Heat Pumps

Get heat from thin air

Ashburn

Ashburn Stoves & Heating www.AshburnHeating.co.uk

Heat Pumps Explained

Heat Pumps – The basics

A heat pump operates like a fridge in reverse, taking the available heat from the ground or the air surrounding a property and using that to add warmth to your home.

Heat pumps use heat exchangers and compressors to take heat from the outside air or the ground and maximize the heat gain available.

For example you may have noticed that a bicycle pump, gets warm when it is used, the gasses in a heat pump experience the same temperature rise due to compression.

Heat Pumps – The technical bit

Heat naturally moves from a hotter area to a colder one. A heat pump works in reverse by using a small amount of electricity to power a cycle of compression and evaporation.

There are four stages to this process:

Evaporator

Low level heat is passed through a heat exchanger – known as the evaporator.

Depending on the type of heat pump, this low-grade heat can come from any number of sources: ground-source heat pumps absorb heat from the earth, air-source from the air, and water-source from a nearby lake or pond.

This heat causes refrigerant liquid to evaporate within the evaporator, (this refrigerant can absorb heat even in very cold conditions.

The refrigerant is then compressed, driving the temperature up. The low-grade heat is therefore upgraded into a useably higher temperature.

Condenser

The refrigerant then transfers heat into the central heating system through a second heat exchanger (the condenser), causing the refrigerant to condense back into a liquid as the central heating absorbs the heat. This heat is stored in an insulated water tank (accumulator or buffer tank) and either circulated around radiators, underfloor heating or used for hot water.

The cooled refrigerant now passes through an expansion valve decreasing the pressure and temperature of the refrigerant, which then returns to the start of the cycle.

Types of heat pump There are two main types of heat pump:

Air Source Heat Pumps

Air source heat pumps are the most popular type of system. These heat pumps look quite similar to a standard air conditioner and are sited outside.

Air is drawn into the heat pump unit by the fan which keeps a constant flow of air coming into contact with the heat exchanger.

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Ground Source Heat Pumps

A ground source heat pump uses the energy stored in the earth as the source of heat for the evaporator and looks similar to a fridge or freezer. It collects the heat through pipes laid underground either as a ground loop / ground array or via a bore hole. A mixture of water and a special type of anti-freeze is then pumped through this network of pipes underground, absorbing the naturally-occurring heat below the frost line. The antifreeze- water mix then delivers the heat to the evaporator within the heat pump, and the same evaporation-compression process begins.

Our borehole systems are sealed and have no effect on the water table or environment.

Ground or Air Source Heat Pumps

Which should you choose?

Efficiency

Heat pumps are capable of operating at 350 or even 400% efficiency (meaning that 1 unit of electricity creates 4 units of heat). This is because heat isn't generated as in a gas boiler or electric heater; it is simply gathering heat and carrying it into your home.

Ground source heat pumps are more efficient than air source heat pumps. This is because heat is transferred through the ground via the movement of water, which can retain more heat than air; it's *heat capacity* being around 4 times greater than air.

Air source systems are also subject to fluctuating temperatures. During the winter when the temperature outside drops, air source heat pumps must work harder to maintain your usual warm temperature inside. Their rate of efficiency drops, so they use more electricity while still remaining cost effective.
In contrast, the temperature underground is almost constantly 10oC all year round.

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Space

Air source uses an external unit (usually sited against an external wall but can be connected to the house via high efficiency insulated pipework), and is similar to an air conditioner unit in shape and size.

Ground source systems need an array of pipes must be laid underground. As a rough guide, this pipe network usually needs to be twice the floor area of your house – including multi-storeys – to meet your home's demand for heating and hot water (subject to the level of home insulation), and has to be buried using a digger.

If you don't have a large amount of space or don't want to dig up your garden, you can opt for a vertical system of pipes, where boreholes are drilled 60 to 100 meters deep.

The internal ground source heat pump resembles a small fridge or freezer.

Cost

Air source systems are substantially cheaper to install than ground source heat pumps. For ground source systems, landscaping and diggers or drilling machines are involved in the installation. However, both types of heat pump are eligible to receive a large portion of the installation costs back from the RHI (2018).

Noise

Air source heat pumps are only as noisy as an air conditioner, but planning permission ensures the external unit won't be sited anywhere that might disturb your neighbours. In contrast, ground source heat pumps can operate almost silently.

RHI

The Renewable Heat Incentive (RHI) is a government-funded scheme to encourage homeowners to switch to renewable heating systems. You receive quarterly payments from the RHI for 7 years.

As the RHI is relative to the installation cost, the rate for air source systems is currently at 10.49p/kWh, whereas the ground source RHI is 20.46p/kWh.

To check current facts and figures for RHI visit:

About RHI: https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi/about-domestic-rhi

The Useful RHI Calculator: https://renewable-heat-calculator.service.gov.uk/

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