Kensa Heat Pumps
A KENSA GROUP COMPANY

Shoebox Heat Pump

Installation and Commissioning Manual

Kensa Heat Pumps
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1. Introduction—a message from the Managing Director

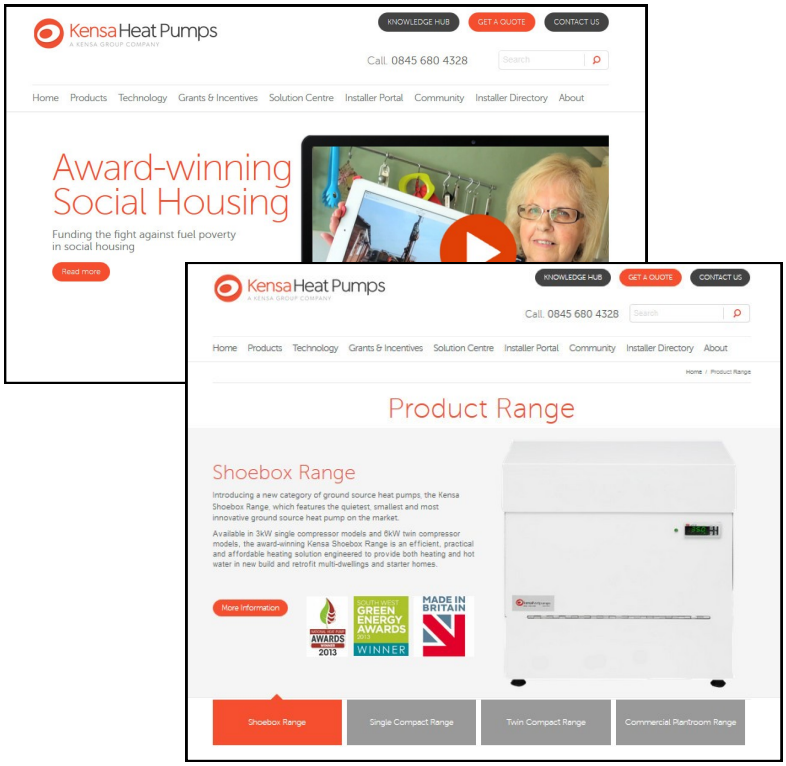
Kensa Heat Pumps has been manufacturing ground source heat pumps since 1999. In the early days, it was difficult to find contractors willing to consider the technology. As a consequence, Kensa made considerable efforts to simplify the installation process to allow any competent plumber to perform the work. The company is now reaping its rewards as heat pumps become mainstream heating appliances.

The purpose of this manual is to guide you through the installation process. It is expected that all the required information has been provided to allow you to connect the heat pump. Critical instructions, aimed at ensuring you do not experience any difficulties, are highlighted on the 'Golden Rules' in the installation section.

Please note you will need to speak to the Technical Support Team on 01392 367080 to receive the 'online commissioning' service, offered free-of-charge. Opening hours are 8.00am to 5.00pm .

Finally, please feel free to contact Kensa should you have any questions, wish to consider ground source heat pumps for any future projects or even just to share your experiences of using a ground source heat pump with us.

Simon Lomax
Managing director
Kensa Heat Pumps Ltd



For further information on ground source heat pumps and their application, please refer to www.kensaHeat Pumps.com

2. Safety information

Safe operation of this unit can only be guaranteed if it is properly installed and commissioned in compliance with the manufacturer's requirements. General installation and safety instructions for pipeline and plant construction, as well as the proper use of tools and safety equipment must also be complied with.

Manufacturer:-
Kensa Heat Pumps
Mount Wellington
Chacewater
Truro
Cornwall
TR4 8RJ
Tel 01872 862140
www.kensaHeat Pumps.com

The product is designed and constructed to withstand the forces encountered during normal use. Use of the product for any other purpose, or failure to install the product in accordance with these Installation and Commissioning Instructions, could damage the product, will invalidate the warranty, and may cause injury or fatality to personnel.

2.1 Access
Ensure safe access before attempting to work on the product. Arrange suitable lifting gear if required.

2.2 Lighting
Ensure adequate lighting, particularly where detailed or intricate work is required.

2.3 Tools and consumables
Before starting work ensure that you have suitable tools and / or consumables available.

2.4 Handling
Manual handling of large and /or heavy products may present a risk of injury. Lifting, pushing, pulling, carrying or supporting a load by bodily force can cause injury particularly to the back. You are advised to assess the risks taking into account the task, the individual, the load and the working environment and use the appropriate handling method depending on the circumstances of the work being done.

2.5 Residual hazards
Many products are not self-draining. Take due care when dismantling or removing the product from an installation.

2.6 Freezing
Provision must be made to protect products which are not self-draining against frost damage in environments where they may be exposed to temperatures below freezing point.

2.7 Disposal/Decommissioning
Kensa offer a life time decommissioning service for this product. This is available on a return to base basis (carriage at users' cost).
Disposal of any antifreeze water mix should follow the disposal instructions as laid out on the COSH Safety Data Sheet available on request.

3. General Product Information

This manual explains how to install and commission a Kensa 'Shoebox' ground source heat pump.

The Kensa 'shoebox' heat pump is designed to provide a low cost renewable heat source for a buildings heating system. It is ideally suited to multi flat developments using a communal ground borehole field. In addition, and if required, the Kensa Shoebox can also provide domestic hot water. Heat pumps can provide lower running costs and will generate significantly lower carbon emissions compared with traditional fossil fuels.

The Kensa 'Shoebox' Heat Pump is designed for straightforward installation and requires no specialist training to install. However the installation must conform to all relevant construction and electrical codes and comply with the requirements of the Microgeneration Certification Scheme (MCS) MIS3005 'Requirements for Contractors undertaking the Supply, Design, Installation, Set to Work Commissioning and Handover of Microgeneration Heat Pump Systems'. If linked to a communal ground array then specialist drillers/contractors should be used for the design and installation of the boreholes.

3.1 Equipment delivery and handling.

Factory shipment
Prior to shipment, the Kensa 'Shoebox' Heat Pump is tested, calibrated and inspected to ensure proper operation.

Receipt of shipment
Each pallet should be inspected at the time of delivery for possible external damage. Any visible damage should be recorded immediately on the carrier's copy of the delivery slip.
Each pallet should be unpacked carefully and its contents checked for damage.
If it is found that some items have been damaged or are missing, notify Kensa immediately and provide full details. In addition, damage must be reported to the carrier with a request for their on-site inspection of the damaged item and its shipping pallet.

Storage
If a Kensa Heat Pump is to be stored prior to installation, the environmental storage conditions should be at a temperature between 0°C and 70°C (32°F and 158°F), and between 10% and 80% relative humidity (non-condensing).

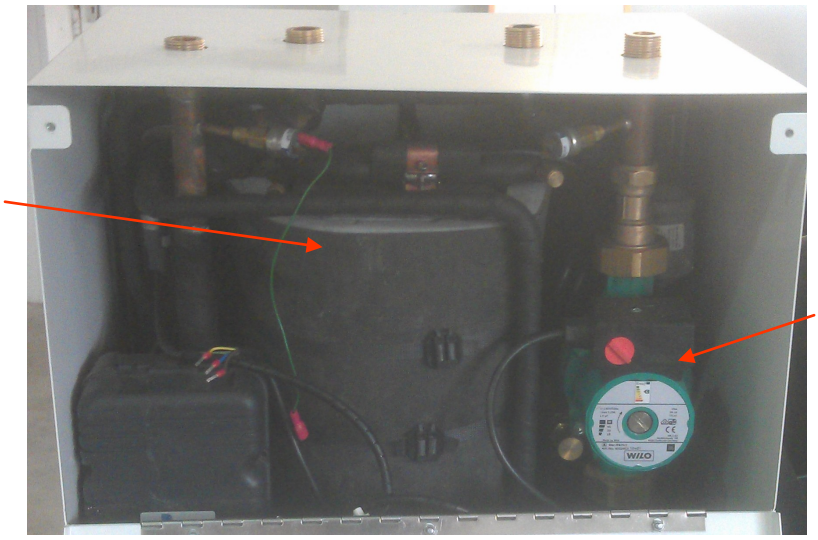


Fig 1. The internals of a single compressor shoebox heat pump

3.2 Kensa Shoebox Technical Details											
Nominal Thermal Output	Power supply rating	Max running Current	Typical running current	Typical starting current	Power supply cable cross sectional area (min)	Power input*	Nominal weight	Compressors	Dimensions	Connection size	Recommended minimum heat transfer area in DHW tank (not supplied)
kW	Amps	Amps	Amps	Amps	mm^2	kW	Kg	Number	HxWxD	mm OD	m^2
Single Phase—230 Volts AC 50 Hz											
3.0	13	7	4	30	2.5	0.8	60	Single	530x465x370	3/4" BSP Parallel with 22mm Adaptor valves	0.75
6.0	25	14	8	34	2.5	1.6	100	Twin	560x605x565		1.5

The figures above are based on a rating to BS EN14511, 0 deg C from the ground, 35 deg C flow to underfloor..
* This figure includes the power consumption of the inbuilt water pump

For clarification of starting currents and details on how these figures are calculated please contact Kensa.

4. Installation

Note: Before actioning any installation observe the 'Safety information' in Section 1.

It is essential that the following installation guidelines are followed carefully.

The installation must conform to all relevant construction and electrical codes and comply with the requirements of the Microgeneration Certification Scheme (MCS) MIS3005 'Requirements for Contractors undertaking the Supply, Design, Installation, Set to Work Commissioning and Handover of Microgeneration Heat Pump Systems'

Any electrical work required to install or maintain this appliance should be carried out by a suitably qualified electrician in accordance with current IEE regulations.

Any plumbing work should be carried out to local water authority and WRC regulations.

4.1 The Golden Rules of Installing a Shoebox Heat Pump

1. Connect the heat pump using only plastic pipe or flexible piping.
2. Ensure a load side water pump is fitted externally to the heat pump and sized correctly.
3. Use the Kensa recommended purge pump for purging the ground arrays and heat pump.
4. On the underfloor heating manifold(s), remove the thermal mixing valve(s) if fitted.
5. On the underfloor heating manifold(s), don't fit electric actuators to more than 75% of the zones, unless a buffer vessel is fitted to each shoebox.
6. Remove the chrome screw on the water pump, and check that the pump is running, and moving water before turning on the compressor (See section 6.3).
7. Read this manual fully before commencing installation
8. Do not connect the heat pump to a thermal store without consulting Kensa first.
9. An electrical isolation switch should be fitted close to the heat pump.
10. Existing heating systems should be power flushed and inhibitors should be added.

4.2 Underfloor Heating Schematics

The following section includes typical schematics of how a heat pump can be connected. Only the load side is shown i.e. the heating distribution system. It is important to note that the schematics are only general arrangements and hence do not illustrate all required valves or fittings.

On the underfloor heating manifold(s) remove any thermal mixing valves, if fitted.

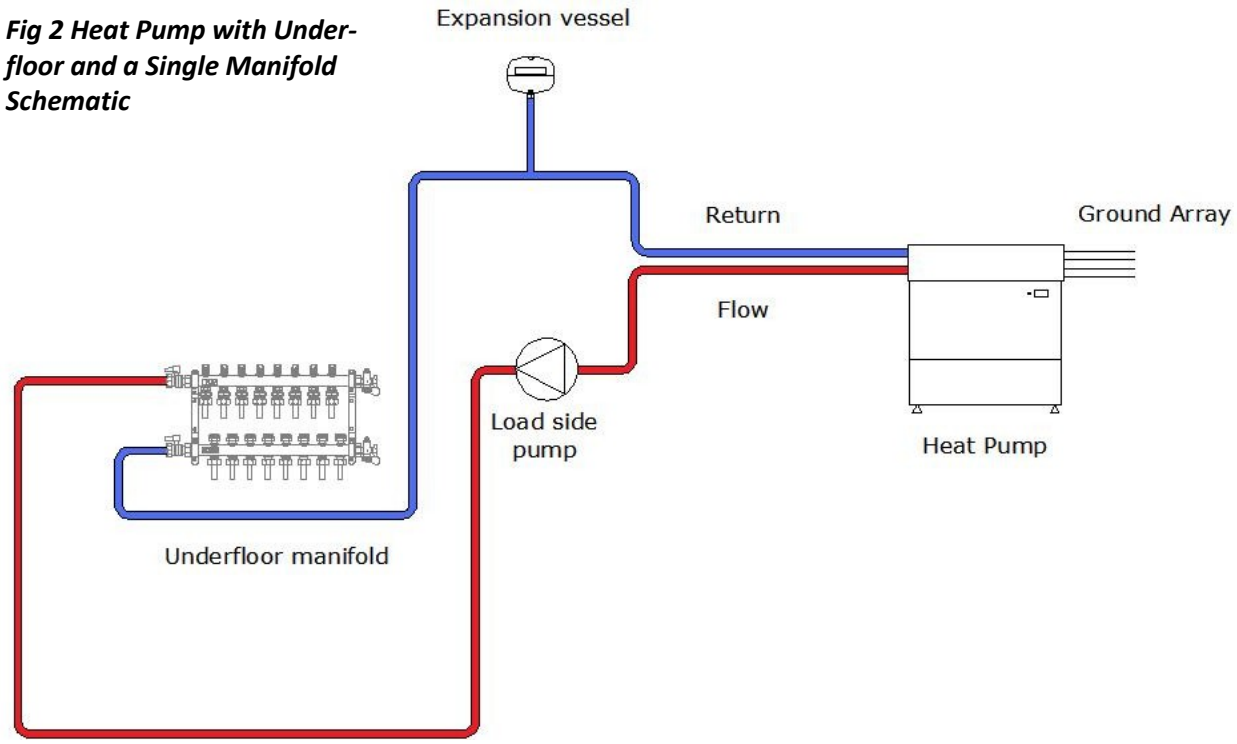
To avoid the heat pump from short cycling, it is important that a correctly sized buffer vessel is used. The buffer vessel should be sized so it is capable of accepting the minimum load from the heat pump. The use of a buffer vessel enables a fully controlled zone system to be used.

Alternatively if a fully controlled zone system is not required and the heating system is capable of absorbing the heat produced during the minimum heat pump runtime, the use of a buffer vessel is not required.
The easiest way to do this is simply to have some zones left "open" – i.e. without electric actuators. These zones will still require room thermostats so can call for heat when required. In houses, the best zones to chose are ensuite bathrooms, and hallways, neither of which are likely to be overheated.

To avoid short cycling of the heat pump the smallest actuator controlled zone (plus all the open zones on that manifold) should be capable of absorbing the minimum thermal load of the heat pump. This minimum load is approximately 25% .

4.2.1 Underfloor with a single manifold. Space heating only

Fig 2 Heat Pump with Under-floor and a Single Manifold Schematic



4.2.2 Underfloor with a multiple manifolds. Space heating only

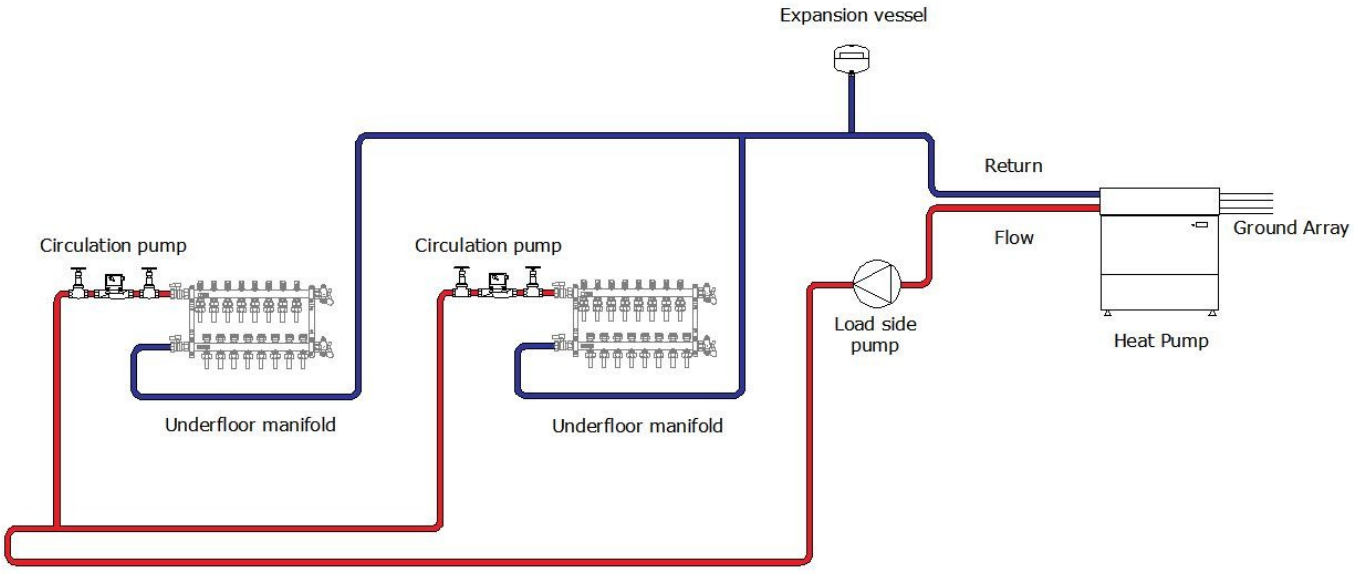


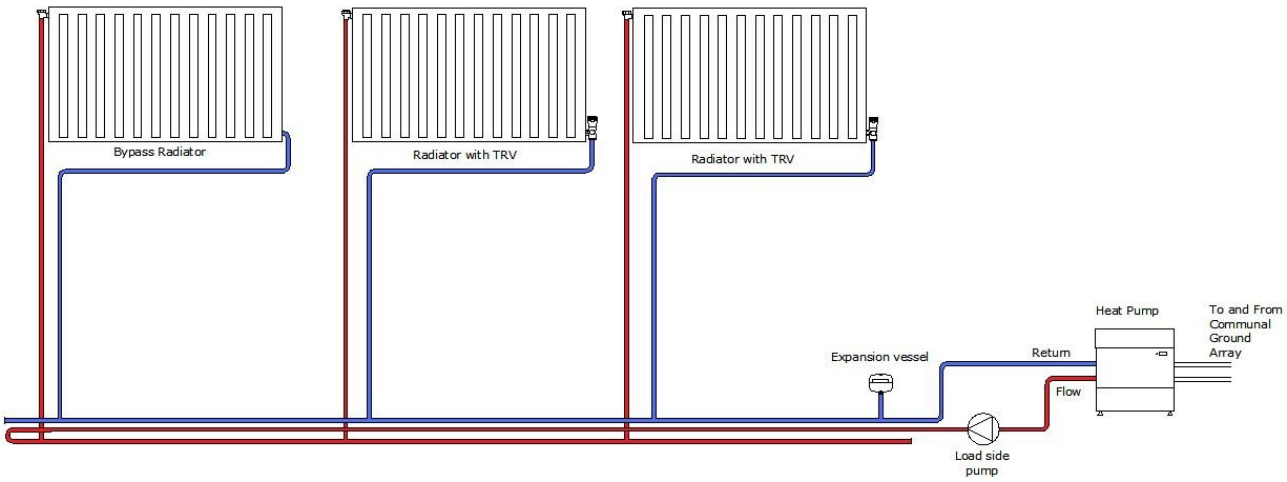
Fig 3 Heat Pump with Underfloor and Multiple Manifolds Schematic

4.3 Radiators. Space heating only

The following section includes typical schematics of how a heat pump can be connected. Only the load side is shown i.e. the heating distribution system. It is important to note that the schematics are only general arrangements and hence do not illustrate all required valves or fittings. They are only a guide and should not be used as full installation plans.

When operated with radiators to avoid short circulating problems if a buffer vessel is not fitted, one by-pass radiator should be left 'open', i.e. any TRV is removed. This radiator can be positioned in areas such as halls or bathrooms.

Fig 4 Heat Pump with Radiators Schematic



4.4 Domestic Hot Water (DHW) —Schematic

The DHW option needs to be specified at time of ordering.

Warning - when a heat pump is used for heating domestic hot water, it may not get the water hot enough to kill the dangerous Legionella that can breed in hot water cylinders. Alternative arrangements should therefore be made to ensure the cylinder is pasteurised regularly.

Under normal conditions the heat pump will provide heat for the space heating distribution system at its design temperature (typically 35°C for underfloor and 45-50°C for radiators).

When the DHW time clock calls for production of DHW, the three-port valve diverts the flow from the heating distribution circuit into the indirect coil. The temperature of the water from the heat pump is raised to approximately 60-65°C.

When the DHW production time period ends, the three port valve switches back to the underfloor distribution and the temperature drops back to its space heating design temperature. The heat pump then reverts to space heating mode or switches off if no zones are calling for heat. The heat pump will not re-enter into DHW mode until 2 hours has passed. Please contact Kensa if this time period needs to be adjusted .

The maximum DHW temperature that the heat pump can achieve will be approximately 60°C.

4.4.1 Type of DHW Tank

The larger the size of the coil within the tank, the better the heat transfer area and hence the better the DHW performance will be.(Refer to table 3.2)

4.4.2 DHW Tank Size

The tank will need to be carefully sized to meet the DHW demand, based on the number of occupants and should have an acceptable recovery rate. Due to the lower DHW temperature achieved by the heat pump than a traditional fossil boiler , a tank 30% larger than normal is recommended. This is due to the higher demand on the tank, as less cold water is used at the point of use to mix the lower temperature DHW to an acceptable temperature.

4.4.3 Three Port Diverting Valve

If the DHW option is ordered, a 3 port diverting valve ('W' plan) is provided by Kensa and is used to divert the flow when the timeclock calls for DHW production from space heating to the DHW tank. The valve's electrical connections are connected to the heat pump's internal wiring. Please note connection 'A' is DHW and 'B' is space heating. Please note the valve should be installed with the motor at any angle vertical to 30° above the horizontal plane .

4.4.4 Tank Thermostat

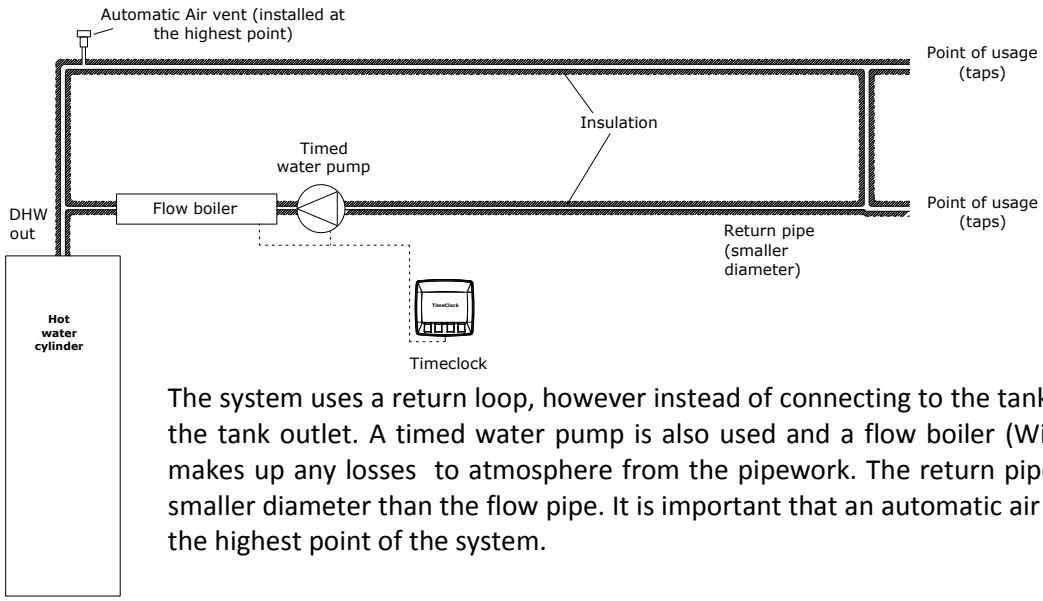
A tank thermostat is not required but maybe fitted and used as a tank safety stat if wired in series with the time clock. This should be set at not less than 65°C.

4.4.5 DHW timeclock

A 24 hour time clock is required to control the production of DHW and is connected to the heat pump's internal wiring. (See section 4.7.4). This timeclock is supplied by others.

4.4.6 Secondary Returns

In long DHW pipe runs, to avoid excessive water draw off before the water is up to temperature at the point of usage, it is common to install cylinders with a secondary return. This is not recommended for systems using heat pumps as it promotes mixing in the tank and a lower flow temperature off the cylinder.



For long pipe runs, to avoid excessive cold water draw offs it is recommend that a flow boiler is used and the pipe is well insulated.

The system uses a return loop, however instead of connecting to the tank it is connected to the tank outlet. A timed water pump is also used and a flow boiler (Willis heater), which makes up any losses to atmosphere from the pipework. The return pipe should also be a smaller diameter than the flow pipe. It is important that an automatic air vent is installed at the highest point of the system.

The operation of the water pump and flow boiler should be timed to a period/s around the time the most hot water is used, i.e. early morning and evening.

If the water pipe is well insulated and the system is timed, the amount of energy this system will use is minimal. It is also possible to use trace heating tape, this removes the additional cost of installation of the secondary return and water pump and the associated running costs of this equipment.

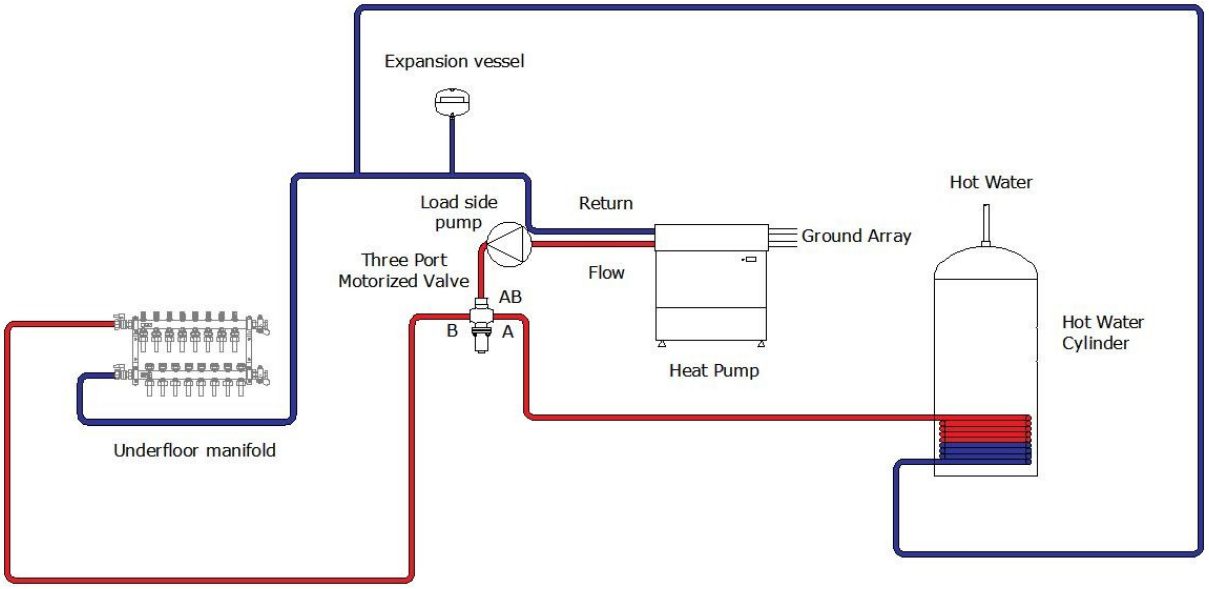


Fig 5 Underfloor with a single manifold and DHW Schematic

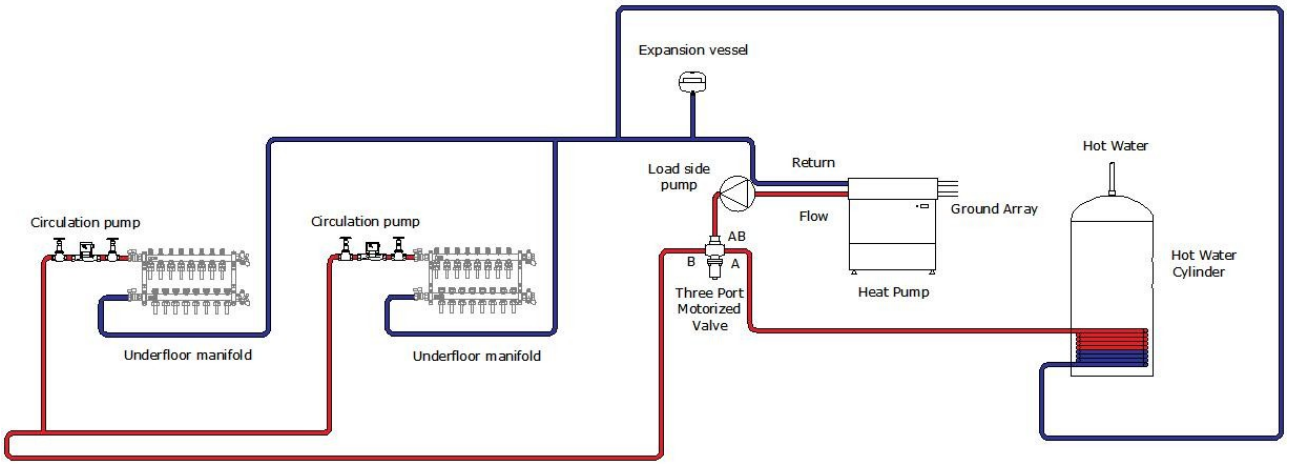


Fig 6 Underfloor with multiple manifolds and DHW Schematic

Note: Additional circulation pumps with multiple manifolds depends on the system design.

4.5 Buffer Vessel Installation

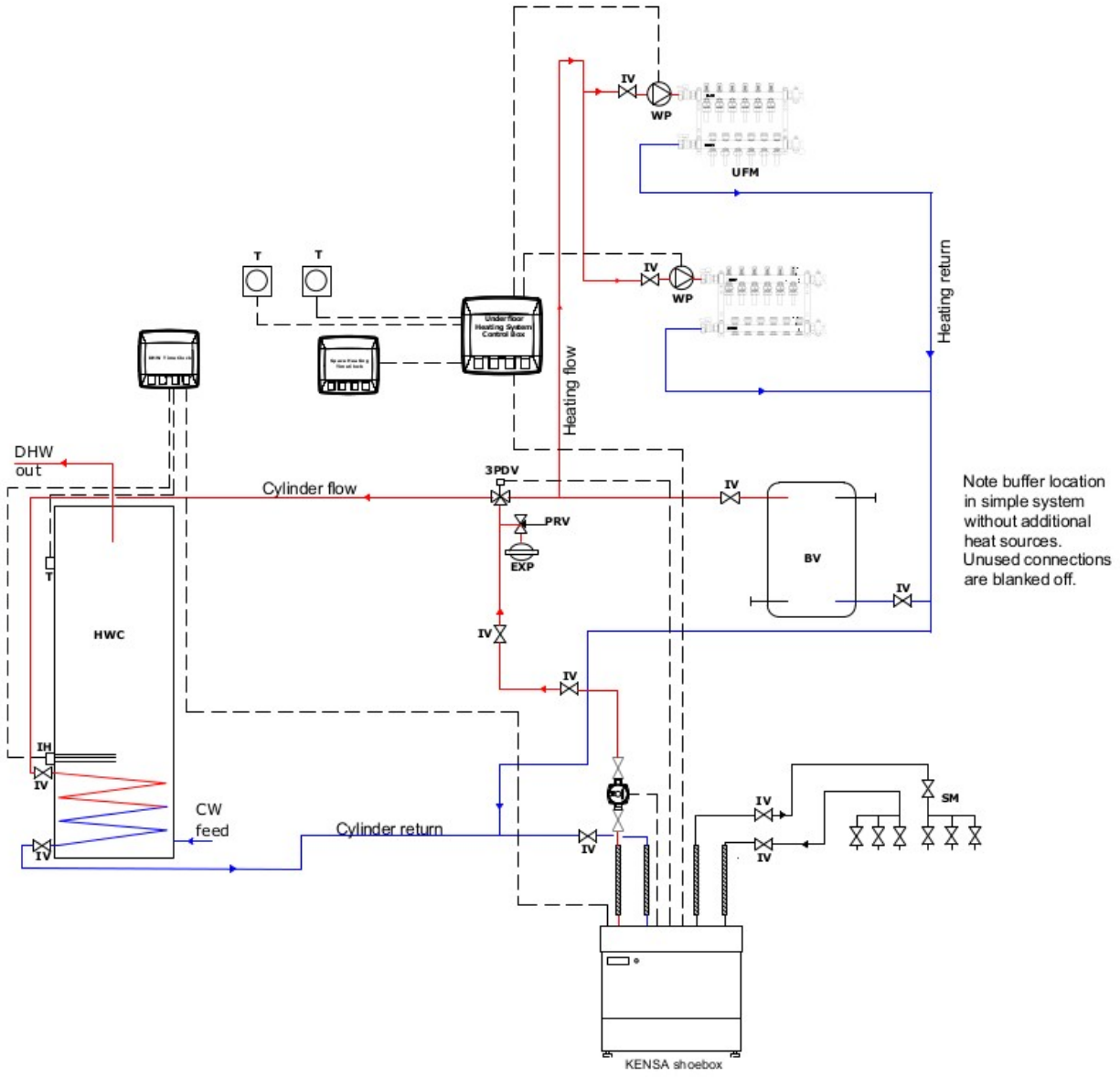


Fig 7 DHW with underfloor and a buffer vessel

If close temperature control of all heating zones is required, it is recommended that a buffer vessel is fitted.

The above schematic shows how a buffer vessel can be incorporated into the shoebox installation without the need of a second water pump.

The buffer vessel allows all radiators or underfloor zones to be fully controlled and prevents the shoebox from short cycling, hence removing the need for 'open' zones.

If there are no water pumps on the underfloor manifolds to improve efficiency, the buffer vessel can be connected to a bypass valve which is set at 0.4 bar. As the heating zones throttle down due to the heating requirement being satisfied, the pressure in the heating circuit increases. Once this pressure increases above 0.4 bar, the bypass valve opens, diverting the flow through the buffer vessel maintaining a load on the heat pump and avoiding it from short cycling.

4.6 Mechanical Installation

4.6.1 Locating the Heat Pump

Decide on a suitable location for the Heat Pump. For the 3kW single compressor version this can be in a kitchen cupboard with a minimum width of 600mm. Alternatively both units can be fitted within an utility room. Take into account the "Recommended Clearances" when finalising the location. It will be necessary if installed in a kitchen cupboard that a slot is cut into the cupboard to accept the minimum dimensions of the shoebox to enable the unit to stand on the floor.

Check the appliance for transport damage. Under no circumstances should a damaged appliance be operated or installed.
Position the appliance on a firm, level and substantial concrete base that will absorb vibration well away from any occupied rooms. Ensure that the appliance does not stand on the electrical supply cable. If the supply cable is damaged, it must be replaced.

Ensure all pipes and wires are adequately supported where necessary, pipes are properly insulated and concentrations of inhibitor (where added) are correct. The appliance and any metal pipes should be properly earthed.

A water treatment device should be provided in hard water areas.
External fill loops to the ground array and heating system should be installed and ideally pressure gauges.

Do not use the appliance as a shelf.

4.6.2 Recommend clearances

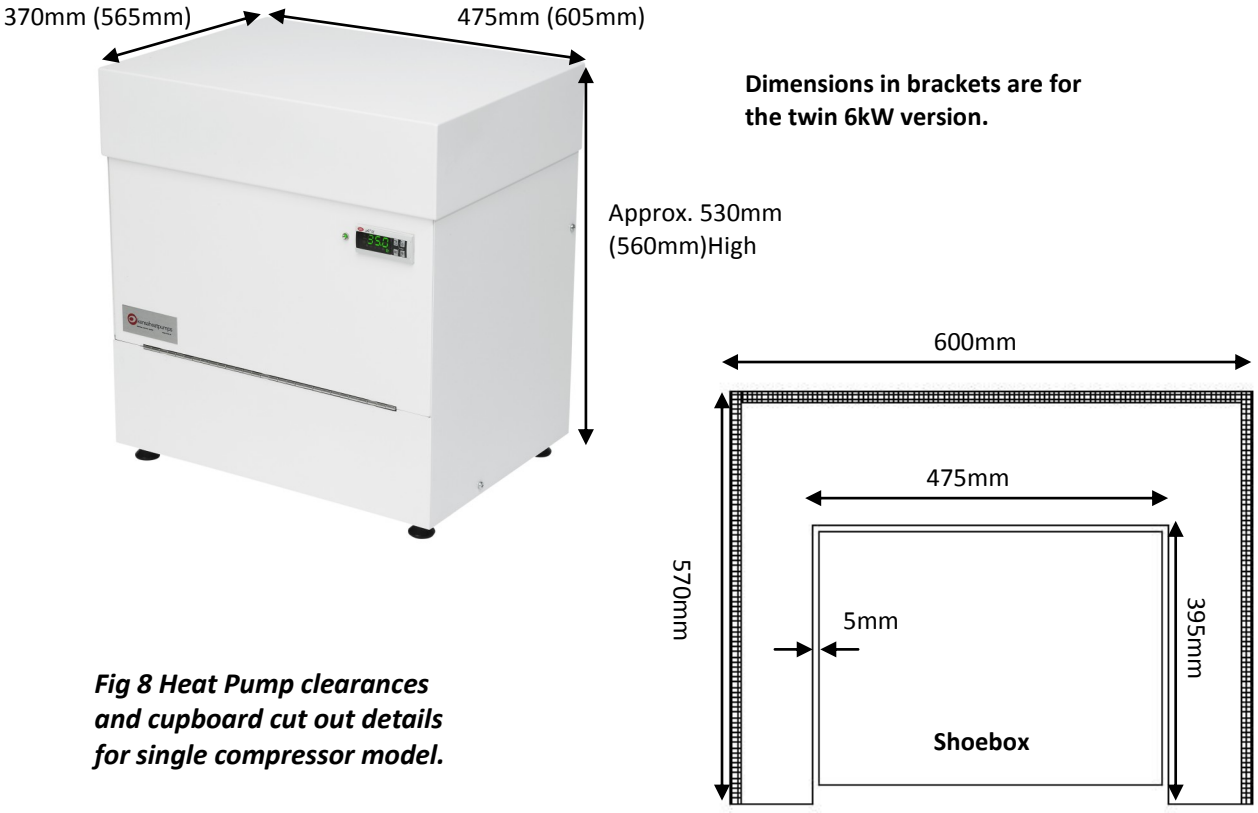


Fig 8 Heat Pump clearances and cupboard cut out details for single compressor model.

4.6.3 Installation of the heat pump

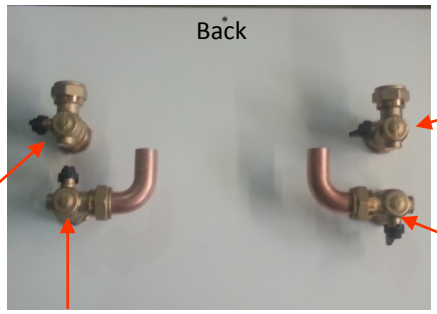
Ideally the heat pump should be placed next to a wall allowing easy access to the ground array manifold. Any pipes internal to the building must be insulated with vapour barrier insulation such as Armaflex.

i. Remove the top of the shoebox heat pump. This is connected via magnets so a short sharp pull of the top forward and up will release this.

Fig 9 Shoebox heat pump top panel

ii. This will now expose the pipe connections and front panel to access the shoebox electronics (See below Fig 10).
iii. Position the appliance on a firm, level and substantial concrete base that will absorb vibration .
iv. Using the adjustable feet, level the unit.
v. Ensure the heating distribution system has been thoroughly purged of any debris.
vii. Connect the cold feed, ground feed & return pipes , feed & return pipes from the underfloor heating manifold ,(which must be connected the correct way round) according to the Illustration below. Flexible hoses are provided with the shoe box to aid in the installation. These hoses should not be directly connected to the connections on the heat pump but used between pipe (i.e. an elbow) connected at the heat pump and the distribution systems (see Fig 11). The flexible pipes can

Fig 10 Shoebox heat pump connections (from the front and above of the unit.)



be fitted in any orientation and work best when slightly curved. The reason for using flexible pipe is that the heat pump is suspended on anti-vibration mounts, so the connections must also be flexible. Ensure there are no kinks within the flexible pipe. Using the stickers provided ensure the flow and return connections are indicated on the manifold.

Fig 10a 90 degree valves shown open (handle points down)

Fig 11 Shoebox with flexi connections

vii. Thread the timeclock/room thermostat wires into the back of the 'Shoebox' and connect them to the terminals required, (see electrical installation section).

viii. For applications where Domestic Hot Water has been specified a 3 port diverting valve ('W' plan) is provided by Kensa and when the timeclock calls for DHW production is used to divert the flow from space heating to an indirect coil in the DHW tank, (See DHW schematic, Section 4.4). The diverting valve should be the first connection in the heat pumps flow line, before any underfloor heating manifolds. The valve's electrical connections are connected to the heat pump's internal wiring. (See 4.7.4)

ix. Check and rectify any leaks that may be in the plumbing system.

x. The appliance should be left for 12 hours after installation before it is turned on, to allow the refrigerant to settle. The area where the heat pump is installed must be dry and rodent free.

4.6.4 Meter Installations

The government is introducing the Renewable Heat Incentive (RHI) to support renewable heat generation in the domestic sector. The scheme will offer tariff payments for supported technologies which include MCS (or equivalent)-certified solar thermal systems, ground source heat pumps, air source heat pumps and biomass boilers or stoves with back boilers for use in the domestic sector.

All RHI installations should be made meter-ready. In addition, in some cases, applicants will require metering for payment in order for their systems to be RHI-compliant, whilst in other cases, applicants could be paid extra for monitoring of system performance.

MCS guidelines make three distinct types of meter installation

> Meter-ready- All RHI installations should be meter-ready for DECC's own metering to be fitted to the site if selected.
>
> Metering for payment- Where a heat pump or biomass boiler is installed alongside certain other heating systems or where the installer is advised that the property is a second home, then the renewable heating system shall be metered in order to receive payment under the RHI.
>
> Metering and Monitoring Service Packages- A Customer may install an optional metering and monitoring service package for either a pellet biomass boiler or a heat pump for which they will receive a financial uplift. The specifications for installation of meters as part of these packages are detailed in this section along with any other requirements in order for the package to be installed in a form that is compliant with the RHI.

For information on Metering for payment and Metering and Monitoring Service Packages it is recommended that the MCS document *MCS Domestic RHI Metering Guidance V1.0* is consulted. The section below covers 'meter ready' installations only.

4.6.4.1 Meter Ready Installations

Some installations incentivised through the RHI will have DECC's own metering fitted where the metering data may then be used to allow DECC to evaluate the effectiveness of the policy and data may be shared with MCS.

DECC intends to install meters to monitor the heat output from a renewable heating system, the energy consumed by those same heat sources, and the heat output from any back-up fossil fuel systems. This could require engineers, appointed by DECC, to install a number of heat meters, electricity meters or other energy meters, depending on the specific heating system and manner of installation. In addition, DECC will install a number of temperature sensors to develop an understanding of the behaviour of a range of heating systems, for example temperature measurement of space heating flow and domestic hot water flow. The sensor outputs will be connected to a logger that will store all readings and regularly transmit them to a centralized secure data source.

All RHI-compliant renewable heating installations should be made meter-ready. MCS installers should:

1) **Leave sufficient space for appropriate meters to be fitted in defined locations; Heat pumps**
The flow meter and return temperature sensor of the heat meter(s) take up the most space and need to be situated on the return pipework between the circulation pump and the distribution system. The required length of straight pipework between isolation valves is 20 times the pipe

Pipe Diameter (mm)	Total length of straight pipework required in return pipe (mm)	Total length of straight pipework required in the flow pipe (mm)
15	300	175
22	440	175
28	560	175
35	700	175
42	840	175

diameter to enable DECC's chosen metering to be installed on the return pipework. The table above shows the length of straight pipe required for a number of standard pipe sizes.

For each location where a heat meter is required, a section of pipe of 175 mm should be left for the heat meter temperature sensor in the flow pipework. This should be no more than 2 m from the flow meter.

2. Install low pressure-drop isolation valves to avoid the need to drain systems when fitting heat meters;

These should be installed at each point where heat metering is required. Heat metering installed between the isolation valves should be able to record the total heat output from the heating system (excluding individual room heaters and immersion heating, the latter of which will be monitored through electricity sensors). Therefore, if there are several return pipes connected to a renewable heating installation, then each one will need to be heat metered, and each one will need to be fitted with isolation valves with sufficient separation to allow heat meters to be installed.

3. Leave sufficient pipework accessible, i.e. not boxed in or under floor boards, to enable meters to be fitted;

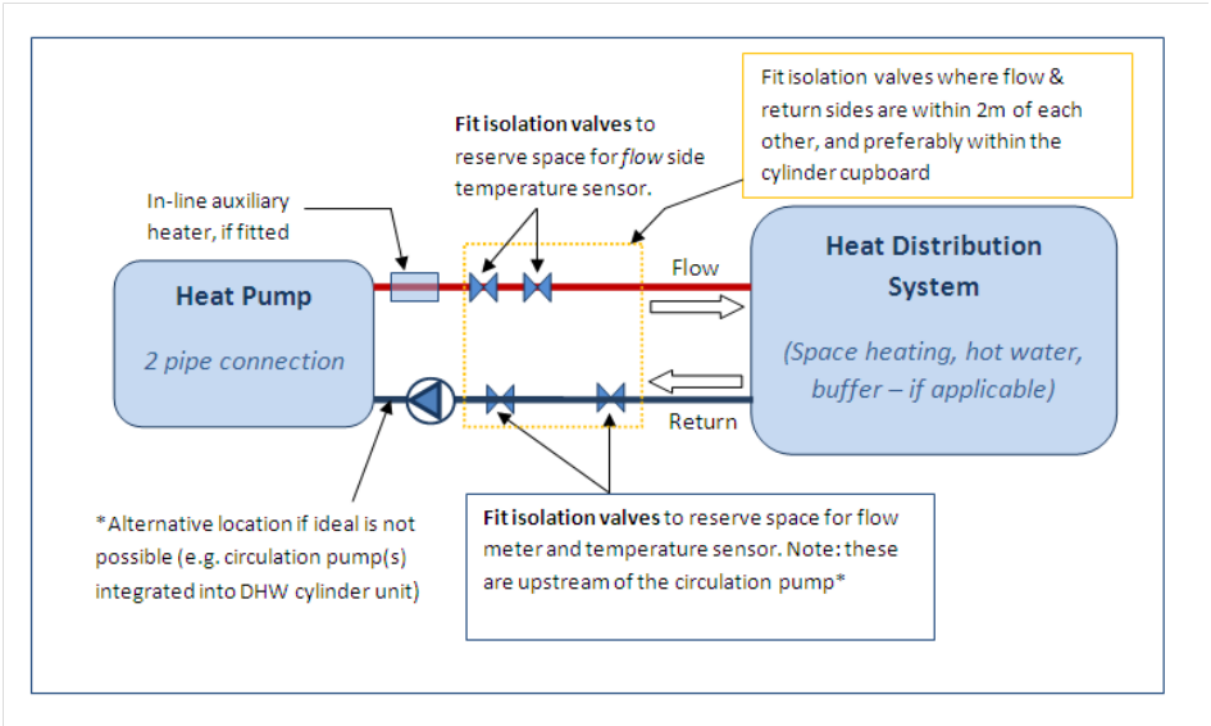


Fig 12 Typical 2 Pipe Heat Meter Installation

Feedback information about the installation

DECC will need to know a number of factors about a site so an application will not be considered to be "meter-ready" if such information has not been provided. The information shall include the following:

To be fed back to MCS through the Compliance Certificates:

Whether it has been possible to make a system meter-ready in accordance with the above requirements and, if not, the reason why;

To be reported to the Customer as part of the document pack (so that the Customer can respond to DECC questions at a later date):

Whether the thermal transfer fluid in any metering location is composed of water or a water/inhibiter/antifreeze mixture and what are the components of the mixture concerned;

Whether the heat pump provides hot water and whether this is also heated with an immersion heater, solar thermal or other system;

Whether the heat pump has a single-phase or three-phase connection.

Notes on making an installation 'meter ready'

Heat meters that have been used by DECC in their metering programmes in the past have required a mains electricity connection. Therefore, at the same time as installing isolation valves for the heat meters, installers should consider the placement of an easily-accessible electricity supply to power the heat meters.

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4.7 Electrical Installation

The Kensa 'Shoebox' heat pump range is available in single phase power supply versions and the single compressor is fitted with a fly lead.

Any electrical work required to install or maintain this appliance should be carried out by a suitably qualified electrician in accordance with current IEE regulations

To access the wiring terminals :-

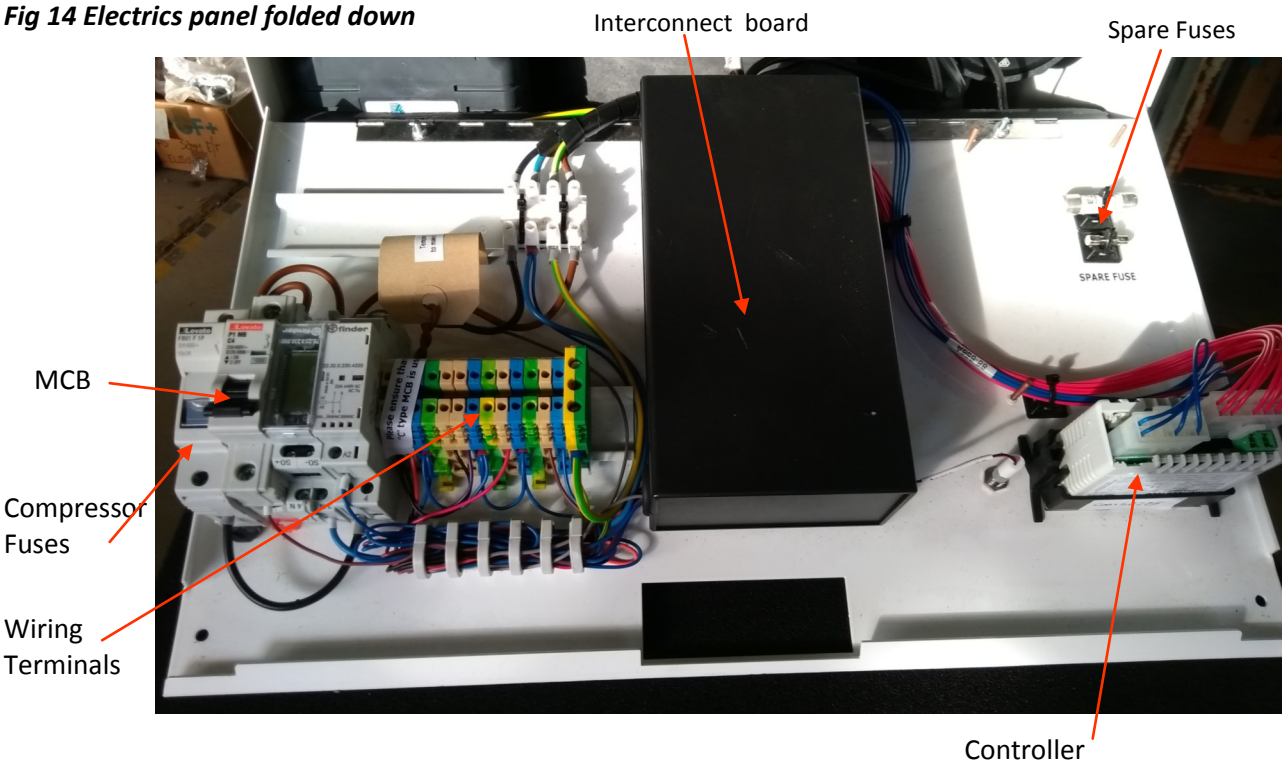
i. remove the top of the shoebox with a short sharp pull forwards and up.
ii. Unscrew the 2 pozi screws on either side of the front panel.

Fig 13 Position of cross head screws on the Electronics cover Plate

iii. Pull the front cover down using the handle.
iv. The wiring terminals will now be exposed.

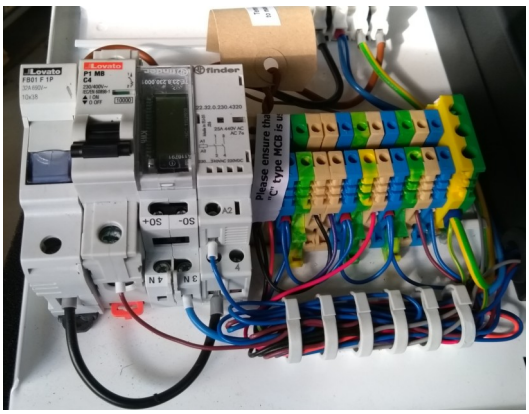
Cables should enter the unit from the back using the cable entry ports provided.

Fig 14 Electrics panel folded down



The following sections detail the wiring connections for various applications.

Fig 15 Shoebox heat pump wiring loom



4.7.1 Single Underfloor Control Unit

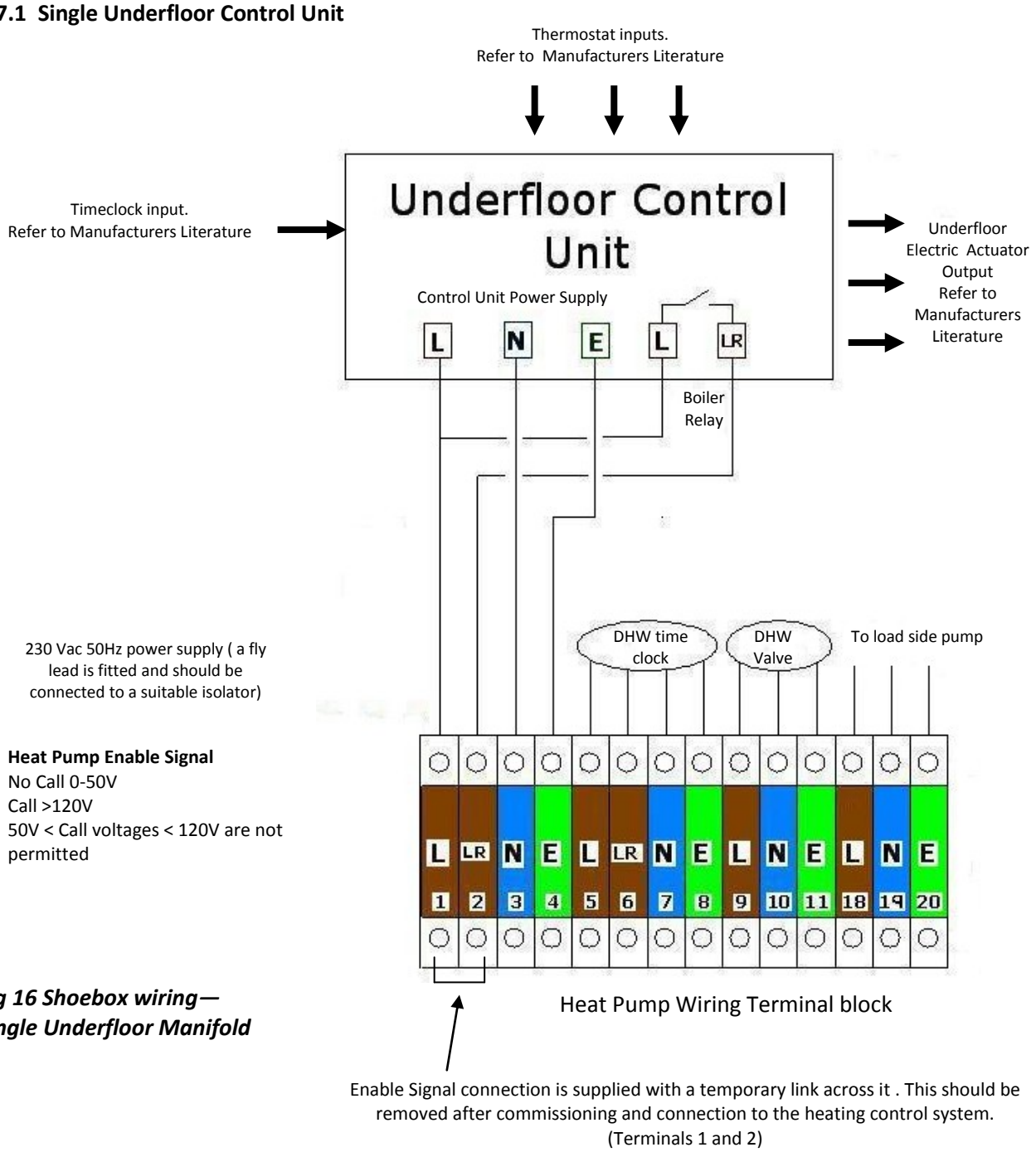


Fig 16 Shoebox wiring— Single Underfloor Manifold

4.7.2 Multiple Underfloor Control Units

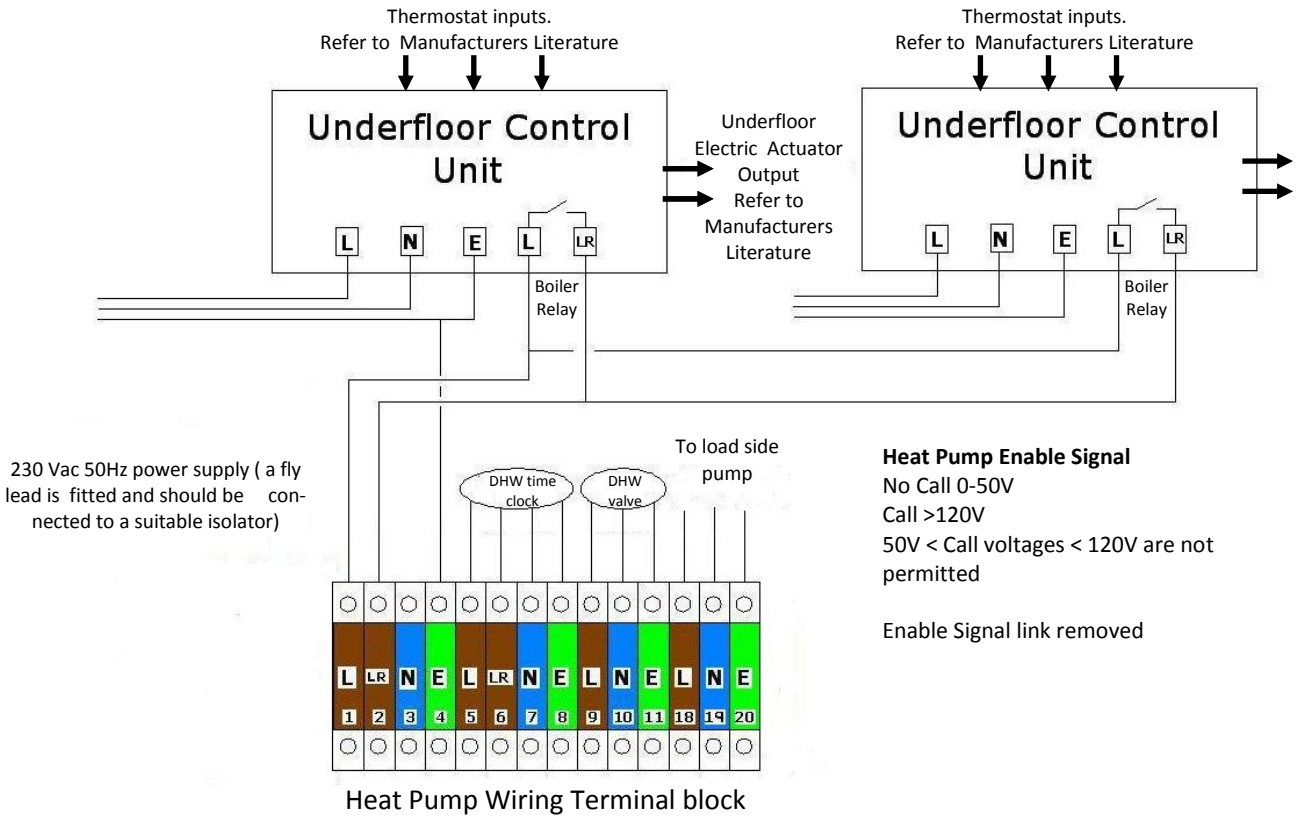


Fig 17 Heat Pump Wiring—Multiple Underfloor Control Units

4.7.3 Radiator with Thermostat

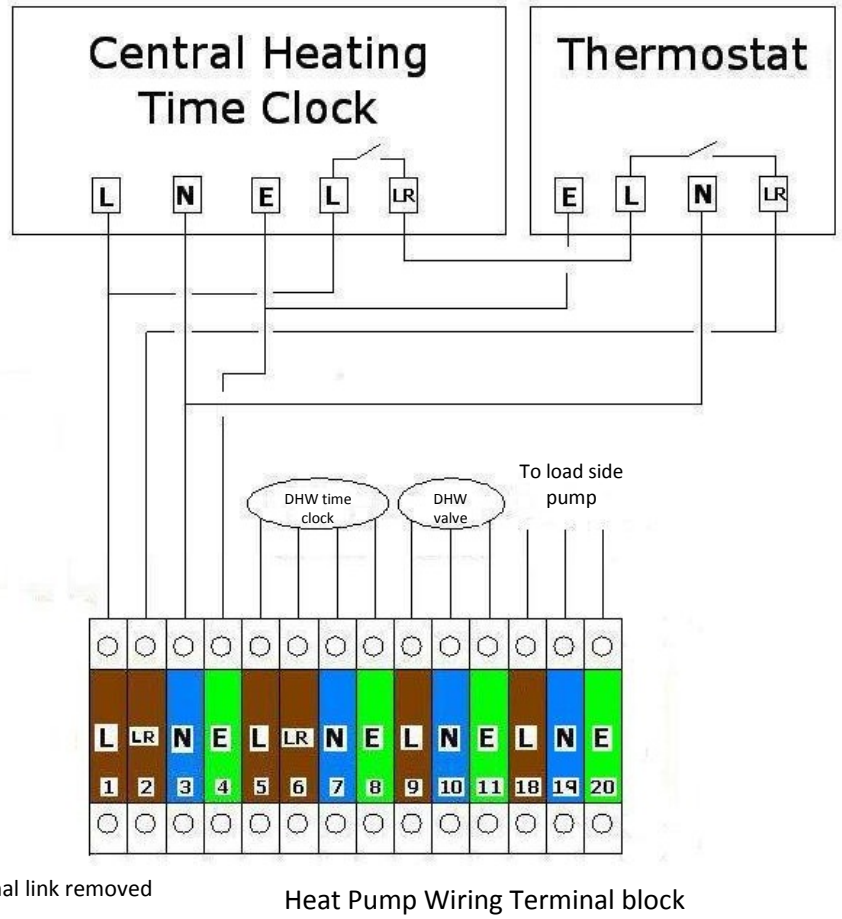


Fig 18 Heat Pump Wiring—Radiators with Thermostat

4.7.4 DHW time clock and 3 way diverting valve wiring

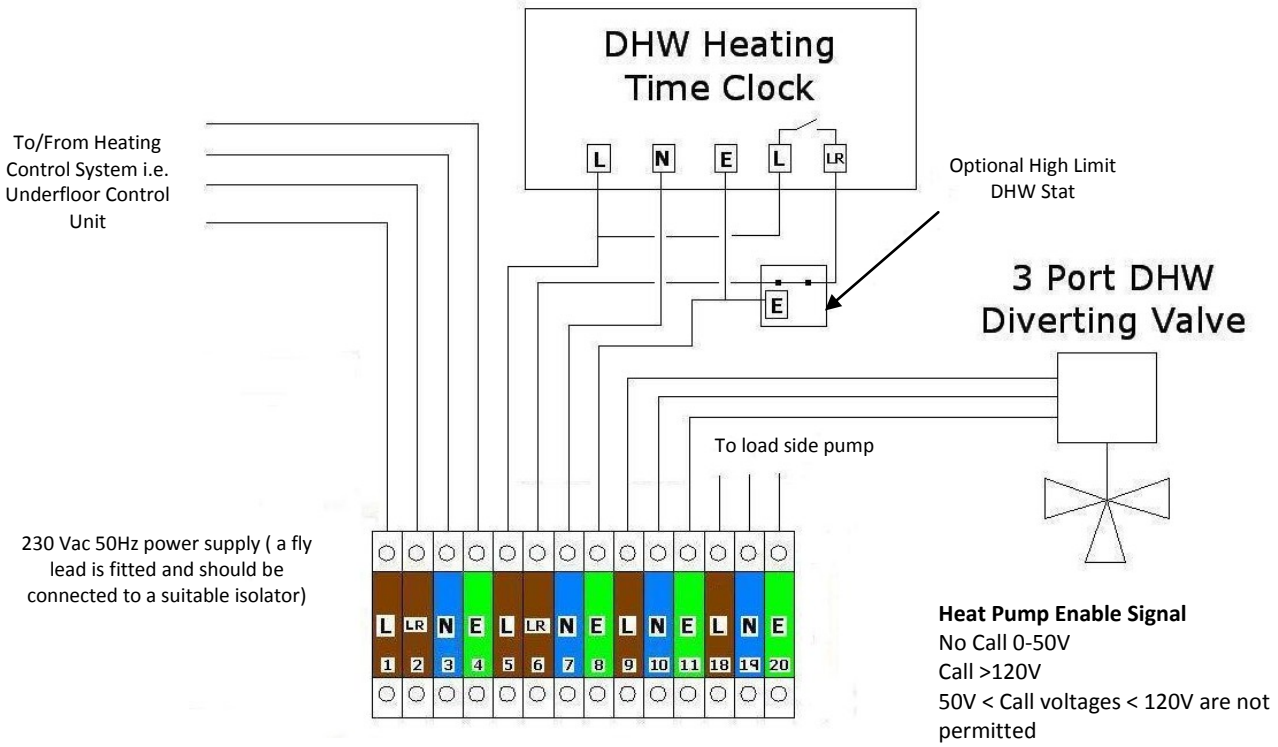


Fig 19 Heat Pump Wiring—DHW

Note: The hot water cylinder high limit stat maybe required to be wired into the live return from the DHW Heating Time Clock.

5.0 Communal Ground Array

Kensa has pioneered the development of a new patented system architecture for ground source heat pumps known as D-VA. The District-Vertical Array system features a communal ground array linked to individual ground source heat pumps installed within each dwelling. It is ideally suited for the shoebox heat pump and for multiple properties within one building such as apartments.

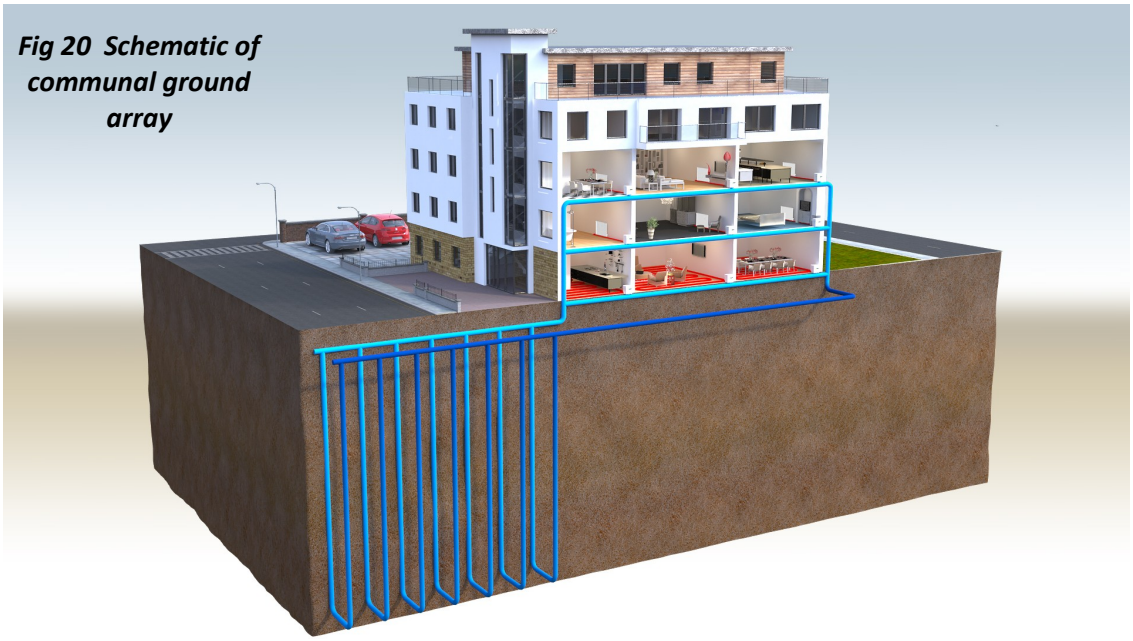


Fig 20 Schematic of communal ground array

As the ground array is a key critical component of the installation it is important that it is designed and installed by specialists.

The distribution pipework needs to be designed in a reverse return configuration as this ensures equal flow throughout the building.

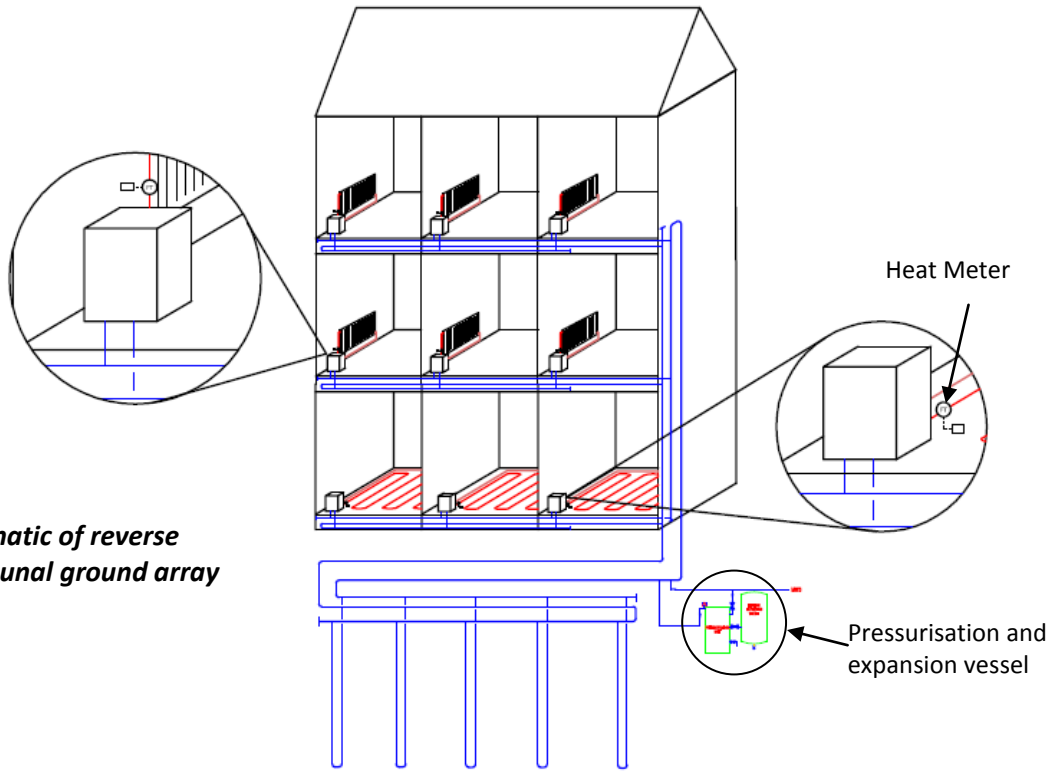


Fig 21 Schematic of reverse return communal ground array

To avoid issues with air within the ground array distribution pipework it is important that an automatic deaerator is fitted on any high point within the system where air can collect, such as the top of the riser.

The shoebox heat pump contains an integral source water pump which draws the thermal transfer fluid from the communal ground array. Due to this no central pumping station is required on the system. It is important however that a pressurisation and expansion set is fitted to the ground array to ensure that as air is removed from the system the fluid content and pressure is maintained.

The ground array pipework should be insulated using insulation suitable for chilled water systems. This will avoid any issues with condensation forming on the pipe within the building .

Use of the D-VA communal ground array allows access to the RHI phase 1 commercial funding stream. If this funding stream is being accessed, heat meters (to an agreed accuracy specification) are required to be fitted on the outlet of each shoebox heat pump and readings taken by the management company for submission to Ofgem. Payments will also be one payment to the applicant (which is assumed to be the management company). For further information please refer to the Ofgem website.

6. Commissioning

After all mechanical and electrical work has been completed, the following commissioning instructions should be followed.

6.1 Purging the ground array of air.

It is important for correct operation that all the air is removed from the ground arrays and heat pump. Deaerators should be fitted at all high points of the system to ensure that any air within the pipe is removed.

A pressurisation and expansion set should also be fitted onto the ground array to ensure that the fluid content and pressure is maintained within the system.

Once all the air has been removed the commissioning process can continue.

6.1.2 Testing of Antifreeze Concentration

It is important that the concentration of the antifreeze within the ground arrays should be a minimum of a protection level of –10°C (minimum 22% by volume, Refractive Index 1.356). Concentrations below this could cause an A1 alarm and the heat pump to cease operation during severe prolonged cold weather.

The antifreeze concentration should be tested with a refractometer .

The concentration of antifreeze is required for the commissioning certificate and it is advised that this figure is noted in the settings table. To comply with MCS guidelines two random samples of anti-freeze concentration should be taken when the ground array is commissioned.

6.1.3 Heating distribution and load side purging

i. Find the cold fill for the heating system and open the valve on the heating system to allow water into the heating system and the Shoebox.
ii. Ensure a load side water pump is fitted and operational.
iii. Follow the manufacturer's procedures for purging the heating system.

We recommend a central heating inhibitor is added to the heating water in the heating distribution circuit.

6.1.4 Reassembling the Heat Pump

i. Ensure all tools and materials are removed from the inside of the unit.
ii. Reposition the front panel
iii. Using the 2 x 5mm cross headed screws secure the front cover in place.
iv. Replace the top of the unit.

6.2 Heat Pump Operation

Prior to use: -

i. Turn off the power supply at the local isolator

ii. Unscrew the 2 pozi screws on either side of the front panel. Lower the front panel.

iii. Check that the ground pressure is at least 0.6 bar. If the pressure is lower than this, find the ground array cold water supply valve (fitted by others, outside the case) fully until the pressure is at least 1.8 bar, at which point a “click” will be heard. Close the mains cold water supply valve fully.

iv. Check that the heating distribution system pressure is at least 0.6 bar. If the pressure is lower than this, find the mains cold water supply valve and pressurize the system until the pressure is at least 1.8 bar, at which point a “click” will be heard. Close the mains cold water supply valve fully. Reassemble the front panel taking care to ensure that the 2 x cross head screws are located correctly.

v. Turn on the power supply at the local isolator and program the external timeclock / thermostat.

6.3 Turning the Heat Pump on for the first time.

i. Make sure the impellor in the ground water pump is free to turn by removing the stainless steel screw in the centre of each water pump and inserting a flat-bladed screwdriver to spin the impellor. Do not try to spin the impellor with the power on.

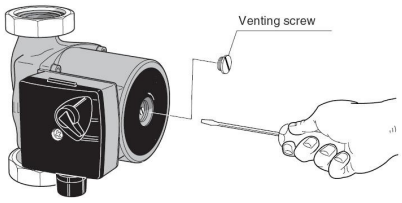


Fig 22 Spinning the pump

ii. Disconnect the fuse to the compressor (as shown on Fig 14) Turn the Shoebox on to enable the controls and water pumps to operate. **DO NOT operate the compressor fuse until Kensa Heat Pumps has been contacted and flow has been confirmed around the system.** Failure to do this could cause the unit to freeze and may invalidate the warranty. Once flow has been confirmed, turn the power off and replace the compressor fuse. Turn the power back on.

iii. The controller display will read the temperature of the water returning from the heating system. If the error Tp is displayed, then the heat pump will not run until both heating distribution and ground circuits are above 1.8 bar pressure.

iv. The commissioning of the heat pump will be carried out remotely (via phone) by a Kensa commissioning engineer and a heat pump commissioning certificate and checklist issued on completion. Please contact Kensa Heat Pumps to book a commissioning call.

v. After commissioning and connection to the heating control system (with the power isolated) remove the enable link between terminals 1 and 2 and replace with building control system.

6.4 Altering the flow temperature from the heat pump

Each heat pump has a dedicated display which can be interrogated to view various parameters, alter the heat pump outlet flow temperature and indicate faults/alarms.

n.b. the numbers above refer to the points below.

Fig 23 Heat Pump Display

The display normally reads the temperature of the water returning from the heating distribution system. The controller will turn the heat pump off once a pre-set temperature of water returning from the heating system has been achieved. This setting is normally 30 Deg C , which is a typical return temperature for an underfloor application.

The Kensa Shoebox Range of heat pumps are delivered with the software pre-configured for a typical underfloor mounted in screed application.

1. The display on the controller indicates the return temperature of the underfloor circuit.
2. The left hand symbols, sun indicate heating (The shoebox is only available for heating applications.)

Sun symbol—heating mode

Compressor running

3. A number"1" and/or "2" will appear in the top right of the controller this is to indicate the compressor number. If the number "1" and/or "2" is flashing the internal timer is activated and the compressor is waiting to run. When the compressors are running the number "1" and/or "2" and the compressor run symbol will be on.

A flashing error code may appear if there is a fault with the heat pump, the most common will be: -

Alarm	Description
TP	Low water pressure (ground or heating distribution)
HP	High gas pressure caused by low or no flow on the heating distribution circuit.
LP	Low gas pressure fault (can occur temporarily on first start up). Call Kensa Technical Department.
A1	Anti freeze alarm, ground getting too cold / insufficient anti freeze/ unit not commissioned correctly/ low flow around ground array

(See Fault Finding Section 7 for further details)

6.4.1 To read flow temperatures and refrigerant pressures

Using the display it is possible to interrogate the heat pump to read flow temperatures and refrigerant pressures.

To read flow temperatures and refrigerant pressures: -

1 Press and hold SEL until -/- is displayed
2 Press the UP arrow until -b- is displayed
3 Press SEL and b01 is displayed
4 Press SEL
5 Temperature of water returning from the underfloor is displayed = b01
6 Press SEL
7 Press the UP arrow once until b02 is displayed
8 Press SEL
9 Temperature of water returning from ground arrays is displayed = b02
10 Press SEL
11 Press the UP arrow once until b03 is displayed
12 Press SEL
13 Temperature of water going out to the ground arrays is displayed = b03
14 Press SEL
15 Press the UP arrow once until b04 is displayed
16 Press SEL
17 Refrigerant pressure (in Bar) is displayed = b04
18 Press SEL
19 Press PRG twice until S-P is displayed
20 Press and hold PRG until the display returns to normal

6.4.2 To change the heat pump return flow temperatures.

Heat pumps are generally controlled on the return temperature from the heating distribution system and work on a temperature differential of approximately 5 degrees, i.e. if the return temperature set point is 30^{o}C the actual flow temperature out of the heat pump is approximately 35^{o}C.

The outlet flow temperature of the heat pump determines the efficiency of the heat pump.

For underfloor systems mounted in screed a flow temperature of 35^{o}C is generally suitable, therefore the return temperature should be set at 30^{o}C. However for joisted systems or systems with insulative floor

coverings then a higher flow temperature may be required and hence the return flow temperature set point may need to be increased.

For radiator systems a flow temperature of 50°C is generally required. This means the return flow temperature set point should be set to approximately 45°C

Warning :- Increasing the outlet flow temperature of the heat pump will result in the unit operating at a lower efficiency with higher fuel bills.

Warning :- for underfloor systems do not increase the outlet flow temperature until the screed that the underfloor is mounted in is fully dry.

Programming can be carried out on the controller

Changing the flow temperatures is protected by a passcode to prevent unauthorised changes. This pass-code is 11 and not changeable.

1 Press and hold PRG and SEL until 00 is displayed.
2 Using the UP arrow increase the displayed number to 11
3 Press SEL (S-P is displayed)
4 Press SEL and -/- is displayed
5 Press the UP arrow until -r- is displayed
6 Press SEL and r01 is displayed
7 Press the UP arrow until r03 is displayed
8 Press SEL
9 The return water temperature setpoint is displayed
10 Press the UP or DOWN arrows to change the setpoint
11 Press SEL
12 Press PRG twice until S-P is displayed
13 Press and hold PRG until the display returns to normal

It is advised that any settings that are changed are noted within Section 9 'Heat Pump Settings Sheet' page 32.

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7. Fault Finding

Many faults which occur on commissioning are found to be due to incorrect wiring or setting up, therefore it is recommended that a thorough check is carried out should there be a problem.

Symptom	Possible Cause	Action
Blank display on software controller	No power supply	Check Fuse in plug and replace if necessary. Check wall mounted electrical isolator switch or call electrician
	Controls MCB tripped	Call electrician to investigate cause
	There is no call from the time-clock or thermostat for heat pump operation	Programme time-clock according to manufacturer's instructions
Compressor not running but display reading temperature near setpoint	Heat pump is up to temperature	No fault
Display flashes fault code tP	Low water pressure in the ground or heating system side due to pipe relaxation or other pressure loss.	The pressures should be between 1 and 2 bar. If below this, the pressure needs to be increased above 1.8 bar To increase the pressure in either circuit, the cold fill valve will need to be opened.
Display flashes fault code HP	Overheat warning. No or low flow around heating distribution circuit because of air in water pump, or stuck water pump impellor, or heating distribution system valves/ actuators closed. HP can also be temporarily displayed when the heat pump reverts from DHW to space heating mode.	Check that the water pumps are operational and spin the impellors. (See section 6.3) No action
Display flashes fault code LP	Low gas pressure in machine. Can occur simultaneously with an A1 alarm. Can occur temporarily on first start up when unit is new or after a long period out of use. Insufficient antifreeze added and heat pump frozen.	Check that the water pump is operational and spin the impellors (see section 6.3) If symptom persists outside of the two listed circumstances, contact Kensa Technical department. No action Allow heat pump to defrost and add the correct antifreeze quantity.
Display flashes fault code A1	Freeze protection system activated. Low or no water flow on the ground (cold) side of the machine. Can also occur after many months of running in very cold weather.	Check antifreeze has been added and unit commissioned correctly. Check that the water pump is operational and spin the impellors (see section 6.3) Ensure no flow restrictions and wait approximately 4 hours (with the machine turned off) for automatic reset.
Display flashes fault code E1, E2, E3 or E4	Loss of contact with probes inside heat pump. E4 could be loss of contact with weather compensation sensor	Refer to Kensa Technical department

8. Warranty

The Kensa Compact Ground Source heat pump is designed and built to the highest standard and as such is guaranteed for 5 years for parts from the date of commissioning or 5 ½ years from the date of manufacture (excluding the internal water pumps and electrical components), whichever is shorter. Internal water pumps (ground side) and electrical components are guaranteed for 2 years for parts from the date of commissioning or 2 ½ years from the date of manufacturer, whichever is shorter.

8.1 Terms and Conditions.

8.1.1 Persons covered by the Warranty

The Warranty applies to the original purchaser and any subsequent owner of the item.

8.1.2 Validity period of the Warranty

The guarantee period (excluding the water pumps and electrical components) is five years calculated from the commissioning date stated on the commissioning certificate or 5 ½ years from the date of manufacture, whichever is shorter. For the water pumps and electrical components it is 2 years from the commissioning date stated on the commissioning certificate or 2 ½ years from the date of manufacture, whichever is shorter.

8.1.3 Scope

Kensa Heat Pumps Ltd warrants to the original purchaser and any subsequent owner of the it ("Buyer") that all parts ("Parts") of the Kensa Compact Ground Source Heat Pump, excluding accessories, shall be merchantable and free from defects in materials and workmanship appearing under normal working conditions.
Kensa Heat Pumps Ltd will, at its option and without charge to the Buyer, replace or repair any Parts which cause the Kensa Compact Ground Source Heat Pump to be inoperable; however, if Kensa Heat Pumps Ltd elects to provide replacement Parts, it shall not be obligated to install such replacement Parts and the Buyer shall be responsible for all other costs, including, but not limited to, shipping fees and expenses.
The warranty applies to faults originating inside the item.

8.1.4 General exceptions

Compensation is not provided for:
- consequential losses
- damage caused by normal wear and tear, inadequate maintenance or care
- damage caused by freezing
- damage of the unit due to non-approved or incorrect quantities of antifreeze being used in the ground side, incorrect flowrates or air in the system
- damage caused by power surges, incorrect supply voltage or lightning strikes.
- cost of inspecting, adjusting or cleaning the item, unless this relates to damage that is eligible for compensation
-minor damage (e.g. scratches and marks) that does not affect the operation of the item
-damage covered by insurance
-indirect damage
-loss or damage caused by gross negligence or intent, misappropriation, fraud or similar crime against property, breach of trust or fraudulent conversion.
-products that have been: altered; subject to misuse, negligence, accidental damage, abnormal use or service; operated or installed in a manner contrary to Kensa Heat Pumps Ltd published or written

instructions.
-products subjected to abrasion or corrosion
-products operated in connection with any liquid source that contains impurities which are corrosive to copper
-products operated in a temperature range inconsistent with Kensa Heat Pumps Ltd's published or written recommendations

8.1.5 Care of Duty

The product must be handled with normal care and attention to minimise the risk of damage or loss.

8.1.6 In the event of Damage

The installing contractor ("Contractor"),or, if the installing Contractor is not available, Kensa Heat Pumps Ltd must be notified of any damage immediately and no later than six months after you first became aware of the damage. The commissioning certificate received on installation should be appended to the claim. If a claim for compensation is made after the deadline specified above or if a commissioning certificate cannot be produced, the guarantee shall not apply.

8.1.7 Replacement Parts

Kensa Heat Pumps Ltd's warranty obligations with respect to replacement parts are identical to those with respect to original parts; provided, however, in no event shall the warranty term for such replacement parts extend beyond the term established by the commencement date (i.e. commissioning date) of the warranty under which Kensa Heat Pumps Ltd was obligated to provide such replacement parts. Kensa Heat Pumps Ltd shall have the right to retain possession or dispose of any parts replaced by it.

9. Heat Pump Settings Sheet

Type of ground arrays	
Ground Arrays purged	
Ground arrays leak tested according to BS805 Section 11.3.3.4	Yes / No
Antifreeze quantity	
Antifreeze concentration	Sample 1 Sample 2
Serial Number	
Visual Inspection	
Feet level on floor	
Visual check of site wiring	
Software operating	
Software errors	
Heating Status	
Ground water pressure	
Underfloor water pressure	
Make of underfloor heating	
Manifolds	
Any UFH water pumps	
Control philosophy	
B01 underfloor return temperature	
B02 ground return temperature	
B03 ground feed temperature	
B04 evaporating pressure	

Comments:

Installed by:-

Date:-

Tel:-