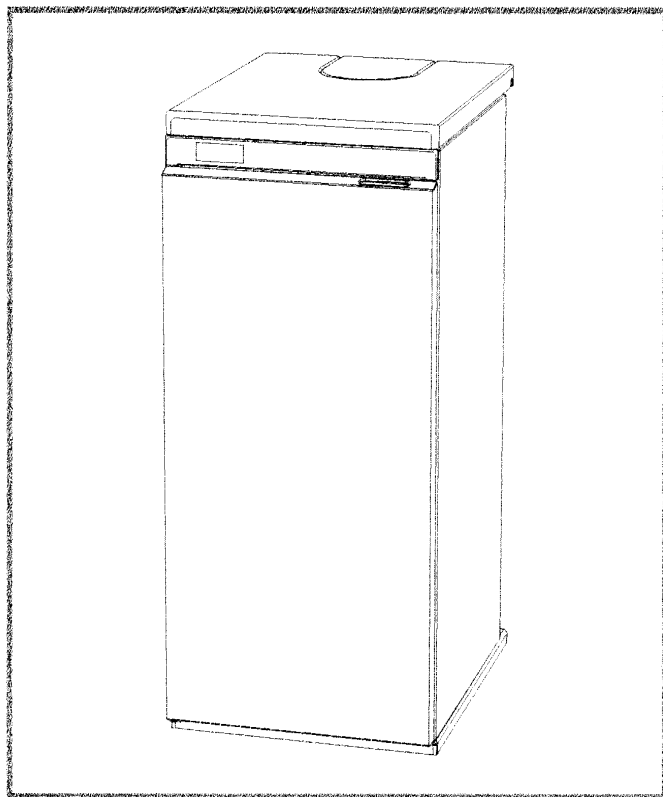


COLIBRI

Ref. 971.14.11.Z - Output 14kW

Ref. 971.21.11.Z - Output 21kW

Central heating hot water boiler
Natural draft vaporising pot burner.

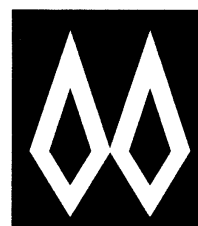


User and Installer Instructions

CONTENTS

These instructions have been laid out as follows.

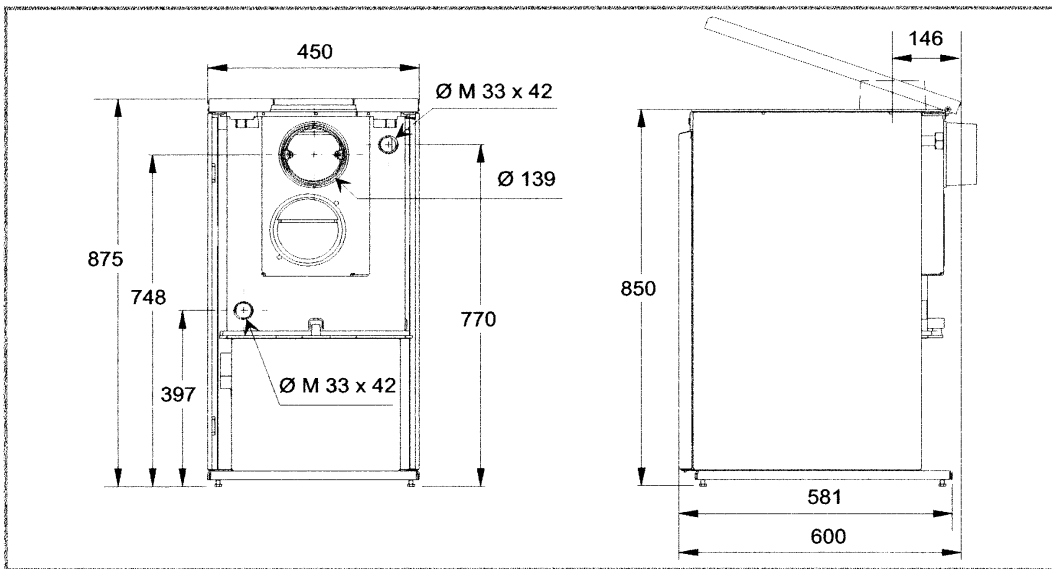
1-0	HEALTH AND SAFETY
2-0	APPLICABLE REGULATIONS
3-0	INTRODUCTION
3-0-1	MATERIALS REQUIRED
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9-0	LIGHTING & COMMISSIONING
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FRANCO BELGE

Les Fondries Franco-Belges
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RC Hazebrouck 445750565B
Matériel sujet à modifications sans préavis
Document non contractuel.

Reference	971.14.11Z	971.21.10Z
Total Output (Max/Min) (kW)	4.5 to 14.1	6,5 to 21
Output to water (kW)	4 to 12.6	5.8 to 19
Output to space (cover closed) (kW)	0.4 to 1.5	0.7 to 2
Oil flow rates:		
Minimum (litres per hour)	0.45	0.66
Maximum (litres per hour)	1.37	2.11
Required Chimney Vacuum		
Minimum (inch water gauge)	0.35	0.5
Maximum (inch water gauge)	0.65	1.1
Water volume in boiler (litres)	14	14
Max. running temperature (degree C)	90	90
Max. operating pressure (bars)	3	3
Flexi oil hose diameter (mm)	6 x 8	6 x 8
Weight (kg)	105	116



1-0 HEALTH AND SAFETY

Control of Substances.

Take great care when handling materials such as insulation boards, glass fibre ropes, ceramic wool, artificial fuel and kerosene oil, diesel oil, they are all irritants and suitable protective clothing such as disposable gloves dust masks and protective goggles should be worn.

Wash off thoroughly after handling any of these materials.

Carefully dispose of redundant or surplus materials and always vac up after service or installation work.

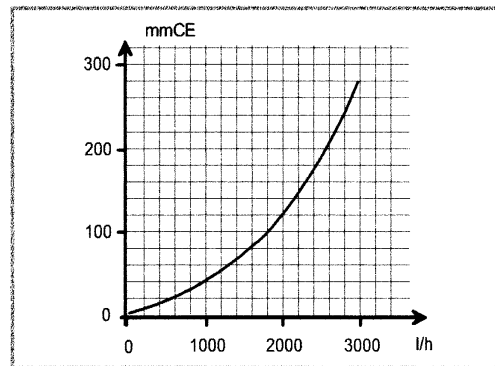


Fig. 1 - Pressure drop across heat exchanger.

2-0 REGULATIONS

The installation of an oil fired appliance must be carried out by a technically competent person, experienced in both solid fuel and oil fired installation and capable of installing, commissioning and servicing to the current requirements of the relevant local building regulations.

In England and Wales these are J 1-2-3 Provision for introduction of air supply and discharge of products of combustion.

Provision for protection against fire and heat.

In Scotland Part F sec 3.

In Northern Ireland Part L.

In Ireland Part J.

British IEEE is wiring regulations, latest edition.

Codes of practice which apply in the UK are -:

B55410, installation of oil fired space heating and hot water supply Part 1, boilers of rated output not exceeding 44KW

B54543, Specification for chimney for oil fired appliances Part 3.

B55449 central heating for domestic premises Part 1 Forced circulation hot water systems.

BS 5601, B58303 & B56461 Pts 1 & 2 1984,

B57566 Parts 1 to 4

The installer should have passed the OFTEC course OFT 101 or attended specialist training available at this company.

Failure to comply with the relevant requirements listed above can be hazardous and could lead to prosecution under the law.

If you have any difficulties please phone our sales department on

Telephone: 01302 742520. (3 lines.)

INTRODUCTION

1.The Colibri is an oil fired, free standing central heating boiler, powered by a natural draft vaporising pot burner.

2.It can be supplied with a built in pressure vessel for unvented installation.

3.It has a cast iron hot plate which can be used for slow cooking.

4.It is operated by an automatic thermostatically controlled oil valve with a built in safety cut out.

5.It can be flued vertically or horizontally.

6.There is a lightweight hot plate cover which can only be used as it was intended on rear flue installations.

7.On top flue installations the cover will not hinge and stay in a vertical position.

8.The appliance is manually ignited and must not be operated without the lighting port bung fitted.

9.Before installation of a Colibri boiler you must make absolutely sure that the chimney does not have a history of downdraughting either intermittent or permanent, see figs 11 and 12.

MATERIALS REQUIRED

1. 125mm dia chimney liner for Colibri 14, 150mm dia chimney liner for Colibri 21.

2. Suitable anti downdraft terminal.

3. Suitable appliance adapter.

4. Suitable Copex vit adapter

5. Oil isolation valve

6. KBB remote sensing firevalve.

7. Boiler unions.

8. 10mm kutalex copper tube.

9. 22mm waste pipe (for wall sleeving).

10. Silicone sealant.
11. Stadium air vent
12. Vermiculite loose fill
13. Cement.
14. Sharp sand.
15. Plugs and screws.
16. Switch fused neon isolator. (for time clock if fitted)
- 17 Suitable compression fittings.

4-0 GENERAL INFORMATION.

4-1 Chimney

To ensure satisfactory performance from the COLIBRI 14/21 hot and cold condition chimneys must be capable of maintaining a constant steady vacuum as stated in the technical specs.

Particular attention is required with the Colibri 21 as the requirement for high fire vacuum is in excess of 0.1" W.G.

It is most important that any existing chimney faults such as :-

1. Occasional or permanent down draughts
2. Excessive up draughts
3. Fume leaks
4. Regular blockages are established and corrected before any installation work is carried out.

If you are unsure about the condition of the chimney, have it thoroughly cleaned and checked by a suitably qualified person.

Always reline and backfill around the chimney lining with vermiculite to keep it warm, prevent condensation and improve the chimney vacuum.

The chimney should terminate 2 feet above the ridge of the main or highest roof, in compliance with relevant legislation.

For a guide to terminal positions (see FIGS 5 and 6)

Provision must be made to allow adequate and easy access into the chimney for cleaning purpose.

The flue pipe from the appliance must not be less than 125mm diameter and must comply to one of the following :-

Acid resistant vitreous enamelled flue pipe to BS 1344 Part 2.

Stainless steel to B51449 Part 2.

Cast iron to BS41.

Mild steel with a wall thickness of 3 mm minimum.

CHIMNEY TERMINATION

The chimney must be terminated with a suitable anti downdraft cowl such as a VEDETTE or EUROCOWL ETC.

WARNING.

Abnormal chimney terminal locations are very likely to cause problems under certain windy weather conditions.

For details see Figs 11 and 12.

Bends in flues and chimneys

Flues and chimneys should always be vertical wherever possible.

On installations where using a bend is unavoidable the maximum allowable bend angle from the vertical is 45 degrees.

45 degree runs should be kept as short as possible (less than 1 metre long) and there should never be more than two bends used.

WARNING

Horizontal flue runs are not allowed.

4-3 OIL FEED AND STORAGE REQUIREMENTS

NOTE

28 Second Commercial Kerosene to B52869 Part 2: 1988 Class C2 is suitable for use with this appliance.

35 second versions are available.

Installation of all oil feed pipework and storage equipment should be in line with -:
B55410 Part 1

Steel oil storage tanks to B5799 Part 5, if there is any doubt consult the tank manufacturer.

OFTEC requirements book T3 July 1995 rev.7.95

Minimum size storage tank should be 300 gals.

The burner can be supplied with oil via a gravity or pumped oil feed system. See FIG
If a gravity system is used the base of the tank must not be less than half a metre above the burner.

Where the tank will be fitted at a lower level than the appliance a lift pump must be used with max. head above the burner base of 3 metres, the max head of the lift pump over the oil supply tank must not exceed 5 metres.

A suitable filter must be fitted and the minimum fuel line diameter is 8 mm but this is dependent upon the length of run.

If other appliances are being supplied from the same oil supply allowance must be made when pipe sizing to ensure that an adequate supply of oil be maintained for each appliance.

The oil line must be sleeved and sealed in a plastic tube where it passes through any brickwork. see FIGS 7 and 8

A remote acting fire valve such as a Teddington KBB C 150 deg F must be fitted with the phial bulb being mounted under the front fender and the valve being fitted at the point where the fuel line enters the property. see FIGS 7 and 8.

There must also be an isolation valve fitted in the same room as the appliance in a conveniently accessible place. see FIGS 7 and 8.

Environment protection is of paramount importance. Where properties are prone to be at risk from flooding take great care when fitting oil storage tanks.

Make sure that they are supported on reinforced concrete walls which are built high enough to keep the tank well above any potential flood level and strong enough to withstand swollen river current or flood tide conditions.

Make sure that the tank is firmly fixed to the supporting walls so as not to be washed away.

Tall, slim line plastic oil tanks must be secured to a substantial base to prevent them from being blown over when they are empty or have a low oil content.

4-4 VENTILATION REQUIREMENTS

Air Supply To The Burner.

See Building Regulations J11213 section 4. and B55410 part 1.

Calculate air requirements at 5.5 cm sq. per kW of output.

It is most essential that a permanent free air supply is established as the burner cannot function correctly without it.

Provision for an adequate FREE air supply in to the room or house where the appliance is fitted is required and can be established by multiplying the kW oil input of the appliance by 5.5cm sq.

The air supply will take the form of a purpose designed, NON hit or miss, air vent of correct cross sectional area.

If an extractor fan is fitted in the same room as the appliance or if there is an open fire in an adjoining room then extra compensatory air must also be made available for both these extra requirements.

Minimum extra requirement for extractor fans is 55 sq. cm and it is preferred if the extra air supply can be positioned in such a way as it can supply air to the extractor fan without the air stream passing the appliance.

Minimum ventilation requirement for open fires is 212 sq. cm

Test for adequacy of air supply is to:-

Set the oil fired appliance going, close all doors and windows in the room, turn on the extractor fan to its maximum capacity, light the open fire and let it get well established.

Test for adequate maintenance of chimney vacuum on the appliance, both before and after the extractor fan is turned on, with the open fire going.

During the tests the flue vacuum of the oil fired appliance should be measured to see if there is any noticeable reduction beyond that called for in these instructions.

WARNING

Instructions on ventilation must be adhered to.

4-4a WATER HEATING

Colibri Boilers are all high water content boilers and as such can easily replace solid fuel installations with the minimum of complication.

Before you start to install a water heating Colibri Boiler remember that the central heating system must comply with BS:5449 part 1.

If a combined heating and domestic hot water system is to be used, then a double feed indirect hot water storage cylinder to BS:1556 part 1 should be used.

In order to prevent the build up of scale and corrosion a suitable inhibitor should be used.

The system must be correctly vented.

The height differential between the header tank and the appliance must not exceed 15.2 metres (50 feet) Where a common return is used an injector tee must be incorporated into the system to ensure adequate primary circulation when the circulating pump is operating. (see detail in FIG16)

The system must incorporate a gravity circuit which will normally heat the domestic hot water and an un-valved radiator or radiators with an output of at least equal to the minimum water heating output of the appliance. (see technical spec for details)

When the appliance is not connected to a domestic hot water system a gravity system must still be used with the unvalved radiator(s) on the gravity circuit having a total output of at least the minimum output of the appliance, this is to prevent boiling in case of pump failure.

Min. pipework in the primary circuit must be 28mm diameter and the gravity flow pipe must rise continuously from the boiler to the open vent.

Typical systems are shown in illustrations FIGS 15,16,18,19 and 20

Connect the heating system to the boiler ensuring that the primary flow pipe rises continuously from the appliance to the vent.

Fill the system with water and check for leaks and air locks.

APPLIANCE CONTROLS

The appliance can be controlled via -:

The oil control valve which is fitted with:-

1. A manually operated oil flow control knob
2. A manually set, automatic thermostat, built into the oil control valve.
3. A manually and automatically operated oil cut off lever, built into the oil control valve.
4. An automatically operated safety shut off thermostat, built into the oil control valve which trips the oil flow cut off lever mentioned in 3 above.

The valve operates as follows, it has flow control potential from mini to maxi via six graduations and so the appliance can be manually controlled from MINI to MAXI by simply turning the flow control knob (1 above), in addition it also has a water sensing thermostat and an automatic safety oil cut off device should the appliance water temperature exceed 90 degree C.

The water sensing thermostat will automatically control the boiler water temperature at what ever setting is required up to a maximum of 70 degree C. (2. above) and it is operated by a control knob situated alongside the oil flow control knob.

If the appliance is fired up at full output it will run on full flame until it achieves the target water temperature, set by rotating the stat knob to the desired position, (clockwise to reduce temperature, anti clockwise to increase temperature)

The flame then drops to its low fire position, from there on it will automatically modulate the flame from high to low in line with the heating load demand.

ADJUSTMENT OF THE OPERATING STAT

Set point of the operating stat can be adjusted as follows.

The thermostat drive knob has a plastic push on cover which slips over it and grips it acting as an adjustable driver.

The plastic driver has a dead stop which acts against a small brass screw so restricting the rotational movement to one full turn, thus allowing adjustment of water temperature from mini to maxi through one full turn.

If the water temperature settings are not as required remove the plastic push on cover and rotate the aluminium knob anticlockwise until the weight comes off, allow the appliance to come up to the required temperature (say 65 deg c) and then rotate the aluminium knob until the fire starts to reduce, refit the plastic push on cover with the scale set as required.

ADJUSTMENT OF THE SAFETY STAT

The safety stat can also be adjusted if it does not trip off at the desired temperature of 90 deg C.

To adjust the set point on the safety stat the aluminium top cover of the oil valve has to be removed. It is held in place by the three slotted screws and the base casting of the thermostat stand.

Undo the three slotted screws and slacken the other two, lift the cover up and work it out from under the aluminium thermostat casting.

When the cover is removed it will reveal the operating bellows of the safety stat, on the left hand end of the bellows is a straight knurled nut which if screwed in will decrease the temperature set point and if screwed out will increase the temperature set point.

(The Oil Controls International oil control valve has a second safety float chamber designed as a safety back up to the first one.

It is possible during installation to accidentally flood the second chamber, if this occurs it will not be possible to trip the safety cut off knob as the flooded safety float disarms the trip mechanism. To re establish the action of the safety cut off knob the second float has to be depressed a few times to remove some of the excess oil. This can be done using a small screw driver, access to the float is obtained by removing the 10mm dia plastic cap pressed into the top of the O.C.V.)

SYSTEM CONTROLS

The circulating pump may be controlled by means of time switches, or room thermostats. Radiators may be either manually or thermostatically controlled except for the heat leak radiators.

These controls will all work in conjunction with the thermostat on the appliance and the low limit pipe thermostat.

We recommend fitting a pipe thermostat onto the gravity return to act as low limit thermostat. This should be wired into the mains supply to the pump so that if the gravity return temperature drops below 45 deg C, the pump will cut out.

This will help to prevent condensation forming on the boiler faces and will thereby increase the life of the boiler. It will also ensure that priority is given to the domestic hot water. These thermostats are available from ourselves if you are unable to obtain them locally.

THE APPLIANCE

The appliance has the oil valve situated behind the front door.

5-0 INSTALLATION AT A GLANCE

1. PREPARE THE HEARTH

Prepare the opening and or hearth .

4. DROP THE LINER DOWN THE CHIMNEY.

6A. FIT SUITABLE VENTILATION INTO THE APPLIANCE SITE SEE SEC 4-4.

7. RUN THE OIL SUPPLY. SEE SEC 4-3.

Run the oil line and, remember that the KBB fire valve may well need in service replacement, an allowance must be made for this to be easily carried out, should the need arise.

Install fuel tank in line with our instructions in sec 4-3 and run a fuel line up to the rear right hand side of the appliance, fit the remote firevalve phial, if it is located in a position where the temperature can exceed 150 deg F, it will trip and need to be reset on the firevalve body.

Fit the isolation valve see figs 7 and 8.

7a RUN THE ELECTRICAL SUPPLIES (optional)

8. FIT THE APPLIANCE.

Before attempting to fit the appliance make sure that it has not suffered any damage in transit particularly

around the oil control valve area.

Check that the lighting port plug is in situ.

Remove all the burner components, as follows -:

CATALYSER AND RING

Check that the swinging barometric damper is swinging freely and closing properly.

Level the appliance in both directions using the adjuster feet, take great care to make sure that the oil runs very slightly towards the lighting port, when it first enters the pot.

11. CONNECT THE PLUMBING

12 CONNECT THE CHIMNEY.

13. CONNECT THE ELECTRICAL SUPPLY. (optional)

14. CONNECT THE OIL SUPPLY.

The appliance leaves the factory with the oil control valve correctly adjusted on the O.C.V. bracket clamping bolts.

Using a small spirit level check the Oil Control Valve which must be made level in both directions but do not disturb the level of the valve as this can cause a problem on oil flow.

14. FILL THE HEATING SYSTEM WITH WATER AND CHECK FOR LEAKS.

22. FIT ANTI DOWN DRAUGHT COWL AND FINISH FLAUNCH CHIMNEY TOP. (SHARP SAND / CEMENT.) fig. 2

23. MAKE UP THE OIL SUPPLY AND PURGE THE LINE.

24. REFIT ALL THE INTERNALS AND EXTERNALS OF THE APPLIANCE.

25. TEST FIRE AND COMMISSION.

9-0 COMMISSIONING

Turn on the oil at the isolation valve.

Press the oil safety cut off knob down to trip the oil on via an audible click. Make sure that the stat is calling.

CHECK FOR OIL LEAKS.

Check that oil does not leak from the pot, valve, descaling device or pipework. If no leaks proceed as follows -:

Turn the oil flow off.

Empty the pot of all oil.

Remove the lighting port cover.

Turn the oil on to the first position via the flow control knob and when oil can be seen to trickle into the pot turn it off so as not to allow an excessive build up, all that is required is a pool the size of a small biscuit.

Dip the lighting wick in the pool of oil and light it, when it is alight place it into the burner and allow 20 – 30 seconds for the oil to catch fire, remove the lighting wick and replace the lighting port cover, turn the fuel flow on again at the lowest setting,

NOTE

If during the lighting stage, excess oil is allowed to build up in the pot, the burner will race and generate quite loud audible vibrations, if this occurs don't panic, lift the oil cut off knob and wait a few minutes until the burner flame starts to reduce in size, at this stage depress the lever to restart the flow of oil so allowing the burner to run correctly at its low speed.

When the burner has been running for five minutes on position 1 LOW FIRE the lower catalizer will be glowing dull red, with very little blue flame, if this is not the case adjust the low fire screw accordingly, when you are happy with the low fire turn the burner slowly and progressively up to full flow, which after 5 minutes, should produce a larger yellow flame. If there is excessive yellow reduce the high fire accordingly.

When you are happy with the flame picture on high and low fire you must then check the action of the APPLIANCE TEMPERATURE CONTROL mechanisms

Check the appliance controls are working correctly See section on-

ADJUSTMENT OF THE OPERATING STAT. ADJUSTMENT OF THE SAFETY STAT.

make sure that the valve does not shut down when the appliance is working under the control of the boiler stat on gravity flow without the pump running.)

NEVER TRY TO RELIGHT A HOT BURNER, MAKE SURE THAT THE BURNER IS COMPLETELY COOLED DOWN BEFORE RE LIGHTING.

EXTINGUISHING

Shutting the burner off is a very simple manoeuvre.

Turn the oil flow control knob fully in a clockwise direction until you feel it stop in its off position.

After a few minutes, the flame will die down and eventually extinguish itself.

INSTRUCT THE USER

1. LIGHTING PROCEDURE
2. POSITION OF ALL OIL CUT OFF SAFETY DEVICES
3. ON THE PRINCIPLES OF CONTROL.
4. THE IMPORTANCE OF REGULAR MAINTENANCE.

FILL IN THE WARRANTY FORM

The warranty covers PARTS ONLY for a period of ONE YEAR and is conditional upon all the requirements of our installation instructions being fully adhered to.

Labour, travelling or consequential loss or damages are not covered.

ARRANGE AN APPOINTMENT FOR SERVICING

6 monthly.

NOTE-;

Once the installation is completed it should be inspected to make sure that the work is of a satisfactory standard.

Commissioning should not be signed off unless the commissioning engineer is satisfied that all the work done complies with the relative standards and regulations detailed within this document.

Checks should be carried out on the following-:

Tank- check for leaks-stability-height-position-vent.

Fuel- check for correct grade

Filter- is it fitted-check for function and leaks.

TANK Site Glass- check for function and leaks

Oil line- check for function, positioning, material suitability and leaks.

Fire valve-check for function and leaks.

Through Wall Sleeving- Check that it is fitted and sealed

Isolation' valve-check for function, convenience of positioning and leaks.

Flush at least 5 litres of oil through the line to check for contamination and to clear the oil line of installation debris and trapped air.

Electrical- check for correct fusing, location and specification of any isolation devices.

Ventilation - make sure that ventilation is provided in line with O.F.T.E.C requirements.

Water systems should be prechecked for leaks and satisfactory functioning and safety of all or any control devices. Make sure that the heat leak circuit is adequate and unvalved.

Chimney system should be checked to make sure that it complies with the relative standards, regulations and all other instructions given.

Check the appliance is fitted with adequate clearances from combustibles. Check high and low fire as per section 9-0

Check action of barometric damper.

Check correct hot condition functioning of water heating system and all controls.

Ensure that the customer is instructed on the basic use of the appliance, timers, controls and oil electrical isolation devices if fitted.

Ensure that the warranty registration documentation is returned to Harworth Heating Ltd.

10-0 FAULT FINDING

1. RACING

1. Audible vibrations generated by the flame caused by too much oil in the pot.
2. Turn off the oil flow until the burner has settled down to a steady burn rate and then turn the fuel on again but don't let the flame go out otherwise the burner **MUST** be allowed to cool down fully before a reignition is attempted.

2. FLUE VACUUM

1. The pot type burner is extremely sensitive to flue vacuum variations.
2. Good combustion will not be possible unless our instructions on chimneys and flue vacuum are followed.
3. If the burner does not burn with a blue flame, recheck the chimney vacuum and oil flow rate.
4. If the burner does not run well check that the seals in the appliance are good and that there is no ingress of air into the appliance flue ways.
5. Check that the swinging damper is not jammed open.
6. Check that the correct fuel oil is being used.
7. Check the levels.

3. BURNER RUNS SOOTY.

If the problem has just started it may be the fuel or an unusual wind condition, check these out before carrying out any adjustments to the flow rates.

1. If the appliance soot's up this indicates that there is not adequate air for blue flame combustion or there is an excess of fuel.
2. Check that the chimney is correctly lined and backfilled with vermiculite, particularly important on exposed gable end chimneys.
3. Check that the fuel is the correct type and quality.
4. Check that the flow rates are correct.
5. Where burners are run at high fuel flow rates on low chimney vacuums, long unsatisfactory yellow flame combustion and bad sooting will occur.
6. To rectify this problem, reduce the high fire flow rate screw on the Oil Control Valve until blue flame combustion occurs.
7. Never switch from low settings to high settings, a longer burner life will be achieved if the regulator is moved only by one number at a time leaving approx. one minute between each setting change.

4. BURNER DOES NOT LIGHT EASILY

1. Check the level of the bottom of the pot and make sure that the appliance is levelled so that the oil flows very slightly towards the glow plug or ignition wick.

5. OIL WILL NOT ENTER THE POT

1. Check that the safety cut out lever has not been accidentally shut off.
2. If it is not possible to reset the safety cut out lever phone us for advice. In case of failure of the first float the second one catches the excess oil and trips the safety cut out lever, making it impossible to reset.
3. Simulated failure can occur if a full oil control valve is disturbed causing the secondary float chamber to flood.

6. APPLIANCE GOES OUT WHEN THE CENTRAL HEATING PUMP IS TURNED OFF.

This problem can be caused by one of the following

1. The flow to the heat leak rad is inadequate.
2. The size of the heat leak rad is inadequate.
3. The safety stat set point needs increasing.

OPERATING FLOW RATES

Flow rates are shown in cc per minute.

	Min.	max.
Colibri 14	0.45l/hr	1.37l/hr
Colibri 21	0.66l/hr	2.11l/hr

To achieve optimum burner performance at these flow rates you will need to have matching flue vacuums as stated.

If the chimney does not generate enough vacuum the flow rates will have to be adjusted so that the burner maintains equilibrium, i.e. blue flame combustion.

This will result in lower output from the appliance.

OIL SMELLS

Visual check on all joints for obvious leaks.

Check that the descaling lever packing gland nut is adjusted.

11-0 SERVICING

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This product is subject to continuous development and improvement and it is consequently acknowledged that due to this process there may be some omissions and errors.

This publication is intended only to assist the reader in the use of this product and therefore Harworth Heating Ltd shall not be liable for any loss or damage whatsoever arising from the use of any information, error or omission found in this guide.

Maintenance on this product must be carried out only by approved personnel, WHO HAVE BEEN SUITABLY TRAINED.

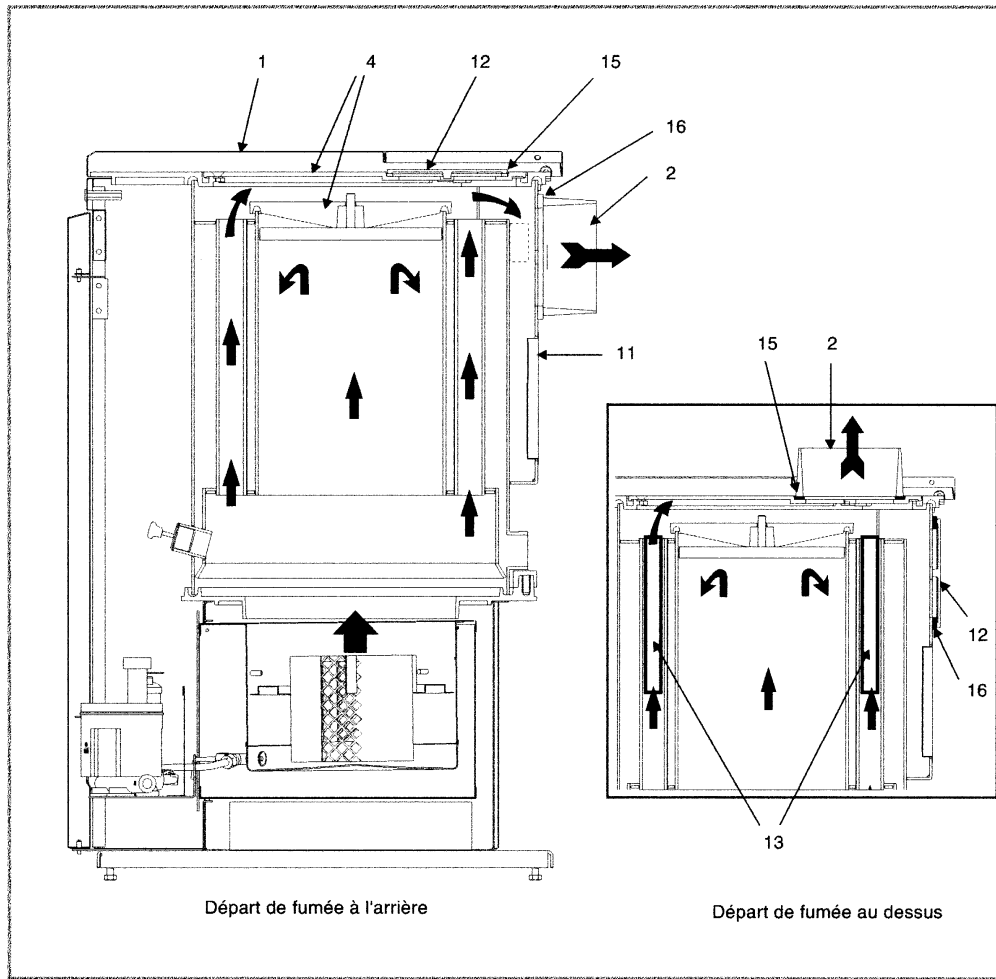


Fig. 3 – Schematic of flue gas flow

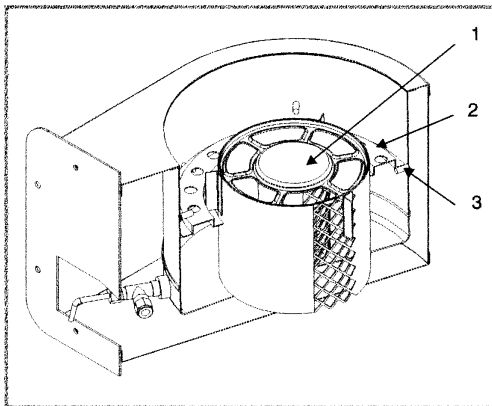


Fig. 4 – 14kW Burner

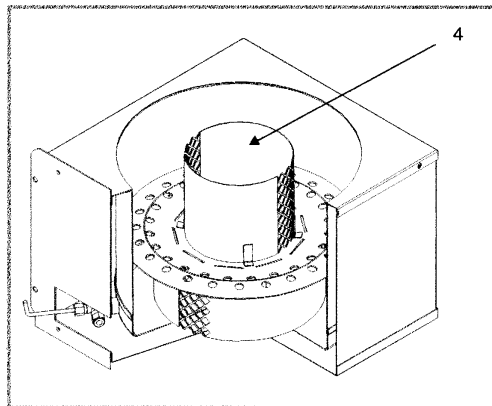


Fig. 5 – 21kW Burner

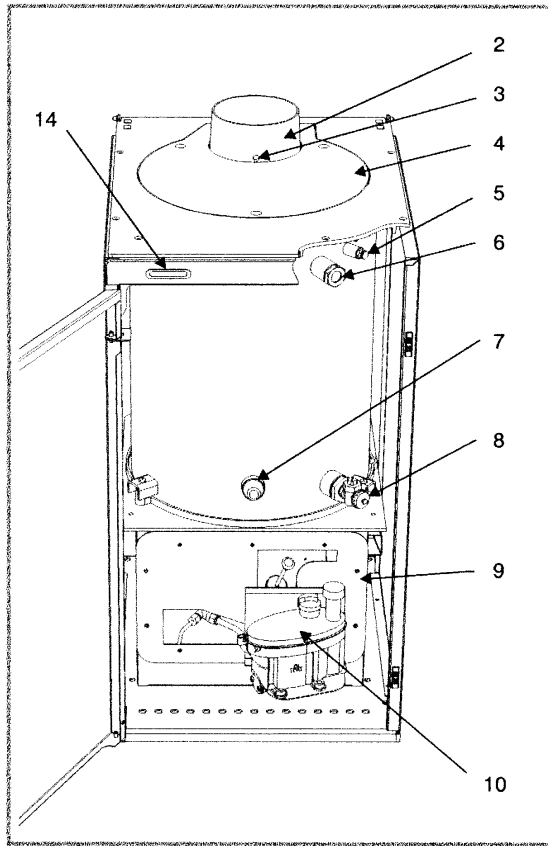
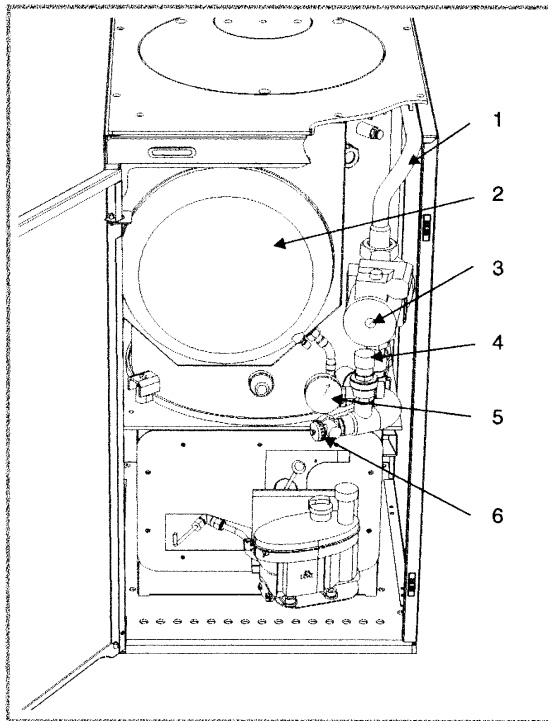


Fig. 6 – Diagram for Parts List



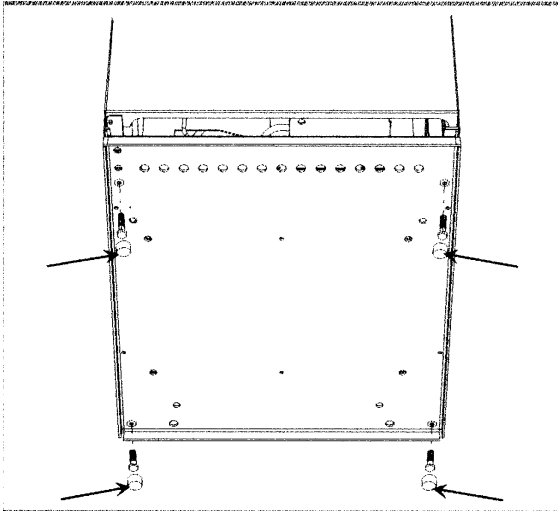


Fig. 8 -

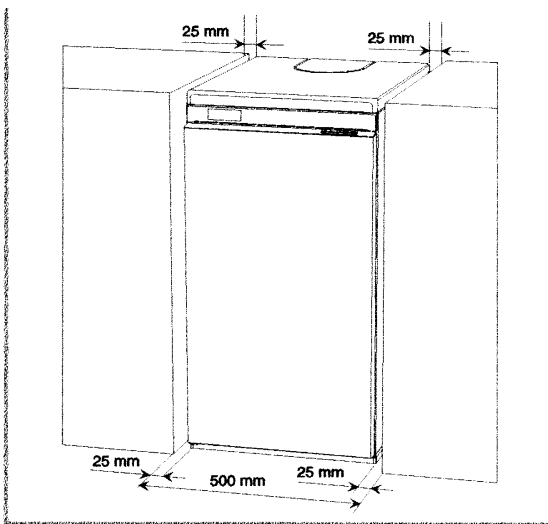


Fig. 9 -

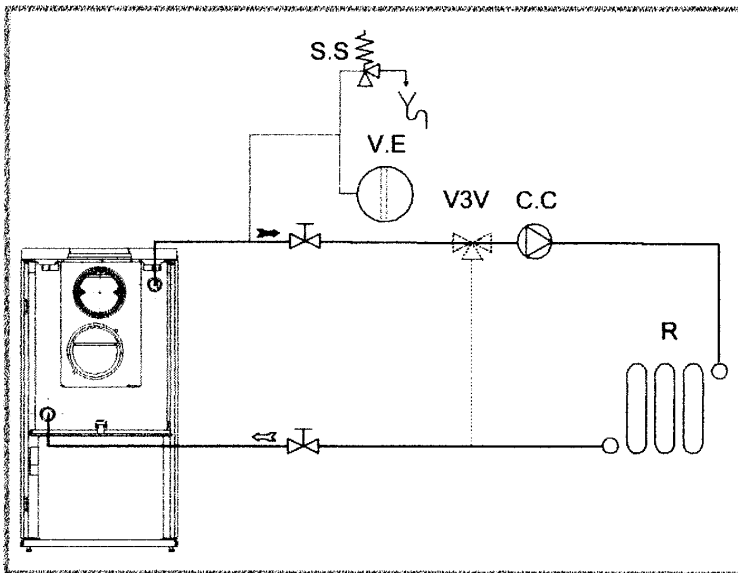


Fig.10 -

C.C -

R -

S.S -

V3V -

V.E -

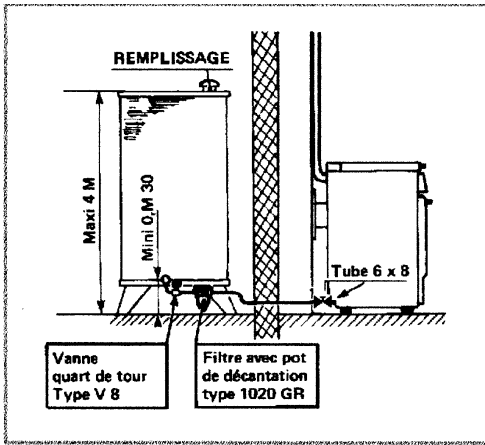


Fig. 11

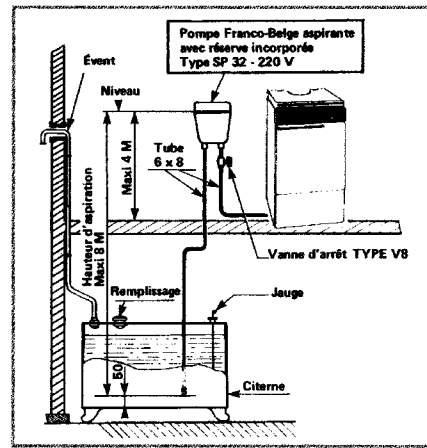


Fig. 12

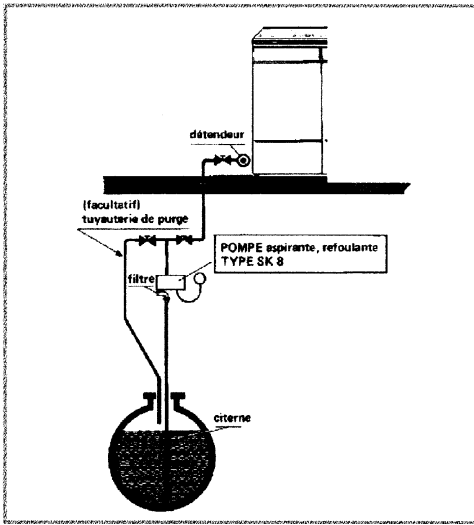


Fig. 13

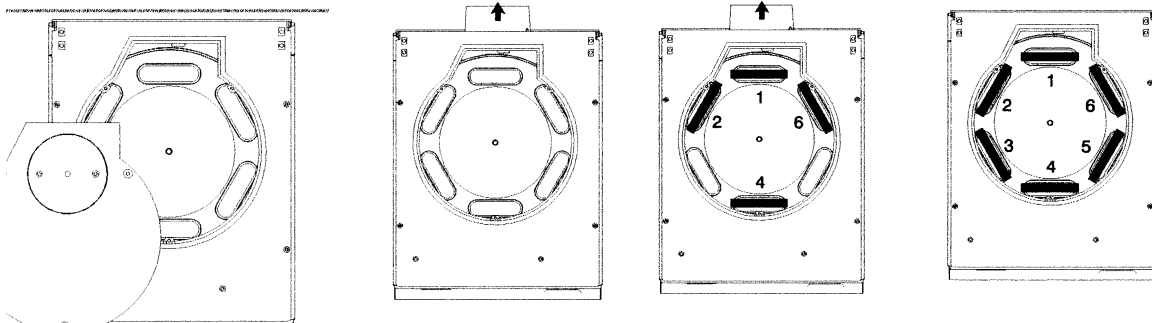


Fig. 14

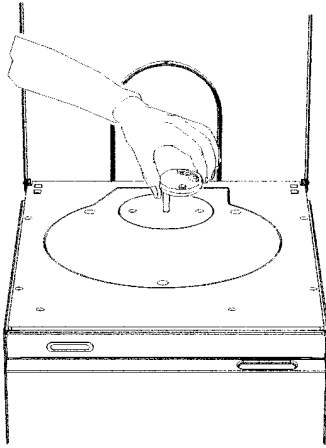


Fig. 15 -

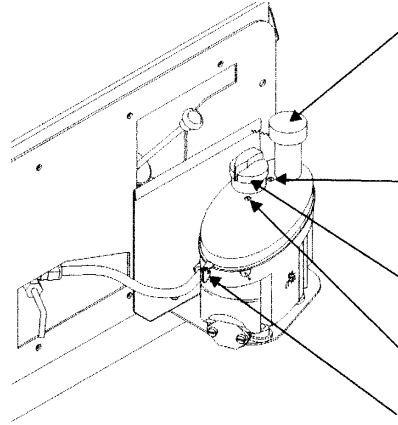


Fig. 16 -

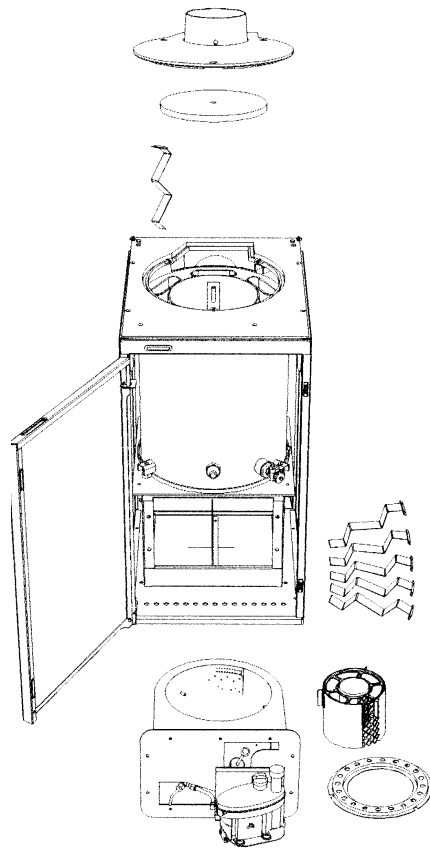


Fig. 17

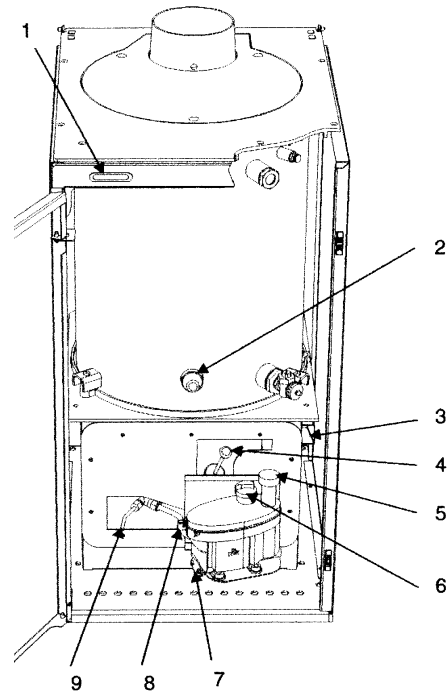


Fig. 19

