STANDARDS DOCUMENT

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MCS 2025

Heat Pump: Design Standard

This Standard was prepared by the MCS Heat Pump Working Group.

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The MCS Service Company Ltd welcomes comments of a technical or editorial nature and these should be sent to *meetings@mcscertified.com*

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ABOUT MCS

MCS: Giving everyone confidence in home-grown energy

With energy costs constantly rising and climate change affecting us all – low-carbon technology has a bigger and bigger role to play in the future of UK energy. MCS is here to ensure it's a positive one.

MCS is the UK's quality mark for small-scale renewable energy technologies like solar PV, solar heating, heat pumps, biomass, and battery storage. We have two main roles – setting and maintaining standards, and providing consumer protection.

Our Standards define how certified renewable energy installations should be designed and installed using MCS certified products. They are a benchmark for quality developed in close consultation with industry through independent technical working groups.

The Standards are owned by The MCS Foundation (a charitable trust), but maintained and developed by MCS.

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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.

Amendments issued since publication

Issue No.	Amendment details	Date
1.0	First publication for MCS:2025 1.0	01/01/2025

FOREWORD

Compliance with this Standard is mandatory for MCS Contractors certified to MCS: 2025.

The purpose of this Standard is to specify best practice in achieving high-quality low carbon technology installations. Whilst it is not possible to ensure safety, this Standard provides requirements which should help mitigate potential safety risks associated with the design and installation of this technology.

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).

NOTE:
This MCS 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.

1 PURPOSE & SCOPE

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

1.2 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 vapour compression and thermally driven heat pumps, as well as systems use for heating only or for both heating and cooling. Heat pumps may be either "Monobloc" or "Split" units.

1.3 The following are expressly excluded from this Standard:

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

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

1.5 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.

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

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

2 DEFINITIONS

Refer to Scheme Rules for general definitions (not specific to Heat Pumps). For technical definitions please see below.

Term	Definition
Heat Pump	A device which takes heat energy from a low temperature source and upgrades it to a higher temperature at which is can be usefully employed for heating and/or hot water. Heat pumps may utilise different heat sources: • Ground source, where heat energy is extracted from the ground (e.g. from boreholes, horizonal trenches or aquifers) • Water source, in which heat energy is extracted from water (e.g. lakes, ponds or rivers) • Air source, where heat energy is directly extracted from ambient air. This includes solar assisted heat pumps.
Closed-Loop Heat Exchanger	A sealed loop of pipe containing a circulating fluid used to exchange heat from ground-or water-sources.
Ground Heat Exchanger	The arrangement of horizontally or vertically installed pipes through which the heat transfer fluid circulates and collects low grade heat from the ground. Can be either closed or open loop.
Heat transfer fluid	Fluid that is used to transfer thermal energy between components in a system.
External absorber	A panel which performs the function of an evaporator in a solar assisted heat pump system. This device is remote from the compressor and is usually mounted externally

3 DESIGN

3.1 LEGISLATION

3.1.1 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.

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

3.1.3 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.

3.1.4 The contractor shall ensure the building (including curtilage) 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.

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

3.1.6 Where responsible for notification under the Building Regulations, the MCS Contractor shall ensure that notification has been completed prior to handing over the installation.

Note: Where notification under the Building Regulations is to be undertaken by others (e.g. the developer of a new-build project) then it is permissible for the MCS Contractor to handover the installation immediately following commissioning.

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.

3.1.7 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.

3.2 MANUFACTURER'S INSTRUCTIONS

3.2.1 All equipment specified should be able to be installed in accordance with its manufacturer's instructions.

3.2.2 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.

3.3 EQUIPMENT CERTIFICATION AND LISTING

3.3.1 The heat pump(s) specified shall be listed on the MCS website (www.mcscertified.com). These listings include heat pumps both MCS certified (according to MCS 007) and by other schemes that MCS considers equivalent.

3.3.2 All equipment specified:

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 but this could change as the UK leaves the EU.

3.4 SPACE HEATING DESIGN

The following procedures shall be followed during the space heating design process for each installation. For systems where the heat pump is to supply 100% of the space heating load with or without a supplementary electric heater, clause 3.4.1 shall be followed. When designing a hybrid heat pump system (see definition) clause 3.4.2 shall be followed.

3.4.1 The following procedure shall be followed for systems where the heat pump is to supply 100% of the space heating load with or without a supplementary electric heater to ensure the correct sizing and selection of a heat pump and related components for each installation:

a) A heat load calculation should be performed on the building using internal temperatures not less than those specified in Table 1 and external temperatures specified in Table 2 column A or B, according to the MCS Contractor's assessment of the building location. If column B is selected, no uplift factor for intermittent heating is required. Heat load calculations shall in other respects comply with BS EN 12831-12017.

b) Any supplementary electric heater shall be designed to not operate above the external temperatures in Table 2.

c) When calculating the heat loss through a solid floor in contact with the ground, the temperature difference to be used is the internal design room temperature (Table 1) minus the local annual average external air temperature (see MGD 007 Section 5).

d) When calculating the heat loss through a suspended floor, the temperature difference to be used is the internal design room temperature (Table 1) minus the design external air temperature (Table 2).

e) A heat pump shall be selected that will provide at least 100% of the calculated heat load taking into consideration the flow temperature at the heat pump and without input from any supplementary electric heater. Performance data from both the heat pump manufacturer and the emitter system designer should be provided to support the heat pump selection.

f) An air source heat pump system should be able to maintain the internal design temperatures across multiple defrost cycles.

3.4.2 The following procedure shall be followed for a hybrid heat pump system to ensure the correct sizing and selection of a heat pump and related components for each installation:

a) A heat load calculation should be performed on the building using internal temperatures not less than those specified in Table 1 and external temperatures specified in Table 2 column A or B, according to the MCS Contractor's assessment of the building location. If column B is selected, no uplift factor for intermittent heating is required. Heat load calculations shall in other respects comply with BS EN 12831-1:2017.

b) When calculating the heat loss through a solid floor in contact with the ground, the temperature difference to be used is the internal design room temperature (Table 1) minus the local annual average external air temperature (see MGD 007 Section 5).

c) When calculating the heat loss through a suspended floor, the temperature difference to be used is the internal design room temperature (Table 1) minus the design external air temperature (Table 2).

d) The combined output of all heat sources shall be not less than 100% of the calculated heat load. The heat pump power output (kW) shall be selected such that it will provide a minimum of 55% of the calculated heat load of the building from 5.5.2 (a). The power output shall be rated at 55°C flow temperature for the device (as taken from the MCS database), at the design external temperature for the location where the system is being installed (even if the emitter design is based on a different flow temperature). Performance data from both the heat pump manufacturer and the emitter system designer should be provided to support the heat pump selection.

e) The control philosophy shall be capable of prioritising heat pump utilisation.

f) All combined heat sources shall be fully and operationally integrated into a single master control system capable of operating all devices either simultaneously or independently depending on operating conditions and the selected controls philosophy, to create a single heating system.

Room	Internal design temperatures (°C)
Living room	21
Dining room	21
Bedsitting room	21
Bedroom	18
Hall and landing	18
Kitchen	18
Bathroom	22
Toilet	18

Table 1: Internal design temperatures taken from CIBSE Guide which should be consulted for data for other applications. CIBSE Guide A also contains information on how to adapt this data for non-typical levels of clothing and activity.

Location	Altitude (m)	Hourly dry-bulb temperature (°C) equal to or exceeded for % of the hours in a year	
		A (99%)	B (99.6%)
Belfast	68	-1.5	-3.2
Birmingham	96	-3.2	-5.1
Cardiff	67	-1.5	-3.1
Edinburgh	35	-3.2	-5.4
Glasgow	5	-3.5	-5.9
London	25	-1.7	-3.0
Manchester	75	-2.7	-4.5
Plymouth	27	-0.2	-1.5

Table 2: Outside design temperatures for different locations in the UK taken from CIBSE Guide A Table 2.5. which also gives information on how to adapt and use this data.

3.4.3 The selection of High Temperature Heat Pumps (HTHPs) should be avoided unless the application requires a flow temperature higher than 55°C.

Note: Listed buildings or other design limitations may prevent the use of larger heat emitters.

3.4.4 Where a system design proposes a flow temperature greater than 55°C, an alternative design using a flow temperature of 55°C or lower should also be provided. Differences to the efficiency and energy consumption of these systems shall be explained to the customer allowing them to choose.

3.5 DOMESTIC HOT WATER DESIGN

3.5.1 In non-domestic buildings calculate the daily hot water demand using an appropriate method accounting for building usage along with number and type of hot water outlets.

3.5.2 In domestic buildings calculate the daily hot water demand ($V_{d,average}$) using the following formula:

$$V_{d,average} = 45 \times N$$

Where N = the greater of:

a) The number of bedrooms + 1

b) The number of known occupants

Note: If installing on a new build property, use (a) as the occupant number is unknown.

3.5.3 Using the daily hot water demand and proposed heat pump heating capacity, an appropriately sized hot water cylinder should be specified.

Note: Guidance for cylinder sizes is given in MGD 007. It is also acknowledged that the size of cylinder may be limited by the available space.

3.5.4 The specification of the heat exchanger for the domestic hot water cylinder shall follow the heat pump manufacturer's and/or cylinder manufacturer's recommendations.

Note: Domestic hot water heat exchangers for heat pump systems tend to require a greater surface area compared to traditional combustion-based heat sources (i.e. boilers) because the flow temperature is typically lower. The Hot Water Association have produced a specification for cylinders suitable for use with Heat Pumps (HWA 002:2020) and use of cylinders labelled in accordance with that document would also satisfy this requirement.

3.5.5 When installing a domestic hot water cylinder to work with a heat pump, the heat pump shall be capable of a flow temperature of at least 55°C at design conditions.

Note: design conditions means the lowest temperature at which the heat pump can meet the heat demand of the building without the need for input from a supplementary heater.

3.5.6 Where an existing domestic hot water cylinder is used then:

a) The thermal insulation of the hot water cylinder, and all pipes connected to it, shall be upgraded to a level at least equivalent to that applicable to new installations under relevant legislation and guidance. For cylinders with factory applied insulation, this condition can be satisfied if the cylinder standing heat loss is certified to comply with Section 12 of BS 1566-1:2002 + A1:2011 or equivalent. Where this certification is not apparent, or where the cylinder does not have factory-applied insulation, the contractor shall install additional insulation certified to comply with BS 5615:1985

b) Proper duty of care shall be exercised to ensure that the hot water cylinder is fit for purpose as regards its mechanical integrity. Consideration shall be given to scale build-up affecting overall system efficiency, damage, and deterioration caused by corrosion. Such issues shall be considered in the context of any additional stress placed upon the cylinder through the connection of the heat pump (e.g. thermal stress or additional system pressure)

c) Where applicable any refrigerant pipe work connecting the external evaporator with the cylinder and other the heat pump components shall be secured and protected in such a way that it is protected from accidental impact and escape of refrigerant gas

d) The size of the cylinder shall comply with the heat pump manufacturer's requirements

3.5.7 Domestic hot water systems shall incorporate a means to prevent bacterial growth (including *legionella bacteria*).

NOTE: where prevention is through periodic pasteurisation of the system then a bacterial risk assessment can help determine how frequent this pasteurisation should occur.

3.5.8 Hot water heat pumps delivering domestic hot water shall use waste heat from boiler rooms, waste heat from server rooms, or waste heat from external ambient air only as detailed in Commission Regulation (EU) No 814/2013. The extraction of heat by the heat pump shall not deplete the heat in the inhabited building space (thus increasing the space heating requirement).

3.6 GENERAL DESIGN CONSIDERATIONS

3.6.1 The contractor shall ensure that the electricity supply is adequate for the size of heat pump specified.

3.7 DESIGN OF CLOSED-LOOP GROUND HEAT EXCHANGERS

Note: Designing ground heat exchangers is a complex engineering procedure. If insufficient information is available to accurately design a ground heat exchanger, the contractor should adopt a conservative approach.

3.7.1 Closed-loop ground heat exchangers shall be designed such that the temperature of the thermal transfer fluid entering the heat pump achieves a state of thermal equilibrium at a temperature greater than 0°C.

NOTE: Thermal equilibrium is where the temperature of the thermal transfer fluid at the end of each year is the same as at the end of the previous year. The ground temperature should fully recover each year. This assumes that, where the heat pump unit is changed, it is a like-for-like replacement extracting no more heat from the ground than originally designed.

3.7.2 Simplified design methods, including look-up tables and nomograms, should only be used where these are location specific and have been designed to take into account UK average ground temperatures conditions, installation practices and comply with clause 3.7.1 above.

3.7.3 The following site characteristics shall be established using the methods given in Table 3:

a) Average ground temperature (in °C).

b) Local ground thermal conductivity (in W/mK)

<table>
<tr><th>Heat exchanger type</th><th colspan="2">Acceptable method(s)</th></tr>
<tr><td>Vertical borehole
(open and closed loop)</td><td colspan="2">• Thermo-geological assessment or
• Data purchased from BGS or
• Borehole data from BGS to determine site geology and lookup tables in MGD 007</td></tr>
<tr><td rowspan="2">Horizontal collector</td><td>Average Ground Temperature</td><td>Met office data for average annual air temperature (as a proxy for ground temperature)</td></tr>
<tr><td>Local ground thermal conductivity</td><td>• Site assessment to identify ground type and use lookup table in MGD 007 or
• Soil conductivity tests</td></tr>
<tr><td>Surface water</td><td colspan="2">• Refer to CIBSE CP2: Surface water source heat pumps: Code of Practice for the UK and
• Obtain advice from a competent specialist</td></tr>
</table>

Table 3

Notes:

For horizontal collectors the average ground temperature should account for the temperature swing throughout a typical year.

The British Geological Survey (BGS) keeps logs from a great many boreholes from all forms of drilling and site investigation work. These can be used to estimate the depth and thermal conductivity of solid geology for closed-loop borehole systems. BGS also compiles reports with information on the estimated thermal conductivity of superficial deposits for horizontal loop systems. Experienced geologists and hydro-geologists will also be able to estimate the local ground thermal conductivity. For larger systems, it may be beneficial to conduct a thermal response test. The Ground Source Heat Pump Association publication "Closed-loop vertical borehole design, installation and materials Standard" contains guidance on thermal response testing. See MGD 007 for ranges of thermal conductivity for different geologies.

3.7.4 Where the heating capacity of the heat pump established in clause 3.4.1 part (e) is ≥30kW$_{th}$, or where the system is to incorporate ground loop replenishment through cooling or otherwise, then proprietary software shall be used for designing the ground heat exchanger.

3.7.5 Where the heating capacity of the heat pump established in clause 3.4.1 part (e) is <30kW$_{th}$ and the system is not to incorporate ground loop replenishment, then either proprietary software or the following procedure shall be used for designing the ground heat exchanger:

a) The total heating energy demand over a year (in kWh) for space heating and domestic hot water shall be estimated using a suitable method. The calculation shall include appropriate consideration of internal heat gains, heat gains from solar insolation, local external air temperature and the heating pattern used in the building (e.g. continuous, bi-modal, with an Economy10 tariff or otherwise).

b) The total heating energy demand calculated in clause 3.7.5 part (a) shall be divided by the heat pump heating capacity selected in clause 3.4.1 part (e) to determine the parameter called the Full Load Equivalent (FLEQ) Run Hours:

$$\text{FLEQ Run Hours} = \frac{\text{Total heating energy demand}}{\text{Heat pump heating capacity}}$$

c) Using the Seasonal Coefficient of Performance or Seasonal Primary Energy Ratio (SCoP or SPERh) as shown on the MCS website (www.mcscertified.com) for the heat pump unit, determine the maximum power to be extracted from the ground ("G") in Watts (W) using the following formulae:

For electrically driven heat pumps:

$$G = H \cdot \left(1 - \frac{1}{SCOP}\right)$$

For gas absorption and adsorption heat pumps:

$$G = 1.1 \cdot H \cdot \left(1 - \frac{1}{SPERh}\right)$$

Where:

"H" is the HP heating capacity at 0°C ground return temperature and design emitter temperature.

d) Using tables in MGD007 lookup the specific heat power extraction from the ground ("g") in Watts per metre (W/m) based on the type of ground heat exchanger (borehole, horizontal or slinky), the average ground temperature, the local ground thermal conductivity and the FLEQ hours.

e) Calculate the minimum length of the ground heat exchanger active elements ("L_b") in metres (m)), using the formula:

$$L_b = \frac{G}{g}$$

f) For horizontal and slinky ground heat exchangers, calculate the total ground heat exchanger area, A (in m^2) using the formula:

$$A = L_b d$$

Where:

"d" is the minimum centre-to-centre spacing of the horizontal or slinky ground heat exchanger specified in the look-up tables and charts.

g) The minimum length of ground heat exchanger pipe in the active elements, L_p (in m), is determined according to the formula:

$$L_p = L_b R_{pt}$$

Where:

"R_{pt}" is a non-dimensional ratio and R_{pt} = 2 for boreholes; R_{pt} = 1 for horizontal ground heat exchangers; and R_{pt} is the minimum pipe length to trench length ratio specified in the look-up tables and charts for slinky ground heat exchangers.

h) The characteristics of the ground heat exchanger active element and thermal transfer fluid shall be such that the Reynolds number is ≥ 2500 at all times.

Note: The look-up charts presume a Reynolds number (a measure of flow characteristic either laminar, transitional or turbulent) greater than 2500.

3.7.6 The hydraulic layout of the ground loop system shall be such that the overall closed-loop ground collector system pumping power at the lowest operating temperature is less than 3% of the heat pump heating capacity.

3.7.7 Where manufacturers' in-house software or another commercial software packages is used to design the ground heat exchanger it shall be location specific taking into account UK average ground temperatures, the annual heat load of the building (space heating and domestic hot water) and the site characteristics established in clause 3.7.3.

3.8 POST DESIGN INFORMATION

3.8.1 Prior to the installation commencing, the installer shall be provided in writing with:

a) All specific room heat losses (in W/m^2)

Note: specific heat loss is the total heat loss divided by floor area.

b) The calculated daily hot water demand

c) The type and dimensions of emitter(s) to be used in the system

d) The design emitter temperature based on the worst performing room

e) The specification of any new domestic hot water cylinder and its recovery rate

f) The design flow temperature of the water leaving the heat pump and before any blending valves

g) The installation's SCoP/SPER (as taken from the MCS website) based on the above design flow temperature, when supplying space heating at the external design temperature

h) Any metering that can be installed and may be required to access any financial incentives

i) In the case of ground source heat pumps:
   a. A site plan showing the intended location of all elements of the ground heat exchanger, showing the depth of boreholes or trenches and the minimum separation distances (including that from structures and underground services)
   b. A completed copy of Table 4

<u>Table 4 - Details of ground heat exchanger design to be provided to the installer</u>

Parameter	Value			Comments
Average ground temperature		°C	[1]	
Local ground thermal conductivity		W/mK	[2]	
Estimate of total heating energy demand over a year for space heating and domestic hot water		kWh	[3]	(state calculation method)
HP heating capacity at 0°C ground return temperature and design emitter temperature, H		kW	[4]	
FLEQ run hours [3]/[4]		hrs	[5]	
Heat pump SCoP or SPERh (from MCS website)			[6]	
Maximum power extracted from the ground (i.e. the heat pump evaporator capacity) G = [4]*1000*(1 - (1/ [6])) for electrical or G = [4]*1000*1.1*(1 – (1/[6])) for absorption		W	[7]	
Maximum power to be extracted per meter length of borehole, horizontal or slinky ground heat exchanger, g		W/m	[8]	
Minimum length of ground heat exchanger required L_b = [7] / [8]		m	[9]	(e.g. 2 no. 50m slinkies)

Borehole, horizontal loop or slinky spacing, d		m	[10]	
Total length of ground heat exchanger active elements, $L_p = [9]*R_{pt}$		m	[11]	(NB: does not include header pipes)
Total length of the ground heat exchanger active elements installed in the ground, L_p'		m	[12]	(NB: state if proprietary software has been used to determine the design length)

4 PUBLICATIONS, REFERENCE AND FURTHER READING

The below lists are provided so that 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:

- 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)
- 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 012 – Product Certification Requirements: Pitched Roof Installation Kits.
- MCS 022 – Ground heat exchanger look-up tables. Supplementary Material to MIS 3005.
- MCS 031 – MCS Heat Pump System Performance Estimate
- MCS Heat Pump Guide

- “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
- CP2: Surface water source heat pumps – a Code of Practice for the UK (CIBSE, 2016)