distance of 1.8m from an oil storage tank.

The flue terminal should be positioned so as to avoid products of combustion accumulating in stagnant pockets around the building or entering into buildings.

Once the outdoor boiler is fixed sufficient clearance **must** be allowed at the front of and below the boiler to remove the burner and baffles for servicing.

4.3 Preparation for Installation

With boiler on pallet, open carton, remove packing and carton from boiler.

Remove door - turn the handle anticlockwise and lift door away from boiler, carefully sliding out from top flange.

Remove internal packaging from within boiler casing.

Remove flue terminal, filling loop and flexible oil hose packs from within boiler.

4.4 Dismantling the Boiler

Dismantle the boiler as follows, keeping all components, screws and washers for re-assembly:

1. Remove screws securing top panel and remove top casing panel from boiler.
2. Disconnect burner electrical plug.
3. System model only – Disconnect pump electrical plug.
4. Unscrew inlet connection to condensate trap and remove trap from boiler.

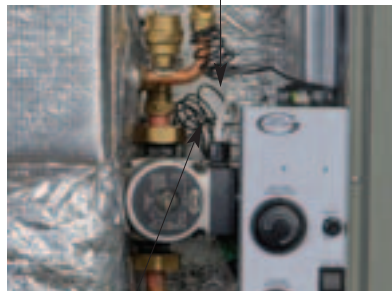


Figure 4-1: Condensate trap and thermostat phial location

5. Remove thermostat phials from their pocket (in right side of heat exchanger – below return connection).

6. System model only - Unscrew and disconnect pressure gauge from PRV body.
7. Remove screws securing right hand side panel and remove side panel, complete with control panel, pulling it forward and away from boiler.
8. Remove screws securing left hand side panel and remove side panel, pulling it forward and away from boiler.
9. Remove screws securing bottom casing panel and remove bottom panel from boiler.
10. System model only - Unscrew expansion vessel hose from connection on boiler shell and remove expansion vessel from boiler.

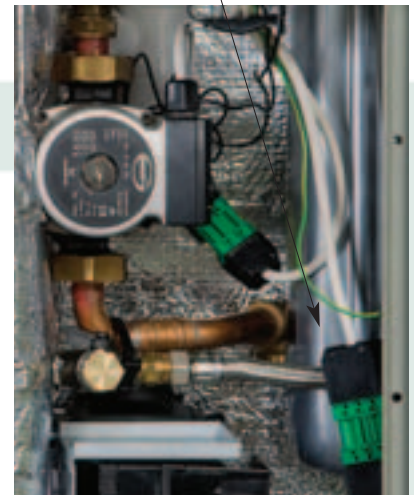


Figure 4-2: Removing thermostat phials

11. System model only - Unscrew upper pump union and remove pump, complete with flow pipe, from boiler.
12. Non-system model – Unscrew compression connection on boiler shell and remove flow pipe from boiler.
13. Unscrew top right compression connection and remove return pipe from boiler.



Figure 4-3: Flow and Return pipe location

14. Using a 13mm socket, slacken burner retaining nut (on top of burner). Rotate burner clockwise (towards rear of boiler), pull burner to the right until burner head is clear of mounting flange and remove burner from boiler.
15. Using 13mm spanner, unscrew the two clean-out door retaining nuts and remove door from front of boiler shell.

16. Remove baffles from boiler shell.



Figure 4-4: Baffle location

17. Undo retaining screw and remove transit bracket from top of boiler shell.
18. Push boiler shell upwards to disengage it from mounting bracket on back panel of boiler.
19. Lift boiler shell away from back panel and stand it upright on the four feet.



Figure 4-5: Lifting boiler out

20. Carefully remove the foil-faced insulation from the back panel.



Figure 4-6: Back panel showing insulating foil

21. Unscrew and remove the two transit screws & nuts securing mounting bracket and back panel to pallet.

4.5 Installing the Boiler

! NOTE

The boiler must be mounted such that the boiler flue terminal (supplied with the boiler) terminates at or above 2 metres above ground level.

If this distance is to be less than this, Grant suggest using the Green system to achieve a termination point of at least 2 metres above ground level.

Figure 4-7 shows the position of holes required to match those in the back panel.

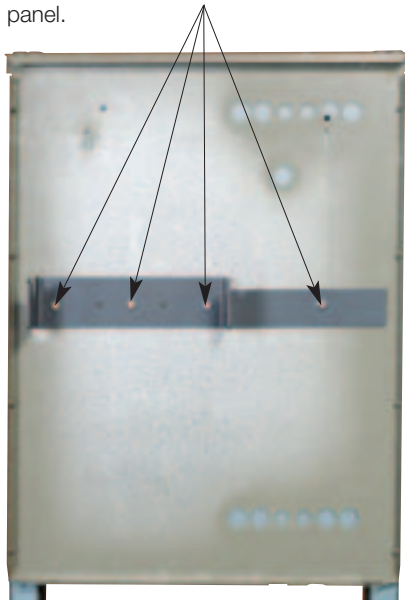


Figure 4-7: Back panel showing fixing holes

1. Locate back panel in required position on wall – mark position of screw holes (two back panel mounting screws and four for mounting bracket screws).
2. Mark position of holes in wall for flow & return pipes, cold main (for filling loop), condensate discharge pipe (if it is to be routed back into house) and electrical power supply.
3. Drill all holes. Fit suitable wall fixing plugs (supplied) in the two panel mounting holes and four mounting bracket holes.

4. Fit screws (not supplied) in the two panel mounting holes and hang back panel using the two 'keyhole' slots.
5. Locate mounting bracket onto back panel, aligning four holes in bracket with those in back panel. Ensure that mounting 'hooks' are pointing upwards and secure using the fixings supplied by Grant UK..
6. Carefully re-fit insulation into back panel, passing mounting 'hooks' through the two slits in the insulation.
7. Lift boiler shell and hang it on the mounting bracket – ensuring that the mounting plates on either side of the shell are fully located in the vertical slot of both mounting hooks.
8. Re-fit return pipe to top right hand connection on boiler shell. Pass return pipe from system through hole in wall and connect to boiler return pipe.
9. System model only - Re-fit pump complete with flow pipe to upper pump union on boiler shell. Ensure that rubber pump union washer is fitted. Pass flow pipe from system through hole in wall and connect to boiler flow pipe.
10. Non-system model – Re-fit flow pipe to compression connection on boiler shell. Pass flow pipe from system through hole in wall and connect to boiler flow pipe.

! NOTE

It is recommended that the system flow and return pipes are connected to the boiler at this point in the installation. Two 22mm isolating valves are supplied for use with sealed system models only. These must not be used on an open vented system.

These boiler isolating valves should be located adjacent to the boiler in a convenient position.

11. Re-fit burner. First remove burner securing nut, locate burner head into hole in burner flange/boiler shell and locate mounting screw through hole on top of burner. Re-fit nut and tighten to secure burner in place. Connect flexible oil lines from oil supply pipework to burner. It is recommended that the copper oil lines are installed at this stage while the side panels are not in place.
12. Re-fit baffles into boiler shell – ensuring they are in the correct order (check marking on each baffle) as shown below:

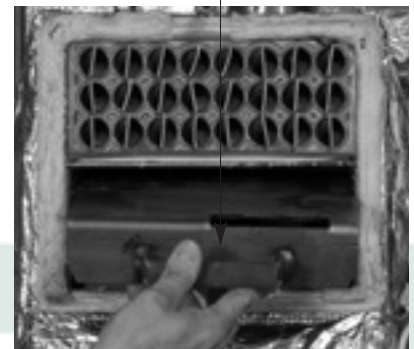


Figure 4-8: Re-fitting baffles into boiler shell

13. Locate clean-out door onto the two studs, re-fit nuts and tighten to secure door in place.

14. Re-fit left hand casing panel and secure in place with screws (with washers).
15. Re-fit bottom casing panel and secure in place with screws (with washers).
16. Re-fit right hand casing panel complete with control panel fitted.
17. Re-locate thermostat bulbs in pocket at rear right hand side of boiler shell.
18. System model only - Re-connect pressure gauge to PRV and tighten.
19. Re-connect burner plug.
20. System model only - Re-connect pump plug.
21. Re-fit condensate trap. Connect condensate discharge pipe to outlet of trap. See also 'Condensate Disposal'.
22. System model only - Re-fit expansion vessel onto bracket inside right hand side panel and re-connect expansion vessel hose to connection on front right hand side of boiler shell. Ensure rubber sealing washer is fitted.
23. Re-fit top casing panel and secure in place with screws (with washers).
24. Fit flue terminal, carefully pushing it through seal in hole in top panel. Ensure that seal is fitted to terminal and that it is pushed fully home into the flue connector on the boiler shell. Position the outlet to point to the left and at an angle of 45° away from the wall.
25. Re-fit front casing panel – locate top edge up under front flange of top panel. Push bottom of front panel into opening until flush with edge of side panels before rotating handle clockwise to secure.

4.6 Regulations Compliance

Installation of a Grant VORTEX Eco External Wall Hung boiler must be in accordance with the following recommendations:-

- Building Regulations for England and Wales, and the Building Standards for Scotland issued by the Department of the Environment and any local Byelaws which you must check with the local authority for the area.
- Model and local Water Undertaking Byelaws.
- Applicable Control of Pollution Regulations.
- The following OFTEC requirements:
 - OFST 100 Polythene oil storage tanks for distillate fuels.
 - OFST 200 Fuel oil storage tanks and tank bunds for use with distillate fuels, lubrication oils and waste oils.

Further information may be obtained from the OFTEC Technical Information Book 3 (Installation requirements for oil fired boilers and oil storage tanks).

The installation should also be in accordance with the latest edition of the following British Standard Codes of Practice:

- BS 715 Metal flue pipes, fittings, terminals and accessories.
- BS 799:5 Oil storage tanks.
- BS 1181 Clay flue linings and flue terminals.
- BS 4543:3 Factory made insulated chimneys for oil fired appliances.
- BS 4876 Performance requirements for oil burning appliances.
- BS 5410:1 Code of Practice for oil firing appliances.

- BS 5449 Forced circulation hot water systems.
- BS 7593 Code of Practice for treatment of water in heating systems.
- BS 7671 Requirements for electrical installations, IEE Wiring Regulations.



NOTE

Failure to install and commission appliances correctly may invalidate the boiler warranty.



WARNING

Before starting any work on the boiler, or fuel supply please read the health and safety information given in Section 14.

4.7 Completion

Please ensure that the OFTEC CD/10 installation completion report (provided with the boiler) is completed in full.

Leave the top copy with the User.

Retain the carbon copy.

Ensure that the User Information pack (supplied with the boiler) is handed over to the Householder.

4.8 Before you Commission

To avoid the danger of dirt and foreign matter entering the boiler the complete heating system should be thoroughly flushed out - before the boiler is connected and then again after the system has been heated and is still hot. This is especially important where the boiler is used on an old system.

For optimum performance after installation, this boiler and its associated central heating system must be flushed in accordance with the guidelines given in BS 7593:1992 'Treatment of water in domestic hot water central heating systems'.

This must involve the use of a proprietary cleaner, such as BetzDearborn's Sentinel X300 or X400, or Fernox Restorer. Full instructions are supplied with the products, but for more details of BetzDearborn's products, view the website www.sentinel-solutions.net and for more details of Fernox products view the website www.fernox.com.

For Long term protection against corrosion and scale, after flushing, it is recommended that an inhibitor such as Betzdearborn's Sentinel X100 or Fernox MB-1 is dosed in accordance with the guidelines given in BS 7593:1992.

Failure to implement the guidelines will invalidate the warranty.

4.9 Heating System Design Considerations

To achieve the maximum efficiencies possible from the Grant VORTEX Eco External Wall Hung boiler, the heating system should be designed to the following parameters:

Radiators:-

- Flow temperature 70°C
- Return temperature 50°C
- Differential 20°C

Underfloor:-

- Flow temperature 50°C
- Return temperature 40°C
- Differential 10°C

Size radiators with a mean water temperature of 60°C.

Design system controls with programmable room thermostats or use weather compensating controls to maintain return temperatures below 55°C.

The boiler should not be allowed to operate with return temperatures of less than 40°C when the system is up to operating temperature.

The use of a pipe stat is recommended to control the return temperature when using weather compensating controls.

4.10 Underfloor Heating Systems

In underfloor systems it is essential that the return temperature **must** be maintained above 40°C to prevent internal corrosion of the boiler water jacket.

4.11 Pipework Materials

Grant boilers are compatible with both copper and plastic pipe. Where plastic pipe is used it **must** be of the oxygen barrier type and be of the correct class (to BS 7291:Part 1:1990) for the application concerned.



NOTE

The first metre of pipework connected to both the heating flow and return connections of the boiler must be made in copper on all types of system - sealed or open-vented.

4.12 Sealed Systems

If plastic pipe is used, the installer must check with the plastic pipe manufacturer that the pipe to be used is suitable for the temperature and pressures concerned.

Plastic pipe must be Class S to BS 7291: Part 1:1990.



WARNING

The system should incorporate a low-pressure switch to shut off power to the boiler if the system pressure drops below 0.2 bar. A suitable low pressure switch kit is available to purchase from Grant Engineering (UK) Limited, Part No. MPCBS 62.

4.13 Underfloor Systems

Plastic pipe may be used on Underfloor systems where the plastic pipe is fitted **after** the thermostatic mixing valve. Copper tube **must** be used for at least the first metre of flow and return primary pipework between the boiler and the underfloor mixing/blending valves.

5 Pipe Connections

5.1 Water Connections

Flow and Return Connections - All models

On all models a 22mm push-fit connection is provided for both the heating flow and return connections.

Holes are provided in the back plate at high and low levels to route the pipework back into the property as required.

! NOTE

All pipes to be fitted into the push-fit connectors provided should be cut using a pipe slicer or pipe cutter - to leave the pipe ends with a slight radius and free from any burrs or sharp edges. Pipes to be used with these fittings should not be cut square using a hacksaw.

5.2 Water Connections – System Models

A 15 mm discharge pipe must be connected to the safety valve outlet connection. The pipework between the safety valve and the boiler must be unrestricted, i.e. no valves. The discharge pipe should be run vertically down to an exit hole in the case, and then terminate so that it cannot cause injury to persons or property. See Figures 5 1 and 5 2 above.

A 15 mm double check valve ballcock type valve is provided on the flexible filling loop hose for connection of the cold mains supply to the heating system. The cold mains supply should terminate inside the boiler casing.

A drain cock is fitted at the bottom on the front of the boiler to allow the heating system to be drained.

The expansion vessel is connected via a flexible hose to allow it to be moved to gain access to the burner and condense trap for servicing. When replacing the vessel, care should be taken to ensure that the flexible connecting hose is not twisted.



Figure 5-1: Non-system boiler flow and return connections



Figure 5-2: System boiler flow and return connections



Figure 5-3: Grant Vortex Eco External boiler with front casing removed

6 Condensate Disposal

6.1 General Requirements

When in condensing mode the Grant Vortex Eco wall-hung boilers produce condensate from the water vapour in the flue gases. This condensate is slightly acidic with a pH value of around 3 (similar to vinegar). Provision must be made for the safe and effective disposal of this condensate.

Condensate can be disposed of using one of the following methods of connection:

Internal Connection (preferred option):

- Into an internal domestic waste system (from kitchen sink, washing machine, etc.).
- Directly into the soil stack

External Connection:

- Into an external soil stack
- Into an external drain or gully
- Into a rainwater hopper (that is part of a combined system where sewer carries both rainwater and foul water)
- Purpose made soakaway

All condensate disposal pipes **must** be fitted with a trap - whether they are connected internally or externally to a domestic waste system/soil stack or run externally to a gully, hopper or soakaway.

6.2 Connections

Connections into a rainwater hopper, external drain or gully should be terminated inside the hopper/drain/gully below the grid level but above the water level.

Condensate disposal pipes should not be connected directly into rainwater downpipes or to waste/soil systems connected to septic tanks.

Condensate should not be discharged into 'grey water' systems that re-use water used in the home (not including water from toilets).

It should be noted that connection of a condensate pipe to the drain may be subject to local Building Control requirement.

6.3 Pipework

Condensate disposal pipework must be plastic (plastic waste or overflow pipe is suitable).

NOTE

Copper or steel pipe is **not** suitable and **must not** be used.

Condensate disposal pipes should have a minimum 'nominal' diameter of 22mm ($\frac{3}{4}$ " - e.g. use 21.5mm OD polypropylene overflow pipe).

Condensate disposal pipes must be fitted with a fall (away from the boiler) of at least 2.5° (~45mm fall per metre run).

NOTE

Where it is not possible for the pipe to fall towards the point of discharge - either internally into a waste system or externally to a gully (e.g. for boilers installed in a basement), it will be necessary to use a condensate pump.

Condensate disposal pipes should be kept as short as possible and the number of bends kept to a minimum.

Pipes should be adequately fixed to prevent sagging, i.e. at no more than 0.5 metre intervals.

6.4 External Pipework

Ideally, external pipework, or pipework in unheated areas, should be avoided. If unavoidable, external pipework should be kept as short as possible (less than 3 metres) and 32mm waste pipe used to minimise the risk of ice blocking the pipe in freezing conditions.

The number of bends, fittings and joints on external pipes should be kept to a minimum to reduce the risk of trapping condensate.

NOTE

For a boiler installed in an unheated area such as an outhouse or garage, all condensate pipework should be considered as an 'external'.

6.5. Condensate Soakaway

To keep external pipework to a minimum, locate the soakaway as close as possible to the boiler but ensure it is at least 1 metre from building foundations and away from other services, for example, gas, electricity, or other services.

The condensate pipe may be run above or below ground level and can enter either the top or side of the soakaway tube. Refer to Figure 6-1.

Ensure that the drainage holes in the soakaway tube face away from the building.

Backfill the soakaway tube and the hole around it with 10mm limestone chippings.

Only use a soakaway where the soil is porous and drains easily.

NOTE

Do not use in clay soils or where the soil is poorly drained.

CAUTION

Any damage due to condensate backing up into the boiler due to a high water table, in the case of a soakaway, or flooded drains when the condensate disposal is via a gully or soil stack, is not covered by the Grant product warranty.

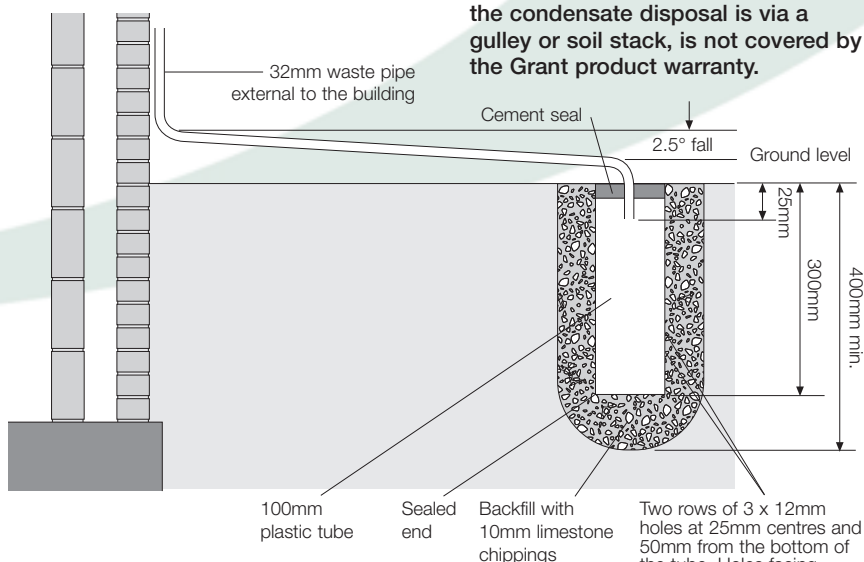


Figure 6-1: Purpose made condensate soakaway

6.6. Condensate Trap

Grant Vortex Eco Wall-hung boilers are supplied with a factory-fitted condensate trap to provide the required 75mm water seal in the condensate discharge pipe from the boiler.

This trap incorporates a float (which will create a seal when the trap is empty) and an overflow warning outlet (fitted with a plastic sealing cap), see Figure 6-2.



Figure 6-2: Condensate trap

The trap is factory-fitted inside the boiler casing – mounted on the outlet of the condensing heat exchanger - in an accessible position to allow for routine maintenance. See Figure 6-3.

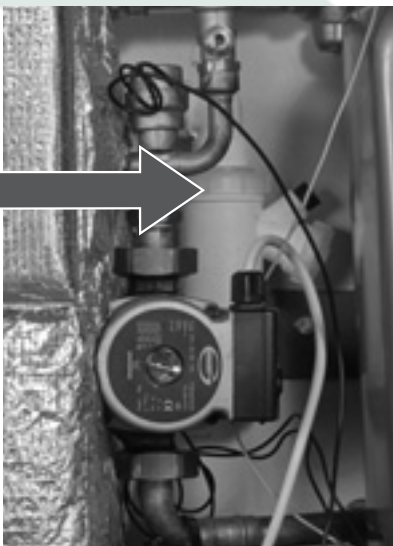


Figure 6-3: Condensate trap in-situ

6.7. Condensate Disposal Pipework

The boiler is supplied with a flexible plastic condensate disposal pipe, factory-fitted to the outlet of the trap.

This flexible discharge pipe must be routed through the boiler to exit via one of the pre-cut 'knock-outs' in the bottom flange of the boiler back panel - at the right rear of the bottom casing.

Push out the 'knock-out' from the hole taking care not to distort the back panel flange.

The outlet end of this flexible pipe will accept 21.5mm OD to 23mm OD Polypropylene overflow pipe for connection of the condensate discharge pipe below the boiler.

! NOTE

When connecting plastic discharge pipe, ensure that the pipe is **fully pushed into the outlet end connector on the flexible pipe to prevent the possibility of leakage.**

6.8 Inspection and Cleaning of Trap

The trap **must** be checked at regular intervals (e.g. on every annual service) and cleaned as necessary to ensure that it is clear and able to operate.

! NOTE

The bottom bowl is sealed to the trap body and cannot be removed.

To inspect and clean the trap

1. Remove expansion vessel (system models only) and hang on front of boiler casing.
2. Leave inlet connector fitted to connecting elbow.
3. Unscrew the inlet connection nut.
4. Separate trap from the 'top hat' inlet connector and nut.
5. Unscrew outlet connection nut, disconnect disposal pipe from trap.
6. Remove trap from boiler.
7. Remove float from trap – clean if necessary.
8. Inspect inside of trap and clean as necessary.
9. Re-assemble trap, re-fit to boiler and re-connect inlet connection. Ensure that elbow is fully pushed onto the 'top hat' inlet connector and disposal pipe is correctly connected to trap outlet.

! CAUTION

Failure to regularly check and clean the condensate trap may result in damage to the boiler and will not be covered by the Product Warranty.

7 Sealed Systems

7.1 Sealed System Installation

For a typical sealed system representation, see Figure 7-1.

All Grant Vortex Eco External boilers are suitable for use with sealed systems complying with the requirements of BS 5449.

The maximum temperature of the central heating water is 80°C.

The system must be provided with the following items:

- Diaphragm expansion vessel complying with BS 4814.
- Pressure gauge.
- Safety valve.
- Approved method for filling the system.

Refer to BS 7074:1 for further guidance.

The expansion vessel can be fitted in either the return or flow pipework in any of the recommended positions as shown in Figure 7-1. To reduce the operating temperature of the expansion vessel diaphragm, position it below the pipe to which it is connected. The expansion vessel may be positioned away from the system, providing the connecting pipe is not less than 13mm diameter.

The pressure gauge should have an operating range of 0 to 4 bar.

The safety valve, set to operate at 2.5 bar, should be fitted in the flow pipework near to the boiler.

The pipework between the safety valve and boiler must be unrestricted, i.e. no valves. The safety valve should be connected to a discharge pipe which will allow the discharge to be seen, but cannot cause injury to persons or property.

Provision should be made to replace water lost from the system. This can be done manually (where allowed by the local water undertaking) using an approved filling loop arrangement incorporating a double check valve assembly (as supplied fitted on System models).

An automatic air vent should be fitted to the highest point of the system.

The system design pressure (cold) should be between 0.5 and 1.0 bar. This pressure is equivalent to the maximum static head in bar + 0.3 (1 bar = 10.2 metres of water).

If thermostatic radiator valves are fitted to all radiators, a system by-pass must be fitted. The bypass must be an automatic type.

If thermostatic radiator valves are fitted, the system must incorporate an adequate by-pass.

Filling of the system must be carried out in a manner approved by the local Water Undertaking.

Where allowed, the system may be filled via the filling loop supplied (the loop arrangement includes a double check valve assembly).

All fittings used in the system must be able to withstand pressures up to 3 bar.

Radiator valves must comply with the requirements of BS 2767(10):1972.

One or more drain taps (to BS 2879) must be used to allow the system to be completely drained.

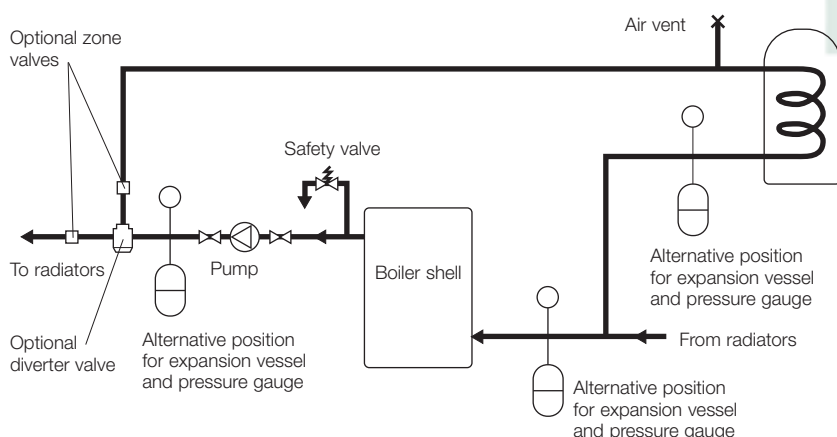


Figure 7-1: Sealed system

If thermostatic radiator valves are fitted, the system must incorporate an adequate by-pass.

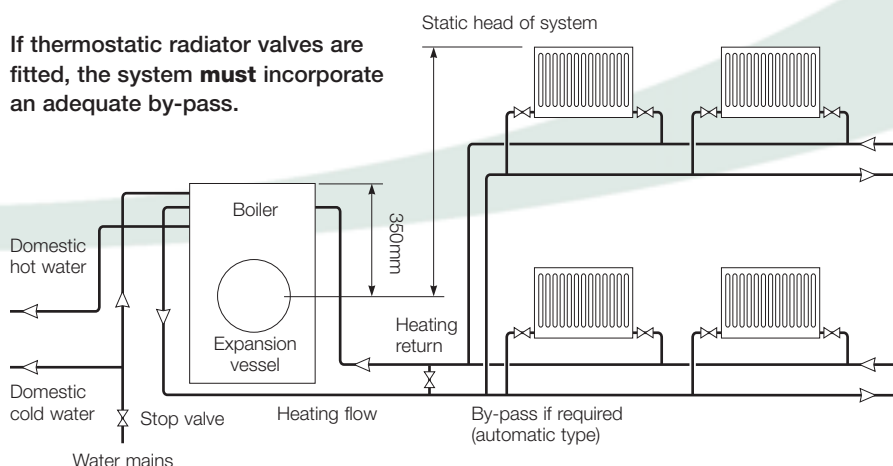


Figure 7-2: Sealed system boilers

All System models have the following sealed system components factory fitted:

- Diaphragm expansion vessel complying with BS 4814, pre-charged at 1.0 bar. Refer to Section 2.2.
- System pressure gauge, with an operating range of 1 to 4 bar.
- Pressure relief safety valve complying with BS 6759 and set to operate at 2.5 bar.
- Automatic air vent, fitted to the flow pipe of the boiler, ensures the boiler is vented.
- Filling loop. This **must** be isolated and disconnected after filling the system.

Refer to Section 2.2 for system volumes and BS 7074: for further guidance, and for further details of the expansion vessel.

The location of the expansion vessel is shown by the large arrow in Figure 7-3.

The expansion vessel fitted, is supplied with a charge pressure of 1.0 bar (equivalent to a max. static head of 10.2 metres). The charge pressure must not be less than the actual static head at the point of connection.



CAUTION

Do not pressurise the vessel above 1.5 bar.

The air pressure in the vessel must be checked annually.

The central heating system volume, using the expansion vessel as supplied, must not exceed the recommended volumes. If the system volume is greater, an extra expansion vessel (complying with BS 4841) must be fitted as close as possible to the central heating return connection on the boiler. The charge pressure of the extra vessel must be the same as the vessel fitted in the boiler.

Refer to BS 7074:1 for further guidance.



Figure 7-3: Expansion Vessel location

The air charge pressure may be checked using a tyre pressure gauge on the expansion vessel Schraeder valve. The vessel may be re-pressurised using a suitable pump. When checking the air pressure the water in the heating system must be cold and the system pressure reduced to zero.

7.2 Fill the Sealed System

Automatic air vent(s) are fitted to the top of the boiler. The procedure for filling the sealed system is as follows:

1. Only ever fill or add water to the system when it is cold and the boiler is off. **Do not overfill.**
2. Check that the fill point valve is closed as shown by the large arrow in Figure 7-4.
3. Remove the cap shown with a suitable spanner.
4. Ensure that the flexible filling loop supplied with the boiler. Check that it is properly connected and that the double check shut off valve connecting it to the water supply is closed. (A valve is open when the operating lever is in line with the valve, and closed when it is at right angles to it).
5. Open the fill point valve shown in Figure Figure 7-4.
6. Gradually open the double check valve from the water supply until water is heard to flow.
7. When the white needle of the pressure gauge is between 0.5 and 1 bar, close the valve.
8. Vent each radiator in turn, starting with the lowest one in the system, to remove air.
9. Continue to fill the system until the pressure gauge indicates between 0.5 and 1.0 bar. Close the fill point valve.
10. Repeat steps 6 and 7 as required.
11. Close the fill point and double check valves either side of the filling loop and disconnect the loop.
12. Refit the cap to the fill point valve shown by the large arrow in Figure 7-4.

It is important that the pump is properly vented to avoid it running dry and damaging its bearings. The procedure for venting the pump is as follows:

1. Remove the cap, then unscrew and remove the plug from the centre of the pump.
2. Using a suitable screwdriver rotate the exposed spindle about one turn.
3. Replace the plug and cap.



Figure 7-4: Position of water supply valve

Now the safety valve operation must be checked and set. The procedure is as follows:

1. Check the operation of the safety valve by turning the head anticlockwise until it clicks. The click is the safety valve head lifting off its seat allowing water to escape from the system.
2. Check that the water is escaping from the system.
3. Continue to fill the system until the pressure gauge indicates between 0.5 and 1.0 bar.
4. Close the fill point valve and check the system for water soundness, rectifying where necessary.

5. Water may be released from the system by manually operating the safety valve until the system design pressure is obtained. The system design pressure (cold) should be between 0.5 bar and 1.0 bar. The pressure is equivalent to the maximum static head in bar + 0.3 (1 bar = 10.2 metres of water), where the static head is the vertical height from the centre of the expansion vessel to the highest point of the system.

Now close the valves either side of the filling loop and disconnect the loop.

Replace the two cap ends that cover the filling valves. Leave the loop inside rear panel base.

8 Electrical

The Vortex boiler requires a 230/240 V ~ 50 Hz supply. It must be protected by a 5 Amp fuse.

WARNING

The Vortex boiler contains electrical switching equipment and must be earthed.

The supply must be fused at 5 Amp and there must only be one common isolator for the boiler and control system, providing complete electrical isolation.

A fused double pole switch or a fused three pin plug and shuttered outlet socket must be used for the connection.

The power supply cable should be at least 0.75 mm² PVC as specified in BS 6500, Table 16.

All the wiring and supplementary earth bonding external to the boiler must be in accordance with the current I.E.E. Wiring Regulations.

Any room thermostat or frost thermostat used with the Vortex boiler must be suitable for use on mains voltage.

The boiler requires a permanent mains supply, do not interrupt it with any external time control.

In the event of an electrical fault after installation of the boiler, the following electrical system checks must be carried out:

- Short circuit
- Polarity
- Earth continuity
- Resistance to earth

8.1 Connecting the Power Supply

It is recommended that the boiler should be connected to a switched mains power supply from a programmer or control system. A 230/240 V ~ 50 Hz mains supply is required.

8.2 Frost Protection

External modules are supplied with a factory fitted frost protection thermostat, located inside the boiler control panel. This is pre-wired to the boiler electrical system and factory set to 5°C.

For total system protection against freezing, particularly during extended periods without electrical power, Grant recommend the use of a combined heating system antifreeze and corrosion inhibitor, used in accordance with the manufacturer's instructions.

For terminal connections, see the wiring diagrams that follow.

8.3 Control System Wiring Diagrams

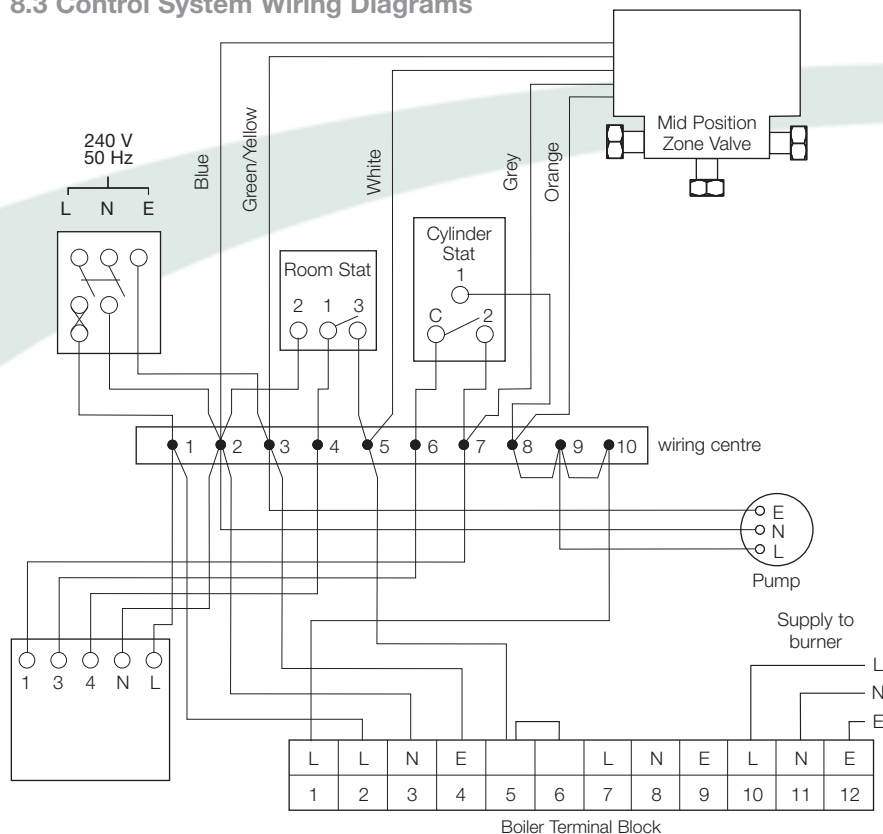


Figure 8-1: Non-system models with 3-port valve control system

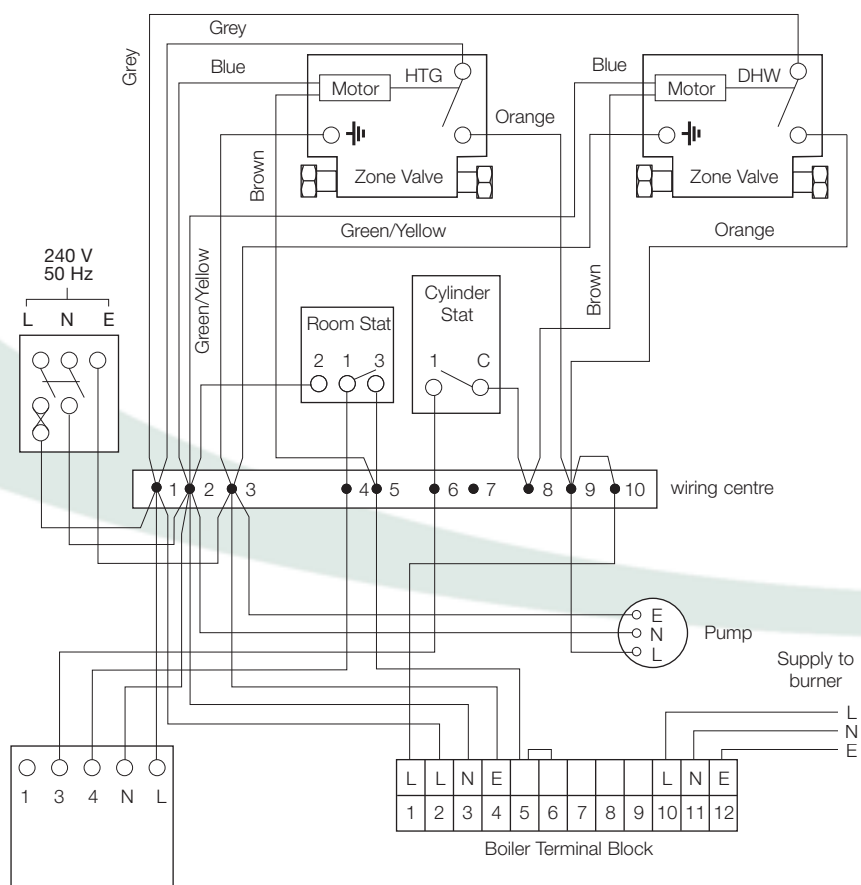


Figure 8-2: Non-system models with 2 x 2-port control system

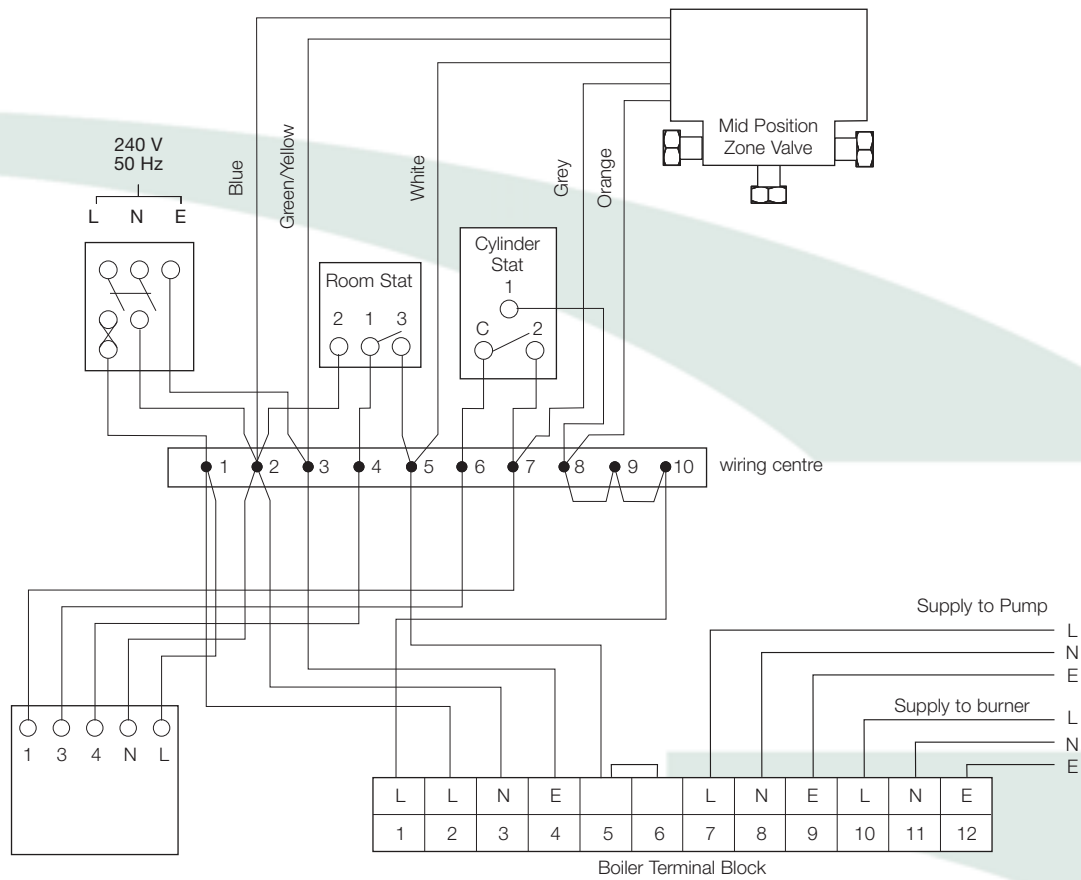


Figure 8-3: System models with 3-port valve control system

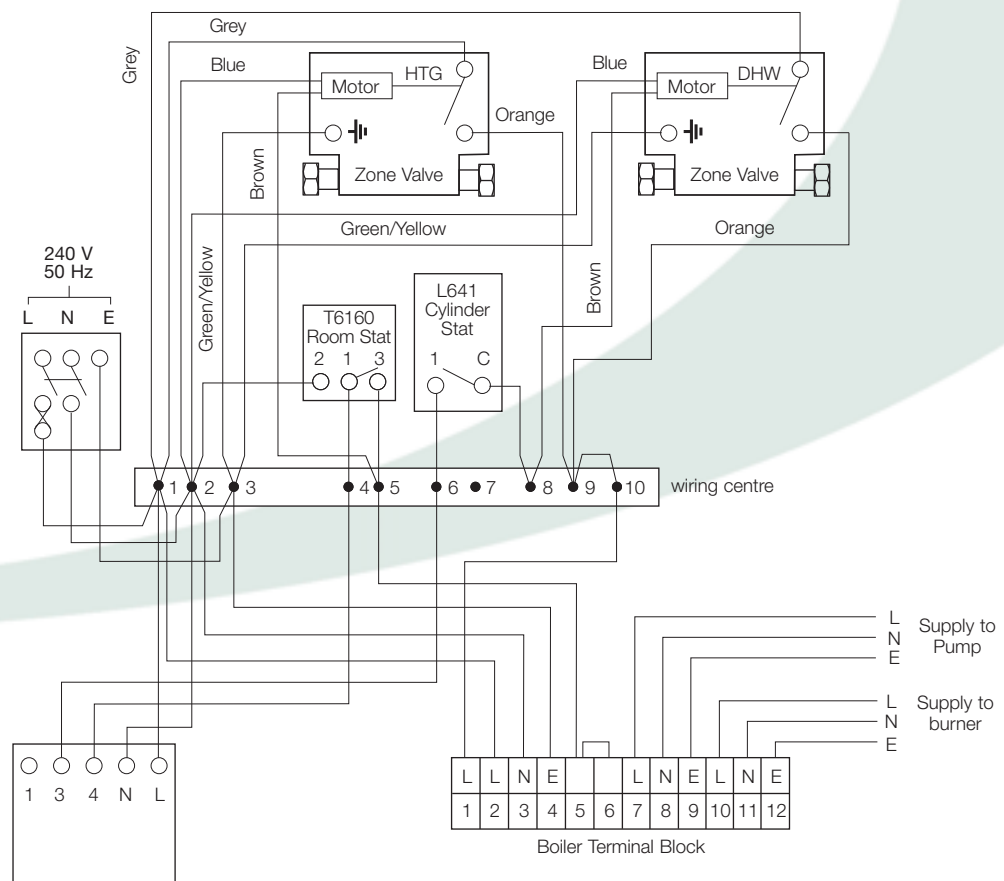


Figure 8-4: System models with 2 x 2-port control system

8.4 Boiler Control Panel Wiring Diagrams

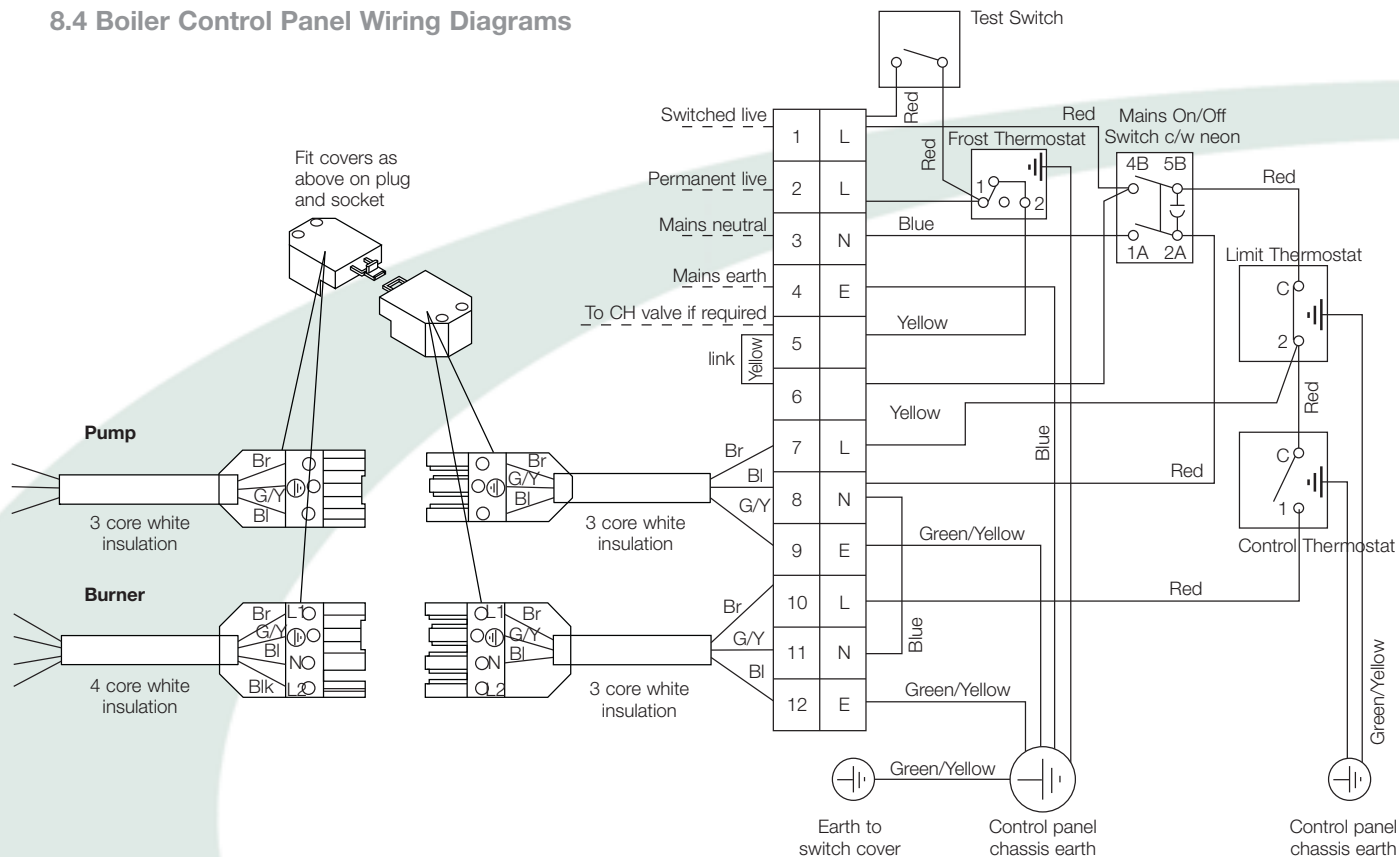


Figure 8-5: Wiring Diagram – System models

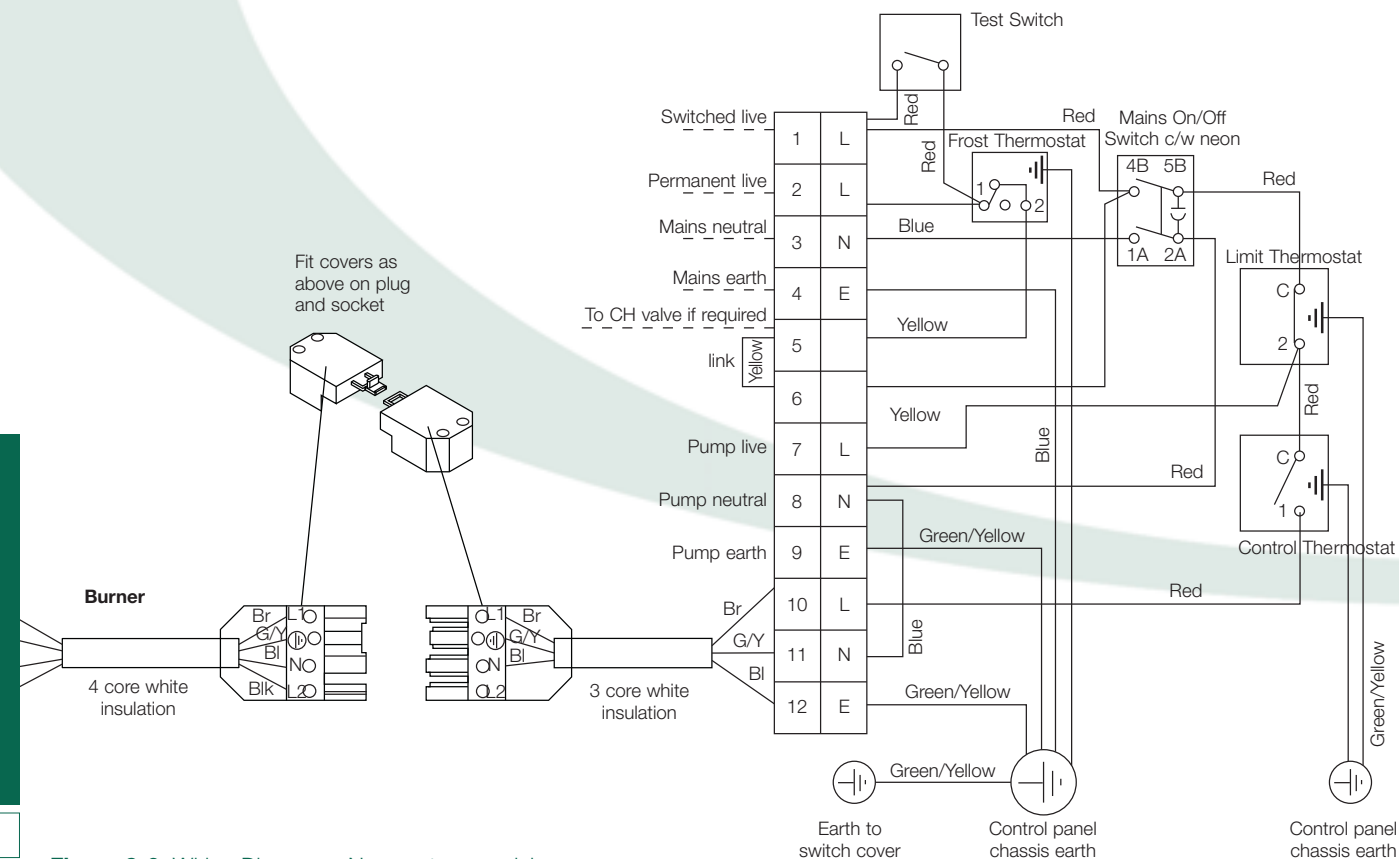


Figure 8-6: Wiring Diagram – Non-system models

9 Flue System and Air Supply

There are two external flue systems that can be used with the Eco External wall Hung boiler, both available from Grant (UK) Ltd:

- Grant Green System – This vertical twin wall stainless steel insulated boiler connector (part number GKM 90C) replaces the low level terminal supplied with the boiler, and may terminate at high level or vertically as required.
- Grant hybrid Green to Orange System - This vertical option allows the use of an existing chimney using part of the Green system and the flexible liner and terminal of the Grant Orange system.

These two systems are described in this chapter.

9.1 Air Supply

A sufficient permanent air supply to the boiler should be provided for proper combustion of fuel and effective discharge of combustion products to the open air.

Grant external boilers draw their air supply via the ventilation holes in the boiler casing. These **must not** be obstructed.

Further details may be obtained from BS 5410:1:1997.

The Grant Vortex Eco External boiler is fitted with a suitable flue. If required to extend this the Grant 'Green' flue system is recommended.

9.2 Conventional Flue System

! NOTE

Under no circumstances can Grant Vortex boilers be installed with existing flue systems. Only flue systems and components suitable for wet flues should be used.

Failure to install the correct type of flue system will invalidate the warranty.

Grant condensing boilers have high operating efficiencies and low flue gas temperatures. Care must be taken to ensure the flue system is suitable for the very low flue gas temperatures and condensate in the flue gases.

The flue must terminate in a down draught free area, i.e. at least 600 mm above the point of exit through the roof or preferably above the ridge level.

The condensate may be allowed to run back into the boiler. A condensate drain at the base of the flue system is not required.

The flue terminal must be at least 600 mm from any opening into the building, and 600 mm above any vertical structure or wall less than a horizontal distance of 750 mm from the terminal.

If an existing chimney is to be used, it must be lined with a smooth bore stainless steel liner suitable for use with oil fired condensing boilers. The top and bottom of the annular space must be sealed.

The internal flue and liner diameter for all models must be 100 mm (4 in).

Grant recommends the use of the Grant 'Green' flue system components for this application.

9.3 Hybrid System Green to Orange

! NOTE

This is an external module that uses a twin wall to single wall adaptor GFCON80 to go from outside to an existing inside chimney. See Figure 9-1.

The maximum vertical height (from the top of the boiler to the terminal) for the 100 mm diameter 'Green' system twin-wall flue is 8 metres.

Twin-wall flues are recommended for externally run flues to reduce the possibility of the condensate freezing in the flue.

No part of any flue system should be made of an asbestos material; aluminium must not be used in any part of the flue. Only stainless steel flue components should be used.

If the draught conditions are satisfactory, the flue should terminate with a standard cowl.

Refer to the locally applicable Building Regulations, BS 5410:1 and OFTEC Installation Requirements (Books 2 and 3) for further guidance on conventional flue systems.

No part of any flue system should be made of an asbestos material; aluminium must not be used in any part of the flue. Only stainless steel flue components should be used.

If the draught conditions are satisfactory, the flue should terminate with a standard cowl.

Refer to the locally applicable Building Regulations, BS 5410:1 and OFTEC Installation Requirements (Books 2 and 3) for further guidance on conventional flue systems.

! CAUTION

It is important to ensure that the flue system is sealed and that condensate cannot escape. Up to 1.5 l/h of condensate can be produced in a conventional flue system.

Do not use fire cement. The use of high temperature silicone sealants is recommended.

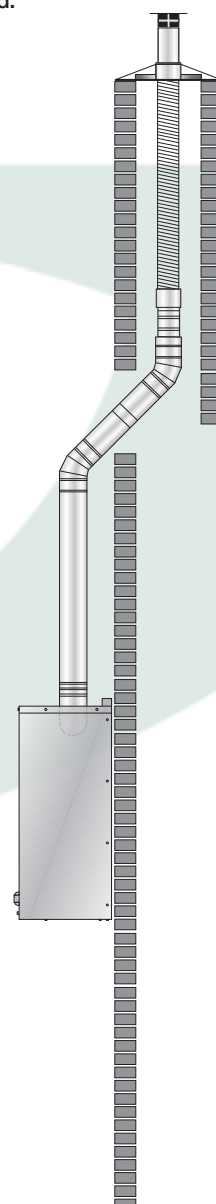


Figure 9-1: Flue system using Grant Green to Orange compatible components

9.4 Connecting a Conventional Flue

External (Green System)

The external system can terminate at either high level or vertically (above roof level) as required.

The minimum dimensions for locating the terminal from building features (windows, doors, etc.) are shown in Figure 9-3.

If the flue terminal is fitted less than 2 metres above a surface to which people have access, the terminal must be protected by a guard. The guard must be fitted centrally over the flue terminal and securely fixed to the wall.

The following external flue (Green system) components are available from Grant UK:

Green System Components	
Item – for models up to 26 kW output	Part No.
150mm extension	GX150/90
250mm extension	GX250/90
450mm extension	GX450/90
950mm extension	GX950/90
195-270mm adjustable extension	GXA250/90
45° elbow	GE45/90
High level terminal	GTH90
Vertical terminal	GTV90
Wall bracket – standard	GWB90
Wall bracket – extended	GEB90
External module starter straight	GKM90C
Twin wall to single wall adaptor	GFCON80

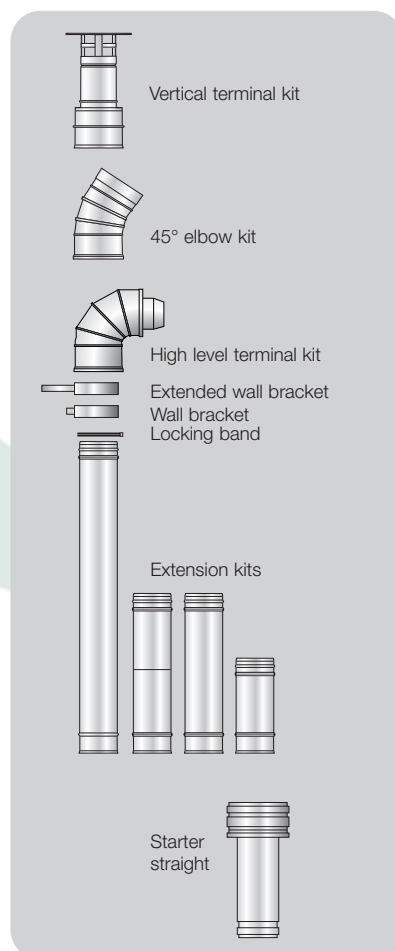
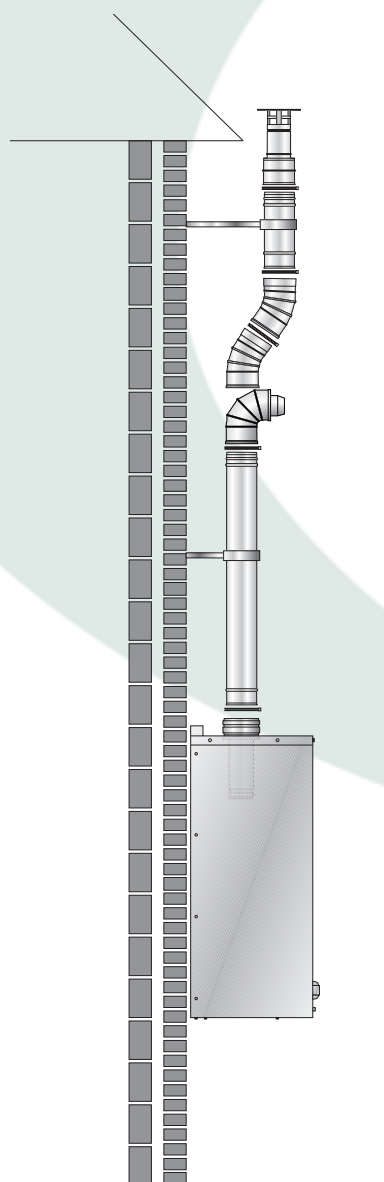


Figure 9-2: Flue system using Grant Green flue system compatible components

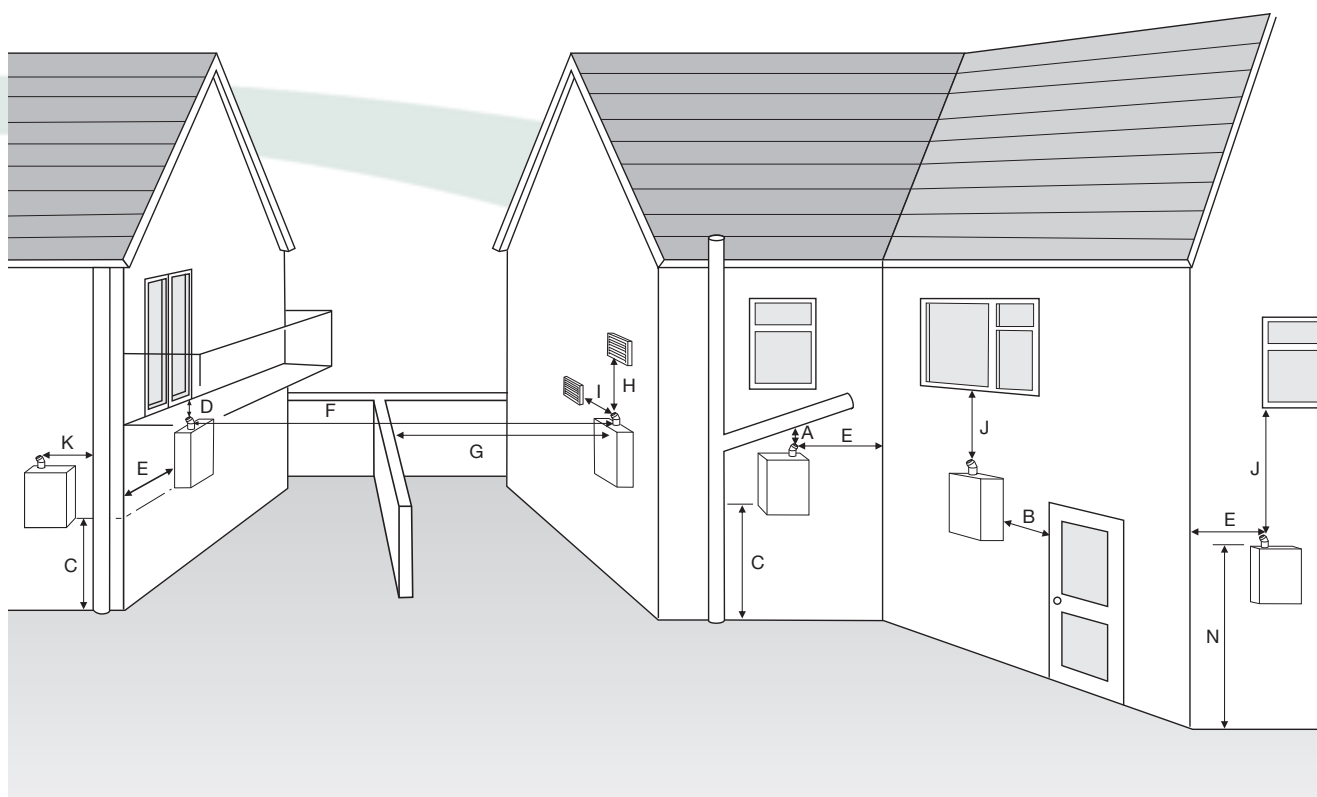


Figure 9-3: Clearances for balanced flues

Terminal position	Min. distance (mm)
A Below gutters, eaves or balconies (with protection)	600*
B Horizontally from a door, window or air vent	600
C Above ground, flat roof or balcony level	300**
D Below gutters, eaves or balconies (with protection)	600*
E From an external corner	300
F From a terminal facing the terminal	1200
G From a surface facing the terminal	600
H Vertically from a terminal on the same wall	1500
I Horizontally from a terminal on the same wall	750**
J Directly below an opening, air brick, window, etc.	600
K From vertical drain pipe or soil pipe	300
L From an internal corner	300

Notes:

* 75mm with protection.

** 300mm British Standards.

Distances measured to rim of terminal.

Clearances recommended by Grant Engineering (UK) Limited in accordance with British Standards and Building Regulations.

The terminal should be positioned so as to avoid products of combustion accumulating in stagnant pockets around the building or entering into buildings. Care should also be taken that the plume from the condensed flue gases does not cause a nuisance.

! NOTE

1. An opening means an openable element, such as an openable window, or a permanent opening such as a permanently open air vent.
2. Notwithstanding the dimensions given, a terminal should be at least 300mm from combustible material, e.g. a window frame.
3. A way of providing protection of combustible material would be to fit a heat shield at least 750mm wide.

10 Commissioning

It is important that the following commissioning procedure is carried out to ensure safe and efficient operation of the boiler.

To access the controls, open the front door by turning the knob at the bottom of the front panel anticlockwise and pulling the panel out from the bottom carefully releasing it from under the flange at the top. The boiler is revealed as shown in Figure 10-1.

The controls are shown at the right hand side of the cabinet. See the large arrow in Figure 10-1.

10.1 Before Switching On

1. Check that the baffles are in position and that the cleaning cover is correctly fitted and a good seal made. See Section 4.5.
2. Check that the turbulators are in position and that the ends are vertical.
3. Check that the water system has been vented (and pressurised if sealed system) and there are no leaks.
4. Ensure the automatic air vent on the condensing heat exchanger is open.
5. Check that all fuel line valves are open.
6. Connect a combined vent manifold and pressure gauge to the pressure gauge connection port on the oil pump. Open the vent screw on your vent manifold to vent the supply while the pump is running.
7. Set the boiler On/Off switch to Off. Check that all system controls are calling for heat and turn the boiler thermostat to maximum.

10.2 Switching on

1. Switch on the electricity supply.
2. Set the boiler On/Off switch to On. The burner fan should start and the burner should light within about 12 seconds. If the burner does not light and the 'Lock-out' reset button lights, wait for about 1 minute then press the reset button to restart the ignition process. This procedure may have to be repeated several times during first lighting.
3. With the burner alight, check the fuel pressure.
4. Refer to the Technical Information, Section 2.3.
5. Adjust the pressure if necessary - see Fig. 7. (Note that the 'Mains On' neon lights lit when the boiler is switched on does not necessarily indicate the burner is firing. It merely indicates that the power is connected).
6. Operate the boiler until it reaches normal operating temperature. Check oil supply/return pipe for leaks, rectifying where necessary.
7. Check the operation of the boiler thermostat. Ensure that by turning it anticlockwise it switches the burner off.
8. With the burner alight, re-check the fuel pressure and re-adjust if necessary. Turn the boiler off, remove the pressure gauge and replace the plug in the pump. Ensure that there are no oil leaks.



Figure 10-1: Boiler front panel removed

10.3 Running the Boiler

1. Relight the boiler and allow it to run for at least 20 minutes.
2. Insert combustion probe into the end of the flue terminal to measure the CO₂ level. Do not use the boiler test point.
3. Turn the air control knob on the burner to adjust the burner air damper (refer to Figure 3-3) as required. Turning the knob anti-clockwise closes the damper and increases CO₂ level. Turning the knob clockwise opens the damper and reduces CO₂ level.
4. Re-check the smoke number if the damper has been moved. Under no circumstances must the smoke number be above 1.

NOTE

It is important that the air damper is correctly set.

To obtain the correct CO₂ level, the final flue gas reading must be taken with all casing panels fitted.

5. Check the flue gas temperature.
6. Check that both the boiler overheat and boiler control thermostat bulbs are correctly located in their respective pockets. For location of thermostat pockets, refer to Figure 10-3.
7. Also check the condition of both thermostat capillaries, i.e. that they are not damaged, broken or kinked, and that they are not trapped or crushed between any internal boiler components.



Figure 10-3: Thermostat phial position

10.4 Balancing the System

1. When the boiler has been adjusted and is running satisfactorily, balance the central heating system by adjusting the radiator lock shield valves. Start with the radiator nearest the boiler and adjust the valves to achieve the required temperature drop across each radiator. If thermostatic radiator valves have been installed, check the system by-pass.
2. Switch off the boiler.

10.5 Completion

1. With the system hot, check again for leaks, rectifying where necessary. Drain the system while it is hot to complete the flushing process. Refill and vent (and pressurise if a sealed system) the system.
2. A suitable central heating system inhibitor must be added to protect the system against the effect of corrosion.

NOTE

After commissioning the boiler complete the Commissioning Report on page 2 of this manual and the OFTEC CD/11 commissioning report. Leave the top copy with the User and retain the carbon copy.

If the boiler is to be left in service with the User, set the controls, remote programmer and room thermostat to the User's requirements.

If the boiler is not to be handed over immediately, close the boiler fuel supply valve and switch off the electricity supply.

CAUTION

If there is any possibility of the boiler being left during frost conditions, then the boiler and system should be drained.

To allow the boiler to be commissioned and serviced correctly a combustion test point is provided on the front cleaning door.

The CO₂ and smoke test may all be carried out using this test point.

NOTE

The test point is not suitable for measuring boiler efficiency or conventional flue draught.

When using the test point on the cleaning cover note that the flue gas temperature reading will be higher than that measured in the flue thus resulting in an inaccurate efficiency reading. To obtain an accurate flue gas temperature and efficiency, the reading can be measured only outside through the low level flue terminal. For high level and vertical flues the reading may be taken from the flue kit test point provided. Refer to Section 2.3.

For Conventional flue draught measurement and efficiency a test point is provided in the conventional flue adaptor.

11 Boiler Servicing

To ensure efficient operation of the boiler it is recommended that it is checked and serviced as necessary at regular intervals. The frequency of servicing will depend upon the particular installation conditions and usage, but in general once per year should be adequate.

Servicing and replacement of parts must only be carried out by a suitably qualified engineer.



CAUTION

Details of every service should be entered in the Service Log, in the Boiler Handbook.

This information may be required to validate the Grant extended warranty.



WARNING

Before starting any work on the boiler, or fuel supply please read the health and safety information given in Section 14.

11.1 Checking Before Servicing

The following sequential checks should be made before any servicing:

1. Check the flue terminal and ensure it is not blocked or damaged.
2. Run the boiler and check the operation of its controls.
3. Ensure that all water/fuel system connections and fittings are sound. Remake any joints and check the tightness of any fittings that may be leaking.
4. If the boiler is used on a sealed central heating system, check the system pressure, check the operation of the pressure relief valve and check the expansion vessel air charge. See Section 7.2.
5. Refill, vent and re-pressurise the system as necessary. See Section 7.2.
6. Check that any ventilation openings are adequate and are clear. See Section 9.2.

7. Remove any sludge/water from the fuel tank by opening the sludge valve at the lower end of the tank.
8. With the fuel supply valve closed, clean/replace the filter element and clean the filter bowl.
9. Flexible fuel supply pipes should be inspected annually when the boiler is serviced and replaced every two years. If in doubt replace the pipes.



WARNING

Before servicing, set the boiler On/Off switch to Off, isolate the electricity supply and close the fuel supply valve.

Allow the boiler to cool.

The data label on the inside of the case side panel will indicate the fuel used and the nozzle fitted.

11.2 Dismantling Prior to Servicing

The procedure for dismantling the boiler is as follows:

1. Remove the door panel.
2. On System models, carefully lift up and remove the expansion vessel from the boiler. Place the vessel on the front of the boiler. A clip is fitted to clip it on to the front edge of the casing.
3. Remove the burner fixing nut (top of mounting flange) and rotate the burner clockwise and withdraw the burner. The burner has a lug to fit over a bracket on the front of the combustion chamber to hold it while servicing takes place.



NOTE

With two flexible pipes connected to the burner, identify (mark if necessary) which is the inlet and return if they are to be disconnected.

11.3 Cleaning the Boiler

The procedure for cleaning the boiler is as follows:

1. Remove the nuts and washers securing the front cleaning door and withdraw the door. Take care – it is heavy.
2. Remove the baffles as shown in Figure 11-1



Figure 11-1: Removing the baffles

3. Remove all deposits from the baffle plates and all the boiler internal surfaces using a stiff brush and scraper if necessary.
4. Check the condition of the flue, clean as necessary.
5. Check the condition of the front cleaning door seal and replace if necessary.
6. Replace the baffles, ensuring they are correctly fitted. See section 4.4.
7. Pull out the spiral turbulators from the heat exchanger tubes.
8. Clean the turbulators using a stiff brush
9. Test the heat exchanger condensate drain by pouring water into one of the lower tubes and observe whether the water discharges from the 22 mm condensate outlet. Replace the turbulators.

10. Replace the front cleaning door, ensuring the seal is in good condition and secure it in position with the nuts and washers previously removed. Tighten to form a seal.
11. Remove the condensate trap and check that it is not blocked and is operating correctly, i.e. the float is free to move. Clean the trap and float as required.
12. Check that the boiler condensate outlet is unobstructed. Clean if necessary.

NOTE

The condensate trap and condensate outlet must be checked on every service and cleaned as necessary.

11.4 Cleaning the Burner

The procedure is:

1. Combustion head - Loosen the two screws securing the combustion head and withdraw the head.
2. Clean the combustion head.
3. Inspect the ignition electrodes - Loosen the electrode clamp screw and withdraw the electrode assembly. Wipe clean and check for any cracks in the ceramic insulation. Replace if necessary.
4. Nozzle - The nozzle should be replaced on an annual service - Check that the nozzle size and type are correct, refer to table in Section 3.3 and boiler data label.
5. Do **not** attempt to clean the nozzle.
6. Remove the nozzle using a good fitting spanner (16mm).



CAUTION

The use of an ill-fitting spanner will damage the nozzle and could lead to an incorrect flame pattern.

7. Always check the electrode settings after replacing the nozzle, see Figure 11-2.
8. Re-connect the HT leads to the electrodes and refit the combustion head.

All models

Photocell - The photocell is a push-fit in the burner body. Carefully pull out the photocell to clean.

Burner fan - Remove the air intake from the burner. Check, inspect and clean the fan as required. Replace the cover.

Pump filter - Remove the four screws securing the pump end cover. Remove the filter and wash in kerosene. Replace the filter and end cover, ensure the 'O' ring is in position.

Re-assemble in reverse order.



WARNING

To ensure safe and efficient operation of the boiler it is important that re-commissioning is carried out, especially combustion checks (CO₂ level, flue gas temperature and smoke number) after the boiler has been serviced.

Refer to the Commissioning instructions in Section 10.

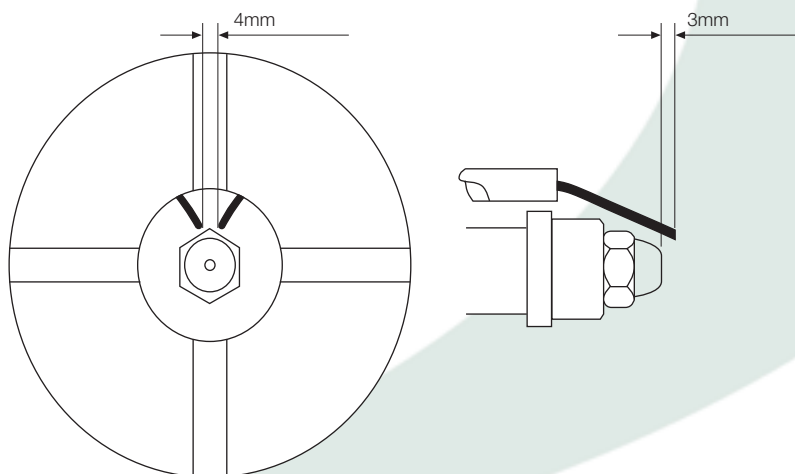


Figure 11-2: Electrodes showing setting

12 Fault Finding

12.1 Burner Fault Finding Chart

1. Burner fails to start – no flame – no lock out

Symptoms	Possible Causes	Actions
Motor fails to run	No electrical supply to boiler	Check On/Off switch is On - mains neon is lit
Lock-out light not lit	Fuse has blown	Check or replace fuse
		If fuse has blown - check reason for failure
	Boiler thermostat not calling	Adjust boiler thermostat to call for heat
	Heating controls are not calling	Adjust programmer & room thermostat to call
	Overheat thermostat has operated	Check and reset overheat thermostat if required
		If operated - check reason for operation
	No power to burner	Check for 230V at control box mains terminals
	Control box faulty	Replace faulty control box

2. Burner fails to start – no flame – goes to lock out

Symptoms	Possible Causes	Actions
Motor fails to run	No power to burner motor	Check for 230V at motor plug terminals
Burner lock-out	Burner motor capacitor faulty	Check and replace if necessary
	Burner motor faulty	Replace burner motor
	Burner motor stalled	
	Seized oil pump	Check and replace faulty oil pump

3. Burner starts – no flame – goes to lock out

Symptoms	Possible Causes	Actions
Motor runs	Flame instability	
▼	▼	
Burner pre-purges	Carbon/soot on blast tube	Clean blast tube
▼	▼	
Burner does not fire	No oil pressure	Check pump drive coupling - replace if failed
▼	▼	
Burner lock-out	Low oil pressure	Check oil pump pressure is correct
	Excessive combustion air	Adjust air damper setting
	Excessive flue draught - CF only	Rectify condition (draught stabiliser required?)
	False light	Check photocell is not sensing ambient light
	No ignition spark	Check HT lead connections are sound Check ignition electrode gap is correct Check for 230V at ignition transformer Check transformer - replace if faulty
	No oil at nozzle	Check for sufficient fuel in tank Check fire valve has not tripped Check all oil supply valves are open Check oil line & pump is not airlocked Check operation of solenoid valve Check pump drive coupling - replace if failed Check fuel pump - replace if seized
	Restriction in oil supply	Check filters, valves and oil lines and rectify
	Fuel contamination (water in tank)	Check tank, filters, oil line for water

4. Burner fires – goes to lock out

Symptoms	Possible Causes	Actions
Motor runs	Flame instability	
▼	▼	
Burner pre-purges	Carbon/soot on blast tube	Clean blast tube
▼	▼	
Burner fires	Fuel contamination (water in tank)	Check tank, filters, oil line for water
▼	▼	
Burner lock-out	Low oil pressure	Check oil pump pressure - reset if necessary
	Excessive combustion air	Adjust air damper setting
	Excessive flue draught - CF only	Rectify condition
	Photocell not sensing light	Check photocell is clean and unobstructed
	Photocell failed	Replace faulty photocell
	Defective nozzle	Replace nozzle

5. Delayed ignition – burner starts violently

Symptoms	Possible Causes	Actions
Burner pulsates on start-up	Excessive combustion air	Re-commission burner - adjust air setting
	Low oil pressure	Check and re-commission burner
	Partially blocked nozzle	Replace nozzle
	Fuel contamination (water in tank)	Check tank, filters, oil line for water
	Fan slipping on shaft	Check and re-tighten
	Pump coupling loose or worn	Check and replace
Burner starts violently	Delayed ignition	Check electrode settings
		Check electrodes for damage
		Check HT lead connections are sound
		Check HT leads for damage or arcing

6. Burner cycles on and off

Symptoms	Possible Causes	Actions
Burner firing	Restriction in oil supply	Check filters, valves and oil lines and rectify
Burner stops firing	Fuel contamination (water in tank)	Check tank, filters, oil line for water
Pre-purge starts	Partially blocked nozzle	Replace nozzle
Burner fires	Vitiated combustion air - BF only	Disconnect snorkel tube and check operation
Burner stops firing		Check flue terminal for obstructions and rectify
		Check flue system for leaks and rectify
	Boiler thermostat hunting	Replace faulty thermostat

12.2 Boiler Fault Finding

Always isolate the electricity supply to the boiler before working on the boiler.

Fault	
Boiler will not start:	Remedies
1 No fuel supply.	Ensure that an adequate supply of fuel is available and that the fuel supply valve is open. Check the condition of the fuel filter, clean if necessary. Ensure fuel supply is reaching burner and vent pump.
2 No electricity supply.	Ensure electricity supply to the boiler is switched on and that all controls are calling for heat. Ensure that the overheat thermostat has not tripped, reset if necessary. Check that a mains supply is present at the burner terminal block. If not, check the boiler and overheat thermostat.
3 Burner not starting - fuel and electricity supplies present.	Press the reset button on the burner if lit on the control box. Refer to burner fault finding flow diagram.
4 Burner lights but goes to 'lock-out'.	If the flame is unstable, check the combustion settings. Refer to burner fault finding flow diagram.
Boiler works but:	
5 Visible smoke from flue or high smoke number.	Insufficient air supply – check the air damper setting and the condition of the fan. Check room ventilation is adequate. See Section 9.1. Check the nozzle size and type. Fuel pressure may be too high – check and adjust.
6 Burner pulsates.	Insufficient air supply – check the air damper setting and the condition of the fan. Check room ventilation is adequate, See Section 9.1. Check the nozzle size and type.
7 Flame slow to stabilise during start up.	Insufficient air supply – check the air damper setting and the condition of the fan. Check room ventilation is adequate, See Section 9.1. Check the nozzle size and type. Fuel pressure may be too low – check and adjust. Insufficient draught – clean boiler heat exchanger and check condition of flue.
8 Water temperature low.	Undersize nozzle and/or low fuel pressure. Check condition of boiler heat exchanger and clean if necessary. Check the boiler thermostat. Check the combustion settings. Check the condition of the fuel filter.
9 Boiler operating on overheat thermostat.	Faulty boiler thermostat. No circulation, check circulating pump. Check for air lock.
10 Fumes and puffing during starting (conventional flue).	Check the condition of the chimney, ensure it is not blocked and is high enough to produce the required draught. Check that there is an adequate air supply near the burner and that a kitchen fan is not drawing products out of the burner.
11 Oil odours.	Check all fuel line connections, remake as necessary.
12 Combustion fumes smell.	Check boiler cleaning cover and seal are correctly fitted. Check burner is correctly fitted onto flange. Check flue is correctly sealed into flue outlet of boiler. Check the condensate pipe and trap are operating correctly.

13 Spare Parts

This section gives an exploded view of the burner in the Grant VORTEX Eco External Wall Hung boiler, and a parts list associated with it.

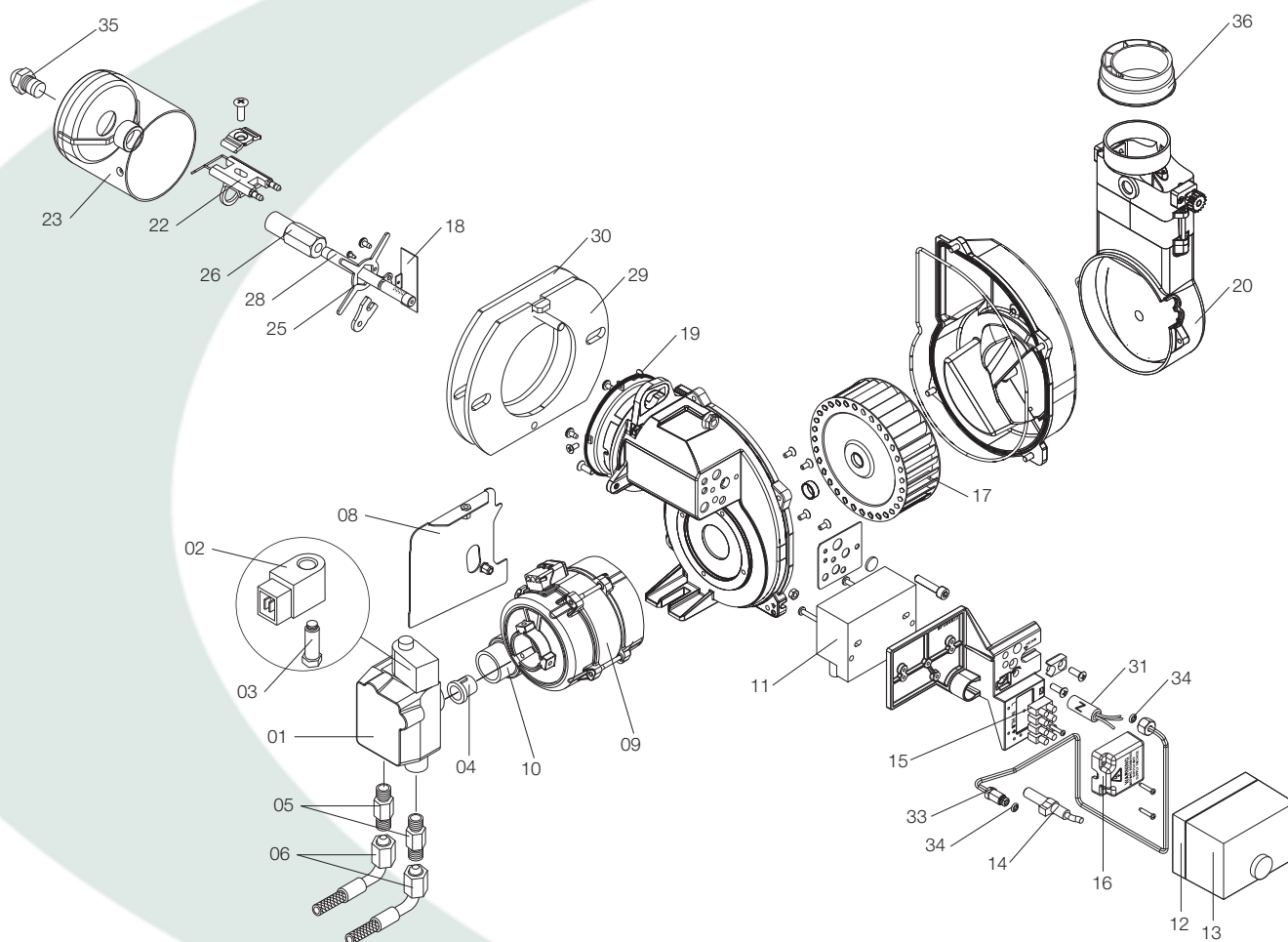


Figure 13-1: Burner components diagram

Key No.	Description		Ecoflam Part No.	Grant Part No.
01	Oil Pump	Danfoss BFP11 R3	P121/3	EBS01
02	Coil	Danfoss	V510/2	EBS02
03	Oil valve	Danfoss	V412/1	EBS03
04	Coupling	AEG	MP504	EBS04
05	Nipple	TN 6X 700	BFRO1103/001	EBS05
06	Hoses	NW 6X 700	S931/055	EBS06
09	Motor	75W AEG	M181/12	EBS09
10	Capacitor	3 μ F x 75W AEG	C107/9	EBS10
11	Ignition transformer	Danfoss CM	T130	EBS11
12	Control box base	Landis	A402	EBS12
13	Control box	Landis LOA24	A117/1	EBS13
14	Photoresistor	Landis	A208/3	EBS14
15	Wiring terminal box		E228	EBS15
16	Protection box		BFC02046/056	EBS16
17	Fan	120 x 34	W123/2	EBS17
18	Fan scoop		BFC02049/001	EBS18
19	O-ring		BFG01043	EBS19
20	Cover air inlet - Eco Wall-hung 12/16		BAA10019	EBS20
21	Cables		BFE01401/3	EBS21
22	Electrodes		BFE01109	EBS22
23	Burner head		BFB01326/007	EBS23
25	Nozzle holder support		BFC10031/001	EBS25
26	Nozzle holder		BFC11017	EBS26
28	Rod		BFA06429/001	EBS28
29	Flange		BFF01022/001	EBS29
30	Gasket		BFG02016	EBS30
31	Anti-jamming filter	D.E.M	S132/3	EBS31
33	Oil pipe		BFT05258	EBS33
34	Pipe gasket		BFG01042	EBS34
35	Nozzle - Eco Wall-hung 12.7kW	0.35 80°EH	-	M1BS27/75
	Nozzle - Eco Wall-hung 14.0kW	0.40 80°EH	-	M1BS27/50
	Nozzle - Eco Wall-hung 16.5 & 18.7kW	0.50 80°EH	-	M1BS27/46
	Nozzle - Eco Wall-hung 20.3kW	0.60 80°EH	-	M1BS27/31
36	Ring		BFC03039/4	EBS36

14 Health and Safety Information

Under the Consumer Protection Act 1987 and Section 6 of the Health & Safety at Work Act 1974, we are required to provide information on substances hazardous to health (COSHH Regulations 1988).

Adhesives, sealants and paints used in the manufacture of the product are cured and present no known hazards when used in the manner for which they are intended.

The following other materials are present in the product:

14.1 Insulation Materials

Material Types: Ceramic fibre board, mineral wool.

Description: Rigid board, slabs, sleeves, gaskets, ropes.

Known Hazards: May cause temporary irritation or rash to skin. High dust levels may irritate eyes and upper respiratory system.

Precautions: Avoid unnecessary or rough handling, or harsh abrasion of boards. Normal handling and use of material should not produce high dust levels.

Avoid inhalation, and contact with skin and eyes.

After handling always follow normal good hygiene practices.

Protection: Use disposable gloves, face mask and eye protection.

First Aid: Eyes - If irritation occurs, wash eyes with copious amounts of water. If symptoms persist, seek immediate medical advice.

Skin - If irritation occurs, wash under running water before washing with soap and water.

Inhalation - Remove to fresh air, drink water to clear throat and blow nose to remove dust/fibres.

Ingestion - Drink plenty of water.

14.2 Insulation Materials

Material Types: Silicone elastomer.

Description: Sealant and adhesive.

Known Hazards: Irritation to eyes.

Precautions: Avoid inhalation of vapour, contact with eyes and prolonged or repeated contact with skin.

After handling always follow normal good hygiene practices.

Protection: Use eye protection. Rubber or plastic gloves should be worn where repeated contact occurs and a face mask worn when working in confined spaces.

First Aid: Eyes - Flush eyes with water for 15 minutes. Seek immediate medical attention.

Skin - Wipe off and wash with soap and water.

Inhalation - Remove to fresh air.

14.3 Kerosene and Gas Oil Fuels (mineral oils)

Known Hazards: The effect of mineral oils on the skin vary according to the duration of exposure and the type of oil.

The lighter fractions remove the protective grease naturally present on the skin, leaving it dry, liable

to crack and more prone to damage by cuts, abrasions and irritant chemicals.

Skin rashes (Oil acne) most often on arms, but also on any part of the body in contact with oil or oily clothing.

Contact with fuel oils can cause dermatitis.

Precautions: Avoid as far as possible any skin contact with mineral oil or with clothing contaminated with mineral oil.

The use of a lanolin-based barrier cream is recommended, in conjunction with regular washing with

soap and rinsing with water to ensure all oil is removed from the skin.

Take care to prevent clothing, especially underwear, from becoming contaminated with oil.

Do not put oily rags or tools in pockets, especially trouser pockets.

Have first-aid treatment at once for an injury, however slight.

Do not inhale any vapours from mineral oils.

15 EC Declaration of Conformity

We declare that the Grant Vortex range of Oil Boilers equipped with Ecoflam MAX 1 burners approved to EN 267: 1999 satisfy the requirements of the following European Directives:-

1. 89/336/EEC - Electromagnetic Compatibility Directive.

Referred to the generic standards EN 55014: 1993, EN 50082: 1: 1992.
2. 73/23/EEC - Electrical Equipment Safety Regulations Directive.

Referred to the generic standard NO: 3260: The Electrical Equipment (Safety) Regulations: 1994.
3. 92/42/EEC - Hot Water Boiler Efficiency Directive.

Referred to the generic standard The Boiler (Efficiency) (Amendment) Regulations 1994 (SI 1994/3083).

In EU Countries

The following information is provided to enable regulatory compliance with the European Union (EU) directives identified and any amendments made to these directives when using electrical or electronic equipment in EU countries.

Disposal of Electrical and Electronic Equipment

European Union (EU) Directive 2002/96/EC Waste Electrical and Electronic Equipment (WEEE)

Do not dispose of electrical or electronic equipment in landfill sites. In the EU, it is the individual recipient's responsibility to ensure that discarded electrical or electronic materials are collected and recycled according to the requirements of EU environmental law.

Disposal of Surplus Packaging

European Parliament and Council Directive 94/62/EC Packaging and Packaging Waste

Do not dispose of surplus packaging in landfill sites. In the EU, it is the individual recipient's responsibility to ensure that packaging materials are collected and recycled according to the requirements of EU environmental law.



In non-EU Countries

In non-EU countries, dispose of electrical and electronic equipment and all surplus packaging in accordance with national and regional regulations.

Complies with EC Low voltage Electromagnetic compatibility and Boiler efficiency Directives.



Notes



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