The Certification Mark for Onsite
Sustainable Energy Technologies

Microgeneration Certification Scheme: MCS 007

Product Certification Scheme Requirements:
Heat Pumps

Issue 6.0

This Standard has been approved by the Standards Management Group of the Microgeneration Certification Scheme.

This document has been prepared by the MCS Working Group 6 'Heat Pumps'.

REVISION OF MICROGENERATION PRODUCT CERTIFICATION STANDARDS

Microgeneration Product Certification Standards will be revised by issue of revised editions or amendments. Details will be posted on the website at www.microgenerationcertification.org

Technical or other changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

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FOREWORD

The following document contains provisions which, through reference in this text, constitute normative or informative provisions of this document MCS 007. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties applying this document MCS 007 are encouraged to investigate the possibility of applying the most recent editions of the documents referenced.

The following document (MCS 007 Issue 6.0) is a major update to MCS 007 Issue 5.0. It is available for reference from the date of publication (26/11/2018). Manufacturers or importers of microgeneration systems who have certificated a microgeneration product in accordance with MCS 007 may commence working in accordance with this update from 26/05/2019.

1. INTRODUCTION

1.1 This Scheme document identifies the evaluation and assessment requirements and practices for the purposes of certification and listing of heat pumps. These requirements are consistent with the requirements for heat pumps in the relevant Commission Regulations, either, supplementing Directive 2010/30/EU of the European Parliament and of the Council, or, implementing Directive 2009/125/EC of the European Parliament and of the Council. Hereinafter the term 'ErP' is generally used in relation to these directives and regulations.

1.2 Certification and listing of products is based on evidence acceptable to the Certification Body:

- that the product meets the MCS Requirements for heat pumps
- that the manufacturer has staff, processes and systems in place to ensure that the product delivered meets the MCS Requirements for heat pumps

And on:

- periodic audits of the manufacturer including testing as appropriate; and,
- compliance with the contract with the Certification Body for listing and approval including agreement to rectify faults as appropriate.

2. DEFINITIONS

For the purposes of these MCS Requirements for heat pumps and for the MCS Scheme the following definitions are used and are taken from the ErP Directive and EN 14825:2016. This includes definitions for both applications and heat pump types. Unless otherwise stated, the term 'heat pump' used throughout this standard includes low and very high temperature heat pumps.

Term	Definition
Low-temperature application	An application where the heat pump space heater delivers its declared capacity for heating at an indoor heat exchanger outlet temperature of 35 °C.
Intermediate temperature application	An application where the heat pump space heater delivers its declared capacity for heating at an indoor heat exchanger outlet temperature of 45°C.
Medium temperature application	An application where the heat pump space heater or heat pump combination heater delivers its declared capacity for heating at an indoor heat exchanger outlet temperature of 55 °C.
High temperature application	An application where the heat pump space heater or heat pump combination heater delivers its declared capacity for heating at an indoor heat exchanger outlet temperature of 65°C.
Low temperature heat pumps	A heat pump space heater that is 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 design conditions for average climate (88% part load condition for water/brine-to-water units).
Heat pump (excluding low temperature heat pumps)	A “heat pump”, as defined by the Commission Regulation, is one that has been demonstrated to be able to 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 design conditions for average climate (88% part load condition for water/brine-to-water units).
Very high temperature heat pump	A heat pump that has been demonstrated to be able to operate at the ‘high temperature application’ condition, defined above, whilst meeting the requirements of the relevant Commission Regulation.
Heat Pump Space heater	A space heater using ambient heat from an air source, water source or ground source, and/or waste heat for heat generation; a heat pump space heater may be equipped with one or more supplementary heaters using the Joule effect in electric resistance heating elements or the combustion of fossil and/or biomass fuels.

Domestic hot water heat pump	Domestic hot water heat pump means a heat pump using ambient heat from an air source, water source or ground source, and/or waste heat for heat generation that is solely designed to provide heat to deliver hot drinking or sanitary water at given temperature levels, quantities and flow rates during given intervals, and is connected to an external supply of drinking or sanitary water.
Heat Pump Combination heater	A heat pump space heater that is designed to also provide heat to deliver hot drinking or sanitary water at given temperature levels, quantities and flow rates during given intervals, and is connected to an external supply of drinking or sanitary water.
Gas absorption/ adsorption heat pump	A heat pump that uses direct heat energy from the combustion of gas (natural or LPG) to affect the absorption or adsorption of a medium into another which creates a low temperature low pressure side and a high pressure high temperature side. The process may be to reversibly change the chemical composition (Absorption) or merely mechanically combine two chemicals temporarily together (Adsorption).
Solar assisted heat pump	A type of air source heat pump that uses a vapour compression cycle to generate heat from a non-aspirated evaporator which should be located externally in the ambient air and is able to benefit from additional heat from direct solar radiation. These are sometimes referred to as “thermodynamic” panels.

3. SCOPE

The scope of this MCS Product Certification Scheme document is limited to single heat pumps up to 45 kWth output, at 100% load at the low temperature standard rating condition specified in EN14511-2.

Products designed for the extraction of heat from loft spaces are excluded from the scope of this MCS Product Certification Scheme document.

This MCS Product Certification Scheme document for heat pumps provides ongoing independent, third party certification of heat pumps for companies who wish to demonstrate that heat pumps, of the types below, meet and continue to meet:

3.1 Relevant requirements

The relevant requirements are identified below:

Heat Pump Type and application	Type of requirement
Heat pumps, including combination heat pumps, with electrically driven compressors for space heating: • Air source • Exhaust air source • Ground source • Water source	Thermal performance
	Sound characteristics
	Safety
Heat pumps with electrically driven compressors, air/water designed for use with outdoor swimming pools	Thermal performance
	Sound characteristics
	Safety
Heat pump with electrically driven compressors used for domestic hot water only	Thermal performance
	Sound characteristics
	Safety
Solar assisted heat pump with electrically driven compressors used for domestic hot water only	Thermal performance
	Sound characteristics
	Safety
Gas-fired absorption and adsorption heat pumps	Thermal performance
	Sound characteristics
	Safety*

Table 1- Heat Pump Type and application and type of requirement

*Note: * In addition to the requirements of MCS 007, ALL gas fired appliances sold in the UK must comply with the requirements of REGULATION (EU) 2016/426 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 9 March 2016 on appliances burning gaseous fuels*

3.2 The management systems requirements detailed in Clause 5.

3.3 The technical documentation requirements detailed in Clause 7.

3.4 The performance and testing requirements detailed in Clause 8.

4. APPLICATIONS TO JOIN THE SCHEME

4.1 Applications should be made to an accredited Certification Body operating this Scheme, who will provide the appropriate application form and details of the applicable fees.

5. MANAGEMENT SYSTEMS CERTIFICATION

5.1 Manufacturers shall operate a documented manufacturing quality control system, certified in accordance with the requirements of MCS 010 - Factory Production Control Requirements.

6. CERTIFICATION AND APPROVAL

6.1 Certification and approval is based on the following:

a) Evidence of meeting the detailed testing requirements for the relevant product type as set out in Clause 8 and in accordance with the requirements of MCS 011 - Acceptance Criteria for Testing Required for Product Certification;
b) Verification of the establishment and maintenance of the manufacturing company's quality management system in accordance with the Factory Production Control (FPC) requirements set out in MCS 010; and
c) Review of the technical documentation relating to the material or product, confirming that it is generally complete and correct and that it fulfils any specific requirements defined in this standard or in the relevant standards with which compliance is claimed, including any requirements for inclusion of information in instruction documents for the product.

6.2 Product family assessment is accepted in this MCS Product Certification Scheme document. Acceptance is based only on the definitions and testing regimes as set out by either the CEN Heat Pump Keymark Scheme or the Eurovent Certita Scheme, current at the time of assessment. Certification Bodies shall satisfy themselves that the product manufacturer has adequately demonstrated and validated the 'Product family' approach, supplying where required, adequate information on predicted data and subsequent test results.

6.3 A certificate may be awarded following demonstration of satisfactory compliance with the appropriate requirements of the Scheme and this Scheme document, taking into account any limitations imposed by relevant standards and other appropriate guidelines, and satisfactory verification/assessment of the manufacturer's FPC systems and technical documentation.

6.4 Certificates contain the name and address of the manufacturer, model and reference number of the heat pump, a unique certificate reference number, the issue number, and date. In addition, limitations on certification shall also be stated. For example, if a solar assisted heat pump product is tested with a 200 litre tank to qualify under MCS then the certificate shall indicate that it shall only be installed with, or retrofitted to tanks of 200 litres or below.

6.5 Certificates are valid from the date of issue, and are maintained and held in force subject to satisfactory completion of the requirements for maintenance of certification (see item 8), but remain the property of the issuing Certification Body.

6.6 Details of the manufacturer and the certificated product(s) are listed at www.microgenerationcertification.org.

7. TECHNICAL DOCUMENTATION

7.1 Technical documentation for the product must be submitted for review. This documentation shall be presented in English and shall be such that it can be assured that the products submitted for test are equivalent to those that are to be manufactured for normal production.

7.2 The documentation must consist of the following as a minimum:

a) Details of intended use, application and classifications (if any) required;
b) Manufacturing drawings and/or specifications including tolerances, issue and revision numbers;
c) The revision number of the product;
d) Raw material and components specifications;

e) Details of the quality plan applied during manufacture to ensure ongoing compliance;
f) Test / Examination reports in accordance with the relevant standards defined above. Where historical test data, carried out in accordance with this standard, is requested to be considered for the application, full test report and details of any existing approvals

Note: Each application will be dealt with on a case by case basis and further information about the acceptance of previous testing is available on request.

g) Evidence of weather compensation capability;
h) Installation, use and maintenance instructions; and
i) The documentation set out in the pertinent regulation (Commission Regulation (EU) No. 813/2014. Annex II, Section 5; Commission Regulation (EU) No. 814/2014. Annex II, Section 1.6; Commission Regulation (EU) No. 206/2012. Annex I, Section 3).

8. PERFORMANCE AND TESTING CRITERIA

This section sets out the performance requirements, testing methods and other specific requirements for each type of heat pump product recognised by the Scheme.

For all product types, physical testing is required at the conditions indicated either in this document or as defined in the relevant standards identified. Testing of products must be in accordance with the requirements of MCS 011.

Note: Where test conditions are taken from EN 14825:2016 the standard requires the product also to be tested at the relevant full load standard rating condition. This is necessary to determine the value of the fluid flow rate(s) to be used during the part load condition tests.

8.1 Product testing and performance criteria for electrically driven air, exhaust air, ground and water source heat pumps for space heating

8.1.1 For compliance with this Scheme, electrically driven heat pumps for space heating must be optimised for heating.

8.1.2 Space heaters shall meet the requirements of the following:

- Table 2 of MCS 007 for Seasonal Space Heating Energy Efficiency; and
- COMMISSION REGULATION (EU) No 813/2013, Annex II, Section 3, “Requirements for sound power level”.

8.1.3 Combination heaters shall meet the requirements of the following:

- Table 2 of MCS 007 - Seasonal Space Heating Energy Efficiency;
- COMMISSION REGULATION (EU) No 813/2013, Annex II, Clause 2, “Requirements for water heating energy efficiency”; and
- COMMISSION REGULATION (EU) No 813/2013, Annex II, Clause 3, “Requirements for sound power level”.

The Seasonal Space Heating Energy Efficiency (SSHEE) as calculated by MCS SCOP Calculator for Air to Water and Ground / Brine to Water heat pumps (or MCS 026) shall not fall below the values in Table 2 below, for heat pump types defined in Clause 2.

Product Category	SSHEE from 26th September 2017
Heat pump space heaters and heat pump combination heaters, with the exception of low temperature heat pumps	110%
Low temperature Heat Pumps	125%

Table 2- Requirements for Seasonal Space Heating Energy Efficiency

8.1.4 Evidence in accordance with MCS 011 shall be provided of actual testing of products at the relevant test point selected from those defined in Table 3.

Heat Pump Type	Type of test	Test conditions
Air to water	Thermal performance:	EN 14825:2016 Table 8 - Condition A or B for Low temperature heat pumps EN 14825:2016 Table 10 - Condition A or B heat pumps EN 14825:2016 Table 11 - Condition A or B for Very High Temperature Heat Pumps
	Sound characteristic:	EN 14511-1:2018 EN 12102-1:2017
	Safety:	EN 14511-4:2018
Water/brine to water	Thermal performance:	EN 14825:2016 Table 12 - Condition A or B for Low temperature heat pumps EN 14825:2016 Table 14 - Condition A or B heat pumps EN 14825:2016 Table 15 - Condition A or B - Very High Temperature Heat Pumps
	Sound characteristic:	EN 14511-4:2018 EN 12102-1:2017
	Safety:	EN 14511-4:2018
Exhaust Air/Water*	Thermal performance:	EN 14825:2016 Table 8 - Condition A or B for Low temperature heat pumps

		EN 14825:2016 Table 10 - Condition A or B heat pumps EN 14825:2016 Table 11 - Condition A or B for Very High Temperature Heat Pumps
	Sound characteristic:	EN 14511-4:2018 EN 12102-1:2017
	Safety:	EN 14511-4:2018
Air to air	Thermal performance:	EN 14825:2016 Table 6 – Condition A or B
	Sound characteristic:	EN 14511-4:2018 EN 12102-1:2017
	Safety:	EN 14511-4:2018

Table 3 – Test point at which test data must be supplied to MCS 011 requirements

* The performance of exhaust air heat pumps should be tested at the minimum air flow rate specified by the manufacturer. This flow rate shall be clearly defined and visible in the product documentation.

8.2 Product testing and performance criteria for electrically driven air/water heat pumps designed for use with outdoor swimming pools.

8.2.1 The heat pump will operate with water flowing from swimming pool filtration systems and so will require a heat exchanger designed and constructed to resist erosion and chemical corrosion from swimming pool water. Materials commonly used for heat exchangers in contact with swimming pool water include stainless steel, cupro-nickel, and titanium. This heat exchanger may be fitted directly to the heat pump or may be fitted as an additional heat exchanger after a heat exchanger that is not suitable for use with swimming pool water.

8.2.2 The test methodology is that described in EN14511-3:2018. Measurement of the outlet water temperature should be performed as follows:

a) For heat pumps fitted with a heat exchanger suitable for use with swimming pool water, the heat exchanger water outlet temperature should be measured directly.
b) For heat pumps that require an additional heat exchanger after the heat pump heat exchanger, the outlet water temperature to the swimming pool should be measured at the outlet of the additional heat exchanger.

8.2.3 The test conditions for air source heat pumps used to heat swimming pools are as defined below.

Outdoor heat exchanger air inlet dry bulb temperature	15°C
Outdoor heat exchanger air inlet wet bulb temperature	12°C
Swimming pool heat exchanger inlet water temperature	23°C
Swimming pool heat exchanger outlet water temperature	26°C

Table 4 - Test conditions for swimming pool heat pumps

8.2.4 When tested under the above conditions air source heat pumps used for heating swimming pools must achieve a minimum COP of 3.6.

8.3 Product testing and performance criteria for gas absorption and adsorption heat pumps

8.3.1 For compliance with this Scheme, gas absorption and adsorption heat pumps for space heating must be optimized for heating.

8.3.2 Space heaters shall meet the requirements of the following:

- Table 5 – of MCS 007 for Seasonal Space Heating Energy Efficiency
- COMMISSION REGULATION (EU) No 813/2013, Annex II, Clause 3, “Requirements for sound power level”

8.3.3 Combination heaters shall meet the requirements of the following:

- Table 5 – of MCS 007 for Seasonal Space Heating Energy Efficiency
- COMMISSION REGULATION (EU) No 813/2013, Annex II, Clause 2, "Requirements for water heating energy efficiency"
- COMMISSION REGULATION (EU) No 813/2013, Annex II, Clause 3, "Requirements for sound power level"

The Seasonal Space Heating Energy Efficiency (SSHEE) as calculated by MCS SCOP Calculator for Air to Water and Ground / Brine to Water gas absorption and adsorption heat pumps (or MCS 027) shall not fall below the values in Table 5 below:

Product Category	SSHEE from 26th September 2017
Gas absorption and adsorption heat pump space heaters and heat pump combination heaters, with the exception of low temperature heat pumps	110%
Gas absorption and adsorption low temperature heat pumps	125%

Table 5 – Seasonal Space Heating Energy Efficiency values

8.3.4 Evidence in accordance with MCS 011 shall be provided of actual testing of products at one of the following test points:

Heat Pump Type	Type of test	Test conditions
Air to water	Thermal performance:	EN 12309-6:2014 Table 5 - Condition A for Low temperature heat pumps EN 12309-6:2014 Table 11 - Condition A for heat pumps EN 12309-6:2014 Table 14 - Condition A for Very High Temperature Heat Pumps

	Sound characteristic:	EN 12309-4:2014 EN 12102-1:2017
	Safety:	EN 12309-2:2015
Water/brine to water	Thermal performance:	EN 12309-6:2014 Table 17 - Condition A for Low temperature heat pumps EN 12309-6:2014 Table 20 - Condition A for heat pumps EN 12309-6:2014 Table 23 - Condition A for Very High Temperature Heat Pumps
	Sound characteristic:	EN 12309-4:2014 EN 12102-1:2017
	Safety:	EN 12309-2:2015

Table 6 – Test point at which test data must be supplied to MCS 011 requirements

8.4 Product testing and performance criteria for electrically driven heat pumps designed for domestic hot water production only

For compliance with this Scheme electrically driven heat pumps designed for domestic hot water production shall meet the requirements of the following:

- COMMISION REGULATION (EU) No 812/2013 Annex II Energy Class A or above.
- COMMISION REGULATION (EU) No 814/2013 Annex II

EN 16147 specifies a method for testing heat pumps designed for domestic hot water production with either integral or stand-alone water storage tanks. The heat pump and storage tank are considered to be a package and are tested and reported together.

The manufacturer's instructions shall:

- State clearly the size of the storage tank with which the heat pump was tested
- Require that the heat pump shall not be installed with a tank of a greater capacity than which it was tested.

Evidence in accordance with MCS 011 shall be provided of actual testing of products as per the requirements of the following table.

Heat Pump Type	Type of test	Test conditions
Heat pump for domestic hot water production	Thermal performance:	EN 16147:2017
	Sound characteristic:	Annex A
	Safety:	EN 16147:2017

Table 7 – Test conditions for Heat Pump type

8.5 Product testing and performance criteria for electrically driven solar assisted heat pumps designed for domestic hot water production

Solar assisted heap pumps designed for domestic hot water production shall meet the requirements for electrically driven heat pumps designed for domestic hot water production as set out in Clause 8.4 of this standard and the additional requirements outlined below.

8.5.1 Requirements for the external absorbers incorporated in solar assisted heat pumps designed for domestic hot water production are defined in Annex B – Product testing and performance criteria for external absorbers incorporated in solar assisted heat pumps designed for domestic hot water production.

8.5.2 The manufacturer's instructions shall:

- state clearly the number and specification of panel(s) to be used in association with the product

8.5.3 Solar assisted heat pumps shall incorporate and demonstrate a means of preventing ice build-up on the external absorber. They shall be tested under conditions which in the absence of such means, ice build-up would occur.

9. MAINTENANCE OF CERTIFICATION AND LISTING

Certificates and listing are maintained and held in force subject to satisfactory completion of the following requirements for maintenance of certification:

9.1 Factory Audits

9.1.1 Certification is maintained through annual FPC quality system audits in accordance with MCS 010, which shall include a detailed check that the product being manufactured is to the same specification as the product tested.

9.2 Product Audits

9.2.1 Product audits will be conducted as follows:

- Review of the product technical data files including materials;
- Review of end of line tests in accordance with the manufacturer's quality plan; and,
- Repeat testing of elements, in accordance with MCS 011, from the product standard as considered appropriate by the relevant certification body to confirm that the product continues to meet the requirements for certification and listing.

10. CERTIFICATION MARK AND LABELLING

10.1 All certificated products listed under this Scheme shall be marked with a label to confirm that the product has been tested and certificated in accordance with the requirements of this Scheme document. See below for details.

10.2 The manufacturer shall use Certification Mark(s) only in accordance with the Certification Body's instructions.

10.3 An example of a Certification Mark that can be used for this Scheme is as follows:

Certificate Number MCS "XXX"

"Description of the Technology certificated"

10.4 Where 'XXX' is the certificate number and the logo of the Certification Body issuing the certification would sit in the right hand side of the box.

10.5 Companies may use the Mark only while certification is maintained.

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Annex A - Acoustic testing for electrically driven heat pumps designed for domestic hot water production only

Acoustic testing of heat pumps is currently detailed in EN 12102 and covers heat pumps designed for space heating only. Acoustic testing of heat pumps designed for domestic hot water product only shall follow the test methodology outlined below.

The purpose of the sound characteristic test is to determine the maximum sound power level of the heat pump during a heating up period.

For compliance with this Scheme, a sound characteristic test shall be performed using the following methodology:

1. The sound power level of the heat pump shall be determined using a Class A methodology as described in EN 12102-1:2017.
2. The settings and test conditions shall be the same as the thermal performance tests (see Table 4 of EN 16147:2017). The water outlet temperature set point shall be set to maximum.
3. The heating up period (Clause 7.7 of EN 16147:2017) shall be carried out and the water outlet temperature shall be checked by regularly carrying out small draw-offs.
4. The first sound measurement (T0) shall be carried out immediately after a draw-off, providing the water outlet temperature has reached 45°C ±2°C (See figure 1 below).
5. A second draw-off followed by a sound measurement shall be carried out 10 minutes after T0, and shall be repeated every 10 minutes thereafter.
6. The final sound measurement shall be carried out after 30 minutes have elapsed, or if the water outlet temperature reaches 55°C ±2°C.
7. If less than four sound measurements are carried out then the test shall be repeated until four sound measurements in total have been performed.
8. The four sound measurements shall be used to determine the sound power level of the heat pump. The maximum determined sound power level shall be used to declare the sound power level of the unit.

9. If there is a wide variation in the determined overall A-weighted sound power levels (> 2dB) then four more sound measurements shall be carried out. If there is still a wide variation in the determined sound power levels, and it can be shown that the testing has been carried out in accordance with the methodology stated above, then it will be presumed that the variation is associated with the normal operation of the unit.

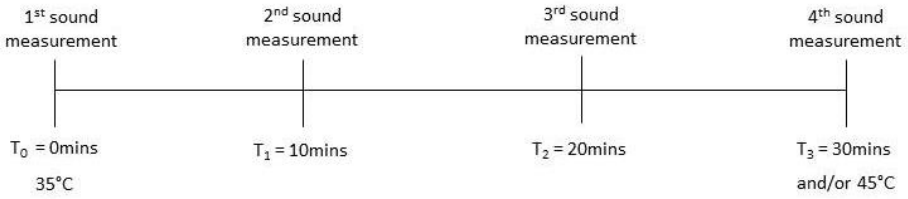

Figure 1 Sound characteristic test

Annex B - Product testing and performance criteria for external absorbers incorporated in solar assisted heat pumps designed for domestic hot water production

1. Scope

This annex specifies tests to be performed on solar assisted heat pump systems for domestic hot water production, of durability (including mechanical strength), reliability and safety of the external absorbers they incorporate. These requirements are in addition to the requirements of EN 16147. This annex also includes provision for the evaluation of conformity to these additional requirements.

An ISO EN 9806:2013 test report would meet the requirements of the tests 6, 7, 8, 9, 10 and 11. For the avoidance of doubt, the thermal performance requirements of ISO EN 9806:2013 are not included within the requirements of this Annex.

2. Normative references

The following documents, in whole or in part, are normatively referenced in this Annex and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN ISO 9488:2000, Solar energy - Vocabulary (ISO 9488:2000)
EN ISO 9806:2013, Solar energy - Solar Thermal collectors - Test methods
EN 12975-1:2006 +A1:2010, Thermal solar systems and components - Solar collectors
EN 16147, Heat pumps with electrically driven compressors - Testing and requirements for marking of domestic hot water units

3. Terms and definitions

For the purposes of this document, the symbols and units given in EN ISO 9488:2000 apply.

External absorber - A panel which performs the function of an evaporator in a thermodynamic solar assisted heat pump system. This device is remote from the compressor and is usually mounted externally.

4. Symbols and units

For the purposes of this document, the symbols and units given in EN ISO 9488:2000 apply.

5. Test overview

The following table summarises the tests that must be undertaken on the solar panel elements of solar assisted heat pumps for hot water production.

Sub-clause (in this Annex)	**Test**
6	Internal pressure test for fluid channels
7	High-temperature resistance
8	External thermal shock test[c]
9	Internal thermal shock test[c]
10	Mechanical load test
11	Final inspection[k]

Table B1 – Test list

C: The external and internal thermal shock tests may be combined with the high-temperature resistance test.

K: Every external absorber tested needs to undergo the final inspection.

6. Internal pressure tests for fluid channels

6.1 Objective

The fluid channels shall be pressure-tested to assess the extent to which they can withstand the pressures which they might meet in service.

6.2 Apparatus and procedure

The apparatus consists of a hydraulic pressure source (electrical pump or hand pump), a safety valve, an air-bleed valve and a pressure gauge with a standard uncertainty better than 5%. The air-bleed valve shall be used to empty the fluid channels of air before pressurisation. The fluid channels shall be filled with nitrogen and pressurised to the test pressure for the test period. This pressure shall be maintained while the fluid channels are inspected for swelling, distortion or ruptures.

6.3 Test conditions

Fluid channels shall be pressure-tested at ambient temperature within the range 5°C to 40°C, shielded from light. The test pressure shall be 1.5 times the maximum external absorber operating pressure specified by the manufacturer. The test pressure shall be maintained (±5 %) for 15 min.

6.4 Results

The external absorber shall be inspected for leakage, swelling and distortion. Leakage can be assumed if pressure loss $\Delta P > 5$ % of the test pressure or 17 kPa, whichever is greater. The results of this inspection shall be reported together with the values of pressure and temperature used and the duration of the test.

7. High-temperature resistance test

7.1 Objective

This test is intended to assess rapidly whether an external absorber can withstand high temperature and irradiance levels without failures such as significant deposits on the external absorber cover from outgassing of external absorber material or any other effect that possibly could lead to reduced performance, lifetime, safety or distorted visual appearance of the external absorber.

7.2 Apparatus and procedure

The external absorber shall be tested outdoors, or in a solar irradiance simulator. The characteristics of the solar irradiance simulator to be used for the high-temperature resistance test shall be those of the solar irradiance simulator used for efficiency testing of fluid heating external absorbers.

The external absorbers shall be mounted outdoors or in a solar simulator. Liquid heating external absorbers shall not be filled with fluid. All of the fluid pipes except for one shall be sealed to prevent cooling by natural circulation of air.

A temperature sensor shall be attached to the absorber to monitor its temperature during the test. The sensor shall be positioned in the hottest region of the external absorber. The location shall be reported with the results. In case of liquid flat plate external absorbers the hottest region can be assumed at two-thirds of the absorber height and half the absorber width. It shall be fixed firmly in a position to ensure good thermal contact with the absorber. The sensor shall be shielded from solar radiation.

The test shall be performed for a minimum of 1 h after steady-state conditions have been established (steady-state conditions can be assumed for absorber temperatures changes of less than ± 5 K for 30 minutes), and the external absorber shall be subsequently inspected for signs of damage.

7.3 Test conditions

The set of reference conditions given in Table B2 shall be used for all climate classes.

Climate parameter	Value for all climate classes
Global solar irradiance on external absorber plane, G in W/m2	> 1000
Surrounding air temperature, ϑa in °C	20 - 40
Surrounding air speed in m/s	< 1

Table B2 – Climate reference conditions for high-temperature resistance test

When testing unglazed external absorbers without backside insulation, the external absorber shall be mounted onto a dark surface (α > 80 %) to rise maximum temperatures as worst case condition.

7.4 Results

The external absorber shall be inspected for degradation, shrinkage, outgassing and distortion.

The results of the inspection shall be recorded as in Table B3 together with the average values of solar irradiance (natural or simulated) on the external absorber plane, surrounding air temperature and speed, and absorber temperature (and the pressure of the suitable fluid in the absorber, if that method is used) recorded during the test. Control functions which have been verified shall be described and reported with the test results.

External absorber tilt angle (degrees from horizontal): °
Average irradiance during test: W/m2
Average surrounding air temperature: °C
Average surrounding air speed: m/s
Average absorber temperature: °C
Duration of test: min

Table B3 – Test Conditions

8. External thermal shock test

8.1 Objective

External absorbers may from time to time be exposed to sudden rainstorms on hot sunny days, causing a severe external thermal shock. This test is intended to assess the capability of an external absorber to withstand such thermal shocks without a failure.

8.2 Apparatus and procedure

The external absorber shall be mounted either outdoors or in a solar irradiance simulator. Liquid heating external absorbers shall not be filled with fluid. All except one of the fluid pipes shall be sealed to prevent Cooling by natural circulation of air. One shall be left open to permit free expansion of air in the absorber. In case of an air heating external absorber the inlet and outlet shall resist water penetration.

An array of water jets shall be arranged to provide a uniform spray of water over the front of the external absorber.

The external absorber shall be exposed to climatic conditions as described in Table B4 (class specified by the manufacturer) for a period of 1 h before the water spray. It is then cooled by the water spray for 15 min before being inspected.

The external absorber shall be subjected to two external thermal shocks.

8.3 Test conditions

The set of reference conditions given in Table B4 shall be used. The specified operating conditions shall be:

- solar (or simulated solar) irradiance G greater than the value shown in Table B4 and,
- surrounding air temperature ϑa greater than the value shown in Table B4.

Climate condition	Value for climate class		
	Class C Temperate	Class B Sunny	Class A Very Sunny
Global solar irradiance on external absorber plane, G in W/m^2/minimum ambient temperature, ϑa in °C	800/10	900/15	1000/20
Values given are minimum values for testing. The same class shall be applied for irradiance and for irradiation values respectively.			

Table B4 – External and internal thermal shock tests (EN ISO 9806:2013)

The water spray shall have a temperature of less than 25 °C and a flow rate in the range 0,03 kg/s to 0,05 kg/s per square meter of external absorber aperture.

If the temperature of the water which first cools the external absorber is likely to be greater than 25 °C (for example if the water has been sitting in a pipe in the sun for some time), then the water shall be diverted until it has reached a temperature of less than 25 °C before being directed over the external absorber.

8.4 Results

The external absorber shall be inspected for any cracking, distortion, water penetration or loss of vacuum. The results of the inspection shall be reported. The measured values of solar irradiance, surrounding air temperature, fluid channel temperature (if measured), water temperature and water flow rate shall also be reported.

9. Internal thermal shock test

9.1 Objective

External absorbers may from time to time be exposed to a sudden intake of cold heat transfer fluid on hot sunny days, causing a severe internal thermal shock, for example, after a period of shutdown, when the installation is brought back into operation while the external absorber is at an elevated temperature. This test is intended to assess the capability of an external absorber to withstand such thermal shocks without failure.

9.2 Apparatus and procedure

The external absorber shall be mounted either outdoors or in a solar irradiance simulator. Liquid heating external absorbers shall not be filled with fluid. One of its fluid pipes shall be connected via a shutoff valve to the heat transfer fluid source and the other shall be left open initially to permit the free expansion of air in the absorber and also to permit the heat transfer fluid to leave the absorber (and be collected). If the external absorber has more than two fluid pipes, the remaining openings shall be sealed in a way that ensures the designed flow pattern within the external absorber.

The external absorber shall be exposed to climatic conditions as described in Table B4 (class specified by the manufacturer) for a period of 1 h before it is cooled by supplying it with heat transfer fluid for at least 5 min.

The external absorber shall be subjected to two internal thermal shocks.

This test is not applicable to those parts of the external absorber which are factory sealed. It is not applicable to those external absorbers in which heat transfer fluid is continuously flowing for protection purposes. In that case control(s) used to manage a no-flow condition shall be validated to be functional in such a way that any failure can be detected.

9.3 Test conditions

Table B4 shall be used.

The specified operating conditions shall be:

- Solar (or simulated solar) irradiance G greater than the value shown in Table B4 - ambient air temperature ϑa greater than the value shown in Table B4

In case of a liquid heating external absorber the heat transfer fluid shall have a temperature of less than 25°C. The fluid flow rate shall be the maximum flow rate of the thermal performance test, at least 0.02 kg/s per square meter of external absorber aperture (unless otherwise specified by the manufacturer). The flow rate shall be the maximum recommended flow rate specified by the manufacturer.

9.4 Results

The external absorber shall be inspected for any cracking, distortion, deformation, water penetration or loss of vacuum. The results of the inspection shall be reported. The measured values of solar irradiance, ambient air temperature, fluid channel temperature before starting the test (if measured), inlet heat transfer fluid temperature and heat transfer fluid flow rate shall also be reported. Control functions which have been verified shall be described and reported with the test results.

10. Mechanical load test with positive or negative pressure

10.1 Objectives

The mechanical load test with positive pressure is intended to assess the extent to which the solar assisted heat pump external absorber is able to resist the positive pressure load due to the effect of wind and snow.

The mechanical load test with negative pressure is intended to assess the deformation and the extent to which the external absorber and the fixings between the external absorber cover and external absorber mounting are able to resist uplift forces caused by the wind.

10.2 Apparatus and procedure

10.2.1 Mechanical load test with positive pressure

For the mechanical load test with positive pressure the external absorber shall be fixed on a stiff even ground using the manufacturers original equipment for mounting. Different methodologies may be used to apply load to the external absorber. If weight of material is used the external absorber shall be placed horizontally.

Note: The external absorber mounting comprises the equipment to connect the external absorber fixings with the supporting framework (e.g. roof anchor, roof hook). The external absorber fixing comprises the equipment to connect the external absorber box/frame with the external absorber mounting equipment (e.g. clamps, bolts).

- Using a foil and gravel or water:

On the external absorber a foil shall be laid and on the external absorber frame a wooden or metallic frame shall be placed, high enough to contain the required amount of gravel or similar material. The gravel, preferably type 2-32 mm, shall be weighed in portions and distributed in the frame so that everywhere the same load is created (If glazed pay attention to the bending of the glass), until the desired height is reached.

- Using suction cups:

The test can also be carried out using suction cups. The suction cups shall be distributed as even as possible on the external absorbers surface. The suction cups shall not hinder the movement of the external absorber cover caused by the mechanical load.

- Using air pressure on the external absorber cover:

Where additional seals are required for the test, such seals shall not hinder the movement induced by the applied air pressure in any way.

10.3 Mechanical load test with negative pressure

For the mechanical load test with negative pressure the external absorber can be placed horizontally and the manufacturers' original equipment for mounting shall be used. Different methodologies may be used to apply load to the external absorber.

A lifting force which is equivalent to the specified negative pressure load shall be applied evenly over the external absorber or cover if applicable. If the cover has not been loosened, or any other failure which could be defined as major, at the final pressure, then the pressure may be stepped up until failure occurs. The time between each pressure step shall be the time needed for the pressure to stabilize.

- Method (a): The load may be applied to the external absorber cover by means of a uniformly distributed set of suction cups.

- Method (b): For external absorbers which have an almost airtight external absorber box, the following procedure may be used to create a negative pressure on the cover. Two holes are made through the external absorber box into the air gap between the external absorber cover and absorber, and an air source and pressure gauge are connected to the external absorber air gap through these holes. A negative pressure on the cover is created by pressurizing the external absorber box. For safety reasons the external absorber shall be encased in a transparent box to protect personnel in the event of failure during this test.

Where flashings or sealing kits that are an integral part of the external absorber provide any uplift resistance, they should be included in the test.

10.4 Test conditions

The test pressure shall be 2400 Pa (positive and negative), 5400 Pa (positive) or as specified by the manufacturer. The reference area to be used is the gross area of the external absorber.

A permanent deformation should be assigned to a load value, while it is completely relieved after every load increment and the distortion is measured compared to the beginning of the test sequence.

10.5 Results

A failure can be the permanent deformation of the external absorber or the fixings. The pressure at which any failure of the external absorber cover or the box or fixings occurs shall be reported together with details of the failure according. If no failure occurs, then the maximum pressure which the external absorber sustained shall be reported. Control functions which have been verified shall be described and reported with the test results.

11. Final inspection

When the tests have been completed, and the same external absorber is not going to be used for the performance test, the external absorber used for the test shall be dismantled and inspected. All abnormalities shall be documented and accompanied by photographs. The external absorber and all of its components shall be described and be photographed (including glazing, absorber, absorber coating, insulation, housing, inlet and outlet ports, glazing supports and retainers, seals, gaskets, back sheet, etc. where applicable).

Specific assessment criteria for each of the tests listed in Table 3 of Clause 8.1 are listed in the respective test paragraphs. The term “no major failure”, denotes that none of the following occurs:

- Fluid channel leakage (in case of liquid heating external absorbers only) or such deformation that permanent contact between absorber and cover is established;
- Breaking or permanent deformation of cover or cover fixing;
- Breaking or permanent deformation of external absorber fixing points or external absorber box;
- Accumulation of humidity in form of condensate on the inside of the transparent cover of the external absorber exceeding 10% of the aperture area. In case of an open loop air heating external absorber for limited periods of time this criterion maybe exceeded.
- Any other abnormality resulting in a significant reduction of performance or service life time.

12. Test Reports

Test reports shall be issued in accordance with MCS 011.Test reports may be issued on single tests or complete test sequences.

For the external absorber, and whenever is applicable, the Annex from ISO 9806:2013 shall be used.

AMENDMENTS ISSUED SINCE PUBLICATION

DOCUMENT NO.	AMENDMENT DETAILS	DATE
1.1	'UK' removed from Scheme name; 'Department of Trade and Industry' MCS Mark replaced by 'BERR ' MCS Mark	11/01/2008
1.2	Revision details added; BRE Certification Limited mark replaced by BRE Global mark.	25/02/2008
1.3	Gemserv details added as Licensee. Document reformatted to reflect brand update. References to BERR updated to DECC, MCS logo updated accordingly. Website and email addresses updated to reflect new name.	01/12/2008
1.4	Quality review	10/01/2009
1.5	New MCS logo added	15/02/2009
2.0	Assessment and performance criteria for exhaust air and swimming pool heat pumps added Version of EN 14511:2013 updated to 2007 (from 2004)	15/12/2009

2.1	Updated to add in section for certification of CO_2 Heat Pumps on pages 9 and 10.	26/10/2011
2.2	Requirements for gas absorption and adsorption heat pumps added. Update reference to EN 14511:2011 version.	22/07/2013
2.3	Correction to reference 12309:2000 Part 1 – 2.	31/07/2013
2.4	ASHP COP requirements updated Requirement to provide data for connection forms.	16/12/2013
3.0	Criteria for VHTHPs, HWHPs and SAHPs added.	21/11/2014
4.0	Updated to be in line with ErP requirements.	01/05/2015
4.1	Minor corrections to cross referencing.	06/05/2015
5.0	Clarification on testing requirements added.	24/09/2015
6.0	Clarification on testing requirements including product families. Updates to definitions. Updates to current versions of standards and regulations.	26/11/2018