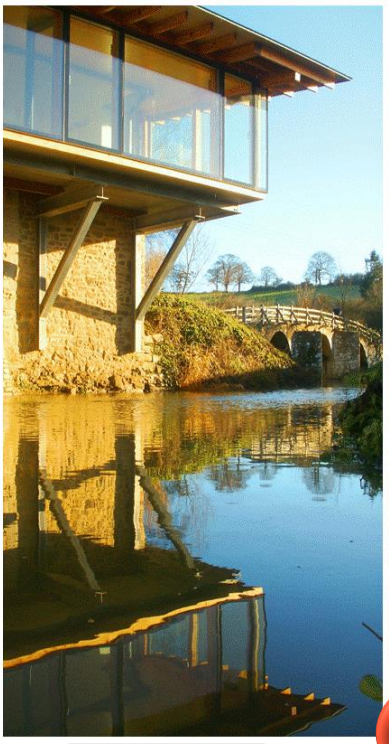
Kensa Heat Pumps
A KENSA GROUP COMPANY

ebook

Ground Source Design Hints & Tips



Top tips from the UK's only dedicated ground source heat pumps manufacturer!

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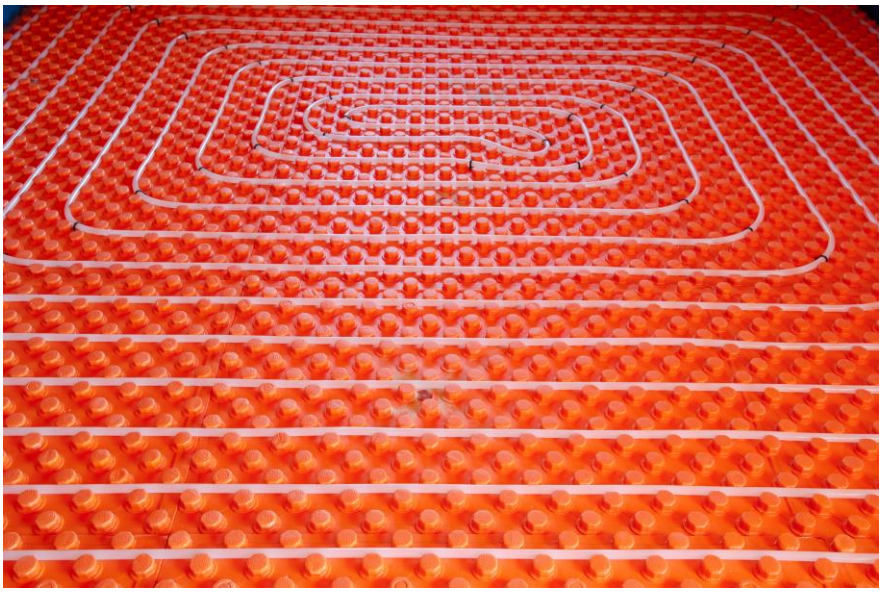
Design



The following are key points when trying to integrate a ground source heat pump into a building for a long, trouble free life with low running costs.

Kensa can design your system for you! Contact us here

Design

Peak Load

Ground source heat pumps should be sized in accordance with the peak heating load of the building.

Heat pumps are a low flow temperature device and the lower the flow temperature the higher the efficiency of the heat pump.

Therefore it is important that the building is insulated as much as possible, and new builds and renovations insulated to current building regulations are ideally suited to heat pumps. If the building is not insulated sufficiently then the heat pump will have high running costs and may not even heat the building.

Watch our video on ground arrays here

> Ground arrays should be designed to meet peak heating & hot water demand.”

For a ground source heat pump the ground arrays should be sized to the peak heating load and hot water demand of the building. There are different types of ground arrays available however Kensa will generally recommend slinky ground arrays.

While these have a similar performance to straight pipe they only require a fifth of the digging. Slinkies should be laid horizontally and must have a separation between the trench centres of 5m. Kensa have to date supplied over 20,000 slinkies, all operating correctly.

Design

Heat Emitters

To get the most efficient operation from a heat pump it's important that the outlet temperature is kept as low as possible, this lends itself to underfloor heating distribution systems.

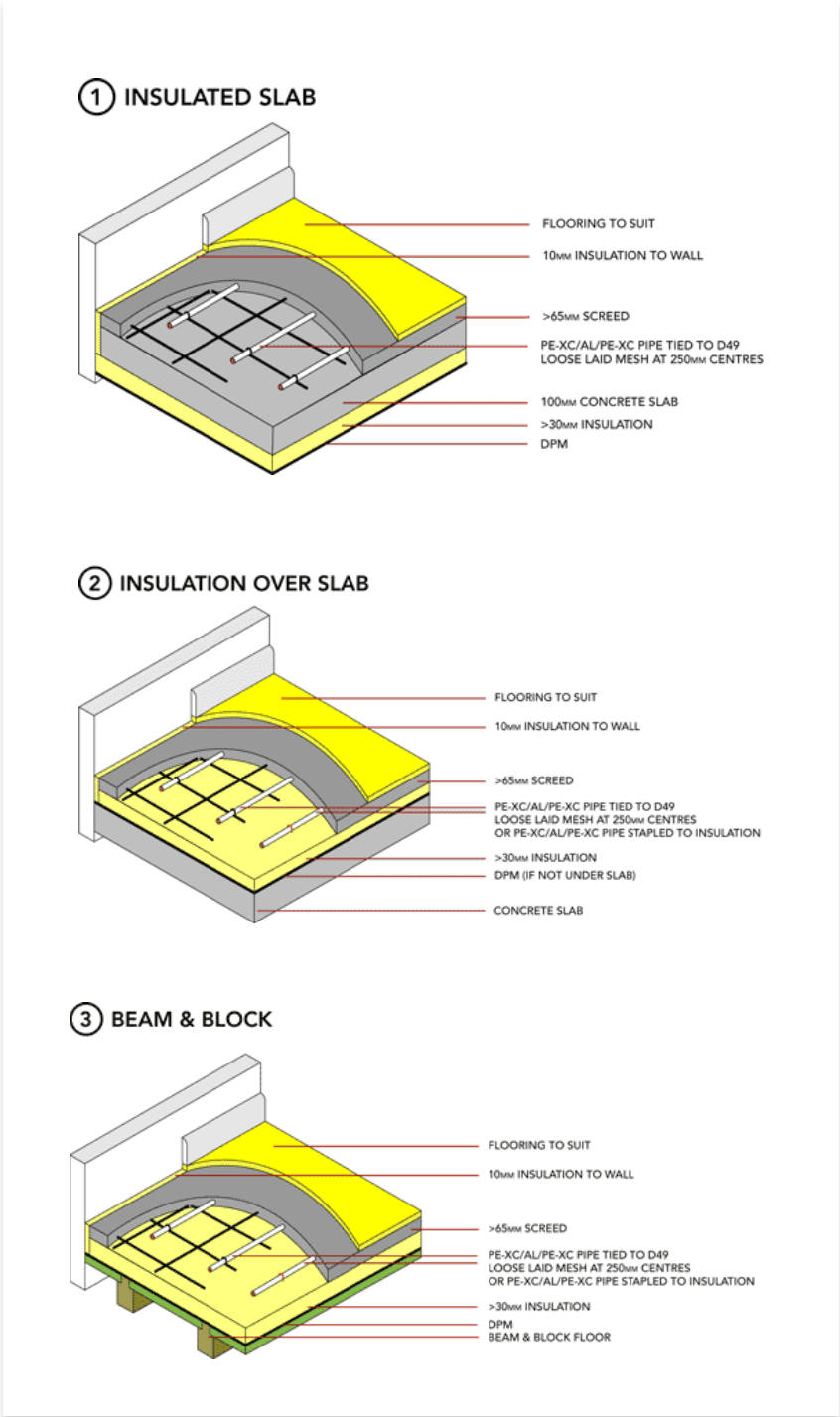
Underfloor Heating (UFH)

Underfloor heating embedded within screed will generally require the lowest flow temperature. Using the screed as a thermal mass allows the occupier to run the heat pump on off-peak tariffs further reducing the running costs. If you are using underfloor heating, the underfloor company should design the layout of pipe for the construction and work out the thermal resistance of the floor covering to establish the optimum running temperature. Kensa will then set the heat pump to the UFH design temperature during commissioning.

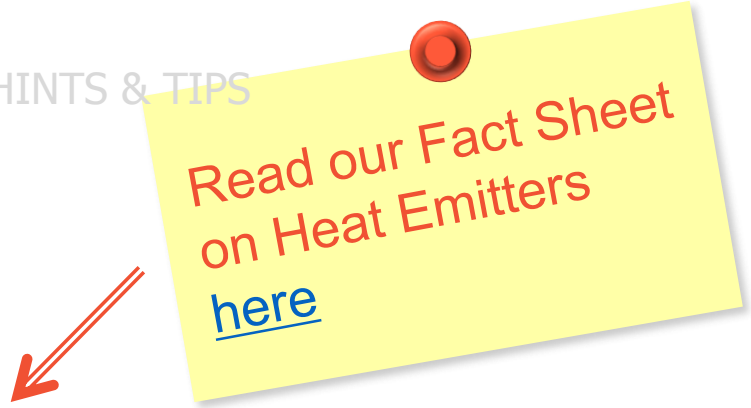
Read our Fact Sheet on underfloor heating here

For first floor applications the ideal building construction is beam and block with the underfloor and screed laid on top. For suspended floors a dry/sand screed can be used either between or over joists, however with these systems structural and height considerations need to be taken into account.

It may also be necessary to run the heat pump at a higher temperature to drive the heat through the overlying chipboard and final floor finish, therefore reducing its efficiency.



Three common UFH constructions



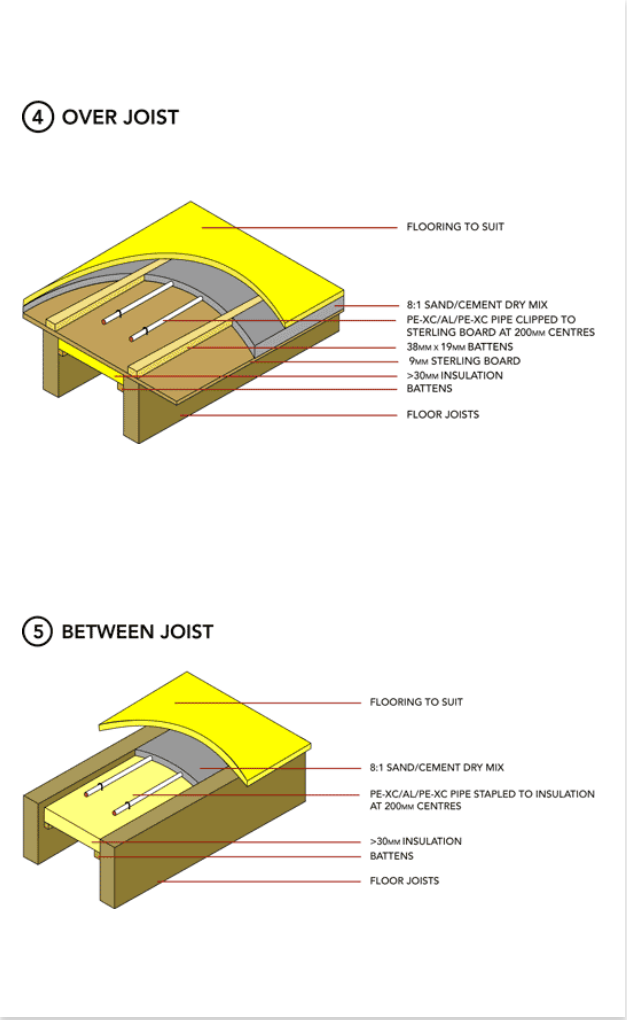
> Remember floor coverings like carpets need to be factored into your sizing."

If you are using UFH heating on the first floor which is joisted, the UFH system should be a plated system (diffuser plates) which sits in a grooved insulated panel which the UFH pipe passes through. The pipe warms the plate which in turns warms the floor and room above. The UFH system sits between the joists on battens and the system should be insulated under the panel to prevent any downward heat losses.

The diffuser plates need to be in contact with the floor once it's laid. This is due to the floor normally being chipboard which is not conductive and has a high thermal resistance. This coupled with normally a lower tog carpet on top, means the heat pump will require setting at a higher temperature.

It is possible to use between joist and over joist screed underfloor systems. However these tend to be difficult and expensive to install and are still affected by the thermal resistance of anything placed above these systems.

This process on the first floor can be expensive, so as an alternative, radiators may be considered. Again the design temperature is important as this ultimately affects the heat pump efficiency.



Over joist and between joist UFH constructions

Read more about underfloor heating here

> Radiators work well with heat pumps too, but must be oversized.”

Radiators

To get the most efficient operation from a heat pump it is important that the outlet temperature is kept as low as possible. For this reason, underfloor heating with its larger heat emitting area has generally been favoured.

However where this is not possible radiator systems can be used, but must be oversized to deliver flow temperatures compatible with the heat pump (typically 45ºC).

Heat pumps can be effectively used with radiators, however they are certain considerations that need to be taken into account.

✓ 45-50ºC flow temperature

Heat pumps with radiators are required to increase their flow temperatures to 45-50ºC, which reduces the Co-efficient of Performance (COP) and hence efficiency.

✓ Oversized hot water coils are required

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. Due to the low flow temperatures generated by the heat pump the hot water tank must have an oversized coil to provide the correct heat transfer.

✓ Off-Peak Tariffs

Due to the low water content of radiator systems and hence low thermal storage, off-peak tariffs such as Economy 10 can not be effectively used and a flat rate tariff might be more effective.

Read more about radiators in existing properties here

The manufacturer of the radiators you choose will have correction tables to work out the output of the radiators based on the lower flow temperature required and the room heat loss.

Air gap underfloor systems should not be used. Ideally, where possible, a reverse return piping arrangement should be used to connect the heat emitters to the heat pump. This will ensure that equal flows are provided to each emitter in the most efficient manner.

Radiator manufacturers will provide output figures to match your heat pump's lower flow temperature

Read the Heat Emitter Guide here

CHAPTER 2:
Controls

There are many options for controlling the time and temperature in your home, provided by the ground source heat pump via your chosen heat emitters.

From simplistic dial controls that can be manually adjusted, to sophisticated fully programmable stats that can control the time and temperature in each room in your home, allowing you to make even more energy savings.

Due to the low flow temperature of ground source heat pumps and their heat emitters, efficient use via heating controls is essential to ensure maximum savings.

Find out more about weather compensation here

Heat pump flow temperatures can change with the weather for more efficient operation.”

All Kensa heat pumps come with weather compensation as standard and with the required sensors for installation, however this function is disabled in the software and it is recommended that this function is not enabled for commissioning and while the purchaser gets used to living with a heat pump.

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.

CHAPTER 3:
Hot water & towel rails

All Kensa ground source heat pumps can be built to provide hot water production capable of delivering temperatures to a comfortable 55ºC.

Where there is an exceptional hot water demand, High Temperature models are available to deliver hot water to 65ºC.

Hot water & towel rails

Domestic Hot Water

As standard, immersion heaters are not used in any Kensa models, due to their costly implications on end users.

Furthermore, Kensa has pioneered an approach to domestic hot water production in its ground source heat pump models removing the requirement for thermostats.

The maximum temperature that the heat pump can achieve is directly related to the refrigerant circuit's maximum pressure, as advised by the compressor manufacture. Kensa has innovated this approach by using a refrigerant pressure switch to terminate the domestic hot water cycle, thus always achieving the hottest water possible leaving the heat pump. Once the heat pump has terminated the domestic hot water cycle an internal timer prevents another cycle from beginning for two hours. This timer is adjustable during the commissioning process.

Read more about domestic hot water here

When there is a demand for hot water the heat pump switches from space heating mode to hot water mode and the heat pump outlet temperature is increased. The maximum temperature from a heat pump is generally around 50ºC, although Kensa High Temperature and Hybrid models are able to deliver hot water to 65ºC. The higher the hot water production, the lower the heat pump efficiency.

This hot water is generally piped through an indirect coil mounted in a separate hot water tank and hence the expected tank temperature will be around the 45-48ºC range. Kensa provides a range of stainless steel pressurised cylinders with large internal coils that complement the heat pumps performance.

The cylinder if possible, should be located in a central location inside the house, this keeps the DHW pipework to a minimum. If a secondary return is being used, do not connect this into the cylinder. It will destroy any stratification and due to the low flow temperature of the heat pump any temperature drop cannot easily be recovered resulting in possible tepid hot water.

Any pipe-work from the cylinder to the point of usage should be well insulated to avoid any drop in temperature between the cylinder and taps.

Hot water & towel rails

Towel rails

Do not install towel rails on the DHW circuit, these can cool the cylinder and again drop the DHW temperature resulting in tepid hot water.

Towel rails should be installed on the space heating circuit on a separate circuit with a control valve. As the towel rails are on the space heating circuit then ferrous towel rails can be used which can be considerably cheaper. If you require the towel rails to be used during the summer then it is advantageous to buy duel element towel rails that utilise electric.

Because the house has been designed around low flow temperatures, make sure all pipe-work is insulated effectively (including pipe-work running through floor voids).

Read our Fact Sheet on towel rails here

CHAPTER 4:
Location

See ground source case studies here

Depending on the building and external environment, the heat pump maybe required to work long hours. This isn't a problem for the heat pump as it is a very robust piece of kit, however they can be considered noisy if located near bedrooms, therefore an external location should be considered.

Custom built shelters, outhouses, and garages are the favoured option by many of our customers.

Get a free quote

www.kensaheatpumps.com/submit-plans/

If you would like a free no obligation quote and design estimate for your project to feature a ground source heat pump go to http://www.kensaheatpumps.com/submit-plans/