Shoebox Heat Pump

Installation Manual

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1. Introduction—a message from the CEO

Kensa Heat Pumps has been manufacturing Ground Source Heat Pumps since 1999. Our mission is to enable mass decarbonisation of heat using our award-winning heat pumps.

A key part of the Kensa heat pump's design is simplifying the installation process to allow any competent plumber to perform the work rather than needing specialist skills. The purpose of this manual is to guide you through the installation process, and we've worked to ensure all the required information has been provided to allow you to connect the heat pump.

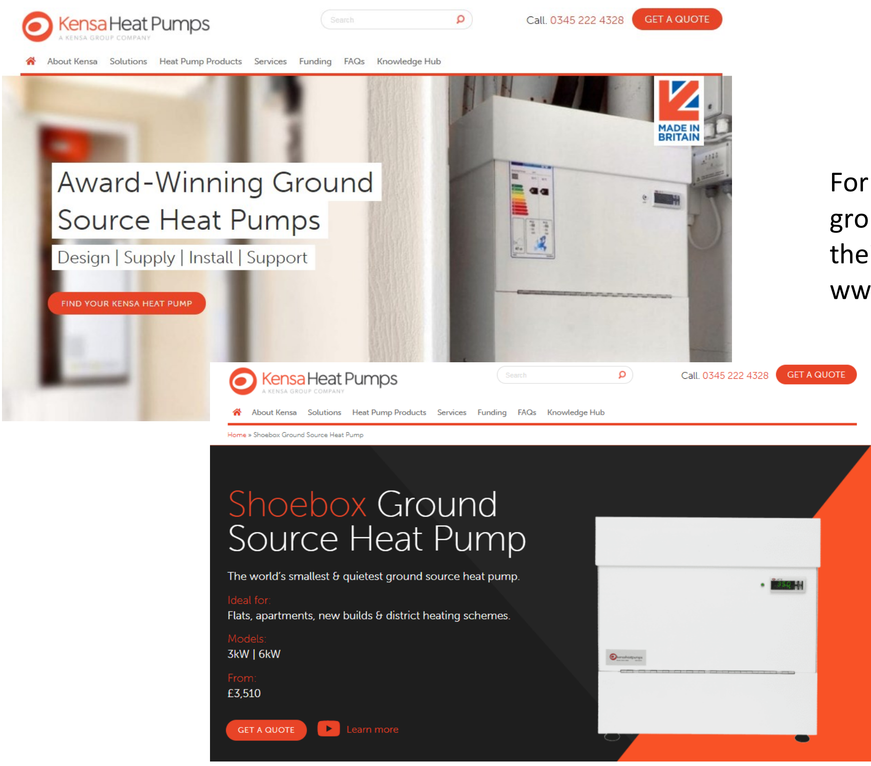
Critical instructions to ensure you do not experience any difficulties are highlighted in the 'Golden Rules' in the installation section.

Please speak to the Technical Support Team on 0345 222 4328 to receive our free-of-charge 'online commissioning' service. Opening hours are 8.00 am to 5.00 pm.

Finally, we'd love to hear from you if you have any questions, wish to consider ground source heat pumps for any future projects, or even just to share your experiences of using ground source heat

Tamsin Lishman

CEO
Kensa Group Ltd



For further information on ground source heat pumps and their application, please refer to www.kensaheatpumps.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 0345 222 4328
www.kensaheatpumps.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 and Egress

Ensure safe access and egress 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.

This symbol on the product indicates that this product must not be disposed of with your other household

waste. Instead, it is your responsibility to dispose of your waste equipment by handing it over to a designated collection point for the recycling of waste electrical equipment. The separate collection and recycling of your waste equipment at the time of disposal will help to conserve natural resources and ensure that it is recycled in a manner that protects human health and the environment. For more information about where you can drop off your waste equipment for recycling, please contact your local city office, your household waste disposal service or the company where this product was purchased.

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).

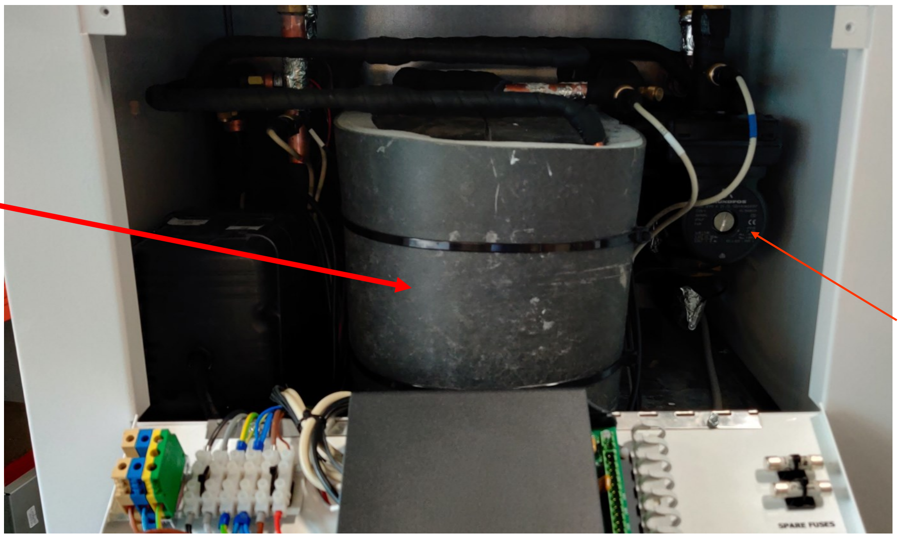


Fig 1. The internals of a twin compressor shoebox heat pump

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	Nominal 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	16	7	4	30	2.5	0.8	62	Single	515x480x360	3/4” BSP Parallel with 22mm Adaptor valves	0.75
6.0	25	14	8	34	2.5	1.6	113	Twin	585x610x595		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 with pole isolation of at least 3mm.
10. Existing heating systems should be power flushed and inhibitors should be added.
11. Ideally use a type C breaker, however a type B is acceptable.

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% .

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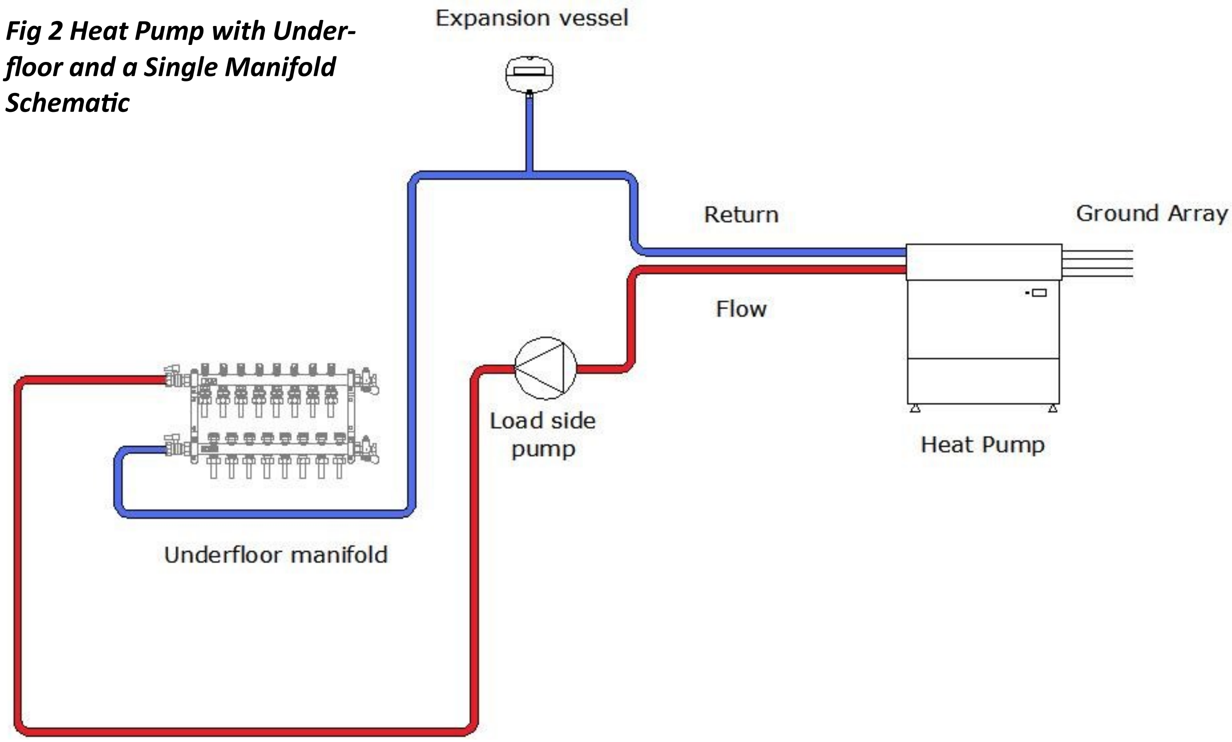
4.2.1 Underfloor with a single manifold. Space heating only

Fig 2 Heat Pump with Underfloor and a Single Manifold Schematic



4.2.2 Underfloor with multiple manifolds. Space heating only

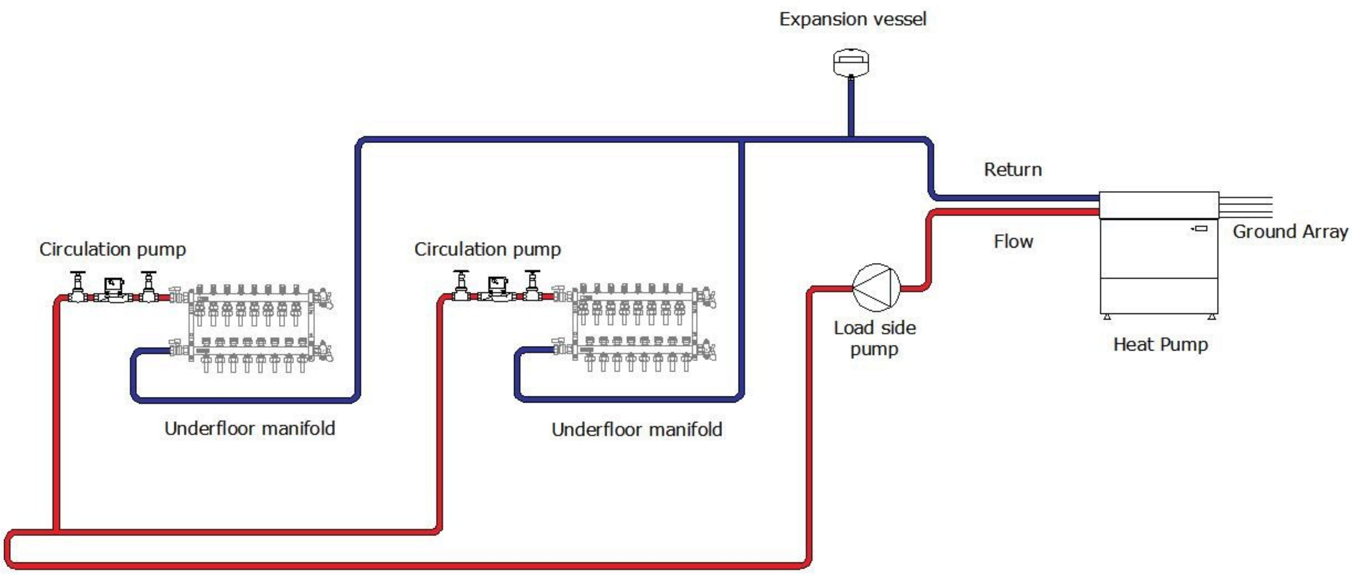


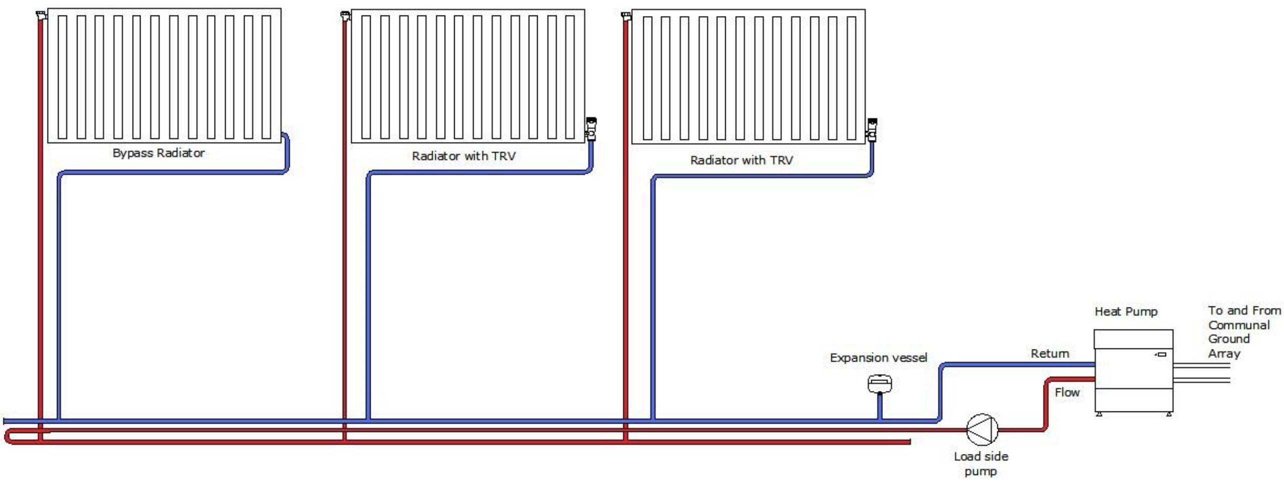
Fig 3 Heat Pump with Underfloor and Multiple Manifolds Schematic

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. The installer/end user should check if this pasteurisation is required by local regulations, bearing in mind that there are often different rules for installations in rented or commercial properties.

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. DHW should be produced at times of low cost electricity and times when the space heating demand is lower, ie during the period of 2am to 6am and 1pm to 4pm.

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.

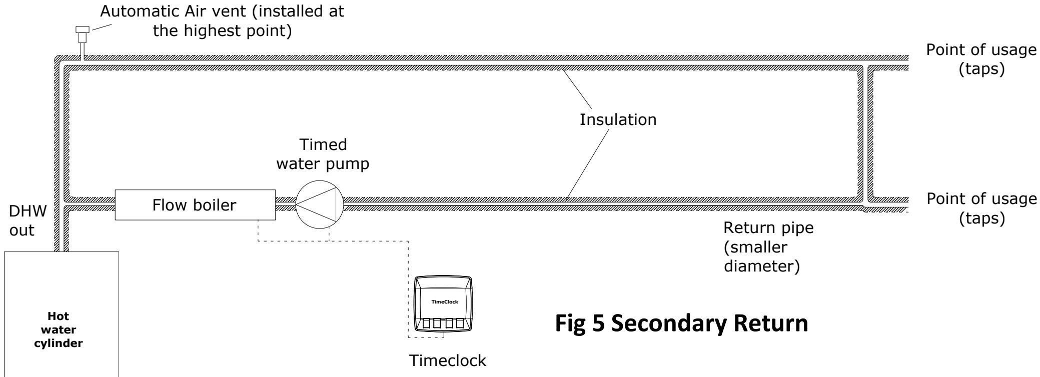


Fig 5 Secondary Return

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.

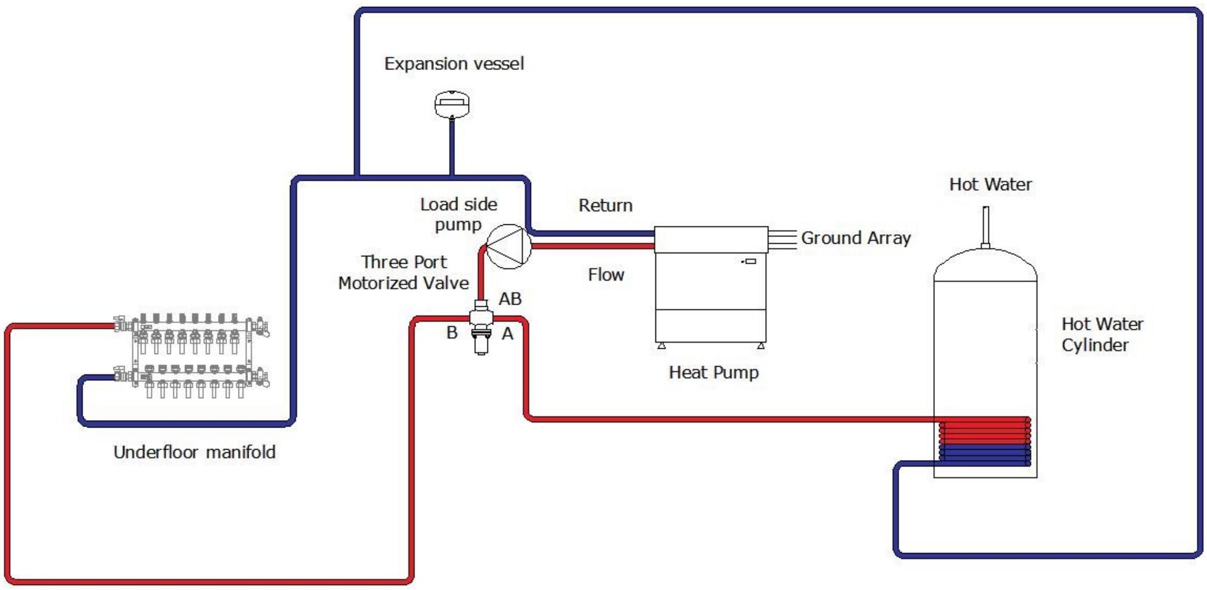


Fig 6 Underfloor with a single manifold and DHW Schematic

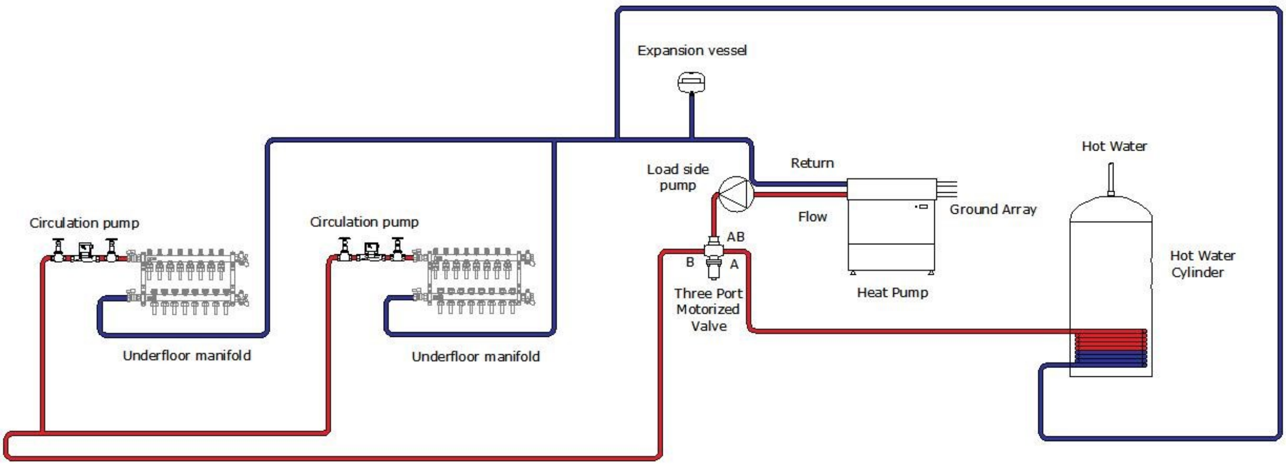


Fig 7 Underfloor with multiple manifolds and DHW Schematic

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

4.5 Buffer Vessel Installation

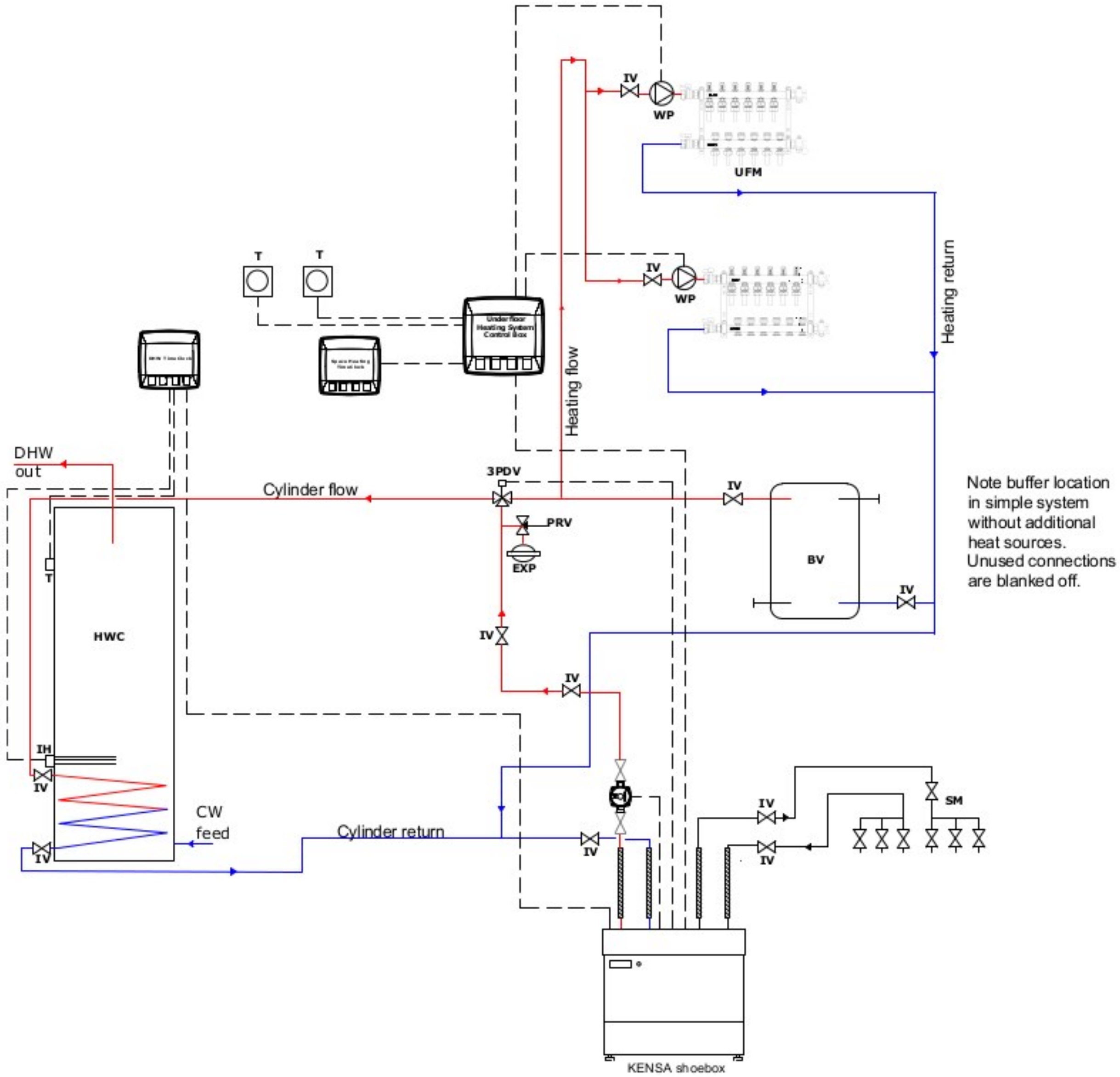


Fig 8 DHW with underfloor and a buffer vessel

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.

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 that the shoebox is accessible in case access is required.
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.
Any damaged cables should only be replaced by a qualified person.

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.
Filling loops should not be left connected under normal operation.
Do not use the appliance as a shelf.

4.6.2 Recommend clearances

Dimensions in brackets are for the twin 6kW version.

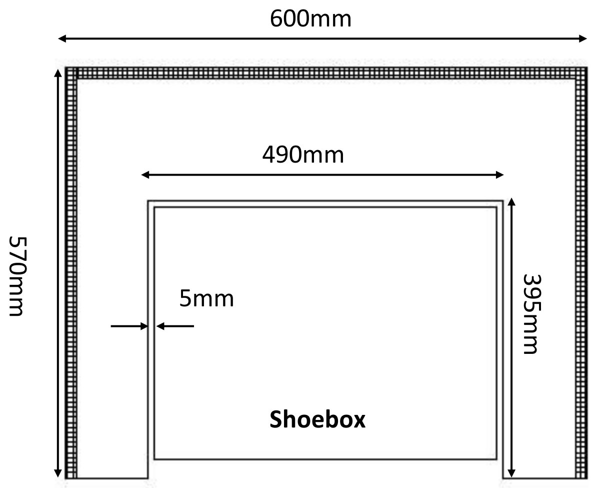


Fig 9 Heat Pump clearances and cupboard cut out details for single compressor model.

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 10 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).

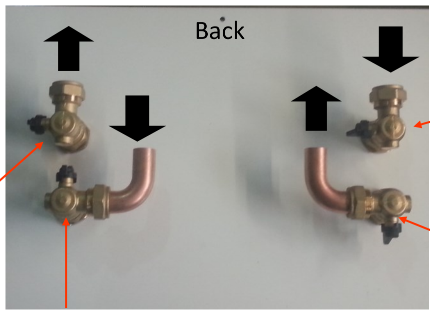
iii. Position the appliance on a firm, level and substantial concrete base that will absorb vibration .

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



From ground array system to heat pump (return) 3/4” parallel BSP thread

To heating system from heat pump (flow)

To ground array system (supply) 3/4” parallel BSP thread

From heating system to heat pump (return) 3/4” parallel BSP thread

Fig 12 90 degree valves shown open (handle points down)

Fig 13 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.

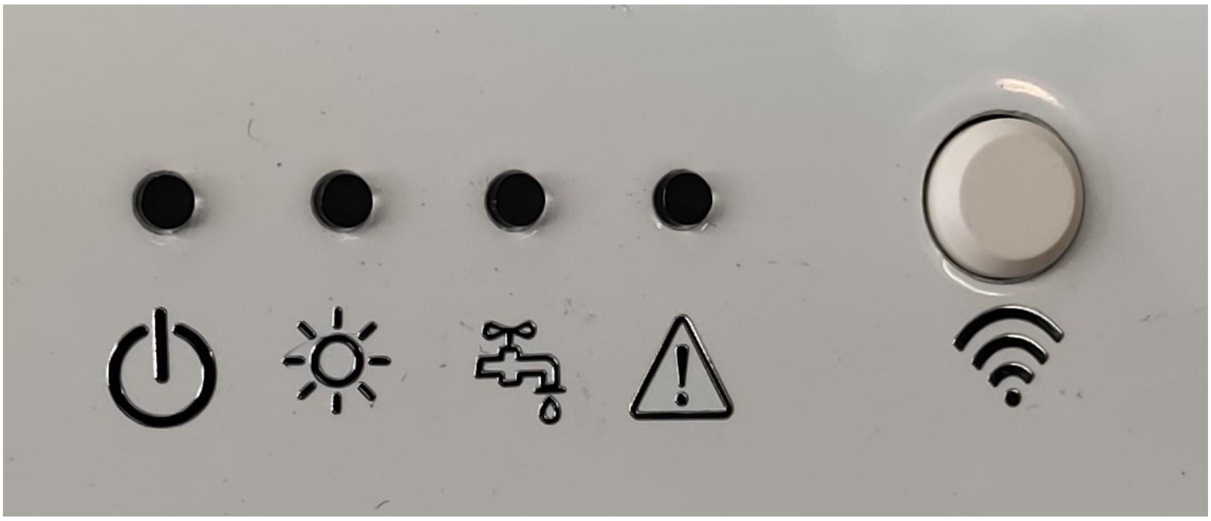


Fig 14 Shoebox LED Lights

Symbol	Colour	Status	Description
Power	Green	solid	Heat Pump controls are powered
Sun	Yellow	solid	Space heating - zone 1
Sun	Yellow	Flashing	Space heating - zone 2
Tap	White	Solid	Domestic Hot water mode
Tap	Blue	Flashing	Soft Access Point connection is open
Tap	White & Blue	Both flashing	Function Test mode
Error	Red	Flashing	Number of flashes represent error code
WiFi	Button		Press for 3 second until blue LED is flashing to enable AP mode

4.6.4 Meter Installations

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

4.6.4.1 Meter Ready Installations

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

BEIS may 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 BEIS, 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, BEIS 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.

It is good practice that all 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 diameter to enable BEIS'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;**

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

<u>Notes on making an installation 'meter ready'</u>

Heat meters that have been used by BEIS 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.

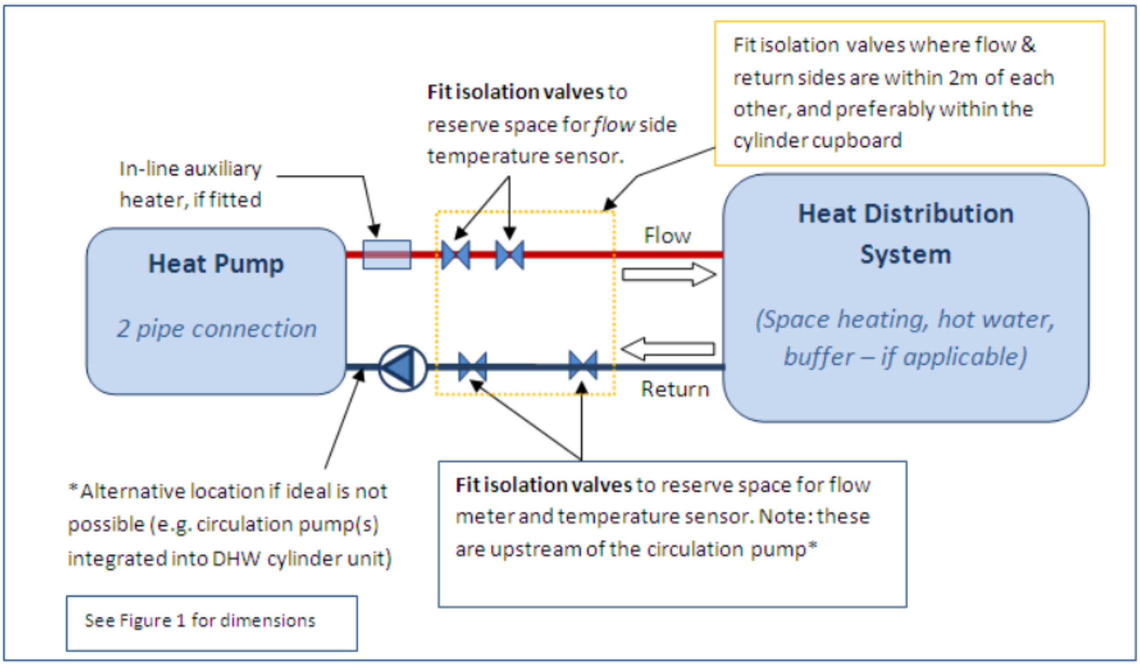


Fig 15 Typical 2 Pipe Heat Meter Installation

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. The shoebox is intended to be fixed to permanent wiring.

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.

2 x 5mm cross head screws

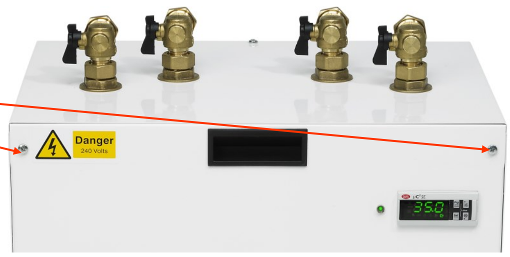


Fig 16 Position of cross head screws on the Electronics cover Plate

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 17 3kW Electrics panel folded down (lid removed from PCB box)

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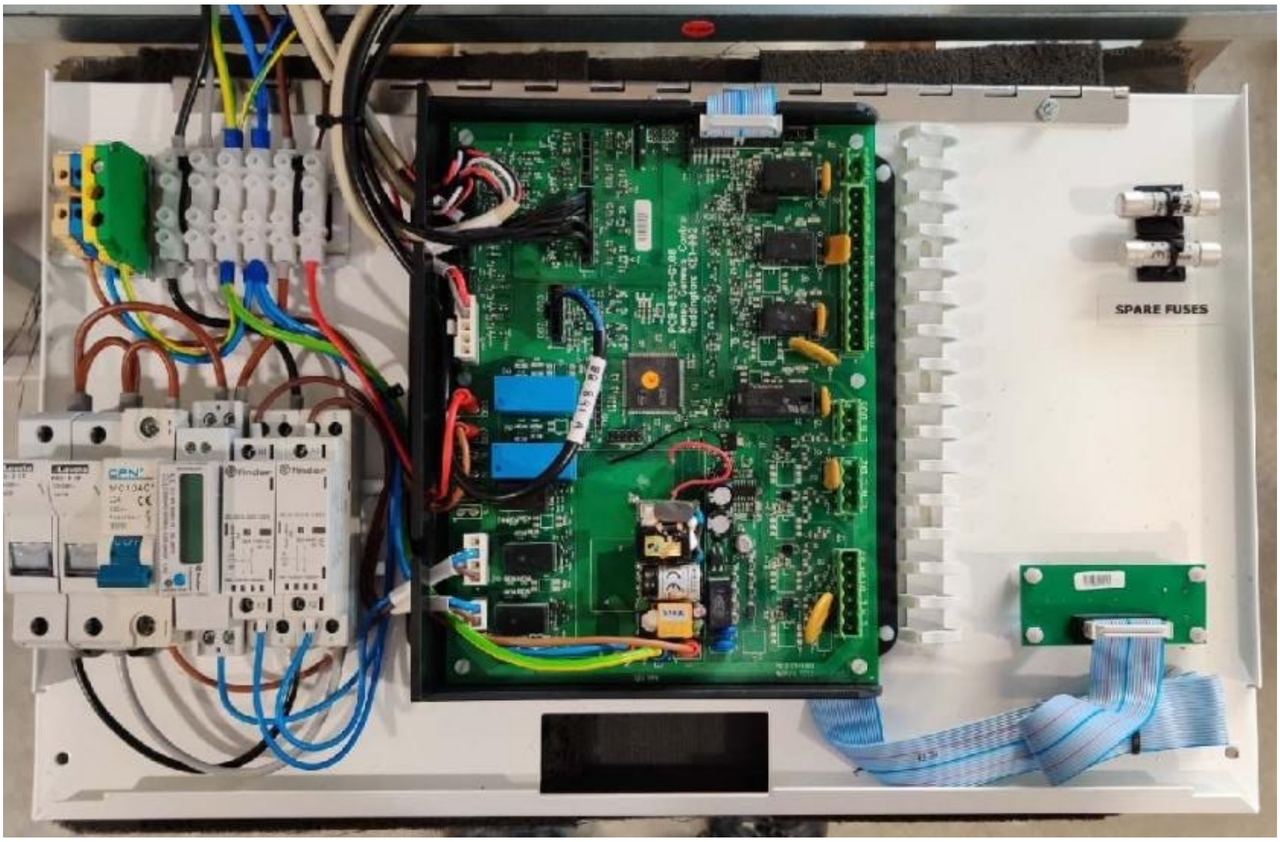
Fig 18 6kW Electrics panel folded down (lid removed from PCB box)



4.7.1 Wiring Diagrams

4.7.1.1 Main Power Supply

230 Vac 50Hz power supply is via a fitted fly lead and should be connected to a suitable isolator. All pole Isolation should be with 3mm separation

The following sections detail the wiring connections for various applications.

Fig 19 3kW Din Rail Units

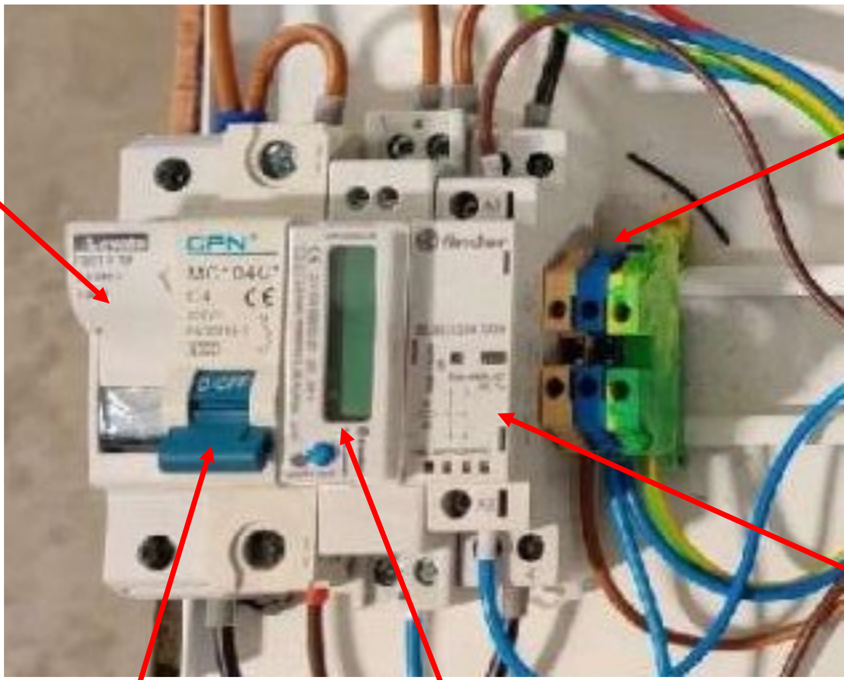
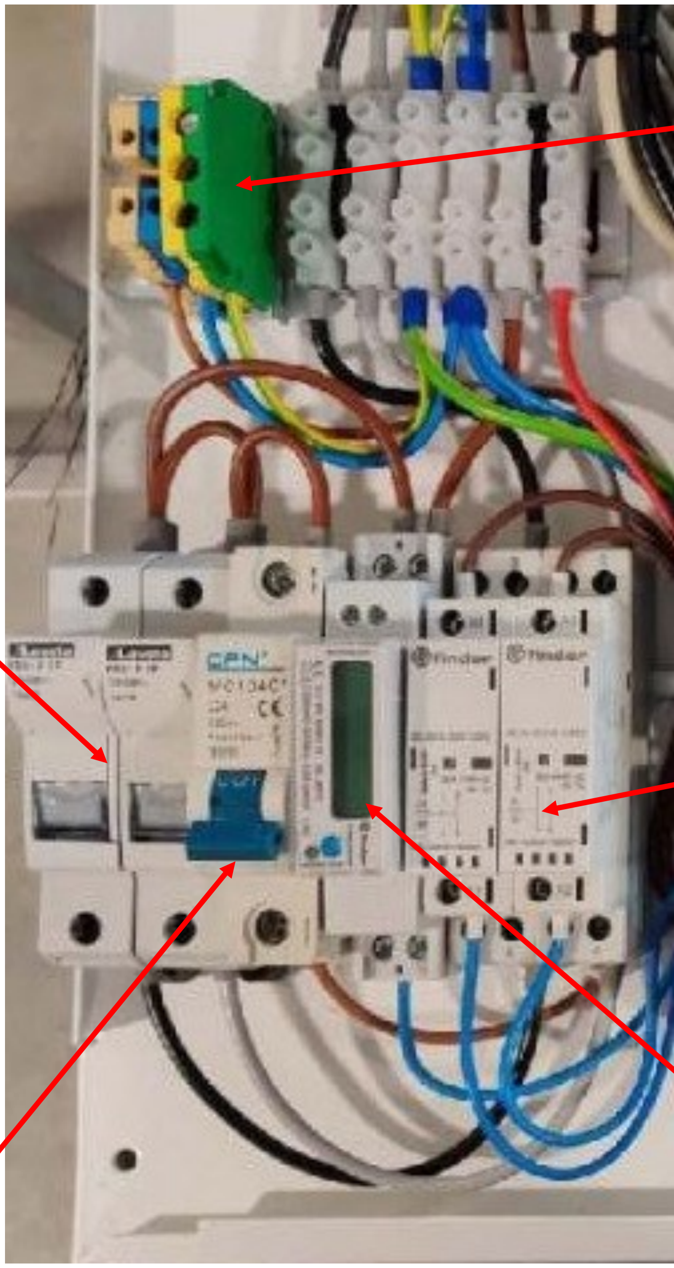
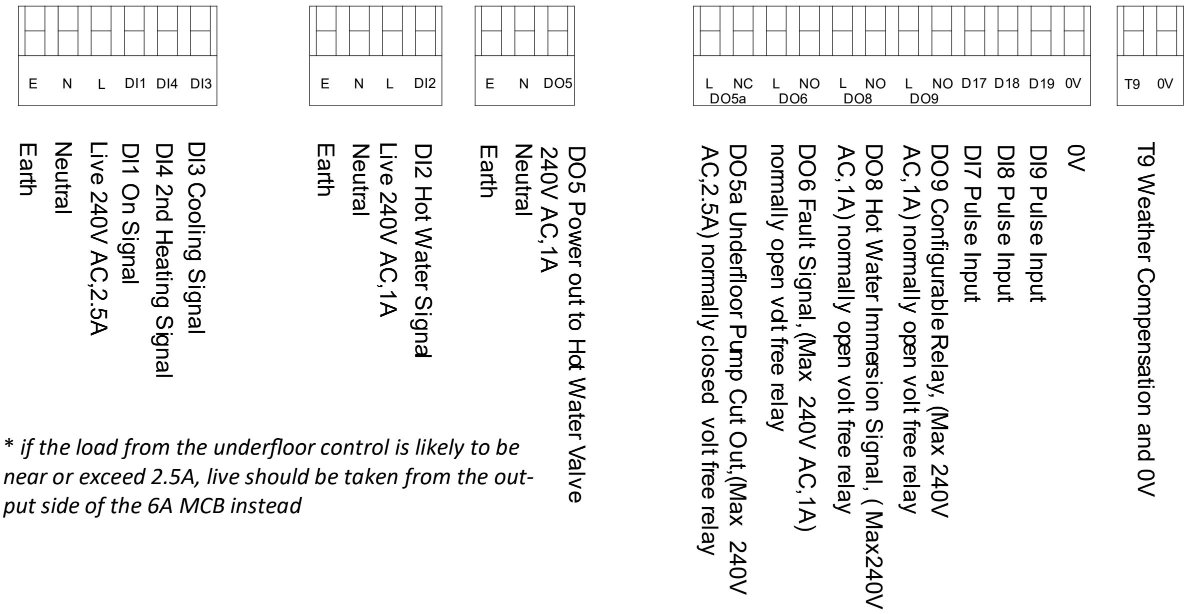


Fig 20 6kW Din Rail Units



4.7.1.2 Main PCB Terminals



** if the load from the underfloor control is likely to be near or exceed 2.5A, live should be taken from the output side of the 6A MCB instead*

Figure 21 Main PCB terminals

Enable Signal connection is supplied with a temporary link across it .
This should be removed after commissioning and connection to the heating control

Heat Pump Enable Signal
No Call 0-50V
Call >120V
50V < Call voltages < 120V are not permitted

DO8 and DO9 must use an external power supply and relay.

*

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4.7.3.3 Main PCB terminals description

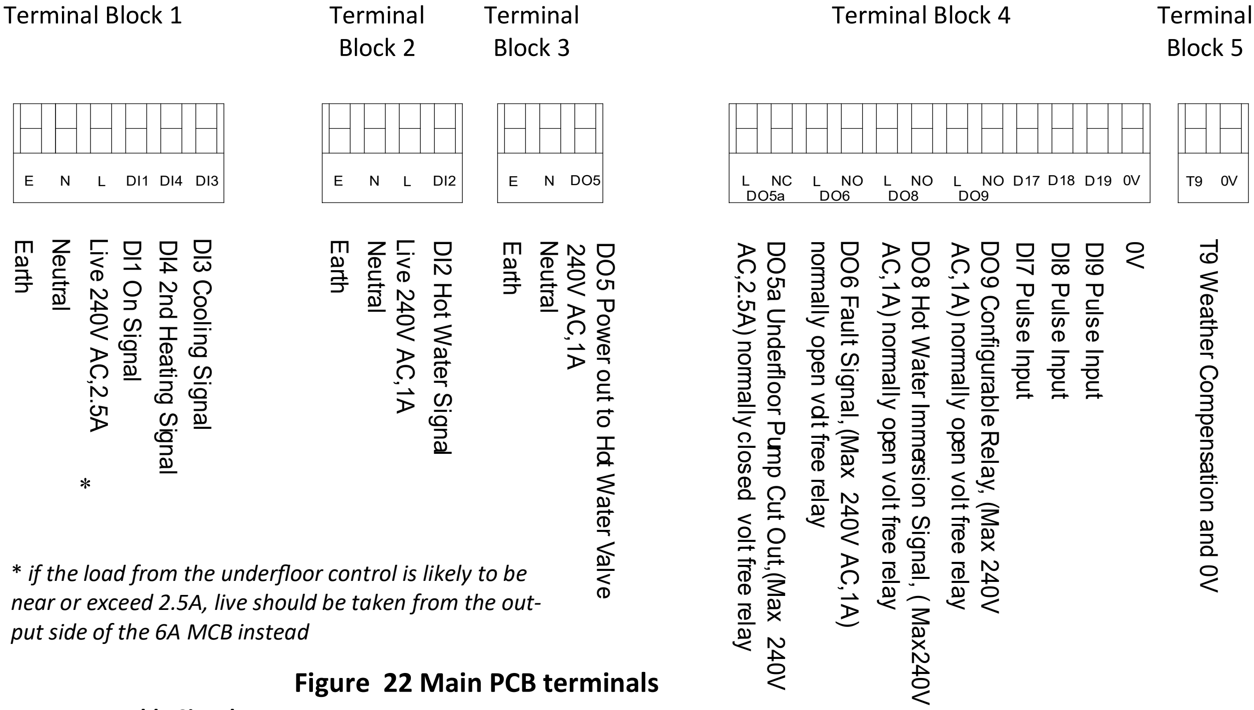


Figure 22 Main PCB terminals

Heat Pump Enable Signal
No Call 0-50V
Call >120V
50V < Call voltages < 120V are not permitted

Enable Signal connection is supplied with a temporary link across it . This should be removed after commissioning and connection to the heating control system. (Terminals DI1 and L)

DO8 and DO9 must use an external power supply and relay.

Terminal Block 1—Space heating/Cooling

Earth—Earth connection for space heating timeclocks/ control devices connected and powered by the Heat Pump such as underfloor control units, heating timeclocks and thermostats.
Neutral—Neutral connection for space heating timeclocks/ control devices connected and powered by the Heat Pump such as underfloor control units, heating timeclocks and thermostats.
Live- 240V AC, 1A Live connection for space heating timeclocks/ control devices connected and powered by the Heat Pump such as underfloor control units, heating timeclocks and thermostats. If the load from the underfloor control is likely to be near or exceed 2.5A, live should be taken from the output side of the 6A MCB instead.
DI1—Live return 240V AC, 1A (On signal) call for heating returned from space heating timeclocks/ control devices connected to the Heat Pump.
DI4– 2nd Heating Signal—Live return 240V AC, 1A (On signal) call for a second heating set point returned from space heating timeclocks/ control devices connected to the Evo. This allows a heating zone to be controlled which requires a higher temperature than other zones. For example a zone of underfloor which requires a lower flow temperature can be controlled by a timeclock connected to DI1 and DI4 can be used to control a zone of radiators requiring a higher flow temperature by a second timeclock. If both call signals occur simultaneously the higher temperature will have priority. In this type of system architecture the underfloor manifolds must be fitted with thermostatic mixing valves.
DI3—Cooling call signal 240V AC, 1A. This is the enable signal to the heat to provide cooling. The heat pump and heating distribution system needs to be configured / specified for cooling applications. Simultaneous calls for heating and cooling will result in the unit returning an error code. Cooling applications can also affect eligibility for grant schemes.

Terminal Block 2—DHW

Earth—Earth connection for domestic hot water timeclock, powered by the Heat Pump.
Neutral—Neutral connection for domestic hot water timeclock, powered by the Heat Pump.
Live- 240V AC, 1A Live connection for domestic hot water timeclock, powered by the Heat Pump.
DI2—Live return 240V AC, 1A (On signal) call for domestic hot water heating returned from the domestic hot water heating timeclock connected to the Heat Pump.

Terminal Block 3 - DHW 3 Port valve connection

Earth—Earth connection for domestic hot water valve, powered by the Heat Pump.
Neutral—Neutral connection for domestic hot water valve, powered by the Heat Pump.
DO5- Live out to domestic hot water valve 240V AC 1A rated.

Terminal Block 4— Additional Inputs and Outputs

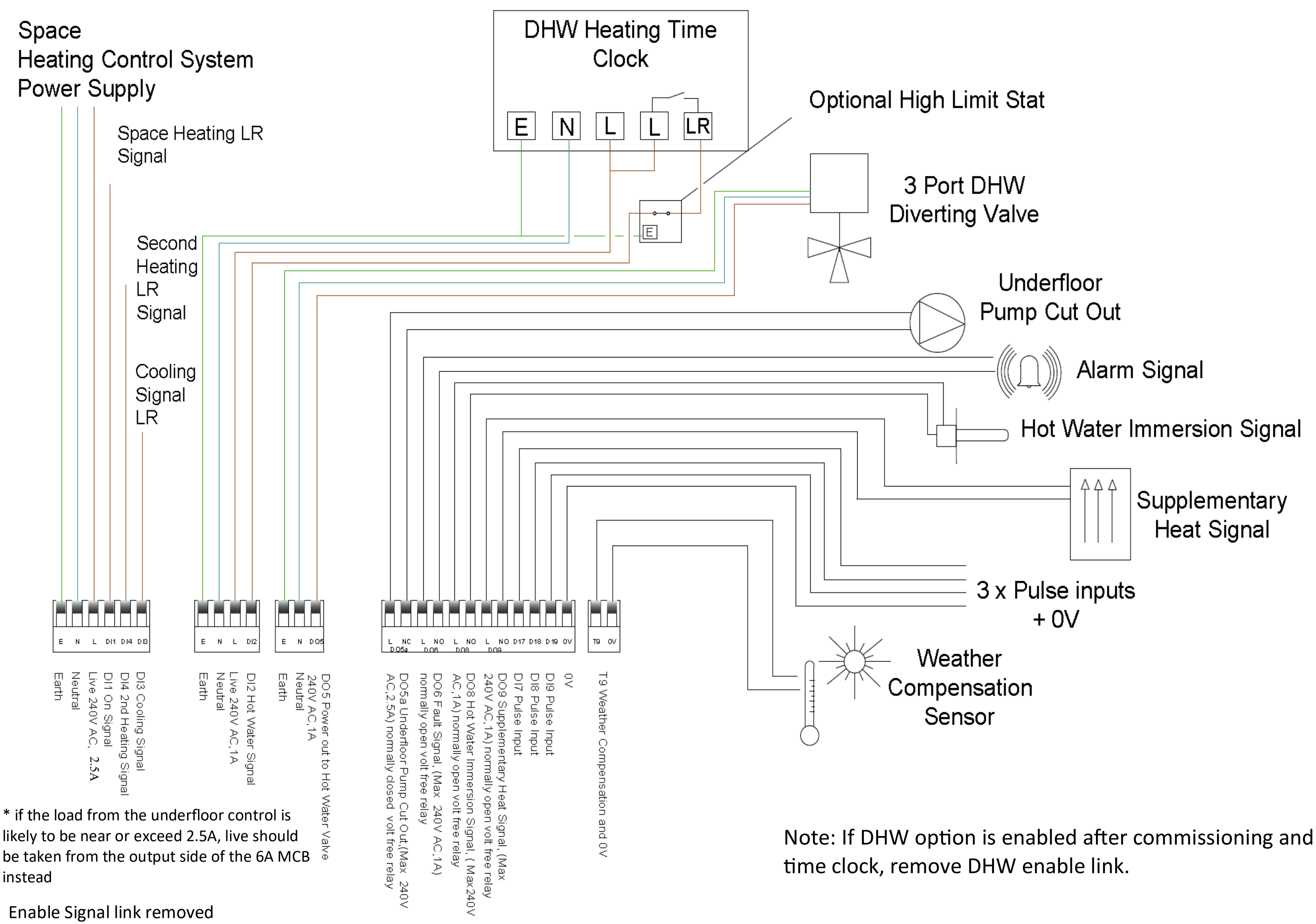
DO5a—Underfloor Pump Cut Out. Normally closed volt free relay (240V, 2.5A) which opens when the DHW valve operates. The relay can be wired directly to the supplementary underfloor manifold water pumps (up to a maximum of 2.5A). When the heat pump is producing domestic hot water if wired this relay will turn all the supplementary underfloor water pumps off increasing the systems efficiency. If the current is greater than 2.5A an external relay must be used.
DO6– Fault Signal. Normally open volt free relay (240V, 1A). Can be used as a general fault indication.
DO8– Hot water immersion heater signal. Volt free relay (240V, 1A). Can be used in conjunction with an external relay to operate the immersion heater (settable via the controller). The immersion heater must be powered by a separate external power supply.
DO9– Configurable Rela. Normally open volt free relay (240v, 1A). This relay can be used to signal to an external supplementary heat source to operate when the controller detects that the heat pump cannot maintain temperature. Configuration of this is via the controller. The supplementary heater must be powered by a separate external power supply. This relay should also be used for Open Loop systems.
DI7, DI8, DI9 and 0V– Digital inputs from devices such as electricity meters, heat meters, etc. The controller only shows the number of pulses detected, for example if a single pulse was an indication of 100 units, it would only register 1 pulse and to get the true reading the number of pulses needs to be multiplied by 100 (or whatever the single pulse is meant to represent).

Terminal Block 5—Weather Compensation T9

The Weather Compensation sensor (supplied with the heat pump) needs to be fixed to a North-facing wall, and connected with 2 core 0.5 mm cable, unshielded, to the heat pump. The cable should be routed inside the heat pump case and connected to the main pcb terminals (Terminal Block 5). If weather compensation is required this should then be enabled within the controller.

Note :- DI4, DO6, DO8, DO9, DI7,DI9 and T9 are all optional.
DI3 is only for use with cooling models
DI2, DO5 and DO5a only for use with DHW enabled models.

Fig 23 Generic wiring diagram



* if the load from the underfloor control is likely to be near or exceed 2.5A, live should be taken from the output side of the 6A MCB instead

Enable Signal link removed

Note: If DHW option is enabled after commissioning and connection to DHW time clock, remove DHW enable link.

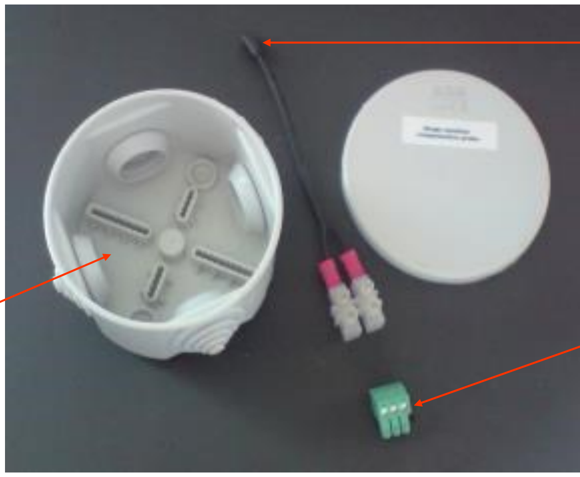
4.7.2 Weather Compensation.

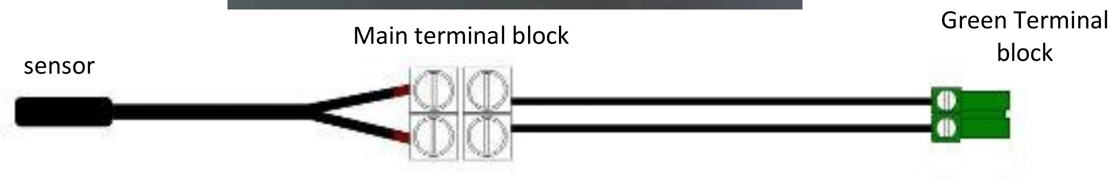
All Kensa Shoebox Heat Pumps are supplied with Weather Compensation as standard. This facility will reduce the return water set-point against a schedule of external ambient temperatures. In more simple terms, the temperature of water flowing into the building's radiators or underfloor heating is reduced in mild weather, which allows the heat pump to run more efficiently. This is particularly important with radiators, as much higher temperatures are required. In cold weather, many people already turn up the temperature of water flowing from their boiler by hand and are therefore weather compensating their heating system manually.

To enable weather compensation (if required) on your heat pump the sensor should be installed and weather compensation enabled within the controller .

The weather compensation sensor is supplied in a small waterproof enclosure.

Fig 24 Weather compensation sensor





Kensa strongly suggest that the heatpump should be run for at least one week after commissioning, before the weather compensation is activated, to enable the client to become use with living with a heat pump and understand the buildings heating profile.

This sensor needs to be fixed to a North-facing wall, and connected with 2 core 0.5 mm cable, unshielded, to the heat pump. The cable should be routed inside the heat pump case and connected to the main pcb terminals. The weather compensation should then be left disabled. If weather compensation is required this should then be enabled within the controller.

5.0 Communal Ground Array

Kensa has pioneered the development of a new system architecture for ground source heat pumps known as Shared Ground Array. The Shared Ground 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.

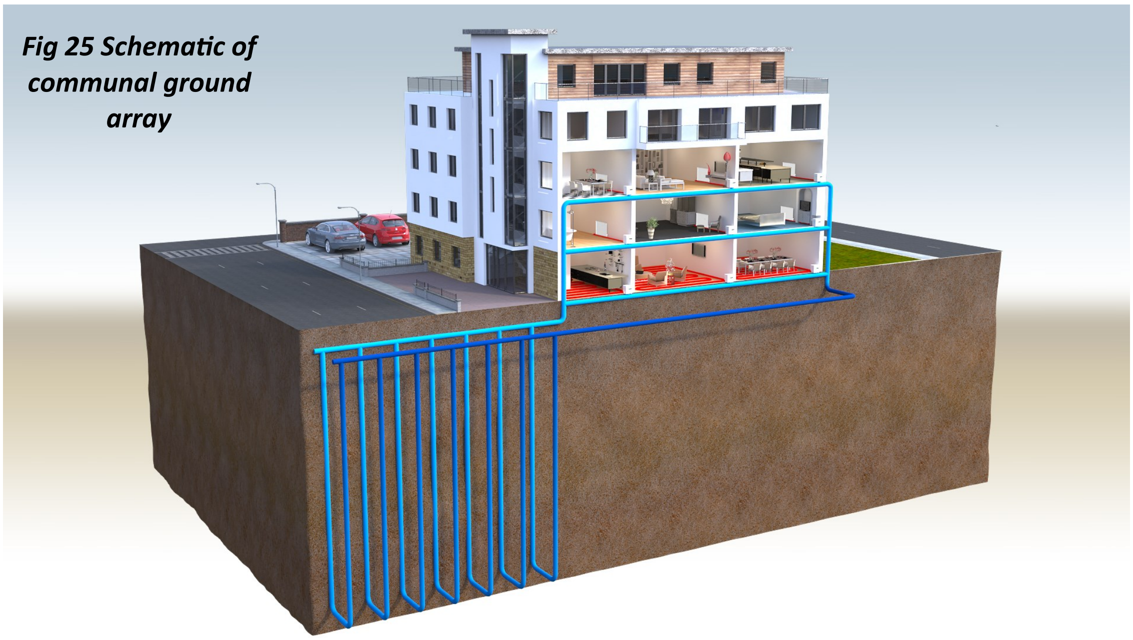


Fig 25 Schematic of communal ground array

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

The heating distribution pipework ideally needs to be designed by a competent heating engineer taking into account hydraulic losses and pipe sizing.

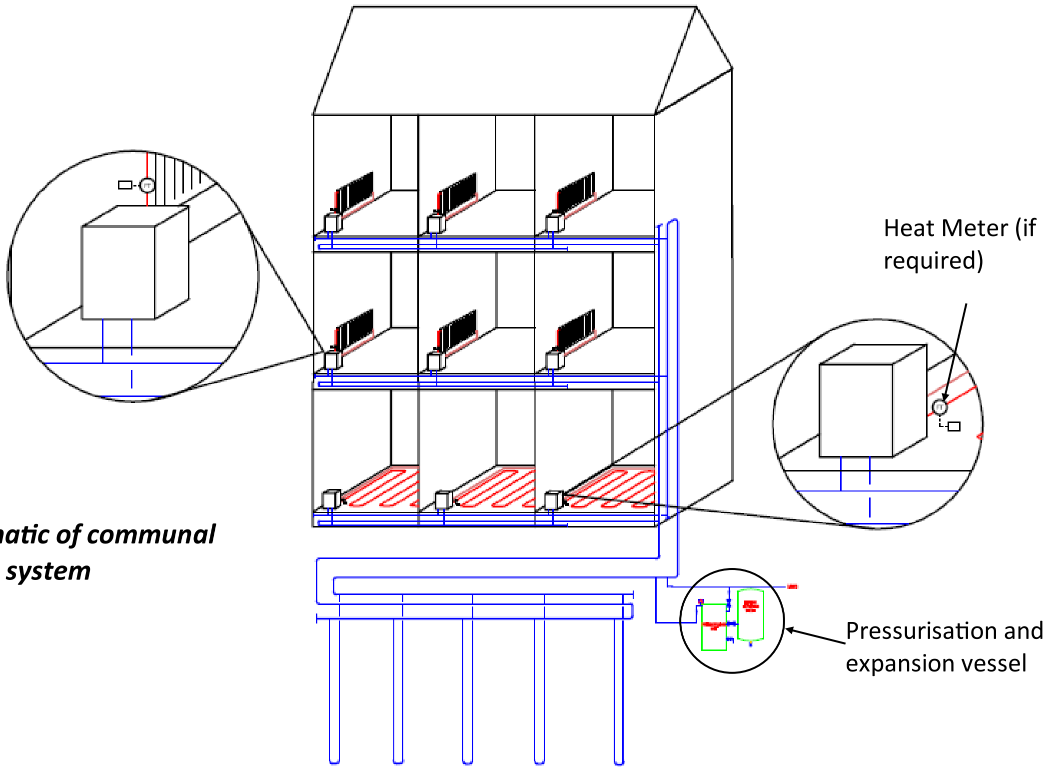


Fig 26 Schematic of communal ground array system

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 .

6. Mechanical Set to Run

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^{o}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. Close the mains cold water supply valve fully. Disconnect the filling loop.
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. Close the mains cold water supply valve fully Disconnect the filling loop. 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.

6.2.1 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.

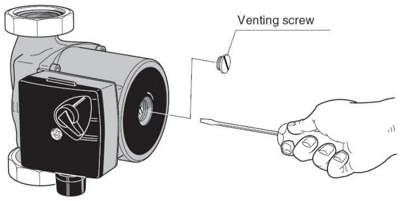


Fig 27 Spinning the pump

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 shoebox can be commissioned via an android or IOS app downloadable via the links listed in the next section. The shoebox can also be linked to the home owners Wi-Fi to allow remote interrogation of the Shoebox.
iv. The heat pump will not run until both heating distribution and ground circuits are above 1.8 bar pressure.
v. 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.

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6.3 Commissioning the shoebox

The unit can be commissioned by using an application downloaded using the link or QR code below. The app is designed to be used on any android or IOS device and will allow the device to connect with the shoebox via the Wi-Fi button.

The app replicates a display for the shoebox on your chosen device.

QR code for phone app	Genesis Controller Installation Manual	Shoebox Operational Instructions

For details of commissioning the unit please refer to Genesis Installation Manual.

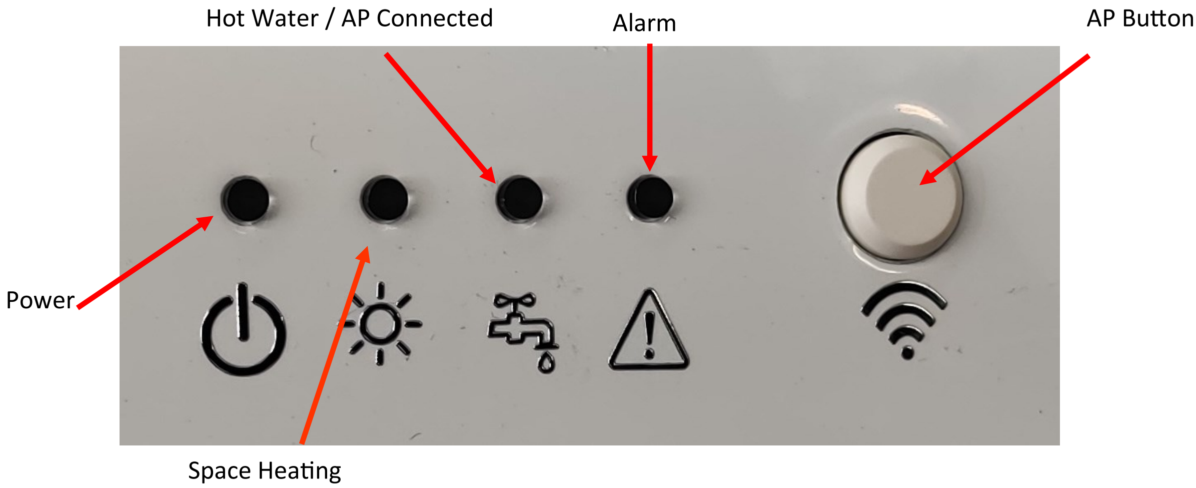

Fig 28 Location of AP button.

6.3.1 Setting the communication link up.

I. Download the app to your chosen android or IOS device and open it.
II. Press the AP button (Access point) button on the front of the shoebox.
III. The hot water LED on the front of the shoebox should flash blue confirming that the shoebox is in AP mode.
IV. Select the network name [kensa…] of the heat pump you wish to connect to.
V. If the desired network is not showing, press the AP button on the front of the heat pump again.

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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.

The alarm LED will flash a number of times indicating what the issue is.

Faults and fault finding due to commissioning can be found in the Genesis Commissioning Manual.

LED flashes	Error	Action
0	Clear	None
1	A1: Antifreeze limit (Heating)	Check Ground Temperature settings - ensure adequate flow in ground side. Error maybe caused by ground pump failure. Check Antifreeze concentration. Compressor 1 will not operate until T5 rises above the lower limit
2	A2: Antifreeze limit (Heating)	Check Ground Temperature settings - ensure adequate flow in ground side. Error maybe caused by ground pump failure. Check Antifreeze concentration. Compressor 2 will not operate until T6 rises above the lower limit
3	TPG: Low Ground Pressure	Top up the ground pressure to clear error. Check water pressure set-up, ground side. The fault should clear by raising the pressure above 2 bar based on default values.
4	TPL: Low Load Pressure	Top up the load water pressure to clear error. Check water pressure setup, load side. The fault should clear by raising the pressure above 1.5 bar based on default values.
5	HP1: High Gas Pressure	Check for flow restriction on load side - usually accompanied with FLH1 (FLC1 if in cooling). Fault maybe caused by load pump failure. Check for temperature probe failure E1
6	HP2: High Gas Pressure	Check for flow restriction on load side - usually accompanied with FLH2 (FLC2 if in cooling). Fault maybe caused by load pump failure. Check for temperature probe failure E1
7	LP1: Low Gas Pressure	Check for flow restriction on ground side - usually accompanied with FGH1 (FGC1 if in cooling). Check Ground Anti-freeze limit, if T5 reading bellow the setpoint, unit might be frozen - allow heat pump to defrost - add correct anti-freeze quantity. This fault could briefly trigger LPS1 fault. Fault may occur on first run or unit has not run for a long time. Fault maybe caused by ground pump failure.
8	LP2: Low Gas Pressure	Check for flow restriction on ground side - usually accompanied with FGH2 (FGC2 if in cooling). Check Ground Anti-freeze limit, if T6 reading bellow the setpoint, unit might be frozen - allow heat pump to defrost - add correct anti-freeze quantity. This fault could briefly trigger LPS2 fault. Fault may occur on first run or unit has not run for a long time. Fault maybe caused by ground pump failure.
9	DHT1: High Discharge Temp	Error may occur if compressor is over heating - accompanied with HP1. Evaporating temperature might be too high. Refer to Kensa Technical Support Department.
10	DHT2: High Discharge Temp	Error may occur if compressor is over heating - accompanied with HP2. Evaporating temperature might be too high. Refer to Kensa Technical Support Department.

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8. Warranty

The Kensa Shoebox Ground Source heat pump is designed and built to the highest standard and as such is warranted 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 warranted 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 warranty 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 Shoebox 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 Shoebox 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 warranty 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.