ENHANCED CAPITAL ALLOWANCE (ECA) SCHEME FOR ENERGY EFFICIENT TECHNOLOGIES

ENERGY TECHNOLOGY CRITERIA LIST

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Issued on behalf of the Secretary of State for the Department for Business, Energy and Industrial Strategy

Signed: Neville-Rolfe

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The Energy Technology List comprises the technologies that qualify for the UK Government's Energy-Saving Enhanced Capital Allowance (ECA) scheme and their energy-saving eligibility criteria.

The Energy Technology List is divided into 2 parts:

- The Energy Technology Criteria List which contains details of the energy-saving criteria that must be met for each of the technology classes;
- The Energy Technology Product List which contains a list of products that have been certified as meeting those standards.

The Energy Technology Criteria List is updated and published annually. *This document is a copy of the ETCL as first published in September 2016.*

The Energy Technology Product List is published annually and is updated at the beginning of each month on the ECA website.

For the most up to date copy of the ETL and for further information about the ECA Scheme please refer to the ECA website http://etl.decc.gov.uk/etl. General information on ECA Schemes is available as http://www.hmrc.gov.uk/manuals/camanual/Index.htm**.**

Ownership for the ECA Scheme for energy-saving technologies resides with the Department for Business, Energy and Industrial Strategy and HM Revenue and Customs. The Carbon Trust promotes the ECA Scheme and manages the Energy Technology List.

CONTENTS

Air-to-Air Energy Recovery Devices

Date added to ETL 2004 (Revised 2016).

1. Definition of Technology

Air-to-air energy recovery devices are heat exchanger products that are specifically designed to recover (or salvage) waste heat from the exhaust air stream from a building ventilation system, and use it to heat the incoming air stream to the same building ventilation system.

2. Technology Description

Air-to-air energy recovery devices use heat exchanger technology to recover heat from the exhaust air of building ventilation systems that would otherwise be lost to atmosphere. The heat exchangers are incorporated into the supply air and extract air ventilation ducts. Some products may also be used to reduce the energy used by air conditioning systems by removing heat from the incoming air.

A wide range of air-to-air energy recovery devices is available. The ECA Scheme aims to encourage the purchase of products with higher levels of effectiveness in heat recovery.

The ECA Scheme covers two categories of product:

1. **Plate heat exchangers (or recuperators).**
   These products must consist of a heat exchanger with alternate channels for the supply and exhaust airflows that are separated by plates through which heat is conducted. They must not contain any moving parts. This category includes both cross-flow type, and counter-current flow type, plate heat exchangers. The product may be designed to recover only sensible heat, or it may incorporate a specialist material (such as treated paper or a polymeric membrane) to enable it to recover both latent and sensible heat.

2. **Rotating heat exchangers (including thermal and desiccant heat wheels).**
   These products must consist of a circular heat transfer medium (or 'wheel') that is designed to slowly rotate within an airtight container, and to pass the exhaust air stream over one section of the wheel, and the supply air stream over the other section of the wheel in counter flow direction. The product may be designed to recover only sensible heat, or it may incorporate a desiccant material to enable it to recover both latent and sensible heat.

Investments in air-to-air energy recovery devices 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

Performance criteria

Products must have:

- A dry heat recovery efficiency at the product's maximum rated air flow balanced flow conditions that is greater than or equal to the values set out in Table 1 below.

- A pressure drop across each side of the heat exchanger(s) within the product at the product's maximum rated air flow that is less than or equal to the values set out in Table 1 below.

Table 1 Performance requirements for air-to-air recovery devices.

	Product category	Dry heat recovery efficiency (%)	Pressure drop (in pascals)
1.	Plate heat exchangers	>= 71%	<= 250 Pa across each side.
2.	Rotating heat exchangers	>= 74%	<= 200 Pa across each side.

">=" means "greater than or equal to"
"<=" means "less than or equal to"

Where:

- The **maximum rated air flow** is the flow rate specified by the manufacturer according to the product's design limits, for example, a maximum pressure drop or maximum face air speed.

For the avoidance of doubt test data should be presented to zero decimal places. As an example, a plate heat exchanger with a minimum dry heat recovery efficiency of 70%, **or** a pressure drop of 251 pascals, would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the relevant procedures and test conditions in one of the following standards:

- BS EN 308:1997 "Heat Exchanger: Test procedures for establishing performance of air to air and flue gases heat recovery devices".
- ANSI / AHRI 1060:2005 "Performance rating of air-to-air heat exchangers for energy recovery ventilation", Air-conditioning, Heating & Refrigeration Institute.
- JIS B 8628: 2003, "Air to air heat exchanger".
- Other equivalent test standards where the resulting performance data can be scientifically proven, using the methodologies in ANSI/ASHRAE Standard 84-2008 "Method of Testing Air-to-Air Heat/Energy Exchangers", to be equivalent to that obtained under BS EN 308:1997.

The dry heat recovery efficiency must be calculated using the formula for temperature ratio in section 6.4 of BS EN308:1997 and test data collected when rating the product's performance in heating mode at the test conditions specified in the selected standard for the type of product.

Where products are too large to be tested at their maximum rated air flow under the standard test conditions specified in AHRI 1060: 2005, BS EN 308: 1997 or JIS B 8628: 2003, then performance data obtained at other test conditions may be extrapolated using validated models (or correlations), in accordance with the methodology outlined in Appendix D of ANSI/ASHRAE Standard 84-2008.

If a single product is submitted for assessment, one detailed test report should be submitted.

For a product range, test results may be submitted in summary form provided:

- Sufficient data is included to confirm that product performance was determined in accordance with the procedures and test conditions laid down in the selected standard.
- Two detailed test reports are submitted per product range.
- Detailed test reports have been prepared for each product tested and are available on request for inspection, where not submitted with the application.

Representative Testing

Where applications are being made for 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 heat transfer mechanisms as the representative models.
- Are constructed from materials with same heat transfer characteristics.
- Have the same or better energy effectiveness as the representative models.

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.

4. 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**.

Automatic Monitoring & Targeting (AMT)

Automatic Monitoring & Targeting Systems

(Formerly Component Based AMT Systems)
Date added to ETL 2003 (Revised 2012).

1. Definition of Technology

Automatic Monitoring & Targeting systems are products that are specifically designed to measure energy consumption, record and distribute metered energy data, and analyse and report on energy consumption.

2. Technology Description

Automatic Monitoring & Targeting (aM&T) systems help users to save energy by identifying energy wastage which they can then take steps to reduce.

An automatic monitoring & targeting system captures energy consumption information automatically from which users can gain an understanding of their businesses energy consumption. It consists of equipment components that measure, record, transmit, analyse, report and communicate the energy management information that a business needs to manage its energy use and to highlight unusual patterns of energy consumption.

A wide range of automatic monitoring & targeting systems are available. The ECA Scheme aims to encourage the installation of systems that can facilitate the proactive management of energy use in business.

Investments in automatic monitoring & targeting systems can only qualify for Enhanced Capital Allowances if the complete installation meets the eligibility criteria set out below. The individual equipment components or products used in the system are not named on the Energy Technology List.

3. Eligibility Criteria

To be eligible, the automatic monitoring & targeting system must:

1. Include the following:

    a) One or more meters or transducers that measure energy use for metering purposes.
    b) Some means of automatically capturing, retrieving & storing energy metering data electronically, for example: Automatic Metering Reading (AMR) equipment.
    c) Software that enables the analysis of energy metering data and the key factors that influence energy use, and the production of reports on energy consumption.

2. Be able to meter at least one of the following:

    a) Electricity use.
    b) Gas use.
    c) Heat flow.

3. Be able to:

   a) Automatically capture data from energy meters or transducers at regular intervals. The collection intervals may be user definable or configured for particular meter types.

   b) Store and process meter readings made on a half hourly basis (as a minimum). The metering data may be transferred into the data store in real-time or at scheduled times.

   c) Automatically identify and report data collection failures, missing metering data and the failure of communications with meters, transducers and any other system components.

   d) Distribute data with no loss of accuracy, except for pulse outputs from meters, where the transmitted metered data must be within +/- 0.5% of the total variable measured.

   e) Present energy consumption data in tabular and graphical reporting formats (for example, histograms, line plots, etc.), and in user selectable time intervals / divisions / bases of 30 minutes, one day, one week, four weeks or one month, and one year.

   f) Export the collected energy data in a standard format for use in other applications (for example, ASCII files or other formats commonly used by standard office applications).

   g) Retain a minimum of 2 complete years of metering data without loss of data resolution or accuracy, in a date/time stamped format, suitable for analysis of trends and patterns.

4. Provide facilities to enable the user to:

   a) Select datasets from individual meters and manipulate them by combining, comparing and calculating in order to analyse, identify and evaluate instances of energy waste.

   b) Undertake regression analysis using two variables in whatever frequency the dataset was obtained, and to display the results in graphical form with a correlation coefficient.

   c) Set up automatic exception reporting where energy consumption during a user defined reporting period is outside a selected variance from a standard or selected data set.

   d) Set up standard management reports that enable total energy consumption during a user selectable period to be compared with the corresponding period in the previous year, including an analysis of energy use by meter, fuel type or energy accounting centre.

In addition where new meters or transducers are being installed, they must comply with the following requirements:

5. Electricity meters must meet the accuracy requirements of one of the following:

BS EN62053-21:2003, “Electricity metering equipment (ac) – Particular requirements - Part 21: Static meters for active energy (classes 1 and 2)”.

- BS 8431:2010, “Electrical static metering for secondary or sub-metering. Specification” (BSI, ISBN 0 580 451178). Classes 1 or 2.
- BS EN 50470-3: 2006, “Electricity meeting equipment (ac). Particular requirements. Static meters for active energy (class indexes A, B and C)”.
- BS EN 62053-22:2003, “Electricity meeting equipment (ac). Particular requirements. Static meters for active energy (class indexes 0,2 S and 0,5 S)”.

6. Gas meters must meet the accuracy requirements of one of the following standards:
    - BS EN12261:2002, “Gas Meters - Turbine gas meters”.
    - BS EN12480:2002, “Gas Meters - Rotary displacement gas meters”.
    - BS EN1359:1999, “Gas Meters - Diaphragm gas meter”.

7. Heat meters must meet the accuracy requirements of:
    - BS EN 1434-1: 2007, “Heat meters- Part 1: General requirements”.

8. Instrument transformers used to measure energy use for metering purposes must conform to the Class 1 accuracy requirements of one of the following:
    - BS EN 60044-1:1996, “Instrument transformers. Current transformers”.
    - BS EN 60044-2:1999, “Instrument transformers. Inductive voltage transformers”.

Meters offering equivalent or better levels of accuracy to those specified above will be accepted, provided they meet the accuracy requirements of applicable British or European Standards. Please note that this includes all electricity, gas and heat meters conforming to the specific accuracy requirements of the EU Measuring Instruments Directive (MID) 2004/22/EC.

4. Scope of Claim

An Enhanced Capital Allowance (ECA) can only be claimed where the installation of AMT equipment results in a complete automatic monitoring & targeting system that complies with the eligibility criteria.

In some instances, only part of the automatic monitoring & targeting system may be eligible for an ECA:

- An ECA cannot be claimed on any component that is not solely used to monitor energy use for energy management purposes. For example, if data collection is done as part of a BMS, IT network or process control system, then an ECA cannot be claimed on these components.
- An ECA cannot be claimed on any component that is owned by an external service provider. For example, if the software used to analyse the energy metering data is purchased/licensed by an internet-based service bureau, then an ECA cannot be claimed on this component.
- An ECA can only be claimed on the specific types of energy meter or transducer mentioned in the eligibility criteria (e.g. electricity, gas or heat meters). (An ECA may also be claimed on water meters listed under the Water Technology List as part of the ECA water scheme).
- An ECA cannot be claimed on components installed in any tax years prior to the creation of a complete automatic monitoring & targeting system that complies with the eligibility criteria.

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.

Portable Energy Monitoring Equipment

(Formerly Portable AMT Equipment)
Date added to ETL 2003. (Revised 2013)

1. Definition of Technology

Portable energy monitoring equipment covers products that are specifically designed to temporarily measure energy use in different locations, and to record, analyse and report on energy consumption.

2. Technology Description

Portable energy monitoring equipment helps to save energy by identifying energy wastage and ensuring the long-term effectiveness of other energy saving investment measures.

Portable energy monitoring equipment enables the temporary monitoring of energy use in different locations, and can be used to record energy consumption data and to highlight unusual patterns of consumption.

A wide range of portable energy monitoring equipment is available. The ECA scheme aims to encourage the purchase of products that can measure and analyse energy consumption data, and produce reports containing energy management information that enable businesses to manage their energy use.

Investments in portable energy monitoring equipment 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be a portable measuring instrument package that includes:

    a) An ‘energy use’ metering device and associated measurement transducers (or probes).
    b) A means of electronically capturing and storing energy consumption data.
    c) A means of transferring data to other computing devices or computer systems.
    d) A software or hardware based means of analysing and displaying energy consumption data, and of producing energy management reports, that can be used to identify the ‘key factors’ that influence energy consumption.

- Be able to meter one or more of the following:

    a) Electricity use.
    b) Gas use.
    c) Heat flow.

- Have a measurement accuracy of +/- 3% of meter reading (or better) across the product’s entire operating temperature range, for all measurement ranges relevant to the metering of electricity use, gas use, or heat flow.

- Be CE marked.

4. 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.

Boiler Equipment

Biomass Boilers

(Formerly Biomass Boilers and Roomheaters)
Date added to ETL 2001/2003 (Revised 2016).

1. Definition of Technology

Biomass boilers are products that are specifically designed to burn solid biomass fuels in order to heat water.

2. Technology Description

Biomass boilers are used to heat water for process or space heating.

Biomass boilers are available with a wide range of efficiencies. The ECA Scheme aims to encourage the purchase of products with the highest thermal efficiency.

The fuels used in biomass boilers are renewable so their use will also reduce the amount of fossil fuel that might otherwise have been consumed.

Investments in biomass boilers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be designed to burn wood, cereal straw, or solid fuels derived from them.
- Heat water for process or space heating.
- Be CE Marked.
- Meet the following air quality emission limits:
    - Particulate matter (PM) emissions must not exceed 30 grams per gigajoule (g/GJ) net heat input
    - Oxides of nitrogen (NO_x) emissions must not exceed 150 grams per gigajoule (g/GJ) net heat input

  Compliance with these emissions limits should be demonstrated by providing valid Renewable Heat Incentive (RHI) emissions certificates for the specific biomass boiler listed, or a certificate confirming that the boiler is part of range (as per the RHI emissions limits type testing rules) that meets these emission limits.

Performance criteria

Eligible products must exceed the minimum thermal efficiency set out in Tables 1 and 2 based on based upon the maximum continuous rated output of the product covered.

Required test procedures

All products must be tested in accordance with the procedures and test conditions set out in Table 1 or 2 based upon the maximum continuous rated output of the product covered.

For products up to and including 300kW all tests must be carried out by, or witnessed by, an accredited laboratory, where "accredited" means accredited by the United Kingdom Accreditation Scheme (UKAS), or other equivalent national accreditation bodies recognised via the European Co-operation for Accreditation, the International Accreditation Forum, or the International Laboratory Accreditation Co-operation (ILAC) agreements.

For products above 300kW, products can be either tested in an accredited laboratory OR performance may be determined from measurements made during field trials or acceptance tests, provided that the measurements have been made by, or witnessed by, an accredited laboratory or contractor that is accredited to make those measurements. The product's net thermal efficiency must be calculated by an independent body that is competent to verify the measurement data.

For the avoidance of doubt net thermal efficiency test data must be presented to one decimal place. As an example, a Biomass hot water boiler with a maximum continuous rated output above 300kW and a net thermal efficiency of 89.9% when tested at between 60% and 100% of its maximum continuous rating (MCR) (as specified in Table 2B) would be deemed to be a fail.

The requirements for testing of PM and NOx are:

- That testing is carried out in accordance with the provisions relevant to emissions of PM and NOx specified in whichever of the following standards applies: EN 303-5:1999; or, EN 303-5:2012.
- That testing is carried out in accordance with EN 14792:2005 for NOx and EN 13284-1: 2002 or BS ISO 9096: 2003 for PM.

Representative Testing

Where applications are being made for products of the same constructional design, which are less than or equal to 300kW, to be included on the Energy Technology Product List (ETPL), the type testing procedures set out in Annex F of BS EN 303-3:1999 or section 5.1.4 of EN 303-5:2012 or Annex C.2.1 of BS EN 304:1992 (as amended) may be used to select representative models for testing and to reduce the overall number of performance tests that must be completed.

Where applications are being made for products of the same constructional design, which are greater than 300kW, to be included on the Energy Technology Product List (ETPL), test data may be submitted for a single representative model provided that the maximum rated output of the products being applied for is not more than twice, or less than half, the maximum rated output of the product tested. Where the range of rated outputs exceeds these limits, products should be grouped into size ranges that comply with these rules, and test data submitted for one representative model for each group.

Where representative testing is used, details of the design calculations and data used to predict the performance of products that have not been tested must be submitted.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

Table 1 For use with biomass hot water boilers with a maximum continuous rated output up to and including 300kW
SECTION 1A –PERFORMANCE THRESHOLDS
To be eligible products must have, when tested at maximum continuous rated output: • For boilers with a nominal rating of <=100kW, a thermal efficiency of at least 90.0 + log (Nominal Heat Output) based on the net calorific value of the fuel. • For boilers with a nominal rating of >100kW and <=300kW, a thermal efficiency of at least 92.0% based on the net calorific value of the fuel.
SECTION 1B –TEST PROCEDURES
All products <= 300kW must be tested in accordance with: • EN 303-5:2012 "Heating boilers for solid fuels, hand and automatically fired, nominal heat output of up to 500 kW. Terminology, requirements, testing and marking". The tests must be done using a biomass test fuel (designated A, B1, B2, C & D) in accordance with Table 7 of EN 303-5:2012 that is appropriate to the advertised usage of the product. Please note that performance data obtained in accordance with the procedures and standard rating conditions laid down in EN 303-5:1999 and using a biomass test fuel (designated A1, A2, B1, B2, C & D) in accordance with Table 8 will be accepted as an alternative to testing in accordance with EN303-5:2012 until further notice.

Table 2 –For use with biomass hot water boilers with a maximum continuous rated output above 300kW
SECTION 2A –PERFORMANCE THRESHOLDS
To be eligible products must have, when tested at an output that is between 60% and 100% of Maximum Continuous Rating (MCR): • A thermal efficiency, of at least 90.0% based on the net calorific value of the test fuel.

SECTION 2B –TEST PROCEDURES
All products >300kW must be tested in accordance with: EITHER ● BS 845-1:1987 “Methods for assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids: Concise procedure”. OR (for shell boilers only) ● BS EN 12953-11:2003 “Shell boilers — Part 11: Acceptance tests”. OR (for water tube boilers only) ● BS EN 12952-15:2003 “Water-tube boilers and auxiliary installations. Acceptance tests”. OR ● The testing procedures set out in EN303-5:2012. OR ● Equivalent procedures within the national standards of EU member states. Where equivalent procedures are used, details of the test procedure used must be supplied in English along with a declaration of equivalence from an accredited laboratory. The tests must be done using a biomass test fuel (designated A, B1, B2, C & D) in accordance with Table 7 of EN 303-5:2012 that is appropriate to the advertised usage of the product. Where BS 845-1: 1987 is used, the standard test conditions are: ● A maximum ambient air temperature of 25 degrees Centigrade. ● An excess combustion air level certified as being representative of normal commercial operation. ● The boiler must be operating at a rating of at least 60% of its maximum continuous rating (i.e. 60 - 100% MCR) during the tests. As an alternative to measurement of losses other than flue gas losses, a standard deduction of 2.0% x 100%/% load may be used. Please note that performance data obtained in accordance with the procedures and standard rating conditions laid down in EN 303-5:1999 and using a biomass test fuel (designated A1, A2, B1, B2, C & D) in accordance with Table 8 will be accepted as an alternative to testing in accordance with EN303-5:2012 until further notice.

4. 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.

Burners with Controls

Date added to ETL 2001 (Revised 2015).

1. Definition of Technology

Burners with Controls covers products that are specifically designed to create and burn air and fuel mixtures in a safe, efficient and controlled manner, and to direct the heat released through combustion into a pressurised vessel (or other combustion chamber).

2. Technology Description

Burners with controls are used to provide heat for hot water, steam and thermal oil boilers, heaters and processes. They are widely used in industry and commerce.

A wide range of burners is available, and these are fitted with combustion controls that offer different levels of precision and repeatability of control. The ECA Scheme aims to encourage the purchase of products that are able to accurately control combustion and maintain their efficiency over a specified turn down range.

Six different categories of burners with controls are covered:

1. Gas fired and dual fuel burners rated up to, and including, 400 kW.
2. Gas fired and dual fuel burners rated between 401 kW and 1,200 kW.
3. Gas fired and dual fuel burners rated in excess of 1,200 kW.
4. Oil fired burners rated up to, and including, 400 kW.
5. Oil fired burners rated between 401 kW and 1,200 kW.
6. Oil fired burners rated in excess of 1,200 kW.

Products that are designed to use liquid or gaseous biofuels are also covered by these categories.

Investments in burners with controls 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be gas and/or oil fired.
- Be a forced draught burner.
- Be fitted with air dampers that fully close on burner shutdown.
- Automatically respond to changes in heat demand by modulating their output:
  a) Across the minimum specified turndown ratio set out in Table 1 below.
  b) In a continuous manner (or alternatively for oil-fired burners rated up to and including 400kW only, in a step-wise manner across at least three stages of output).
  c) Whilst adjusting the ratio of air and fuel fed to the product's burner in a manner that maintains combustion efficiency across the required turndown range and complies with

the maximum permitted levels of oxygen and carbon monoxide in the product's exhaust gases, as set out in Table 1.

- Conform to the requirements of the Pressure Equipment Directive 97/23/EC in respect of their design, manufacture and testing procedures, or be CE Marked.
- **Not** use any form of mechanical linkage between the product's modulating fuel valve, and its air damper or air control valve, to adjust the product's air to fuel ratio.

In addition, products with a thermal output in excess of 400kW must:

- Incorporate a microprocessor based burner control system.
- Where mechanical dampers are used to modulate the **air flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis.
- Where control valves are used to modulate the **fuel flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis. (This requirement shall not apply to pneumatically operated modulating gas valves).
- Where the product is gas fired or dual fuelled, use a variable speed motor controller (or variable speed drive) to operate its forced draught fan.

In addition, gas fired and dual fuelled burners with a thermal output up to, and including, 400kW must incorporate pneumatic or electronic air fuel ratio controls that permit the oxygen levels in the exhaust gases to be adjusted at each of the test points specified in Table 1.

Performance criteria

Products must not exceed the maximum permitted levels of oxygen (O_2) and carbon monoxide (CO) in their exhaust gas at each of test points specified in Table 1.

Table 1 Minimum performance requirements for burners with controls.

	Product category	Minimum turndown ratio	Maximum O_2 level at test point			Maximum CO level
			High	Mid	Low	All test points
1.	Gas fired and dual fuel burners rated up to, and including, 400 kW	3.33:1	3%	4%	4.8%	20 ppmv
2.	Gas fired and dual fuel burners rated between 401 kW and 1,200 kW	4:1	3%	4%	5.0%	20 ppmv
3.	Gas fired and dual fuel burners rated in excess of 1,200 kW	4:1	3%	4%	5.0%	20 ppmv
4.	Oil fired burners rated up to, and including, 400 kW	3.33:1	3%	4%	4.8%	20 ppmv
5.	Oil fired burners rated between 401 kW and 1,200 kW	3.33:1	3%	4%	4.8%	20 ppmv
6.	Oil fired burners rated in excess of 1,200 kW	4:1	3%	4%	5.0%	20 ppmv

Where the required test points are:

- **High**: the burner is operating at 100% of its maximum continuous rating.
- **Mid**: the burner is operating at 50% of its maximum continuous rating.
- **Low**: the burner is operating at a level corresponding to the specified minimum turndown, which is 25% of maximum continuous rating for 4:1 and 30% for 3.33:1.

And:

- Dual fuel means that the product can separately burn both gas **and** oil.

Required test procedures

Product performance at the three required test points specified in Table 1 (above) must be determined in accordance with the procedures and test conditions in the following standards:

- BS EN 676:2003 (as amended), "Automatic forced draught burners for gaseous fuels".
- BS EN 267:2009 (as amended), "Automatic forced draught burners for liquid fuels".

Where the product's turndown ratio is greater than the minimum required, performance at the low and mid test points may be calculated by linear interpolation of the test results. Where operation at the product's maximum continuous rated output is not possible, performance at the high test point may be determined by extrapolation of test data at two additional test points (e.g. 70% and 90%).

For the avoidance of doubt oxygen levels in the product's exhaust should be presented to 1 decimal place, and carbon monoxide levels to zero decimal places. As an example, a gas fired burner rated in excess of 1,200 kW and whose exhaust gases contain oxygen levels of 3.1%, or carbon monoxide levels of 21 ppmv, at 100% of its maximum continuous rating, would be deemed to be a fail.

Representative Testing

Where applications are being made for 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:

- Are designed to burn the same fuel(s) as the representative models.
- Have the same basic constructional design as the representative models.
- Use the same burner control system / mechanisms as the representative models.
- Have the same or better energy efficiency as the representative models.

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.

4. 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.

Condensing Economisers

Date added to ETL 2001 (Revised 2013).

1. Definition of Technology

Condensing Economisers are products specifically designed to improve boiler net thermal efficiency by recovering both sensible and latent heat from boiler flue gases.

2. Technology Description

Condensing economisers are a type of heat exchanger that enables some of the sensible heat and latent heat from boiler flue gases to be recovered. This heat is normally used to preheat the boiler's feedwater and to supply low grade heating requirements. Typically a condensing economiser will improve boiler net thermal efficiency (expressed in percentage terms) by at least 9 points (i.e. a boiler with efficiency of 84.0% is improved to at least 93.0%).

Investments in condensing economisers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

Performance criteria

The product must increase the net thermal efficiency of the boiler system to which it is designed to be fitted by at least 9.0 %, when the boiler system is operating at the test points set out in Table 1.

Table 1 – Performance test points for condensing economisers

Test point % MCR	Increase in net thermal efficiency of boiler system.
30	>= 9.0 %
50	>= 9.0 %
100	>= 9.0 %

">=" means "greater than or equal to"

Where MCR is the maximum continuous rating (MCR) of the boiler system for which the product is designed.

For the avoidance of doubt the increase in net thermal efficiency of the boiler system must be presented to one decimal place. As an example, a condensing economiser that delivers an increase

in net thermal efficiency of 8.9% at 100% of the maximum continuous rating (MCR) of the boiler system for which the product is designed would be deemed to be a fail.

Required test procedures

The required minimum performance must be demonstrated using Methods A, B or C, as set out in Tables A, B and C below:

TABLE A METHOD A - INDIRECT MEASUREMENT
Under this test method, product performance must be demonstrated by measuring the improvement in net thermal efficiency of a test boiler resulting from the addition of the condensing economiser. Net thermal efficiency must be measured at test points that are equivalent to 30%, 50% and 100% of the maximum continuous rating (MCR) of the boiler system for which the product is designed. Boiler net thermal efficiency must be measured in accordance with the procedures set out in BS 845:Part 1:1987, BS EN 303-3:1999 or BS EN 304:1992. Where BS 845:Part 1:1987 is used, the standard test conditions are: a maximum ambient air temperature of 25 degrees Centigrade and an excess combustion air level of not less than 15%.

TABLE B METHOD B - DIRECT MEASUREMENT
Under this test method, product performance must be demonstrated by calculating the improvement in boiler net thermal efficiency that will occur at 30%, 50% and 100% of the maximum continuous rating (MCR) of the boiler system for which the product is designed. This calculation must be based on an assessment of the transfer of heat power that will occur at each of these test points. The assessment of transfer of heat power must be done in accordance with the procedures set out in EN 305:1997, EN 306:1997 and/or EN308:1997.

TABLE C	METHOD C – VALIDATED DESIGN CALCULATIONS

Under this test method:

1. The product's performance is determined from design calculations. The calculations should assess the improvement in the net thermal efficiency of a boiler system that the product will deliver at the full and part load conditions specified in Table 1 when tested in accordance with the procedures and test conditions specified in Method A.
2. The accuracy of these design calculations must be confirmed by interpolation and extrapolation of measurements of the improvement in net thermal efficiency actually realised by the product. The measurements must be obtained using an indirect method (flue gas loss method) from one of the test standards specified in Method A:
   a) At least one test point between 60% and 100% MCR, **and**:
   b) At least one test point between 20% and 40% MCR.
3. To be eligible, the improvement in the net thermal efficiency of the boiler system at the full and part load conditions realised by fitting the product to the boiler system must exceed the performance thresholds specified in Table 1.

The test report must include (or be accompanied by):

a) Details of the calculations used to determine product performance.
b) A copy of the published performance data for the product.
c) Manufacturer's design data for the product.
d) The following test data, which must be obtained with the product operating under stable conditions at each selected test point before and after fitting the product:
   I) Analysis of flue gas composition, including as a minimum, the levels of oxygen (or carbon dioxide) and carbon monoxide in the flue gas.
   II) Ambient and flue gas temperatures.
   III) Net thermal efficiency of the boiler system.
e) Details of the boiler system used during the test.

Representative Testing

Where applications are being made for condensing economiser products of the same constructional design to be included on the Energy Technology Product List (ETPL), test data may be submitted for a single representative model provided that the maximum rated output of the products being applied for is not more than twice, or less than half, the maximum rated output of the product tested. Where the range of rated outputs exceeds these limits, products should be grouped into size ranges that comply with these rules, and test data submitted for one representative model for each group.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

4. 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.

Flue Gas Economisers

Date added to ETL 2001 (Revised 2013).

1. Definition of Technology

Flue Gas Economisers are products that are specifically designed to improve boiler net thermal efficiency by recovering sensible heat from boiler flue gases.

2. Technology Description

Flue gas economisers are a type of heat exchanger that enables some of the sensible heat in boiler flue gases to be recovered. This heat is normally used to preheat the boiler's feedwater. Typically a flue gas economiser will increase boiler net thermal efficiency (expressed in percentage terms) by at least 3 points (i.e. a boiler with efficiency of 89.0% is improved to at least 92.0%).

Investments in flue gas economisers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

Performance criteria

The product must increase the net thermal efficiency of the boiler system to which it is designed to be fitted by at least 3.0%, when the boiler system is operating at the test points set out in Table 1.

Table 1 – Performance test points for flue gas economisers

Test point % MCR	Increase in net thermal efficiency of boiler system.
30	>= 3.0 %
50	>= 3.0 %
100	>= 3.0 %

">=" means "greater than or equal to"

Where MCR is the maximum continuous rating (MCR) of the boiler system for which the product is designed.

For the avoidance of doubt the increase in net thermal efficiency of the boiler system must be presented to one decimal place. As an example, a flue gas economiser that delivers an increase in net thermal efficiency of 2.9% at 100% of the maximum continuous rating (MCR) of the boiler system for which the product is designed would be deemed to be a fail.

Required test procedures

The required minimum performance must be demonstrated using Methods A, B or C, as set out in Tables A, B and C below.

TABLE A METHOD A - INDIRECT MEASUREMENT
Under this test method, product performance must be demonstrated by measuring the improvement in net thermal efficiency of a test boiler resulting from the addition of the flue gas economiser. Net thermal efficiency must be measured at test points that are equivalent to 30%, 50% and 100% of the maximum continuous rating (MCR) of the boiler system for which the product is designed. Boiler net thermal efficiency must be measured in accordance with the procedures set out in BS 845:Part 1:1987, BS EN 303-3:1999 or BS EN 304:1992. Where BS 845:Part 1:1987 is used, the standard test conditions are: a maximum ambient air temperature of 25 degrees Centigrade and an excess combustion air level of not less than 15%.

TABLE B METHOD B - DIRECT MEASUREMENT
Under this test method, product performance must be demonstrated by calculating the improvement in boiler net thermal efficiency that will occur at 30%, 50% and 100% of the maximum continuous rating (MCR) of the boiler system for which the product is designed. This calculation must be based on an assessment of the transfer of heat power that will occur at each of these test points. The assessment of transfer of heat power must be done in accordance with the procedures set out in EN 305:1997, EN 306:1997 and/or EN308:1997.

TABLE C	METHOD C – VALIDATED DESIGN CALCULATIONS

Under this test method:

1. The product's performance is determined from design calculations. The calculations should assess the improvement in the net thermal efficiency of a boiler system that the product will deliver at the full and part load conditions specified in Table 1 when tested in accordance with the procedures and test conditions specified in Method A.
2. The accuracy of these design calculations must be confirmed by interpolation and extrapolation of measurements of the improvement in net thermal efficiency actually realised by the product. The measurements must be obtained using an indirect method (flue gas loss method) from one of the test standards specified in Method A:
   c) At least one test point between 60% and 100% MCR, **and**:
   d) At least one test point between 20% and 40% MCR.
3. To be eligible, the improvement in the net thermal efficiency of boiler system at the full and part load conditions realised by fitting the product to the boiler system must exceed the performance thresholds specified in Table 1.

The test report must include (or be accompanied by):

f) Details of the calculations used to determine product performance.

g) A copy of the published performance data for the product.

h) Manufacturer's design data for the product.

i) The following test data, which must be obtained with the product operating under stable conditions at each selected test point before and after fitting the product:

   IV) Analysis of flue gas composition, including as a minimum, the levels of oxygen (or carbon dioxide) and carbon monoxide in the flue gas.

   V) Ambient and flue gas temperatures.

   VI) Net thermal efficiency of the boiler system.

j) Details of the boiler system used during the test.

Representative Testing

Where applications are being made for flue gas economiser products of the same constructional design to be included on the Energy Technology Product List (ETPL), test data may be submitted for a single representative model provided that the maximum rated output of the products being applied for is not more than twice, or less than half, the maximum rated output of the product tested. Where the range of rated outputs exceeds these limits, products should be grouped into size ranges that comply with these rules, and test data submitted for one representative model for each group.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

4. 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.

Gas-fired Condensing Water Heaters

Date added to ETL 2004 (Revised 2016).

1. Definition of Technology

Gas-fired condensing water heaters are products that are specifically designed to continuously provide hot water either by the direct heating of water as it passes through the product, or the heating of water contained in an integral storage vessel.

2. Technology Description

Gas-fired condensing water heaters are used to provide hot water for domestic purposes or process heating, and offer an energy efficient method of generating hot water. They can be installed close to the point of use, or in a central plant room.

Gas-fired condensing water heaters are described as 'storage' type products if they generate hot water by heating water stored within the product itself. Other types of gas-fired condensing water heaters are described as 'non-storage' type products, and can be divided into continuous flow type products that are designed to instantaneously generate hot water directly from cold water, and those that heat water as it is circulated round a loop (which may also include buffer vessels).

Gas-fired condensing water heaters are available in a range of different efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers three categories of gas-fired condensing water heaters:

1. Storage type, gas-fired condensing water heaters not exceeding 150kW

2. Non- storage, instantaneous (or continuous flow) type, gas-fired condensing water heaters

3. Non-storage, circulator (or multi-pass) type, gas-fired condensing water heaters.

Investments in gas-fired condensing water heaters 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible products, must:

- Be gas-fired.
- Comply with the requirements of the Water Supply (Water Fittings) Regulations 1999, the Water Byelaws 2000 Scotland and the Water Regulations in Northern Ireland (for example, by inclusion in the Water Regulations Advisory Scheme's Water Fittings and Materials Directory).
- Be CE Marked.

In addition, non-storage – circulator type, gas-fired condensing water heaters must:

- Use fully premixed burners or an appropriately matched forced draught burner (or burners).
- Automatically respond to changes in hot water demand by modulating their output in a continuous manner across a minimum turndown ratio of 3.33:1, without initiating a purge cycle.
- Products with a thermal output in excess of 400kW must **either** use burners from the "burners with controls" part of the Energy Technology Product List **or**:
    - Incorporate a microprocessor based burner control system.
    - Use a variable speed motor controller (or Variable Speed Drive) to operate each forced draught fan incorporated into the product.
    - Where mechanical dampers are used to modulate the **air flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis.
    - Where control valves are used to modulate the **fuel flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis. (This requirement shall not apply to pneumatically operated modulating gas valves).

In addition, non-storage – instantaneous type, gas-fired condensing water heaters exceeding 70kW must be fitted with an integral, fully pre-mixed, modulating burner.

Performance criteria

Eligible products must meet or exceed the appropriate performance criteria:

- Products with a rated heat output <= 400 kW, must meet or exceed the gross water heating energy efficiency η_{wh} thresholds shown in Table 1 at the declared load profile.
- Products with a rated heat output > 400 kW, must meet or exceed the gross thermal efficiency thresholds shown in Table 2.

Table 1 Minimum gross water heating energy efficiency (η_{wh}) for gas-fired condensing water heaters with a rated heat output of 400kW or less (all product categories)

Declared load profile	3XS	XXS	XS	S	M	L	XL	XXL	3XL	4XL
Water Heating Energy Efficiency (η_{wh})	>= 70.0 %						>= 80.0 %	>= 85.0 %		

Where:

- Water Heating Energy Efficiency (η_{wh}) is the ratio between the useful energy in the water provided and the energy required for its generation, expressed as a percentage.
- Load profile is a given sequence of water draw-offs, as specified in in Annex III, Table 1 of Commission Regulation (EU) No 814/2013 "Ecodesign requirements for water heaters and hot water storage tanks".

Table 2 Minimum gross thermal efficiency for gas-fired condensing water heaters with a rated heat output of over 400kW

Product category	**Nominal heat input (kW)**	**Test conditions**	**Gross thermal efficiency %**
Non storage – instantaneous type	> 400kW	At 100% load, flow/return temperatures of 80/60ºC	>= 85.6 %
		At 30% load, return temperature of 30ºC	>= 93.7 %
Non storage - circulator type	> 400kW	At 100% load, flow/return temperatures of 80/60ºC	>= 85.6 %
		At 30% load, return temperature of 30ºC	>= 93.7 %

" >=" means "greater than or equal to"

For products with a rated heat output <= 400 kW, the load profile used for the test must be declared by the manufacturer and shall be the maximum load profile or the load profile one below the maximum load profile for the product.

Products with a rated heat output > 400 kW must meet or exceed the minimum gross thermal efficiencies at both full load **and** part load test conditions, as specified in Table 2.

For the avoidance of doubt, all efficiency test data should be presented to one decimal place. As an example, a 500kW non storage, instantaneous, gas fired condensing water heater with a gross thermal efficiency of 85.5% at the full load condition would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures set out in one of the test standards recognised by the ETL as set out below, or in accordance with equivalent procedures for assessing thermal efficiency within applicable British or European Standards, or the national standards of EU Member States.

Tests to determine gross water heating energy efficiency (products <= 400kW) must be carried out at the conditions specified in BS EN 13203-2:2015.

Tests to determine gross thermal efficiency (products > 400kW) must be carried out at the test conditions specified in an appropriate test standard named in Table 3.

Table 3 – ETL recognised test standards to determine gross thermal efficiency

Test standard	**Applicable product categories**		
	1	**2**	**3**
BS EN 89:2000 Gas-fired storage water heaters for the production of domestic hot water	☑		
BS EN 89:2015 Gas-fired storage water heaters for the production of domestic hot water	☑		
BS EN 303-3:1999 Heating boilers — Part 3: Gas-fired central heating boilers — Assembly comprising a boiler body and a forced draught burner‘.			☑
BS EN 303-7:2006 Heating boilers — Part 7: Gas-fired central heating boilers equipped with a forced draught burner of nominal heat output not exceeding 1,000 kW‘.			☑
BS EN 15502-1:2012+A1:2015 Gas-fired heating boilers. General requirements and tests BS EN 15502-2-1:2012 Gas-fired central heating boilers. Specific standard for type C appliances and type B2, B3 and B5 appliances of a nominal heat input not exceeding 1 000 kW			☑
BS EN 483:1999+A4:2007 Gas-fired central heating boilers. Type C boilers of nominal heat input not exceeding 70 kW‘			☑
BS EN 677:1998 Gas-fired central heating boilers. Specific requirements for condensing boilers with a nominal heat input not exceeding 70 kW			☑
BS EN 26:1998 Gas fired instantaneous water heaters for the production of domestic hot water, fitted with atmospheric burners		☑	☑
BS EN 26:2012 Gas-fired instantaneous water heaters for the production of domestic hot water		☑	☑
BS EN 26:2015 Gas-fired instantaneous water heaters for the production of domestic hot water		☑	☑

Representative Testing

Where applications are being made for gas fired condensing water heaters that are variants of the same constructional design and rated outputs up to and including 400 kW to be included on the Energy Technology Product List (ETPL), test data may be submitted for a representative selection of models. The representative models must be selected by dividing the range of products into groups of models with similar design characteristics, and testing a model in the lowest quartile of predicted performance in each group. The performance of each model in the group must be predicted using a

validated mathematical model. As a minimum, at least one model must be tested in each range of products.

Where applications are being made for products of the same constructional design and rated outputs greater than 400 kW to be included on the Energy Technology Product List (ETPL), test data may be submitted for a single representative model provided that the maximum rated output of the products being applied for is not more than twice, or less than half, the maximum rated output of the product tested. Where the range of rated outputs exceeds these limits, products should be grouped into size ranges that comply with these rules, and test data submitted for one representative model for each group.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

4. 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.

Heat Recovery from Condensate and Boiler Blowdown

Date added to ETL 2001 (Revised 2013).

1. Definition of Technology

Heat recovery from condensate and boiler blowdown covers products that are specifically designed to recover heat from steam condensate and / or water from boiler blowdown, by means of heat exchangers and/or flash steam recovery vessels.

2. Technology Description

Significant amounts of heat can be recovered from the water extracted during boiler blowdown and from steam condensate. However this water can contain significant levels of contaminants that reduce the efficiency of the heat recovery process.

The ECA Scheme encourages the purchase of heat recovery equipment that is specifically designed to recover heat from steam condensate and/or water from boiler blowdown.

The ECA Scheme covers three categories of product:

1. **Flash steam recovery vessels or packages**
   with associated control and safety devices
2. **Heat exchanger units or packages**
   with associated control and safety devices
3. **Flash steam vessel with heat exchanger packages**
   with associated control and safety devices

Where packages may include the following components necessary for operation of the equipment: pressure gauges, vacuum breakers, vent heads, valves and steam traps.

Investments in equipment for heat recovery from condensate and boiler blowdown 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible products, must:

- Be specifically designed to recover heat from steam condensate and / or water from boiler blowdown, by means of heat exchangers and/or flash steam recovery vessels.

- Conform to the requirements of the EU Pressure Equipment Directive PED 97/23/EC in respect of their design, manufacture and testing procedures.

4. 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.

Heating Management Controllers (for Wet Heating Systems)

(Formerly Optimising Controls for Wet Heating Systems)
Date added to ETL 2003 (Revised 2013).

1. Definition of Technology

Heating management controllers (for wet heating systems) are products that are specifically designed to control heat generation and distribution within a wet heating system in an energy efficient manner that reflects weather conditions, occupation schedules and user requirements.

2. Technology Description

Heating management controllers (for wet heating systems) realise fuel savings by adapting boiler firing and heat distribution patterns to match variations in heat demand and user requirements.

A wide range of heating management controls is available for wet heating systems including products designed to control space heating within both zoned and un-zoned buildings. The ECA Scheme aims

to encourage the purchase of products that automatically adapt to changes in weather conditions, and thermal response time of the building and/or wet heating system.

The ECA Scheme covers three categories of product:

1. **Standalone units** that are self-contained control units that are designed to directly control the operation of, and to be directly connected to, the external control inputs of the boilers/burners, pumps and control valves in a wet heating system.
2. **'Add-on' modules** that designed to be incorporated into other control systems, and to either directly, or indirectly, control the operation of wet heating systems.
3. **Packaged products** that consist of two or more control modules or units that are designed to be connected together during installation, and to either directly, or indirectly, control the operation of wet heating systems.

Investments in heating management controllers (for wet heating systems) can only qualify for Enhanced Capital Allowances if the product is named on the Energy Technology Product List. To be eligible for inclusion on the Energy Technology Product List, products must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

1. Incorporate a microprocessor based controller that is pre-programmed to:
   a) Automatically control heat generation and heat distribution within a wet heating system, in a manner that reflects weather conditions and building occupation schedules.
   b) Automatically switch between operating modes, in accordance with the predefined weekly occupation schedule of the space (or spaces) being heated.
   c) Maintain the temperature of the space or spaces being heated within pre-set limits, by modulating the heat flow around each heating circuit, in response to the output of one or more temperature sensors.

2. Be designed to have at least two of the following operating modes:
   a) A "normal" operating mode in which the wet heating system is operated in a manner consistent with the building being occupied, or prepared for occupation.
   b) An "economy" mode where the wet heating system operated at a reduced level to reflect, for example, the fact that the building is unoccupied, or reduced levels of activity in the building, **or**
   c) A "standby" or "holiday" mode where the wet heating system is switched off or operated solely for fabric, frost and equipment protection.

3. Incorporate:
   a) An optimum start mechanism that monitors external and/or internal temperatures, and calculates when boilers need to be switched on in order to just reach pre-set temperatures by the start of the next occupancy period.

b) A “self-learning” algorithm that automatically monitors the accuracy of the optimum start mechanism and periodically updates the heating curve that the mechanism uses, to reflect changes in building characteristics.

c) A “self-adaptive weather compensation” mechanism that automatically saves energy during milder weather conditions, by reducing the temperature set-point of the boiler water circuit as the external temperature rises, and also the temperature of, or heat flow through, any individual zone heating circuits controlled.

d) A “frost protection” mechanism that monitors internal or external temperatures (or pipework temperatures), and switches on boilers and heating circuits (as required), in order to prevent equipment and pipework from “freezing up”.

e) A building fabric protection mechanism that monitors external or internal temperatures and switches heating on to prevent condensation occurring.

f) A mechanism that prevents the boilers supplying the heating system from “dry cycling” (i.e. switching on and off), when there is no change in heat demand.

g) Interlock and inhibit mechanisms that can be used to prevent simultaneous heating and cooling, and space heating when windows have been opened.

h) An anti-tampering mechanism that prevents the product’s control strategy and configuration settings from being modified and automatic control from being disabled, except during commissioning, maintenance or testing.

4. Provide facilities that enable building managers to:

   a) Define the normal occupation times for the building and for each zone controlled (in intervals of five minutes or less), for each day of the week, including at least two periods of occupation per day (i.e. at least 14 different occupation period per week).

   b) Define the temperature set-points for each operating mode to +/- 1 degree centigrade, and separate set-points for each space heating circuit controlled.

   c) Define periods or circumstances throughout the year when the wet heating system should be placed into economy, holiday or standby modes.

   d) Define a separate seven-day schedule for the operation of any domestic hot water (DHW) system controlled, including at least two periods of operation per day.

   e) “Temporarily override” or manually adjust the degree (or amount) of weather compensation applied to each heating circuit controlled.

5. Provide facilities that enable building users or managers to:

   a) “Temporarily override” the pre-set time when the heating is scheduled to be switched off for a predefined period not exceeding 24 hours per override.

   b) Only adjust the temperature set-points in the space (or spaces) being heated for a limited period of time, or by a limited amount (or allow no user adjustment).

   c) Switch the wet heating system into economy or standby mode for the remaining portion of a pre-set occupation period.

6. Conform with the requirements of the EU EMC Directive 89/336/EEC (as amended) or its replacement EU EMC Directive 2004/108/EC, or be CE Marked.

4. 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.

Hot Water Boilers

Date added to ETL 2001 (Revised 2016).

1. Definition of Technology

Hot water boilers are products that are specifically designed to heat water by means of a heat exchanger that transfers heat from combustion into the water as it passes through the product.

2. Technology Description

Hot water boilers are used to produce hot water for space heating, process heating and domestic uses. They are available in a wide range of different designs and efficiencies.

The ECA scheme aims to encourage the purchase of the higher efficiency, modulating, gas and oil fired hot water boilers, including products that are designed to use liquid and gaseous biofuels.

The ECA Scheme covers three categories of products:

1. **High temperature, high pressure, high efficiency hot water boilers with rated outputs greater than 400kW**.
   Boilers designed to operate with a water pressure greater than 6 bar and/or outlet water temperature greater than 105°C, and that are not designed to recover latent heat from flue gases by condensing water vapour.
2. **Low temperature, low pressure, high efficiency hot water boilers with rated outputs greater than 400kW**.
   Boilers designed to operate with a water pressure up to and including 6 bar and/or an outlet water temperature up to and including 105°C that are not designed to recover latent heat from flue gases by condensing water vapour.
3. **Condensing hot water boilers (of all rated outputs)**:
   Boilers designed to recover latent heat from flue gas water vapour.

Investments in hot water boilers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be gas and/or oil fired (where gas includes biogas and oil includes liquid biofuels).
- Automatically respond to changes in hot water demand by modulating their output in a continuous manner across a minimum specified turndown ratio, as set out in Table 1 in the performance criteria below, without initiating a purge cycle.

- Conform to the requirements of the Pressure Equipment Directive 97/23/EC in respect of their design, manufacturer and testing procedures, or be CE Marked.

In addition, products with a rated output greater than 400kW must **either** use burners from the "burners with controls" part of the Energy Technology Product List **or**:

- Incorporate a microprocessor based control system that continuously modulates burner output in response to measured boiler temperature or pressure values.
- Use fully pre-mixed burners, or forced draught burners. Where forced draft burners are used, automatic (electronic or pneumatic) air fuel ratio controls must be fitted.
- Where mechanical dampers are used to modulate the **air flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis.
- Where control valves are used to modulate the **fuel flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis. (This requirement shall not apply to pneumatically operated modulating gas valves).
- Where the product is gas fired or dual fuelled, use a variable speed motor controller (or variable speed drive) to operate each fan incorporated into the product that controls air flow rate to the burner and, where relevant, the fuel-air pre-mixer.

Performance Criteria

Eligible products must meet or exceed the minimum thermal efficiencies set out in Table 1 below at the specified part and full load test conditions, which vary according to product category and fuel type.

Table 1 – Performance requirements and test points for hot water boilers

Product Category		Fuel Type	Turndown ratio	Test point (% of Maximum Nominal Input)	Net thermal efficiency %
1.	High temperature, high pressure, high efficiency hot water boilers	Gas, oil or dual fuelled	>= 3.33:1	30	>= 93.0 %
				100	
2.	Low temperature, low pressure, high efficiency hot water boilers	Gas, oil or dual fuelled	>= 3.33:1	30	>= 93.0 %
				100	
3.	Condensing hot water boilers	Gas fired or dual fuelled	>= 3.33:1	30	>= 108.0 %
				100	>= 97.0 %
		Oil fired		30	>= 101.0 %
				100	>= 95.0 %

">=" means "greater than or equal to"

For the avoidance of doubt net thermal efficiency test data must be presented to 1 decimal place. As an example, a condensing hot water boiler with a net thermal efficiency of 94.9% at 100% of its maximum rated output would be deemed to be a fail.

Required test procedures

Product performance must be demonstrated using Method A, Method B **or** Method C (as set out in Tables A, B and C below), which are subject to the following restrictions:

- Method A must only be used, where all the burners incorporated in the product are listed on the "burners with controls" part of the Energy Technology Product List.

- Method B must be used to demonstrate the performance of modular boilers, or where any of the burners incorporated in the product are **not** listed on the "burners with controls" part of the Energy Technology Product List. A modular boiler is defined as an assembly of two or more similar (but not necessarily identical) modules, each with their own heat exchanger, burner, and control and safety devices. The assembly has common water feed and return connections, but the water flow to, and flow from each module is independently controlled.

- Method C may only be used for category 1 and 2 boilers with rated outputs above 400kW and category 3 boilers with rated outputs above 900kW, where it is not possible to measure product performance in a laboratory due to product size.

All performance measurements must be carried out in accordance with the procedures set out in one, or more, of the test standards recognised by the ETL as set out in Table 2, or in accordance with equivalent procedures for assessing net thermal efficiency within applicable British or European

Standards, or the national standards of EU Member States. The selected test standard(s) must be appropriate to the specific type of boiler tested.

Table 2 – ETL recognised test standards

Test standard	Applicable product categories		
	1	2	3
BS EN 625:1996 'Gas-fired central heating boilers. Specific requirements for the domestic hot water operation of combination boilers of nominal heat input not exceeding 70 kW'			☑
BS EN 483:1999+A4:2007 'Gas-fired central heating boilers. Type C boilers of nominal heat input not exceeding 70 kW'			☑
BS EN 677:1998 'Gas-fired central heating boilers. Specific requirements for condensing boilers with a nominal heat input not exceeding 70 kW'			☑
BS EN 13836:2006 'Gas fired central heating boilers. Type B boilers of nominal heat input exceeding 300 kW, but not exceeding 1 000 kW'			☑
BS EN 15417:2006 'Gas-fired central heating boilers. Specific requirements for condensing boilers with a nominal heat input greater than 70 kW but not exceeding 1000 kW'			☑
prEN 15420:2005 'EN 15420. Gas-fired central heating boilers. Type C boilers of nominal heat input exceeding 70 kW, but not exceeding 1000 kW' (CEN document code 06/30144913 DC)			☑
BS 845-1:1987 'Methods for Assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids — Part 1: Concise procedure'.	☑	☑	☑
BS 7190:1989 'Method for assessing thermal performance of low temperature hot water boilers using a test rig'		☑	☑
BS EN 303-3:1999 'Heating boilers — Part 3: Gas-fired central heating boilers — Assembly comprising a boiler body and a forced draught burner'.		☑	☑
BS EN 303-7:2006 'Heating boilers — Part 7: Gas-fired central heating boilers equipped with a forced draught burner of nominal heat output not exceeding 1,000 kW'.		☑	☑
BS EN 304:1992 'Heating boilers — Test code for heating boiler for atomising oil burners' (as amended).	☑	☑	☑
BS EN 12953-11:2003 "Shell boilers — Part 11: Acceptance tests".	☑	☑	☑
BS EN 12952-15:2003 "Water-tube boilers and auxiliary installations. Acceptance tests".	☑	☑	☑
BS EN 14394:2005+A1:2008 "Heating boilers. Heating boilers with forced draught Burners. Nominal heat output not exceeding 10 MW and maximum operating temperature of 110°C".	☑	☑	
BS EN 15502-2-1:2012 "Gas-fired central heating boilers. Specific standard for type C appliances and type B2, B3 and B5 appliances of a nominal heat input not exceeding 1000 kW"			☑

Where BS 845- 1:1987 is used, the following standard test conditions must be observed:

- A maximum ambient air temperature of 25ºC.
- An excess combustion air level of not less than 15%.

TABLE A METHOD A - SEPARATE TESTING BOILERS AND BURNERS
Under this test method: 1. Boiler and burner performance are demonstrated separately. 2. Boiler performance can be assessed using any burner (or burners) that can provide the heat input and operational stability needed to complete the test. 3. The boiler's net thermal efficiency at full load (100%) must be measured in accordance with the procedures set out in an ETL recognised standard (Table 2). 4. The boilers net thermal efficiency at part load (30%) is then inferred from burner performance data and design calculations of burner/boiler matching.

TABLE B METHOD B - INTEGRATED TESTING AT FULL AND PART LOADS
Under this test method, overall product performance must be demonstrated by: 1. Measuring the net thermal efficiency at the test points specified in Table 1, in accordance with the procedures set out in an ETL recognised standard (Table 2).

TABLE C	METHOD C – VALIDATED DESIGN CALCULATIONS

Under this test method:

1. The product's net thermal efficiency at the full and part load conditions specified in Table 1 and the test conditions specified in one of the ETL recognised standards (Table 2) is determined from design calculations.
2. The accuracy of these design calculations must be confirmed by using an indirect method (flue gas loss method) from one of the ETL recognised standards (Table 2) to measure the product's actual net thermal efficiency:
   a) At least one test point between 60% and 100% of product's maximum rated input at the temperature conditions specified for the 100% test point, **and**:
   b) At least one test point between 20% and 40% of product's maximum rated input at or near the temperature conditions specified for the 30% test point.
3. To be eligible, the product's net thermal efficiency must exceed the performance thresholds specified in Table 1.

The test report must include (or be accompanied by):

a) Details of the calculations used to determine product performance.

a) A copy of the published performance data for the product.

b) Manufacturer's design data for the product.

c) The following test data, which must be obtained with the product operating under stable conditions at each selected test point:

   i. Analysis of flue gas composition, including as a minimum levels or oxygen or carbon dioxide and carbon monoxide.

   ii. Ambient and flue gas temperatures.

   iii. Total conductive, convective and radiative loss rate.

   iv. Net thermal efficiency.

d) Details of the burners used during the test.

Representative Testing

Where applications are being made for hot water boilers that are variants of the same constructional design and rated outputs up to and including 400 kW to be included on the Energy Technology Product List (ETPL), test data may be submitted for a representative selection of models. The representative models must be selected by dividing the range of products into groups of models with similar design characteristics, and testing a model in the lowest quartile of predicted performance in each group. The performance of each model in the group must be predicted using a validated mathematical model. As a minimum, at least one model must be tested in each range of products.

Where applications are being made for products of the same constructional design and rated outputs greater than 400 kW to be included on the Energy Technology Product List (ETPL), test data may be submitted for a single representative model provided that the maximum rated output of the products being applied for is not more than twice, or less than half, the maximum rated output of the product tested. Where the range of rated outputs exceeds these limits, products should be grouped into size ranges that comply with these rules, and test data submitted for one representative model for each group.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

4. 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**.

Localised Rapid Steam Generators

Date added to ETL 2003 (Revised 2013).

1. Definition of Technology

Localised rapid steam generators are products that are specifically designed to convert water into pressurised steam by means of a burner that converts fuel into heat and a heat exchanger that transfers the heat into the water as it passes through the product, and to achieve full operating steam pressure within a few minutes of being turned on, from a cold condition.

2. Technology Description

Localised rapid steam generators are steam boilers with a low water capacity that are designed to be installed close to the point of use, thereby avoiding the thermal losses associated with steam distribution from a central boiler-house. Their low thermal inertia means that they can respond rapidly to changes in demand.

Localised rapid steam generators are available in a range of different designs and efficiencies. The ECA scheme aims to encourage the purchase of the higher efficiency gas and oil fired localised rapid steam generators.

The ECA Scheme covers two categories of product:

1. Localised Rapid Steam Generators sold with an economiser
2. Localised Rapid Steam Generators sold without an economiser

Investments in localised rapid steam generators 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be gas and/or oil fired.
- Use an appropriately matched forced draught burner (or burners).
- Automatically respond to changes in steam demand by modulating their output in a continuous manner across a minimum specified turndown ratio, as set out in the performance criteria below, without initiating a purge cycle.
- Conform to the requirements of the Pressure Equipment Directive 97/23/EC in respect of their design, manufacturer and testing procedures, or be CE Marked.

In addition, products with a thermal output in excess of 400kW must **either** use burners from the "burners with controls" part of the Energy Technology Product List **or**:

- Incorporate a microprocessor based burner control system.
- Where mechanical dampers are used to modulate the **air flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis.
- Where control valves are used to modulate the **fuel flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis. (This requirement shall not apply to pneumatically operated modulating gas valves).
- Where the product is gas fired or dual fuelled, use a variable speed motor controller (or variable speed drive) to operate each forced draught fan incorporated into the product.

Performance criteria

Eligible products must meet or exceed the minimum thermal efficiencies set out in Table 1 below at the specified part and full load conditions, which vary according to product category and fuel type.

Table 1 – Performance test points for localised rapid steam generators

Product Category	Fuel Type	Turndown ratio	Test point % MCR	Net thermal efficiency %
Localised Rapid Steam Generators sold with an economiser	Gas fired or dual fuelled	3.33:1	30	>= 92.0%
			100	>= 92.0%
	Oil fired	2:1	50	>= 92.0%
			100	>= 92.0%
Localised Rapid Steam Generators sold without an economiser	Gas fired or dual fuelled	3.33:1	30	>= 88.0 %
			100	>= 88.0 %
	Oil fired	2:1	50	>= 88.0 %
			100	>= 88.0 %

">=" means "greater than or equal to"

Where MCR is the product's maximum continuous rating (MCR).

For the avoidance of doubt net thermal efficiency test data must be presented to 1 decimal place. As an example, a Localised Rapid Steam Generators sold without an economiser with a net thermal efficiency of 87.9% at 100% of its maximum continuous rating (MCR) would be deemed to be a fail.

Products must also:

- Be capable of achieving maximum working pressure in less than eight minutes starting with a water temperature of less than 25 degrees Centigrade.

Required test procedures

The required minimum performance must be demonstrated using Method A or Method B, as set out in Table A and Table B below.

Method A must only be used, where the all burners incorporated in the product are listed on the "burners with controls" part of the Energy Technology Product List.

Method B must be used to demonstrate the performance of modular boilers, or where any of the burners incorporated in the product are **NOT** listed on the "burners with controls" part of the Energy Technology Product List. A modular boiler is defined as an assembly of two or more similar (but not necessarily identical) modules, each with their own a heat exchanger, burner, and control and safety devices. The assembly has common water feed and steam output connections, but the water flow to, and steam flow from each module is independently controlled.

Representative Testing

Where applications are being made for localised rapid steam generators of the same constructional design to be included on the Energy Technology Product List (ETPL), the type testing procedures set out in Annex F of BS EN 303-3:1999 or Annex C.2.1 of BS EN 304:1992 (as amended) may be used to select representative models for testing and to reduce the overall number of performance tests that must be completed.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

TABLE A METHOD A - SEPARATE TESTING OF STEAM GENERATORS AND BURNERS
Under this test method: 1. Steam generator and burner performance are demonstrated separately. 2. Steam generator performance can be assessed using any burner (or burners) that can provide the heat input and operational stability needed to complete the test. 3. There is no requirement to measure the net thermal efficiency at part loads or standby losses, since these are inferred from burner performance requirements. Steam generator performance must be demonstrated by measuring its net thermal efficiency at 100% of the product's maximum continuous rating (MCR) in accordance with the procedures set out in one of the following standards: • BS 845:Part 1:1987 'Methods for Assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids — Part 1: Concise procedure'. • BS EN 12952-15:2003 'Water-tube boilers and auxiliary installations — Part 15: Acceptance tests'. Where BS 845:Part 1:1987 is used, the standard test conditions that must be used are: a maximum ambient air temperature of 25 degrees Centigrade and an excess combustion air level of not less than 15%.

TABLE B METHOD B - INTEGRATED PRODUCT TESTING AT FULL AND PART LOADS
Under this test method, overall product performance must be demonstrated by: 4. Measuring the net thermal efficiency at the test points specified in Table 1, in accordance with the procedures set out in one of the following standards: • BS 845:Part 1:1987 'Methods for Assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids — Part 1: Concise procedure'. • BS EN 12952-15:2003 'Water-tube boilers and auxiliary installations — Part 15: Acceptance tests'. Where BS 845:Part 1:1987 is used, the standard test conditions that must be used are: a maximum ambient air temperature of 25 degrees Centigrade and an excess combustion air level of not less than 15%. 5. Estimating the standby loss rate from the amount of fuel required to restore the output steam pressure to its starting pressure after a suitable shutdown period.

4. 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.

Retrofit Burner Control Systems

Date added to ETL 2001 (Revised 2012).

1. Definition of Technology

Retrofit burner control systems are products that are specifically designed to automatically control in an energy efficient manner, the operation of industrial and commercial burners, and the matching of burner heat production with heat demand.

2. Technology Description

Burners are used to provide heat for hot water, steam and thermal oil boilers, heaters and processes. They are widely used in industry and commerce. Traditionally adjustable cams and mechanical linkages have been used to control the fuel valves and air dampers that modulate burner heat output. These mechanisms are susceptible to mechanical wear and hysteresis, and are progressively being replaced by more accurate burner control systems.

A range of retrofit burner control systems is available, and these offer different levels of precision and repeatability of control. The ECA Scheme aims to encourage the purchase of microprocessor-based products that are able to accurately control combustion and maintain burner efficiency over a specified turn down range.

As installers assemble retrofit burner control systems on site from standard components from different manufacturers, which reflect the specific requirements of the installation, only the retrofit burner control units are listed the Energy Technology Product List (ETPL).

Investments in retrofit burner control systems 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate a microprocessor based control system.
- Be designed to:
  a) Control one or more forced draught, gas and/or oil fired burners.
  b) Use a precision servomotor to adjust any mechanical airflow dampers and/or modulating gas valves that control the air-fuel ratio of the burners controlled. Each precision servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis.
  c) Where the burners being controlled are gas fired or dual fuelled, use a variable speed motor drive or controller to operate the burners' forced draught fans.
  d) Fully close the air dampers of the burners being controlled on shutdown.

- Automatically respond to changes in heat demand by modulating burner output:
  a) In a continuous manner across a minimum specified turndown ratio of 4:1
  b) Whilst adjusting the ratio of air and fuel fed to the burner in a manner that maintains combustion efficiency across the required turndown range and complies with the maximum permitted levels of oxygen and carbon monoxide in the burner's exhaust gases, as set out in Table 1.
- Be CE Marked, or conform with the EU EMC Directive 89/336/EEC (as amended) or its replacement EU EMC Directive 2004/108/EC in respect of their design, manufacturer and testing procedures.
- **Not** depend on any form of mechanical linkage between a modulating gas valve, and air damper or air control valve, when adjusting the air fuel ratio of a burner.
- **Not** incorporate any form of control valve, actuator, or variable speed drive.

Performance criteria

Products must be able to control all categories of burners for which they are designed in a manner that does not exceed the maximum permitted levels of oxygen (O_2) and carbon monoxide (CO) in the burners' exhaust gas at each of test points specified in Table 1.

Table 1 Minimum performance requirements for retrofit burner control systems

Maximum O_2 level at test point			Maximum CO level
100% MCR	**50% MCR**	**25% MCR**	**All test points**
3.0%	4.0%	5.0%	20 ppmv

Where MCR is the product's maximum continuous rating.

Required test procedures

Product performance at the three required test points specified in Table 1 (above) must be determined by fitting the product to an appropriate burner and testing in accordance with the procedures and test conditions in one of the following standards:

- BS EN 676:2003 (as amended) "Automatic forced draught burners for gaseous fuels".
- BS EN 267:2009, "Automatic forced draught burners for liquid fuels.

Where the product's turndown ratio is greater than the minimum required, performance at the 25% and 50% test points may be calculated by linear interpolation of the test results. Where operation at the burner's maximum continuous rated output is not possible, performance at the 100% test point may be determined by extrapolation of test data at two additional test points (e.g. 70% and 90%).

For the avoidance of doubt, the oxygen levels in the test burner's exhaust should be presented to 1 decimal place, and carbon monoxide levels to zero decimal places. As an example, where the test burner's exhaust gases contain oxygen levels of 3.1%, or carbon monoxide levels of 21 ppmv, at 100% of the test burner's maximum continuous rating, the product would be deemed to be a fail.

4. 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.

Steam Boilers

Date added to ETL 2001 (Revised 2011).

1. Definition of Technology

Steam boilers are products that are specifically designed to convert water into pressurised steam by means of a burner that converts fuel into heat and a heat exchanger that transfers the heat into the water as it passes through the product.

2. Technology Description

Steam boilers are used to produce steam for process heating, space heating and water heating. They consist of a burner, a pressure vessel containing a heat exchanger, and associated burner control systems and boiler control equipment.

Steam boilers are available in a range of different designs and efficiencies. The ECA Scheme aims to encourage the purchase of the higher efficiency gas and oil fired steam boilers, including products that are designed to use liquid and gaseous biofuels.

Investments in steam boilers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be gas and/or oil fired.
- Use an appropriately matched forced draught burner (or burners).
- Automatically respond to changes in steam demand by modulating their output in a continuous manner across a minimum specified turndown ratio, as set out in the performance criteria below, without initiating a purge cycle.
- Conform to the requirements of the Pressure Equipment Directive 97/23/EC in respect of their design, manufacturer and testing procedures, or be CE Marked.

In addition, products with a thermal output in excess of 400kW must **either** use burners from the "burners with controls" part of the Energy Technology Product List **or**:

- Incorporate a microprocessor based burner control system.
- Where mechanical dampers are used to modulate the **air flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis.
- Where control valves are used to modulate the **fuel flow** to the burners, they must be operated by a precision servomotor. The servomotor must be controlled by a positional or flow based feedback mechanism that automatically adjusts its operation to correct for mechanical wear, valve stiction and hysteresis. (This requirement shall not apply to pneumatically operated modulating gas valves).
- Where product is gas fired or dual fuelled, use a variable speed motor controller (or variable speed drive) to operate each forced draught fan incorporated into the product.

Performance criteria

Products must have a minimum net thermal efficiency of 92.0% at the full load and part load conditions set out in Table 1 below.

Table 1 – Performance test points for steam boilers

Fuel Type	Turndown ratio	Test point % MCR	Net thermal efficiency %
Gas fired or dual fuelled	3.33:1	30	>= 92.0 %
		100	>= 92.0 %
Oil fired	2:1	50	>= 92.0 %
		100	>= 92.0 %

">=" means "greater than or equal to"

Where MCR is the product's maximum continuous rating (MCR).

For the avoidance of doubt net thermal efficiency test data must be presented to 1 decimal place. As an example, a product with a net thermal efficiency of 91.9% at 100% of its maximum continuous rating (MCR) would be deemed to be a fail.

Required test procedures

The required minimum performance must be demonstrated using Method A, Method B or Method C, (as set out in Tables A, B and C below), which are subject to the following restrictions:

- Method A must only be used, where the all burners incorporated in the product are listed on the "burners with controls" part of the Energy Technology Product List.

- Method B must be used to demonstrate the performance of modular boilers. A modular boiler is defined as an assembly of two or more similar (but not necessarily identical) modules, each with their own a heat exchanger, burner, and control and safety devices. The assembly has common water feed and steam output connections, but the water flow to, and steam flow from each module is independently controlled.

- Method C may only be used for products with rated outputs above 600kW, where it is not possible to measure product performance in a laboratory due to product size.

All performance measurements must be carried out in accordance with the procedures set out in one of the following test standards:

- BS 845: Part 1:1987 'Methods for assessing thermal performance of boilers for steam, hot water and high temperature heat transfer fluids — Part 1: Concise procedure'.
- BS EN 12953-11:2003 'Shell boilers — Part 11: Acceptance tests'.

Where BS 845- 1:1987 is used, the following standard test conditions must be observed:

- A maximum ambient air temperature of 25ºC.
- An excess combustion air level of not less than 15%.

Representative Testing

Where applications are being made for products of the same constructional design to be included on the Energy Technology Product List (ETPL), test data may be submitted for a single representative model provided that the maximum rated output of the products being applied for is not more than three times, or less than one third of, the maximum rated output of the product tested. Where the range of rated outputs exceeds these limits, products should be grouped into size ranges that comply with these rules, and test data submitted for one representative model for each group.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

TABLE A METHOD A - SEPARATE TESTING OF BOILERS AND BURNERS
Under this test method: 1. Boiler and burner performance are demonstrated separately. 2. Boiler performance can be assessed using any burner (or burners) that can provide the heat input and operational stability needed to complete the test. 3. The boiler's net thermal efficiency at 100% of product's maximum continuous rating (MCR) in accordance with the procedures in one of the specified standards. 4. The boiler's net thermal efficiency at part load (30%) is then inferred from burner performance data and design calculations of burner/boiler matching.

TABLE B METHOD B - INTEGRATED TESTING AT FULL AND PART LOADS
Under this test method, overall product performance must be demonstrated by: 1. Measuring the net thermal efficiency at the test points specified in Table 1, in accordance with the procedures in one of the specified test standards.

TABLE C METHOD C – VALIDATED DESIGN CALCULATIONS
Under this test method: 1. The product's net thermal efficiency at the full and part load conditions specified in Table 1 is determined from design calculations. 2. The accuracy of these design calculations must be confirmed by interpolation and extrapolation of measurements, obtained using the procedures in one of the specified test standards, of the product's net thermal efficiency: a) At least one test point between 60% and 100% MCR, **and**: b) At least one test point between 20% and 40% MCR. The test report must include (or be accompanied by): a) Details of the calculations used to determine product performance. b) A copy of the published performance data for the product. c) Manufacturer's design data for the product. d) The following test data, which must be obtained with the product operating under stable conditions at each selected test point: i. Analysis of flue gas composition, including as a minimum levels or oxygen or carbon dioxide and carbon monoxide. ii. Ambient and flue gas temperatures. iii. Total conductive, convective and radiative loss rate. iv. Net thermal efficiency. e) Details of the burners used during the test.

4. 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.

Combined Heat and Power

Combined Heat and Power is the simultaneous generation of heat and power (usually electricity) in a single process. CHP Schemes are by their nature bespoke and approval of a given CHP manufacturer or product would not provide sufficient assurance of environmental benefit. With CHP, case by case Certification is needed to ensure support is provided for 'good quality' CHP. Certification is achieved using the CHP Quality Assurance programme (CHPQA). Because a certificate is used, no specific products appear on the Energy Technology Product List.

Guidance on claiming Enhanced Capital Allowances for CHP is set out below.
Further information about CHP eligibility criteria and the CHPQA programme can be found at http://chpqa.decc.gov.uk

Questions on CHP eligibility should be directed to the CHPQA Helpline – 01235 75 3004 or chpqainfo@chpqa.com

USE OF CHPQA TO OBTAIN ENHANCED CAPITAL ALLOWANCES

1 One of the aims of the CHPQA programme is to ensure that entitlements to fiscal and other benefits are in line with, and incentivise, the environmental performance of CHP Schemes. Eligibility for Enhanced Capital Allowances (ECAs) is one of the fiscal benefits available to Good Quality CHP certified under the programme. ECAs give relief for the full cost of qualifying expenditure incurred in the accounting period, subject to any scale back of benefit, as applicable. To qualify for the allowances in respect of a CHP Scheme a "Certificate of Energy Efficiency" must be obtained from the Secretary of State. This is separate and distinct from the CHPQA Certificate.

2 The purpose of this guidance is to provide developers with step-by-step guidance on how to use CHPQA Certificates pertaining to proposed new or upgraded CHP Schemes to obtain ECAs. It will assist developers of Schemes:

- understand the overall procedure for applying for ECA, including the role of the CHPQA Certificate in the process
- with specific guidance on the timing and detail of each step of their application
- to interpret the application of the CHPQA Standard for ECA eligibility under specific circumstances, e.g. mixed fuel use.

3 The administration of ECAs is the responsibility of HM Revenue and Customs (HMRC). This guidance has been prepared in consultation with and has been approved by HMRC.

4 Further information can be obtained from
- The CHPQA web site: http://chpqa.decc.gov.uk/guidance-notes/
- The HMRC web site: www.hmrc.gov.uk

Readers seeking further clarification on the procedures described herein should refer initially to these sites. Subsequent queries on tax issues should be addressed to the reader's local tax office.

Glossary

5 The following terms are used in this guidance, the majority of which are defined in more detail in the CHPQA Standard, Issue 5, November 2013.

> **Annual Operation** is a period commencing on 1st January and finishing on 31st December of the same year.

Initial Operation is the period during which reduced Threshold Criteria apply and will include at least one full calendar year Operation.
Energy services provider (also known as ESCOs) may own an asset that is supplied for use by a client in return for a financial reward but this will only be one part of a much wider service. Energy service providers provide energy efficiency and/or load reduction services usually to commercial or industrial facilities. They are uniquely identified because their financial rewards are dependent on the energy savings that they achieve for their client. Typically, an ESCO offers the following services:

- develop, design and finance energy efficient projects
- install and maintain energy-efficient equipment
- measure, monitor and verify the project's energy savings
- assume the risk of guaranteed energy savings

It is the provision of this wide range of energy management services compared to the contract of hire by an equipment lessor that enables the energy service provider to be differentiated from the "lessor".

Qualifying Power Capacity is the registered power generation capacity (MWe) qualifying as Good Quality CHP.
Qualifying Expenditure is the expenditure incurred on Plant and Machinery. Such expenditure may be eligible for ECAs if installed as part of a CHP Scheme for which all or part of the capacity is certified as Good Quality CHP as defined in the CHPQA Standard Issue 5. Further guidance can be found on the CHPQA web site: http://chpqa.decc.gov.uk/guidance-notes/
Total Power Capacity is the registered maximum power generation capacity of a CHP Scheme (MWe).

6 To qualify for a Combined Heat and Power Certificate of Energy Efficiency a CHPQA Certificate must be obtained.

CHPQA Certification

7 The CHPQA Certificate for a CHP Scheme in design (either a new Scheme or a proposed modification to an existing Scheme):

- records parameters, valid until the end of the year of issue, relating to the projected energy efficiency and the environmental performance of the Scheme
- must be renewed by annual submission of CHPQA Form F3 from each January, to confirm or update the proposed design.

  » See CHPQA GN3.

- A CHPQA Certificate is required to obtain a Combined Heat and Power Certificate of Energy Efficiency. However, possession of a CHPQA Certificate does not compel applicants to obtain a Combined Heat and Power Certificate of Energy Efficiency.

Combined Heat and Power Certificate of Energy Efficiency

8 The Combined Heat and Power Certificate of Energy Efficiency for each Scheme:

- is valid from the date of issue, unless varied or revoked provided the operator maintains a valid CHPQA Certificate.
- states the CHPQA Scheme Reference Number, the Total Power Capacity and the Qualifying Power Capacity all as recorded in the CHPQA Certificate at the time of issue.
- states the percentage of total Qualifying Expenditure eligible as ECA

- **may be revoked if**
  - the CHP Scheme design changes during its development
  - the Scheme development ceases
  - the Scheme is not built in accordance with the design certified under CHPQA

9 To obtain a Combined Heat and Power Certificate of Energy Efficiency (ECA Eligibility), which is issued on behalf of the Secretary of State by DECC, simply tick the box on CHPQA Form F3 when making your annual Self-Assessment.

10 Any change in design, whether or not it causes a change to the Qualifying Power Capacity or Power Efficiency, must be notified to the CHPQA Administrator by resubmitting a revised Form F3. This may trigger the revocation of any existing Certificate of Energy Efficiency and, if one is still required, the issue of a new Certificate of Energy Efficiency. An example Combined Heat and Power Certificate of Energy Efficiency is given in Appendix A.

Eligible Organisations

11 In considering the UK notification of the proposed ECA scheme, the European Commission ruled that, in the case of CHP, the award of ECAs does not constitute State Aid (and is therefore allowable) provided that;

"the main intended business will be to provide heat and power for clearly identified users on site or to known third parties, and not to generate power for sale to or via unspecified third parties."

This statement is elaborated in a further reference;

"ECAs for CHP will be available for all companies except for companies whose core business is electricity production, insofar as they use the CHP system to produce electricity to be sold to unknown end users."

12 The statements above are clearly intended to avoid unfair competition in the Electricity Generating Industry between Member States. They should not affect the vast majority of CHP Scheme operators in UK however and provided that applicants can demonstrate their intention to supply heat and power to known end users they should fall outside the exclusion.

13 Such intention is recorded in the CHPQA Form F3, which asks for details about intended power exports.

Threshold Criteria for ECA Eligibility

14 The Threshold Criteria for ECA eligibility are based on the CHPQA Threshold Criteria for Good Quality CHP for Proposed New Power Generation Capacity as set out in the CHPQA standard, Issue 5. However, the Threshold Power Efficiency Criterion is relaxed for Schemes that burn a proportion of biomass or solid or liquid waste fuels as shown in the table below.

› See CHPQA GN 14 for more information on biomass or solid or liquid waste fuels

	Q1 Threshold		Power Efficiency Threshold
All new or upgraded Schemes **Except** for the special cases below	≥ 105 under MaxHeat Conditions	&	≥ 20% under long term annual operation
	≥ 105 under MaxHeat Conditions	&	≥ 10% under long term annual operation

New or upgraded Schemes that use only biomass or solid or liquid waste fuels			
New or upgraded Schemes that use part biomass or solid or liquid waste fuels (See note below)	≥ 105 under MaxHeat Conditions	&	≥ (20 – 10 x Fw) % under long term annual operation

Note: Fw = fraction of total energy inputs as biomass plus solid waste plus liquid waste fuels

Calculation of ECA Value

15 ECAs are claimed in the same way as other capital allowances on the Corporation Tax Return for companies and the Income Tax Return for individuals and partnerships. The responsibility for notifying the HMRC of any changes in eligibility lie with the tax payer and significant penalties are possible in the event of fraudulent or negligent claims.

Important Note: CHP Schemes failing to meet the relevant Threshold Power Efficiency Criterion (see Table above) do not qualify for ECA on any expenditure incurred.

16 Where the Scheme fails to meet the Threshold Quality Index Criterion the entitlement to ECAs is restricted. Claims are made in respect of the individual items of plant and machinery within the Scheme and qualifying expenditure on these may not exceed a maximum calculated as follows:

1. identify the expenditure incurred on qualifying plant and machinery in the CHP Scheme
2. add any additional Eligible Costs listed on the web site such as transportation and installation charges
3. multiply the total value of Qualifying Expenditure and Eligible Costs, as identified in points 1 and 2, by the portion of the capacity of the proposed CHP scheme that qualifies as Good Quality CHP (for further details see CHPQA Guidance Notes 27).
4. select individual items from the list of Qualifying Expenditure and Eligible Costs, the value of which add up to, but do not exceed, the value calculated in point 3

The value of the items selected in point 4 is the value of ECA to be claimed. The remaining expenditure will qualify for capital allowances at the relevant rate.

The equipment that qualifies as Plant and Machinery, and will be eligible for ECA if installed as part of a CHP Scheme Certified by CHPQA as Good Quality is given on the CHPQA website [http://chpqa.decc.gov.uk/guidance-notes/]. The classes of equipment that can qualify for CHP ECAs include the additional equipment required for the operation of CHP facilities using Solid Recovered Fuel (SRF). These changes took effect for tax purposes from 11 August 2008.

Claimants should note that in respect of ECAs for CHP facilities using SRF they will need to demonstrate that:-

- the SRF throughput tonnage is equal to or greater than 50% of the rated capacity of the plant in any one Tax Year or any part of a Tax Year on a pro-rata basis; and

- they have met the above criterion for at least five consecutive years from the date of Plant Acceptance (as defined in the relevant plant construction contract) to avoid the forfeit of the monetary value of the ECA.

17 ECAs are claimed on the relevant Tax Return for the year in which the Qualifying Expenditure was incurred and can only be whilst in possession of a valid Combined Heat and Power Certificate of Energy Efficiency.

Annual Review/Variations

18 A Certificate of Energy Efficiency may be withdrawn and any allowances recovered if, for example, the CHP Scheme is not built to the design certified under CHPQA. An application may be made for a new Certificate of Energy Efficiency where appropriate.

APPENDIX A: Combined Heat and Power Certificate of Energy Efficiency (example)

ENHANCED CAPITAL ALLOWANCES FOR ENERGY-SAVING INVESTMENTS: CERTIFICATE OF ENERGY EFFICIENCY – COMBINED HEAT AND POWER

For the CHP Scheme referred to below the Secretary of State certifies that:

Address of Scheme

Date of Exemption Certificate	DD/MM/YYYY
CHPQA Scheme Reference Number	XXXX X
Qualifying Power Capacity (MWe)	Total Power Capacity (MWe)

Qualifying Expenditure:

Expenditure on plant and machinery of a description specified under the heading "combined heat and power" in the Energy Technology Criteria List issued by the Secretary of State, which does not exceed [QPC/TPC]% of the total expenditure on such specified plant and machinery for the Scheme to which this Certificate applies.

Signed by authority of the Secretary of State

Signature:

Name in block capitals:

Notes

1. This Certificate of Energy Efficiency is issued in accordance with, and for the purposes of Section 45B of the Capital Allowances Act 2001.
2. This Certificate is valid from the date of issue onwards, unless revoked.
3. This Certificate may be revoked if the Scheme is not built in accordance with the design certified under CHPQA.
4. This certificate may be revoked if it has been issued in the basis of incorrect information supplied for the purposes of an application for a Certificate of Energy Efficiency.
5. If a person who has made a tax return becomes aware that, as a result of the revocation of a Certificate of Energy Efficiency after the return was made, the return has become incorrect, he or she must give notice to HM Revenue and Customs specifying how the return needs to be amended. The notice must be given within 3 months beginning with the day on which the person first became aware that anything in the tax return had become incorrect because of the revocation of the Certificate.

Compressed Air Equipment

Desiccant Air Dryers with Energy Saving Controls

Date added to ETL 2014.

1. Definition of Technology

Desiccant air dryers are products that are specifically designed to extract water vapour from industrial compressed air systems by absorbing moisture using a desiccant material which is then, for example, regenerated by blowing air through the dryer.

2. Technology Description

Desiccant air dryers are commonly fitted to compressed air systems to prevent moisture from condensing within pipe work and equipment. They are typically utilised where compressed air is needed at higher quality or with a lower dew point than can be achieved by a refrigerated air dryer.
They contain a desiccant material which absorbs the moisture and is then regenerated, for example, by blowing air through the dryer.

The direct energy usage of a desiccant air dryer typically increases the energy used in compressed air generation by between 10% and 25% depending on the product design and how it is controlled. Indirect energy usage, in the form of the pressure drop across the dryer and the compressed air used for purging can increase the overall energy usage in compressed air generation by between 20% and 50%. The aim of the ECA Scheme is to encourage the purchase of higher efficiency models, which have low pressure drops across them. The aim of the ECA Scheme is to encourage the purchase of models which use energy efficient methods of desiccant regeneration, have low pressure drops across them and include energy savings controls.

Investments in desiccant air dryers with energy savings controls 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Have a dew point rating of -40ºC i.e. Class 2 specifications for moisture removal in BS ISO 8573-1:2010.
- Utilise a regeneration method which is either heatless or internally/externally electrically heated or utilises a blower or vacuum system. Desiccant dryers that utilise steam, heat of compression or are heated in any way other than electrically are not eligible.
- Incorporate dew point sensing controls that automatically control the regeneration cycle to optimise the time between regenerations depending on the dew point of the exit air in a manner that reduces the energy consumption of the product.
- **Not** exceed the limits set out in the performance criteria below for the composite specific energy consumption (SEC) at 100% load (i.e. rated air flow), corrected for the pressure drop across the dryer and any compressed air used by the dryer for regeneration, purging and/or cooling.
- Conform with the requirements of the EU Pressure Equipment Directive PED 97/23/EC in respect of their design, manufacture and testing procedures, or be CE Marked.

Performance criteria

Products must not exceed the values for composite specific energy consumption (SEC), corrected for the pressure drop across the dryer and any compressed air used by the dryer, set out in the Table 1 below at 100% load (i.e. rated air flow).

Table 1 Maximum Allowable Composite SEC in kW/m^3/min

Percentage of full load (i.e. rated air flow)	Maximum allowable Composite SEC (kW/m3/min)
100 %	<= 1.07

The composite SEC should be calculated as follows:

$$SEC = \frac{P + (1.67 \times \Delta p \times Q) + (5 \times C)}{(Q - C)}$$

Where:

P = Total electrical power consumed by air dryer, inclusive of any external heaters, blowers , vacuum pumps or other associated equipment, kW
Δp = Pressure drop across air dryer, bar
Q = Flow rate of air, m^3/min
C = Total compressed air loss of air dryer for regeneration, purging, cooling or any other purpose, m3/min

For the avoidance of doubt composite SEC data must be presented to 2 decimal places. As an example, a product with a composite SEC of 1.08 at 100% of full load would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures and test conditions laid down in BS ISO 7183:2007, which specifies how to measure the electrical power consumed by the product at full load, the pressure drop across the dryer, compressed air loss and the flow rate of air through the product. The test results should be presented in the format laid down in Annex B of BS ISO 7183-2:2007.

Products must also meet the Class 2 specifications for moisture removal in BS ISO 8573-1:2010, "Table 2 Compressed air purity classes for humidity and liquid water"

4. 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.

Flow Controllers

Date added to ETL 2008.

1. Definition of Technology

Flow controllers are products that are specifically designed to regulate the pressure in compressed air systems in a manner that maintains a set pressure regardless of volumetric changes caused by a fluctuating compressed air demand.

2. Technology Description

Flow controllers can be used, in conjunction with appropriate air storage capacity, to reduce the pressure fluctuations that normally occur in compressed air distribution systems when machines turn on and off, or compressed air demand is variable. This enables compressed air generation systems to be operated closer to the minimum required air distribution pressure, thereby realising energy savings.

Investments in flow controllers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate a pressure transducer that has a measurement accuracy of at least (i.e. <=) +/- 0.5% of full scale output across its rated operating pressure range and across a rated temperature range of –25 to 80 degrees Centigrade.
- Incorporate one or more precision control valves and associated valve positioning devices that do not vent more than 10 standard litres per minute (SLPM at 20 degrees Centigrade) of compressed air to atmosphere during normal operation.
- Incorporate a microprocessor based controller that is pre-programmed to:
  a) Define the downstream air pressure set-point in intervals not exceeding 0.1 bar.
  b) Calibrate the operation of the product's control valve(s) and associated valve positioner(s) to ensure correct operation across the product's turn down range.
  c) Tune the controller operation to eliminate controller hunting, minimise valve overshoot, and compensate for valve hysteresis and/or stiction.
- Be able to automatically regulate the air pressure downstream of the product, to within +/-0.1 bar of a set-point, across a minimum turn down range of 5:1, as air demand varies between the product's minimum and maximum rated air flows.
- Incorporate an anti-tampering mechanism that prevents automatic control from being disabled, except during commissioning, maintenance or testing.
- Conform with the requirements of the EU Pressure Equipment Directive (PED) 97/23/EC, and be CE Marked.
- **Not** incorporate facilities to directly control the operation of air compressors.

Where the product provides facilities for users to temporarily override automatic control, the product must automatically reset the override within 24 hours.

4. 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.

Master Controllers

Date added to ETL 2008 (Revised 2010).

1. Definition of Technology

Master controllers are products that are specifically designed to control the operation of multiple air compressors in a manner that maintains the operating pressure of the compressed air system within a narrow band, thereby minimising energy consumption.

2. Technology Description

Master controllers are microprocessor-based controllers that can be used to improve the control of compressed air systems with two or more compressors. They realise energy savings by reducing the pressure fluctuations that are normally present in compressed air systems when simple cascade or sequence controls are used to maintain system pressure, and by allowing users to schedule compressor operations that reflect working patterns.

Investments in master controllers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be able to automatically control the operation of:
  a) At least two air compressors.
  b) Both fixed speed and variable speed compressors.
  c) Any positive displacement compressor that is capable of accepting a remote load/unload control signal via a volt-free switching circuit or electromechanical pressure switch, or in the case of variable speed drives capable of accepting a speed control signal or a remote pressure set point adjustment.
- Incorporate a microprocessor based controller that is pre-programmed to provide facilities for users to:
  a) Prioritise the use of more efficient compressors over less efficient ones, whilst making optimal use of any variable speed compressors being controlled.
  b) Schedule the times of the week (in intervals of five minutes or less) when the compressed air system should be switched on and off, and be operated at a reduced pressure.
  c) Schedule at least two different operating pressures for the compressed air system (to enable for example operation at lower pressure at off peak times).
  d) Define the minimum and maximum limits for the operating pressure (or pressure band) that the controller must maintain the compressed air system within.
- Incorporate an anti-tampering mechanism that prevents automatic control from being disabled, except during commissioning, maintenance or testing.

- Incorporate a pressure transducer that has a measurement accuracy of at least (i.e. <=) +/- 0.5% of full scale across its rated operating pressure range and across a rated temperature range of –25 to 80 degrees Centigrade.
- Incorporate automatic control algorithms that monitor rate of change in system air pressure/flow and prevent compressors from being brought on load or unloaded in response to small fluctuations in demand.
- Be capable of automatically regulating the operating pressure of the compressed air system (where all compressors in the system are situated at a single location), based on the output of a single pressure transducer, to within +/-0.2 bar of the operating pressure set-point, as air demand varies between 10% and 100% of the maximum combined, continuous, rated output of air compressors being controlled.
- Conform with the requirements of the EU EMC Directive 89/336/EEC (as amended) or its replacement EU EMC Directive 2004/108/EC, and be CE Marked.

Where products provide facilities for operators to override automatic control, they must be pre-programmed to return to automatic control at the next scheduled time for system switch off / on, and to automatically reset the override within 24 hours.

Where products are also designed to control desiccant air dryers, they must also satisfy the eligibility criteria for 'energy saving controls for desiccant air dryers'.

Automatic control may be implemented either directly by means of an analogue or digital signal connection, or indirectly by means of another control device or network. Where products are designed to indirectly control variable speed compressors, they must be capable of monitoring the operating speed of the variable speed compressors, and of remotely adjusting the speed or pressure set points (or pressure or speed range limits) within the variable speed compressor's control device.

Products that cannot directly control the speed (or speed range) of a variable speed compressor, or indirectly control their speed of operation by adjusting their pressure set points, are not eligible.

4. 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.

Refrigerated Air Dryers with Energy Saving Controls

Date added to ETL 2003 (Revised 2014).

1. Definition of Technology

Refrigerated air dryers are products that are specifically designed to extract water vapour from industrial compressed air systems by means of cooling with a refrigeration cycle.

2. Technology Description

Refrigerated air dryers are commonly fitted to compressed air systems to prevent moisture from condensing within pipe work and equipment. They work by cooling the air to a desired dew point temperature, thus forcing moisture to condense out of the air. This resulting condensate is then drained from the compressed air system.

A refrigerated air dryer typically increases the energy used in compressed air generation by between 2% and 5% depending on the type of product selected and how it is controlled. The pressure drop across the refrigerated air dryer is also a key factor in the amount of additional energy consumed as a result of the use of refrigerated air dryers. The aim of the ECA Scheme is to encourage the purchase of higher efficiency models, which have low pressure drops across them.

Investments in refrigerated air dryers with energy savings controls 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate energy saving controls that automatically reduce the cooling output of the refrigerated air dryer as the average flow rate and temperature of the inlet air decreases in a manner that reduces the energy consumption of the product.
- Automatically control their output between 20% and 100% in response to changes in the flow rate and/or temperature of the inlet air and/or outlet air.
- **Not** exceed the limits set out in the performance criteria below for pressure drop corrected composite specific energy consumption (SEC) at 50%, 75% and 100% load (i.e. rated air flow).
- Conform with the requirements of the EU Pressure Equipment Directive PED 97/23/EC in respect of their design, manufacture and testing procedures, or be CE Marked.

Performance criteria

Products must not exceed the values for pressure drop corrected composite specific energy consumption (SEC) set out in the Table 1 below at the specified percentage of full load.

Table 1 Maximum Allowable Composite SEC in kW/m^3/min

Percentage of full load (i.e. rated air flow)	Maximum allowable Composite SEC (kW/m3/min)
50 %	<= 0.30
75 %	<= 0.40
100 %	<= 0.50

The pressure drop-corrected composite SEC should be calculated as follows:

$$SEC = \frac{P + (1.67 \times \Delta p \times Q)}{Q}$$

Where:

P = Total electrical power consumed by air dryer, kW
Δp = Pressure drop across air dryer, bar
Q = Flow rate of air, m^3/min

For the avoidance of doubt composite SEC data must be presented to 2 decimal places. As an example, a product with a composite SEC of 0.49 at 75% of full load) would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures and test conditions laid down in BS ISO 7183:2007, which specifies how to measure the electrical power consumed by the product at full load, the pressure drop across the dryer and the flow rate of air through the product. The test results should be presented in the format laid down in Annex B of BS ISO 7183-2:2007.

Products must also meet the Class 4 specifications for moisture removal in BS ISO 8573-1:2010, "Table 2 Compressed air purity classes for humidity and liquid water"

In addition, manufacturers should use the above procedures to evaluate the pressure drop corrected composite SEC of their products at two part load conditions (50% and 75%).

Please note that performance data obtained in accordance with the procedures in ISO 7183:-1986 will be accepted as an alternative to testing in accordance with ISO 7183:2007 until further notice.

4. 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.

Heat Pumps

Air Source: Air to Water Heat Pumps

Date added to ETL 2009 (Revised 2016).

1. Definition of Technology

Air to water heat pumps are products that are specifically designed to transfer heat from the air outside a building to a water-based heating system, by means of a refrigerant cycle.

2. Technology Description

An air to water heat pump uses an electrically driven refrigeration system to transfer heat from outside air into a water-based heating system. They can be used to provide space heating in a wide range of buildings, and some products also are able to provide heat to deliver domestic hot water and /or cooling by reversing the refrigerant flows around the product.

Air to water heat pumps are available with a wide range of efficiencies and the ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers two categories of products:

1. **Low temperature heat pumps**
   that are specifically designed for low-temperature application, and that **cannot** deliver heating water with an outlet temperature of 52 °C at an inlet dry (wet) bulb temperature of – 7 °C (– 8 °C) in the reference conditions for average climate

2. **Heat pumps (except low temperature heat pumps)**
   that **are capable** of delivering water with an outlet temperature of 52 °C or greater at an inlet dry (wet) bulb temperature of – 7 °C (– 8 °C) in the reference conditions for average climate

Investments in air 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate an electrically driven refrigeration system.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked
- Be designed primarily to provide space heating only, i.e. “space heater” as defined by Commission Regulation (EU) No 813/2013, **or**
- Be designed primarily to provide space heating, in addition to being capable of providing heat to deliver domestic hot water, i.e. “combination heater” as defined by Commission Regulation (EU) No 813/2013.

In addition, single split products must consist of an ‘outdoor’ unit and one ‘indoor’ unit that are:

- Factory–built sub-assemblies.

- Supplied as a matched set of units.
- Designed to be connected together during installation.

Performance criteria

Eligible products must meet the performance criteria set out in Table 1 below for:

- Seasonal Space Heating Energy Efficiency (SSHEE)
- Energy Efficiency Ratio (EER) at 100% (full) load in cooling mode, where the product is designed to provide cooling.

Table 1 Performance thresholds for air to water heat pumps

	Product Category	**Heating mode (SSHEE)**	**Cooling mode (EER)**
1.	Low temperature heat pumps	>=150%	>3.30
2.	Heat pumps (except low temperature heat pumps)	>=125%	>3.30

">" means "greater than"
">=" means "greater than or equal to"

For the avoidance of doubt test data should be presented to three significant figures. As an example, a low temperature heat pump with a cooling mode EER of 3.30 **or** a heating mode SSHEE of 149% would be deemed to be a fail.

Required test procedures

Performance data must be determined and the SSHEE calculated, following the requirements of Commission Regulation (EU) No 813:2013.

The product's capacity and COP at part load, and EER (where the product is designed to provide cooling), must be determined at the conditions shown in Table 2 and in accordance with the procedures detailed in BS EN 14825:2013 "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 2 Part load conditions for air to water heat pumps

	Product category	**Heating mode COP and Capacity at part load**	**Cooling mode EER**
1.	Low temperature heat pumps	BS EN 14825:2013, Table 12 Average heating conditions	BS EN 14825:2013 Table 4, Part load condition A, cooling floor application
2.	Heat pumps (except low temperature heat pumps)	BS EN 14825:2013, Table 18 Average heating conditions	BS EN 14825:2013 Table 4, Part load condition A, cooling floor application

A heating mode test report at part load condition A or B and a cooling mode test report (where the product is designed to provide cooling) at condition A as specified in Table 2 must be provided. The testing should be carried out in accordance with BS EN 14511:2013.

The seasonal coefficient of performance (SCOP) must be determined according to the calculation methods in BS EN 14825:2013.

The SSHEE must be calculated in accordance with the requirements of Commission regulation (EU) No 813/2013 Annex III, by dividing the SCOP by the factor 2.5 (to allow for generation efficiency), corrected by contributions accounting for temperature controls.

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) must be made available. Tests undertaken to verify the accuracy of the calculations must be carried out in accordance with the test procedures described above.

Test results may be submitted in summary form provided that:

- Sufficient data is included to confirm that the heating / cooling capacity (kW), part load COPs and EER of each product were determined in accordance with the test procedures in BS EN 14825:2013 / BS EN 14511:2013 and determined at, or corrected to, the part load conditions outlined in Table 2.

- At least two detailed test reports are submitted for each range of products. The data must be recorded in a detailed test report as defined in Table 6 of BS EN 14511:2013. The test report must include details of the data recording period and duration of the performance measurement.

Please note that performance data **for cooling mode EER only** obtained in accordance with the corresponding procedures and standard rating conditions laid down in BS EN 14511:2004, BS EN 14511:2007, BS EN 14511:2011 or BS EN 14511:2013, will be accepted as an alternative to testing in accordance with BS EN 14825:2013 Table 4, until further notice.

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.
- 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.
- Use the same defrosting method (e.g. hot gas defrost)
- Fit within the same product category (i.e. are all low temperature air to water heat pumps, or are all air to water heat pumps (except low temperature heat pumps).

The representative models must 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 must be predicted using a validated mathematical model. As a minimum, at least one model must be tested in each range of products and in each laboratory used for testing.

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.

4. 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**.

Air Source: Gas Engine Driven Split and Multi-Split (including Variable Refrigerant Flow) Heat Pumps

Date added to ETL 2004 (Revised 2014).

1. Definition of Technology

Air-source, gas engine driven (GED), heat pumps covers products that are specifically designed to transfer heat from the air in one space to the air in another space by means of a refrigeration cycle that is driven by a gas-fired internal combustion engine.

'Split' type heat pumps have separate heat collection and rejection units for each space known as 'indoor' and 'outdoor' units. The 'indoor' and 'outdoor' units are specifically designed to be connected together during installation by refrigerant pipework to form a single functional unit.

Variable refrigerant flow (VRF) heat pumps are specifically designed to automatically adjust the flow of refrigerant to each indoor unit so that the heat delivered is matched to the demand.

2. Technology Description

Air-source gas engine driven (GED) split and multi-split heat pumps use a gas-fired internal combustion engine driven refrigeration system to transfer heat from air outside a building to the air inside it. They can be used to provide space heating in a wide range of buildings, and some products also are able to provide cooling by reversing the refrigeration flows around the product. (These products are known as reversible gas engine driven 'air-cooled' air conditioning units).

Air source gas engine driven split and multi-split heat pumps are available with a wide range of efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers four categories of products:

1. **Air source: GED single split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit and one 'indoor' unit.
2. **Air source: GED dual split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit and two 'indoor' units.
3. **Air source: GED multi-split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit connected to two or more 'indoor' units using either individual refrigerant circuits (with the indoor units individually controlled) or using a common refrigerant circuit with the indoor units controlled as one.
4. **Air source: GED split or multi-split variable refrigerant flow (VRF) heat pumps**
   that consist of one 'outdoor' unit connected to one or more 'indoor' units using a common refrigerant circuit with the indoor units individually controlled.

Investments in air source gas engine driven split and multi-split (including variable refrigerant flow) 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Consist of an 'outdoor' unit and one or more 'indoor' units that are:
  a) Factory–built sub-assemblies.
  b) Supplied as a matched set of units.
  c) Designed to be connected together during installation.
- Incorporate a refrigeration system that is driven by a gas-fired internal combustion engine.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.

Performance criteria

Eligible products must meet the performance criteria set out in Table 1 below for:

- Coefficient of Performance (COP) across the range of connected capacities and including 100% (full) load in heating mode.
- Energy Efficiency Ratio (EER) across the range of connected capacities and including 100% (full) load in cooling mode, where the product is designed to provide cooling.

Table 1 Performance requirements for air source: gas engine driven (GED) split and multi-split heat pumps

	Product Category	Heating mode (COP)	Cooling mode (EER)
1.	Air source: GED single split (non VRF) heat pumps.	>1.30	>1.10
2.	Air source: GED dual split (non VRF) heat pumps.	>1.30	>1.10
3.	Air source: GED multi-split (non VRF) heat pumps.	>1.30	>1.10
4.	Air source: GED split and multi-split variable refrigerant flow (VRF) heat pumps.	>1.30	>1.10

">" means "greater than"

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, an air source gas engine driven single split (non-VRF) heat pump product with a heating mode COP of 1.30 would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures laid down in the following standards:

- JIS B 8627-1: 2006, "Gas engine driven heat pump air conditioners – Part 1 General requirements".
- JIS B 8627-2: 2000 "Gas engine driven heat pump air conditioners – Part 2: non-ducted gas engine driven heat pump air conditioners – Testing and rating for performance".
- JIS B 8627-3: 2000 "Gas engine driven heat pump air conditioners – Part 3: Ducted gas engine driven heat pump air conditioners – Testing and rating for performance".

The standard rating conditions are set out in the Table 2 below.

Table 2 Test conditions for air source: gas engine driven (GED) split and multi-split heat pumps

	Product Category	**Heating mode (COP)**	**Cooling mode (EER)**
1.	Air source: GED single split (non-VRF) heat pumps.	JIS B 8627-1:2006 Table 1.1 Heating standard test	JIS B 8627-1:2006 Table 1.1 Cooling standard test
2.	Air source: GED dual split (non-VRF) heat pumps.	JIS B 8627-1:2006 Table 1.1 Heating standard test	JIS B 8627-1:2006 Table 1.1 Cooling standard test
3.	Air source: GED multi-split (non-VRF) heat pumps.	JIS B 8627-1:2006 Table 1.1 Heating standard test	JIS B 8627-1:2006 Table 1.1 Cooling standard test
4.	Air source: GED split and multi-split variable refrigerant flow (VRF) heat pumps.	JIS B 8627-1:2006 Table 1.1 Heating standard test	JIS B 8627-1:2006 Table 1.1 Cooling standard test

Notes

1. The heating standard test requires an entering air temperature on the indoor side of 20°C (Dry-bulb), and an entering air temperature on the outdoor side of 7°C (Dry-bulb) and 6°C (Wet-bulb).

2. The cooling standard test requires an entering air temperature on the indoor side of 27°C (Dry-bulb) and 19°C (Wet-bulb), and an entering air temperature on the outdoor side of 35°C (Dry-bulb).

4. 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.

Air Source: Packaged Heat Pumps

Date added to ETL 2002 (Revised 2016).

1. Definition of Technology

Air source heat pumps are products that are specifically designed to transfer heat from the air in one space to the air into another space by means of a refrigeration cycle.

'Packaged' type heat pumps are single factory assembled units that incorporate all the elements of the refrigeration system and air distribution mechanisms for space heating.

2. Technology Description

Air source packaged heat pumps use an electrically operated refrigeration system to transfer heat from air outside a building to the air inside it. They can be used to provide space heating in a wide range of buildings, and some products also are able to provide cooling by reversing the refrigeration flows around the product. (These products are known as reversible 'air-cooled' air conditioning units).

Air source packaged heat pumps are available with a wide range of efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

Investments in air source packaged 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Consist of a single factory–built unit.
- Incorporate an electrically driven refrigeration system.
- Incorporate all the elements of the air distribution mechanisms for space heating.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.

Products must be designed to primarily supply heating by means of the built-in heat pump and must not incorporate a gas-fired burner, hot water heating coil or steam heating coil.

Performance criteria

Eligible products must meet the performance criteria set out in Table 1 below for:

- Coefficient of Performance (COP) at 100% (full) load in heating mode.
- Energy Efficiency Ratio (EER) at 100% (full) load in cooling mode, where the product is designed to provide cooling.

Table 1 Performance requirements for air source: packaged heat pumps

Product Category	Heating mode (COP)	Cooling mode (EER)
Air source: packaged heat pumps	>3.20	>2.80

">" means "greater than"

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, a product with a heating mode COP of 3.20 would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures in BS EN 14511:2013. The standard rating conditions are set out in the Table 2 below.

Table 2 Test conditions for air source packaged heat pumps

Product Category	Heating mode (COP)	Cooling mode (EER)
Air source: packaged heat pumps	BS EN 14511-2:2013 Table 3 Standard rating Conditions, Outdoor air/recycled air	BS EN 14511-2: 2013 Table 4 Standard rating Conditions, Comfort Outdoor air/recycled air

Please note that performance data obtained in accordance with the corresponding procedures and standard rating conditions laid down in BS EN 14511: 2004, BS EN 14511: 2007 or BS EN 14511:2011 will be accepted as an alternative to testing in accordance with BS EN 14511-2:2013 until further notice.

4. 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.

Air Source: Split and Multi-Split (including Variable Refrigerant Flow) Heat Pumps

Date added to ETL 2002 (Revised 2015).

1. Definition of Technology

Air source heat pumps are products that are specifically designed to transfer heat from the air in one space to the air into another space by means of a refrigeration cycle.

'Split' type heat pumps have separate heat collection and rejection units for each space known as 'indoor' and 'outdoor' units. The 'indoor' and 'outdoor' units are specifically designed to be connected together during installation by refrigerant pipework to form a single functional unit.

Variable refrigerant flow (VRF) heat pumps are specifically designed to automatically adjust the flow of refrigerant to each indoor unit so that the heat delivered is matched to the demand.

2. Technology Description

Air source split and multi-split heat pumps use an electrically operated refrigeration system to transfer heat from air outside a building to the air inside it. They can be used to provide space heating in a wide range of buildings, and some products also are able to provide cooling by

reversing the refrigeration flows around the product. (These products are known as reversible 'air-cooled' air conditioning units).

Air source split and multi-split heat pumps are available with a wide range of efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers four categories of products:

1. **Air source: single split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit and one 'indoor' unit.
2. **Air source: dual split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit and two 'indoor' units.
3. **Air source: multi-split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit connected to two or more 'indoor' units using either individual refrigerant circuits (with the indoor units individually controlled) or using a common refrigerant circuit with the indoor units controlled as one.
4. **Air source: split or multi-split, variable refrigerant flow (VRF) heat pumps**
   that consist of one 'outdoor' unit connected to one or more 'indoor' units using a common refrigerant circuit with the indoor units individually controlled.

A heat pump driven air curtain unit for multi-split heat pumps may replace one or more 'indoor' heat pump units within an ECA eligible multi-split (including VRF) heat pump.

Investments in air source split and multi-split (including variable refrigerant flow) heat pumps can only qualify for Enhanced Capital Allowances if the products meet the eligibility criteria set out below. The individual products purchased do not need to be named on the Energy Technology Product List.

3. Eligibility Criteria

To be eligible, products must:

- Consist of an 'outdoor' unit and one or more 'indoor' units that are:
  a) Factory–built sub-assemblies.
  b) Supplied as a matched set of units.
  c) Designed to be connected together during installation.
- Incorporate an electrically driven refrigeration system.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.

To be eligible, heat pump driven air curtain 'indoor' units for multi-split heat pump products must also:

- Be specifically designed to be fitted above a doorway or similar opening.
- Be designed to use electrical air heaters (where fitted) only during defrosting or heat pump failure.
- Have been rated in terms of air curtain airflow rate, outlet air velocity uniformity and air curtain velocity projection in accordance with the procedures in BS ISO 27327-1:2009.

Performance criteria

Eligible products must meet the performance criteria set out in Table 1 for:

- Coefficient of Performance (COP) across the range of connected capacities and including 100% (full) load in heating mode.
- Energy Efficiency Ratio (EER) across the range of connected capacities and including 100% (full) load in cooling mode, where the product is designed to provide cooling.

Except for non-VRF products with a rated cooling capacity less than, or equal to, (<=) 12kW which must meet the performance criteria set out in Table 1 for:

- Seasonal Performance (SCOP) across the range of connected capacities.
- Seasonal Energy Efficiency Ratio (SEER) across the range of connected capacities.

Table 1 Performance requirements for air source split and multi-split heat pumps

	Rated Cooling Capacity	**>12kW**		**≤12KW**	
	Product Category	**Heating mode (COP)**	**Cooling mode (EER)**	**Heating mode (SCOP)**	**Cooling mode (SEER)**
1.	Air source: single split (non-VRF) heat pumps	>3.70	>3.20	≥4.00	≥6.10
2.	Air source: dual split (non-VRF) heat pumps	>3.70	>3.20	≥4.00	≥6.10
3.	Air source: multi-split (non-VRF) heat pumps	>3.70	>3.20	≥4.00	≥6.10
4.	Air source: split or multi-split variable refrigerant flow (VRF) heat pumps	>3.80	>3.40	N/A	N/A

">" means "greater than" and "≥" means "greater than or equal to"

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, a 20kW air source, single split (non-VRF) heat pump product with a heating mode COP of 3.70 would be deemed to be a fail.

In addition, eligible heat pump driven air curtain 'indoor' units for multi-split heat pump products must have an outlet air velocity uniformity (u_{ACU}), as defined in Section 5.4.4 of BS ISO 27327-1: 2009, greater than or equal to 70% over the range of doorway/opening heights that they are designed to be fitted above.

Required test procedures

Testing for non-VRF products with a cooling capacity greater than 12kW and all VRF products must be carried out in accordance with the procedures in BS EN 14511:2013. The standard rating conditions are set out in the Table 2 below.

Table 2 Test conditions for air source split and multi-split heat pumps >12kW and VRF

	Product Category		Heating mode (COP)	Cooling mode (EER)
1.	Air source: single split (non VRF) heat pumps		BS EN 14511:2013Table 3 Standard rating Conditions, Outdoor air/recycled air.	BS EN 14511:2013Table 4 Standard rating Conditions, Comfort Outdoor air/recycled air
2.	Air source: dual split (non VRF) heat pumps		BS EN 14511:2013Table 19 Standard rating Conditions.	BS EN 14511:2013Table 20 Standard rating Conditions.
3.	Air source: multi-split (non VRF) heat pumps		BS EN 14511:2013Table 19 Standard rating Conditions.	BS EN 14511:2013Table 20 Standard rating Conditions.
4.	Air source: split or multi-split variable refrigerant flow (VRF) heat pumps:	Single split	BS EN 14511:2013Table 3 Standard rating Conditions, Outdoor air/recycled air.	BS EN 14511:2013Table 4 Standard rating Conditions, Comfort Outdoor air/recycled air
		Multi-split	BS EN 14511:2013Table 19 Standard rating Conditions.	BS EN 14511:2013Table 20 Standard rating Conditions.

Please note that performance data obtained in accordance with the corresponding procedures and standard rating conditions laid down in BS EN 14511: 2004 or BS EN 14511: 2007 or BS EN 14511:2011 will be accepted as an alternative to testing in accordance with BS EN 14511: 2013 until further notice.

Testing for non-VRF products with a cooling capacity less than or equal to 12kW should be carried out in accordance with the procedures in BS EN 14825: 2013 under the test conditions set out in the Table 3 below.

Performance data for non-VRF products with a cooling capacity less than or equal to 12kW must be determined following the requirements of Commission Regulation (EU) No 206/2012 Annex II.

Table 3 Test conditions for air source split and multi-split heat pumps ≤12kW (Excluding VRF)

	Product Category	Heating mode (SCOP)	Cooling mode (SEER)
1.	Air source: single, dual or multi split (non VRF) heat pumps	BS EN 14825: 2013Table 6 Average heating conditions.	BS EN 14825: 2013Table 2

Please note that performance data obtained in accordance with the corresponding procedures and standard rating conditions laid down in BS EN 14825: 2012 will be accepted as an alternative to testing in accordance with BS EN 14825: 2013 until further notice.

Calculated results

Where results are determined by calculation then this should be on the basis of design and/or extrapolation from other combinations of indoor and outdoor units. 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) must be made available. Tests undertaken to verify the accuracy of the calculations must be carried out in accordance with the test procedures described above.

4. 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**.

Ground Source and Surface Water Source Heat Pumps

(Formerly Ground Source: Brine to Water Heat Pumps)
Date added to ETL 2004 (Revised 2016).

1. Definition of Technology

Ground source heat pump systems are specifically designed to transfer heat from the ground to a water-based heating system by means of a refrigeration cycle.

Surface water heat pump systems are specifically designed to transfer heat from surface water to a water-based heating system by means of a refrigeration cycle.

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.

2. Technology Description

Ground source and surface water source brine/water 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 refrigerant flows around the product.

The ECA Scheme aims to encourage purchase of higher efficiency ground source and surface water source brine/water to water heat pumps, which can be used to realise substantial reductions in carbon emissions.

Investments in ground source and surface water source brine/water 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- 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.

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.

Performance criteria

Eligible products must meet the relevant performance criteria set out in Table 1 below for:

- Seasonal Space Heating Energy Efficiency (SSHEE)
- Energy Efficiency Ratio (EER) at 100% (full) load in cooling mode, where the product is designed to provide cooling.

Table 1 Performance thresholds for ground source brine/water to water heat pumps

Product Category	**Heating mode (SSHEE)**	**Cooling mode (EER)**
Brine to water heat pumps	>175%	>3.20
Water to water heat pumps	>200%	>3.20

">" means "greater than"
"<=" means "less than or equal to"

For the avoidance of doubt SSHEE data should be presented with no decimal places and EER data should be presented to two decimal places. As an example, a brine to water heat pump with a heating mode SSHEE of 175% **or** a cooling mode EER of 3.20 would be deemed to be a fail.

Required test procedures

Performance data must be determined and the SSHEE calculated, following the requirements of Commission Regulation (EU) No 813:2013.

The product's capacity and COP at part load, and EER (where the product is designed to provide cooling), must be determined at the conditions shown in Table 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 2 Part load conditions for brine/water to water heat pumps

Product Category	Heating mode COP and Capacity at part load	Cooling mode EER
Brine to water heat pumps	BS EN 14825:2016, Table 12 reference heating season "A" = average outdoor heat exchanger conditions for brine	BS EN 14825:2016 Table 5, Part load condition A, cooling tower application and cooling floor application
Water to water heat pumps	BS EN 14825:2016, Table 12 reference heating season "A" = average outdoor heat exchanger conditions for ground water	BS EN 14825:2016 Table 5, Part load condition A, cooling tower application and cooling floor application

A heating mode test report at part load condition A or B and a cooling mode test report (where the product is designed to provide cooling) at condition A as specified in Table 2 must be provided. The product's capacity and COP at other part load conditions may be determined by calculation. All testing should be carried out in accordance with BS EN 14511:2013.

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

The SSHEE must be determined in accordance with the requirements of Commission Regulation (EU) No 813/2013, Annex III, and 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) must be made available. Tests undertaken to verify the accuracy of the calculations must be carried out in accordance with the test procedures described above.

Test results may be submitted in summary form provided that:

- Data is included to confirm that the heating / cooling capacity (kW), part load COPs and EER of each product were determined in accordance with the test procedures in BS EN 14825:2016 / BS EN 14511:2013 and determined at the part load conditions outlined in Table 2 or, where this is not possible, corrected to these part load conditions.

- At least one detailed test report is submitted for each range of products. The data must be recorded in a detailed test report as defined in Table 6 of BS EN 14511-3:2013. The test report must include details of the data recording period and duration of the performance measurement.

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

Please note that performance data **for cooling mode EER only** obtained in accordance with the corresponding procedures and standard rating conditions laid down in BS EN 14511:2004, BS EN 14511:2007, BS EN 14511:2011, BS EN 14511:2013, or BS EN 14825:2013 will be accepted as an alternative to testing in accordance with BS EN 14825:2016 Table 5, until further notice.

4. 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**.

Heat Pumps for Domestic Hot Water Heating

(Formerly CO_2 Heat pumps for domestic hot water heating)
Date added to ETL 2013 (Revised 2016).

1. Definition of Technology

Heat pumps for domestic hot water heating are products that are specifically designed to transfer heat from the ambient air, ground, or water into a system for heating domestic hot water by means of a refrigeration cycle.

2. Technology Description

Heat pumps for domestic hot water heating use an electrically operated refrigeration system to transfer heat from the ambient source into a water heating system. They can be used to provide sanitary hot water in a wide range of buildings.

Heat pumps for domestic hot water heating are available in a range of efficiencies. The ECA Scheme aims to encourage purchase of higher efficiency products. Heat pumps for domestic hot water heating can realise substantial reductions in carbon emissions when used instead of fossil fuel based water heating.

The ECA Scheme covers four categories of products:

1. Air Source CO_2 heat pumps for domestic hot water heating
2. Ground Source CO_2 heat pumps for domestic hot water heating
3. Water Source CO_2 heat pumps for domestic hot water heating
4. Air Source non-CO_2 heat pumps for domestic hot water heating

Investments in heat pumps for domestic hot water heating 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Consist **either** of a single factory built unit **or** of an 'outdoor' unit and one or more 'indoor' units that are:
    - a) Factory-built sub-assemblies.
    - b) Supplied as a matched set of units.
    - c) Designed to be connected together during installation.
- Incorporate an electrically driven refrigeration system that **either** uses carbon dioxide (R744) as the refrigerant **or** uses another type of refrigerant which has a Global Warming Potential (GWP) of below 1,800.

- Be designed for, and include fittings for, permanent installation.
- Be designed primarily to provide domestic hot water heating, by being connected to or incorporating a domestic hot water storage tank.
- Be CE marked.

GWP values will be those set out in Annex I to Regulation (EC) No 842/2006. For refrigerants not included in this reference, the IPCC UNEP 2010 report on Refrigeration, Air Conditioning and Heat Pumps should be used as the reference.

Performance criteria

Eligible products must meet the performance criteria set out in Table 1 below for:

- Water Heating Energy Efficiency (η_{wh}) at the declared load profile.

Table 1 Performance thresholds for heat pumps for domestic hot water heating (all product categories)

Declared load profile	L	XL	XXL	3XL	4XL
Water Heating Energy Efficiency (η_{wh})	>=100%	>=105%	>=110%	>=115%	>=120%

">=" means "greater than" or equal to

Where:

- Water Heating Energy Efficiency' **(η_{wh})** is the ratio between the useful energy in the water provided and the energy required for its generation, expressed as a percentage.
- Load profile is a given sequence of water draw-offs, as specified in in Annex III, Table 1 of Commission Regulation (EU) No 814/2013 "Ecodesign requirements for water heaters and hot water storage tanks".

For the avoidance of doubt test data should be presented to zero decimal places. As an example, an air source domestic hot water heat pump product with a declared load profile of XL and a water heating energy efficiency of 104% would be deemed to be a fail.

Required test procedures

The product's performance data must be determined in accordance with the procedures detailed in BS EN 16147:2011 "Heat pumps with electrically driven compressors - Testing and requirements for marking of domestic hot water units" and the water heating energy efficiency calculated, following the requirements of Commission Regulation (EU) No 814:2013 or Commission Regulation (EU) No 812:2013".

The load profile used for the test must be declared by the manufacturer and shall be the maximum load profile or the load profile one below the maximum load profile for the product.

4. 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**.

Heat Pump Dehumidifiers

Date added to ETL 2008 (Revised 2016).

1. Definition of Technology

Heat pump dehumidifiers are products that are specifically designed to remove water vapour from moist air using an electrically driven refrigeration cycle.

2. Technology Description

Heat pump dehumidifiers are widely used to improve personal comfort, to protect building fabric and stored goods or materials, and to dry industrial products. They work by circulating the moist air over the evaporator of the refrigeration system. This reduces the temperature of the air, which causes the water vapour to condense. The resulting condensate can be then drained away.

Heat pump dehumidifiers are available in a range of different designs and efficiencies. The ECA Scheme aims to encourage the purchase of the higher efficiency products that recover both sensible and latent heat released during dehumidification, and use it to heat the air as it leaves the product or for other useful purposes, such as water heating.

Investments in heat pump dehumidifiers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- **Either** be a single packaged unit **or** consist of two or more factory built sub-assemblies that are designed to be connected together during installation.
- Incorporate an electrically driven refrigeration system that is designed to remove water vapour from the surrounding atmosphere, as the air is recirculated through the product.
- Recover both sensible and latent heat released during dehumidification, and use it to heat the air as it leaves the product and/or for other useful purposes (such as water heating).
- Incorporate a control system that monitors the relative humidity of the surrounding atmosphere, and automatically switches off dehumidification, or modulates the rate of dehumidification, when the relative humidity falls below a pre-set value.
- Be designed for, and include fittings for, permanent installation within a building.
- Have a dehumidification capacity that is greater than or equal to (>=) 0.625 litres per hour.
- **Not** be designed to be connected to compressed air systems.
- Be CE marked.

Performance criteria

Products must have a dehumidification efficiency ratio (DER) equal to or greater than the thresholds set out in Table 1 below, which depend on the dehumidification capacity (C) of the product.

Table 1 – Performance test points for heat pump dehumidifiers

Dehumidification capacity (C) (Litres/hour)	**Dehumidification efficiency ratio (DER)** (Litres/kWh)
>= 0.625 and < 1.5	>= 1.40
>= 1.5 and < 2.3	>= 1.80
>= 2.3	>= 2.30

">=" means "greater than or equal to"

Where the product's dehumidification capacity and dehumidification efficiency ratio are defined in sections 3.5 and 3.6 (respectively) of BS EN 810:1997 "Dehumidifiers with electrically driven compressors. Rating tests, marking, operational requirements and technical data sheet".

For the avoidance of doubt, test data should be presented to 2 decimal places. As an example, a DER of 1.39 litres/kWh for a heat pump dehumidifier with a dehumidification capacity of 1.2 litres per hour would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures laid down in BS EN 810:1997.

The dehumidification capacity must be determined at the appropriate rating test conditions for the type of product (or intended application) as set out in Tables 2, 3 and 4 of BS EN 810:1997.

The dehumidification efficiency ratio must be determined at an air inlet temperature of 27 degrees Centigrade (dry bulb) and 21 degrees Centigrade (wet bulb) and, where applicable, include the corrections for the power input of fans and water pumps specified in section 4.1 of BS EN 810:1997.

Test results may be submitted in summary form provided that:

- Sufficient data is included to confirm that the dehumidification capacity (kW), COP and DER of each product was determined in accordance with the test procedures in BS EN 810:1997 and at the appropriate rating test conditions as described above.
- At least two detailed test reports are submitted for each range of products. The data must be recorded in a detailed test report as defined in Section 5 of BS EN 810:1997. The test report must include details of the data recording period and duration of the performance measurement.

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.
- 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.
- Use the same defrosting method (e.g. hot gas defrost).
- Consist of the same number of units (e.g. are all single packaged units).

The representative models must 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 must be predicted using a validated mathematical model. As a minimum, at least two models must 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.

4. 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.

Heat Pump Driven Air Curtains

Date added to ETL 2012 (Revised 2015).

1. Definition of Technology

Heat Pump Driven Air Curtains are products that are specifically designed to be fitted above a doorway or similar opening, and to produce an air curtain that is specifically designed to reduce the infiltration or transfer of air from one space to another, and that is heated and/or cooled by a heat pump that transfers heat by means of a refrigeration cycle.

2. Technology Description

Air curtain heaters are used to reduce losses by disrupting the natural convection between two adjacent areas or spaces in a building that are at differing temperatures, thereby reducing the amount of heating or cooling needed to maintain the temperature of a space. They are typically used in commercial premises for situations where an open door is required to allow uninterrupted access or where traffic through the doorway is so high that the door is open for extended periods.

Heat pump driven air curtains use a heat pump to heat or cool the air curtain expelled by the product. This reduces the need to heat the air with electricity or heat derived from other fuels.

The ECA Scheme aims to encourage the purchase of higher efficiency split type heat pump driven air curtains, which have separate heat collection and rejection units for each space known as 'indoor' and 'outdoor' units. The 'indoor' and 'outdoor' units are specifically designed to be connected together during installation by refrigerant pipework to form a single functional unit.

The ECA Scheme covers:

1. **Single-split Heat Pump Driven Air Curtains**
   that consist of one 'outdoor' heat pump unit and one air curtain unit.

Heat pump driven air curtain units for multisplit heat pumps, that consist of one air curtain unit that is specifically designed to replace one or more 'indoor' heat pump units are covered by the Air Source: Split and Multi-Split (including Variable Refrigerant Flow) Heat Pumps technology category.

Investments in heat pump driven air curtains can only qualify for Enhanced Capital Allowances if the specific product is named in the Energy Technology Product List. To be eligible for inclusion on the Energy Technology Product List, products must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Include an air curtain unit or package that:
  a) Is specifically designed to be fitted above a doorway or similar opening.
  b) Is specifically designed to use a heat pump to heat and/or cool the air curtain expelled by it, and to use electrical air heaters (where fitted) only during defrosting or heat pump failure.
  c) Has been rated in terms of air curtain airflow rate, outlet air velocity uniformity and air curtain velocity projection in accordance with the procedures in BS ISO 27327-1:2009.
- Be able to automatically modulate in response to changes in air inlet temperature and/or space temperature(s), the amount of heating and/or cooling applied to the air curtain between 40% and 100% of its nominal rated heating/cooling capacity output.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.

In addition, single split heat pump driven air curtain products must:

- Consist of one air curtain unit (or package) and one outdoor heat pump unit that are:
  a) Factory–built sub-assemblies.
  b) Supplied as a matched set of units.
  c) Designed to be connected together during installation.
- Incorporate an electrically driven refrigeration system.

Performance criteria

Eligible products must meet the performance criteria set out in Table 1 below for:

- Coefficient of Performance (COP), across the range of connected capacities, including at 100% (full) load, in heating mode, where the product is designed to heat the expelled air.
- Energy Efficiency Ratio (EER) across the range of connected capacities, including at 100% (full) load in cooling mode, where the product is designed to cool the expelled air.
- Outlet air velocity uniformity (u_{ACU}), as defined in Section 5.4.4 of BS ISO 27327-1: 2009, over the range of doorway/opening heights that they are designed to be fitted above.

Table 1 Performance requirements for heat pump driven air curtains

	Product Category	**Heating mode (COP)**	**Cooling mode (EER)**	**Outlet air velocity uniformity (u_{ACU})**
1.	Single-split heat pump driven air curtains	>2.80	>2.80	>= 70%

">" means "greater than"
">=" means "greater than or equal to"

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, a single split heat pump driven air curtain with a heating mode COP of 2.80 would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures in BS EN 14511:2013 using the standard rating conditions as set out in the Table 2 below.

Table 2 Test conditions for heat pump driven air curtains

Product Category			**Heating mode (COP)**	**Cooling mode (EER)**
1.	Single-split heat pump driven air curtains	Air source	Table 3 Standard rating conditions, Outdoor air/recycled air.	Table 4 Standard rating conditions: Comfort (outdoor air/recycled air)

Please note that performance data obtained in accordance with the corresponding procedures and standard rating conditions laid down in BS EN 14511:2004, BS EN 14511:2007 or BS EN 14511:2011 will be accepted as an alternative to testing in accordance with BS EN 14511:2013 until further notice.

Representative Testing

Where applications are being made for two or more products that are variants of the same basic design, test data may be submitted for a single 'representative model', provided that all variants:

- Have the same model of outdoor heat pump unit.
- Are the same basic model of indoor air curtain unit, the only difference being the exterior housing.

- Use the same refrigerant as the representative model.
- Have the same nominal heating capacity and fan power as the representative model.
- Fit within the same product category (e.g. are all single split heat pump driven air curtains).

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.

4. 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**.

Water Source: Split and Multi-Split (including Variable Refrigerant Flow) Heat Pumps

Date added to ETL 2002 (Revised 2014).

1. Definition of Technology

Water source heat pumps are products that are specifically designed to transfer heat from water (in an internal water loop) into the air within the space to be heated by means of a refrigeration cycle.

'Split' type heat pumps have separate heat collection and rejection units for each space known as 'indoor' and 'outdoor' units. The 'indoor' and 'outdoor' units are specifically designed to be connected together during installation by refrigerant pipework to form a single functional unit.

Variable refrigerant flow (VRF) heat pumps are specifically designed to automatically adjust the flow of refrigerant to each indoor unit so that the heat delivered is matched to the demand.

2. Technology Description

Water source split and multi-split heat pumps use an electrically operated refrigeration system to transfer heat from an internal water loop into the air within the space to be heated. They can be used to provide space heating in a wide range of buildings, and some products also are able to provide cooling by reversing the refrigeration flows around the product. (These products are known as reversible 'water cooled' air conditioning units).

Water source split and multi-split heat pumps are available with a range of efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers four categories of products:

1. **Water source: single split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit and one 'indoor' unit
2. **Water source: dual split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit and two or more 'indoor' units.
3. **Water source: multi-split (non-VRF) heat pumps**
   that consist of one 'outdoor' unit connected to two or more 'indoor' units using either individual refrigerant circuits (with the indoor units individually controlled) or using a common refrigerant circuit with the indoor units controlled as one.
4. **Water source: split or multi-split variable refrigerant flow (VRF) heat pumps**
   that consist of one 'outdoor' unit connected to one or more 'indoor' units using a common refrigerant circuit with the indoor units individually controlled.

Investments in water source split and multi-split (including variable refrigerant flow) 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Consist of an 'outdoor' unit and one or more 'indoor' units that are:
  a) Factory–built sub-assemblies.
  b) Supplied as a matched set of units.
  c) Designed to be connected together during installation.
- Incorporate an electrically driven refrigeration system.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.

Performance criteria

Eligible products must meet the performance criteria set out in Table 1 below for:

- Coefficient of Performance (COP), across the range of connected capacities and including 100% (full) load in heating mode.
- Energy Efficiency Ratio (EER) across the range of connected capacities including 100% (full) load, where the product is designed to provide cooling.

Table 1 Performance thresholds for water source split and multi-split heat pumps

	Product Category	Heating mode (COP)	Cooling mode (EER)
1.	Water source: single split (non-VRF) heat pumps	>3.70	>3.30
2.	Water source: dual split (non-VRF) heat pumps	>3.70	>3.30
3.	Water source: multi-split (non-VRF) heat pumps	>3.70	>3.30
4.	Water source: split and multi-split variable refrigerant flow (VRF) heat pumps	>4.10	>3.50

">" means "greater than"

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, a water source single split (non VRF) product with a heating mode COP of 3.70 would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with the procedures in BS EN 14511:2013. The standard rating conditions are set out in the Table 2 below.

Table 2 Test conditions for water source split and multi-split heat-pumps

	Product Category		Heating mode (COP)	Cooling mode (EER)
1.	Water source: single split (non-VRF) heat pumps		BS EN 14511-2: 2013 Table 5 Standard rating Conditions, Water loop.	BS EN 14511-2: 2013 Table 6 Standard rating Conditions, Cooling tower.
2.	Water source: dual split (non-VRF) heat pumps		BS EN 14511-2: 2013 Table 22 Standard rating Conditions, Water loop.	BS EN 14511-2: 2013 Table 23 Standard rating Conditions.
3.	Water source: multi-split (non-VRF) heat pumps		BS EN 14511-2: 2013 Table 22 Standard rating Conditions, Water loop.	BS EN 14511-2: 2013 Table 23 Standard rating Conditions.
4.	Water source: split and multi-split variable refrigerant flow (VRF) heat pumps:	Single split	BS EN 14511-2: 2013 Table 5 Standard rating Conditions, Water loop.	BS EN 14511-2: 2013 Table 6 Standard rating Conditions, Cooling tower.
		Multi-split	BS EN 14511-2: 2013 Table 22 Standard rating Conditions, Water loop.	BS EN 14511-2: 2013 Table 23 Standard rating Conditions.

Please note that performance data obtained in accordance with the corresponding procedures and standard rating conditions laid down in BS EN 14511: 2004, BS EN 14511: 2007 or BS EN 14511:2011 will be accepted as an alternative to testing in accordance with BS EN 14511: 2013 until further notice.

4. 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.

Heating, Ventilation and Air Conditioning (HVAC) Equipment

Active Chilled Beams

Date added to ETL 2014 (Revised 2015).

1. Definition of Technology

Active chilled beams incorporate an integral (primary) air supply and cooling coil(s) to provide cooled air into occupied spaces without the use of an integral fan, in order to achieve comfortable working conditions. The primary air supply enhances and controls the induction of air from the occupied space through the cooling coil.

2. Technology Description

Active chilled beams are terminal units attached to heating, ventilation and air conditioning (HVAC) systems that are specifically designed to provide chilled air into a treated environment.

Active chilled beams are convectors with an integrated (primary) air supply and cooling coil(s) through which chilled water passes to provide the cooling effect. Primary ventilation air produces an inductive effect to increase the convection of room air. The induced air flow passes through the cooling coil, and then mixes with the primary air before being discharged into the space through integral air distributors.

Active chilled beams do not incorporate fans for air distribution. They are designed to use dry (sensible) cooling to prevent condensation thus negating the need for condensate collection and disposal. Dehumidification of the primary supply air is important to prevent the risk of condensation as well as any internal latent gains.

Active chilled beams can be linear or modular in format:

- Linear active chilled beams are produced in various widths and lengths with either one or two directional air throw patterns (1 or 2 way throws). One or more linear active chilled beams can be installed as a continuous linear beam to make up desired length.

- Modular or cassette format active chilled beams are characterized by modular sized units, typically 0.6m x 0.6m and 0.6m x 1.2m with 4 directional outlets (4-way throws).

- Bulkhead active chilled beams are designed to fit into restricted spaces with low ceilings such as bulkheads, and require a higher rate of primary air flow to operate. They deliver chilled air in a horizontal direction.

Multi-service chilled beams (MSCBs) combine chilled beams with additional building services such as lighting, controls & control sensors, sprinklers, cables or public address speakers. Some components of a MSCB will not be eligible for an ECA claim – see section 4.

The ECA scheme aims to encourage the purchase of active chilled beams which are energy efficient due to their use of relatively high chilled water temperatures, resulting in increased efficiency of chiller operation and the opportunity to maximise free-cooling.

Investments in chilled beams 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be an active chilled beam designed to introduce primary ventilation air into the treated space through the beam.
- Be designed to operate above the dew point. Any condensate tray fitted should be included as a precautionary measure only, and should have no facility to connect to drainage.
- Not include any electrical heating elements.
- Not include an integral fan

Multi-service chilled beams that contain lighting equipment are eligible as long as the lighting equipment also meets the relevant ETL criteria for high efficiency lighting units, white light emitting diode lighting units, or lighting controls, as appropriate.

Performance criteria

Products must have a "Specific Waterside Cooling Capacity" that is greater than or equal to the values set out in Table 1 for "Linear Active Beams" and Table 2 for "Modular Active Beams" and Table 3 for "Bulkhead Active Beams" at the operating conditions specified below.

Table 1 – Linear Active Beam Performance Requirements

Nominal Active Beam Width	<= 300mm		>300mm and <= 600mm	
Air Throw	1 Way	2 Way	1 Way	2 Way
Primary Air Flow Rate Per Active Length (q_p / L)	<= 7.5 l/s/m	<= 15.0 l/s/m	<= 7.5 l/s/m	<= 15.0 l/s/m
Cooling Water Flow Rate (q_w)	<= 0.1 l/s	<= 0.1 l/s	<= 0.1 l/s	<= 0.1 l/s
Specific Waterside Cooling Capacity	>= 15.0 W/mK	>= 25.0 W/mK	>= 20.0 W/mK	>= 45.0 W/mK

Table 2 – Modular Active Beam Performance Requirements

Nominal Active Beam Size (Active width x Active length)	600mm x 600mm	600mm x 1200mm
Air Throw	4 Way	4 Way
Primary Air Flow Rate (q_p)	<= 11.0 l/s	<= 20.0 l/s
Cooling Water Flow Rate (q_w)	<= 0.04 l/s	<= 0.05 l/s
Specific Waterside Cooling Capacity	>= 45.0 W/mK	>= 40.0 W/mK

Table 3 – Bulkhead Active Beam Performance Requirements

Nominal Active Beam Size (Active length)	Bulkhead unit up to 1500mm
Primary Air Flow Rate Per Active Length (q_p / L)	<= 20.0 l/s/m
Cooling Water Flow Rate (q_w)	<= 0.1 l/s
Specific Waterside Cooling Capacity	>= 40.0 W/mK

Where:

- Specific Waterside Cooling Capacity = $\frac{Pw}{L\,\Delta\Theta}$

  P_w = Waterside Cooling Capacity [Watts]
  L = Cooling Length [Meters], the Active length of cooling section
  $\Delta\Theta$ = Temperature Difference between Reference Air Temperature (Θ_r) and Mean Cooling Water Temperature (Θ_w) i.e. $\Delta\Theta = (\Theta r - \Theta w)$ [Kelvin]

- Nominal active beam width/dimensions is the size of the active cooling element excluding architectural components that do not affect product cooling performance
- All other terms are as defined in BS EN 15116:2008
- "< =" means "less than or equal to", ">=" means "greater than or equal to"

For the avoidance of doubt test data should be presented to one decimal place. As an example, a Specific Waterside Cooling Capacity of 14.9 Watts/mK for a 1 Way throw linear active beam with Nominal Active Width of <=300 mm would be deemed to be a fail.

In addition:

Eligible active chilled beam products must comply with BS EN ISO 7730:2005 Ergonomics of the thermal environment – Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort.

Required test procedures

Product performance specified in Tables 1, 2 and 3 (above) must be determined in accordance with the procedures and test conditions laid out in the following standard:

- BS EN 15116:2008 Ventilation in buildings — Chilled beams — Testing and rating of active chilled beams at operating conditions specified above

In addition, all products must be tested at the following operating conditions:

- Cooling Water Inlet Temperature (Θ_{w1}) = 14.0 °C
- Reference Air Temperature (Θ_r) = 23.0 °C
- Primary Air Pressure (ΔP_a) < = 120 Pa
- Cooling Water Temperature Difference ($\Theta_{w2} - \Theta_{w1}$) > = 2 K
- Waterside Pressure Drop (Δp_w) < = 15kPa

4. 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.

Active chilled beams classed as MSCB can include additional technologies such as lighting and lighting controls, speakers, sprinklers, presence sensors, data cabling, or architectural metal work. Many of these additional technologies are not energy saving and an ECA is not available on their purchase. **Only the cost of the base active chilled beam unit is eligible.**

Where the additional technologies are supported by the ECA scheme (e.g. lighting and lighting controls, building environment zone controls) and meet ECA scheme requirements (e.g. meet ETCL performance criteria, are listed on the ETL – where appropriate) then an ECA **may** be claimed on their purchase.

Therefore, when claiming ECAs for multi-service chilled beams, only the following costs may be claimed:

- **The cost of the base active chilled beam, for which <u>published claims values must be used</u>**
- **The cost of any additional features (such as lighting) which meet ECA scheme requirements**

Building Environment Zone Controls

(Formerly Heating, Ventilation and Air Conditioning (HVAC) Zone Controls)
Date added to ETL 2004 (Revised 2013).

1. Definition of Technology

Building environment zone controls (formerly listed as HVAC zone controls) are products that are specifically designed to automatically control in an energy efficient manner, the amount of heating, cooling, ventilation or air conditioning that is applied to individual rooms or defined areas within a building, known as "zones".

"HVAC" is the collective term used to refer to the combination of heating, cooling, ventilation, or air conditioning that is specifically employed within a particular building.

2. Technology Description

Building environment zone controls are used to control the environmental conditions (i.e. temperature, ventilation rate and/or air condition) in individual zones (i.e. rooms or areas) within a building. They can be programmed to maintain these environmental conditions within pre-set limits in a manner that reflects occupation schedules, occupation status and/or level of activity in the zone, whilst also taking account of environmental conditions, and the specific operating requirements of the zone.

Some products are also able to switch lighting and electrical appliances in a zone on and off in line with its occupation schedule or occupation status, and some can control the operation of window shading equipment in a manner that minimises the amount of cooling needed to maintain zone environmental conditions without excessively reducing the amount of natural light that can be used.

A wide range of building environment zone controls is available. The ECA Scheme aims to encourage the purchase of products that automatically minimise the energy consumption of building heating, cooling, ventilation, or air conditioning equipment, and associated distribution systems.

The ECA Scheme covers four categories of products:

1. **Standalone control units** that are self-contained zone control units that are designed to control one or more zones, but not centralised HVAC plant.
2. **Centralised control units** that are self-contained central control units that are designed to control two or more zones, and centralised HVAC plant.
3. **Packaged control products** that consist of two or more control modules or units that are designed to be connected together during installation, and that are designed to control one or more zones. They may also control centralised HVAC plant, provided they are also designed to control at least two zones.
4. **'Add-on' control modules** that are not self-contained units, but are designed to incorporate zone control facilities into HVAC control units or equipment.

Investments in building environment zone controls can only qualify for Enhanced Capital Allowances if the product is named on the Energy Technology Product List. To be eligible for inclusion on the Energy Technology Product List, products must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

1. Incorporate a microprocessor based controller that is pre-programmed to:

   a) Automatically control the individual environmental conditions in one or more zones within a building, in an energy efficient manner that reflects the occupation status or the level of activity in each zone <u>and/or</u> predefined zone occupation schedules.

   b) <u>EITHER</u> automatically switch between pre-defined operating modes, in accordance with the predefined occupation schedule or occupation status of the zones being controlled, <u>OR</u> automatically modulate the amount of zone heating, cooling, ventilation and air-conditioning applied in a manner that reflects the level of activity in the zone.

2. Be able to automatically control the operation of the equipment:

   a) Heating and/or cooling the zones being controlled; and/or:

   b) Ventilating and/or air-conditioning the zones being controlled.

3. Be designed to have at least two of the following zone operating modes:

   a) A "normal" operating mode where zone environmental conditions are maintained within predefined levels consistent with zone occupation or a high level of activity in the zone.

   b) An "economy" mode where zone environmental conditions are maintained at reduced levels to reflect, for example, the fact that the zone is unoccupied, or a reduced level of activity in the zone **<u>or</u>**

   c) A "standby" mode where the zone heating, cooling, ventilation and air-conditioning is switched off or operated solely for fabric, frost and equipment protection.

4. Incorporate an anti-tampering mechanism that prevents the product's control strategy and configuration settings from being modified, and automatic control from being disabled, except during commissioning, maintenance or testing.

5. Comply with the relevant requirements for particular type of zone control and type of HVAC plant controlled, as set out in Tables 1 to 6 below, for products that:

    a) Control zone temperature (see Table 1).
    b) Control zone ventilation rate or air condition (see Table 2).
    c) Control based on zone occupation status or level of activity (see Table 3).
    d) Control based on zone occupation schedules (see Table 4).
    e) Control centralised HVAC plant (see Table 5).
    f) Control wet heating systems (see Table 6).

6. **Not** incorporate any form of control valve, actuator, damper, motor, pump, fan or variable speed drive, except for fans or pumps incorporated solely for the purpose of product cooling.

7. Conform with the requirements of the EU EMC Directive 89/336/EEC (as amended) or its replacement EU EMC Directive 2004/108/EC, or be CE Marked.

In addition, products that are designed to control any type of heating or cooling equipment (including centralised heating or cooling plant) must control zone temperature.

Table 1 CONTROL OF ZONE TEMPERATURE
All products that are designed to control zone temperature must: 1. Be designed to directly measure zone temperature by means of a temperature sensor, and automatically adjust heat flow into, or out of, the zone to maintain temperature within the predefined temperature limits for the operating mode. 2. Provide facilities that enable building managers to define the temperature set-points for each operating mode in each zone to +/- 1 degree centigrade. 3. Limit the ability of building users to adjust the temperature set-point within individual zones, so any adjustments are restricted in terms of duration. In addition, products that are designed to control both zone heating and cooling must: 4. Provide facilities that enable building managers to define separate temperature set-points for zone heating and zone cooling in each zone. 5. Incorporate a mechanism or mechanisms that prevent simultaneous zone heating and cooling, and frequent cycling of heating and cooling equipment on and off. In addition, products that are designed to control window shading equipment must: 6. Be designed to monitor the position of the sun by means of a solar tracking sensor, and automatically adjust the position of window blinds or orientation of louvres in a manner that minimises the entry of solar radiation without excessive reduction in natural light
Notes
7. Products that solely rely on an external thermostatic device (for example, a digital thermostat) to determine when additional heating or cooling is required within a zone, are not eligible. 8. Products must automatically reset temperature set-point adjustments made by building users either after a pre-defined time interval (that may be fixed or defined by the building manager), or where zone control is based on occupation schedule, at the next scheduled switching time.

Table 2 CONTROL OF ZONE VENTILATION RATES OR AIR CONDITION
All products that are designed to control zone ventilation rate or air condition must: 1. Be designed to monitor zone ventilation rate or air condition by means of a presence detector or activity sensor (see Table 3, note 3), and automatically adjust the airflow into, or out of, the zone to maintain zone ventilation rates or air condition within the predefined limits for the operating mode. 2. Incorporate a mechanism that automatically minimises ventilation rates in unoccupied zones, and in zones operating in economy or standby modes.
Notes
3. Products that solely rely on an electronic or mechanical 'timing out' mechanism (for example, a spring loaded button) to determine when a zone is unoccupied are not eligible. 4. Products must not allow building users to adjust ventilation rate set-points, but may incorporate facilities that enable them to temporarily override ventilation rates for a limited period. 5. Products that have a "night cooling mode" that is designed to make use of natural ventilation to remove excess heat and cool the building fabric when the zone is unoccupied are eligible.

Table 3 CONTROL BASED ON ZONE OCCUPATION STATUS OR LEVEL OF ACTIVITY
All products that are designed to control zones based on occupation status must: 1. Be able to monitor zone occupation status by means of presence detector or activity sensor, and automatically adjust zone-operating mode to maintain environmental conditions within the predefined limits for the zone occupation status. 2. Provide facilities that enable building managers or users to manually switch the zone into economy or standby mode, without disabling automatic zone controls. All products that are designed to control zones based on level of activity must: 3. Be able to monitor the level of activity in the zone by means of presence detector or activity sensor, and automatically modulate the amount of heating, cooling, ventilation and air-conditioning applied in a manner that reflects the level of activity in the zone. 4. Provide facilities that enable building managers or users to manually switch the zone into economy or standby mode, without disabling automatic zone controls. In addition, products that are designed to control kitchen ventilation equipment must: 5. Be designed to monitor the level of fumes resulting from the cooking activity, and to automatically reduce the rate of extraction to the minimum necessary to maintain air condition within predefined limits
Notes
6. The product may monitor zone occupation status by means of one or more presence detectors, or activity sensors, which may include for example, CO2 level monitors, heat or motion detectors, moisture sensors etc. However, manually operated devices (for example, electrical switches, electronic touch buttons or entry detection devices) are not considered to be presence detectors unless they automatically reset to a “no presence detected state” after a pre-set period of time. 7. A key card activated master control switch may be used as an alternative to a presence detector, provided that when the key card is removed from it: it is designed to switch the zone controller into economy or standby mode and to switch off all lighting and electrical appliances being controlled. 8. Products that are designed to monitor the usage of lighting and electrical appliances by measuring energy use are eligible, provided that they are also designed to use a presence detector or activity sensor to detect that the zone is unoccupied, and then to automatically switch such equipment off. 9. Products that are designed to monitor the operation of plant and machinery within a zone and raise an alarm when a fault or fire is detected, or when unauthorised occupation is detected, are eligible. In this context, a fault may include the local override of control settings or automatic control. 10. Products that are designed to share the use of presence detectors and activity sensors with other types of management and control systems (e.g. building management systems) are eligible.

Table 4 CONTROL BASED ON ZONE OCCUPATION SCHEDULES
All products that are designed to control zones based on occupation schedules must: 1. Automatically switch zones between operating modes, in accordance with the predefined and individual weekly occupation schedule for each zone controlled. 2. Provide facilities that enable building managers to define the normal occupation times in each zone (in intervals of five minutes or less), for each day of the week, including at least two periods of occupation per day (i.e. at least 14 different occupation periods a week). 3. Provide facilities that enable building users to temporarily override the predefined schedules and/or to cancel the remaining portion of a pre-defined occupation period. 4. Provide facilities that enable building managers to define future dates (e.g. holidays) when zone heating, cooling, ventilation and air-conditioning should be completely switched off, or operated at frost, fabric or equipment protection levels. In addition, products that also control zone heating and cooling must: 5. Incorporate a zone "optimum start" mechanism that monitors external and/or internal temperatures, and calculates when heating or cooling needs to begin in the zone in order to reach the pre-set temperature by the start of the next occupancy period. 6. Provide facilities that enable building managers to define different temperature set-points for each scheduled period of normal occupation throughout the day and week.
Notes
7. Products that control domestic hot water (DHW) systems must provide facilities that enable building managers to define a separate operating schedule for the operation of DHW systems. 8. Products must automatically reset overrides, either after a pre-defined time interval (which may be fixed or defined by the building manager) or at the next scheduled switching time.

Table 5 CONTROL OF CENTRALISED HVAC PLANT
Where products control the operation of centralised HVAC plant, they must: 1. Incorporate a mechanism that enables the building's HVAC systems to be easily switched into economy or standby mode, for example, when a scheduled activity finishes early. In addition, products that control central heating or cooling systems must: 2. Provide facilities to control the operation of the centralised heating or cooling systems, and zone environmental conditions based on zone occupation schedules (as defined in Table 4). 3. Monitor internal temperatures and automatically switch zone heating circuits on or cooling circuits off, to stop condensation occurring and to protect building fabric. 4. Incorporate an overall "optimum start" mechanism that monitors external or internal temperatures, and calculates when the heating or cooling system needs to be switched on in order to reach pre-set temperatures by the start of the next occupancy period, after taking account of the requirements of each zone.
Notes

5. Products that control centralised HVAC plant must be designed to control at least two zones.

Table 6 CONTROL OF WET HEATING SYSTEMS
Where products control the overall operation of wet heating systems, they must: 1. Incorporate a "self-adaptive weather compensation" mechanism that automatically saves energy during milder weather conditions, by reducing the temperature set-point of the boiler water circuit as the external temperature rises, and also the temperature of, or the heat flow through, the individual heating circuits for each zone controlled. The mechanism must be able to 'learn' the thermal characteristics of the zone(s) and to automatically optimise the amount of weather compensation applied to each zone. 2. Incorporate a "frost protection" mechanism that monitors external and/or internal temperatures (or pipework temperatures), and switches on boilers and heating circuits as required to prevent equipment and pipework from "freezing up". 3. Provide facilities for building managers to "temporarily override" or manually adjust the degree (or amount) of weather compensation applied to each zone controlled.
Notes
4. The requirements in Table 5 also apply to products that control wet heating systems.

Where:

- Automatic control may be implemented either directly by means of an analogue or digital signal connection, or indirectly by means of another control device or network.
- A mechanism is defined as "any sequence of pre-defined actions that performs a given function, where an action can be defined in hardware and/or software".
- An algorithm is defined as "a mechanism that is defined in software".
- In this context: "activity" includes the unattended operation of plant and machinery.
- The product's control strategy is the combination of automatic control functions, mechanisms and facilities specified for particular type of zone control or HVAC plant controlled. In this context, products may be pre-programmed in one of the following ways:
  a) One or more fixed control strategies that are designed to control specific type of zone, or set of equipment (or plant), and that can be selected during commissioning.
  b) One or more flexible control strategies that can be configured to control different types of zones, and equipment, as part of a clearly defined commissioning procedure.
- Products designed to control the types of equipment specified in Table 7, must also comply with the relevant parts of the eligibility criteria for ECA compliant products in those areas.
- Products that are designed to other types of equipment not specified in Table 7 are only eligible, if control is based on zone occupation schedules, status or levels of activity.

Table 7 Additional requirements when other types of equipment are controlled

Type of equipment controlled	Relevant ECA eligibility criteria
Electrical lighting equipment	Lighting controls
Automatic monitoring and targeting equipment	Component based AMT systems

Commercial refrigeration equipment	Refrigeration system controls
Two or more air compressors	Master controllers

4. 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.

Close Control Air Conditioning Equipment

Date added to ETL 2009 (Revised 2016).

1. Definition of Technology

Close control air conditioning equipment covers products that are specifically designed to provide the cooling needed to maintain the air temperature, and optionally the relative humidity, in rooms that contain equipment or processes with high sensible heat loads.

2. Technology Description

Close control air conditioning equipment is used to control temperature (and optionally humidity) in rooms and enclosures containing heat generating equipment, such as servers, computers or telecommunications devices, and in some types of manufacturing process (e.g. clean rooms). The equipment typically operates continuously and has a much higher unit floor area cooling load requirement than conventional air conditioning.

Close control air conditioning equipment is available with a wide variety of efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers seven categories of product:

1. DX air cooled close control air conditioning equipment (without free cooling coil).
2. DX air cooled close control air conditioning equipment with integral chilled water free cooling coil(s).
3. DX water cooled close control air conditioning equipment (without free cooling coil).
4. DX water cooled close control air conditioning equipment with integral chilled water free cooling coil(s).
5. Chilled water (CHW) cooled close control air conditioning equipment.
6. Dual mode: DX air cooled and chilled water (CHW) cooled close control air conditioning equipment (without free cooling).
7. Dual mode: DX water cooled and chilled water (CHW) cooled close control air conditioning equipment (without free cooling).

Where DX stands for ‘direct expansion’ and refers to products that effect cooling, or partial cooling, of the air by evaporating a refrigerant in their indoor heat exchangers.

The ECA Scheme covers products that are designed to provide close control air conditioning to the room containing the heat generating equipment (room air conditioning, or room AC, products) and those that are designed to provide close control air conditioning to the local area surrounding the heat generating equipment or the heat generating equipment itself (close coupled cooling, or CCC, products).

Investments in close control air conditioning equipment 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- **Either** be a single packaged unit **or** consist of two or more factory built sub-assemblies that are designed to be connected together during installation.
- **Either** incorporate an electrically powered compressor (or compressors) **and / or** incorporate a chilled water cooling coil with fittings for connection to an external chilled water circuit.
- Have a ratio of sensible cooling capacity to the total cooling capacity (i.e. sensible heat ratio) that is greater than or equal to (>=) 0.9 at the relevant rating conditions specified in Tables 2 and 3 below.
- Be CE marked.

Performance criteria

Products must have an energy efficiency ratio (EER), and a free cooling capacity (where applicable) that is greater than or equal to the values set out in Table 1 below.

Table 1 Performance thresholds for close control air conditioning equipment

	Product category		EER	Free cooling capacity
1.	DX air cooled (without free cooling).		>= 3.20	
2.	DX air cooled with integral chilled water free cooling coil(s).		>= 3.00	Free cooling coil cooling capacity >= 90% of cooling capacity in DX operating mode where both cooling capacities are measured at the rating conditions given in Table 2 for room AC products and Table 3 for CCC products.
3.	DX water cooled (without free cooling).		>= 3.90	
4.	DX water cooled with integral chilled water free cooling coil(s).		>= 3.60	Free cooling coil cooling >= 90% of cooling capacity in DX operating mode where both cooling capacities are measured at the rating conditions given in Table 2 for room AC products and Table 3 for CCC products.
5.	Chilled water (CHW) cooled (only).		>= 18.00	
6.		DX mode	>= 3.20	

	Dual mode: DX air cooled and chilled water cooling (without free cooling).	CHW mode	>=18.00	
7.	Dual mode: DX water cooled and chilled water cooled (without free cooling).	DX mode	>= 3.90	
		CHW mode	>= 18.00	

'>=' means 'greater than or equal to'.

Where EER is the ratio of total gross cooling capacity (Watts) to the electric power absorbed by the product (P_{elec}). In the case of DX and dual mode products, the electric power absorbed by the product should include that of both the indoor and outdoor heat exchangers.

For the avoidance of doubt test data should be presented to 2 decimal places. As an example an EER of 3.19 for a DX air cooled product would be deemed a fail.

Required test procedures

All room AC products must be tested in accordance with the test standards, procedures and conditions specified in Table 2. All CCC products must be tested in accordance with the test standards, procedures and conditions specified in Table 3.

Table 2 Required test procedures for room AC close control air conditioning equipment

	Product category		**Standard**	**Rating condition**
1.	DX air cooled (without free cooling).		BS EN 14511:2013	Outdoor heat exchanger, inlet dry bulb temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
2.	DX air cooled with integral chilled water free cooling coil(s).	DX refrigeration part	BS EN 14511:2013	Outdoor heat exchanger, inlet dry bulb temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
		Free cooling coil	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397: 2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
3.	DX water cooled (without free cooling).		BS EN 14511:2013	Outdoor heat exchanger, inlet temperature 28.3°C and outlet temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
4.	DX water cooled with integral chilled water free cooling coil(s).	DX refrigeration part	BS EN 14511:2013	Outdoor heat exchanger, inlet temperature 28.3°C and outlet temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C

		Free cooling coil	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
5.	Chilled water (CHW) cooled (only).		BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
6.	Dual mode: DX air cooled and chilled water cooling (without free cooling).	DX mode	BS EN 14511:2013	Outdoor heat exchanger, inlet dry bulb temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
		CHW mode	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
7.	Dual mode: DX water cooled and chilled water cooling (without free cooling).	DX mode	BS EN 14511:2013	Outdoor heat exchanger, inlet temperature 28.3°C and outlet temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C
		CHW mode	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 23.9°C and inlet wet bulb temperature 16.2°C

Table 3 Required test procedures for CCC close control air conditioning equipment

	Product category		**Standard**	**Rating condition**
1.	DX air cooled (without free cooling).		BS EN 14511:2013	Outdoor heat exchanger, inlet dry bulb temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
2.	DX air cooled with integral chilled water free cooling coil(s).	DX refrigeration part	BS EN 14511:2013	Outdoor heat exchanger, inlet dry bulb temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
		Free cooling coil	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C

3.	DX water cooled (without free cooling).		BS EN 14511:2013	Outdoor heat exchanger, inlet temperature 28.3°C and outlet temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
4.	DX water cooled with integral chilled water free cooling coil(s).	DX refrigeration part	BS EN 14511:2013	Outdoor heat exchanger, inlet temperature 28.3°C and outlet temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
		Free cooling coil	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) orBS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
5.	Chilled water (CHW) cooled (only).		BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
6.	Dual mode: DX air cooled and chilled water cooling (without free cooling).	DX mode	BS EN 14511:2013	Outdoor heat exchanger, inlet dry bulb temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
		CHW mode	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
7.	Dual mode: DX water cooled and chilled water cooling (without free cooling).	DX mode	BS EN 14511:2013	Outdoor heat exchanger, inlet temperature 28.3°C and outlet temperature 35°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C
		CHW mode	BS 4856-3:1975 (if ducted) BS 4856-2:1975 (if not ducted) or BS EN 1397:2015	Liquid side conditions, inlet temperature 10°C and outlet 16.7°C Indoor heat exchanger, inlet dry bulb temperature 35.0°C and inlet wet bulb temperature 19.9°C

An external static pressure of at least (>=) 20 Pascals must be used for testing downflow units with ducted outlets.

Please note that performance data obtained in accordance with the corresponding procedures and the standard rating conditions for Close Control laid down in BS EN 14511:2007 or BS EN 14511:2011 will be accepted as an alternative to testing in accordance with BS EN 14511:2013 and the rating conditions given in Tables 2 and 3 until further notice.

Please note that performance data obtained in accordance with the corresponding procedures laid down in BS EN 1397:1999 will be accepted as an alternative to testing in accordance with BS EN 1397:2015 until further notice.

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.
- 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.
- Fit within the same product category (e.g. are all DX air cooled without free cooling).
- Use the same indoor heat exchanger configuration (e.g. 4-row and fan blow through).

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

4. 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**.

High Speed Hand Air Dryers

Date added to ETL 2011 (Revised 2014)

1. Definition of Technology

High speed hand air dryers are products that are specifically designed to dry human hands by moving air past the hands in a manner that removes water from the hands by physical displacement and/or evaporation.

2. Technology Description

Hand air dryers are widely used in washrooms to dry hands after washing, as an alternative to paper or linen hand towels. They use an electric blower to produce one or more jets of air that are used to dry hands placed under, or into, the hand air dryer unit. Some models heat the air jets prior to use with electrical heating elements or by passing it over the electric motor that drives the blower.

Hand air dryers are available with a wide range of efficiencies. The ECA Scheme aims to encourage the purchase of high speed hand air dryer products with the highest efficiency.

Investments in hand air dryers 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 List, products must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate an electrically driven blower that produces one or more jets of high speed air that can be used to dry human hands that are placed beneath, or into, the product.
- Automatically switch off power to the blower and air heater (where fitted) when hands are removed from the product's drying zone.
- **Not** incorporate facilities to wash or apply soap to hands, or to dispense towels.
- Be CE Marked.

Performance criteria

Eligible products must:

- Use not more than (<=) 5.5 kWh of electricity per 1,000 standard drying cycles in its normal mode of operation.
- Have a standard drying time that is less than, or equal to, 15 (+/- 0.5) seconds

For the avoidance of doubt, test data should be presented to one decimal place. As an example, a product that uses 5.6 kWh per 1,000 standard drying cycles would be deemed to be a fail.

Required test procedures

The product's standard drying time and electricity consumed per standard drying cycle must be determined in accordance with the method and test conditions set out in:

- ETL Method for Testing of High Speed Hand Dryers, as published on the ECA Website.

4. 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.

Lighting

High Efficiency Lighting Units

Date added to ETL 2001 (Revised 2015).

1. Definition of Technology

High efficiency lighting units are products that are specifically designed to provide efficient illumination.

2. Technology Description

High efficiency lighting units (HELUs) are a combination of a light fitting (or luminaire), one or more lamps, and associated control gear that have been assembled either into a single packaged unit or a luminaire with remote control gear. Neither light fitting, lamp or control gear alone can be said to 'comply with the ETL'. HELUs may also incorporate lighting control devices such as light regulation (dimming) and 'presence' controls.

HELUs have been included in the Enhanced Capital Allowance (ECA) scheme because they offer substantial energy and carbon savings. A wide variety of products are available with a range of performance levels. The ECA scheme aims to encourage the purchase of higher efficiency products that meet certain minimum design and performance standards.

The ECA Scheme covers four categories of products:

1. Amenity, accent and display lighting units
2. General interior lighting units
3. Exterior area lighting units
4. Exterior floodlighting units

Where:

- **Amenity lighting** is decorative lighting intended to enhance the appearance of a building or outdoor area in order to promote the activities of a business. It can include 'mood' lighting of hotels, bars and restaurants and other leisure activities; and decorative lighting for public areas of buildings and parts of buildings or the surrounding grounds (where such lighting is necessary to the enhancement of the business function). It does not include lighting to provide general illumination or circulation, or building lighting that would be present regardless of the type of business being carried out.

- **Display lighting** comprises lighting intended to highlight displays of exhibits, signs associated with the business function, or merchandise. It includes spot or projector lighting in shops, theatres, galleries and studios; and display case lighting.

- **Accent lighting** comprises lighting that is intended to provide additional light over a specific small area in order to carry out or promote the activities of a business. This may include lighting required for a particular task (e.g. medical or dental examination, supplementary lighting for fine machining work or critical inspection work). It does not cover general lighting for an entire room or a large part of a room.

- **General interior lighting** covers all other interior lighting.

- **Exterior area lighting** covers all exterior lighting which is intended to provide downward light onto horizontal or near horizontal surfaces, including roadways, car parks, paths, stairs, ramps, gardens and other open spaces. This includes illuminated bollards and post-top lanterns.

- **Exterior floodlighting** covers exterior lighting that is intended to light vertical or near vertical surfaces, including floodlighting of buildings, monuments and statues.

Investments in products containing high efficiency lighting units can only qualify for Enhanced Capital Allowances if the products meet the eligibility criteria set out below. The individual products purchased do not need to be named on the Energy Technology Product List.

3. Eligibility Criteria

To be eligible, products must:

- Include one or more lamps, a luminaire and associated control gear.
- Use lamps other than light emitting diodes i.e. solid state lighting devices. (Products that use light emitting diodes are covered under White Light Emitting Diode Lighting Units).
- Not be emergency lighting.

In addition:

- The luminaire, lamps and control gear must be CE marked.
- Where products incorporate fluorescent or compact fluorescent lamps, they must be controlled by non-dimmable 'warm start' or 'dimmable' (regulating) type, high frequency (HF) electronic control gear.
- Where products incorporate compact fluorescent lamps, they must be of the non-integral type (i.e. those types that do not incorporate the control gear in the lamp cap).
- Where products incorporate high intensity discharge lamps rated below 200W, they must use electronic control gear.

In addition, lamps and control gear must comply with the following performance standards (where relevant):

- Compact fluorescent lamps must comply with BS EN 60901:1996 (as amended), “Specification for single-capped fluorescent lamps. Performance specifications”.
- Linear fluorescent lamps must comply with BS EN 60081:1998 (as amended), “Double-capped fluorescent lamps. Performance specifications”.
- "Warm start" high-frequency control gear (where fitted) for fluorescent lamps must comply with BS EN 60929:2011, “A.C. supplied electronic ballasts for tubular fluorescent lamps. Performance requirements”.

Performance criteria

All products must:

- Have a luminaire efficacy (i.e. lighting efficiency) that is greater than, or equal to, the thresholds set out in either Table 1 or Table 2 (as relevant) below, when tested after 100 hours of continuous operation.
- Have a power factor that is greater than, or equal to, 0.7 at all levels of product light output.

In addition:

- General lighting units installed indoors must comply with the glare and angular exclusion zone recommendations in paragraph 94 of HSG 38 (1997).
- Individual control gear must have a standby power not exceeding 0.5 Watts when the lighting unit incorporates an electronically addressed dimming or switching circuit. If the product is not fitted with an automatic switching or dimming circuit, the product must not consume power when it is switched off.
- Fluorescent and compact fluorescent lamps in all categories, and all lamps used in amenity, accent and display lighting fittings must have a colour rendering index that is at least Ra 80. All other lamps must have a colour rendering index of at least Ra 20.
- If the product incorporates dimming control it shall be tested at its highest light output level.

Table 1 Minimum luminaire efficacies for high efficiency lighting units with CRI>=80 OR with lamp rated power <200 Watts per lamp

Category	**Minimum luminaire efficacy (in luminaire lumens per circuit watt)**
Amenity, accent and display lighting units	≥ 75
General interior lighting, using downlighting units (DLOR/LOR>=0.9)	≥ 82
General interior lighting using uplighting units (DLOR/LOR<0.1)	≥ 100
General interior lighting using combined up and down lighting units (DLOR/LOR>=0.1 and <0.9)	≥ 100 – (18 x DLOR/LOR)
Exterior area lighting units	≥ 82
Exterior floodlighting units	≥ 82

Table 2 Minimum luminaire efficacies for high efficiency lighting units with CRI<80 AND with lamp rated power >=200 Watts per lamp.

Product Category	**Minimum luminaire efficacy (in luminaire lumens per circuit watt)**	
	Lamp Watts >= 200 and < 500 per lamp	Lamp Watts >= 500 per lamp
Exterior area lighting units	>= 85	>= 105
Exterior floodlighting units	>= 85	>= 105

">=" means "greater than or equal to".

Where:

- Luminaire efficacy is defined in terms of lumens of light output emitted by the luminaire per circuit watt of electrical power consumed.
- The electrical power consumed (in circuit watts) is defined as the total power consumed by the whole lighting unit from main circuit connection point to lamp, including losses in the control gear (ballast).
- For amenity, accent and display lighting units, general interior lighting units, and exterior floodlighting units, light output is defined as:

  Initial (100 hour) lamp lumen output x Light Output Ratio (LOR)

  where the Light Output Ratio (LOR) is the ratio of the light emitted by the unit to that emitted by the bare lamp(s).

- For exterior area lighting, light output is defined as:

  Initial (100 hour) lamp lumen output x Downward Light Output Ratio (DLOR)

  where the Downward Light Output Ratio (DLOR) is the ratio of the light emitted by the unit in a downward direction to that emitted by the bare lamp(s) in any direction. Thus for this type of lighting, upward light emitted by the unit does not count towards its light output.

Required test procedures

All products must be tested in accordance with the procedures laid down in:

- BS EN 13032-1:2004 (as amended), "Light and lighting. Measurement and presentation of photometric data of lamps and luminaires. Measurement and file format".

Where lamp lumens are those obtained when operated with a specific control gear.
For the avoidance of doubt test data should be presented to zero decimal places. As an example, an efficacy of 74 lumens per circuit watt for a display lighting unit would be deemed to be a fail.

4. 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**.

Lighting Controls
Date added to ETL 2001 (Revised 2016).

1. Definition of Technology

Lighting controls are products that are specifically designed to switch electric lighting on or off, and/or to dim its output.

2. Technology Description

Lighting controls manage electric lighting levels within specific areas, as and when required to match changes in daylight or occupancy, or individual activities.

A wide variety of lighting control products are available, and these range from simple manual switches to fully automatic control systems that adjust electric lighting levels to reflect planned operating hours, activities, occupation levels and the availability of daylight in specific areas.

The Enhanced Capital Allowance scheme aims to encourage the purchase of lighting controls that realise energy savings by automatically switching or dimming lighting in these ways.

Five different categories of lighting controls are covered by the ECA scheme:

1. Time controllers that automatically switch off lighting, or dim it down, at predetermined times.
2. Presence detectors with associated controllers that monitor occupancy or movement of personnel, and automatically switch off lighting, or dim it down, when the area is unoccupied.
3. Daylight detectors with associated switching controllers that monitor daylight availability, and automatically switch off lighting when daylight is sufficient to illuminate the area.
4. Daylight detectors with associated dimming controllers that monitor daylight availability, and automatically dim lighting, by reducing its power consumption, to the level needed to sufficiently illuminate the area.
5. Central **area and network** control units that provide the facility to manage the overall operation of electric lighting installations that include some or all of the categories of lighting controls above.

The above categories of controls may be installed either individually, or in combination.

Investments in lighting controls can only qualify for Enhanced Capital Allowances if the product meets the criteria as set out below. The individual products purchased do not need to be named on the Energy Technology Product List.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate one or more of the categories of lighting controls set out in Tables 1 to 5 below, and comply with the specific eligibility criteria in the relevant table(s).
- Be CE marked.

Products may also incorporate the facility that permits the automatic switching of lights to be temporarily overridden on a central basis for maintenance or security purposes, or to ensure the safety of occupants during particular events or activities.

Table 1 Time Controllers.
SECTION 1A –ELIGIBILITY CRITERIA
To be eligible under this category of Lighting Controls: • The product must automatically switch the lighting off, or dim it down, at predetermined times of the day or week, or after a predefined interval. Where automatic dimming controls are used, they must be capable of reducing the power consumption of the controlled lamps by at least 75%. Where fluorescent lighting is being dimmed, it must incorporate high frequency dimmable ballast and electronic control gear. Other forms of lighting may incorporate either mains frequency or high frequency dimmable ballasts and associated controls.
SECTION 1B –Notes
1. The product may also be set to automatically switch on the lighting at predetermined times. 2. Products may incorporate the facility for local users to manually switch on and off lighting in a local area and thus to override the predetermined lighting levels at that particular time. However products that allow local users to locally override subsequent predetermined times for the lighting to be automatically switched off, or dimmed down, are not eligible. 3. If the product used is designed to control any form of heating, ventilation or air conditioning (HVAC) equipment, then it must be listed under the HVAC Zone Controls part of the Energy Technology Product List (ETPL).

Table 2 Presence detectors with associated controllers
SECTION 2A –ELIGIBILITY CRITERIA
To be eligible under this category of Lighting Controls: • The product must automatically switch off the lighting, or dim it down, after the area has become unoccupied. Where automatic dimming controls are used, they must be capable of reducing the power consumption of the controlled lamps by at least 75%. Where fluorescent lighting is being dimmed, it must incorporate high frequency dimmable ballast and electronic control gear. Other forms of lighting may incorporate either mains frequency or high frequency dimmable ballasts and associated controls.
SECTION 2B –Notes
1. The product may also automatically switch on the lighting when the space becomes occupied. Alternatively local users may manually switch on the lighting at the start of occupancy. 2. Products may incorporate the facility for local users to manually override the presence detector/controller and to switch the lighting off at any particular instance. However products that allow local users to override the ability of the presence detector/controller to automatically switch off, or dim the lighting, are not eligible. 3. Products must not consume more than 0.5 Watts in parasitic power, when the associated lights are turned off.

Table 3 Daylight detectors with associated switching controllers
SECTION 3A –ELIGIBILITY CRITERIA
To be eligible under this category of Lighting Controls: • The product must monitor the availability of daylight and automatically switch the lighting off when sufficient daylight is available to illuminate the area.
SECTION 3B –Notes
1. The product may also automatically switch on the lighting when daylight has fallen below the required level. Alternatively local users could be allowed to switch on the lighting manually, when daylight has fallen below the required level. 2. Products may incorporate the facility for local users to manually override daylight detector/controller and switch the lights off at any particular instance. However products that allow local users to override the ability of the daylight detector/controller to automatically switch off the lighting are not eligible. 3. Products must not consume more than 0.5 Watts in parasitic power, when the associated lights are turned off.

Table 4 Daylight detectors with associated dimming controllers
SECTION 4A –ELIGIBILITY CRITERIA
To be eligible under this category of Lighting Controls: • The product must monitor the availability of daylight and automatically dim the electric lighting to the level just needed to sufficiently illuminate the area, and switch it off when there is enough daylight. • The product must be able to reduce the power consumption of the lamps being controlled by at least 75% through dimming. Where fluorescent lighting is being dimmed, it must incorporate high frequency dimmable ballasts and electronic control gear. Other forms of lighting may incorporate either mains frequency or high frequency dimmable ballasts and associated controls.
SECTION 4B –Notes
1. The product may also automatically switch on the lighting when daylight has fallen below the required level. Alternatively local users could be required to switch on the lighting manually, as and when needed. 2. Products may incorporate the facility for local users to manually override the dimming controller at any particular instance and to set the lighting to a lower level than it would be under automatic control, or switch it off. However products that allow local users to override the ability of the daylight detector/controller to automatically dim the lighting are not eligible. 3. Products must not consume more than 0.5 Watts in parasitic power, when the associated lights are turned off.

Table 5 Central area and network control units (lighting control systems)
SECTION 5A –ELIGIBILITY CRITERIA
To be eligible under this category of Lighting Controls: • The product must be able to manage the overall operation of the electric lighting installation that includes some or all of the categories of lighting controls set out in Tables 1 to 4 above.

SECTION 5B –Notes
1. The product may make use of pre-programmed “scenes” that configure the lighting levels in different areas for a particular activity or daylight level or occupancy status in the most energy efficient manner. However products that are only capable of manual scene setting are not eligible. 2. Products may also incorporate the facility to monitor lighting energy consumption. 3. If the product is designed to control any form of heating, ventilation or air conditioning (HVAC) equipment then, it must be listed under the HVAC Zone Controls part of the Energy Technology Product List (ETPL).

4. 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**.

White Light Emitting Diode Lighting Units

Date added to ETL 2008 (Revised 2015).

1. Definition of Technology

White light emitting diode lighting units are products that are specifically designed to provide white light by means of solid-state lighting devices.

2. Technology Description

White LED lighting units are products that consist of one or more white LEDs, incorporated into a light fitting (or luminaire) and includes associated electronic control gear. The luminaire generally also includes an optical system that reflects and/or focuses the product’s light output onto the item(s) being illuminated. White LED lighting units may also incorporate lighting control devices such as light regulation (dimming) and 'presence' controls. Luminaires designed to incorporate or supplied with LED based ‘lamps’ that retrofit to traditional light sources such as LED T8 replacement tubes or MR16 Low Voltage Lamps are not included in the scope.

White LED Lighting Units have been included in the Enhanced Capital Allowance (ECA) scheme because they offer substantial energy and carbon savings. A wide variety of LED lighting units are available in a range of designs with different performance levels. The ECA scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers four categories of products:

1. Amenity, accent and display lighting
2. General interior lighting
3. Exterior area lighting
4. Exterior floodlighting

Where:

- **Amenity lighting** is decorative lighting intended to enhance the appearance of a building or outdoor area in order to promote the activities of a business. It can include ‘mood’ lighting of hotels, bars and restaurants and other leisure activities; and decorative lighting for public areas of buildings and parts of buildings or the surrounding grounds (where such

lighting is necessary to the enhancement of the business function). It does not include lighting to provide general illumination or circulation, or building lighting that would be present regardless of the type of business being carried out.

- **Display lighting** comprises lighting intended to highlight displays of exhibits, signs associated with the business function, or merchandise. It includes spot or projector lighting in shops, theatres, galleries and studios; and display case lighting.
- **Accent lighting** comprises lighting that is intended to provide additional light over a specific small area in order to carry out or promote the activities of a business. This may include lighting required for a particular task (e.g. medical or dental examination, supplementary lighting for fine machining work or critical inspection work). It does not cover general lighting for an entire room or a large part of a room.
- **General interior** lighting covers all other interior lighting.
- **Exterior area** lighting covers all exterior lighting which is intended to provide downward light onto horizontal or near horizontal surfaces, including roadways, car parks, paths, stairs, ramps, gardens and other open spaces. This includes illuminated bollards and post-top lanterns.
- **Exterior floodlighting** covers exterior lighting that is intended to light vertical or near vertical surfaces, including floodlighting of buildings, monuments and statues.

Investments in products containing white light emitting diode lighting units can only qualify for Enhanced Capital Allowances if the products meet the eligibility criteria set out below. The individual products purchased do not need to be named on the Energy Technology Product List.

3. Eligibility Criteria

To be eligible, products must:

- Include one or more solid-state LED devices, luminaire and associated electronic control gear.
- Be capable of producing white light. White light is defined in Annex 2, paragraph 3b of EC Regulation 245/2009 “Implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps”.
- Be CE Marked.
- **Not** be luminaires designed to incorporate or supplied with LED based ‘lamps’ that retrofit to traditional light sources such as LED T8 replacement tubes or MR16 Low Voltage Lamps.
- **Not** be emergency lighting.

In addition, control gear must comply with the following performance standards (where relevant):

- BS EN 61347-2-13:2014, “Lamp control gear. Particular requirements for d.c. or a.c. supplied electronic control gear for LED modules”.
- BS EN 62384:2006 (as amended), “D.C. or A.C. supplied electronic control gear for LED modules. Performance requirements”.

Performance criteria

All products must:

- Have a luminaire efficacy (i.e. lighting efficiency) that is greater than, or equal to, the thresholds set out in Table 1 below, after 100 hours of continuous operation.
- Be able to provide a light output (in lumens) after 6000 hours of continuous operation that is not less than 90% of their initial light output (in lumens).
- Have a colour rendering index that meets the requirements of Section 2.2 of Commission Regulation (EU) no 1194/2012 (implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment)
- Have a power factor that is greater than, or equal to, 0.7 at all levels of product light output.

In addition:

- General lighting units installed indoors must comply with the glare and angular exclusion zone recommendations in paragraph 94 of HSG 38 (1997), "Lighting at work" (ISBN: 9780717612321).
- Individual control gear must have a standby power not exceeding 0.5 Watts when the lighting unit incorporates an electronically addressed dimming or switching circuit. If the product is not fitted with an automatic switching or dimming circuit, the product must not consume power when it is switched off.
- Amenity, accent and display lighting units to be installed indoors must have a minimum light output of at least 100 lumens after 100 hours of continuous operation. All other fittings must have a minimum light output of at least 200 lumens after 100 hours of continuous operation.

Table 1 – Minimum luminaire efficacies for white LED lighting units

Category	**Minimum luminaire efficacy (in luminaire lumens per circuit watt)**
Amenity, accent and display lighting units	>= 75
General interior lighting, using downlighting units (DLOR/LOR>=0.9)	>= 82
General interior lighting using uplighting units (DLOR/LOR<0.1)	>= 100
General interior lighting using combined up and down lighting units (DLOR/LOR>=0.1 and <0.9)	>= 100 – (18 x DLOR/LOR)
Exterior area lighting units	>= 82
Exterior floodlighting units	>= 82

">=" means "greater than or equal to".

Where:

- Luminaire efficacy is defined in terms of the lumens of light output emitted by the luminaire per circuit watt of electrical power consumed.
- The electrical power consumed (in circuit watts) is defined as the total power consumed by the whole lighting unit from main circuit connection point to 'LED module', including losses in the power supply and constant current source, and losses due to the effects of temperature. It is not the 'rated wattage' of the LED chip.
- The product must perform at the minimum required efficacy at each drive current for which the product is designed to operate, when tested after 100 hours of continuous operation. If the product incorporates dimming control it shall be tested at its highest light output level.
- For amenity, accent and display lighting units, general interior lighting, and exterior floodlighting units, light output is defined as the total light output in all directions (TLO), which is the sum of:

  a) Light output in a downward direction (DLO) i.e. below the horizontal as installed, and
  b) Light output in an upward direction (ULO) i.e. above the horizontal as installed.

- For exterior area lighting units **only**, light output is defined as total light output in a downward direction (DLO) only i.e. below the horizontal as installed (i.e. light output in an upward direction is not included in the calculation of product light output or luminaire efficacy).

Required test procedures

All products must be tested in accordance with the procedures laid down in one of the following:

- BS EN 13032-4:2015, "Light and lighting. Measurement and presentation of photometric data of lamps and luminaires. LED lamps, modules and luminaires".
- IES LM-79-08, "Electrical and Photometric Measurements of Solid-State Lighting Products".
- DD IEC/PAS 62722-2-1:2011. "Luminaire performance Part 2-1: Particular requirements for LED luminaires".

However if a product is sold solely for use in refrigerators or freezers with a declared application temperature of 5ºC or below, its efficacy and luminous flux may be measured at a temperature of between 0º and 5ºC on its external casing. The light output measurements at 0 and 6000 hours shall both be made at the same temperature.

The following test conditions must be observed:

- Testing of efficacy, minimum light output, power factor and standby power must be conducted on the complete product (i.e. solid state LED device(s), luminaire and associated electronic control gear) and under normal operating conditions.
- Measurements of the reduction in product light output with time shall be made over a period of 6000 hours according to the methods in either DD IEC/PAS 62722-2-1:2011 "Luminaire performance Part 2-1: Particular requirements for LED luminaires" or IES LM-80-08, "Measuring Lumen Maintenance of LED Light Sources". These measurements may be carried out on the complete product.

- Measurements of the product's light output and electrical power consumption at different drive currents must be taken after the junction temperature has stabilised to a constant level after selecting the particular drive current.

For the avoidance of doubt test data should be presented to zero decimal places. As an example, an efficacy of 74 lumens per circuit watt for a display lighting unit would be deemed to be a fail.

Please note that performance data obtained in accordance with the procedures and conditions detailed in BS EN 13032-1:2004 (as amended) will be accepted as an alternative to testing in accordance with BS EN 13032-4:2015 until further notice.

4. 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**.

Motors and Drives

Converter-Fed Motors

(Formerly Permanent Magnet Synchronous Motors)
Date added to ETL 2010 (revised 2016).

1. Definition of Technology

Converter-fed motors are products that are specifically designed to convert electrical power into mechanical power, and to rotate a drive shaft at a speed that is directly related to the non-sinusoidal multi-phase electrical power supplied to the motor.

Converter-fed ac motor drives consist of a motor, and a matched, electronic, variable speed drive (VSD) that is specifically designed to provide the multi-phase electrical power input needed to operate the motor, and to vary its speed in a controlled manner in response to an external signal.

2. Technology Description

Converter-fed motors are applied throughout industry and commerce in a wide range of 'general purpose' and specialist applications.

A converter-fed motor is designed to be operated from a non-sinusoidal multi-phase electrical power supply and may comprise permanent magnet, synchronous reluctance or other design.

A converter-fed motor drive is a combination of a motor and an electronic VSD. The VSD can either be physically mounted on the motor to form a single factory assembled, integrated unit, or the VSD and motor can be supplied as a package of two units that are designed to be connected together during installation.

Converter-fed motors are available in a wide range of designs and efficiencies. The ECA Scheme aims to supports the purchase of higher efficiency products.

The ECA Scheme covers three categories of product:

1. Converter-fed ac motors (sold without VSD).
2. Integrated converter-fed motor drive units.
3. Matched converter-fed motor drive packages.

Integrated converter-fed motor drive units include electrically commutated motors which comprise a brushless dc multi-phase motor and an integral electronic control device. The ac power supply is commutated to dc by the control device and the power output is used to rotate the motor.

Investments in converter-fed motors 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

Eligible products must:

- Be designed to include or operate with an electronic VSD
- Incorporate a converter-fed motor that:
    a) Has a rated operating voltage between 200 and 700 Volts

b) Is CE Marked.

- **Not** incorporate any type of mechanical apparatus that derives its motive force from the product's motor, except for fans or pumps incorporated solely for the purpose of product cooling or lubrication, integrated torque couplings, and position encoding mechanisms.

- **Not** include a mechanically commutated dc motor

Category 1 (converter-fed ac motor) products must be designed to operate with an electronic VSD providing a non-sinusoidal multi-phase ac electrical power supply to the motor.

Category 2 and 3 (converter-fed motor drive unit and package) products must be configured for direct connection to the UK public electricity supply system, or a private alternating current supply of nominally fixed frequency and voltage. The electronic VSD should provide a non-sinusoidal multi-phase electrical power supply to the motor.

In addition, for all products (except for electronically commutated motors) that include an electronic VSD, the VSD must also comply with the separate ETL criteria for Variable Speed Drives.

Performance criteria

Products must have an efficiency at 100% of their maximum continuous speed rating that is greater than or equal to the values shown in Table 1 below, which vary with power rating and maximum continuous speed rating. If the product's specific power rating is not shown in Table 1, then the performance threshold for the next highest power rating should be used to determine eligibility.

Table 1 Performance thresholds for converter-fed motors and motor drive units

Rated Power of motor, P_N (kW)	Efficiency at full load of motor and VSD combined			
	Maximum continuous speed rating (RPM)			
	up to 750	751 to 1000	1001 to 1500	Over 1500
0.75	>=75.0	>= 78.9	>= 82.5	>= 80.7
1.1	>=77.7	>= 81.0	>= 84.1	>= 82.7
1.5	>=79.7	>= 82.5	>= 85.3	>= 84.2
2.2	>=81.9	>= 84.3	>= 86.7	>= 85.9
3.0	>=83.5	>= 85.6	>= 87.7	>= 87.1
4.0	>=84.8	>= 86.8	>= 88.6	>= 88.1
5.5	>=86.2	>= 88.0	>= 89.6	>= 89.2
7.5	>=87.7	>=90.0	>=91.5	>=90.5
11.0	>=89.0	>=91.1	>=92.3	>=91.5
15.0	>=89.9	>=91.8	>=93.0	>=92.3
18.5	>=90.5	>=92.4	>=93.3	>=92.8
22.0	>=90.9	>=92.8	>=93.7	>=93.1
30.0	>=91.6	>=93.3	>=94.1	>=93.7
37.0	>=92.1	>=93.7	>=94.5	>=94.0
45.0	>=92.4	>=94.0	>=94.7	>=94.3
55.0	>=92.8	>=94.4	>=95.1	>=94.6
75.0	>=93.3	>=94.7	>=95.4	>=94.9
90.0	>=93.6	>=94.9	>=95.5	>=95.2
110.0	>=93.9	>=95.2	>=95.7	>=95.4
132.0	>=94.1	>=95.4	>=95.9	>=95.6
160.0	>=94.4	>=95.6	>=96.1	>=95.7
200	>=94.7	>=95.7	>=96.2	>=96.0
250	>=94.7	>=96.0	>=96.2	>=96.0
315 up to 400	>=94.7	>=96.1	>=96.2	>=96.0

">=" means "greater than or equal to"
"<=" means "less than or equal to"

Where the rated power (P_N) is that of the motor, for 'Duty type S1 – Continuous running duty' as defined in Section 4.2.1 of BS EN 60034-1: 2010 "Rotating electrical machines – Part 1: Rating and performance", and is determined with the product operating at 100% of its maximum continuous speed rating.

The efficiency at full load refers to the overall efficiency of the motor and VSD combined.

For the avoidance of doubt test data should be presented to 1 decimal place. As an example, a product with a rated power output of 45.0 kW, maximum continuous rated speed of 1,200 rpm, and an efficiency of 94.6 % would be deemed to be a fail.

Required test procedures

Product efficiency at 100% of maximum continuous speed rating must be determined using:

Method 2-1-1B according to Table 2 in Section 6.1.1 of BS EN 60034-2-1:2014 "Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)". Where the input power P 1, must be measured at the main input terminals to the electronic VSD.

Note: until further notice results of tests according to Section 9.1.1 of BS EN 60034-2-1:2007 will also be accepted.

Products must be operated from a standard 230, 400 or 690 Volt ac, 50Hz electrical power supply during testing, and any filters that are required by the product in order to comply with EU EMC Directives must be fitted.

Where the product does not include a VSD, it may be tested using any appropriately matched VSD.

If a single product is submitted for assessment, one detailed test report should be submitted.

For a product range, test results may be submitted in summary form provided:

- Sufficient data is included to confirm that product performance was determined in accordance with the procedures and test conditions laid down in the relevant standards.
- Detailed test reports have been prepared for each product tested and are available on request for inspection, where not submitted with the application.

Representative testing

Where applications are being made for 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 are of the same product range as the representative models and the primary variations between models are rated power and physical dimensions.
- All variants are constructed from the same materials.
- At least one detailed representative test report is provided for each product range.
- Clear descriptions of the formulae or mathematical model used for calculating performance of the variants, and details of measurements taken to verify this model are provided. Tests undertaken to verify the accuracy of the model must be carried out in accordance with the test procedures described above.

It should be noted that:

- The efficiency value stated on the ETL for tested products should be taken from the test data provided, and not from the calculated or modelled values.
- 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.

4. 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**.

Line Operated AC Motors

(formerly Single Speed AC Induction Motors)
Date added to ETL 2001 (Revised 2015).

1. Definition of the Technology

Line operated ac motors covers products that are specifically designed to convert standard three phase electrical power into mechanical power, and to rotate a drive shaft at a fixed speed that is directly related to the frequency of the electrical power supply.

2. Technology Description

Line operated ac motors are used to drive plant and machinery throughout industry and commerce, and a wide range 'general purpose' products are available in internationally agreed, standard designs with different rated power outputs, frame sizes, fixed operating speeds, and energy efficiency ratings.

The ECA Scheme aims to encourage the purchase of higher efficiency line operated ac motors.

Investments in line operated ac motors 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 must meet minimum performance criteria as set out below.

3. Eligibility Criteria

To be eligible products must:

- Be a totally enclosed, three-phase, single speed, ac motor that has:

    a) A maximum rated operating voltage less than or equal to 1,000 Volts ac

    b) 2, 4, 6 or 8 poles.

    c) A built in method of cooling that is classified according to BS EN 60034-6:1994, "Rotating electrical machines. Methods of cooling (IC Code) as:

        - IC 410: (frame surface cooled – free convection),
        - IC 411: (frame surface cooled – self circulation)
        - IC 418: (frame surface cooled circulation by relative displacement.)

    d) Dimensions and a power rating that conform with the requirements of IEC 60072-1: 1991-02 (sixth edition), "Dimensions and output series for rotating electrical machines – Part 1: Frame numbers 56 to 400 and flange numbers 55 to 1080".

- Be capable of direct connection to the UK public electricity supply system, or a private alternating current supply of nominally fixed frequency and voltage
- Be rated at 50 Hz in accordance BS EN 60034-1:2010 (or IEC 60034-1: 2010) "Rotating electrical machines - Part 1: *Rating and performance*".
- Have a 'Duty type S1 – Continuous running duty' rated power output that is greater than or equal to 0.75kW and less than or equal to 400kW as defined in Section 4.2.1 of BS EN 60034-1: 2010.
- Be CE Marked.

Performance Criteria

Products must have an efficiency when tested in accordance with BS EN 60034-2-1: 2014 at full load (i.e. 100% of their maximum continuous rated power output) that is greater than or equal to the values shown in Table 1 below, which vary with rated power output and number of poles. If the product's specific rated power output is not shown in Table 1, then the performance threshold is determined by interpolation in accordance with the method set out in Section 5.4.5 of BS EN 60034-30-1: 2014.

Note: until further notice results of tests according to BS EN 60034-2-1:2007 will also be accepted.

Table 1 Performance thresholds for line operated ac motors

Rated Power Output (kW)	Efficiency at full load			
	2 Pole	4 Pole	6 Pole	8 Pole
0.75	>= 80.7	>= 82.5	>= 78.9	>=75.0
1.1	>= 82.7	>= 84.1	>= 81.0	>=77.7
1.5	>= 84.2	>= 85.3	>= 82.5	>=79.7
2.2	>= 85.9	>= 86.7	>= 84.3	>=81.9
3	>= 87.1	>= 87.7	>= 85.6	>=83.5
4	>= 88.1	>= 88.6	>= 86.8	>=84.8
5.5	>= 89.2	>= 89.6	>= 88.0	>=86.2
7.5	>=91.7	>=92.6	>=91.3	>=89.3
11	>=92.6	>=93.3	>=92.3	>=90.4
15	>=93.3	>=93.9	>=92.9	>=91.2
18.5	>=93.7	>=94.2	>=93.4	>=91.7
22	>=94.0	>=94.5	>=93.7	>=92.1
30	>=94.5	>=94.9	>=94.2	>=92.7
37	>=94.8	>=95.2	>=94.5	>=93.1
45	>=95.0	>=95.4	>=94.8	>=93.4
55	>=95.3	>=95.7	>=95.1	>=93.7
75	>=95.6	>=96.0	>=95.4	>=94.2
90	>=95.8	>=96.1	>=95.6	>=94.4
110	>=96.0	>=96.3	>=95.8	>=94.7
132	>=96.2	>=96.4	>=96.0	>=94.9
160	>=96.3	>=96.6	>=96.2	>=95.1
200	>=96.5	>=96.7	>=96.3	>=95.4
250	>=96.5	>=96.7	>=96.5	>=95.4
280	>=96.5	>=96.7	>=96.6	>=95.4
315	>=96.5	>=96.7	>=96.6	>=95.4
355	>=96.5	>=96.7	>=96.6	>=95.4
375	>=96.5	>=96.7	>=96.6	>=95.4
400	>=96.5	>=96.7	>=96.6	>=95.4

">=" means "greater than or equal to"

For the avoidance of doubt test data should be presented to 1 decimal place. As an example, a 4 pole, single speed motor with a rated power output of 45.0 kW and an efficiency at full load of 95.3% would be deemed to be a fail.

Required test procedures

Product efficiency at full load (100% of maximum continuous rated power output) must be determined in accordance with:

- Method 2-1-1B according to Table 2 (Induction Machines - preferred testing methods) of BS EN 60034-2-1:2014 "Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)"

OR

- The low uncertainty method according to Table 2 (Induction Machines) of BS EN 60034-2-1:2007 "Rotating electrical machines – Part 2-1: Standard methods for determining losses and efficiency from tests (excluding machines for traction vehicles)".

Products must be operated from a 400 Volt ac, 3 phase, 50Hz electrical power supply during testing. (If the product is not designed to operate at this voltage, then product testing should be undertaken using a 230V ac or 690V ac electrical power supply, or alternatively at all rated operating voltages).

If a single product is submitted for assessment, one detailed test report should be submitted.
For a product range, test results may be submitted in summary form provided:

- Sufficient data is included to confirm that product performance was determined in accordance with the procedures and test conditions laid down in the relevant standards.
- Detailed test reports have been prepared for each product tested and are available on request for inspection, where not submitted with the application.

Representative testing

Where applications are being made for 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 are of the same product range as the representative models and the primary variations between models are rated power and physical dimensions.
- All variants are constructed from the same materials.
- A detailed test report is provided for at least one representative product in each range.
- The representative model is in the bottom quartile of predicted performance within each range.
- Clear descriptions and formulae describing the relationship between the representative model(s) and the variants are provided.

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.

4. 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.

Variable Speed Drives

Date added to ETL 2001 (Revised 2015).

1. Definition of Technology

A variable speed drive is specifically designed to drive a motor in a manner that rotates the motor's drive shaft at a variable speed dictated by an external signal.

2. Technology Description

A variable speed drive is essentially an electronic power converter that generates a multi-phase, variable frequency output that can be used to drive a standard line operated ac motor, or permanent magnet synchronous or other converter-fed motor, and to modulate and control the motor's speed, torque and mechanical power output.

Variable speed drives may be purchased either as a stand-alone product or purchased as part of another item of plant or machinery. They are included on the Energy Technology Product List because they can realise substantial energy savings when used to control the speed of machinery.

The ECA Scheme covers two categories of products:

1. Variable Speed Drives for line operated ac motors (as defined within the ETL category line operated ac motors)
2. Variable Speed Drives for converter-fed motors (as defined within the ETL category converter-fed motors)

Products which are able to control both line operated ac motors **and** converter-fed motors are also covered, as long as all of the eligibility criteria are met for both forms of control.

Investments in variable speed drives 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

Eligible products must:

- Incorporate an electronic VSD that generates a controlled variable frequency, variable voltage, 3 phase power output (with each phase displaced by approximately 120 degrees) that is suitable for operating a 3 phase motor.
- Provide an adjustable variable-voltage, variable-frequency output that can be matched to the torque-speed characteristic of the load (being driven by the motor), including both loads with a quadratic torque-speed and linear torque-speed characteristics. The relationship between the voltage and frequency of the product's output must either be:

    a) Predefined prior to sale to match a number of specific motor loads, which can be selected during commissioning; OR

    b) Programmed into the product during installation using a multi-point approximation or parametric motor model as part of a clearly defined commissioning procedure; OR

    c) Determined during commissioning by a self-tuning or automatic model identification algorithm that automatically minimises the energy consumption of the drive; OR

    d) Automatically adjusted during operation as part of a control algorithm in a manner that ensures the product's output matches the characteristics of the motor and its load and minimises energy consumption of the drive; OR…

    e) Any combination of (a) to (d) above.

- Be able to automatically vary, in response to an external control signal, the frequency of its output between 5% (or less) and 100% (or greater) of the frequency of its alternating current supply.
- Be configured for direct connection to the UK public electricity supply system, or a private alternating current supply of nominally fixed frequency and voltage.
- Be designed to make smooth controlled transitions between speed changes by the use of predefined, programmable, or automatically adjusted, acceleration and deceleration ramps.
- **Be CE Marked, or otherwise demonstrate conformity with the requirements of the EU EMC** Directive 89/336/EEC, or its replacement EU EMC Directive 2004/108/EC.
- **Not** incorporate any type of mechanical apparatus that derives its motive force from the product's variable frequency output, including any form of electric motor or fluid movement mechanism, except for fans or pumps incorporated solely for the purpose of product cooling.

Where the relationship between the voltage and frequency of the product's output is determined by a multi-point approximation, then flux optimisation must be adjustable at a minimum of five points.

4. 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.

Pipework Insulation

Date added to ETL 2001 (Revised 2013).

1. Definition of Technology

Pipework insulation covers products that are specifically designed to be applied to the outer circumference of a pipe with the primary objective of reducing thermal flow into or out of the pipe.

2. Technology Description

Pipework insulation is used to reduce the amount of heat lost from pipework containing hot fluids, and the amount of heat gained by pipework containing cold and chilled fluids, thus reducing the amount of energy wasted on maintaining the temperature of the fluids.

The ECA Scheme covers six categories of pipework insulation:

1. Refrigeration pipework.
2. Chilled water pipework
3. Process pipework.
4. 'Domestic' heating & hot water services (excluding insulation within individual dwellings).
5. Non-domestic hot water services.
6. Non-domestic heating services.

Investments in pipework insulation can only qualify for Enhanced Capital Allowances if the installation meets the eligibility criteria set out below. Individual products used in an installation do not need to be named on the Energy Technology Product List.

3. Eligibility Criteria

To be eligible, installations of pipework insulation must:

1. For categories 1, 2 and 3, comply with the relevant clauses, tables and annexes of BS 5422: 2009 as set out in Table 1 below.

Table 1: Relevant clause, table(s) and annex(es) of BS 5422 (2009) used to determine the minimum required thickness for each category of pipework insulation covered by the ECA Scheme.

	Category	**Relevant Clause**	**Relevant Table(s)**	**Relevant Annex**
1.	Refrigeration pipework.	6	None	F
2.	Chilled water pipework.	7	10 & 11	A
3.	Process pipework.	10	21	A

2. For categories 4, 5 and 6, comply with the maximum permissible heat loss criteria found within Tables 2, 3 & 4 below, which duly form the basis for determining the minimum required thickness of pipework insulation for each category for an eligible installation.

Table 2: Maximum Permissible Heat Losses for Domestic Heating & Hot Water

Domestic Heating & Hot Water **Maximum permitted heat loss (W/m), where temperature = 60°C**	
Outside pipe diameter (mm)	Permitted Heat loss (W/m)
8	<= 5.82
10	<= 6.20
12	<= 6.52
15	<= 7.03
22	<= 8.02
28	<= 8.87
35	<= 9.63
42	<= 10.58
54	<= 11.83

Table reproduced with kind permission from the 'ECA Enhanced' tables of NES Y-50 (2011).

Table 3: Maximum Permissible Heat Losses for Non-Domestic Hot Water Supply

Non-Domestic Hot Water Supply **Maximum permitted heat loss (W/m), where temperature = 60°C**	
Outside pipe diameter (mm)	Permitted Heat loss (W/m)
17.2	<= 6.04
21.3	<= 6.45
26.9	<= 7.00
33.7	<= 7.71
42.4	<= 8.46
48.3	<= 9.01
60.3	<= 9.94
76.1	<= 11.25
88.9	<= 12.17
114.3	<= 14.29
139.7	<= 16.09
168.3	<= 18.24
219.1	<= 22.06
273 and above	<= 25.95

Table reproduced with kind permission from the 'ECA Enhanced' tables of NES Y-50 (2011).

Table 4: Maximum Permissible Heat Losses for Non-Domestic Heating Supplies

Non-Domestic Heating Installations Maximum permitted heat loss (W/m)			
Temperature	Low	Medium	High
	<=95°C	96-120°C	121-150°C
Outside pipe diameter (mm)	Permitted Heat loss (W/m)	Permitted Heat loss (W/m)	Permitted Heat loss (W/m)
17.2	<= 7.78	<= 10.57	<= 13.27
21.3	<= 8.42	<= 11.25	<= 14.06
26.9	<= 9.05	<= 12.06	<= 15.02
33.7	<= 9.86	<= 13.04	<= 16.07
42.4	<= 10.83	<= 14.12	<= 17.34
48.3	<= 11.42	<= 14.80	<= 18.09
60.3	<= 12.61	<= 16.22	<= 19.62
76.1	<= 14.12	<= 17.88	<= 21.41
88.9	<= 15.28	<= 19.20	<= 22.87
114.3	<= 17.51	<= 21.66	<= 25.53
139.7	<= 19.72	<= 23.99	<= 27.98
168.3	<= 22.34	<= 26.63	<= 30.69
219.1	<= 26.61	<= 31.15	<= 35.25
273 and above	<= 30.91	<= 35.83	<= 40.05

Table reproduced with kind permission from the 'ECA Enhanced' tables of NES Y-50 (2011).

Where:

- Where "<=" means "less than or equal to"
- If the pipe diameter differs from the parameters used to generate these tables, then linear interpolation methods may be used to calculate the maximum permissible heat flows and, in combination with information on the thermal conductivity of the chosen product at the relevant mean temperature, the minimum required thickness of insulation.
- If the parameters of the specific installation are outside the scope of these tables (e.g. different ambient air temperature, or linear interpolation is not possible) then the minimum required thickness of insulation must be calculated from first principles using the methodology set out in Annex A of BS 5422: 2009.
- The methodology set out in Annex F of BS 5422: 2009 must be used to calculate the minimum required thickness for refrigeration pipework insulation needed to comply with clause 6.3.2 of BS 5422: 2009.

4. Scope of Claim

Expenditure on the provision of plant and machinery can include not only the actual costs of buying the pipework insulation products, 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.

Radiant and Warm Air Heaters

Biomass Fired Warm Air Heaters

Date added to ETL 2010.

1. Definition of Technology

Biomass fired warm air heaters covers products that are specifically designed to provide space heating by using the heat generated by a continuously stoked biomass burner to raise the air temperature in the space(s) being heated.

2. Technology Description

Biomass fired warm air heaters are used to provide space heating for workshops, factories, warehouses, retail sheds, sports centres, and other buildings containing similarly large spaces. They contain a continuously stoked burner that is used to heat the air in the space indirectly by means of heat exchanger. A fan is used to distribute the warm air throughout the space(s) being heated.

Biomass fired warm air heaters are available in a range of different types and efficiencies. The ECA Scheme encourages the purchase of higher efficiency biomass fired warm air heaters.

Investments in biomass fired warm air heaters 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be designed to burn wood, cereal straw, or solid fuels derived from them.
- Incorporate an automatic stoker that supplies a continuous flow of fuel into the combustion chamber at a rate corresponding to the rate of combustion.
- Incorporate a fan to distribute warm air within the heated space.
- Be CE marked.

Performance criteria

All products must have a net thermal efficiency when operating at 100% of their maximum continuous rating (MCR) that is greater than, or equal to, 82.0%.

For the avoidance of doubt net thermal efficiency test data should be presented to 1 decimal place. As an example, a biomass fired warm air heater with a net thermal efficiency of 81.9% at 100% of its maximum continuous rating (MCR) would be deemed to be a fail.

Required test procedures

The product's net thermal efficiency at 100% of its maximum continuous rating (MCR) must be determined in accordance with:

- The method in BS EN 1020:1998, "Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, incorporating a fan to assist transportation of combustion air and/or combustion products".

The product's flue gas losses must be determined in accordance with the procedures at BS EN 13240:2001, "Roomheaters fired by solid fuel. Requirements and test methods".

All tests must be done using either a biomass test fuel (designated A1, A2, B1, B2, C & D) in accordance with Table 8 of BS EN 303-5:1999, or using sawdust and/or shavings from woodworking operations.

All testing must be carried out, or witnessed and certified, by a contractor that is accredited by the United Kingdom Accreditation Scheme (UKAS), or other equivalent national accreditation bodies recognised via the European Co-operation for Accreditation, the International Accreditation Forum, or the International Laboratory Accreditation Co-operation (ILAC) agreements for the measurements made during the testing.

Representative Testing

Where applications are being made for products of the same constructional design to be included on the Energy Technology Product List (ETPL), test data may be submitted for a single representative model provided that the maximum rated output of the products being applied for is not more than twice, or less than half, the maximum rated output of the product tested. Where the range of rated outputs exceeds these limits, products should be grouped into size ranges that comply with these rules, and test data submitted for one representative model for each group.

It should be noted that:

- If a manufacturer voluntarily removes a representative model from the 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 models will be removed from the ETPL.

4. 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.

Radiant Heating Equipment

Date added to ETL: 2002 (Revised 2014).

1. Definition of Technology

Radiant heating equipment covers products that are specifically designed to heat people or objects in the space below them by infrared radiation without heating the surrounding air directly, and optimising controllers that ensure radiant heating systems operate in an efficient manner.

2. Technology Description

Radiant heaters are widely used to provide space heating for warehouses, retail sheds, sports centres, factories, and other buildings containing similarly large spaces. Radiant heaters contain a gas or oil fired burner that is used to heat a tube, cone or plaque that emits infrared radiation when hot. This infrared radiation is focussed and directed downwards by reflectors within the product.

Radiant heaters are available in a range of different types and efficiencies. The ECA Scheme encourages the purchase of higher efficiency radiant heaters. It also encourages the purchase of optimising controllers that ensure that radiant heating products and systems operate in an energy efficient manner that reflects weather conditions, occupation schedules and user requirements.

The ECA Scheme covers five categories of product:

1. Unitary radiant tube heater units and packages.
2. Multi burner radiant tube heater units and packages.
3. Continuous radiant tube heater units and packages.
4. Radiant plaque and cone heater units and packages.
5. Optimising controllers for radiant heating systems.
   (including both standalone unit and add-on module type products).

Where packages consist of a combination of radiant heater units, and an optimising controller.

Investments in radiant heating equipment 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, all products must comply with the relevant requirements set out below:

7. All products incorporating radiant heaters must:
   - Be gas or oil fired.
   - Be designed to be permanently mounted above head height.
   - Be CE marked.

8. All products incorporating radiant tube type heaters must incorporate a reflector (with end caps) that directs the radiated heat downwards.

9. All products that incorporate optimising controllers must:
   - Incorporate a microprocessor based controller that is pre-programmed to:
     a) Automatically control the temperature in one or more zones within a building in an energy efficient manner that reflects predefined zone occupation schedules.
     b) Automatically switch radiant heating equipment on and off in accordance with the predefined occupation schedule for each of the zones being controlled.
   - Incorporate the following automatic control mechanisms:
     a) A frost protection mechanism that monitors internal air temperature, and switches on the radiant heaters to prevent equipment and/or pipework from freezing up.
     b) A building fabric protection mechanism that monitors external or internal temperatures and switches heating on to prevent condensation from occurring.
     c) An anti-tampering mechanism that prevents the product's control strategy from being modified, and the specified automatic control mechanisms from being disabled, except during commissioning, maintenance or testing.
   - Provide facilities that enable building managers to:
     a) Define the normal occupation times for the building and for each zone controlled (in intervals of five minutes or less), for each day of the week, including at least two periods of occupation per day (i.e. at least 14 different occupation period per week).
     b) Define the temperature set-points for each zone to +/- 1 degrees centigrade.
   - Provide facilities that enable building users to "temporarily override" the pre-set times when the radiant heating is scheduled to be switched off within an individual zone.
   - Incorporate, or be packaged with, a black bulb sensor.
   - Conform with the requirements of the EU EMC Directive 89/336/EEC (as amended) or its replacement EU EMC Directive 2004/108/EC, or be CE Marked.

Where:

- A mechanism is defined as "any sequence of pre-defined actions that performs a given function, where an action can be defined in hardware and/or software terms".
- Products that incorporate control strategies that are specifically designed to control other types of equipment (other than warm air or radiant heaters) are not eligible.

Performance criteria

All products that incorporate radiant heaters must have a radiant efficiency, and a net thermal efficiency, when operating at 100% of their maximum continuous rating (MCR) that is greater than or equal to the values set out in Table 1 below.

Table 1 Performance requirements for radiant heating equipment.

	Product category	Radiant efficiency %		Net thermal efficiency %
1.	Unitary radiant tube heater units and packages.	>= 65.0 %	**AND**	>= 87.0 %
2.	Multi burner radiant tube heater units and packages.	>= 62.5 %	**AND**	>= 91.0 %
3.	Continuous radiant tube heater units and packages.	N/A		>= 92.0 %
4.	Radiant plaque and cone heater units and packages.	>= 67.5 %		N/A

">=" means "greater than" and “N/A” means “not applicable”.

For the avoidance of doubt efficiency test data must be presented to 1 decimal place. As an example, a unitary radiant tube heater with a radiant efficiency of 64.9% or a net thermal efficiency of 86.9%, at 100% of its maximum continuous rating (MCR) would be deemed to be a fail.

Required test procedures

The radiant efficiency of the heating units within the product must be determined in accordance with the relevant procedures and test conditions in the following standards:

- BS EN 416-2:2006, “Single burner gas-fired overhead radiant tube heaters for non-domestic use – Part 2: Rational use of energy”.
- BS EN 419-2:2006, “Non-domestic gas-fired overhead luminous radiant heaters – Part 2: Rational use of energy”.

The net thermal efficiency of the product must be determined in accordance with the procedure and test conditions in:

- Section 7.4 of BS EN 1020:2009, “Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, incorporating a fan to assist transportation of combustion air and/or combustion products” (as amended).

The product must be tested with the minimum possible length of flue that is consistent with the product’s design specification, and where the product is supplied in several parts that must be connected together during installation, with the minimum possible interconnecting pipework.

If the test report has not been prepared by an independent body, then evidence must be provided that a representative sample of product test data has been independently verified or cross-checked.

Please note that performance data obtained in accordance with the procedures and standard rating conditions laid down in Section 6.4 of BS EN 1020:1998 will be accepted as an alternative to testing in accordance with section 7.4 of BS EN 1020:2009 until further notice.

4. 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.

Warm Air Heating Equipment

Date added to ETL 2003 (Revised 2015).

1. Definition of Technology

Warm air heating equipment covers products that are specifically designed to provide space heating by using the heat generated by a burner to raise the air temperature in the space(s) being heated, and optimising controllers that ensure warm air heating systems operate in an efficient manner.

2. Technology Description

Warm air heaters are widely used to provide space heating for warehouses, retail sheds, sports centres, factories, and other buildings containing similarly large spaces. Warm air heaters contain a gas or oil fired burner that is used to heat the air in the space directly, or indirectly by means of heat exchanger. A fan is used to distribute the warm air throughout the space(s) being heated.

Warm air heaters are available in a range of different types and efficiencies. The ECA Scheme encourages the purchase of higher efficiency warm air heaters. It also encourages the purchase of optimising controllers that ensure that warm air heating products and systems operate in an energy efficient manner that reflects weather conditions, occupation schedules and user requirements.

The ECA Scheme covers three categories of product:

1. **Indirect fired condensing packaged warm air heater units**
   including on/off, high/low and fully modulating type products.
2. **Indirect fired condensing packaged air heater modules**
   including on/off, high/low and fully modulating type products.
3. **Optimising controllers for warm air heating systems**
   including both standalone unit and add-on module type products.

Investments in warm air heating equipment 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, all products must comply with the relevant requirements set out below:

1. All products incorporating warm air heaters must:
   - Be gas or oil fired (where gas includes biogas and oil includes liquid biofuels).
   - Be designed to be permanently installed in one of the following ways:

a) As a suspended, wall mounted or floor-standing unit.

b) As a heating module within an air handling unit.

- Incorporate a fan to distribute warm air within the heated space, unless they are warm air heating modules that are specifically designed to be installed in an air handling unit.
- Be CE marked.

2. All products that incorporate optimising controllers must:

- Incorporate a microprocessor based controller that is pre-programmed to:

  a) Automatically control the air temperature in one or more zones within a building in an energy efficient manner that reflects predefined zone occupation schedules.

  b) Automatically switch warm air heating equipment on and off in accordance with the predefined occupation schedule for each of the zones being controlled.

- Incorporate the following automatic control mechanisms:

  a) An optimum start mechanism that monitors external and/or internal temperatures, and calculates when the warm air heating equipment need to be switched on in order to just reach pre-set temperatures by the start of the next occupancy period.

  b) A “self-learning” algorithm that automatically monitors the accuracy of the optimum start mechanism and periodically updates the heating curve that the mechanism uses, to reflect changes in building characteristics.

  c) A frost protection mechanism that monitors internal air temperature, and switches on the warm air heaters to prevent equipment and/or pipework from freezing up.

  d) A building fabric protection mechanism that monitors external or internal temperatures and switches heating on to prevent condensation from occurring.

  e) An anti-tampering mechanism that prevents the product’s control strategy from being modified, and the specified automatic control mechanisms from being disabled, except during commissioning, maintenance or testing.

- Provide facilities that enable building managers to:

  a) Define the normal occupation times for the building and for each zone controlled (in intervals of five minutes or less), for each day of the week, including at least two periods of occupation per day (i.e. at least 14 different occupation period per week).

  b) Define the temperature set-points for each zone to +/- 1 degree centigrade.

  c) Define future dates (e.g. holidays) when the warm air heating equipment should be completely switched off, or operated at frost, fabric or equipment protection levels.

- Provide facilities that enable building users to “temporarily override” the pre-set times when the warm air heating is scheduled to be switched off within an individual zone.
- Conform with the requirements of the EU EMC Directive 89/336/EEC (as amended) or its replacement EU EMC Directive 2004/108/EC, or be CE Marked.

Where:

- A mechanism is defined as “any sequence of pre-defined actions that performs a given function, where an action can be defined in hardware and/or software terms”.
- Products that incorporate control strategies that are specifically designed to control other types of equipment (other than warm air or radiant heaters) are not eligible.

Performance criteria

All products must have a net thermal efficiency that is greater than, or equal to, the value set out in Table 1 below at the specified load point, which depends on whether the product is fitted with on/off, high/low, or fully modulating controls.

Table 1 Performance requirements for warm air heating equipment.

	Type of controls	Load point (% of nominal heat input)	Net thermal efficiency %
1.	On/off controls	100%	>= 101.0 %
2.	High/low controls	60%	>= 101.0 %
3.	Fully modulating controls	60%	>= 101.0 %

">=" means "greater than or equal to"

For the avoidance of doubt net thermal efficiency test data must be presented to 1 decimal place. As an example, an indirect fired, condensing, packaged warm air heater unit fitted with on/off controls and a net thermal efficiency of 100.9% at 100% of its nominal rated input would be deemed to be a fail.

Similarly products fitted with fully modulating or high/low controls that cannot reduce their average firing rate to at least 60% of nominal heat input without turning off would be deemed to be a fail.

Required test procedures

The product’s net thermal efficiency must be determined at 100% of nominal heat input in accordance with the methods set out in:

- BS EN 1196:2011, “Domestic and non-domestic gas-fired air heaters. Supplementary requirements for condensing air heaters”. Section 6.8 and Annex A.

In addition, the net thermal efficiency of products fitted with high/low and fully modulating controls must be determined at a low test point between 20% and 30% of nominal heat input (or the product’s minimum heat input where the product is not able to operate down to 30%).

The tests should be carried out under the general test conditions in one of the following standards:

- BS EN 1020:2009, “Non-domestic forced convection gas-fired air heaters for space heating not exceeding a net heat input of 300 kW, incorporating a fan to assist transportation of combustion air or combustion products”.

- BS EN 13842:2004, "Oil fired forced convection air heaters. Stationary and transportable for space heating".
- BS 5991:2006, "Specification for indirect gas fired forced convection air heaters with rated heat inputs greater than 330 kW but not exceeding 2 MW for industrial and commercial space heating. Safety and performance requirements (excluding electrical requirements) (2nd family gases)".
- BS EN 621:2009, "Non-domestic gas-fired forced convection air heaters for space heating not exceeding a net heat input of 300 kW, without a fan to assist transportation of combustion air and/or combustion products"

For products fitted with modulating and hi/low controls, the net thermal efficiency at the 60% load point should be calculated by linear interpolation using the following formula:

$$\eta_{60\%} = \eta_{100\%} - 40^* (\eta_{100\%} - \eta_{low}) / (100 - Q_{low})$$

Where:

- $\eta_{100\%}$ is the net thermal efficiency at 100% nominal heat input.
- η_{low} is the net thermal efficiency at the low test point.
- Q_{low} is the heat input at the low test point (as a percentage of nominal heat input).

If the test report has not been prepared by an independent body, then evidence must be provided that a representative sample of product test data has been independently verified or cross-checked.

4. 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**.

Refrigeration Equipment

Absorption & Other Heat Driven Cooling & Heating Equipment

This category only covers products installed as part of a CHP scheme that has been awarded a certificate from the CHP Quality Assurance (CHPQA) programme. The absorption chiller's useful chilling effect must be driven by heat derived from the CHP plant. The absorption plant is assessed with the CHP plant under CHPQA programme - for further information go to **www.chpqa.com**.

Air Blast Coolers

(Formerly Forced Air Pre-Coolers)
Date added to ETL 2003. (Revised 2013)

1. Definition of Technology

Air blast coolers are products that are specifically designed to cool water or process liquid by means of a heat exchanger, over which air is forced by a fan(s), prior to transfer to a refrigeration system.

2. Technology Description

Air blast coolers (including 'ambient air pre-coolers' and 'dry adiabatic coolers', and commonly known as 'free coolers' and 'hybrid coolers', and previously referred to as 'forced air pre-coolers') normally consist of a finned tube heat exchanger and ~~a~~ cooling fan(s). The cooling fan is used to force air over the heat exchanger and to cool water and other process liquids as they passed through the heat exchanger. Some products also make use of adiabatic cooling for limited periods.

Air blast coolers can be used to reduce the load on refrigeration systems by cooling water and other process liquids, prior to their transfer into the refrigeration system.

The ECA Scheme encourages the purchase of free standing air blast coolers that **either** turn off the cooling fan when the ambient air temperature is high, **or** feature variable speed drives to modulate the cooling fan speed according to cooling demand.

Air blast coolers that are sold as an integrated part of a mechanical chiller are not included in this category, but are covered by the 'Packaged Chillers' sub-technology of the ETL.

Investments in air blast coolers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate a heat exchanger designed to cool water or other process liquids.
- Incorporate a fan(s) which forces air over the heat exchanger.
- Conform with the requirements of the EU Pressure Equipment Directive PED 97/23/EC in respect of its design, manufacture and testing procedures, or be CE Marked.

In addition air blast coolers must incorporate:

Either:

- a series of control valves (or "by-pass mechanism") that re-direct the water or other process liquid around the pre-cooler in response to a control signal, **and** a controller that operates the by-pass mechanism and turns off the cooling fan at times when the ambient air temperature is higher than the water/process liquid inlet temperature.

And/Or:

- a variable speed drive which reduces the duty of the cooling fan as the cooling demand decreases, or as the ambient air temperature decreases

Performance criteria

Eligible products must have:

- A minimum energy efficiency rating (EER) that, at 10K approach temperature difference, is greater than or equal to (>=) 10.0.

Where EER = net cooling capacity (kW) / effective power input (kW).

Required test procedures

The required minimum performance must be demonstrated using Method A or B, as set out in Tables A and B below:

TABLE A METHOD A - DIRECT MEASUREMENT
Product performance must be demonstrated by measuring the cooling capacity and power input in accordance with the test procedure in EN 1048:1998 at 3 test points corresponding to a 10K, 15K and 20K difference in approach temperature. The EER should be determined for each test point. The approach temperature is the difference in temperature between the water into the product and the air onto the product (or ambient temperature).

TABLE B METHOD B - INDIRECT MEASUREMENT
Product performance must be demonstrated by two separate tests conducted on the same product model and in accordance with EN 1048: 1998, using a different set of operating conditions for each test. The product performance and EER at 10K approach temperature difference shall then be determined by extrapolation from the test results.

For both methods A and B, the liquid for the test shall be water. Effective measured power input is the electricity required to run the fan(s) at full speed plus any control equipment. Water pump power

shall not be included. The measurement of air flow will not be required as part of the test. Hybrid coolers must be run dry i.e. without adiabatic cooling.

Representative Testing

Where applications are being made for two or more products that are variants of the same basic design, heat exchanger test data may be submitted for a single representative model, provided that all variants:

- Use air to liquid heat exchangers of the same constructional design.
- Have the same general arrangement of fans and heat exchangers.
- Are constructed from materials with same heat transfer characteristics.
- Have the same (+/- 5%) or better energy efficiency as the representative models.

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.

4. 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.

Air-Cooled Condensing Units

Date added to ETL 2004 (Revised 2016).

1. Definition of Technology

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.

2. Technology Description

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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- 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.

Performance Criteria

Products must 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 below, according to the rated cooling capacity of the product.

Table 1. Performance thresholds for air-cooled condensing units

		Evaporating temperature (Dew Point)	Rated cooling capacity, P_A (kW)	Performance indicator	Threshold
Operating temperature	HT	+5°C	N/A	COP	>= 3.9
	MT	-10°C	$0 < P_A \leq 5$	COP	>= 2.8
			$5 < P_A \leq 20$	SEPR	>= 2.40
			$20 < P_A \leq 50$	SEPR	>= 2.50
			$P_A > 50$	COP	>= 2.8
	LT	-35°C	$0 < P_A \leq 2$	COP	>= 1.6
			$2 < P_A \leq 8$	SEPR	>= 1.55
			$8 < P_A \leq 20$	SEPR	>= 1.60
			$P_A > 20$	COP	>= 1.6

">=" means "greater than or equal to"

COP, where applicable, should be measured at the specified UK rating points shown in Table 2.

Table 2. Testing conditions for COP of air-cooled condensing units at the UK rating points

Temperature Category	Evaporating temperature (Dew Point)	Ambient (condenser air-on) temperature	Compressor suction gas temperature
High temperature units	+5°C	20°C	20°C
Medium temperature units	-10°C	20°C	20°C
Low temperature units	-35°C	20°C	20°C

Where:

- COP = refrigerating capacity / power absorbed.
- Seasonal Energy Performance Ratio = 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 prEN13215:2015 "Condensing units for refrigeration – Rating conditions, tolerances and presentation of manufacturer's performance data".
- Any condenser sub-cooling factored into the refrigerating capacity must be clearly declared, noting that when a liquid receiver is incorporated into the product with no subsequent subcooler, the liquid temperature at the unit outlet should be used to determine capacity.

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 3.8 would be deemed to be a fail.

Required test procedures

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 must be provided and include a statement of achieved performance at the required UK rating point. Data on refrigerating capacity and COP at the 32°C ambient temperature standard reference point specified in EN13215:2000 for air cooled condensing units must also be included in the test report to enable the test results at the UK rating point to be cross-checked against the manufacturers published rating data for the product.

2. For SEPR measurement, a detailed test report must be provided for test point condition A or condition B according to the rating conditions defined in the transitional method published by the European Commission: "Transitional Method for Determination Of The SEPR (Seasonal Energy Performance Ratio) for Air-Cooled Condensing Units".

   In addition, a statement of performance at load conditions A, B, C and D, must 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 must be made available.

3. The refrigerant properties used in the analysis of product / compressor performance must be obtained from one of the following sources:

   - The US National Institute of Standards & Technology (NIST) Standard Reference Database 23 Thermodynamic and Transport Properties of Refrigerants and Refrigerant Mixtures Database: Version 6.0 or later. See http://fluidproperties.nist.gov/ or http://www.nist.gov/.
   - 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 must 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.

Method A to determine COP

Under method A:

- The product's coefficient of performance (COP) at relevant UK rating point (as specified in Table 1) must 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 must be confirmed in the following manner:

  a) Actual product performance should be determined at two test conditions close to the relevant UK rating point specified in Table 1 that comply with the following limits:

     i. Evaporation temperature must be within +/- 1ºC of the UK rating point.

     ii. Ambient temperature must be within +/- 5ºC of the UK rating point, and one point must be above the standard rating condition, and one below it.

     iii. Suction Temperature must be within +/- 1ºC of the UK rating point.

  The following measurements must be made at each test condition with the level of measurement uncertainty specified in Table 2 of BS EN 13771-2: 2007, 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.

  b) The condenser's UA value is determined at each test condition using the verified compressor performance data to establish the heat rejection rate.

  c) 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 UK rating point.

- The test report must 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 UK 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).

Method B to determine COP

Under method B, product performance must be demonstrated by testing the product in accordance with the following standards: *BS EN13771-2: 2007 "Compressor and condensing units for refrigeration. Performance testing and test methods. Part 2: Condensing units"*.

Method C to determine SEPR

Under method C, product performance must be demonstrated by testing the product in accordance with the procedures in *BS EN13771-2: 2007 "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 the transitional method published by the European Commission: "Transitional Method for Determination of The SEPR (Seasonal Energy Performance Ratio) for Air-Cooled Condensing Units".

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

4. 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**.

Automated Permanent Refrigerant Leak Detection Systems

Date added to ETL 2001 (Revised 2016).

1. Definition of Technology

Automated permanent refrigerant leak detection systems are products that are specifically designed to continuously monitor the atmosphere in the vicinity of refrigeration equipment and, in the event of detection of refrigerant, give an alarm.

2. Technology Description

An automated permanent refrigerant leak detection system continuously monitors the atmosphere in the vicinity of refrigeration equipment, and other components or pipework that contain refrigerant. The detection system must be permanently fixed in place at the site of the refrigeration equipment.

The ECA Scheme aims to encourage the purchase of products that give an early warning of refrigerant leaks, to allow their early repair, and thus improve the energy efficiency of the refrigeration system and reduce carbon emissions.

Investments in automated permanent refrigerant leak detectors 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Continuously monitor the refrigeration system for refrigerant leakage.
- Detect the presence of one or more refrigerants (which must be clearly named in the information supporting the application) and raise an audible alarm when a pre-set level of refrigerant is reached.
- Have fittings to allow permanent fixing to the wall or floor.
- Be able to operate in conditions of between 0 to 50ºC and humidities of up to 90%.
- Be CE marked.

Automated permanent refrigerant leak detectors must be calibrated for each refrigerant named in the application. The product must be capable of detecting at least one of the following types of refrigerant: HCFC, HFC, HC, HFO or Carbon Dioxide (CO_2).

Automated permanent leak detection systems dedicated to ammonia detection are not eligible.

Performance criteria

To be eligible, products must:

- Generate an alarm signal when the level of refrigerant in the atmosphere exceeds the relevant threshold set out in Table 1 below, which varies with refrigerant type.
- Have a measurement accuracy of +/- 20 ppm and be able to detect a change of 10 ppm in the level of refrigerant in the atmosphere at refrigerant concentrations up to the relevant alarm threshold in Table 1.

Table 1 – Performance thresholds for automated permanent refrigerant leak detection systems

Refrigerant	**Alarm signal threshold** (parts per million, ppm)
HCFC, HFC, HFO or HC	<=100
CO_2	>=1,500

">=" means "greater than or equal to"
"<=" means "less than or equal to"

Required test procedures

The performance of the equipment must be tested at the concentrations stated in the performance criteria using calibration gases produced using methods that are traceable to national standards.

A calibration report must be supplied that demonstrates the product's sensitivity, accuracy and alarm setting using test gases.

The following test procedures can be used to demonstrate product performance:

- BS EN 14624:2005 "Performances of mobile leak detectors and of room controllers of halogenated refrigerants". (Section 11.2 – Efficiency tests of room controller).
- BS EN 14624:2012 "Performance of portable leak detectors and of room monitors for halogenated refrigerants".
- Gas Detector Selection and Calibration Guide, SIRA, 2005, ISBN 10: 1856092976 ISBN 13: 9781856092975.

Representative Testing

Where applications are being made for two or more products that are constructed using a common set of sensors and electronic modules, then test data may be submitted for a representative selection of models that clearly demonstrate the performance of each type of sensor with each refrigerant, and impact on performance of using different electronic modules.

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.

4. 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**.

Cellar Cooling Equipment

Date added to ETL 2003 (Revised 2016).

1. Definition of Technology

Cellar cooling equipment covers refrigeration products that are specifically designed to maintain, by means of a refrigeration system, an indoor environment at a condition suitable for the storage of chilled beverages below 12°C, and free cooling units that ensure free cooling is utilised when the outside ambient temperature is sufficiently low.

2. Technology Description

Cellar cooling refrigeration equipment is permanently installed and uses the standard refrigeration cycle of evaporation, compression and condensation to cool a cellar or other storage space.

Cellar cooling refrigeration equipment is available in a range of different designs and efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products. It also encourages the purchase of free cooling units that utilise free cooling in order to reduce the energy consumption of the cellar cooling refrigeration equipment when weather conditions are suitable.

The ECA Scheme covers three categories of cellar cooling equipment:

- **Single split systems** with the equipment supplied in two parts (evaporator and condensing unit) to be connected on installation.
- **Dual split systems** with the equipment supplied in three parts (two evaporators and one condensing unit) to be connected on installation.
- **Free cooling units** for cellar cooling.

Investments in cellar cooling equipment 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 must meet minimum eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, cellar cooling refrigeration equipment products must:

- Have a cooling capacity of between 2 kW and 12 kW at the standard rating conditions for ambient air temperature of 32°C and a cellar air temperature of 10°C.
- Consist of two or three factory-built sub-assemblies that are designed to be connected together during installation.
- Conform with the requirements of EU Pressure Equipment Directive PED 97/23/EC.

To be eligible, free cooling unit products must:

- Utilise a fan to draw in ambient air from outdoors to provide free cooling when the ambient temperature is sufficiently below the required indoor temperature.
- Incorporate a fan which meets the minimum energy efficiency requirements for fans driven by motors with an electric input power between 125 W and 10 kW as given in eco-design regulation (EU) No 327/2011.
- Include a damper which is designed to close when the free cooling unit is not in operation in order to prevent air leakage from outdoors into the cooled space.
- Incorporate an automatic control system which controls both the free cooling unit and cellar cooling equipment as follows:
  - The free cooling unit is in operating mode when the outside ambient temperature is below a set temperature.
  - Air is circulated within the cooled space by using one or two fans of the cellar cooling unit evaporator when the free cooling unit is in operating mode, the remaining one or more evaporator fans being switched off.
  - The free cooling unit fan starts and draws ambient air into the cooled space when the temperature rises to a given setpoint and the outside ambient temperature is below the set temperature.
  - When the temperature of the cooled space reduces to the setpoint temperature minus the set temperature differential, the free cooling unit fan switches off.
  - If the outside temperature rises above the set temperature, the free air cooling system goes into standby mode and the cellar cooling equipment resumes normal operation.
- Be CE Marked.

Performance Criteria

Cellar cooling refrigeration products must have a coefficient of performance (COP) equal to or greater than the figures shown in Table 1 below.

Table 1 Performance thresholds for cellar cooling equipment

Product category	COP
Single split systems	>= 3.30
Dual split systems	>= 3.30

">=" means "greater than or equal to"

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, a COP of 3.29 would be deemed to be a fail.

Required test procedures

Testing must be carried out in accordance with:

- BSI Publicly Available Specification PAS 57:2003 "Cellar cooling equipment – Procedure for determining performance and calculating energy efficiency".

With following amendments:

Section 6.2 "Cooling capacity measurement"

- The test period shall be at least 1 hour and at the end of the test period, the temperature of the thermal mass must be at or below the temperature that it was at when the test period started.

Section 6.3 "System energy consumption measurement":

- System energy measurement conditions - room B temperature at 10 °C ± 2 °C.
- Steady state conditions:
  - b) air on to the evaporator is maintained within the band 8 °C to 12 °C.
  - d) the thermal mass is maintained at a temperature of 10 °C ± 0.5 °C.
- The temperature in test room B for the system efficiency test shall be 10 °C ± 2 °C, with the average temperature during the test period being 10 °C ± 0.5 °C.
- The test period shall be at least 2 hours and must end at the same point in the temperature control cycle for room B that the test started at.
- At the end of the test period, the temperature of the thermal mass must be at or below the temperature that it was at when the test period started.

Section 6.4 "Conditions to be recorded":

- Section 6.4.2 "Temperature (°C), accuracy ± 0.3 °C of the:"
  - Add m) thermal mass at two locations (the closest location to, and furthest location from, the air off the evaporator).

Test reports must be submitted and contain a statement of achieved performance at the required rating points and the information specified in section 8 of PAS 57:2003.

The following additional information shall be included in the test report:

- A copy of data recorded for both the capacity and energy consumption tests.
- Thermal mass - type, temperature and quantity. Number and type of containers used.
- Photograph(s) of the interior of Room B clearly showing the position of the evaporator(s) and the thermal mass.
- Room A & B dimensions, insulation type and U value.

If the test report has not been prepared by an independent body, then evidence must be provided that a representative sample of product test data has been independently verified or cross-checked.

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.
- 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.
- Have the same number of evaporators.
- Fit within the same product category (e.g. are all split systems).

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

4. 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**.

Curtains, Blinds, Doors and Covers for Refrigerated Display Cabinets

Date added to ETL 2001 (Revised 2015).

1. Definition of Technology

Curtains, blinds, doors and covers (for refrigerated display cabinets) are products that are specifically designed to reduce the infiltration of ambient air into a refrigerated display cabinet.

2. Technology Description

Curtains, blinds, doors and covers are barriers that can be used to reduce the infiltration of ambient air (and heat flow) into refrigerated display cabinets, thereby reducing the energy consumption of the cabinet.

The ECA Scheme covers six categories of products:

1. **Strip curtains** that consist of transparent, flexible strips hung adjacent to each other, and fastened at both ends to neighbouring strips, in a manner that allows temporary openings to be made in the curtain for the purpose of removing items from the cabinet.
2. **Blinds** that consist of a flexible fabric mounted on a roller mechanism that enables the blind to be deployed across the display window of the cabinet when the retail outlet is closed or during trading. The blind may also incorporate a motorised control system.
3. **Transparent chest freezer covers** (or 'bubble lids') that consist of a rigid transparent material that fits across the display window of the cabinet, and incorporates access holes that enable items to be removed from the cabinet without removing the cover.
4. **Transparent sliding doors** that consist of doors with a heat reflective coating, mounted in a mechanism (that is designed to be installed in the window of the cabinet) that enables the doors to be opened when items need to be removed from the cabinet.
5. **Transparent hinged doors** that consist of doors with a heat reflective coating, mounted in a mechanism (that is designed to be installed in the window of the cabinet) that enables the doors to be opened when items need to be removed from the cabinet.
6. **Enhanced air flow management equipment** designed to enhance the descending air curtain at the front of an open refrigerated display cabinet in order to reduce the infiltration of ambient air. This equipment comprises modifications or attachments to the shelves of the cabinet.

Investments in curtains, blinds, doors and covers for refrigerated display cabinets 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be of fixed design and dimensions with a unique product code.

In addition, products in categories 1, 2, 3, 4 and 5 must:

- Provide a flexible or rigid barrier that can be used to reduce the infiltration of ambient air (and heat flow) through the open display window of a refrigerated display cabinet.
- Be designed to fit one or more specific types or models of refrigerated display cabinet in a manner that ensures that when fitted there is no air gap around the edges of the product's rigid barriers, and an air gap of less than 20mm around the edges of the product's flexible barriers.

Products in category 6 must:

- Be a physical device designed to modify or be permanently attached to the shelving of one or more specific types or models of refrigerated display cabinet.
- Be designed to guide the air flow(s) more closely down the entire front of a refrigerated display cabinet in order to reduce the infiltration of ambient air.

Equipment that contains integrated lighting equipment is eligible as long as the lighting equipment also meets the relevant ETL criteria for high efficiency lighting units or white light emitting diode lighting units as appropriate.

4. 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.

Evaporative Condensers

Date added to ETL 2001 (Revised 2016).

1. Definition of Technology

Evaporative Condensers are specifically designed to cool and condense high-pressure refrigerant vapour by means of a heat exchanger that has a wetted external surface across which air is blown by a fan.

2. Technology Description

Evaporative condensers allow refrigeration systems to operate with lower head pressures and higher efficiencies than can be achieved using air-cooled condensers or water-cooled condensers. They use evaporative cooling to remove heat from the refrigerant vapour.

Evaporative condensers are generally used in larger refrigeration systems and the ECA Scheme aims to encourage their purchase as an alternative to lower efficiency solutions.

Investments in evaporative condensers can only qualify for Enhanced Capital Allowances if the product is named on the Energy Technology Product List. To be eligible for inclusion on the Energy Technology Product List, products must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate:
  a) A heat exchanger that is designed to cool and condense refrigerant vapour.
  b) A fan that blows air over the heat exchanger.
  c) A mechanism that wets the external surface of the heat exchanger that includes a water pump and a water storage tank.
  d) A blow down facility for the water storage tank to enable total dissolved solids content of the water in the storage tank to be controlled.

- Conform with the requirements of the EU Pressure Equipment Directive PED 97/23/EC or EU Directive 2014/68/EU in respect of its design, manufacture and testing procedures, or be CE marked.

In addition, where products incorporate an automatic blow down control system, they must also incorporate a means of measuring total dissolved solids content of the water in the storage tank.

4. 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**.

Packaged Chillers (tested for seasonal performance to ESEER)

Date added to ETL 2014 (revised 2016)

1. Definition of Technology

Packaged chillers cover products that are specifically designed to cool liquids by means of a refrigeration system that is packaged within a single factory assembled unit. Optionally products also may be designed to heat liquids.

2. Technology Description

Packaged chillers generate chilled water that can be used to provide space cooling in summer in large air-conditioned buildings. They can also be used to generate chilled water or other fluids for industrial process cooling. Reverse cycle packaged chillers are able to heat fluids and can be used to provide space heating in winter, or for industrial process heating. Some air cooled packaged chillers also incorporate free cooling mechanisms that can be used to reduce the amount of electricity needed by the product to provide cooling at lower ambient temperatures.

Packaged chillers are available in a wide range of different designs and efficiencies. The ECA Scheme aims to encourage the purchase of the higher efficiency products.

The ECA Scheme covers four categories of products:

1. Air-cooled packaged chillers that provide cooling only and have a cooling capacity that is less than or equal to 1,500kW.

2. Air-cooled, reverse cycle, packaged chillers that provide both heating and cooling and have a cooling capacity that is less than or equal to 750kW.

3. Water-cooled packaged chillers that provide cooling only and have a cooling capacity that is less than or equal to 2,000kW.

4. Water-cooled, reverse cycle, packaged chillers that provide both heating and cooling and have a cooling capacity that is less than or equal to 2,000kW.

Investments in packaged chillers 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Incorporate the following items of equipment:
  a) One or more electrically powered compressors.
  b) One or more air-cooled or water-cooled condensers.
  c) One or more evaporators.
  d) A control system that ensures the safe, reliable and efficient operation of the product.
- Be CE Marked.

Where the product incorporates an integral free-cooling mechanism, it must be:

- Fully integrated into the packaged chiller unit during product manufacturing.
- Directly controlled by the product's control system in a manner that maximises the use of free cooling for outside air, dry bulb temperatures between 2.0 and 15.0°C.
- Able to provide a cooling capacity at an outside air, dry bulb temperature of 2.0°C and an outlet water temperature of 7.0°C that is at least (=>) 50% of the cooling capacity obtained at the standard rating condition specified in Table 3 below.

Performance Criteria

Products must have a cooling European seasonal energy efficiency rating (ESEER) that is equal to or greater than the values set out in Table 1, which vary with product category. In addition, reverse cycle products must have a coefficient of performance (COP) equal to or greater than the values set out in Table 1.

Table 1 Performance thresholds for packaged chillers at standard rating conditions.

Product Category			Cooling Capacity (kW)	Performance thresholds	
				Cooling ESEER	Heating COP
1.	Air-cooled packaged chillers that provide cooling only.	**without** integral free cooling mechanism.	<= 100kW	>= 4.20	
			101 to 500 kW	>= 4.20	
			501 to 750 kW	>= 4.30	
			751 to 1,500 kW	>= 4.20	
		with integral free cooling mechanism.	<= 100kW	>= 4.10	
			101 to 500 kW	>= 4.10	
			501 to 750 kW	>= 4.20	
			751 to 1,500 kW	>= 4.10	
2.	Air-cooled, reverse cycle, packaged chillers that provide heating and cooling.		<= 100kW	>= 4.10	>= 2.90
			101 to 500 kW	>= 4.10	>= 2.90
			501 to 750 kW	>= 4.10	>= 2.90
3.	Water-cooled packaged chillers that provide cooling only.		<= 100kW	>= 5.80	
			101 to 500 kW	>= 5.80	
			501 to 750 kW	>= 6.00	
			751 to 2,000 kW	>= 6.40	
4.	Water-cooled, reverse cycle, packaged chillers that provide heating and cooling.		<= 100kW	>= 5.40	>= 4.10
			101 to 500 kW	>= 5.60	>= 4.30
			501 to 750 kW	>= 6.20	>= 4.70
			751 to 2,000 kW	>= 6.60	>= 4.70

">=" means "greater than or equal to"

Where:

- ESEER = European Seasonal Energy Efficiency Ratio, a weighted formula which takes into account the variation of EER with loading and varying air or water inlet condenser temperature. ESEER is calculated as:

$$ESEER = A \times EER_{100\%} + B \times EER_{75\%} + C \times EER_{50\%} + D \times EER_{25\%}$$

where $EER_{x\%}$ is the Energy Efficiency Ratio (EER) at load x% and the weighting coefficients A-D are as shown in Table 2.

Table 2 Weighting coefficients A to D for calculation of ESEER

Load Rate (%)	100	75	50	25
Weighting Coefficients	A = 0.03	B = 0.33	C = 0.41	D = 0.23

- EER = net cooling capacity (kW) / effective power input (kW) in cooling mode.
- COP = net heating capacity (kW) / effective power input (kW) in heating mode.
- The standard rating conditions for packaged chillers are defined in Table 3 below.

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, a water-cooled, reverse cycle, packaged chiller with a refrigeration capacity of 100kW, and a cooling ESEER of 5.39, **or** a heating COP of 3.89, would be deemed to be a fail.

Required test procedures

All products must be tested to determine product performance in laboratory conditions in accordance with the procedures set out in:

- BS EN 14511: 2013, "Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling".

The product's cooling capacity (kW), EER ($EER_{100\%}$) and COP must be determined at the standard rating conditions set out in Table 3 below, which vary by product category.

Table 3 Standard rating conditions for Packaged Chillers

Product category		**Cooling EER AND Cooling capacity (kW)**	**Heating COP**
1.	Air-cooled packaged chillers that provide cooling only.	BS EN 14511-2: 2013 Table 16, Standard rating conditions, Water (for medium temperature applications)	
2.	Air-cooled, reverse cycle, packaged chillers that provide heating and cooling.	BS EN 14511-2: 2013 Table 16, Standard rating conditions, Water (for medium temperature applications)	BS EN 14511-2: 2013 Table 13, Standard rating conditions, Outdoor air.
3.	Water-cooled packaged chillers that provide cooling only.	BS EN 14511-2: 2013 Table 11, Standard rating conditions, Water to water (for medium temperature cooling applications) from cooling tower	
4.	Water-cooled, reverse cycle, packaged chillers that provide heating and cooling.	BS EN 14511-2: 2013 Table 11, Standard rating conditions, Water to water (for medium temperature cooling applications) from cooling tower	BS EN 14511-2: 2013 Table 8, Standard rating conditions, Water

The product's cooling capacity (kW) and EER at part load must be determined at the part load conditions shown in Table 4 below and in accordance with the procedures detailed in:

- BS EN 14825:2013 "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 4 Part Load Conditions for Packaged Chillers

Product category	Cooling EER and cooling capacity (kW) at part load
Air-cooled packaged chillers	BS EN 14825:2013 Table 4, Part ratios B, C and D, fan coil application, fixed outlet
Water-cooled packaged chillers	BS EN 14825:2013 Table 5, Part ratios B, C and D, cooling tower application

Test results may be submitted in summary form provided that:

- Sufficient data is included to confirm that the cooling capacity (kW), EER and COP of each product was determined in accordance with the test procedures in BS EN 14511: 2013 and determined at, or corrected to, the standard rating conditions outlined in Table 3 and the part load conditions outlined in Table 4.
- At least two detailed test reports are submitted for each range of products. The data that must be recorded in a detailed test report for the test at standard rating conditions is defined in Table 6 of BS EN 14511: 2013. The test report must include details of the data recording period and duration of performance measurement.
- Detailed test reports have been prepared for each product tested and are available on request for inspection, where not submitted with the application.

If the test report has not been prepared by an independent body, then evidence must be provided that a representative sample of product test data has been independently verified or cross-checked.

Please note that performance data obtained in accordance with the procedures and standard rating conditions laid down in BS EN 14511:2011 will be accepted as an alternative to testing in accordance with BS EN 14511:2013 until further notice.

Calculation of ESEER

The ESEER must be calculated using the following equation:

$$ESEER = A \times EER_{100\%} + B \times EER_{75\%} + C \times EER_{50\%} + D \times EER_{25\%}$$

where $EER_{x\%}$ is the Energy Efficiency Ratio (EER) at load x% and the weighting coefficients (A, B, C and D) are as shown in Table 2.

The values for $EER_{75\%}$, $EER_{50\%}$ and $EER_{25\%}$ should be calculated from the measured part load performance figures using the method described in BS EN 14825:2013.

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.
- 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.
- Fit within the same product category (e.g. are all water cooled packaged chillers).

The representative models must 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 must be predicted using a validated mathematical model. As a minimum, at least two models must be tested in each range of products.

For Air-cooled packaged chillers that provide cooling only, test data for representative models that incorporate free cooling can only be used to represent variants of similar design that incorporate free cooling. Test data for representative models that do not incorporate free cooling can only be used to represent variants of similar design that do not incorporate free cooling.
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.

4. 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**.

Professional Refrigerated Storage Cabinets

(Formerly Commercial Service Cabinets)
Date added to ETL 2003 (Revised 2016).

1. Definition of Technology

Professional refrigerated storage cabinets are products that are specifically designed to store, but not to display, chilled and frozen foodstuffs.

2. Technology Description

Professional refrigerated storage cabinets are widely used in the catering industry to store frozen or chilled foodstuffs (including super-chilled or partly-frozen foodstuffs), but a door, lid or drawer must be opened to view or access the contents of the cabinet.

Professional refrigerated storage cabinets are available in a range of different designs and efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers three categories of product:

- Single door (vertical) professional refrigerated storage cabinets
- Double door (vertical) professional refrigerated storage cabinets
- Under counter and counter (counter type) professional refrigerated storage cabinets with solid doors or drawers.

Investments in professional refrigerated storage cabinets 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 must meet the eligibility criteria as set out below. The ECA Scheme aims to encourage the purchase of higher efficiency products.

3. Eligibility Criteria

To be eligible, products must:

- Be designed to store chilled or frozen foodstuffs, whilst maintaining them within prescribed temperature limits.
- Be fitted with solid-faced lids, drawers or doors that:

    a) Are normally kept closed, but can be opened to access the contents.
    b) Obscure the contents of the cabinet from view when closed.
    c) Enable users to access the contents of any part of the interior without stepping into the refrigerated space.

- Be a ‘plug in’ type cabinet with an integral refrigeration system (i.e. incorporating a compressor and condensing unit).
- Have a gross internal volume equal to that specified in Table 1; where the gross internal volume is as defined as the volume within the inside walls of the cabinet or of a compartment without internal fittings, with any doors being closed.
- Be CE marked.

Performance Criteria

Products must have an Energy Efficiency Index (EEI) that is less than, or equal to, the thresholds set out in Table 1 below, which depend on the type of cabinet and temperature classification.

Table 1 Performance thresholds for professional refrigerated storage cabinets

		EEI (ratio) performance threshold	
Type	Gross internal volume (litres)	Chilled (M1)	Frozen (L1)
Single door professional refrigerated storage cabinets (vertical)	400 to 600 (±15%)	<= 77.0	<= 69.0
Double door professional refrigerated storage cabinets (vertical)	1,300 (±15%)	<= 82.0	<= 93.0
Under counter and counter professional refrigerated storage cabinets with solid doors or drawers (counter)	80 to 800 (±15%)	<= 40.0	<= 78.0

"<=" means "less than or equal to"

Where the Energy Efficiency Index (EEI) is defined as the ratio between AEC (Annual Energy Consumption of the cabinet in kWh/year) and SAEC (Standard Annual Energy Consumption of the cabinet in kWh/year), as per the formula shown below:

$$EEI = \frac{AEC}{SAEC} \times 100 = \frac{E24h \times 365}{(M \times Vn + N)} \times 100$$

Where:

E24h = the energy consumption of the cabinet over 24 hours, as defined in prEN 16825:2015 (measured in kWh)

Vn= net volume of the appliance, which is the sum of net volumes of all compartments of the cabinets (measured in litres)

Net volume is as defined in Section 6.1 of prEN 16825:2015. The net volume should be calculated as follows: the usable shelf area that food can be loaded onto, multiplied by the usable height into which food can be loaded minus an allowance for the height of the shelves, minus any other protrusions into the usable space.

M and N are scaling coefficients with values defined in the table below:

Climate class 4 (30°C 55%RH)	**Value for M**	**Value for N**
Vertical chilled (single or double door)	1.643	609
Vertical frozen (single or double door)	4.928	1,472
Counter chilled	2.555	1,790
Counter frozen	5.840	2,380

For the avoidance of doubt test data should be presented to 1 decimal place. As an example, a frozen, single door vertical professional refrigerated storage cabinet with an EEI of 69.1 would be deemed to be a fail.

Required test procedures

Cabinets must be tested in a test room conforming to prEN 16825:2015.

Cabinets must be able to conform to the following temperature classifications when tested to prEN 16825:2015 in climate class 4 (30°C, 55% RH):

- For chilled cabinets: M1 (all measurement packs must be between –1 and 5°C).
- For frozen cabinets: L1 (the highest temperature of the warmest measurement pack must be less than or equal to –15°C and the lowest temperature of the warmest measurement pack must be less than or equal to –18°C).

Cabinets must be tested according to the requirements for "Commercial Service Refrigerated Cabinets and Counters intended for use in commercial kitchens" in prEN 16825:2015 with the following test conditions:

- **Loading**: as described in prEN 16825:2015. For cabinets with shelves, the minimum number of shelves to be used is calculated by dividing by 300mm the vertical distance from the surface of the lowest shelf or loadable surface to the load limit line. The number of shelves resulting shall be rounded to the nearest lowest integer, with a minimum of one shelf to be used. The lowest height shelf should be located at the lowest available height fitting.
- **Temperature** test: as described in prEN 16825:2015, specifically section 5.3.4
- **The energy consumption of the cabinet over 24 hours (E24h)** of cabinets fitted with integral condensing units must be measured in accordance with sections 5 and 6 of prEN 16825:2015, and to the accuracy specified in section 5.3.2.7 of prEN 16825:2015.

If the test report has not been prepared by an independent body, then evidence must be provided that a representative sample of product test data has been independently verified or cross-checked.

Equivalent test standards will be accepted as an alternative to testing in accordance with prEN16825:2015 where the resulting performance data can be shown to be equivalent to that obtained under prEN16825:2015.

Representative Testing

Where applications are being made for two or more cabinet models that are variants of the same basic design, test data may be submitted for a single 'representative model'. The rules in Table 2 must be used to select the representative model that should be performance tested.

Table 2 Rules for selecting the representative model for performance testing

Variation between models	Selection rule
Cosmetic differences to the exterior	Any model may be selected to be the representative model.
Heaters (door, trim etc.), fans, defrosts, lighting and other accessories	The model with the greatest energy consumption must be the representative model.
Cabinets with the same refrigeration system components but different refrigerants	The model with the greatest energy consumption must be the representative model.
Two or more of the above variations	The rules set out above must be combined when selecting the representative model.

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.

4. 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.

Refrigerated Display Cabinets

Date added to ETL 2004 (Revised 2016).

1. Definition of Technology

Refrigerated display cabinets are products that are specifically designed to store and display chilled and/or frozen foodstuffs.

2. Technology Description

Refrigerated display cabinets are used to maintain foodstuffs and drinks at chilled and frozen temperatures. There are many different designs of refrigerated display cabinets, but all enable the

customer to view the foodstuff stored in the cabinet, either through an opening in the cabinet, or through a transparent door or lid.

Refrigerated display cabinets are available in a range of different designs and efficiencies. The ECA Scheme aims to encourage the purchase of higher efficiency products.

The ECA Scheme covers two categories of products:

- 'Plug in'/ integral refrigerated display cabinets with integral refrigeration systems (i.e. incorporating a compressor and condensing unit).
- 'Remote' refrigerated display cabinets that are designed to work with a non-integral refrigeration system (i.e. where the compressor and condenser, or all or parts of the refrigeration system are located at a different location from the cabinet).

Investments in refrigerated display cabinets 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be designed to display chilled and/or frozen foodstuffs, whilst maintaining them within prescribed temperature limits.
- Conform to one of the temperature classifications in Table 1 when tested to BS EN ISO 23953-2:2005+A1:2012 in climate class III (25°C, 60% RH).
- Be classified in accordance with the precise 5 digit classification system set out in Annex A of BS EN ISO 23953-1:2005 +A1:2012.
- Be CE marked.

Table 1 Classification according to temperature

Class	The highest temperature θ_{ah} of the warmest Mpackage equal to or lower than °C	The lowest temperature θ_b of the coldest M-package equal to or higher than °C	The lowest temperature θ_{al} of the warmest M-package equal to or lower than °C
L1	-15	-	-18
L3	-12	-	-15
M0*	+4	-1	-
M1	+5	-1	-
M2	+7	-1	-
H1	+10	+1	-
H2	+10	-1	-

*Note: All classes are as described in BS EN ISO 23953-2:2005+A1:2012, except M0, which is based upon recommendations from the British Refrigeration Association.

Performance Criteria

Products must have an Energy Efficiency Index (EEI) that is less than, or equal to, the threshold shown in Table 2 for the relevant temperature class and type of cabinet.

Table 2 Performance thresholds for refrigerated display cabinets

		EEI performance thresholds (kWh/day/m^2)			
		"Plug in" / integral type		Remote type	
		Geometry/configuration		Geometry/configuration	
		Horizontal	Vertical	Horizontal	Vertical
Temperature Class	L1	<=15.50	<=17.50	<=15.00	<=17.00
	L3	n/a	n/a	<=14.50	<=16.50
	M0	<=8.00	<=10.00	<=7.50	<=9.50
	M1	<=7.50	<=9.50	<=7.00	<=9.00
	M2	<=7.00	<=9.00	<=6.50	<=8.50
	H1	n/a	n/a	<=6.00	<=7.00
	H2	<=7.00	<=8.00	<=6.50	<=7.50

"<=" means "less than or equal to"

Where the Energy Efficiency Index (EEI) is defined as the ratio of the product's Total Energy Consumption (TEC) to Total Display Area (TDA) i.e. EEI = TEC/TDA, and:

- TEC is calculated according to BS EN ISO 23953-2:2005+A1:2012 section 5.3.6.3.4.

- TDA is calculated according to BS EN ISO 23953-2:2005+A1:2012 Annex A.

And where the geometry/configuration of the cabinet refers to the designation under the classification system in BS EN ISO 23953-21:2005+A1:2012 Annex A, as follows:

- Vertical (V) cabinets comprise VC1 to VC~~3~~ 4, VF1,VF2 and VF4, YC1 to YC4, YF1 to YF4, and YM5 to YM8 units
- Horizontal (H) cabinets comprise HC1 to HC8 and HF1 to HF7 units

For the avoidance of doubt M-package temperatures should be rounded to the nearest integer value (where 0.5 should be rounded up). Other test data should be presented to 2 decimal places. As an example, a vertical remote type M0 cabinet with an EEI performance threshold of 9.51 would be deemed to be a fail.

Required test procedures

All cabinets must be tested in a test room conforming to BS EN ISO 23953-2:2005+A1:2012.

During testing the cabinet shall comply with the conditions defined in BS EN ISO 23953-2:2005+A1:2012 with the following specifications:

- Section 5.3.2.7.1 – Lighting – section (b).
- Section 5.3.2.7.2 – Night covers - Test data must not include results from testing with night blinds.
- Section 5.3.6 - Heat extraction rate measurement when condensing unit is remote from cabinet shall be calculated according to section 5.3.6.3.1, section (b) and 5.3.6.3.2 method $Ø_{24\text{-deft}}$.

The test report must be prepared in accordance with specification in BS EN ISO 23953-2:2005+A1:2012.

If the test report has not been prepared by an independent body, then evidence must be provided that a representative sample of product test data has been independently verified or crosschecked.

Please note that performance data obtained in accordance with the procedures and standard rating conditions laid down in BS EN ISO 23953-2:2005 will be accepted as an alternative to testing in accordance with BS EN ISO 23953-2:2005+A1:2012 until further notice.

Representative Testing

Where applications are being made for two or more cabinet models that are variants of the same basic design, test data may be submitted for a single 'representative model' provided that have same precise 5 digit classification according to Annex A of BS EN ISO 23953-1:2005 +A1:2012. The rules in Table 3 must be used to select the representative model that should be performance tested.

Table 3 Rules for selecting the representative model for performance testing

Variation between models	Selection rule
Cosmetic differences to the exterior	Any model may be selected to be the representative model.
Heaters (door, trim etc.), fans, defrosts, lighting and other accessories	The model with the greatest direct electrical energy consumption (DEC) must be the representative model.
Temperature level	The model with the lowest temperature setting must be the representative model.
Length	The representative model must have a length of between 2.25 and 2.80 metres. This length of model can only be used to represent models between 1.80 m and 5.00m in length; and separate data must be submitted for each model outside of these limits.
Type of doors	Where some variants have sliding doors and some have hinged doors, the representative model should be equipped with hinged doors.
Cabinet depth	The model with the greatest cabinet depth must be the representative model.
Shelves	The model with the lowest number of shelves must be the representative model.
Front-opening height (throat):	The model with the largest front-opening height (throat) must be the representative model.
Two or more of the above variations	The rules set out above must be combined when selecting the representative model

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.

4. 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**.

Refrigeration Compressors

Date added to ETL 2002 (Revised 2016).

1. Definition of Technology

Refrigeration compressors are products that are specifically designed to raise the pressure, temperature and energy level of a refrigerant vapour by mechanical means as part of a "vapour-compression, economised vapour compression or transcritical CO_2 refrigeration cycle.

Economiser packages consist of a refrigeration compressor, an expansion device, and an economiser that is capable of increasing refrigerant sub-cooling and refrigeration cycle efficiency.

2. Technology Description

Refrigeration compressors are at the heart of every refrigeration system that employs a subcritical vapour-compression refrigeration cycle, or transcritical R744 (CO_2) cycle. They range in size from those used in refrigerated display cabinets used in shops and supermarkets, to those used in large industrial refrigeration systems in breweries.

Refrigeration compressors are available in a range of different designs and efficiencies, and can be manufactured as fully hermetic, semi-hermetic or open products. The ECA Scheme aims to encourage the purchase of the higher efficiency products.

The categories of refrigeration compressor and economiser package covered are:

1. High temperature with HFC or HC refrigerant.
2. Medium temperature with HFC or HC refrigerant
3. Low temperature with HFC or HC refrigerant
4. Medium temperature transcritical/subcritical with R744 refrigerant.
5. Low temperature transcritical/subcritical with R744 refrigerant
6. Low temperature subcritical cascade with R744 refrigerant.

Where:

- These categories are defined in terms of the specific refrigerant type and the product performance at a particular temperature rating point.
- ‘Subcritical cascade’ refers to the first stage of a two stage process using two vapour compression cycles, the first stage with R744 and the second stage with an HFC or other refrigerant.

- ‘Transcritical/subcritical’ refers to single stage products that normally operate in a subcritical mode, but can also operate in transcritical mode as and when conditions demand.
- Products may be submitted under more than one category.

Investments in refrigeration compressors 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Use the refrigerant specified by the product category.
- Be **either** a refrigeration compressor **or** an economiser package.
- Incorporate a positive displacement type, hermetic or semi hermetic compressor (with integral electric motor).
- Be subject to quality assurance procedures that ensure consistency of performance between one production item and any other.

In addition, all low temperature transcritical/subcritical R744 products must include an appropriately matched gas intercooler that is capable of reducing the intermediate gas temperature to the level required for second stage compression.

Products that depend on an external motor for compressor operation (i.e. ‘open’ type compressors) are not eligible.

Performance Criteria

Products must have a coefficient of performance (COP) that is greater than the values shown in Table 1 below at the specified UK rating points.

Table 1 Performance thresholds for refrigeration compressors at the UK rating points

Category	Evaporating temperature (Dew Point)	Condensing temperature (Dew Point)	Compressor suction gas temperature	Liquid sub-cooling	COP threshold
High temperature with HFC or HC refrigerant	+5°C	35°C	20°C	0K	>5.20
Medium Temperature with HFC or HC refrigerant	-10°C	30°C	20°C	0K	>3.50
Low Temperature with HFC or HC refrigerant	-35°C	25°C	20°C	0K	>2.00
Medium temperature transcritical/subcritical with R744 refrigerant	-10°C	15°C	0°C	0K	> 4.20
Low temperature transcritical/subcritical with R744 refrigerant	-35°C	15°C	-25°C	0K	> 1.80
Low Temperature Subcritical with R744	-35°C	-5°C	-25°C	0K	> 3.20

">" means "greater than"

Where COP must be calculated in the manner specified in BS EN12900:2013 “Refrigerant compressors – Rating conditions, tolerances and presentation of manufacturer’s performance data”.

For economiser packages, zero subcooling refers to the liquid condition at the condenser exit.

For the avoidance of doubt test data should be presented to 2 decimal places. As an example, a product in the high temperature category with a COP of 5.20 would be deemed to be a fail.

Required test procedures

All products must be tested in accordance with one of the following standards:

- BS EN13771-1:2003 “Compressor and condensing units for refrigeration. Performance testing and test methods. Part 1: Refrigerant compressors”.
- ANSI/ASHRAE Standard 23-2005 “Methods of Testing for Rating Positive Displacement Refrigerant Compressors and Condensing Units”.

The refrigerant properties used in the analysis of compressor performance must be obtained from one of the following sources:

- The US National Institute of Standards & Technology (NIST) Standard Reference Database 23 Thermodynamic and Transport Properties of Refrigerants and Refrigerant Mixtures Database: Version 6.0 or later. See http://fluidproperties.nist.gov/or http://www.nist.gov/.
- 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/).

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.

Where necessary some liquid sub-cooling may be used during testing to ensure the correct operation of the test apparatus, provided the results are corrected back to a liquid sub-cooling of 0 K.

The product's performance at the specified UK rating point may be calculated by interpolation of performance data obtained in accordance with the specified test standards at a minimum of three rating points commonly used to independently verify compressor performance characteristics within the industry. The calculated performance must be adjusted to take account for uncertainties in the measurements and interpolation method in line with industry best practice.

A test report must be submitted in accordance with the formats specified in EN13771-1:2003. This must include a statement of measured or calculated performance at the required UK rating point. For products using HFC or HC, data on refrigerating capacity and COP at the appropriate standard rating point specified in BS EN12900:2013 must also be submitted to enable the test results at the UK rating point to be cross-checked against the manufacturers published rating data for the product.

If the test report has not been prepared by an independent body, then evidence must be provided that a representative sample of product test data has been independently verified or cross-checked.

Please note that calculations and rating points defined in BS EN 12900:2005 will be accepted as an alternative to those defined in BS EN 12900:2013 until further notice.

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:

- Are the same compressor type i.e. method of compression (e.g. reciprocating or scroll) and type of enclosure (e.g. hermetic or semi-hermetic) as the representative model.
- Fit within the same product category (e.g. are all high temperature HFC or HC units).

The representative models must be selected by dividing the range of products into groups of models with similar design characteristics using the same refrigerant, and testing a model in the lowest quartile of predicted performance in each group. The performance of each model in the group must be predicted using a validated mathematical model or validated simulation software. Evidence should be provided for both the method and type of validation used. As a minimum, test reports for at least two models in each range of products must be provided..

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.

4. 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.

Refrigeration System Controls

Date added to ETL 2001 (Revised 2016).

1. Definition of Technology

Refrigeration system controls are products that are specifically designed to automatically optimise the operating temperatures, fan speeds and/or pressures within a distributed commercial refrigeration system in a manner that minimises the system's energy consumption, whilst maintaining the spaces or equipment being refrigerated within predefined temperature limits.

2. Technology Description

Refrigeration system controls are used to control the temperatures, pressures and fan speeds within a distributed, commercial refrigeration system, and to automatically adjust the refrigeration system operation to reflect changes in load, weather conditions, and operating requirements.

A wide range of refrigeration system control products is available. The ECA Scheme aims to encourage the purchase of products that automatically optimise the operation of a distributed, commercial refrigeration system and minimise its energy consumption.

The ECA Scheme covers two categories of products:

- **System management units or packages** consisting of one or more control units or modules that are designed to optimise an entire refrigeration system, including the operation of refrigeration compressor(s), evaporator(s) and condenser(s).
- **'Add-on' controllers** that are designed to be used in conjunction with a specific system management unit or package, and enable the operation of additional refrigeration compressors, evaporators and condensers to be optimised.

Investments in refrigeration controls can only qualify for Enhanced Capital Allowances if the product is named on the Energy Technology Product List. To be eligible for inclusion on the Energy Technology Product List, products must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

1. Incorporate a microprocessor based controller that is pre-programmed to automatically control the rate of flow of refrigerant through, and/or operating temperature of, and/or the fan speed of, at least one of the following types of refrigeration equipment:

   a) Evaporators.

   b) Condensers.

   c) Compressors.

2. Be one of the following:

   a) A system management unit or package that:

      - Automatically adjusts system operating set points in a manner that minimises the refrigeration system's energy consumption under different operating loads, weather conditions and surrounding air temperatures.

      - Is pre-programmed to undertake one or more of the following:

        i. Monitor temperatures and/or pressures around the refrigeration system, and automatically initiate defrost cycles, or inhibit (or delay) scheduled defrost cycles, within individual parts of the refrigeration system, as required, to optimise the overall performance of the refrigeration system.

        ii. Monitor refrigeration system energy input (kWh) and generate a visual or audible alarm when system power consumption exceeds a pre-defined limit, or when system efficiency degradation is preventing automatic adjustment.

        iii. Automatically in accordance with a pre-defined weekly time schedule, turn off, or turn down, ancillary power loads around the refrigeration system (such as lighting in display cabinets, trim heaters or fans), or activate night blinds, in order to reduce system energy consumption.

      - Provides facilities that enable system managers to define the default set points, and alarm limits, for each item of refrigeration equipment controlled.

   b) An add-on controller that:

      - Automatically accepts instructions from the system manager to change its operating set points or alarm limits, or to initiate or inhibit a defrost cycle.

      - Automatically transmits data on operating temperatures, pressures, or flow rates to the system manager at intervals not exceeding 1 minute.

      OR:

- For products which solely control the evaporator fan speed, automatically transmit data on the evaporator fan speed to the system manager at intervals not exceeding one minute.

3. Comply with the relevant requirements, as set out in Tables 1 to 4 below, for products that directly control by means of an analogue or digital signal connection:
   a) Evaporators (see Table 1).
   b) Condensers (see Table 2).
   c) Compressors (see Table 3).
   d) Evaporator fan (see Table 4)

4. Incorporate an anti-tampering mechanism that prevents the product's control strategy and configuration settings from being modified, and automatic control from being disabled, except during commissioning, maintenance or testing.
5. Conform to the requirements of the EU EMC Directive 89/336/EEC (as amended) or its replacement EU EMC Directive 2004/108/EC, or be CE Marked.
6. **Not** incorporate any form of variable speed drive (with the exception of evaporator fan speed controllers), fan, pump, heat exchanger or valve, except where incorporated solely for the purposes of cooling electronic circuitry.

Table 1 Control of evaporators
All products that directly control evaporators must: 1. Be designed to directly measure evaporator pressure or temperature by means of a sensor, and automatically adjust the flow of refrigerant through the evaporator to maintain the refrigerated space within pre-defined operating limits. 2. Automatically terminate its defrost cycle when: • The temperature of the evaporator or refrigerated space exceeds a pre-set value. • A maximum defrost time consistent with sensor failure has been exceeded. 3. Provide facilities that enable system managers to define separate temperature set points and alarm limits for each evaporator being controlled. 4. Provide facilities that enable system managers to take the equipment out of service for cleaning or maintenance. 5. Generate an alarm signal when the temperature of the refrigerated space is in danger of straying outside, or has strayed outside, it's pre-defined safe operating limits.

Table 2 Control of condensers
All products that directly control condensers must: 1. Be designed to directly measure condenser pressure or temperature by means of a sensor, and automatically adjust the airflow across the condenser(s) in a manner that maintains condensation at the rate required to maintain the thermal balance of the refrigeration system under different operating loads and weather conditions. 2. Allow the compressor discharge (head) pressure to "float" with ambient temperature down to the minimum safe level for the particular refrigeration system. 3. Provide facilities that enable system managers to define separate temperature set points and alarm limits for each condenser being controlled. 4. Generate an alarm signal when the condensing pressure or temperature is in danger of straying outside, or has strayed outside, the predefined safe limits.

Table 3 Control of compressors
All products that are designed to directly control compressors must: 1. Be able to control the operation of at least two refrigeration compressors. 2. Incorporate automatic control algorithms that monitor rate of change in system suction pressure or refrigerant temperature to prevent compressors from unnecessarily being controlled to load or unload in response to small fluctuations in cooling demand.

Table 4 Evaporator fan speed controllers
All products that are designed to directly optimise the speed of evaporator fans must: 1. Be able to optimise the speed of at least two evaporator fans. 2. Incorporate automatic control algorithms that reduce the speed of the evaporator fans in response to signals from the master controller, for example that the set point has been reached/exceeded, a doorway within the refrigerated space has been opened or a defrost cycle is underway. 3. Not affect the ability of the refrigeration system to achieve the set point and maintain any temperature legally required to refrigerate products contained in the space. 4. Be compatible with ETL compliant system management unit or package type refrigeration system controls

Where:

- Automatic control may be implemented either directly by means of an analogue or digital signal connection, or indirectly by means of another control device or network.
- A mechanism is defined as “any sequence of pre-defined actions that performs a given function, where an action can be defined in hardware and/or software”.
- An algorithm is defined as “a mechanism that is defined in software”.
- The product’s control strategy is the combination of automatic control functions, mechanisms and facilities specified for the particular equipment controlled. In this context, products may be pre-programmed in one of the following ways:

  a) One or more fixed control strategies that are designed to control a specific set of equipment that can be selected during commissioning.

  b) One or more flexible control strategies that can be configured to control different equipment, as part of a clearly defined commissioning procedure.

- ● Products that incorporate control strategies that are designed to control any type of equipment that is not directly related to refrigeration systems are not eligible.

4. 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.

Solar Thermal Systems and Collectors

(formerly Solar Thermal Systems)
Date added to ETL 2002 (Revised 2014).

1. Definition of Technology

Solar thermal systems are products that are specifically designed to capture solar energy and convert it to useful heat for water heating applications.

2. Technology Description

Solar thermal systems are energy saving products that reduce the amount of fossil fuel consumed by conventional water heating plant. They are built around a solar collector that has a dark coloured absorbing surface, which 'traps' solar radiation and converts it into heat. This heat is then transferred to a storage vessel by means of a circulating fluid, or in some instances, the solar collector could be directly connected into the heating circuit.

A solar thermal system either may be assembled by an installer using plumbing components from different suppliers, or a complete system may be purchased in kit form direct from a single manufacturer. To cover these options, the ECA Scheme covers two categories of product:

- Individual solar collectors for use in installer-assembled solar thermal systems.
- Complete, ready to install, fixed configuration, solar thermal systems.

Investments in solar thermal systems 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 must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must either:

- Use collectors that comply with the requirements of BS EN 12975-1:2006 "Thermal solar systems and components. Solar collectors. General requirements"; or
- Be sold as a complete, ready to install, fixed configuration, solar thermal system that complies with the requirements of BS EN 12976-1:2006 "Thermal solar systems and components. Factory made systems. General requirements".

Where a solar thermal system may include the following components:

- One or more solar collectors.
- One or more appropriately sized storage vessels (where required).
- The pipework and valves forming the connection loop between the solar collector(s) and storage vessel(s), including any non-return valves, control valves, pressure relief valves, air bleed valves etc., as required for the effective operation of the product.
- Circulation pumps (where required).
- Any controls or sensors (and their associated power supplies) needed to:

  a) Stop circulation when the yield is low.

b) Ensure compliance with Health & Safety Executive (HSE) requirements.
c) Operate a drain down or a frost protection strategy (where required).

The following items shall not be considered to be part of a solar thermal system unless they are required to deliver the functionality outlined above:

- The pipework from the storage vessel(s) to the point of use.
- Any auxiliary tanks used to provide back-up heating to the solar thermal system.
- Any cold water tanks and associated pipework used to replace the water being consumed at the point of use.
- Any re-enforcement to roof or structure required to mount the solar thermal system.

Performance criteria

The solar collector within the product must:

- Pass the reliability tests detailed in the standards specified in Table 1 below:

Table 1 – Requirements for reliability tests

Product Category	Applicable Standard
Individual solar collectors	BS EN 12975-2:2006 "Thermal Solar Systems and Components – Solar Collectors – Part 2 test methods".
Complete, ready to install, fixed configuration, solar thermal systems	BS EN 12976-2:2006 "Thermal solar systems and components — Factory made systems — Part 2: Test methods".

Required test procedures

All products must be tested in accordance with the procedures and test conditions laid down in the standards specified in the performance criteria above.

4. 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.

Uninterruptible Power Supplies

Date added to ETL 2009 (Revised 2016).

1. Definition of Technology

Uninterruptible power supplies are products that are specifically designed to maintain the continuity and quality of a power supply to electrical appliances or electrically driven equipment. When the mains electricity supply is operating, they charge up an energy storage device, which can be used to provide electrical power for a defined period when the mains electricity supply is interrupted.

2. Technology Description

Uninterruptible power supplies are used to allow electrical equipment to continue operating when the mains power supply is interrupted for a period, or the quality of the power supply deteriorates. They are widely used throughout industry and commerce to maintain the safety critical and business critical systems located in process control stations, computer rooms, data centres and server areas.

Uninterruptible power supplies are available with a wide range of different efficiencies. The ECA Scheme aims to encourage the purchase of products with the highest efficiency.

The ECA Scheme covers two categories of products:

1. **Static uninterruptible power supply units or packages** that use one or more electronic DC to AC converters to generate their output voltage when operating without mains input power.
2. **Rotary uninterruptible power supply units or packages** that use one or more rotating electrical machines (i.e. AC generators) to generate their output voltage when operating without mains input power.

Investments in uninterruptible power supplies can only qualify for Enhanced Capital Allowances if the specific product is named on the Energy Technology Product List, and in order to be eligible for inclusion on the List, products must meet the eligibility criteria as set out below.

3. Eligibility Criteria

To be eligible, products must:

- Be one of the following categories of product:
  - a) A static uninterruptible power supply as defined in BS EN 62040-3:2011 (or IEC 62040-3: 2011).
  - b) A rotary uninterruptible power supply as defined in BS EN 88528-11:2004 (or IEC 88528-11: 2004).
- Include the following components (within the unit or package):
  - a) An electronic control system that controls the operation of the product.
  - b) Voltage inverter and rectifier devices (required for static uninterruptible power supplies, optional for rotary uninterruptible power supplies).

c) One or more energy storage devices (for example: batteries, flywheels, etc.) specified for use with the UPS .

d) One or more power supply filters.

e) A bypass switch (where required)

f) A motor generator set or alternator (for rotary uninterruptible power supplies only).

- Be designed to be connected to, and to provide electrical power backup to, a three-phase electricity supply of nominally fixed frequency and voltage.
- Be CE Marked.

Performance criteria

Eligible products must:

(a) Meet or exceed the minimum efficiencies at full and part load conditions set out in Table 1 below, which depends on the product category.
(b) Have an input power factor that is greater than or equal to (i.e. >=) 0.93 at 25%, 50%, 75% and 100% of rated maximum power output.
(c) Have an input total harmonic distortion (THD) that is less than or equal to (i.e. <=) 5% at 100% of rated maximum power output.

Table 1 Performance thresholds for uninterruptible power supplies

Product Category	**Power range (kVA)**	**% of rated maximum power (i.e. % full load)**			
		25%	**50%**	**75%**	**100%**
Static uninterruptible power supply units or packages	>=10	>=93.0	>=94.5	>=95.0	>=95.0
Rotary uninterruptible power supply units or packages	>=200	>=91.0	>=94.5	>=95.0	>=96.0

"<=" means "less than or equal to"
">" means "greater than"
">=" means "greater than or equal to"

For the avoidance of doubt, test data should be presented to one decimal place. As an example, a rotary uninterruptible power supply product with an efficiency of 94.4% when operating at 50% of its rated maximum power output would be deemed to be a fail.

Required test procedures

Product performance must be tested in accordance with the procedures and standard rating conditions laid down in the following standard:

- Section 6.4.1.6 and Annex J of BS EN 62040-3:2011 (or IEC 62040-3:2011): "Uninterruptible power systems (UPS) – Part 3: Method of specifying the performance and test requirements".

With the following amendments:

- Products must be operated in their least efficient normal operating mode from a standard 230/400 Volt AC (+/-3%), 50Hz electrical power supply.
- The package tested must exclude additional isolation transformers that are not physically incorporated into the uninterruptible power supply unit or package, switchgear, low voltage switchboards, and generation sets.
- Any static bypass switches fitted must be in the 'open' position.

Representative Testing

Where applications are being made for two or more products that are constructed out of a number of identical power supply modules, test data may be submitted for a single 'representative model'.

4. Scope of Claim

An Enhanced Capital Allowance (ECA) can be claimed on the purchase of an ETL listed complete UPS product that includes all of the ETL required components (including one or more energy storage devices).

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.

Waste Heat to Electricity Conversion Equipment

Date added to ETL 2015

1. Definition of Technology

Waste heat to electricity conversion equipment (WHECE) covers products that are specifically designed to convert waste heat to electrical power by means of a closed thermodynamic power cycle that does not involve the internal combustion of fuel.

2. Technology Description

Waste heat to electricity conversion equipment typically captures waste heat from exhaust stacks in manufacturing plants, or other waste heat from industrial processes, and uses it to generate electricity that is used on site.

The ECA scheme covers products that can capture low to medium grade waste heat through an Organic Rankine Cycle (ORC). In ORC units, the captured waste heat is used to heat a working fluid. Vapour is produced, which is used to mechanically drive an electricity generator by means of an expander (e.g. turbine or screw). The low pressure vapour is then condensed (rejecting its heat to a lower temperature heat sink) and pumped back to the higher pressure, to complete the cycle.

The waste heat may be captured directly, by means of an internal or external heat exchanger, or indirectly, by means of a secondary heat recovery system.

Heat rejection to the lower temperature ambient heat sink may be directly to the air using a heat exchanger, or via a secondary cooling medium (e.g. cooling water).

The ECA scheme covers three categories of product:

1. **Remote, secondary-cooling type**
   These products include a complete, closed circuit for the working fluid, contained within the unit. The condensing heat-exchanger is supplied with open connections for a secondary cooling circuit (eg cooling water), for connection on site.
2. **Integral cooling type**
   These products include a complete, closed circuit for the working fluid, contained within the unit. The condenser rejects its heat directly or indirectly to the air, via a heat exchanger (contained within the unit). The heat exchanger may use dry air cooling, evaporative or adiabatic cooling.
3. **Split-circuit type**
   'Split' type products have separate heat collection and rejection units specifically designed to be connected together during installation by pipework to create the closed circuit for the working fluid, forming a single functional unit. The main assembly includes the heat capture heat-exchanger, expander and power generator. The second unit includes the condensing heat-exchanger, for rejection of heat to the air, using dry air cooling, evaporative or adiabatic cooling.

WHECE is available in a range of efficiencies. The ECA Scheme aims to encourage purchase of higher efficiency products, which can realise substantial reductions in carbon emissions when used to reduce the use of electricity from the mains supply.

Investments in WHECE 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 must meet the eligibility criteria as set out below.

ECA's can only be claimed for equipment where the electricity will be used on site, and not where power is generated for sale to or via unspecified third parties.

3. Eligibility Criteria

To be eligible, products must:

- Consist of a factory-built packaged unit or split system (comprising a main assembly and a matched heat-rejection unit, designed for connection together on site).
- Be designed to generate electricity from waste heat with a temperature of less than or equal to (<=) 250 °C.
- Be designed to provide three-phase electricity at 230/400 Volt a.c. at 50Hz.
- Be rated for continuous operation with an electrical power output not exceeding 200 kWe.
- Not incorporate any form of combustion equipment, including boost burners.
- Not use water, ammonia or any water based solution as a working fluid.
- Be designed for, and include fittings for, permanent installation.
- Be CE marked.

Performance criteria
Eligible products must meet or exceed the minimum adjusted net efficiency set out in Table 1, according to the maximum temperature of waste heat that the product is designed to capture:

Table 1 – Adjusted net efficiency thresholds for waste heat to electricity conversion equipment

	Maximum design waste heat temperature (°C)	**<= 125°C**	**> 125°C and <= 250°C**
	Product Category	**Minimum adjusted net efficiency, $\bar{\eta}$**	
1.	Remote, secondary-cooling type	>= 7.0%	>= 12.5%
2.	Integral cooling type	>= 4.6%	>= 10.6%
3.	Split-circuit type	>= 4.6%	>= 10.6%

"<=" means "less than or equal to"
">=" means "greater than or equal to"
“>” means “greater than”

Where:

$$Net\ Efficiency, \eta = \frac{Electrical\ output\ (kW) - Electrical\ input\ (kW)}{Thermal\ input\ (kW)}$$

And adjusted net efficiency $\bar{\eta}$ is defined in Table A below.

The electrical input applies to 100% of the electrical consumption of the product, including any pumps and fans contained within it. However, for remote, secondary-cooling type (category 1) products, the energy use of pumps and fans associated with the secondary cooling circuit should not be included as electrical input, and are not included in the net efficiency calculation.

For the avoidance of doubt, test data should be presented to one decimal place. As an example, a remote, secondary-cooling type product designed to capture waste heat with a temperature of 125°C, with an adjusted net efficiency of 6.9%, would be deemed to be a fail.

Required test procedures

The required minimum performance must be determined using Methods A or B, as set out in Tables A and B below.

Products can either be tested in an accredited laboratory, or performance may be determined from measurements made during field trials or acceptance tests, provided that the measurements have been made by, or witnessed by, an accredited laboratory or contractor that is accredited to make those measurements. The product's adjusted net efficiency must be calculated by an independent body that is competent to verify the measurement data.

TABLE A METHOD A – DIRECT MEASUREMENT

Under this test method, product performance must be demonstrated by calculating the net efficiency (as defined above), from measurements of thermal input, electrical output and electrical input, in the application and at the rated capacity, for which it is designed.

The reference test conditions, which depend on the maximum temperature of waste heat that the product is designed to capture, are set out in Table 2 below.

Table 2 – Reference test conditions

Maximum design waste heat temperature (°C)		**<= 125°C**	**> 125°C and <= 250°C**
		Reference test conditions	
T_1 – inlet temperature of the captured waste heat source		125 °C	250 °C
T_2 – inlet temperature of the heat rejection sink	Remote, secondary-cooling type products (inlet temperature of the secondary coolant)	30 °C	30 °C
	Integral cooling type products (air on temperature, dry bulb)	20 °C	20 °C
	Split-circuit type products (air on temperature, dry bulb)	20 °C	20 °C

At the reference conditions, the adjusted net efficiency, $\bar{\eta}$, is equal to the net efficiency η, as defined above.

Where the application does not make it feasible for tests to be carried out at the conditions above, then alternative inlet temperatures T1 and T2 can be used. In such cases, the adjusted net efficiency, $\bar{\eta}$, should be calculated as defined in Table 3 below.

Table 3 – Adjusted net efficiency for alternative inlet temperatures

Maximum design waste heat temperature (°C)	**<= 125°C**	**> 125°C and <= 250°C**
T_1 (allowable range)	<= 125°C	> 125°C and <= 250°C
Remote, secondary-cooling type products Adjusted net efficiency, $\bar{\eta} =$	$\eta\left(\frac{125-30}{T_1-T_2}\right)\left(\frac{273.15+T_1}{273.15+125}\right)$	$\eta\left(\frac{250-30}{T_1-T_2}\right)\left(\frac{273.15+T_1}{273.15+250}\right)$
Integral cooling and split circuit type products Adjusted net efficiency, $\bar{\eta} =$	$\eta\left(\frac{125-20}{T_1-T_2}\right)\left(\frac{273.15+T_1}{273.15+125}\right)$	$\eta\left(\frac{250-20}{T_1-T_2}\right)\left(\frac{273.15+T_1}{273.15+250}\right)$

Note: T_1 and T_2 above are defined in Table 2 and expressed in degrees Celsius.

The adjusted efficiency, $\bar{\eta}$, must meet or exceed the associated minimum adjusted net efficiency threshold defined in Table 1.

The assessment of thermal input must be done in accordance with the procedures set out in:

- EN 305:1997 "Heat exchangers – Definitions of performance of heat exchangers and the general test procedure for establishing performance of all heat exchangers"; or
- EN 306:1997 "Heat exchangers – Methods of measuring the parameters necessary for establishing the performance"; or
- EN 308:1997 "Heat exchangers – Test procedures for establishing the performance of air to air and flue gas heat recovery devices".

The assessment of electrical output and electrical input must be done in accordance with the relevant procedures set out in:

- BS ISO 8528-6:2005 "Reciprocating internal combustion engine driven alternating current generating sets – Test methods".

TABLE B METHOD B – VALIDATED DESIGN CALCULATIONS
Under this test method, product performance must be demonstrated by calculating net efficiency (as defined above), from design calculations. The accuracy of these calculations must be confirmed by interpolation and extrapolation of measurements obtained from tests (carried out according to Method A above) of at least two units of the same basic design as the product, i.e.: • Use the same working fluid as the product • Use the same thermodynamic cycle • Have the same expander type – i.e. manufacturer, method of expansion (e.g. reciprocating, turbine, or screw) • Use the same heat exchanger types – for both waste heat capture and heat rejection to the ambient heat sink; and any other recuperative heat exchangers • Use the same method of rejecting heat to the ambient heat sink – i.e. water-cooled; or dry or evaporative air-cooled. The product must have a rated maximum electrical output of no more than 20% greater or smaller than one of the tested products. The test report must include (or be accompanied by): a) Details of the methodology and calculations used to determine product performance b) A copy of the published performance data for the product c) Manufacturer's design data for the product d) The following data for the tests carried out according to Method A and for the design conditions of the product: i. Details of the composition, specific heat capacity, inlet and outlet temperatures, and flow-rates of: • The captured waste heat source • The low-temperature heat sink ii. Electricity output and input iii. Calculated net efficiency and adjusted net efficiency e) Details of main components of the tested units and (where these are not identical to the product) calculations demonstrating that their performance can be used to validate that of the product, including: i. Heat exchangers ii. Expander iii. Alternator

4. 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.