

# Heat Pump Data

HEAT PUMP ASSOCIATION DATA SHEET

*Helping you save energy  
to create a better environment*



www.heatpumps.org.uk

Data Sheet No. 2

## GROUND TO WATER HEAT PUMPS — DOMESTIC

### What is a ground to water heat pump?

A device which extracts energy from the ground and uses it to heat water.

### How does it work?

A ground to water heat pump absorbs low temperature energy from the ground and raises it to a higher, more useful temperature using a refrigerant cycle and uses water to deliver the heat. A heat exchanger transfers the energy from the ground to a refrigerant with a low boiling point which evaporates and circulates in a closed system. The pressure of the refrigerant gas is raised by a compressor, which also raises the temperature to a useable level. The refrigerant then condenses in a second heat exchanger and releases heat to a water delivery system. The pressure of the refrigerant is then reduced by an expansion valve, its temperature falls, and it is ready to start the cycle again and absorb energy from the ground.

There are three ways to collect the heat from the ground:

#### **Closed-loop, indirect circulation** —

A mixture of water and antifreeze is circulated through a closed loop of plastic pipe which is buried either horizontally in a shallow trench or vertically in a borehole. The water/antifreeze solution absorbs heat from the ground and then passes through the heat pump heat exchanger where this heat is extracted. This is the most common way to collect the energy from the ground. This type of collector can also be submerged in a lake or pond.

#### **Closed-loop, direct circulation (Direct Expansion DX)** —

The heat pump refrigerant is circulated directly through a loop of copper pipe buried in the ground. The heat exchange is more efficient because no circulating pump or heat exchanger is needed but a larger volume of refrigerant is required. This type of collector is uncommon in the UK because installation and operation are subject to more stringent requirements with respect to refrigerant handling and environmental protection. Direct circulation products are not included in the Microgeneration Certification Scheme.

**Open-loop** — Where there is a suitable source of ground water this can be extracted and circulated directly through the heat pump heat exchanger and either

re-injected if from an aquifer or discharged. Heat exchange is efficient but an abstraction licence and discharge consents will be needed and there is likely to be a charge both to abstract and discharge the water.

### Types of ground to water heat pump

Ground to water heat pumps can be:

- Single packaged for outdoor installation (fully weatherproofed with insulated water distribution pipes to and from the building).
- Single packaged for indoor installation (with pipework from the building to the ground collector).
- Split (a matched pair of units with the heat pump evaporator mounted outside and the condenser mounted indoors — the two units are linked with pipework containing refrigerant).

See diagram overleaf of basic heat pump system configuration.

### What you need to know to select a product

- The building heat loss — it is important to size the heat pump accurately. Heat pumps are usually sized to meet all of the heating load. Always improve energy efficiency where possible before sizing the heat pump.
- Heat pump dimensions and location requirements — The physical size will vary depending on the output and type but will be larger than a gas boiler of the same capacity. Typically a 12 kW (heating) single packaged unit will be about 1000 × 600 × 600 mm and weigh between 150 kg and 220 kg. Products with integral domestic hot water storage can weigh double this when full.
- Heat pump efficiency — usually given as the Coefficient of Performance (CoP)\* at a specific operating condition (the Standard rating condition is BOW35, i.e. brine (the water/antifreeze solution in the ground coil) at 0°C, output water at 35°C).
- The operating range of the heat pump — the temperature of the water/antifreeze solution entering the heat pump from a closed loop ground collector will depend on the ground temperature and ranges from about 12°C to just above 0°C. The

temperature drop across the heat exchanger is usually between 3°C and 5°C. The fluid in a closed loop ground collector should be protected from freezing down to at least -15°C. The maximum water temperature for heating is typically 55°C but can be up to 65°C.

- The type of heating distribution system, including any buffer/storage tank arrangement.

### Applications

#### **Space heating**

This is the main application. The lower the distribution temperature in the heating system the higher the efficiency of the heat pump will be. Heat pumps are therefore best suited for use with low temperature heating systems such as:

- Underfloor heating (delivery temperature 30-45°C).
- Fan coils (delivery temperature 35-55°C).
- Low temperature radiators (delivery temperature 45-55°C).

#### **Domestic hot water**

Heat pumps able to provide supply water in the range 60-65°C can provide full water heating.

Where the output temperature is lower than this the heat pump can provide the majority of the water heating but supplementary heating will be needed.

#### **Space cooling**

**Passive cooling** — The water/antifreeze solution from the ground coil can be circulated through fan coil units to provide limited cooling in summer.

**Active cooling** — Reversible heat pumps can be used with fan coils to provide cooling in summer. With underfloor heating partial cooling can be provided (the floor surface temperature should be limited to about 18°C to limit the risk of condensation).

\* The Coefficient of Performance is measured as the heating output (kW) divided by the total power consumed by the system including fans, pumps and controls (kW). The European Standard for testing and rating heat pump performance is EN 14511.

# GROUND TO WATER HEAT PUMPS — DOMESTIC

Ground to water heat pumps are suitable for both new build and retrofit

The ideal site:

- Is new build (easy to use low temperature heating system).
- Has no access to gas (relatively high fuel prices).

## Advantages

- High efficiency.
- Low energy consumption.
- Low running costs.
- Low carbon emissions (lower than gas condensing boiler).
- Relatively low noise (lower than an air source heat pump because there is no external fan noise).
- Low maintenance and long life (the ground collector should have a life of at least 50 years).

## Aspects to consider

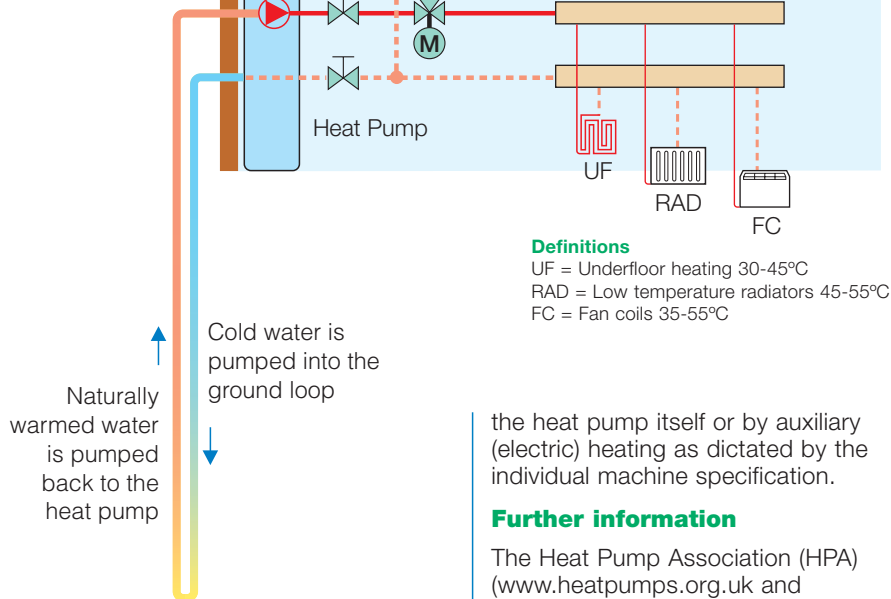
- Area required (for horizontal closed-loop ground collector).
- Access for drilling rig (for vertical closed-loop ground collector).
- Water quality and minimum volume flow required (for open loop ground collector).
- With a single phase electricity supply the maximum output is about 12 kW (heating output) i.e. sufficient to heat a well insulated property of around 200 m<sup>2</sup>). Larger capacity products are likely to require a 3-phase electricity supply.
- When supplementary heating is in use the system efficiency will be significantly decreased so its use needs to be carefully controlled. Ensure that the heat pump is sized to achieve the majority of the required duty.

## Financial incentives

VAT on heat pump installations is charged at 5%.

Possible grants are available for domestic installations (Low Carbon Building Programme, or from Electricity suppliers).

**Note:** Heat Pump may be mounted outside of the dwelling.



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 (Repeated from front of leaflet)

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## Diagrams and notes

The diagram is for illustrative purposes only. Refer to supplier for comprehensive installation details.

The Heat Pumps shown represent equipment that supplies warm water for space heating or DHW on a priority basis.

Heat Pumps that can supply warm water for space heating and DHW simultaneously will have two separate heat pump circuits.

Domestic hot water must be regularly heated to at least 60°C to eliminate any risk of legionella. This may be achieved by

the heat pump itself or by auxiliary (electric) heating as dictated by the individual machine specification.

## Further information

The Heat Pump Association (HPA) ([www.heatpumps.org.uk](http://www.heatpumps.org.uk) and [www.feta.co.uk](http://www.feta.co.uk)).

The Microgeneration Certification Scheme ([www.microgenerationcertification.org](http://www.microgenerationcertification.org)) — The Scheme provides lists of certified products and installers.

The Energy Saving Trust ([www.energysavingtrust.org.uk](http://www.energysavingtrust.org.uk)) — Provides information on grants available.

The Ground Source Heat Pump Association ([www.gshp.org.uk](http://www.gshp.org.uk)) — The Association provides information on ground source heat pumps via a helpline and their website.

## HPA members list and products

For information on heat pump products available, please go to our website where there is an up-to-date list of members contact details.



a FETA Association

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