1 Water or Brine to Water Heat Pumps

<table>
<thead>
<tr>
<th>Date published</th>
<th>2019</th>
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<tbody>
<tr>
<td>Date previously reviewed</td>
<td>2016</td>
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<tr>
<td>Date first launched</td>
<td>2004</td>
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</tbody>
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| Former name | Ground Source and Surface Water Source Heat Pumps  
Ground Source: Brine to Water Heat Pumps |

1.1 Scope

Water or Brine to Water Heat Pump systems are specifically designed to transfer heat from the ground or surface water to a water-based heating system by means of a refrigeration cycle.

The liquid heat transferring medium for the heat pump may be brine or water.

In a brine to water heat pump, the heat is collected from the ground or surface water by circulating a solution of water and anti-freeze (known as ‘brine’) through a buried or submerged, closed-loop, ground heat exchanger.

In a water to water heat pump, the heat is collected from ground water (aquifer) or surface water by circulating the water through a direct, open-loop heat exchanger.

1.2 Definitions

Water or Brine to Water Heat Pumps use an electrically operated refrigeration system to transfer heat from the ground or surface water into a water-based heating system. They can be used to provide space heating in a wide range of buildings, and some products may be also able to provide cooling by reversing the refrigeration cycle within the product.

Products which are designed to be used for a water heat source without the use of an intermediate circuit, i.e. direct open-loop system, are classified as water to water heat pumps. All others are classified as brine to water heat pumps. The ECA Scheme aims to encourage the purchase of higher efficiency water or brine to water heat pumps, which can be used to realise substantial reductions in carbon emissions.

1.3 Requirements

Investments in water or brine to water heat pumps can only qualify for Enhanced Capital Allowances if the specific product is named on the Energy Technology Product List. To be eligible for inclusion on the Energy Technology Product List, products shall meet the eligibility criteria as set out below.

1.3.1 Eligibility requirements

To be eligible, products shall:

- Consist of a single factory-built unit.
- Incorporate an electrically driven refrigeration system.
- Be designed to use an indirect, closed-loop ground heat exchanger, indirect, closed-loop surface water heat exchanger or a direct, open-loop ground or surface water heat source.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.
1.3.2 **Performance requirements**

Eligible products shall meet the relevant performance criteria set out in Table 1.1 below for:

- Seasonal Space Heating Energy Efficiency ($\eta_{s,h}$) as defined by Commission Regulation (EU) No 813/2013.
- Seasonal Energy Efficiency Ratio (SEER) for average climate conditions, where the product is designed to provide cooling.

**Table 1.1 Performance thresholds for water or brine to water heat pumps**

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Heating mode ($\eta_{s,h}$)</th>
<th>Cooling mode (SEER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Brine to water heat pumps</td>
<td>≥175%</td>
<td>≥5.00</td>
</tr>
<tr>
<td>2. Water to water heat pumps</td>
<td>≥185%</td>
<td>≥5.00</td>
</tr>
</tbody>
</table>

*≥* means "greater than or equal to"

1.4 **Measurement and Calculations**

1.4.1 **Energy efficiency metrics**

Seasonal Space Heating Efficiency ($\eta_{s,h}$) – ratio between the space heating demand for reference heating season, supplied by a space heater and the annual primary energy consumption required to meet this demand (as defined by Commission Regulation (EU) No 813/2013).

Seasonal Coefficient Of Performance (SCOP) – overall coefficient of performance of a heat pump using electricity, representative of the heating season, calculated as the reference annual heating demand divided by the annual energy consumption for heating (as defined by Commission Regulation (EU) No 813/2013).

Seasonal Energy Efficiency Ratio (SEER) – ratio of the total cooling capacity to the effective power input of the unit (BS EN 14825:2016).

Primary energy consumption for electricity usage is obtained using Conversion Coefficient (CC), known also as Primary Energy Factor, equal to 2.5, as defined by Ecodesign Commission regulation (EU) 813/2013.

**Reference heating season**, called also **climate** – a set of operating conditions describing per bin the combination of outdoor temperatures and the number of hours these temperatures occur for heating for which the unit is declared fit for purpose. There are three reference heating seasons: “A” average, “C” colder and “W” warmer. UK is located in two reference zones: A and W, but for the ETL purposes “A” for average is to be used.

Correction factor ($F_1$) is correction that accounts for a negative contribution to the seasonal space heating energy efficiency of heaters due to adjusted contributions of temperature controls, equal to 3% (BS EN 14825:2016).

Correction factor ($F_2$) is correction that accounts for a negative contribution to the seasonal space heating energy efficiency of heaters due to electricity consumption of brine and water pumps, equal to 5% (BS EN 14825:2016).

Equation corresponding to section 7.1 of BS EB 14825:2016:

\[ \eta_{s,h} = \frac{\text{SCOP}}{\text{CC}} - F_1 - F_2 \]
1.4.2 Test Requirements

No additional testing requirements beyond the measurement standard below.

1.4.3 Measurement standards

Performance data shall be determined and the SSHEE calculated, following the requirements of Commission Regulation (EU) No 813/2013, Annex III.

The product’s capacity and performance indicators, shall be determined at the conditions shown in Table 1.2 and in accordance with the procedures detailed in BS EN 14825:2016 “Air conditioners, liquid chilling packages and heat pumps, with electrically driven compressors, for space heating and cooling - Testing and rating at part load conditions and calculation of seasonal performance.”

Table 1.2 Part load conditions for water or brine to water heat pumps

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Heating mode (\eta_{s,h})</th>
<th>Cooling mode (SEER)</th>
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</thead>
</table>

The seasonal coefficient of performance (SCOP) shall be determined according to the calculation methods in BS EN 14825:2016.

Where results are determined by calculation then this should be on the basis of design and/or extrapolation. In this case, details of such calculations and/or extrapolations, and of tests to verify the accuracy of the calculations undertaken (including details of the mathematical model for calculating performance of such combinations, and of measurements taken to verify this model) shall be made available. Tests undertaken to verify the accuracy of the calculations shall be carried out in accordance with the test procedures described above.

Please note that the performance data for heating mode COP can only be obtained in accordance with the corresponding procedures laid down in BS EN 14825:2016 and standard rating conditions laid down in Table 12, BS EN 14825:2013 will be accepted as an alternative to testing in accordance with Table 24, BS EN 14825:2016 until further notice.

1.4.4 Rounding

For the avoidance of doubt data should be presented to three significant figures. As an example, a brine to water heat pump with a heating mode performance \(\eta_{s,h}\) of 174.4% would be deemed to be a fail.

1.5 Verification for ETL Listing

There are five main ways that applicants can demonstrate their product’s performance:

- In-house testing – Self-certified
- In-house testing – Self-tested and verified or cross-checked by an independent body
■ Witnessed testing
■ Independent testing
■ Representative testing (see clause 1.5.1)

Further information regarding the first four routes can be found in Guidance Note 5 on the ETL product testing framework\(^1\).

### 1.5.1 Representative Testing

Where applications are being made for a range of products that are variants of the same basic design, test data may be submitted for a representative model, provided that all variants, i.e. models, share following characteristic features:

■ Use the same refrigerant
■ Have the same compressor type (i.e. manufacturer, line of models), which should imply:
  - same method of compression (e.g. reciprocating or scroll) and
  - same type of enclosure (e.g. hermetic or semi-hermetic)
■ Are powered using same configuration of inverters.

The representative models may be selected by dividing the range of products into groups of models with similar design characteristics. The performance of each model shall be predicted using a validated mathematical model. At least one model in each group shall be tested for validation purposes. A report documenting performed model calculations, showing all significant calculation steps, shall be submitted with the application.

It should be noted that:

■ If a manufacturer voluntarily removes the representative model from the Energy Technology Product List (ETPL) then other products linked with that representative model may or may not be permitted to remain on the ETPL.
■ If any product submitted under these representative model rules is later found not to meet the performance criteria when independently tested, then all products based on the same representative model will be removed from the ETPL.

### 1.6 Conformity testing

Products listed on the ETL may be subject to the scheme's conformity testing programme in order to ensure listed models continue to meet the ETL requirements.

### 1.7 Scope of Claim

Expenditure on the provision of plant and machinery can include not only the actual costs of buying the equipment, but other direct costs such as the transport of the equipment to site, and the direct costs of installation. Clarity on the eligibility of direct costs is available from HMRC.

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\(^1\) [https://www.gov.uk/government/publications/energy-technology-list-etl-product-testing-framework](https://www.gov.uk/government/publications/energy-technology-list-etl-product-testing-framework)
1.8 Review

1.8.1 Indicative review date

The next technical review is scheduled for 2022-23.

1.8.2 Illustrative future direction of the requirements

Future changes to the Specification may include:

■ An increase of the performance thresholds for $\eta_{p,h}$
■ Introduction of refrigerant GWP limits.