The most **commonly asked questions** about Air Source Heat Pumps

**Q. What are air source heat pumps (ASHP)?**

A. Air Source Heat Pumps use basic thermodynamic principles to convert latent/sensible heat (contained within the ambient air) into heat energy that can be used to provide heating and hot water. In this respect the device can be classified as a renewable energy source because the heat in the ambient air is replenished by the sun.

There are two types - ‘air to air’ and ‘air to water. Air to air heat pumps release the captured energy through an air heat exchanger, which is then forced (by fan) around the dwelling by trunking, or directly into the room. Most commercial buildings use this type of heating medium. Grant Aerona ASHP are the air to water type. Air to water heat pumps release the energy into a water circuit which is then used in a wet heating system.

**Q. How do ASHP work?**

A. Air to water heat pumps employ the dynamics of the vapour/compression cycle used for many years in the basic refrigeration process found within a domestic fridge. A low pressure, low boiling point liquid (refrigerant) is exposed to a higher temperature in the coil of the evaporator. The liquid boils off to a gas and in doing so, absorbs energy. The refrigerant gas is then compressed to a higher pressure and temperature before passing through a heat exchanger where it gives its heat energy to water. The heated water is then delivered to a cylinder or heating system. After passing through the heat exchanger the refrigerant condenses back into a liquid before starting the process again.
Q. What is different about Grant’s approach to air source heat pumps?

A. Air source heat pumps generally fall into three categories:

1) Units that have been designed specifically for heating only.

2) Units that were originally designed for air conditioning (cooling), but have been modified to provide heating.

3) Units that were originally designed for both cooling and heating with cooling the main function.

The Grant Aerona falls into the first category, having been designed specifically for heating homes in the UK and Irish markets. This is particularly evident in the Aerona’s visual appearance and also its ease of installation.

The units are available in sizes ranging from 6.5kW-13kW.

Q. What is meant by the COP for a heat pump and how can I compare products?

A. COP Stands for ‘Coefficient of Performance’. This is a ratio with no units, basically indicating the amount of energy required to run the compressor, compared with the amount of energy being produced by the heat pump, to heat the water.

Standard testing, carried out to EN14511 establishes a benchmark COP at a particular ambient and circuit water temperature. This is 7°C for ambient air and 35°C for water flow temperature and usually produces a COP in the region of 3.5. For example, the Grant Aerona 6.5kW ASHP model produces a COP of 4.1, when tested to this level. This means for every kilowatt (kW) of energy used to run the Aerona, 4.1kW of energy is being given to the heating system in return.

Q. Is the Grant Aerona Air Source Heat Pump Range MCS approved?

A. Yes, all models within the Grant Aerona Range are listed on the MCS Approved Register. Provided that the installer is also MCS approved, householders will be able to access the Renewable Heat Incentive grant (RHI) due to be launched in April 2011. For approval numbers, please visit the MCS website - www.microgenerationcertification.org
Q. How efficient is an ASHP compared with a gas or oil fired boiler?

A. To compare efficiencies with gas/oil boilers in monetary terms is always going to be a moving target, as world prices for fossil fuels fluctuate. To get a reasonable indicator you have to establish how much energy is produced by, say a litre of fuel oil, along with the cost, and then compare it with the cost of a Kilowatt of electricity to run the heat pump and the pumps output. If the heat pump is more cost effective then the heat pump is more efficient.  In environmental terms, the heat pump is vastly more beneficial as it is using solar energy contained within the ambient air to produce heat energy.

Q. Why have Grant chosen to market an ASHP encompassing weather compensation and an electrical backup?

A. Heat pump equipment derived from the air conditioning industry is the result of many years of product development. Although they do work well, the technology tends to be over complicated for domestic heat pump applications and makes installation slow for heating engineers. Due to their design, this technology may require the assistance of a refrigeration technician for installation and commissioning.

Weather compensation is not a new idea for the heating sector. Grant has taken tried and tested technology and given customers the benefit of incorporating it into every Aerona ASHP.

As the COP of the heat pump is affected by weather conditions, it can sometimes result in poor performance and efficiency. Grant has built in an independent heating element to provide a boost in the rare times when the COP drops to inefficient levels.

Q. As the stated kW output of an ASHP is established testing at 7°C ambient air and 35°C water flow temperature (EN14511 standard testing conditions), what happens to the performance of the ASHP if the air temperature drops or the required water temperature is set higher?

A. All ASHP will have a decrease in output if the air temperature is cooler than the standard test conditions (STC). This is also true if the system water temperature is raised to a higher temperature than the STC. It is therefore vital that an accurate heat loss calculation is carried out to ensure the sizing of the heat pump is correct.

Not surprisingly, if the air temperature is higher, or system water temperature is lower, an increase in output can occur.
**Q. When the weather is cold will the ASHP still work?**

A. When the weather is cold the ambient air contains less heat energy. At lower ambient temperatures the energy required to boil off the refrigerant, will require more input from the internal compressor. The water will be heated, but at a slower rate, so the efficiency of the heat pump reduces. Low temperatures of around –15°C will affect the heat pump performance in this way.

**Q. Can an ASHP meet all the heating and hot water needs for a house throughout the year?**

A. Under anything but the most severe weather conditions, provided the property is well insulated and the unit has been sized correctly, the heat pump will supply the necessary heating requirements for the majority of the year. However, in any situation where the weather can be severe, a supplementary heat source will be required to maintain target temperature. This would normally be provided by a backup immersion (part of the weather compensation unit in the Grant Aerona Range), but could also be in the form of a supplementary gas/oil boiler.

An ASHP works at a higher COP when run at lower flow temperatures, typically 35-50°C. Domestic hot water is normally stored around temperatures of 60°C, so it is therefore likely that a supplementary heat source in the form of a tank immersion element may be required, especially if the heat pump is the only provider of domestic hot water and is not being assisted by solar thermal.

**Q. What water temperature will the ASHP generate?**

A. Even at a temperature as low as -15°C, air contains a certain amount of heat. In the United Kingdom it is rare that our external air temperature would fall below this point, meaning ASHP technology can be a very effective heating method. In traditional terms an ASHP produces low temperature water, in comparison to traditional heating appliances. This is due to the following:

1) The physical properties of the refrigerants used are limited to the amount of energy that they can absorb and therefore give up, further into the process.

2) The ambient air contains insufficient heat energy to successfully boil off the refrigerant vapour.

Refrigerants used throughout the industry can comfortably produce water temperatures in the region of 50°C based on current independent testing criteria.
Q. Can I heat a swimming pool with an ASHP?

A. Yes, an ASHP can be used to heat a swimming pool provided the system is correctly designed and the heat loss is calculated. The system design must ensure that the swimming pool water does not come into direct contact with the heat pump components.

Q. Can I connect an ASHP to my existing hot water cylinder?

A. Due to the lower water temperatures produced by a heat pump, any heat exchange taking place in an indirect cylinder will require a coil with a larger surface area compared with that of a traditional cylinder. This will ensure efficient heat transfer. Therefore it is recommended that the cylinder be checked for suitability and changed for one designed for use with heat pumps. Grant produce a range of ASHP cylinders, specifically for this application.

Q. I am aware that an ASHP works well with under floor heating but can it also work with radiators?

A. A heat pump will cope well when used with panel radiators, provided that the system is properly designed and that the building has a high level of insulation. Due to the lower temperatures involved, radiators have to be oversized and the heating will need to be on for longer periods, in order to meet the heating demand. Customer perceptions may be different as the radiators will be cooler to touch, giving the impression that the heating is not functioning correctly, even though room temperature targets are being met. Radiator and underfloor heating systems can also be combined.
Q. Is an ASHP suitable for an existing house as a replacement for a gas or oil fired boiler?

A. It is unlikely that an ASHP will be considered as a direct replacement for an existing boiler, unless the present system is considerably updated to ensure that the ASHP can sufficiently heat the property. This will include a full and detailed heat loss calculation, radiator replacement, cylinder replacement, as well as an assessment and possible upgrade of the properties insulation. However an ASHP can always be used as the main heating source, provided a back up system is also incorporated.

Q. What are monovalent and bivalent systems, and which is best?

A. With a monovalent system, the heat pump is designed to provide all the required heat. Initial capital costs however, may mean it is more economical to use a bivalent system where the heat pump only covers the base heating load. An additional heat source e.g. oil boiler, gas boiler, or electric back up, will meet the remaining peak demand. Which system to choose, purely depends on the home and heating requirements.

Q. What type of controls should I use?

A. It is perceived that the ideal heating arrangement for ASHP installation is a well designed under floor heating system that uses low temperature water as its heating medium. The controls for the system will be as specified by the underfloor heating manufacturer. A temperature sensor on the heating system, will control the running of the water circulating pump in the ASHP, to achieve the required target temperature. If the heat pump is to also be used as a supplement for domestic hot water, via an indirect cylinder, then a traditional ‘S-plan’ type arrangement can be used.
Q. How easy is a Grant Aerona ASHP to install?

A. A Grant Aerona ASHP is supplied fitted with the weather compensation unit and electrical backup. Only two pipe connections are required from the house: heating system flow and return, and an electrical supply. The heat pump itself should be placed at least 300mm from the wall to ensure that there is an unobstructed air flow to the unit.

The electrical supply should be fed from a dedicated MCB with a suitable external isolation switch, situated near the heat pump.

Q. What cable size should be used to connect the ASHP to the mains supply?

A. Cable size will vary dependent upon the size of heat pump installed, type of cable and its length of run. We recommend that all electrical work is carried out by a registered and qualified electrician, in accordance with current legislation.

Q. Which is best, a single or three phase electrical supply?

A. The efficiency and capacity of both single and three phase units is virtually identical, but the majority of domestic houses in the United Kingdom are connected to single phase supplies. Grant Aerona Air Source Heat Pumps are available in single phase only.

Q. Where can you site an ASHP?

A. An ASHP can be fitted almost anywhere externally, provided there is an unobstructed air flow available to the unit to ensure trouble free efficient operation, and you take into consideration your pipe and cable runs to and from the property.
Q. What is the defrost cycle?

A. To ensure the unit operates as efficiently as possible, the evaporator matrix has to be kept ice free (as ice acts as an insulator). The ASHP will automatically switch to ‘defrost mode’ periodically to ensure that the evaporator stays clear.

In the case of the Grant Aerona, this reverses the heat pumps refrigeration process for a short time, thereby supplying latent heat in the form of hot gas to the evaporator, which defrosts any ice present. In normal operating conditions the defrost cycle will not result in a deterioration of the dwelling’s core temperature.

Q. How do you size a heat pump?

A. In a monovalent system (e.g. in a new-build situation), the ASHP should be matched to 100% of the thermal heat loss for the property*.

In a bivalent system (for existing buildings with an auxiliary heat source) the ASHP should be sized to 60-70% of the thermal heat loss*.

* The heat demand for the property should be accurately calculated and not estimated. You should always remember to allow for domestic hot water requirements.
Q. Why fit an air source heat pump (ASHP) in preference to a ground source heat pump (GSHP)?

A. The choice between the two could be down to the following:

1) The difference in COP between ASHP and GSHP is minimal compared with the difference in cost of the equipment and installation.

2) The installation of a GSHP may cause considerable disruption to the property and could require the services of specialist consultants and installers. In comparison, the installation of an ASHP is far easier to plan and carry out.

3) For GSHP, the suitability of the property is a major factor, as they require either sufficient ground surface area, or a suitable local geology. No such considerations apply to ASHP.

Q. What refrigerant is used in a Grant Aerona ASHP?

A. The refrigerant used is R407 c, which is a Hydrofluorocarbon (HFC) blend with a boiling point of −44°C. An HFC refrigerant is Ozone friendly. However, it should be remembered that the discharge of refrigerant is forbidden under European and UK Law.

Q. Can an ASHP be combined with other renewable technologies to provide a more energy efficient home?

A. Absolutely, as long as a thermal store or a suitable cylinder is used in the initial design, then other technologies can be incorporated to make the whole system as efficient as possible.

The technology that is most beneficial to incorporate in such a system would be solar thermal.
Q. What maintenance is required for a Grant Aerona ASHP and how often will it need to be serviced?

A. No intrusive servicing is required or indeed allowed under legislation unless undertaken by a qualified refrigeration engineer.

The servicing routine is annual and limited to ensuring that the evaporator coil/matrix is clear of debris, which will significantly affect the performance of the heat pump if allowed to build up.

Q. Who can install a Grant Aerona ASHP?

A. To install Grant Aerona Air Source Heat Pumps, the installer must be a G-One Accredited Heat Pump Installer. This scheme provides installers with the essential tools to confidently fit the range and in turn, ensures homeowners are happy that their renewable heating system was installed to the highest possible standard by a manufacturer’s certified installer, guaranteeing the best efficiency, reliability and return on their investment.

To become a Grant Accredited Heat Pump Installer, the applicant must successfully complete the Grant Accredited Heat Pump Installer course and meet other scheme criteria.
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