1 Air-Cooled Condensing Units

1.1 Scope

Air-cooled condensing units covers products that are specifically designed to provide cooling to other equipment and systems that incorporate evaporators (and associated expansion valve control systems). Air-cooled condensing units are factory-assembled units that consist of an air-cooled condenser, one or more compressors, and interconnecting pipe work. They may include liquid receivers, filter driers, oil separators, shut off valves and related controls, and a weatherproof housing.

1.2 Definitions

An air-cooled condensing unit is a factory-assembled, packaged unit that consists of a refrigeration compressor, an air-cooled condenser and various ancillary components. This packaged unit does not contain a complete refrigeration system, but is designed to provide a convenient method for cooling a cold room or other equipment fitted with an evaporator that is controlled by an expansion valve.

Air-cooled condensing units are used in a variety of commercial and industrial cooling applications, including cold rooms, refrigerated display cabinets, back-bar equipment, temperature controlled food preparation areas, and for air conditioning systems.

Air-cooled condensing units are available in a range of different designs and efficiencies. The ECA Scheme aims to encourage the purchase of the higher efficiency products.

The ECA Scheme covers products in three temperature categories:

- High temperature units.
- Medium temperature units.
- Low temperature units.

These categories are defined in terms of the product performance at a particular temperature rating point. Products may be submitted under more than one category.

Investments in air-cooled condensing units 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 requirements as set out below.

1.3 Requirements

1.3.1 Eligibility requirements

To be eligible, products shall:

- Be designed to operate with one or more clearly identified standard refrigerants.
- Be a factory assembled unit that incorporates at least the following components:
  a) Air-cooled refrigerant condenser.
  b) One or more electrically driven refrigeration compressors.
  c) A control system that controls the product's compressor(s) and cooling fan(s).
- Conform to the requirements of the Pressure Equipment Directive 2014/68/EU in respect of their design, manufacture and testing procedures.

### 1.3.2 Performance requirements

Products shall have a coefficient of performance (COP) or Seasonal Energy Performance Ratio (SEPR) that is greater than or equal to the values shown in Table 1.1, according to the rated cooling capacity of the product.

#### Table 1.1 Performance thresholds for air-cooled condensing units

<table>
<thead>
<tr>
<th>Evaporating temperature (Dew point)</th>
<th>Rated cooling capacity, $P_A$ (kW)</th>
<th>Performance parameter</th>
<th>Threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>HT</td>
<td>+5°C</td>
<td>COP</td>
<td>≥ 3.4</td>
</tr>
<tr>
<td>MT</td>
<td>-10°C</td>
<td>COP</td>
<td>≥ 2.0</td>
</tr>
<tr>
<td>LT</td>
<td>-35°C</td>
<td>COP</td>
<td>≥ 1.1</td>
</tr>
</tbody>
</table>

Where:
- $\geq$ means "greater than or equal to"
- $\leq$ means "less than or equal to"

The COP, where applicable, should be measured at the specified standard rating points shown in Table 1.2.

#### Table 1.2 Testing conditions for COP of air-cooled condensing units at the standard rating points

<table>
<thead>
<tr>
<th>Temperature category</th>
<th>Evaporating temperature (Dew point)</th>
<th>Ambient (Condenser air-on) temperature</th>
<th>Compressor suction gas temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>High temperature units</td>
<td>+5°C</td>
<td>32°C</td>
<td>20°C</td>
</tr>
<tr>
<td>Medium temperature units</td>
<td>-10°C</td>
<td>32°C</td>
<td>20°C</td>
</tr>
<tr>
<td>Low temperature units</td>
<td>-35°C</td>
<td>32°C</td>
<td>20°C</td>
</tr>
</tbody>
</table>

Where:
- COP = refrigerating capacity divided by the power absorbed.
- SEPR = reference annual cooling demand divided by the annual electricity consumption of the product
- Refrigerating capacity, power absorbed and reference annual cooling demand are as defined in BS EN13215:2016 “Condensing units for
Any condenser sub-cooling factored into the refrigerating capacity shall be clearly declared, noting that when a liquid receiver is incorporated into the product with no subsequent sub-cooler, the liquid temperature at the unit outlet should be used to determine capacity.

1.4 Measurement and Calculations

1.4.1 Measurement standards

The following standards, where applicable, shall be used for measuring and calculating product performance:

- BS EN 13215:2016 “Condensing units for refrigeration – Rating conditions, tolerances and presentation of manufacturer’s performance data”
- BS EN 13771-2:2017 “Compressor and condensing units for refrigeration. Performance testing and test methods. Part 2: Condensing units”
- BS EN 12900:2013 “Refrigerant compressors. Rating conditions, tolerances and presentation of manufacturer’s performance data”

Please note that performance data obtained in accordance with the test procedures set out in BS EN 13771-2:2007 will be accepted as an alternative to testing in accordance with BS EN 13771-2:2017 until further notice.

For product categories where a COP threshold is specified, performance data obtained in accordance with BS EN 13215:2000 will be accepted as an alternative to BS EN 13215:2016 until further notice.

1.4.2 Test Requirements

Product performance can either be determined using Method A or Method B to determine COP, or Method C to determine SEPR, subject to the following reporting requirements:

1. For COP measurement, a detailed test report shall be provided and include a statement of achieved performance at the required standard rating point.

2. For SEPR measurement, a detailed test report shall be provided for test point condition A or condition B according to the rating conditions defined in BS EN 13215:2016 “Condensing units for refrigeration – Rating conditions, tolerances and presentation of manufacturer’s performance data”. In addition, a statement of performance at load conditions A, B, C and D, shall be provided. 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 shall be made available.

3. The refrigerant properties used in the analysis of product / compressor performance shall be obtained from one of the following sources:
The ASERCOM properties database as defined in the ASERCOM Compressor Certification scheme, which is based closely on the NIST database (see http://www.asercom.org/).

4. For the high temperature category only, data for a suction gas temperature of 20°C may be obtained by the thermodynamic translation of data physically tested at 10K superheat.

5. To enable calculations to be checked, the report shall include (or be accompanied by) the manufacturer’s design data for the product and its key components, including the type of refrigerant used, condenser fan motor power, and compressor make and model number.

1.4.3 Performance metrics

1.4.3.1 Method A to determine COP

Under method A:

- The product’s coefficient of performance (COP) at relevant standard rating point (as specified in Table 1.2) shall be calculated with the method used to generate its published performance over the standard range of air temperature and evaporating temperature conditions.

- The accuracy of these calculations shall be confirmed in the following manner:
  
  a) Actual product performance should be determined at two test conditions close to the relevant standard rating point specified in Table 1.2 that comply with the following limits:
     i. Evaporation temperature shall be within ±1°C of the standard rating point.
     ii. Ambient temperature shall be within ±5°C of the standard rating point, and one point shall be above the standard rating condition, and one below it.
     iii. Suction Temperature shall be within ±1°C of the standard rating point.
  
  b) The following measurements shall be made at each test condition with the level of measurement uncertainty specified in Table 3 of BS EN 13771-2: 2017, whilst the product operating under stable conditions at full load:
     i. Condensing and evaporating pressures and dew point temperatures at the compressor inlet and outlet.
     ii. Superheat and sub-cooling at the compressor’s inlet and the product’s outlet.
     iii. Condenser air inlet temperature.
  
  c) The condenser’s UA value is determined at each test condition using the verified compressor performance data to establish the heat rejection rate.
  
  d) The arithmetic mean of the UA values at the two test conditions is used to determine the condensing temperature, and the product’s performance at the standard rating point.

- The test report shall include (or be accompanied by):
  
  a) Details of the calculation used to determine product performance.
  
  b) The following information on the product’s compressor:
     i. Refrigerating capacity and COP at the appropriate standard rating point specified in BS EN 12900: 2013, and at the relevant standard rating point specified in the eligibility criteria for ‘refrigeration compressors’.
ii. Evidence that the product’s compressor is listed on the Energy Technology Product List, or that its performance has been independently verified

iii. A copy of the manufacturer’s published performance data (or a print out of its key performance data from the manufacturer’s design/selection software).

1.4.3.2 Method B to determine COP
Under method B, product performance shall be demonstrated by testing the product in accordance with BS EN 13771-2: 2017 “Compressor and condensing units for refrigeration. Performance testing and test methods. Part 2: Condensing units”.

1.4.3.3 Method C to determine SEPR
Under method C, product performance shall be demonstrated by testing the product in accordance with the procedures in BS EN 13771-2: 2017 “Compressor and condensing units for refrigeration. Performance testing and test methods. Part 2: Condensing units”. The test conditions to be used, and the SEPR calculation method, should be those described in BS EN 13215:2016 “Condensing units for refrigeration – Rating conditions, tolerances and presentation of manufacturer’s performance data”.

1.4.4 Rounding
For the avoidance of doubt COP test data should be presented to 1 decimal place. SEPR test data should be provided to 2 decimal places. As an example, a product in the high temperature category with a COP of 3.3 would be deemed to not meet the performance requirements.

1.5 Verification for ETL Listing
Any of the following testing routes may be used to demonstrate the conformity of products against the requirements:

■ In-house testing – Self-tested and 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 framework1.

1.5.1 Representative Testing
Where applications are being made for a range of two or more products that are variants of the same basic design, test data may be submitted for a representative selection of models, provided that all variants:

■ Use the same refrigerant as the representative model.

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■ Have the same compressor type (i.e. manufacturer, method of compression (e.g. reciprocating or scroll) and type of enclosure (e.g. hermetic or semi-hermetic)) as the representative model.
■ Have the same sub cooling arrangement as the representative model.
■ Fit within the same product category (e.g. are all high temperature units).

The representative models shall be selected by dividing the range of products into groups of models with similar design characteristics, and testing a model in each group. The performance of each model in the group shall be predicted using a validated mathematical model. As a minimum, at least one model shall be tested in each range of products.

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 some of the direct costs of Installation. Clarity on the eligibility of direct costs is available from HMRC.

1.8 Review

1.8.1 Indicative review date
This specification is scheduled for review during the 2021/22 ETL review cycle.

1.8.2 Illustrative future direction of the requirements
As the use of new low Global Warming Potential (GWP) refrigerants becomes more widespread in the air cooled condensing units market, eligibility and performance requirements may be reviewed, to account for the range of new lower GWP refrigerants that will become more widespread due to the EU F-gas regulations. The performance parameters may also be reviewed; products could potentially be assessed on their overall environmental impact accounting for seasonal efficiency, refrigerant GWP and refrigerant leakage.