



MICROGENERATION PRODUCT STANDARD: MCS 014

MCS Product Certification
Scheme Requirements:

Heat-led micro-cogeneration packages or add-on units

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

This Standard was prepared by the Microgeneration Certification Scheme Working Group 7 Micro-CHP systems.

REVISION OF MICROGENERATION CERTIFICATION STANDARDS

Microgeneration Standards will be revised by issue of revised editions or amendments. Details will be posted on the website at www.mcscertified.com

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.

The issue number will be given in decimal format with the integer part giving the issue number and the fractional part giving the number of amendments (e.g. Issue 3.2 indicates that the document is at Issue 3 with 2 amendments).

Users of this Standard should ensure that they possess the latest issue and all 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 014. At the time of publication, the editions indicated were valid. All documents are subject to revision, and parties applying this document MCS 014 are encouraged to investigate the possibility of applying the most recent editions of the documents referenced.

The following document (MCS 014 Issue 2.0) is a major update to MCS 014 Issue 1.3. It is available for reference from the date of publication (12/11/2018).

Newly certified products shall comply with (MCS 014 Issue 2.0) from the date of publication (12/11/2018). Issue 2.0 is mandatory from 12/11/2019 for manufacturers or importers who have products currently certified to Issue 1.3.

1. INTRODUCTION

This Scheme document identifies the evaluation, assessment requirements and practices for the purposes of certification and listing of heat-led Micro-Cogeneration Packages. Certification and listing of packages is based on evidence acceptable to the Certification Body:

- that the package falls within the scope of this scheme document;
- that the Certificate Holder staff, processes and systems that have been audited by MCS in accordance with MCS 010 in place to ensure that the package placed on the market meets the requirements of this scheme document,

And on:

- periodic audits of the Certificate Holder testing as appropriate;
- compliance with the contract with the Certification Body for listing and certification including agreement to rectify faults as appropriate.

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2. SCOPE

This Scheme provides ongoing independent, third party assessment and approval of Heat-Led Micro-Cogeneration Packages or add-on units intended and designed for installation in residential and commercial buildings as the primary heating and or domestic hot water system, where the Package/add-on unit:

- a) has a thermal and electrical output of less than 45 kW_t or 50 kW_e respectively,
- b) is fuelled by any of the following – second and third family gas; gas from a bespoke source; hydrogen; mineral oil; other liquid fuels, principally bio-oils; other fuels including unconventional fuels and solid fuels.

3. NORMATIVE REFERENCES

The following referenced documents are indispensable for the application of this scheme document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- PAS 67: 2013, or the latest available version thereof:

Laboratory tests to determine the heating and electrical performance of heat-led micro-cogeneration packages primarily intended for heating dwellings.

- G83/2: August 2012, or the latest available version thereof:

Recommendations for the connection of small-scale embedded generators (up to 16A per phase) in parallel with Public Low-Voltage Distribution Networks.

- G59/3: June 2014, or the latest available version thereof:

Distributed Generation Connection Guide – A guide for connecting generation to the distribution network that falls under G59/3.

- COMMISSION REGULATION (EU) No 811/2013
- COMMISSION REGULATION (EU) No 812/2013
- Product Characteristics Database

See: <http://www.ncm-pcdb.org.uk/sap/searchpod.jsp?id=17>

CEN/TR 1749: 2014, or the latest available version thereof:

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European Scheme for the classification of gas appliances according to the method of evacuation of the combustion products (types).

4. DEFINITIONS

4.1 CATEGORIES OF MICRO-COGENERATION PACKAGES

- combiPK - Micro-Cogeneration Package for providing space and water heating in which the Domestic Hot Water (DHW) service is provided wholly from within the Package.
- heatPK - Micro-Cogeneration Package for providing space heating only (no DHW service).
- regPK - Micro-Cogeneration Package for providing space and water heating intended for connection to a separate DHW storage cylinder of standard specification.
- DHWPK - Micro-Cogeneration Package for the provision of hot water heating alone for residential or commercial buildings.
- Add-On DHWPK - Micro-Cogeneration Unit added to the existing system for the provision of hot water heating alone for residential or commercial buildings

4.2 COGENERATION

Combined generation of electricity and heat by an energy conversion system and the concurrent use of electric and thermal energy from the conversion system.

4.3 COGENERATION UNIT

A Unit that is capable of cogeneration.

4.4 ADD-ON MICRO-COGENERATION UNIT

A lead mCHP unit added to or replacing part of a building's existing heating system which responds to a thermal or electrical demand signal and controls operation of the existing heating plant as necessary to meet the building's heat requirements.

4.5 ADD-ON MICRO-COGENERATION PACKAGE

A Package that consists of an Add-On Micro-Cogeneration Unit together with its controls and ancillary items as supplied to allow the system to function as designed by the Certificate Holder.

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Note 1: Ancillary items could include but would not be limited to, heat interface unit, Cylinder, hot water store, buffer vessel, pumps etc.

Note 2: where suitable existing controls are in place these may be re-used to control the add-On Micro-Cogeneration unit and existing plant.

4.6 HEAT-LED MICRO-COGENERATION PACKAGE

Micro-Cogeneration Package the control of which is by heat demand.

4.7 HPER

The measure of environmental performance is the Heating Plant CO₂ Emission Rate (HPER) in units of kgCO₂/kWh

4.8 MICRO-COGENERATION PACKAGE (MCP)

Micro-Cogeneration Unit with associated equipment as specified by the manufacturer or distributor when submitting for testing.

Note: Manufacturer or distributor is the organisation that submitted the Package for testing against PAS 67.

4.9 CERTIFICATE HOLDER

For the purposes of this scheme document, a Certificate Holder is:

- a manufacturer of a Micro-Cogeneration Unit or Package, selling under his own brand in the UK; or
- a business based in the UK selling under his own brand (or another brand under licence) a Micro-Cogeneration Unit or Package manufactured by another business; or
- a professional importer introducing a Micro-Cogeneration Package to the UK market.

4.10 MICRO-COGENERATION UNIT

A Cogeneration Unit with a thermal and electrical output of less than 45 kWt or 50 kWe respectively suitable for connection in parallel with the UK public low voltage distribution network in accordance with G83/2 or G59/3.

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Note: This concept is sometimes referred to as “domestic CHP” (combined heat and power).

4.11 SYNCHRONOUS MODE

Operation of a Micro-Cogeneration Package connected to a public alternating current (AC) electricity distribution network and capable of exporting electrical power to it.

5. APPLICATIONS TO JOIN THE SCHEME

Applications should be made to an MCS Certification Body licensed to operate this scheme. The Certification Body will provide the appropriate application form and details of the applicable fees.

6. MANAGEMENT SYSTEMS CERTIFICATION

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

7. CERTIFICATION AND APPROVAL OF THE MICRO- COGENERATION UNIT OR PACKAGE

This section sets out the criteria against which the Certification Body will assess the Micro-Cogeneration Package as suitable for certification and approval together with some supplementary explanatory notes.

7.1 ACCEPTANCE CRITERIA

Acceptance of documented evidence will be at the discretion of the Certification Body providing the certification, but at least the following criteria shall be applied:

- a. Evidence of compliance with conditions a) and b) of the Scope of this scheme document
- b. Evidence of compliance with the relevant requirements of applicable European Directives and UK regulations
- c. Evidence of compliance with the technical requirements for connection and operation as a fixed Micro-Cogeneration Package when installed in parallel with the UK public low voltage distribution network (synchronous mode) in accordance with G83/2 or G59/3

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- d. Evidence of compliance with the performance criteria listed in § 9 of this scheme document
- e. Verification of the establishment and maintenance of the manufacturing company's quality management system in accordance with the Factory Production Control Requirements (FPC) detailed in § 6 of this scheme document
- f. Satisfactory review of the technical documentation relating to the Package.

7.2 SUPPLEMENTARY EXPLANATORY NOTES

Applications for a range of common Packages (Package families) will be dealt with on a case by case basis.

For example, where one or more characteristics are the same for Packages with similar design, construction and functionality then the results of tests for these characteristics on one Package may be applied to other similar products.

- A certificate is awarded following demonstration of satisfactory compliance with this scheme document, i.e. Package performance; FPC; and technical documentation.
- Certificates contain the name and address of the manufacturer, model and reference number of the Micro-Cogeneration Package, a unique certificate reference number and the issue number and date.

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 § 10) but remain the property of the issuing Certification Body.

Details of the Certificate Holder and the certificated product(s) are listed on the MCS website

www.microgenerationcertification.org.

8. TECHNICAL DOCUMENTATION

Technical documentation for the Package or Unit must be submitted for review. This documentation shall be presented in English and shall be such that it can be assured that the Package or Unit submitted for test is equivalent to those that are to be manufactured for normal production. The documentation must consist of the following as a minimum;

- a) Manufacturer's name,
- b) Brand name,
- c) Package or Unit name,

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- d) Unique Package or Unit identifier – *shall not be the same as any other Package currently listed on the Product Characteristics Database, or for a DHWPK listed on the MCS website,*
- e) Nominal rated heat output,
- f) Nominal maximum electrical output,
- g) Electrical specification – *either 230V 50Hz synchronous single phase or 400V 50Hz synchronous three phase (3 wire or 4 wire),*
- h) Description of Package or Unit – prime mover (e.g. *internal combustion engine, external combustion engine, fuel cell, or other (if other an amplified description is required),* plus heat interface unit, (e.g. Heat recovery unit / thermal store), and the necessary controls,
- i) Type of fuel used – *where fuel is unconventional a full description is required,*
- j) Whether condensing or non-condensing,
- k) Type of flue system – *designated in accordance with CEN/TR 1749,*
- l) Category of Package – *i.e. combiPK, heatPK, regPK or DHWPK,*
- m) Details of intended use and application – *where relevant, this must include details of the minimum and maximum design heat loss of the dwelling for which the Micro-Cogeneration Package is suitable and the recommended plant size ratio (except for DHWPK) – the design heat loss is the instantaneous heat loss in kW from the dwelling when the temperature differential between inside and outside is 20K; the plant size ratio is the nominal rated heat output of the micro-cogeneration package divided by the design heat loss*
- n) A noise test report – *set out in accordance with § 9.3 of this scheme document,*
- o) Manufacturing drawings and/or specifications including tolerances, issue and revision numbers,
- p) Raw material and components specifications necessary to establish the build status of the Unit or Package,
- q) Details of the quality plan applied during manufacture to ensure ongoing compliance,
- r) Where historical test data 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),
- s) Installation, use and maintenance instructions, *plus additional information for Add-On-MCP (See “Micro-Cogeneration Add-On-Test Package: Test methodology based on PAS 67:2013”),*
- t) For Add-On Micro-Cogeneration Packages, reference test boiler type, output rating and SAP annual efficiency (%),

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- u) For Add-On Micro-Cogeneration Packages providing space heating, output at 100% load factor for the reference test package,
- v) For Add-On Micro-Cogeneration Packages providing hot water or DHWPK, DHW heating performance results and tapping cycle number(s).

9. PERFORMANCE CRITERIA

For compliance with this Scheme, Micro-Cogeneration Packages must be able to demonstrate the listed performance criteria shown below. Evidence of compliance is generally accepted as independent third-party testing by a UKAS (or equivalent) accredited test laboratory. However, other evidence of compliance may be considered at the discretion of the Certification Body (see document MCS 011 'Testing acceptance criteria').

- a) An attributable, independently verified, energy performance report produced from the comprehensive set of test conditions detailed in PAS 67 appropriate for the intended application of the Micro-Cogeneration Package or DHWPK.

Note: It is permitted to assess larger tapping cycles, not detailed in PAS67, but given in BS EN 13203-2:2015, as part of the energy performance report provided that the general test methodology of PAS67 is adhered to for these tapping cycles.

- b) A full set of data produced from the annual energy performance evaluation method for Micro-Cogeneration Packages recorded in the Product Characteristics Database, other than for DHWPK.

Note: For information on the "full set of data" required for inclusion in the database producers should contact the Database Operator; Kiwa Ltd T/A Kiwa GASTEC, Kiwa House, Malvern View Business Park, Stella Way, Bishops Cleeve, Cheltenham GL52 7DQ. Phone: 01242 677877.

- c) A Table in their installation instructions of the HPER value for plant size ratios between 0.5 and 10, or for Add-On units/packages, state the limits in heating plant sizes where the add-on is acceptable. Table not applicable to DHWPK.

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Note: HPER results can be determined using the APM [Annual Energy Performance Method] calculator (an Excel workbook called "PAS67 APM rev 4e v5 05 18-05-2011 (SAP 2009) - issued GaC 20140421.xls, or the latest version thereof, available from Kiwa GASTEC

A Micro-Cogeneration Package providing space heating qualifies with this scheme for all plant size ratios where the HPER is $\leq 0.251 \text{ kgCO}_2/\text{kWh}$ or for new build following an SAP assessment where the emissions for the new build are found to be lower using a mCHP package than for a SAP2009/SAP2012 86% gas boiler of the same fuel type. For an Add-On Micro-Cogeneration Package to qualify with this scheme the heating system environmental performance shall be better than before installation for all heat-load and DHW draw tests but not necessarily for the standby test.

For a DHWPK to qualify with this scheme the HPER of a DHWPK shall be less than the corresponding values shown in Annex 2 Table 1.

For compliance with this Scheme Micro-Cogeneration Packages or Units must have an attributable noise test report in accordance with MCS 011, and COMMISSION REGULATION (EU) No 811/2013, or COMMISSION REGULATION (EU) No 812/2013 at the maximum tapping water flow rate (*DHWPK's capable of tapping cycles 3XL and 4XL, shall be assessed at the maximum tapping water flow rate of tapping cycle XXL*).

9.1 ADDITIONAL PERFORMANCE CRITERIA

9.1.1 Combination heaters (combiPK) (as defined in COMMISSION REGULATION (EU) No 812/2013) shall meet the requirements of the following:

- COMMISSION REGULATION (EU) No 813/2013, Annex II, Clause 2.

9.1.2 DHWPKs shall meet the requirements of the following:

- COMMISSION REGULATION (EU) No 814/2013 Annex II Clause 1.1.

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10. ADD-ON UNITS SUPPLEMENTARY TESTS

10.1 The test procedures for the Add-On Micro-Cogeneration Packages are supplemented by the following:

- a) Measurements of additional parameters are required because these products are tested with a separate reference heat source e.g. gas boiler. This is defined in the document titled “Micro-Cogeneration Add-On-Test Package: Test methodology based on PAS 67:2013”
- b) Additional processing of test results is required for input into the APM calculator. This is defined in the “Micro-Cogeneration Add-On Calculator”.

10.2 ADD-ON DHWPK

Add-On-DHWPK shall be tested in accordance with The Micro-Cogeneration Add-On-Test Package: Test methodology based on PAS 67:2013. The domestic hot water draw off pattern(s) shall be those specified in the latest version of the PAS67.

Add-On-DHWPK products are tested with referenced supplementary heat source (e.g. 30 kW boiler). However, these products will be installed in a range of buildings with different type & size of supplementary heat sources, therefore the DHW performance test results should be normalised for the installation dwelling using the following:

- a) Micro-Cogeneration Add-On-Test Package: Test methodology based on PAS 67: 2013,
- b) Micro-Cogeneration Add-On Calculator.

10.3 DHWPK

A DHWPK shall be tested in accordance with latest version of the PAS67. The domestic hot water draw off pattern(s) shall be those specified in the latest version of the PAS67.

The HPER for the DHWPK shall be calculated using test results from the latest version of the PAS67 and the method described below.

Note: The DHWPK could consist of a standalone Micro-Cogeneration unit.

10.3.1 DHWPK HPER CALCULATION PROCEDURE

The DHWPK is tested at specified tapping cycles. The HPER calculation is illustrated by the following example.

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Tapping cycle used for measuring the performance of DHWPK	TC_No	XXL	[-]
Measured energy content of DHW during testing	QT _{HWTC}	24.459	[kWh/24h]
Electricity generated	QE _{EXP,HWTC}	8.895	[kWh/24h]
Electricity consumed	QE _{IMP,HWTC}	0.101	[kWh/24h]
Fuel energy consumption	QF _{HWTC}	39.662	[kWh/24h]
CO ₂ Emissions - Fuel = QF _{HWTC} × 0.216	CO ₂ Fuel	8.567	[kgCO ₂ /24h]
CO ₂ Emissions - Electricity generated = QE _{EXP,HWTC} × 0.519	CO ₂ Eexport	4.617	[kgCO ₂ /24h]
CO ₂ Emissions - Electricity imported = QE _{IMP,HWTC} × 0.519	CO ₂ Eimport	0.052	[kgCO ₂ /24h]
Net CO ₂ emissions = CO ₂ Fuel + CO ₂ Eimport - CO ₂ Eexport	CO ₂ Net	4.003	[kgCO ₂ /24h]
CO ₂ Emission rate (HPER_DHW) = CO ₂ Net / QT _{HWTC}	HYPER_DHW	0.164	[kgCO ₂ /kWh]

If HPER_DHW value is less than the corresponding DHW tapping cycle value in Table 1, then the Unit complies with the HPER requirements of this Standard.

11. 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:

11.1 FACTORY AUDITS

Certification is maintained through annual FPC quality system audits, which shall include a detailed check that the package being manufactured is to the same specification as the package tested.

11.2 PRODUCT AUDITS

Package 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;
- In circumstances, justified by the Certification Body, repeat testing of elements from § 9.1 a) of this scheme document to confirm that the package continues to meet the minimum performance requirements for certification and listing.

12. CERTIFICATION MARK AND LABELLING

All approved products listed under this Scheme shall be traceable to identify that they have been tested and certificated in accordance with the requirements of the test standard. See below for details.

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

An example of the Certification Mark(s) that can be used for this Scheme is as follows:

From the 1st December 2019 the new MCS Certification Mark is available for use:



Prior to the 1st December 2019 but still in use until a product is phased out or a Manufacturer wishes to migrate over to the new MCS Certification Mark:



Certificate Number MCS "XXX"

"Description of the technology certificated"

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Where “XXX” is the certificate number, and the logo of the Certification Body issuing the certification would sit on the right hand side of the logo.

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

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ANNEX 1: ADDITIONAL TESTS FOR STIRLING AND ORGANIC RANKINE CYCLE PACKAGES USING LPG

Where a Stirling or Organic Rankine Cycle Package has received MCS approval using natural gas, an LPG fuel variant can be considered as also having MCS approval if its performance is similar. The parameters for acceptable performance, and the method for measuring them, are detailed below.

For the integrated Boiler

For Packages with an integrated boiler, refer to the latest version of SAP, and use the method for calculating seasonal efficiency for boilers fuelled by LPG.

Note: the boiler will use the test result derived from natural gas.

For the Micro Cogeneration Unit

Units with continuous flames e.g. Stirling engines and Organic Rankine Cycle Packages.

If the following criteria are met the PAS 67/APM data obtained with G20 is acceptable:

- a) The net energy input between fuels is within +/-5%,
- b) The change between the two fuels is technically simple e.g. change of injector,
- c) The excess air rate between fuels is within +/-5%,
- d) A full output test in accordance with PAS 67(2013) Section 12.2 over 4 hours or for DHWPK, a one day DHW tapping test at the highest declared tapping cycle in accordance with PAS 67 as augmented for the larger tapping cycles in BS EN13203:2 2015, indicates a net electrical production efficiency expressed as a percentage of gas input energy as between -1.0% and +3.0% of the value obtained with G20 on the same appliance. This test shall be undertaken on a GAD certified appliance and witnessed by a Notified Body.

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ANNEX 2: Maximum permitted CO₂ HPER (kgCO₂/kWh) for DHWPK

Table 1: Maximum permitted CO ₂ HPER (kgCO ₂ /kWh) for DHWPK						
S	M	L	XL	XXL	3XL	4XL
0.346	0.289	0.271	0.262	0.260	0.255	0.252

AMENDMENTS ISSUED SINCE PUBLICATION

Document Number	Amendment Details	Date
1.0	First Issue	10/07/2009
1.1	Added annex 1 for LPG fuel variant	07/02/2011
1.2	Updated references to read "or latest available version thereof" Updated boiler efficiency database to read "product characteristics database".	18/05/2012
1.3	Updated definitions.	01/05/2015
2.0	Updated to include Add-On Units or Packages and DHWPK. Alignment to Appendix B "Environmental Performance" within MIS 3007.	12/11/2018
2.1	MCS Mark Updated. Rebranding of document, update of email and website addresses and cosmetic changes.	01/12/2019