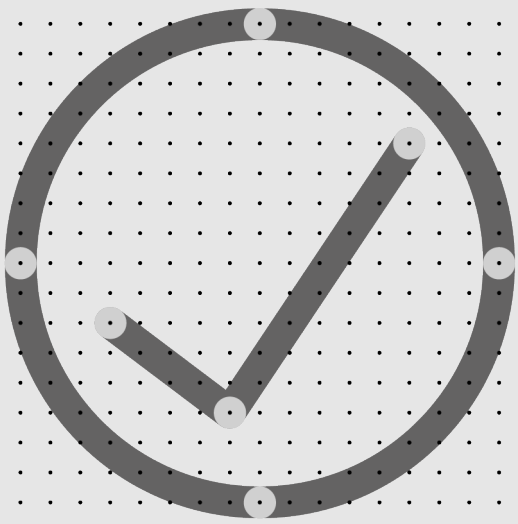
STANDARDS DOCUMENT

MIS 3005-I ISSUE 1.0

# The Heat Pump Standard

## (Installation)



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# ABOUT MCS

## Giving you confidence in home-grown energy

With energy costs constantly rising and climate change affecting us all, low-carbon technology has an ever increasing role to play in the future of UK energy.

We're here to ensure it's a positive one.

Working with industry we define, maintain and improve quality – certifying products and installers so people can have confidence in the low-carbon technology they invest in. From solar and wind, to heat pumps, biomass and battery storage, we want to inspire a new generation of home-grown energy, fit for the needs of every UK home and community.

### About

The Microgeneration Certification Scheme Service Company Ltd (MCSSCo Ltd) trades as MCS and is wholly owned by the non-profit MCS Charitable Foundation. Since 2007, MCS has become the recognised Standard for UK products and their installation in the small-scale renewables sector.

We create and maintain standards that allow for the certification of products, installers and their installations. Associated with these standards is the certification scheme, run on behalf of MCS by Certification Bodies who hold UKAS accreditation to ISO 17065.

MCS certifies low-carbon products and installations used to produce electricity and heat from renewable sources. It is a mark of quality. Membership of MCS demonstrates adherence to these recognised industry standards; highlighting quality, competency and compliance.

### Vision

To see MCS certified products and installations in every UK home and community.

### Mission

To give people confidence in low-carbon energy technology by defining, maintaining and improving quality.

### Values

1. We are expert – ensuring quality through robust technical knowledge
2. We are inspiring – helping to reshape energy in UK homes and communities
3. We are collaborative – working with industry and government to create positive change
4. We are principled – operating in a way that's clear, open and fair
5. We are determined – supporting the UK's drive towards a clean energy future

## CHANGES TO STANDARDS

When MCS Standards are revised, the issue number is also revised to indicate the nature of the changes. This can either be a whole new issue or an amendment to the current issue. Details will be posted on the website at www.mcscertified.com

Technical or other significant 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 is given on the left of the decimal point, and the amendment number on the right. For example, issue 3.2 indicates that it is the third significant version of the document which has had two sets of minor amendments.

Users of this Standard should ensure that they are using the latest issue.

| Issue No. | Amendment Details | Date |
|---|---|---|
| 1.0 | First Publication | 01/12/2021 |
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| | | |
| | | |

# FOREWORD

This document contains references to other documents which may be either normative or informative. At the time of publication any editions of those documents, where indicated, were valid. However, as all documents are subject to revision, any users of this document should apply the most recent editions of those referenced documents (unless a dated version is specified).

The previous MIS 3005 V5.0 combined Design and Installation into one Standard. These have now been separated into two new Standards; MIS 3005-D (for design only) and MIS 3005-I (for installation only.

These new Standards are available for reference from the date of publication 01/12/2021. Compliance with these Standards becomes mandatory for MCS Contractors certified in accordance with MIS 3005 from 01/04/2022 (date of implementation). Issue 5.0 of MIS 3005 ceases to be valid after 31/03/2022 (date of withdrawal).

MCS Contractors certified in accordance with MIS 3005 prior to 31/03/2022 can, at the next surveillance assessment, either:

- remain certified for both Design and Installation (i.e. in accordance with both MIS 3005-D and MIS 3005-I);
- change to being only a certified Designer (against MIS 3005-D);
- change to being only a certified Installer (against MIS 3005-I).

This Standard describes the MCS requirements for the assessment, approval and listing by Accredited Certification Bodies of contractors undertaking the installation (including setting to work and commissioning) of heat pump systems where design is undertaken by others. This Standard also includes requirements where contractors undertaking installation also contract with customers to supply and handover a fully working system whilst subcontracting the design.

Both documents can be used together for contractors contracting with customers to handover a fully working heat pump system (i.e. undertaking all of the supply, design, installation, set to work, commissioning and handover).

The listing and approval is based on evidence acceptable to the certification body:

- that the system or service meets the Standard;
- that the contractor has staff, processes and systems in place to ensure that the system or service delivered meets the standard;
- And on:
- periodic audits of the contractor including testing as appropriate;
- compliance with the contract for the MCS listing and approval including agreement to rectify faults as appropriate.

This Standard shall be used in conjunction with the scheme document MCS 001 and any other guidance and supplementary material available on the MCS website specifically referring to this Standard (MIS 3005-I).

*NOTES:*
*This Microgeneration Installation Standard makes use of the terms 'must', 'shall' and 'should' when prescribing certain requirements and procedures. In the context of this document:*

- *the term 'must' identifies a requirement by law at the time of publication;*
- *the term 'shall' prescribes a requirement or procedure that is intended to be complied with in full and without deviation;*
- *the term 'should' prescribes a requirement or procedure that is intended to be complied with unless reasonable justification can be given.*

*Compliance with this MCS Standard does not in itself confer immunity from legal obligations.*

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# 1 PURPOSE & SCOPE

1.1 This Standard specifies the requirements for MCS Contractors undertaking the installation of microgeneration heat pump systems supplying permanent buildings with space heating and/or domestic hot water.

1.2 Contractors can seek certification:

a) Against this Standard **and** MIS 3005-D (design)
Or
b) Against **only** this Standard (in which case limitations apply detailed below)

1.3 Where the Contractor is certified against both this Standard and MIS 3005-D then all clauses in both this Standard and MIS 3005-D shall apply.

1.4 Where the Contractor is certified against only this Standard to undertake installation yet contracts directly with the customer to handover a fully installed heat pump system, then all clauses in this Standard shall apply and design shall be undertaken by a subcontractor certified against MIS 3005-D.

*Note: MCS 001-1 Clause 4.10.1 makes it a requirement that MCS Contractors shall contract directly with the customer for the installation of a system. This is to ensure a single point of contractual responsibility. Therefore, MCS Contractors certified against this standard for installation yet are not themselves also certified against MIS3005-D for design, need to appoint another contractor who is certified against MIS3005-D as its subcontractor. In this way the MCS Contractor with the contract with the customer has complete responsibility for the compliance of the system.*

*Where customers contract separately for design and installation, the arrangement is not compliant and an MCS certificate cannot be issued.*

1.5 Whichever certified Contractor (designer or installer) is contracting directly with the customer is responsible for compliance with clauses 4 (Pre-sale information) and 7 (Documentation & Handover).

1.6 Microgeneration heat pump systems can use different primary heat sources (ground, air, and water), each of which requires different design and installation considerations. This standard includes the requirements for both compression and thermally activated heat pumps, as well as heat pump systems for heating only or for both heating and cooling. Heat pumps may be either "Monobloc" or "Split" units.

1.7 The following are expressly excluded from this Standard:

- Cooling only systems
- Direct expansion (DX) ground-loop systems
- Heat pumps used for extraction of heat from loft spaces

1.8 Reversible heat pump systems able to provide both heating and cooling are included but shall be designed and optimised for heating.

1.9 For the purposes of this Standard, microgeneration heat pumps are defined as those having a thermal output not exceeding 45 Kilowatt ($kW_{th}$) as defined by the MCS Product Certification scheme document MCS 007.

1.10 Multiple MCS certified heat pumps may be used in a single installation with a total design heat load not exceeding 70$kW_{th}$ (determined in accordance with BS EN 12831-1:2017 provided that no single heat pump shall exceed an output of 45$kW_{th}$.

1.11 The MCS Contractor shall be assessed under one or more of the following five categories of heat pump installation work:

- Ground/Water source heat pump (GSHP/WSHP) systems;
- Air source heat pump (ASHP) systems including High Temperature (HTHP) and $CO_2$ heat pumps;
- Exhaust air heat pump (EAHP) systems;
- Gas absorption and adsorption heat pump (GAHP) systems;
- Solar assisted heat pump (SAHP) systems

1.12 Hot water heat pump systems installed in accordance with this standard shall be used for the provision of domestic hot water only.

1.13 The Certification Body shall identify the scope of works that the MCS Contractor wishes to be registered for and undertake the assessment in accordance with this Standard using the clauses relevant to the category of heat pump installation work.

1.14 MCS Contractors successfully assessed for the design of GSHP/WSHP systems are deemed able to also design ASHP systems but not vice versa.

# 2 DEFINITIONS

Refer to MCS 001 for definitions.

# 3 REQUIREMENTS OF THE MCS CONTRACTOR

## 3.1 CAPABILITY

3.1.1 MCS Contractors shall have the competency (see Section 9) and capacity to undertake the installation of heat pumps Microgeneration systems.

## 3.2 ORGANISATION

3.2.1 MCS Contractors shall organise themselves using policies, procedures and systems which meet the minimum requirements in MCS001 to ensure every heat pump design meets this Standard.

*Note: MCS001 defines the requirements for "MCS Contractors" but for certification against this standard then Installers need to meet those same requirements.*

*MCS001 includes requirements for Quality Management System, Customer Care, Personnel, Continual Improvement, External Documents, Software Control, Customer Requirements, Contracts, Subcontracting, Purchasing, Test and Measurement Equipment, Product Handling, Training and Competence, all of which can affect the quality of installed systems.*

# 4 PRE-SALE INFORMATION

## 4.1 PERFORMANCE ESTIMATION

4.1.1 For domestic installations a valid Energy Performance Certificate (EPC) should be used to produce an estimate of the annual energy performance of the system using MCS 031: Heat Pump System Performance Estimate Template.

*Note: A valid EPC is one which has not expired and where the given annual heat demand is not expected to change such as by, for example, an extension or refurbishment of the building, and where the heat pump is intended to supply that changed heat demand. Where no valid EPC exists on the public register, but it is possible to obtain one through a Domestic Energy Assessment, then an EPC should be obtained and lodged. Neither the annual heat demand of the building nor the annual energy performance of the system are appropriate for sizing the system.*

4.1.2 Where it is not possible to obtain a valid EPC, or it is not possible to use a SCoP (e.g. GAHP, SAHP), an estimate of the annual energy performance shall be made using the methodology given in Appendix A.

*Note: Examples of where it would not be possible to obtain a valid EPC for use in MCS 031 would be non-domestic buildings, a planned refurbishment changing the heat demand, or the building is new and not yet complete.*

4.1.3 This estimate shall be communicated to the client before the point that the contract is awarded and accompanied by the Key Facts (Appendix B).

*Note: the full system design information (as defined in MIS 3005-D clause 5.9) can be provided before or after the point that the contract is awarded.*

4.1.4 Additional estimates may be provided using an alternative methodology, including proprietary software packages, but:

a) such estimates shall clearly describe and justify the approach taken and factors used
b) they shall not be given greater prominence than the standard MCS estimate
c) they shall be accompanied by warning text stating that it should be treated with caution if it is significantly better than the result given by the standard method.

### 4.2 MINIMUM TECHNICAL INFORMATION

4.2.1 As a minimum, the following technical information shall be communicated in writing to the customer before the point that the contract is awarded:

a) The result of the performance estimate calculated in accordance with Section 4.1
b) Manufacturer's datasheet for the proposed heat pump
c) Manufacturer's datasheet for the proposed hot water cylinder (if applicable)
d) Any other requirements stipulated by the Consumer Code (if applicable)
e) Details of any subcontractors proposed to undertake design

# 5 DESIGN

### 5.1 TIMESCALES

5.1.1 Completion of the design of the heat pump system shall not be unduly delayed and should be complete within 60 calendar days from the day the contract is agreed.

### 5.2 LEGISLATION

5.2.1 All applicable legislation and directives must be met in full.

*Note: the legislation which applies may be different in England, Wales, Scotland and Northern Ireland.*

5.2.2 MCS Contractors shall ensure, and be able to demonstrate, that they are aware of all current applicable legislation.

5.2.3 MCS Contractors shall make their customers aware of all permissions, approvals and licences required for the installation including, but not limited to, abstraction and discharge of ground water.

5.2.4 For Air Source Heat Pumps, where an installation is intended to proceed with Permitted Development Rights for air source heat pumps in England, MCS 020 Planning Standards must be complied with.

5.2.5 The MCS Contractor shall ensure the building is assessed by a competent professional experienced in heat pump systems to ensure that it is suitable for the installation and, by undertaking the proposed works, the building's compliance with the Building Regulations (in particular those relating to energy efficiency and electrical safety) is not compromised.

5.2.6 Suitable and sufficient risk assessments shall be conducted before any work on site commences.

5.2.7 Where work is undertaken that is notifiable under the Building Regulations it shall be made clear to the customer who shall be responsible for this notification.

5.2.8 The MCS Contractor shall ensure that notification under the Building Regulations has been completed prior to handing over the installation.

Note: Self-certification, in lieu of building control approval, is only permitted where installation and commissioning is undertaken by a person or organisation deemed competent and registered with a Competent Persons Scheme (CPS) approved by the relevant government department for the scope of work being undertaken. Further details can be found at *http://www.competentperson.co.uk*.

5.2.9 The MCS Contractor shall ensure that the installation is notified to the Distribution Network Operator in accordance with the procedures published by the Energy Networks Association and permission sought to connect to the network in advance of installation where necessary.

*Note: a Flow-chart detailing the ENA procedure is available from the website www.energynetworks.org along with the process to follow for connection and notification.*

## 5.3 MANUFACTURER'S INSTRUCTIONS

5.3.1 All equipment should be installed in accordance with its manufacturer's instructions.

5.3.2 Where the manufacturer's instructions conflict with the requirements of this Standard then the requirements of this Standard take precedence unless it can be proven that system performance, safety and durability are no worse than if the requirements of this Standard are followed.

### 5.4 EQUIPMENT CERTIFICATION AND LISTING

5.4.1 The heat pump(s) installed shall be listed on the MCS website (www.mcscertified.com). These listings include heat pumps both MCS certified and by other schemes MCS considers equivalent.

5.4.2 All equipment installed:

a) Shall be fit for its purpose in the installation
b) Has completed the conformity assessment process and is appropriately marked by a Notified Body in compliance with the relevant legislation.

*Note: for example this means the CE mark or the UKCA mark from 1st January 2023.*

### 5.5 DESIGN

5.5.1 Design shall be in accordance with MIS 3005-D and undertaken by a contractor certified against that Standard.

5.5.2 Where there is a change to the agreed design and/or estimated performance of the system from that given before the detailed design then customer shall be given:

a) An updated estimate of performance, in accordance with the 'MCS Heat Pump System Performance Estimate'
b) A variation to contract
c) The opportunity to cancel the contract without further cost, obligation or liability

5.5.3 Prior to the installation commencing, the customer shall be provided in writing with the design information provided by the designer as detailed in clause 5.9.2 of MIS 3005-D

# 6 INSTALLATION & COMMISSIONING

### 6.1 INSTALLATION

6.1.1 All work under this standard work shall be carried out:

a) with adequate and proper materials which
   i) are appropriate for the circumstances in which they are used,
   ii) are adequately mixed or prepared, and
   iii) are applied, used or fixed so as adequately to perform the functions for which they are designed; and
b) in a workmanlike manner.

## 6.2 METERING & COMMUNICATION

Metering

6.2.1 A means of recording and displaying the total electricity consumption of the system shall be installed.

6.2.2 The heat pump(s) should be installed so that heat metering could be added at a future date with minimum cost or disruption.

*Note: a means of making the addition of heat metering possible with minimum disruption would be to include straight and surface-mounted flow and return pipes near the heat pump and each incorporate 2 full-bore isolation valves. Those isolation valves on the flow pipe should be separated by no less than 175mm. On the return pipe, those valves should be separated by no less than 20 times the pipe diameter (for example the distance between the valves should be 300mm or more of straight pipe when pipe diameter of 15mm).*

Data Communication & Security

6.2.3 The data privacy and security of the site's home area network shall be maintained. Where the installation comprises of any internet connected devices:

- The device's network access credentials (username & passwords) shall be updated in consultation with the customer;
- Relevant components in the heat pump system should comply with the technical specification ETSI Technical Specification 103 645 Cyber Security for Consumer Internet of Things.

6.2.4 For installations requiring local area network, home area network, and/or internet access in commercial and industrial premises, permission shall be obtained from those responsible for the client organisation's information technology and information security policies and procedures.

## 6.3 SITE SPECIFIC ISSUES

6.3.1 Heat pumps should be located according to the manufacturer's instructions.

*Note: For air source heat pumps, these will include consideration of factors that may detrimentally affect the performance of the heat pump system such as recirculation of chilled air.*

6.3.2 Heat pumps should not be located adjacent to sleeping areas or on floors that can transmit vibration.

6.3.3 Anti-vibration pads/mats/mounts and flexible hose connections should be installed according to the manufacturer's instructions to reduce the effects of vibration on the building structure.

6.3.4 The location of external fans and heat pump compressors should be chosen to avoid nuisance to neighbours and shall comply with planning requirements.

*Note: See MCS 020 Planning Standards for permitted development installations of wind turbines and air source heat pumps on domestic premises which contains useful guidance even when permitted development may not apply.*

6.3.5 Internal fans and ducts should be fitted with sound attenuation devices where required to meet recommended or required sound levels..

6.3.6 For air source heat pumps, condensate shall be discharged safely to a suitable drain or soakaway.

6.3.7 Solar Assisted Heat Pump external absorber(s) mounted above or integrated into a pitched roof shall be installed in accordance with MIS 3001.

*Note: MIS 3001 contains requirements for mounting solar thermal collectors under the action of wind loads, fire, rainfall and wind driven rain.*

6.3.8 Where the external absorber(s) of Solar Assisted Heat Pumps are mounted other than to a pitched roof, the absorber and associated fixings achieve shall be fixed in such a way that achieves the same level of performance as absorbers mounted on a pitched roof.

6.3.9 Where it can optimise system efficiency with the maximum possible gradient, weather compensation should be enabled.

*Note: Where weather compensation would reduce the efficiency of the system or be of no practical value, there is no requirement to enable it. However, the MCS Contractor may be expected to explain why this action has been taken and the option retained to enable it at a later date if required. Examples may be the use of fan convectors or other heat emitters exhibiting distinctly non-linear heat outputs at varying temperatures, the lifestyle profile of the occupant and the buildings responsiveness to the heating system.*

## 6.4 COMMISSIONING

6.4.1 The heat pump system shall be commissioned according to a documented procedure to ensure that the system is safe, has been installed in accordance with the requirements of this Standard and the manufacturers' requirements, and is operating correctly in accordance with the system design.

*Note: Suitable commissioning checklists can include those provided by the heat pump manufacturer and the example given in Appendix C.*

Closed-loop ground heat exchangers

6.4.2 The following commissioning procedure shall be followed for each installation:

a) Ground arrays (including header pipes and manifolds) shall be flushed in both directions as one system to remove all debris and purged to remove all air. The heat pump (and its associated pipework) shall be isolated from the ground heat exchanger during this process to avoid damaging the heat exchanger inside the heat pump.

b) The heat pump (and its associated pipework) shall be flushed and purged as another system, in isolation from the ground array system.

c) Once the ground array is free from debris and visible air bubbles/pockets, purging should continue on the entire system, including the heat exchanger inside the heat pump, for a at least 15 minutes with a minimum flow velocity of 0.6 m/s. This is to remove micro air bubbles formed on the inside of the ground array pipes.

*Note: Minimum flow rates to achieve a velocity of 0.6m/s for various pipe diameters and collector types are given in Table 1. Flow rates significantly greater may be required to purge all debris and visible micro-air bubbles. Parallel loops or layouts with variable pipe geometry may require higher flow rates to achieve the required velocity.*

| Pipe Outer Diameter /mm | Recommended flow rate for flushing and initial purging | | Minimum flow rate for purging micro air bubbles after flushing and initial purging |
|---|---|---|---|
| | Horizontal ground arrays (1m/s) /litres/min | Slinky ground arrays (1.5m/s) /litres/min | All ground arrays (0.6m.s) /litres/m |
| 25 | 20 | 30 | 12 |
| 32 | 32 | 48 | 20 |
| 40 | 50 | 76 | 31 |
| 50 | 79 | 118 | 48 |
| 65 | 133 | 200 | 81 |

*Table 1*

d) Once purged of all micro-air bubbles, pressure test in accordance with BS EN 805:2000 section 11.3.3.4 to ensure watertight. The entire system, which usually comprises the heat pump, header pipes, manifold and all ground arrays shall also be pressure tested.

e) Sufficient antifreeze shall be added to the ground array thermal transfer fluid to protect from freezing down to at least -10°C. The quantity and type of antifreeze shall be appropriate for the system design, in particular with respect to the flow rate stipulated by the heat pump manufacturer; the viscosity of the finished thermal transfer fluid; and the choice of ground array circulation pump.

f) A quantity of biocide recommended by the manufacturer and/or supplier of the antifreeze shall be added to the ground array thermal transfer fluid.

g) Two separate, random samples of the commissioned thermal transfer fluid should be tested using a refractometer to confirm that freeze protection down to at least -10°C has been achieved. Evidence should be provided to the customer that this has been achieved.

*Note: Further guidance on commissioning ground loop heat exchangers is published by the Ground Source Heat Pump Association (www.gshp.org.uk).*

# 7 DOCUMENTATION & HANDOVER

## 7.1 DOCUMENTATION

7.1.1 The MCS Contractor shall collate a comprehensive document handover pack which, as a minimum, includes:

- Copies of all forms and checklists used to commission the system
- The maintenance requirements and maintenance services available
- Manufacturer user manuals and warranty details
- Any documentation or checklists required for any incentive schemes

## 7.2 HANDOVER

7.2.1 At the point at which the heat pump system is handed over to the customer, the documentation as detailed in 7.1.1 shall be provided and explained along with a document signed by the MCS Contractor containing at least the following:

- A declaration, signed by the MCS Contractor's on-site representative, confirming that the installation meets the requirements of this Standard
- Client name and address
- Site address (if different)
- Contractor's name, address, contact details, MCS certification body and certification number
- List of the key components installed
- The estimation of system performance calculated according to Section 4
- Recommended interval for the first periodic inspection
- MCS contact details (helpdesk telephone number and email address)

*Note: See Appendix D for a model handover document.*

7.2.2 No later than 10 working days after commissioning, the installation shall be registered by the MCS Contractor on the MCS Installation Database (MID) and an MCS Certificate generated.

7.2.3 The MCS Certificate shall be sent to the customer with instruction to include it within the handover pack.

7.2.4 The generation of the certificate shall be undertaken in full compliance with the terms and conditions of use of the MID[1] and the registration of the system on the MID shall be undertaken only after the system has been fully installed and commissioned and not before.

7.2.5 A "per installation" fee is levied on MCS Contractors for each registration added to the database. Details of any such fee will be advised from time to time through MCS Certification Bodies.

# 8 MAINTENANCE

8.1 Maintenance checks should be undertaken periodically in accordance with the manufacturer's requirements.

*Note: in the absence of a manufacturer's maintenance checklist, an example is given in Appendix E.*

8.2 Any annual maintenance check should assess the return temperatures from any ground loop heat exchanger and log the results to compare against previous years.

8.3 As a minimum, handover documents shall include the checks customers should carry out themselves, the recommended frequency of those checks, and what to do if any issues are identified.

# 9 ROLES & COMPETENCY

9.1 All personnel involved in the design and installation of heat pump systems either employed by, or subcontracted to, the MCS Contractor shall be competent or instructed for the activities they undertake.

9.2 For two or multi-piece split systems, personnel shall be appropriately qualified for the handling of refrigerants e.g. EU F-GAS regulations, the Fluorinated Greenhouse Gases Regulations and Gas Safe.

9.3 For gas absorption and adsorption heat pumps installation and commissioning personnel shall be deemed competent and registered for the appropriate scope of work with the Gas Safe Register.

9.4 Complete records of training (where appropriate) and competence skills of personnel shall be maintained by the MCS Contractor, in particular:

- Design personnel - Shall be able to demonstrate a thorough technical knowledge of the technologies involved and the interaction of associated technologies and be able to deliver a compliant design to the requirements of MIS 3005-D;
- Installation personnel – Shall be able to demonstrate an adequate level of technical knowledge and installation skills, to install systems to the specified design in accordance with the requirements of this Standard, applicable codes of practice, manufacturer's instructions and Statutory Regulations.

*Note: As a minimum MCS Contractors should have personnel with demonstrable training and / or experience of heat pump systems in accordance with the requirements of this Standard.*

# 10 REGIONAL OFFICES

Where the MCS Contractor wishes to design and commission under the Certification Scheme in regional offices, then these offices shall meet the requirements of this standard to be eligible for Certification.

# 11 PUBLICATIONS, REFERENCE AND FURTHER READING

11.1.1 The below lists are provided so that MCS Contractors know which documents have been used as a basis for the development of the requirements of this MIS standard and they are able to further research topics if they need to do so.

11.1.2 It is a scheme requirement for MCS Contractors to own or have immediate access to at least one copy of the following documents in each office or regional office undertaking design, installation and commissioning work:

- MIS 3005 – D
- MIS 3005 - I
- MGD 007 – MCS – Heat Pump Guidance Document

11.1.3 It is not a scheme requirement for MCS Contractors to own or have immediate access to the following documents unless this MIS standard does not adequately cover off the aspects required.

- BS 7671:2018+A1:2020 Requirements for Electrical Installations (IET Wiring Regulations Eighteenth Edition). Available from British Standards Institution (BSI): www.bsi-global.com or The Institution of Engineering and Technology (IET): www.theiet.org/publications/
- GSHPA standards
- BS EN 805:2000
- Approved Document G3 "Hot Water Supply and Systems" (England and Wales)

[1] The terms and conditions of use can be found on the MCS Installation Database website.

- Hot Water Association Specification HWA 002:2020: Hot water storage vessels for Domestic Purposes for use with Heat Pumps
- BS EN 12831-1:2017 Heating systems in buildings
- CIBSE Domestic Heating Design Guide. A CIBSE publication
- Closed-loop Vertical Borehole – Design, Installation & Materials Standard Issue 1.0 2011 www.gshp.org.uk
- "Design of low-temperature domestic heating systems – a guide for system designers and installers", 2013, BRE Trust publication FB59, www.brebookshop.com
- EN 806-5:2012: Specifications for installations inside buildings conveying water for human consumption
- BS EN ISO 52016-1:2017 Energy Performance of buildings – energy needs for heating and cooling, internal temperatures and sensible and latent heat loads. Calculation procedures
- EN 8558:2015 Guide to the design, installation, testing and maintenance of services supplying water for domestic use within buildings and their curtilages. Complementary guidance to BS EN 806-5:2012
- Environmental good practice guide for ground source heating and cooling. GEHO0311BTPA-E-E. Published by Environment Agency 2011 www.environment-agency.gov.uk
- Guide A: Environmental Design. A CIBSE publication
- HSE Approved code of practice (ACOP) L8 - The control of legionella bacteria in water systems approved code of practice and guidance
- MCS 001 MCS Contractor certification scheme requirements document.
- MCS 012 – Product Certification Requirements: Pitched Roof Installation Kits.
- MCS 022 – Ground heat exchanger look-up tables. Supplementary Material to MIS 3005.
- MCS 021 – Heat Emitter Guide.
- MCS 020 – Planning Standards.
- MCS 031 – MCS Heat Pump System Performance Estimate
- "Report for DECC: Measurement of domestic hot water consumption in dwellings", Energy Monitoring Company, March 2008. Available from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48188/3147-measure-domestic-hot-water-consump.pdf
- The Compliance Certificate template for heat pump systems.
- CP2: Surface water source heat pumps — a Code of Practice for the UK (CIBSE, 2016)

# APPENDIX A – PERFORMANCE ESTIMATION METHOD

For all systems where the premises are not entitled to obtain a domestic EPC (e.g. non-domestic) as defined in clause 4.1.2 or where it is not possible to use a SCoP (e.g. GAHP, SAHP), the means of estimating the annual energy performance shall be as follows:

a) Assess the annual heat load for the building (space heating and / or hot water) using any suitable performance calculation method. Such calculation method shall be clearly described and justified.

b) Multiply the result from a) by the proportion of the relevant heat load to be provided by the heat pump system.

c) For space heating, divide the result from b) by the default efficiency (expressed as a Seasonal Coefficient of Performance or Seasonal Primary Energy Ratio (SCoP or SPERh)) for heat pumps calculated using the data available on the MCS website (www.mcscertified.com). For water heating, divide the result from b) by the efficiency (expressed as a Seasonal Coefficient of Performance or Seasonal Primary Energy Ratio (SCoP or SPERh)) when the heat pump is operating at the flow temperature of the heat pump while providing water heating service.

d) For Domestic Hot Water (SAHPs and HWHPs), the efficiency to be expressed as a Seasonal Performance Factor (SPF) shall be taken as the Coefficient of Performance (COP) (in accordance with the SEPEMO report: D2.5/D3.5 Position paper on heat pump SPF) obtained from the test results undertaken as part of the MCS 007 heat pump product certification scheme requirements for SAHPs and HWHPs.

e) Calculate the energy to be supplied by any supplementary heater by multiplying the result from a) by the proportion of the relevant heat load not supplied by the Heat Pump.

f) Add the result from c) to the result from d) to give the total energy required for the relevant heat load.

g) The results from e) for space heating and hot water are added together to give an overall energy requirement for the building for these heat loads.

# APPENDIX B – KEY FACTS

**Predicting the heat demand of a building, and therefore the performance and running costs of heating systems, is difficult to predict with certainty due to the variables discussed here. These variables apply to all types of heating systems, although the efficiency of heat pumps is more sensitive to good system design and installation. For these reasons your estimate is given as guidance only and should not be considered as a guarantee.**

Seasonal Coefficient of Performance:

MCS Seasonal Coefficient of Performance (SCoP) is derived from the EU ErP labelling requirements, and is a theoretical indication of the anticipated efficiency of a heat pump over a whole year using standard (i.e. not local) climate data for 3 locations in Europe. It is used to compare the relative performance of heat pumps under fixed conditions and indicates the units of total heat energy generated (output) for each unit of electricity consumed (input). As a guide, a heat pump with a MCS SCoP of 3 indicates that 3 kWh of heat energy would be generated for every 1 kWh of electrical energy it consumes over a 'standard' annual cycle.

Energy Performance Certificate

An Energy Performance Certificate (EPC) is produced in accordance with a methodology approved by the government. As with all such calculations, it relies on the accuracy of the information input. Some of this information, such as the insulating and air tightness properties of the building may have to be assumed and this can affect the final figures significantly leading to uncertainty especially with irregular or unusual buildings.

Identifying the uncertainties of energy predictions for heating systems

We have identified 3 key types of factor that can affect how much energy a heating system will consume and how much energy it will deliver into a home. These are 'Fixed', 'Variable' and 'Random'. Most factors are common to ALL heating systems regardless of the type (e.g oil, gas, solid fuel, heat pump etc.) although the degree of effect varies between different types of heating system as given in the following table.

The combined effect of these factors on energy consumption and the running costs makes overall predictions difficult however an accuracy $\pm$ 25-30% would not be unreasonable in many instances. Under some conditions even this could be exceeded (e.g. considerable opening of windows). Therefore it is advised that when making choices based on mainly financial criteria (e.g. payback based on capital cost verses net benefits such as fuel savings and financial incentives) this variability is taken into account as it could extend paybacks well beyond the period of any incentives received, intended occupancy period, finance agreement period etc.

| Factor | Impact |
|---|---|
| **'Fixed'** which include: | |
| Equipment Selection Performance figures (SCoP) from ErP data | System Efficiency |
| Energy Assessment via the EPC (e.g. assumptions as to fabric construction and levels of insulation; the variation in knowledge and experience of Energy Assessors) | Energy Required |
| **'Variable'** which are affected by the system design and include: | |
| Accuracy of sizing of heat pump- i.e. closeness of unit output selection (kW) to demand heat requirement (kW) | System Efficiency |
| Design space and ambient (external) temperatures | Energy Required |
| Design flow /return water temperatures, and weather compensation | System Efficiency |
| Type of Heat emitter (e.g. Under-floor; natural convector (e.g. 'radiator'), fan convector etc.) | System Efficiency |
| **'Random'** which cannot be anticipated and include: | |
| User behaviour: | |
| • Room temperature settings | Energy Required |
| • Hot water usage and temperature settings | Energy Required |
| • Occupancy patterns/times | Energy Required |
| • Changing the design HP flow temperatures | System Efficiency |
| • Ventilation (i.e. opening windows) | Energy Required |
| Annual climatic variations (i.e. warmer and colder years than average) | Energy Required |

Key:

The statement at the end of each item indicates the major factor affected as follows:

Energy Required: the heat energy output requirement of the system which directly impacts on running costs. This requirement exists regardless of the heating system chosen as it is the heat required to keep the space comfortable. Opening windows or increasing room temperatures will demand more heat output, which means more energy input but this would NOT directly affect the efficiency. Thus increased energy demand does NOT automatically mean reduced efficiency.

System Efficiency: the efficiency of the system has been directly affected and will therefore demand more input energy to achieve the same heat output thus increasing running costs. However, increased energy input does NOT necessarily mean lower system efficiency (see above).

# APPENDIX C – EXAMPLE COMMISSIONING CHECKLIST

*Note: Please refer to any manufacturers commissioning checklist and record information requirements as this may affect the equipment warranty.*

| Customer Details | | Company Details | |
|---|---|---|---|
| Customer Name: | | Job Reference: | |
| Address: | | Date: | |
| | | Technician: | |
| | | MCS No: | |
| Post Code: | | Contact No: | |
| Email: | | Email: | |

| Product Information | | | |
|---|---|---|---|
| Heat pump type: | | Manufacturer: | |
| HP Model No: | | Serial No: | |
| Indoor Model No: | | Serial No: | |
| Interface Model No: | | Serial No: | |
| Installed as per manufacturer's instructions: | | | |

| Pre-commissioning Checks - Electrical | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electrical supply (single/three phase): | | Incoming Voltage | | | | | |
| Resistance to earth (L-E): | Ω | L1-N | v | L1-E | v | N-E | v |
| Short circuit test (L-N): | Ω | L2-N | v | L2-E | v | L1-L2 | v |
| Visual condition of installation: | | L3-N | v | L3-E | v | L1-L3 | v |
| All sensors checked and reading correctly: | | | | | | L2-L3 | v |

| Heat pump control parameters | | | | | |
|---|---|---|---|---|---|
| Running Mode (Auto/Man/Eco): | | Comp start (min): | | Legionella cycle heat source (1): | |
| Heat Curve setting: | | Collector pump setting: | | Type of auxiliary heating (1): | |
| Max flow temp (MAX): | °C | CH pump setting: | | Max auxiliary power (1): | kW |
| MAX at outdoor temp: | °C | DHW start: | °C | Auxiliary bi-valent point: | °C |
| Min flow temp (MIN): | °C | DHW stop: | °C | Aux heat meter reading (kWh): | |
| MIN at outdoor temp: | °C | Legionella cycle temp: | °C | | |
| Heat stop temp: | °C | Legionella freq (days): | | | |

| Heat pump running data | | | | | |
|---|---|---|---|---|---|
| Outdoor: | °C | Source in: | °C | Superheat: | K |
| Indoor: | °C | Source out: | °C | Subcooling: | K |
| Flow: | °C | Discharge: | °C | TEV inlet: | °C |
| Return: | °C | Suction: | °C | DHW temp: | °C |
| HP running hours: | | DHW running hours: | | Aux heater running hours: | |
| kWh meter 1 reading: | | kWh meter 2 reading: | | Heat meter reading (MWh): | |

(1): Where more than one back-up or auxiliary (supplementary) heat source exists please identify clearly in "Technicians Comments" including if bi-valent or co-valent

## Absorber (ASHP only)

| | | | | | |
|---|---|---|---|---|---|
| Antifreeze make & type: | | Anti-vibration feet fitted where req: | | Clearance around unit | |
| Freeze protection: | °C | Condensate drainage suitable: | | Back: | mm |
| Correct clearance around unit: | | Evaporator clear of debris: | | Front: | mm |
| Installed on suitable base/bracket: | | Insulated and vapour sealed: | | Right: | mm |
| SPLIT SYSTEMS ONLY: System evacuated and refrig charged by F Gas registered operative: | | | | Left: | mm |
| Refrigerant No and charge: | | | kg | Below: | mm |

## Collector (GSHP only)

| | | | | | |
|---|---|---|---|---|---|
| Type of ground collector: | | Header pipe diameter: | mm | Freeze Protection to: | °C |
| Total No of loops/boreholes: | | Pressure tested to BS EN 805: | | Expansion vessel pre-charge: | bar |
| Total length of collector: | m | System flushed & purged: | | Collector system pressure: | bar |
| Collector pipe diameter: | mm | Biocide used: | | Insulation vapour sealed: | |
| Total length of header: | m | Thermal Transfer Fluid make & type: | | Collector installed to design: | |

## Central Heating System

| | | | | | |
|---|---|---|---|---|---|
| Emitter types: | | Heating (HTG) ΔT: | K | Inhibitor/anti-freeze used: | |
| System pressure: | bar | Strainers/filters clear: | | HTG system purged of air: | |
| Expansion vessel pre-charge: | bar | HTG System flushed and cleaned: | | DHW cylinder volume (litres): | |
| Safety relief valve setting: | bar | HTG System cleaner used: | | G3 commissioning cert completed: | |
| Buffer store volume (litres): | | HTG system water treated: | | System installed as per design: | |
| Circulation pump setting: | | Do all emitters heat up evenly with a similar ΔT across F&R: | | | |

## Heating system controls

| | | | |
|---|---|---|---|
| Type of HTG controls installed: | | HP control (demand or degree minutes): | |
| Have the controls been setup as per design: | | HTG control (HP or 3rd party): | |
| Have the controls been demonstrated and explained to the customer? | | DHW control (HP or 3rd party): | |
| Has the customer been provided with all documentation required by MIS 3005 D & I? | | | |

## Technicians comments

| | | | |
|---|---|---|---|
| Technicians Signature: | | Date: | |
| Customers Signature: | | Date: | |

# APPENDIX D – MODEL HANDOVER DOCUMENT

| Heat Pump Handover Document | ☐ Initial verification<br>☐ Periodic verification |
|---|---|

| | |
|---|---|
| Client | |
| Installation Address | |
| Test Date | |

| | |
|---|---|
| Description of installation (key components installed) | |
| System Rated Capacity | kW |
| Annual Space Heating demand | kWh |
| Annual Hot Water demand | kWh |

| | |
|---|---|
| Contractor's name and address | |
| MCS Contact | Telephone: 0333 103 8130<br>Email: hello@mcscertified.com |

| | |
|---|---|
| Design Flow Temperature | |
| Heat Pump SCoP (at the design flow temperature) | |

## Design, Construction, Inspection and Testing

I/we being the person(s) responsible for the design, construction, inspection and testing of the Heat Pump installation (as indicated by the signatures below), particulars of which are described above, having exercised reasonable skill and care when carrying out the design, construction, inspection and testing, hereby certify that the said work for which I/we have been responsible is, to the best of my/our knowledge and belief, in accordance with MCS Installation Standard MIS 3005.

| | | |
|---|---|---|
| Signature(s):<br><br>Name(s):<br><br>Date:<br>(The extent of liability of the signatory(s) is limited to the work described above) | Next inspection recommended after not more than: | Years |
| | Comments: | |

# APPENDIX E – EXAMPLE MAINTENANCE CHECKLIST

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## Heat Pump Service Record

| **Occupier name and address (inc postcode):** | **If Applicable - Landlord/agent name and address (inc postcode):** |
|---|---|
| | |

| Service details | | | |
|---|---|---|---|
| **Service provider name and address (inc postcode):** | Company Tel. No. | | |
| | Inspection date | | |
| | Technician name | | |
| | Technician signature: | | |

| | | | | | |
|---|---|---|---|---|---|
| Appliance owner | Homeowner / Tenant / Landlord / Agent | Heat pump location | | | |
| Heat pump make | | Heat pump model | | | |
| Heat pump serial number | | Type of system | Monoblock | Split | |

| Heat Pump Service Schedule | | | | | | |
|---|---|---|---|---|---|---|
| Required checks | Pass | Fail | Comments | | | |
| Electrical switches and wiring condition (isolation) | | | | | | |
| Internal components and fans (clean as necessary) | | | | | | |
| Visually inspect refrigerant circuit for condition/leaks | | | | | | |
| Overall condition, support and location clear of obstruction/s | | | | | | |
| Hydraulic circuits condition/insulation/leaks/damage | | | | | | |
| Condition of evaporator | | | | | | |
| Meter/s condition and readings (if installed) | | | | | | |
| Outdoor temperature sensors condition and location | | | | | | |
| Check/clean strainers and filters in the hydraulic circuits | | | | | | |
| Verify anti-freeze levels and top up to manufacturers specification as necessary (monoblock type) | | | % | | Temp (-°C) | |
| Type of antifreeze (glycol) - if used | | | Quantity (ltr) | | | |
| Verify Legionella purge cycle settings | | | Temp (°C) | | Duration (mins) | |
| User controls operation in HW and CH modes | | | | | | |
| Heat pump expansion vessel location and condition | | | Charge (bar) | | | |
| Hydraulic circulation, controls and vent system as necessary | | | | | | |
| Initiate a defrost cycle and check for the proper sequence | | | | | | |
| Voltage/Amps (kVA) while operating at full power | | | Volts | | Amps | |
| Condensate collector and termination | | | | | | |
| Appliance serviced in accordance with the manufacturers instructions | | | | | | |

| Hot Water Storage and Hydraulic System | | | |
|---|---|---|---|
| Hot water storage make | | Hot water storage model | |
| Hot water storage location | | Hot water storage capacity (ltr) | |
| Incoming CWM pressure (bar) | | Pressure reducing valve setting (bar) | |
| DHW flow rate (ltr/m) | | DHW temp at primary outlet (°C) | |

| Required checks | Pass | Fail | Comments | |
|---|---|---|---|---|
| Combined temperature and pressure relief fitted and discharge tested | | | | |
| Pressure relief, tundish and discharge pipework checked | | | | |
| CWM expansion vessel location and condition | | | Charge (bar) | |
| CH expansion vessel location and condition | | | Charge (bar) | |
| Check/clean strainers and filters in the hydraulic circuits | | | | |
| Electrical switches and wiring condition (isolation and thermal cut out) | | | | |
| Appliance serviced in accordance with the manufacturers instructions | | | | |

| Additional comments and remedial action required |
|---|
| |