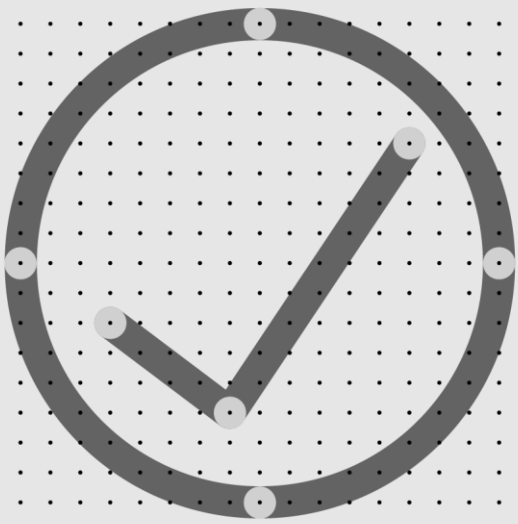
STANDARDS DOCUMENT

MIS 3001 ISSUE 5.0

The Solar Thermal 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 a bigger and bigger 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
1.2	Amended 3.4 Consumer Code of Practice wording. Updated e-mail and website addresses.	25/02/2008
2.0	Addition of text under Section 6 – Handover incorporating the generation of MCS Certificates from the MID for each installation. Changes are as agreed at SG meeting of May 27th 2010.	26/08/2010
3.0	Substantive update with re-writes to all sections.	01/10/2013
4.0	Addition of compliance certificate. Minor amendments to all sections following public consultation period.	16/12/2013
5.0	Substantive update with re-writes to all sections and: • Modernised document style and updated to new MCS Standard text. • New model handover document, example commissioning checklist and maintenance schedule.	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).

This issue 5.0 is a significant update and replaces issue 4.2. It is available for reference from the date of publication 01/12/2021. Compliance with this issue becomes mandatory for MCS Contractors certified in accordance with MIS 3001 from 01/04/2022 (date of implementation). Issue 4.2 ceases to be valid after 31/03/2022 (date of withdrawal).

This Standard describes the MCS requirements for the assessment, approval and listing of contractors undertaking the supply, design installation, set to work, commissioning and handover of solar thermal microgeneration systems by Accredited Certification Bodies. 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 3001).

NOTES:
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 Installation Standard does not in itself confer immunity from legal obligations.

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1 PURPOSE & SCOPE

1.1.1 This Standard specifies the requirements for MCS Contractors undertaking the supply, design, installation, set to work, commissioning and handover of Solar Thermal systems to supply solar thermal energy for space heating and/or domestic hot water for permanent buildings. The scope of this MCS Installation Standard is limited to installations with a design heat load requirement of up to 45 kW_{th}.

2 DEFINITIONS

2.1.1 Refer to MCS 001 and MCS 004 for definitions.

2.1.2 Where a definition does not appear in this Standard, informative reference is made to ISO 9488 (Solar energy – Vocabulary).

3 REQUIREMENTS OF THE MCS CONTRACTOR

3.1 CAPABILITY

3.1.1 MCS Contractors shall have the competency (see Section 8) and capacity to undertake the supply, design, installation, set to work, commissioning and handover of Solar Thermal systems.

3.1.2 Where MCS Contractors do not engage in the design or supply of Solar Thermal systems, but work solely as a MCS Contractor for a client who has already commissioned a system design; then the MCS Contractor shall be competent to review and verify that the design would meet the design requirements set out in this Standard and this should be recorded.

3.2 ORGANISATION

3.2.1 MCS Contractors shall organise themselves using policies, procedures and systems which meet the minimum requirements in MCS 001 to ensure every Solar Thermal installation meets this Standard.

Note: MCS 001 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 An estimate of the annual energy performance of the Solar Thermal system shall be made using the method detailed in MCS 024 Solar Domestic Hot Water Energy Calculator.

4.1.2 This estimate shall be communicated in the prescribed format to the client before the point that the contract is awarded and shall be accompanied by the following text:

"Important Note: The performance of a Solar Thermal system is impossible to predict with certainty due to the variability in the amount of solar radiation (sunlight) from location to location and from year to year. This estimate is based upon the standard MCS procedure and is given as guidance only. It should not be considered as a guarantee of performance."

4.1.3 Where the Shade Factor (SF) is less than 1.0 (i.e. shading is present) the following additional note shall accompany the above important note:

"Shading will be present on your solar thermal collectors and the impact of this shading on the energy performance of your system is reflected in the estimated heat generation."

4.1.4 Where the site has been evaluated remotely, the following additional note shall accompany the above important note:

"This system performance calculation has been undertaken using estimated values for array orientation, inclination and shading. Actual performance may be significantly lower or higher if the characteristics of the installed system vary from the estimated values."

4.1.5 The results of the performance estimate shall be given in the format set out in table 1 below:

Table 1 - Require format for presentation of performance estimates

A. Installation data		
Manufacturer and model number of Solar Thermal Product		
Total installed Solar Thermal Product area		m^2
Storage tank volume		m^3
Orientation of the Solar Thermal system – degrees from South		°
Inclination of system – degrees from horizontal		°
Type of heat demand – space heating / hot water		
Overshading factor		%
Postcode region		
B. Performance calculations		
Household occupancy (full time equivalent)		
Daily hot water demand (including hot water adjustment)		Litres/day
Estimated annual solar input to hot water cylinder		kWh
Estimated annual fuel saving		kWh/year

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4.1.6 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 At 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) Manufacturers' datasheet(s) for the proposed Solar Thermal product(s).
c) Manufacturers' product information for the proposed heat storage tank(s) and controller(s).
d) A drawing of the proposed Solar Thermal array layout and a drawing of the Solar Thermal system configuration.
e) Any other requirements stipulated by the MCS Contractor's Consumer Code (if applicable).

4.2.2 For multi-building/system projects (e.g. new-housing developments) item e) above can be omitted from the information communicated in writing to the customer.

5 DESIGN & INSTALLATION REQUIREMENTS

5.1 LEGISLATION

5.1.1 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.

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

5.1.3 MCS Contractors shall make their customers aware of all permissions and approvals required for the installation.

5.1.4 The MCS Contractor shall ensure the building is assessed by a competent professional experienced in Solar Thermal 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) is not compromised.

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

Note: The installation of a Solar Thermal system presents a unique combination of hazards – due to risk of scalding and burning, falling and simultaneous manual handling difficulty. All of these hazards are encountered as a matter of course on a building site, but rarely all at once. While roofers may be accustomed to minimising risks of falling or injury due to manual handling problems, they may not be used to dealing with the risk of scalding and burning. Similarly, heating engineers would be familiar with scalding and burning hazards but not with handling large objects at heights.

5.1.6 Where work is undertaken that is notifiable under the Building Regulations, the MCS Contractor shall make clear to the customer who shall be responsible for this notification.

5.1.7 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.

5.1.8 The MCS Contractor must ensure the installation is compliant with all relevant Regulations, which may include:

- Supply (Water Fittings) Regulation 1999, The Water Supply (Water Fittings) (Scotland) Byelaws 2014 and the Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
- Pressure Equipment Regulations 1999.
- The Gas Safety (Installation and Use) Regulations 1998.
- Electrical Safety, Quality and Continuity Regulations 2002 and Electricity at Work Regulations 1989.
- The Building Regulations.
- Control of Substances Hazardous to Health Regulations 2002 (COSHH).

5.2 MANUFACTURERS' INSTRUCTIONS

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

5.2.2 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.

5.3 EQUIPMENT CERTIFICATION AND LISTING

5.3.1 When making installations in accordance with this Standard the Solar Thermal products shall be certificated according to one of the following schemes:

- MCS 004 and listed: www.mcscertified.com
- CEN Solar Keymark and listed: http://www.solarkeymark.nl

5.3.2 Solar Thermal products mounted above, or integrated into, the roofs of buildings should utilise installation kits or components tested and approved according to MCS 012 The Roof Fixing Standard.

5.3.3 The mounting system used must be compliant with current Building Regulations for weather-tightness, fire and wind resistance. Use of mounting equipment approved according to MCS 012 The Roof Fixing Standard may be a means of demonstrating compliance.

5.3.4 All components used to mount the solar panels shall be specifically approved by the manufacturer(s) of those components to work together unless described by the manufacturer(s) as universally compatible with other manufacturers' components.

5.3.5 Where the MCS 012 certification of a mounting system specifically refers to its compatibility with a named Solar Thermal product (or products) then only those Solar Thermal products shall be used.

5.3.6 All installed equipment:

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 the 1st January 2023.

5.4 DESIGN AND INSTALLATION

5.4.1 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.

5.4.2 The Solar Thermal array layout should allow access for maintenance and emergency services.

Note: For larger installations, special consideration should be given to:

- *The provision of access/walkway around the perimeter of the array.*
- *Arranging larger arrays into smaller blocks with access corridors between.*
- *The provision of permanent protection over fragile roof elements such as skylights.*
- *The provision and type of permanent access ladders.*

5.4.3 The MCS Contractor must undertake an assessment to identify and assess the risk of exposure to legionella bacteria from the perspective of the Solar Thermal system installation, operation and decommissioning. The MCS Contractor must implement the steps needed to prevent or control the risks identified in the assessment.

5.4.4 The Solar Thermal system shall:

- Be designed so that it operates effectively assuming no user intervention.
- Be designed and installed to prevent the export of non-solar generated heat to the Solar Thermal array.
- Be designed and installed to incorporate a safety device to control the risk of over-pressure in system components.
- Be designed such that any release to atmosphere of any high temperature fluid (vapour or liquid) is either safely contained in a suitable vessel or discharged externally.
- Be designed and installed such that any auxiliary heating system has a control interlock wherever possible.
- Be designed so that the Solar Thermal system performance is optimised by controlling the timing of backup (auxiliary / non-solar) sources of water heating.
- Be designed such that there is auto-resume of normal operation after stagnation without user intervention (often referred to as "intrinsically secure").

5.4.5 The Solar Thermal system should incorporate hot water storage that:

a) Where vented hot water storage, complies with BS 1566-1
b) Where unvented hot water storage, complies with BS EN 12897
c) Includes a dedicated solar pre-heat storage volume which is either:

i) 80% of the daily hot water demand for pre-heat vessels, or
ii) 25 litres per net square meter of the solar collector absorber area (where the collector area is measured as the effective aperture area or net absorber area, whichever the smaller).

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5.4.6 All pipes of a Solar Thermal system transferring heat should be insulated to reduce heat loss, except for branch pipes to expansion vessels, to a conductivity no greater than 0.040W/mK and with an insulation thickness at least one and half times the pipe diameter (or so as to provide an equivalent heat loss measured at 50°C).

Note: For the solar primary circuit, the minimum insulation thickness set out in table 2 below is deemed to satisfy both this requirement and Part L of the Building Regulations in England and Wales.

Table 2: Minimum required wall thickness for High Temperature EPDM based rubber insulation products.

Minimum required wall thickness for High Temperature EPDM based rubber insulation products used for solar primary circuits assuming a mean flow temperature of 50°C and a conductivity of 0.040 W/mK						
	Pipe Outside Diameter					
	10mm	12mm	15mm	22mm	28mm	35mm
Minimum insulation wall thickness	9mm	13mm	13mm	19mm	25mm	32mm

5.4.7 Where the pipes and cables of the Solar Thermal system pass through the building's insulated structure, these services should be designed to minimise the risk of air infiltration.

5.4.8 The Solar Thermal system should be designed and installed to allow for safe and environmentally responsible decommissioning.

5.5 CONTROLS, METERING & COMMUNICATION

Controls

5.5.1 Where a Solar Thermal system utilises pumped primary circulation then:

a) The system shall be controlled by a temperature-sensitive device that accurately measures the difference in temperature between the absorber and the pre-heat storage.

b) The settings for adjustable values of differential and hysteresis within the system should be provided to the customer.

c) The system controller should include a manual override to engage circulation for commissioning in all weather conditions.

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Displays and Metering

5.5.2 A means of recording and displaying the heat generation of the system should be installed.

Note: This does not require the installation of a separate calibrated heat meter; many differential temperature controllers used in Solar Thermal systems include a function to calculate and display the amount of heat delivered by the Solar Thermal system.

5.5.3 The Solar Thermal system should include a means of accurately indicating the circulation flow rate within the system's primary circuit.

5.5.4 Where a Solar Thermal system utilises a pressurised primary circuit, a pressure gauge shall be included which displays the pressure within the circuit.

5.5.5 The means of recording heat generation, be it the Solar Thermal system controller or a dedicated heat meter (if fitted), the means of indicating system flow rate and, where appropriate, the means of indicating system pressure, should be accessible and readable by the customer without requiring the use of a tool, ladder or torch.

5.5.6 For systems utilising thermosiphonic primary circulation, the hot water temperature shall be indicated by means of a thermometer or temperature indication device on the hot water tank in a clearly visible location, or on a remote device within the property**.**

Data Communication & Security

5.5.7 A means of indicating to the customer within 48 hours of the system ceasing to operate, or beginning to operate abnormally, should be provided.

Note: The installation of a solar controller with an automatic warning light and/or error message function and/or heat quantity measurement capability installed in accordance with clause 5.6.2 could satisfy this requirement.

5.5.8 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 Solar Thermal system should comply with the Standard ETSI Technical Specification 303 645 Cyber Security for Consumer Internet of Things.

5.5.9 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.

5.6 SAFETY AND DURABILITY

Note: This Section is not intended to be a comprehensive list of safety and durability features of a professionally designed, installed and commissioned Solar Thermal system. To be safe and durable, Solar Thermal system installations must be compliant with all relevant Regulations (Section 5.1.8), with the Water Regulations and Building Regulations being relevant to all Solar Thermal system installations. This Section is intended to compliment Regulations (Section 5.1.8) and the MCS Contractor's installation experience (Section 8.1.1) by highlighting some of the key elements of the Solar Thermal system design and installation which require particular attention to detail to ensure the system is safe and durable.

Fire Performance

5.6.1 The MCS Contractor shall be able to demonstrate that the installation of the Solar Thermal Products has not affected the fire performance of the roof.

Note: This can be demonstrated by:

a) Mounting above an existing non-combustible roof covering (pitched roofs).

b) Where in-roof (forming the main roof covering) using an in-roof kit with the appropriate fire performance rating for the proposed location of the array. See Appendix C for a worked example and guidance on fire classification relevant to distance from boundaries reproduced from Approved Document B applying in England & Wales.

5.6.2 Care should be taken to ensure that the installation of the Solar Thermal system meets the fire safety requirements set out in Building Regulations in relation to the fire safety and suitability of materials and products used (under all anticipated operating and stagnation conditions) and with respect to the fire resistance of the building.

Climate Conditions

5.6.3 Solar Thermal systems shall incorporate a means to protect the system from damage or malfunction due to freezing without the need for user intervention or electricity.

High Temperatures, High Pressure and Burn Risk

5.6.4 When operating, none of the Solar Thermal system components shall be exposed to temperatures or pressures outside their designed range and safeguards shall be implemented to ensure pressures do not exceed the pressure rating of the weakest component. The design shall include mechanisms to ensure than an over-pressure event does not pose a risk to the long-term durability of the Solar Thermal system.

5.6.5 All Solar Thermal system components transferring or storing heat shall be insulated to protect against burns, except for branch pipes to expansion vessels.

5.6.6 The Solar Thermal system shall incorporate safety devices to ensure that the temperature of the stored water does not exceed 100°C at any time.

5.6.7 The Solar Thermal system shall incorporate a means to limit the temperature of the water at all points of use after an assessment of scald risk factors.

Note: For domestic applications this requirement might be met through the provision of thermostatic mixing valves (TMVs) within 2,000mm of all points of use set at no more than 46°C (or lower dependent upon the point of use in question) OR the provisions of TMVs at the outlet(s) from the hot water cylinder set at 55°C – 60°C OR the provision of a thermostatic device to limit the solar input to the hot water cylinder OR a combination of the above.

5.6.8 In the case when the Solar Thermal system is supplying pre-heated water to the cold inlet of an instantaneous water heating appliance, the design shall ensure that the pre-heated water is at a temperature no higher than the maximum cold inlet temperature for the appliance as specified by the manufacturer.

Legionella and Water Supply

5.6.9 The Solar Thermal system shall incorporate an automatic means to control bacterial growth to ensure safe operation, and must include protection against Legionella bacteria (Legionnaires' disease: The control of legionella bacteria in water systems. Approved Code of Practice and guidance on regulations L8, Health & Safety Executive).

5.6.10 The Solar Thermal system shall ensure the wholesome water supply is not contaminated. This may include the installation of devices to prevent backflow or back-siphoning where applicable.

Heat Transfer Fluid

5.6.11 All the Solar Thermal system components in contact with the heat transfer fluid shall have been designed to work with the heat transfer fluid used.

5.6.12 The Solar Thermal system shall have adequate provision for the expected expansion of the heat transfer fluid and the design shall ensure that the loss of heat transfer fluid during standard operating conditions (including stagnation) is minimised.

5.6.13 The design of the Solar Thermal system shall ensure that future safety is not significantly affected by mineral deposits, sludge, ice or other solids forming in the solar primary circuit.

5.7 SITE SPECIFIC ISSUES

5.7.1 The Solar Thermal array shall not adversely affect the weather tightness or structural integrity of the building to which it is fitted. The system should be designed and installed to ensure this is maintained for the life of the system.

5.7.2 Where the existing roof covering is under warranty, then the roof warranty provider should be consulted to establish whether warranties will be invalidated by the installation.

5.7.3 Where any existing warranty may be invalidated by the proposed installation, the MCS Contractor shall notify the customer in writing and obtain explicit written agreement from the customer if the installation is to proceed.

Note: a clause in the MCS Contractor's standard terms & conditions would not satisfy this requirement.

Installation on Pitched Roofs

Note: Pitched roofs are defined as those with an angle greater than 10° but less than 70° to the horizontal.

5.7.4 The MCS Contractor shall ensure that the roof structure is checked by a suitably competent person to ensure it can withstand the loads imposed by the Solar Thermal array.

5.7.5 For the typical roof structure types shown in Table 3, the calculation methodologies given should be used.

5.7.6 Where the roof structure is in any way unusual, or there is any doubt whatsoever, a **qualified structural engineer** shall be consulted.

Note: An unusual roof structure would include any that:

- *Is not shown in Table 1.*
- *Shows signs of structural distress.*
- *Shows signs of post construction modification (e.g. removal of timbers, notching, change of roof covering to a heavier material).*
- *Where the roof pitch is particularly shallow (i.e. less than 30° to the horizontal).*
- *The roof design has increased potential for snow build-up (e.g. dormers, valleys, parapets etc).*

5.7.7 Solar Thermal Products should not be mounted within 400 mm from any edge of a domestic roof unless specific measures are taken to:

- Resist the increased wind uplift forces in the edge zone through additional fixings and, where necessary, additional roof timbers for those fixings.
- Ensure ridge-tiles remain secure.
- Ensure rainwater run-off patterns are not affected.
- Ensure build-up and shedding of snow cannot cause injury or property damage.
- Reduce nuisance from wind noise.

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5.7.8 Where necessary to ensure rooftiles or slates are not displaced creating gaps greater than those pre-existing the installation, then those tiles or slates shall be notched or flashed as appropriate.

5.7.9 When screw-fixing brackets directly to metal roof cladding the roof-sheet thickness shall be checked to ensure that it is compatible with the fixing bracket and screws and it can withstand the additional wind uplift introduced by the Solar Thermal array.

5.7.10 The fixing of the metal roof cladding to the main roof structure shall be checked to ensure that it is capable of transferring the imposed and wind uplift loads introduced by the Solar Thermal array.

Installation on Flat Roofs

Note: Flat roofs are defined as those with an angle less than 10° to the horizontal.

5.7.11 For mechanically fixed systems:

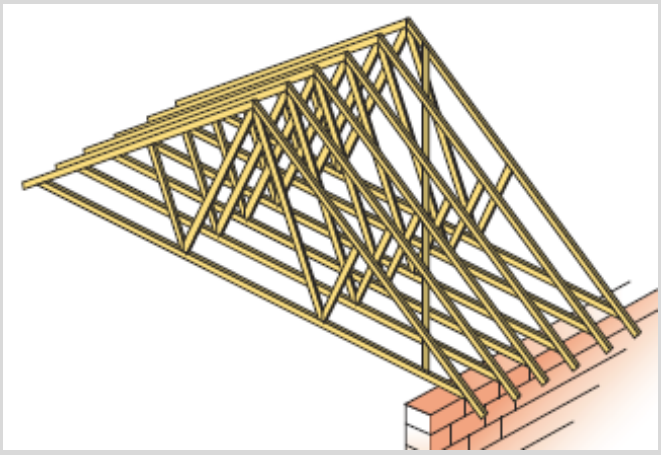
a) When fixing to an existing solid deck (e.g. concrete, brick or similar), a condition survey should be carried out and pull out tests undertaken.
b) Where it is not possible to reliably calculate the pull-out value, for example, for a concrete roof or where the roof build-up is not possible to ascertain the roof structure from the survey, pull out tests should be undertaken in accordance with the technical guidance published by the Single Ply Roofing Association "Site pull-out test protocol for flat roofs" (S15-19).

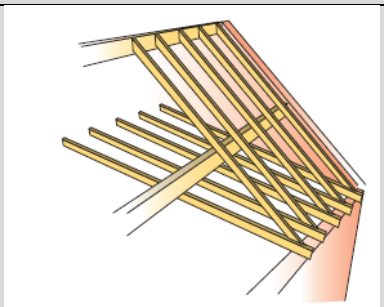
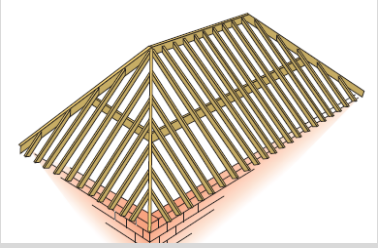
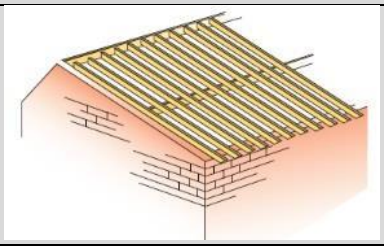
5.7.12 For ballasted systems:

c) The pressure coefficients shall be taken from BRE Digest 489 'Wind loads on roof-mounted photovoltaic and solar thermal systems' or from recognised test data commissioned for the specific purpose of determining the wind loads on solar systems.
d) A protection/slip layer shall be used which is confirmed as compatible with the waterproofing layer(s).
e) The calculation of resistance to sliding for ballasted mounting systems shall use a coefficient of friction of 0.3 unless the material combination (including slip layer) has been tested in accordance with MIS 3002 Appendix D in which case the test results shall be used.
f) Where installed on granular substrates (e.g. gravel or green roofs) the calculation of resistance to sliding shall use a test value in accordance with MIS 3002 Appendix D or shall be mechanically restrained against sliding (see note).
g) The wind resistance calculation shall declare the coefficient of friction used and where the coefficient of friction is greater than 0.3 the value should be evidenced by a test report.
h) A qualified structural engineer shall be consulted to ensure the roof is able to withstand the imposed load from both the Solar Thermal array and the proposed ballast.

Note: Methods to mechanically restrain the system against sliding include the installation of a kerb in front of the Solar Thermal array or the use of tether cables attached to an appropriate fixed point on the roof.

Table 3: Typical roof structure types and roof loading methods

<table>
<tr><th>Diagram</th><th>Construction Diagram Type of Roof</th><th>Typical Methods</th></tr>
<tr><td colspan="2">Roof constructed from Timber Trussed Rafters
  </td><td>Method 1:
Assuming a typical design dead load of 0.785 kN/m^2, deduct the load of the existing roof covering to give the maximum allowable residual load available for the Solar Thermal array.

Method 2:
(not generally applicable where the roof pitch exceeds 60°):
Assuming a typical design imposed load of 0.75 kN/m^2, deduct the likely snow load for the location taken from Eurocode-1 (BS EN 1991-1) to give the maximum allowable residual load available for the Solar Thermal array.</td></tr>
<tr><td>  </td><td>Traditional cut roofs constructed from timber rafters/purlins - gable ended</td><td>Calculate the maximum dead load for the rafters and purlins using the timber research and development association (TRADA) Span tables; deduct the load of the existing roof covering to give the maximum allowable residual load available for the Solar Thermal array.</td></tr>
<tr><td>  </td><td>Traditional cut roofs constructed from timber rafters/purlins - with hips and/or valleys</td><td>Consult a structural engineer.</td></tr>
<tr><td>  </td><td>Asymmetric duo-pitched roofs constructed from rafters and purlins</td><td>Consult a structural engineer.</td></tr>
</table>

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6 COMMISSIONING & HANDOVER

6.1 COMMISSIONING

6.1.1 A pre-commissioning checklist should be used which is customised to incorporate any pre-commissioning checks recommended by the manufacturer of any of the components being used in the Solar Thermal system.

6.1.2 The Solar Thermal 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.

6.1.3 The MCS Contractor should complete a suitable commissioning checklist when commissioning the Solar Thermal system

Note: An example of a suitable commissioning checklist is shown in Appendix B.

6.2 DOCUMENTATION & LABELLING

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

- Copies of all forms and checklists used to commission the system.
- The maintenance requirements and maintenance services available (see Section 7).
- Manufacturers' user manuals and warranty details.
- Details of the heat transfer fluid used, including information on formulation, potential hazards (human and environmental), manufacturer, expected service life and method(s) of safe disposal.
- Details of the Solar Thermal system energy performance assessment as outlined in MCS 024.
- Any documentation or checklists required for any incentive schemes.

6.2.2 As part of the handover pack, the MCS Contractor shall provide the client with the following information (written in an easy-to-understand manner) about the operation and maintenance of the Solar Thermal system:

- Where the solar and backup heating share the same hot water cylinder, a description of how the timing of back-up heating relative to the times of hot water use should be controlled to achieve maximum energy yield from the Solar Thermal system.
- A warning of the risk of bacterial growth within the hot water system and how this should be controlled (including protection against Legionella bacteria).
- A note explaining the presence of the temperature controls in the Solar Thermal system and their purpose in preventing scald injuries.
- An explanation of any user actions (including frequency) necessary to maintain limescale protection devices.

- Where the solar heated water is feeding a combination boiler, documentation from the boiler manufacturer confirming that the boiler is capable of accepting the pre-heated water from the Solar Thermal system and, where appropriate, describing any requirement to set a limiting valve.
- Details of the methods employed to control damaging effects of freezing, along with the lowest temperature that these methods protect to. The method and frequency of maintaining this protection (where required) should also be stated.
- Any routine maintenance required, such as visual inspection, pump replacement, and antifreeze replacement.

6.2.3 The following labels shall be fixed to the appropriate part of the Solar Thermal system:

- Showing the contact details of the Solar Thermal system installer/commissioner.
- Warning of the possible discharge at the pump station or at the pressure relief valve, if installed separately from the pump station.

6.2.4 The MCS Contractor should include a decommissioning plan for the Solar Thermal system, highlighting to the client how the system can be decommissioned in a safe and environmentally responsible manner.

6.3 HANDOVER

6.3.1 At the point at which the Solar Thermal system is handed over to the client, the documentation as detailed in 6.2.1 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).
- The MCS Contractor's name, address, contact details etc.
- List of the key components installed.
- The estimation of system performance calculated according to Section 4.
- Recommended interval for the first periodic inspection.

Note: See Appendix D for a model handover document.

6.3.2 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.

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

6.3.4 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.

6.3.5 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.

7 MAINTENANCE

7.1.1 An example of a maintenance schedule including the checks to be undertaken and their frequency is given in Appendix E according to building type/occupancy.

7.1.2 **The maintenance checks suggested along with their frequency are advisory only** and include:

- Customer checks (visual only).
- An intermediate maintenance visit by an MCS Contractor.
- A full maintenance visit with more involved tests requiring specialist equipment, again by an MCS Contractor.

Note: The actual checks required and how frequent will be dependent upon system size, the use/occupancy of the building, and ease of roof access along with specific requirements of the customer and any other stakeholders such as insurers.

7.1.3 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.

8 ROLES & COMPETENCY

8.1.1 All personnel involved in the design and / or installation of Solar Thermal systems, either employed by or subcontracted to the MCS Contractor, shall be competent, skilled or instructed for the activities they undertake.

8.1.2 Complete records of training and / or qualifications demonstrating the required competencies shall be maintained by the MCS Contractor, in particular:

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

- 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 this Standard.
- 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, manufacturers' instructions and Statutory Regulations.

Note: As a minimum the MCS Contractor should have personnel with demonstrable training and / or experience of Solar Thermal systems in accordance with the requirements of this Standard. Entry level qualifications as shown in Appendix A, may be deemed as suitable for simple non-complex systems.

9 REGIONAL OFFICES

9.1.1 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.

10 PUBLICATIONS, REFERENCE AND FURTHER READING

10.1.1 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 Standard and they are able to further research topics if they need to do so.

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

MCS Standards:

- MCS 001 The MCS Contractor Standard (Part 1 and Part 2).
- MCS 004 The Solar Thermal Standard (Product).
- MIS 3001 The Solar Thermal Standard (Installation).
- MCS 024 Solar Domestic Hot Water Energy Calculator.
- CC 003 Solar Thermal Compliance Certificate Template.
- MGD 005: Solar PV Shade Evaluation Procedure.
- MIS 3002 The Solar PV Standard (Installation).
- MCS 012 Product Certification Scheme Requirements: Pitched Roof Installation Kits.

Standards, guidance and documents including with regard to health and safety:

- Construction (Design and Management) Regulations 2015. Guidance on Regulations (Series Code: L153).
- HSE Approved Code of Practice (ACOP) L8 (Fourth edition) Legionnaires' disease. The control of legionella bacteria in water systems.
- HM Government Domestic Building Services Compliance guide 2013 edition (incorporating 2018 amendments).
- Level 3 Solar Thermal Hot Water Systems Training Manual (LCL Awards, BPEC or City & Guilds).

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

Selected Solar Thermal system Design Guidance:

- Chartered Institution of Building Services Engineers (2016) The Solar heating design and installation guide.
- CORGIdirect (2012) Domestic solar hot water systems.
- Deutsche Gesellschaft für Sonnenenergie (2005) Planning and installing solar thermal systems: a guide for installers, architects, and engineers.

Related MCS Standards available from: https://mcscertified.com

- MIS 3004 Requirements for MCS Contractors undertaking the supply, design, installation, set to work, commissioning and handover of solid biofuel heating systems.
- MIS 3005 Requirements for MCS Contractors undertaking the supply, design, installation, set to work, commissioning and handover of microgeneration heat pump systems.

Solar Thermal standards available from: https://shop.bsigroup.com

- BS 5918:2015 Solar heating systems for domestic hot water – Code of practice for design and installation.
- BS EN 12975-1:2006+A1:2010 Thermal solar systems and components. Solar collectors. General requirements.
- BS EN 12976-1:2017 Thermal solar systems and components. Factory made systems. General requirements & BS EN 12976-2:2019 Thermal solar systems and components. Factory made systems. Test methods.
- BS EN 12977-1: 2018 Thermal solar systems and components – Custom built systems. General requirements for solar water heaters and combisystems.
- BS EN 12977-3: 2018 Thermal solar systems and components – Custom built systems. Performance test methods for solar water heater stores.
- BS EN ISO 9806:2017 Solar Energy – Solar thermal collectors – test methods.

Controller Standards available from: https://www.etsi.org

- ETSI EN 303 645: CYBER Cyber Security for Consumer Internet of Things: Baseline Requirements.

Standard Assessment Procedure (SAP) available from: https://www.bregroup.com/sap

- The Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP 2012 Edition).
- The Government's Standard Assessment Procedure for Energy Rating of Dwellings (SAP 10 Edition).

Construction Standards: https://shop.bsigroup.com & https://www.brebookshop.com

- BS EN 1991-1-1:2002 Eurocode 1. Actions on structures. General Actions. Densities, self-weight, imposed loads for buildings.
- BS EN 13374:2013+A1 Temporary edge protection systems. Product specification. Test methods.
- BRE Digest 489 Wind loads on roof-mounted photovoltaic and solar thermal systems.
- BRE Digest 495 Mechanical installation of roof-mounted photovoltaic systems
- Single Ply Roofing Association (SPRA) Site Pull-Out Test Protocol For Flat Roofs (S15/19).

Regulations available from: http://www.legislation.gov.uk

- Supply (Water Fittings) Regulation 1999, The Water Supply (Water Fittings) (Scotland) Byelaws 2014 and the Water Supply (Water Fittings) Regulations (Northern Ireland) 2009.
- Pressure Equipment Regulations 1999.
- The Gas Safety (Installation and Use) Regulations 1998.
- Electrical Safety, Quality and Continuity Regulations 2002 and Electricity at Work Regulations 1989.
- Control of Substances Hazardous to Health Regulations 2002 (COSHH).

The Building Regulations:

- England and Wales available from: https://www.planningportal.co.uk
- Northern Ireland available from: http://www.buildingcontrol-ni.com
- Scotland available from: https://www.gov.scot

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APPENDIX A – ENTRY LEVEL QUALIFICATIONS

The following course and qualifications can help demonstrate competency, but a single qualification should not be presumed to prove an individual competent for all situations.

Level 3 Award in the Installation and Maintenance of Solar Thermal Hot Water Systems (IMSTHWS) – LCL Awards.

Level 3 Award in the Installation and Maintenance of Solar Thermal Hot Water Systems – BPEC.

Level 3 Award in the Installation of Solar Thermal Hot Water System (2399-21) - City & Guilds.

Level 3 Award in the Installation and Maintenance of Solar Thermal Hot Water Systems (2399-22) - City & Guilds.

APPENDIX B – EXAMPLE COMMISSIONING CHECKLIST

Note: Please refer to any manufacturer's commissioning checklists that apply and record information requirements as appropriate as this may effect equipment warranties.

Commissioning Checklist		
Installation address	Reference:	
	Date:	
	Test Instruments:	
For solar primary sealed systems – fully-filled and drainback. Enter key specification details and adjustment variables		
User instructions explained and handed over	[ ]	Yes/No
Decommission schedule for collector and cylinder left on site	[ ]	Yes/No
Installation and maintenance instructions left on site	[ ]	Yes/No
Specialist maintenance schedule (including frequency, maintenance andlist of parts to be replaced during normal maintenance) left on site	[ ]	Yes/No
Store commissioning certificate completed and signed	[ ]	Yes/No
System drawing indicating hydraulic, valve and electrical connections	[ ]	Yes/No
Conformity declarations for EU directives	[ ]	Yes/No
All documentation to be kept visibly near store protected from heat,water and dust. Name of location where documentation is left		
Glazing format of solar collector	Tube / Flat	
Absorber type	Selective / Non-selective	
Net absorber or aperture area	[ ]	m^2
Copy of EN 12975 conformity certificate left on site	[ ]	Yes/No
If no EN 12975 conformity, what is max design temperature	[ ]	°C
If no EN 12975, will primary system prevent collector overheating	[ ]	Yes/No
Manufacturer's name		
Unique serial no		
Maximum stagnation temperature of collector	[ ]	°C
Maximum design pressure of collector	[ ]	Bar
Maximum design pressure of pre-heat store exchanger	[ ]	Bar
Primary pressure limit of weakest component	[ ]	Bar
System pressure setting adjusted when cold	[ ]	Bar
Minimum allowable primary system pressure/level before user action required	[ ]	Bar
Procedure for user to follow if primary pressure/level is below limit		
Location of primary system pressure gauge		
Frequency of regular test of pressure safety device	Yearly/Biennially	
Location of pressure safety device		
Location of electrical fused isolating switch		
Fuse rating	[ ]	Amps
Electrical controls and temperature sensors operating correctly	[ ]	Yes/No

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Non-solar DHW heating fitted with a thermostatresponding to the solar pre-heat store temperature	[ ]	Yes/No
Differential pump control setting	[ ]	°C
Hysteresis setting about differential switching points	[ ]	°C
Expansion vessel pre-charge (Bar), or drainback vessel expansion volume (Litres)	[ ]	Bar/Litres
Expansion or drainback vessel capacity	[ ]	Litres
Expansion capacity suitable to be inherently secure	[ ]	Yes/No
Written warning left on site if there is potentially no automaticresumption of normal operation after stagnation	Yes/No/Not required	
Lowest ambient temperature of primary system without freeze damage	[ ]	°C
The heat transfer fluid provides freeze protection to	[ ]	°C
Type of transfer fluid	Water/Glycol	
Maximum Ambient temp for pump	[ ]	°C
Minimum ambient temperature for pump	[ ]	°C
Circulation rate setting	[ ]	Litres per minute
Noise at full circulation acceptable	[ ]	Yes/No
Direction of circulation through collector and heatexchanger matched to sensor positions	[ ]	Yes/No
If drainback, pipes fall greater than 1:33 or filled with antifreeze	[ ]	Yes/No
Solar pre-heat store type	Combined with DHW / Separate from DHW	
Solar primary heat exchanger type	Copper/Steel/Plain/Ribbed	
Solar primary heat exchanger area	[ ]	m^2
Volume of dedicated solar pre-heat	[ ]	Litres
Location of DHW isolation valve		
Method of anti-scalding in DHW distribution	Pump control/ thermostatic mixer valve	
Location of digital temperature gauge fitted tomonitor risk of DHW overheating		
Limescale risk to heat exchanger	Low/Medium/High	
Limescale control in heat exchanger	Cleaning hatch/ Thermostat on primary circulation	
Expected annual delivered solar energy to taps	[ ]	kWh
Expected annual solar fraction of DHW	[ ]	per cent
Daily DHW load assumption	[ ]	Litres per day at °C
Date of site visits for bacterial, water quality and access risk assessments		
Commissioned by		
On behalf of		
Date system commissioned and handed over		

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APPENDIX C – FIRE RATING WORKED EXAMPLE

Approved Document B (2019 edition) applicable in England & Wales provides the following table:

Table 12.1 Limitations on roof coverings

Designation[1] of covering of roof or part of roof	Distance from any point on relevant boundary			
	Less than 6m	At least 6m	At least 12m	At least 20m
B_{ROOF}(t4)	●	●	●	●
C_{ROOF}(t4)	○	●	●	●
D_{ROOF}(t4)	○	●(2)(3)	●(2)	●
E_{ROOF}(t4)	○	●(2)(3)	●(2)	●(2)
F_{ROOF}(t4)	○	○	○	●(2)(3)

● Acceptable.

○ Not acceptable.

NOTES:

Separation distances do not apply to the boundary between roofs of a pair of semi-detached dwellinghouses and to enclosed/covered walkways. However, see Diagram 5.2 if the roof passes over the top of a compartment wall.

Polycarbonate and uPVC rooflights that achieve a class C-s3, d2 rating by test may be regarded as having a B_{ROOF}(t4) designation.

1. The designation of external roof surfaces is explained in Appendix B.
2. Not acceptable on any of the following buildings.
   a. Dwellinghouses in terraces of three or more dwellinghouses.
   b. Any other buildings with a cubic capacity of more than 1500m^3.
3. Acceptable on buildings not listed in (1) if both of the following apply.
   a. Part of the roof has a maximum area of 3m^2 and is a minimum of 1500mm from any similar part.
   b. The roof between the parts is covered with a material rated class A2-s3, d2 or better.

A developer wants to install solar collectors onto a pair of semi-detached houses which has a cubic capacity of 1000m^3 and bounded on three sides by other properties and the fourth by a road as shown in the diagram. The relevant boundaries are with the adjoining properties and the centre-line of the road.

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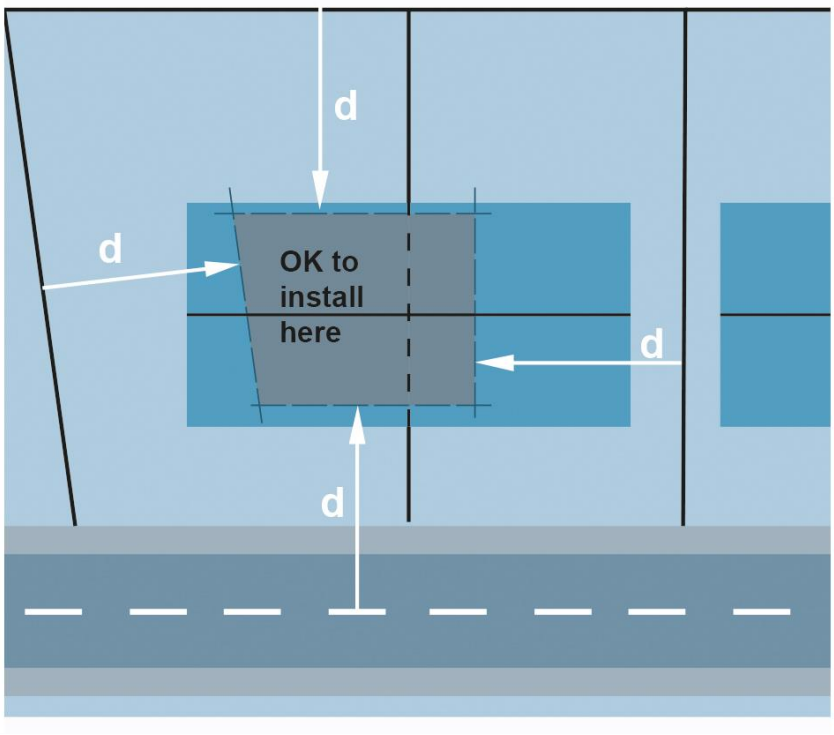

Figure 1

1. B_{roof} rated solar kit - the solar collectors can be installed anywhere and in any amount of roof covering.
2. C_{roof} rated solar kit - the solar collectors can be installed within a bounded area with the distance d ≥ 6m.
3. D_{roof} and E_{roof} rated solar kit – the solar collectors can be installed within a bounded area with the distance (because in this example footnote 2 in the table is satisfied):
    a. d ≥ 6m and < 12m provided that the panels are installed in areas no bigger than $3m^2$ with a gap of 1.5m covered with tiles between areas which themselves have a classification no less than A2-s3, or d2 or
    b. d ≥ 12m
4. F_{roof} rated solar kit – the solar collectors can be installed as in point 3b. above but within a bounded area with the distance d ≥ 20m

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APPENDIX D – MODEL HANDOVER DOCUMENT

Model Handover Document

Solar Thermal system Verification Certificate	☐ Initial verification
	☐ Periodic verification

Client	
Installation Address	
Test Date	

Description of installation (key components installed)	
Heat Transfer Fluid Used	
System Capacity	kW
Estimated System Performance	kWh

Contractor's name and address	
MCS Contact	Telephone: 0333 103 8130 Email: hello@mcscertified.com

Commissioning Certificate Part 1	
Commissioning Certificate Part 2	
Pressure Relief Value Safety Label	
Commission By Label	

Design, Construction, Inspection and Testing

I/we being the person(s) responsible for the design, construction, inspection and testing of the Solar Thermal system 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 3001.

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

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APPENDIX E – EXAMPLE MAINTENANCE SCHEDULE

	Customer	MCS Contractor	
		Intermediate	Full
Visual check of collectors from ground level (check for slipped collectors, damage, soiling etc)	✓	✓	✓
Visual check of pump station where safe access (check for indication of fault or damage)	✓	✓	✓
Recorded generation is increasing and there are no faults	✓	✓	✓
Visual check for signs of structural distress (Particularly after heavy winter snow)	✓	✓	✓
Reduce shading from vegetation growth where possible	✓	✓	✓
Anti-legionella control is operational		✓	✓
Controller operating in correct manner and control settings are set to maximise solar generation		✓	✓
The life of the heat transfer fluid has not expired		✓	✓
Heat transfer fluid check for chemical stability, chemical content and correct levels		✓	✓
Pressure control devices and sensing devices are in place and functioning		✓	✓
System has appropriate fuse rating and any motorised components are functioning correctly		✓	✓
Internal and external pipework in good condition and there are no signs of corrosion		✓	✓
The labels are in position and updated at the time of the service visit		✓	✓
The expansion vessel pre-charge is checked and the system is pressurised		✓	✓
System documentation is in good condition and stored appropriately		✓	✓
Collector clamps and fixings are secure (Check torque of random sample)			✓
Collector mounting rails secure and free of distortion (Including fixing brackets)			✓
Collector fixings have not caused any deterioration in the roof's main weatherproof layer			✓

Frequency:			
Domestic Privately Owned	1 yr	2 yr	15 yr
Domestic Rented (Private or Social landlord)	-	2 yr	10 yr
Public Building (e.g. school, hospital)	6-monthly	1 yr	5 yr
Commercial and Industrial	monthly	1 yr	2 yr

Note: the checks above, the categorisation of buildings and systems along with the frequency are advisory only. System size is also a factor such that larger systems may justify an increased frequency and smaller systems a reduced frequency.

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