System Heating Design Hints and Tips V2

As the UK's only manufacturer of a full range of ground source heat pumps capable of handling space heating and domestic hot water production, Kensa Heat Pumps has considerable experience and expertise to help with your project.

Having pioneered the introduction of heat pump technology in the UK since 1998, Kensa is determined to maintain its unblemished reputation. A central tenet of the Kensa philosophy is to ensure its products are only installed in properties where the purchaser or property owner has been fully consulted on the issues affecting application and performance. It is important that the purchaser fully understands the best possible way of maximising the heat pump's efficiency and how the system will integrate with the building.

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.

Design

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.

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.

The heat distribution design is important to the operation of the heat pump as the system with the lowest required flow temperature will result in the highest efficiency from the heat pump. Under-floor heating embedded within screed will generally require the lowest flow temperature and the under-floor design company is responsible for its design. The under-floor company should calculate room by room heat losses 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.

If the UFH Company you were proposing to use does not provide this service then the efficiency of the heat pump maybe compromised.

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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 under-floor 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 maybe considered. Again the design temperature is important as this ultimately affects the heat pump efficiency. All radiators should be designed using a flow temperature of no more than 45-50^{o}C.

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 under-floor 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.

Controlling the Heat Pump

The heat pump is controlled with a time clock, same as with a gas or oil boiler. If the time clock indicates that the heat pump should run, it will run as long as there is a demand for heat. It is then controlled via programmable room thermostats this gives the option of variable temperatures in different rooms. Similarly if radiators are used then TRV's should be utilised.

Programmable room thermostats also allow the under-floor (if its mounted in screed) to have a high set back temperature of around 16^{o}C. The under-floor should be kept at this set back temperatures.

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 at least the first year or two while the purchaser gets used to living with a heat pump.

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Domestic Hot Water (DHW)

Ground source heat pumps can provide domestic hot water as well as space heating; however they work on domestic hot water priority and therefore cannot provide space heating and DHW simultaneously. When producing domestic hot water as the required outlet temperature of the heat pump is higher, its efficiency is reduced compared to space heating.

Again the design is essential, heat pumps will provide hot water up to 50 degrees, because of the lower temperature, the cylinder indirect coil requires a much larger surface area to dissipate the heat. 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 pipe-work 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.

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).

Heat pump location

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 and an external location should be considered.