DHW on Ground Source Heat Pumps V3

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

The success of heat pumps at heating DHW varies enormously and depends upon many factors such as:-

i. Quantity of DHW required each day.
ii. Target temperature of DHW.
iii. Ratio of tank volume to heat pump capacity.
iv. Refrigerant type.
v. Tank efficiency—surface area to tank volume ratios of the coils

DHW demand can vary greatly as it depends upon the total occupants of the building and is much more difficult to quantify than space heating. Most ground source heat pumps use a closed-loop ground array system, such as slinkies or boreholes that use the ground as a solar battery. This is an exhaustible source of heat energy that needs to be recharged via ground water (rainfall) or during the warmer summer months. For space heating as the length of the heating season is roughly 4-6 months and the ground recovers during the summer. However as DHW is required all year round, the ground doesn't have the same recovery time and an additional load is placed on the ground. Hence the ground arrays need to be increased to meet this.

To provide DHW at 50C, the heat pump would need to generate hot water at around 55C. This reduces the efficiency of the heat pump significantly to a COP of around 2.66—2.3. If it isn't feasible to produce the DHW within the off-peak periods due to the space heating demand, it becomes more cost effective to use an off-peak immersion heater. This avoids the heat pump from having to produce DHW in the higher cost peak electricity periods and the costs associated with this.

Solar panels (which will provide up to 75% of the DHW demand throughout the year for free) backed up by an off-peak immersion heater is the ideal solution for the production of DHW. For the applications where the above limitations are acceptable and solar panels are not an option, Kensa has designed an industry leading and straightforward DHW option to simplify the production of DHW using a heat pump. The heat pump is designed to operate at the optimum temperature that provides DHW, at the maximum efficiency and without using any inbuilt direct electric heaters.

Facts at a glance:

DHW Production—Heat pumps can produce DHW however while doing this efficiency is reduced and the temperature limited to approx 50°C.

Ground arrays—Due to the additional load and all year round demand for DHW additional ground arrays are required.

Solar Thermal—The most efficient method of producing DHW is via solar thermal backed up with an off peak immersion heater.

DHW on Ground Source Heat Pumps V3

The system does not need a tank thermostat or a software temperature setpoint. A standard boiler/tank combination would generally be based on a Honeywell "Sundial Y Plan" valve, or similar. This allows simultaneous space and DHW heating. This is generally not possible with a heat pump, so a "W" plan is used instead. This can prove to be complex to install and so Kensa have dramatically simplified the installation.

Type of DHW Tank
Any indirect DHW tank can be used, however the better designed the coil within the tank, the better the heat transfer and hence the better the DHW performance will be.

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, 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.

Immersion Heater
Although not required by Building Regulations, it is generally advised that to provide legionella protection the tank is raised above 62^{o}C at least once a week. To provide this we would recommend that a 3 kW electric immersion heater is fitted to the tank, with its own dedicated 7 day timeclock.

3 Port Diverting Valve
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.

Tank Thermostat
A tank thermostat is not required.

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.

Facts at a glance:

Simple Installation—Designed to simplify installation by removing the need for complicated control logic, buffer tanks, balancing valves and hot water cylinder thermostats.

Oversized DHW hot water coils are required—The larger size 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.

Factsheet

DHW on Ground Source Heat Pumps V3

Page(s)