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Compact Heat Pump
User Manual

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1. Introduction—a message from the Managing Director

Thank you for choosing a Kensa Compact ground source heat pump for your project. Kensa Engineering has been manufacturing ground source heat pumps since 1999 and have significant experience in providing these systems in domestic and commercial applications.

Your Kensa heat pump will provide you with many years of low energy bills and maintenance free running while also reducing your carbon footprint. Kensa Compact heat pumps are designed for ease of operation and once set by your installer to provide the optimum flow temperature for your heating system should not require adjusting.

The purpose of this manual is to guide you through the operational aspects of living with a heat pump.

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 Engineering Ltd

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

2. Safety information

Safe operation of this unit can only be guaranteed if it is properly installed and commissioned in compliance with the operating instructions. 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 Engineering
Mount Wellington
Chacewater
Truro
Cornwall
TR4 8RJ
Tel 01872 862140
www.kensaengineering.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 Operation Instructions, could cause damage to the product, will invalidate the warranty, and may cause injury or fatality to personnel.

2.1 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 in the Installation Manual.

2.2 Returning products

Customers and stockists are reminded that under EC Health, Safety and Environment Law, when returning products to Kensa Engineering they must provide information on any hazards and the precautions to be taken due to contamination residues or mechanical damage which may present a health, safety or environmental risk. This information must be provided in writing including Health and Safety data sheets relating to any substances identified as hazardous or potentially hazardous.

3. General Product Information

This manual explains how to install, commission and operate a Kensa ground source heat pump.

3.1 Kensa Engineering

Kensa Engineering is the leading UK manufacturer of a full range of ground source heat pumps. Kensa provides exceptional levels of expertise and advice on the use, design and application of heat pumps. Kensa have been active in the heat pump market since 1999 and remains a well-respected company, not only in the industry but also with all our customers and stakeholders.

Since 1999 the company has manufactured and installed over a thousand heat pumps of various types throughout Europe and manufacture ranges suitable for the domestic market and specifically designed for commercial applications.

Kensa are ISO9001 approved for the design and manufacture of heat pumps and hold an unique status as being accredited by Microgeneration Certification Scheme for both the manufacture and installation of ground source heat pumps. Kensa were also a founding member of the Ground Source Heat Pump Association and play a major role in helping to raise the profile of heat pumps and formulate Industry Standards.

Kensa's aim has always been to take the mystery and complexity out of heat pumps, designing systems that can be easily installed without any specialist training, making the product available to a larger market and helping to reduce CO2 emissions while reducing client's energy bills.

3.2 Product description

Heat pumps basically extract solar energy stored in the ground, water courses and in the air and convert this to a higher temperature to use in a building's heating distribution system. They work in a similar manner to a fridge in reverse, where the inside of the fridge is the heat source and the grill at the back of the fridge is the heating system.

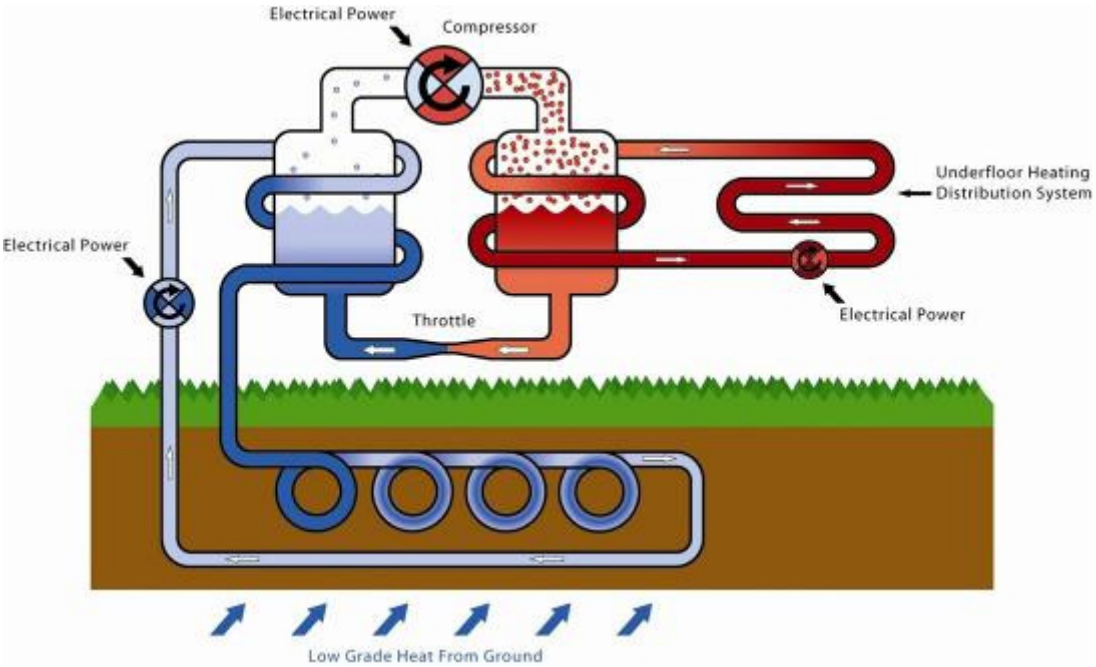

Fig 1. Heat pump Schematic

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A ground source heat pump (GSHP) extracts heat from the ground by circulating a cold solution of water and antifreeze (brine) around pipes buried in the ground. As these pipes are buried below 1m in depth, where the temperature of the ground remains pretty constant (8 to 10°C), heat is absorbed from the ground into the fluid (approximately 5°C). This brine is then passed through one side of a heat exchanger (called the evaporator) and a refrigerant through the other. The refrigerant has a very low boiling point and by absorbing the energy in the brine this causes the refrigerant to evaporate.
The refrigerant gas is then passed through a compressor where its pressure is increased which in turn increases its temperature. This high pressure hot gas then flows around a second heat exchanger (called a condenser) with the heating distribution fluid passing through the other side of the heat exchanger. Energy is then transferred from the refrigerant into the heating distribution system; this in turn causes the refrigerant to condense.

This high pressure cold refrigerant is then passed through an expansion valve (or throttle) and the pressure is reduced. The whole cycle is then repeated.

GSHPs are an extremely energy efficient technology, with every unit of electricity used (to drive the pumps and compressor) producing between 3 and 4 units of heat.

The Kensa Compact Heat Pump is designed to provide a low cost renewable heat source for a buildings heating system. In addition, and if required, the Kensa Compact 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.

Fig 2. A single compressor heat pump

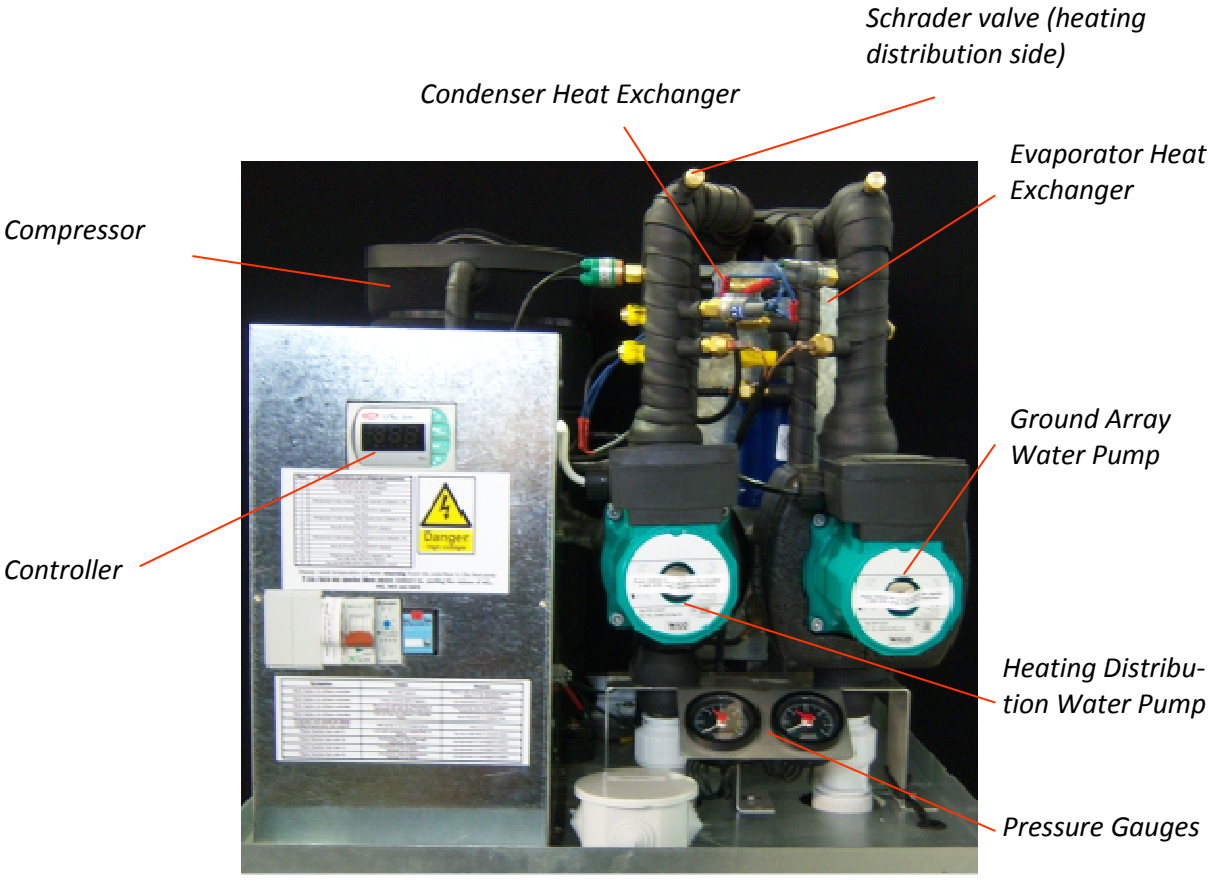

Fig 3. The internals of a single compressor heat pump

Fig 4. A twin compressor heat pump

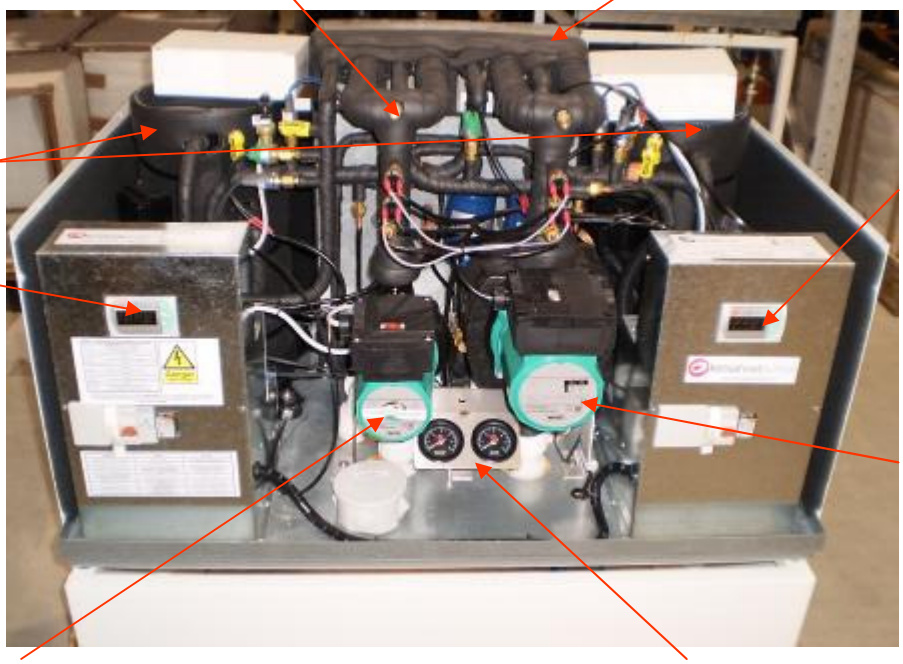

Fig 5. The internals of a twin compressor heat pump

3. 3 Kensa Compact Technical Details										
Thermal Output	Power supply rating	Max running Current	Typical running current	Typical starting current	Power supply cable size	Power input*	Nominal dry weight	Compressors	Dimensions	Connection size
kW	Amps	Amps	Amps	Amps	Mm	kW	Kg	Number	HxWxD	mm OD
Single Phase—230 Volts AC 50 Hz										
4	16	15	8 (10)	25	2.5	1.6 (2.1)	85	Single	900x550x570	28
6	25	18	10 (12)	30	2.5	2.1 (2.5)	90	Single	900x550x570	28
8	25	22	14 (16)	30	4.0	2.6 (3.3)	95	Single	900x550x570	28
10	32	26	14 (18)	30	4.0	2.9 (3.8)	100	Single	900x550x570	28
12	32	33	18 (22)	40	6.0	3.6 (4.5)	110	Single	900x550x570	28
12	40	36	20 (24)	40	6.0	4.0 (4.8)	165	Twin	900x900x570	28
16	63	44	27 (32)	44	10.0	5.2 (6.6)	167	Twin	900x900x570	50
20	63	53	28 (35)	44	10.0	5.8 (7.6)	170	Twin	900x900x570	50
24	65	61	35 (44)	48	16.0	7.2 (9.2)	180	Twin	900x900x570	50
Three Phase— 400 Volts AC 50 Hz										
4	16	5.7	3.5 (4)	24	2.5	1.5 (2.0)	85	Single	900x550x570	28
6	16	7.2	4.5 (5)	32	2.5	1.9 (2.4)	92	Single	900x550x570	28
8	16	8.0	5 (6)	37	2.5	2.5 (3.2)	95	Single	900x550x570	28
10	16	9.4	6 (7)	42	2.5	2.8 (3.7)	100	Single	900x550x570	28
12	16	12	8 (9)	53	2.5	3.5 (4.5)	105	Single	900x550x570	28
12	25	14	8 (10)	62	2.5	3.7 (4.6)	165	Twin	900x900x570	28
16	25	16	11 (13)	80	2.5	4.9 (6.4)	167	Twin	900x900x570	50
20	25	19	12 (14)	92	2.5	5.2 (7.4)	170	Twin	900x900x570	50
24	32	24	15 (18)	114	4.0	6.9(9.0)	180	Twin	900x900x570	50
30	32	27	18 (21)	131	4.0	8.1 (10.6)	185	Twin	900x900x570	50

The figures in the table are based on a rating to BS EN14511, 0 deg C from the ground, 35 deg C flow to underfloor. The figures in parentheses are values obtained to BS EN14511, 0 deg C from the ground, 50 deg C flow to radiators.

* This figure includes the power consumption of the inbuilt water pumps.

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

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3.4 Kensa High Temperature Compact Technical Details—Single Compressor										
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 dry weight	Compressors	Dimensions	Connection size
kW	Amps	Amps	Amps	Amps	mm^2	kW	Kg	Number	HxWxD	mm OD
Single Phase—230 Volts AC 50 Hz										
3.5	16	16	7 (7)	25	2.5	1.1 (1.8)	85	Single	900x550x570	28
4.3	25	19	9.5 (10)	30	2.5	1.4 (2.3)	90	Single	900x550x570	28
6.2	25	22	13 (14)	30	4.0	1.8 (3.0)	95	Single	900x550x570	28
7	32	26	12 (14)	30	4.0	2.0 (3.1)	100	Single	900x550x570	28
8.5	32	27	12 (14)	30	4.0	2.3 (3.7)	105	Single	900x550x570	28
Three Phase— 400 Volts AC 50 Hz										
3.5	16	5.8	3.3 (3.6)	23	2.5	1.1 (1.8)	85	Single	900x550x570	28
4.6	16	7.3	4.2 (4.5)	29	2.5	1.4 (2.3)	90	Single	900x550x570	28
6	25	8.0	5 (5.9)	38	2.5	1.7 (2.8)	95	Single	900x550x570	28
7	25	9.4	5.6 (6.2)	39	2.5	1.9 (3.0)	100	Single	900x550x570	28
8.5	25	12	7.1 (7.9)	50	2.5	2.3 (3.7)	105	Single	900x550x570	28
10	25	14	8.2 (9.2)	57	2.5	2.7 (4.4)	110	Single	900x550x570	28

The figures above are based on a rating to BS EN14511, 0 deg C from the ground, 35 deg C flow to underfloor. The figures in parentheses are values obtained to BS EN14511, 0 deg C from the ground, 65 deg C flow to the heating distribution system.
* This figure includes the power consumption of the inbuilt water pumps

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

3.5 Kensa High Temperature Compact Technical Details—Twin Compressor										
Thermal Output	Power supply rating	Max running Current	Typical running current	Typical starting current	Power supply cable cross sectional area (min)	Power input*	Nominal dry weight	Compressors	Dimensions	Connection size
kW	Amps	Amps	Amps	Amps	mm^2	kW	Kg	Number	HxWxD	mm OD
Single Phase—230 Volts AC 50 Hz										
12	50	43	24 (30)	42	6.0	3.4(5.8)	165	Twin	900x900x570	28
Three Phase— 400 Volts AC 50 Hz										
12	32	15	11(12)	71	2.5	3.2 (5.4)	165	Twin	900x900x570	28
17	32	23	13 (15)	91	2.5	4.3 (7.1)	167	Twin	900x900x570	50
20	32	26	16 (18)	106	2.5	5.1 (8.5)	170	Twin	900x900x570	50

The figures above are based on a rating to BS EN14511, 0 deg C from the ground, 35 deg C flow to underfloor. The figures in parentheses are values obtained to BS EN14511, 0 deg C from the ground, 65 deg C flow to the heat distribution system.
*Includes the power consumption of both inbuilt water pumps.

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

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4. Operational Instructions

Always ensure that individuals using the appliance have read and fully understood the Operation instructions.

Do not operate the appliance with the cover removed.
Do not operate the appliance in anything other than dry conditions.
Do not exert any strain on electrical or pipe connections to the appliance.
Do not put any foreign object into the appliance.
Do not spill water or any other substance onto the appliance.

4.1. Maximising the efficiency of the heat pump.

In order to increase the efficiency of the heat pump and lower the overall energy costs of the building there are a number of simple steps that can be taken.

1. Insulate the property as much as possible. This will reduce the heat loss from the building, which in turn will reduce running time of the heat pump and hence energy costs.
2. The lower the flow temperature from the heat pump the higher the efficiency so consider a heating system with a large heat emitting area such as underfloor.
3. If in a well insulated building with underfloor mounted in screed throughout, consider running your heat pump on off-peak electricity tariffs such as Economy 10.
4. With underfloor systems, avoid the use of insulative coverings such as thick carpets and wooden floors.
5. Consider the use of Solar Thermal for the production of the majority of DHW.

4.2 Display

Each heat pump has a dedicated display which can be interrogated to view various parameters and indicate faults/alarms. Twin compressors units have two displays, one for each compressor where as single compressor unit only has one.

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

Fig 6 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°C for underfloor applications, which is a typical return temperature for an underfloor application. (In twin compressor units the left hand controller is set at 30°C the right hand at 31°C). For radiators this is generally set during commissioning at 45°C for standard units and 55°C for high temperature models.

The Kensa Compact 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, (top left) and frost, (bottom left) indicate heating & cooling respectively (Heating only heat pumps will only use the sun symbol and cooling heat pumps only the frost symbol. Reverse cycle machines will use both symbols, the one being displayed being dependant on the operating mode selected at the time.)


Sun symbol—heating mode


Frost symbol—cooling mode

3. A number "1" will appear top right of controller this is to indicate compressor number, if the number "1" is flashing the internal timer is activated and compressor is waiting to run. When the compressor is running the number "1" and the compressor run symbol will be on.


Compressor running

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 to cold / insufficient anti freeze/ unit not commissioned correctly / low flow around ground arrays.

(See Fault Finding Section 5 for further details)

4.2.1 To read flow temperatures and refrigerant pressures

Using the display it is possible to interrogate the heat pump to read temperatures and refrigerant pressures. For twin compressor units the left hand unit reads temperatures and pressures in compressor one and the right hand controller compressor two).

To read 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

4.2.2 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 29°C to 30°C the actual flow temperature out of the heat pump is approximately 35°C.

The outlet flow temperature of the heat pump determines the efficiency of the heat pump and should have been set for your particular heating system and application at commissioning. This is passcode protected to avoid unauthorised changes.

If for any reason that the heat pump return flow needs to be changed, please contact Kensa Engineering's Technical Department on 01872 862140.

4.3 DHW Production (Needs to be specified at time of order)

The most efficient way of producing Domestic Hot Water (DHW) is by using Solar Thermal, however DHW can be provided by most heat pumps. The installation and operation of a heat pump in DHW mode is more complex than space heating and needs careful design and installation.

To simplify the production of DHW using a heat pump, Kensa has designed an industry leading and straightforward DHW option. The heat pump is designed to operate at the optimum temperature that provides DHW, at the maximum efficiency, without using any inbuilt direct electric heaters. The system does not need a tank thermostat or a software temperature setpoint.

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.

4.3.1 DHW Operation

To get the most cost effective production of DHW (and space heating), it is advised that the system is used in conjunction with an off-peak electricity tariff, for example Economy 10.

Economy 10 will provide three periods of off-peak electricity throughout a 24 hour period. The majority of the off-peak period should be used for space heating and the settings on the DHW timeclock should reflect this. DHW production takes priority over the space heating so it is important that sufficient time is allocated to the space heating to ensure that the building is warm.

Using the in-built controls the heat pump will continue to produce DHW until the timeclock ceases to call for DHW or the controls automatically stop the heat pump. If the controls stop the production of DHW the heat pump will not restart for a period of approximately two hours as the number of compressor starts are limited in DHW mode for a given period of time.

Standard Compact Units

The maximum temperature that the heat pump can produce depends on the ground temperature and hence the time of year. The heat pump will achieve a DHW temperature of approximately 50-55^{o}C. In summer, it could be higher, due to the warmer ground conditions. If 65^{o}C is required all year round it is recommended that an immersion heater is linked to a second channel on the DHW timeclock and this is programmed to operate for a period immediately following the DHW production. This means that the majority of the heating load for the DHW is produced at a lower cost using the heat pump, as opposed to using only the direct immersion heater.

If 50^{o}C water is acceptable, then it is recommended that the immersion heater is programmed to raise the temperature to above 60^{o}C once a week.

High Temperature Compact Units

These are designed to provide higher outlet temperatures so will produce DHW at 60-65^{o}C, however as with all heat pumps increasing the outlet temperature decreases the efficiency .

4.4 Cooling

This option needs to be specified at time of order. Cooling is simply operated by means of a volt free contact (as indicated on the wiring diagrams), however its effectiveness depends on the delivery system. All the settings for cooling are factory set. Please contact Kensa Engineering for further details.

4.5 Maintenance

No routine maintenance is required to Compact Heat Pumps, and there are no user serviceable components inside. If further help is required then telephone our helpline on 01872 862140 or send an email to technical@kensaengineering.com

Before cleaning, always switch off the appliance at the electrical isolator.
Use only soap and a damp cloth; do not use solvents.

5. 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 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.	Check the pressure gauges below the two water pumps. 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. The Ground cold fill is provided with every Kensa heat pump, and is found on the right hand side of the heat pump, underneath. The heating distribution system should have it's own fill point.
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.	Bleed the heating distribution system pump within the heat pump, using the schrader valve above the pump. (See Fig 3 and 4) Check that the water pumps are operational and spin the impellors (see section 4.3of the Installation Manual) 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.	Check that the water pumps are operational and spin the impellors (see section 4.3of the Installation Manual) If symptom persists outside of the two listed circumstances, contact Kensa Technical department. No action
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 pumps are operational and spin the impellors (see section 4.3 of the Installation Manual) 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

6. Complaint Procedure

The expertise of members and the assurance provided by the Real Code make sure that micro renewable technology supplied and installed under the scheme are free from manufacturing or installation faults. Occasionally, however, problems can develop.

If you want to complain about the quality of the equipment, the installation, the advice given, the standard of service or any other aspect of the contract between Kensa and yourself, the following procedure should be used.

Any complaint should be notified to Kensa Engineering within three months of first noticing the problem.

a. If the complaint cannot be rectified remotely, Kensa or a representative on its behalf will arrange to inspect the system, within 20 working days from receiving the complaint.
b. If the complaint is about under-performance, you should make evidence available to Kensa.
c. Kensa will consider the details of the complaint and report the findings clearly to the consumer within seven working days from any inspection.
d. Kensa will try to find an agreed course of action to solve the complaint to the consumer's satisfaction.
e. Kensa will co-operate fully with local consumer advisers or any other person that you consult when making a complaint.
f. If a complaint cannot be sorted out through the above procedure, you or Kensa can use the conciliation service offered by the Real Assurance scheme. (Please see www.realassurance.org.uk)

7. RTB and Extended Warranty Statement

All Kensa heat pumps have a two year RTB (Return To Base) warranty as standard. The warranty runs from date of delivery of the heat pump.

RTB means that if a product is thought to be defective, then it is returned to the manufacturer, with carriage paid by the customer. The manufacturer then examines the product. If no fault is found, then the customer pays the return carriage. The manufacturer may also charge the customer for anytime or materials expended, before returning the product. If a fault is found, then the manufacturer pays for both the parts and labour for the repair, and the return carriage is paid by the manufacturer.
The situation is the same for a suspect component, except that the component is despatched direct to the client, for which payment is made by the client, including the carriage. The client's installer then installs the new component, and sends the old component back to the manufacturer. If the manufacturer confirms the component as faulty, then the cost of the component and the carriage back to the client is paid. Most manufacturers would also meet the costs of an installer, although if the installer had received a discount on supplying the equipment, then this would usually be expected to cover minor labour costs.
The above is a description of the "bare minimum" as prescribed by an RTB warranty.

7.1 Extending the RTB Warranty

The RTB warranty can be extended. The warranty extension must be requested, and paid for in full prior to delivery.
The warranty can be extended for a maximum of five years from date of delivery.

7.1.1 Parts Only

The cost of this is 5% of the original list price of the heat pump for every year that the warranty is extended.
Excluded from the warranty is neglect or misuse of the products, or their components.

7.1.2 Labour & Parts

The cost of this is 7.5% of the original list price of the heat pump for every year that the warranty is extended.

Any labour supplied under an extended warranty will be on a "planned" rather than "emergency" call out basis only.

Please note that labour may be provided by a company or person nominated by Kensa Heat Pumps, or by another nominated party by written mutual agreement prior to any work being undertaken.