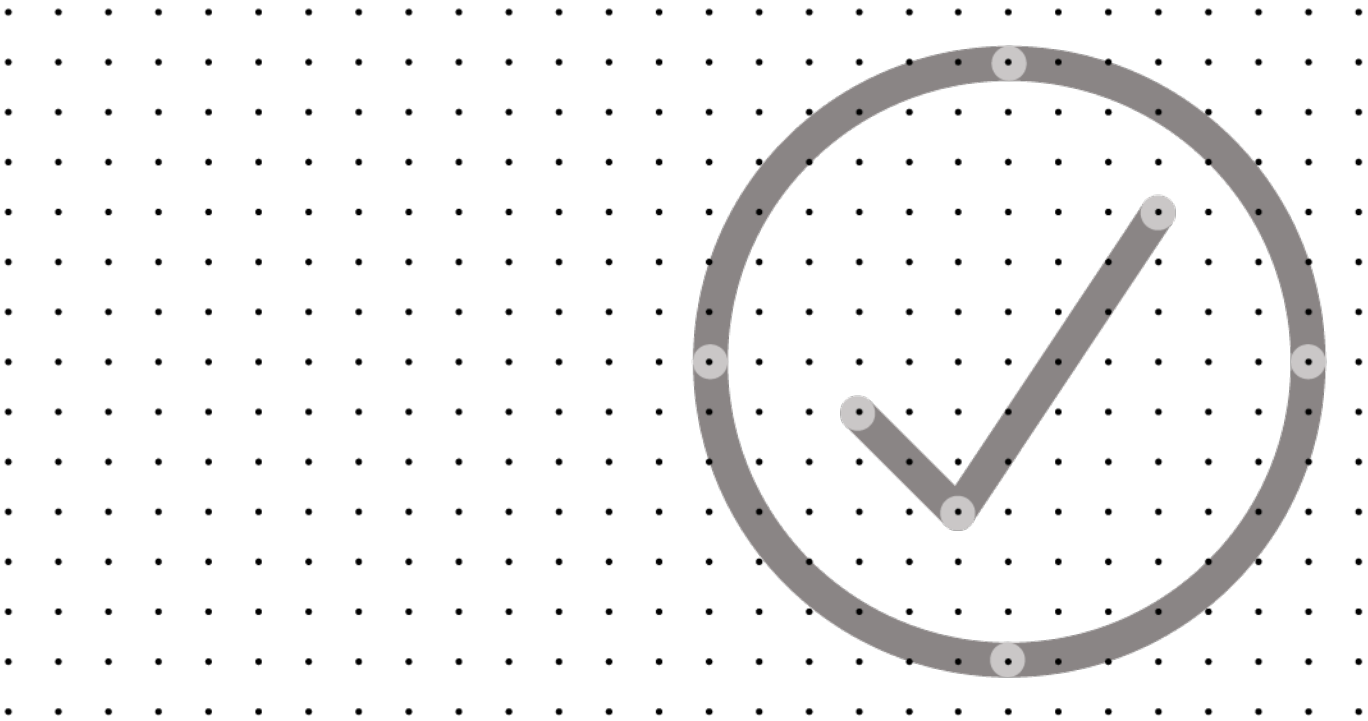
STANDARDS DOCUMENT

MCS 024: 2025 ISSUE 1.0

MCS 2025

Solar Heating: Pre-Sale Information and System Performance Estimate Standard

To be used in conjunction with the MCS Customer Commitment



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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 online, 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 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 SCOPE

This Standard describes a method for calculating the expected annual energy produced, and the fuel energy saving, for a solar heating system designed to provide domestic hot water only. This document is to be used in conjunction with the MCS Customer Commitment. The format in which this shall be presented to the customer is also given along with the technical information to accompany the estimate.

Performance estimates enable customers to compare different systems. The use of this MCS Standard for performance estimates brings a comparable and consistent methodology for different solar heating configurations.

The estimates are based on the best knowledge of MCS of solar heating applications.

This Standard and its associated requirements shall be complied with before a contract is awarded to the customer.

Note: Where site characteristics are unknown (e.g. where the contract may be signed when the property is pre-built), best assumptions shall be made.

2 METHOD

Calculate the annual solar energy input to the cylinder, using Appendix H of the Standard Assessment Procedure (SAP 2012) with the following modifications:

(a) If the occupation of the building is known, determine the number of full time equivalent occupants, N, of the dwelling by completing the table below and applying an upper limit of 6.

Question	Count	Answer	Multiply by	Full time equivalent
How many people live in this dwelling as full time residents?	People		1.0	
How many people live in this dwelling as part time residents (for example because the dwelling is their second home, or because they are students living there only outside term time)?	People		0	
For each of the part time residents, estimate how many days per year they live in the dwelling.	Days/year		1/365	
Total full time equivalent				
N (equal to the total full time equivalent or 6, whichever is the lower)				

(b) If the occupation is not known (for example in many new-build situations) N shall be taken from box 42 of a SAP 2012 assessment of the building, and subject to an upper limit of 6.

(c) Calculate the daily hot water demand, $V_{d,average}$, as (25×N + 36) litres/day. This represents (43) where referred to in SAP Appendix H, and is used in (H14) and (H8).

(d) Calculate the energy content of hot water used, representing $\Sigma(45)_m$ where referred to in SAP Appendix H, as (4.190 × $V_{d,average}$ × 365 × 37 / 3600).

(e) Calculate the modified solar-to-load ratio (H8) as:

Modified solar to Load Ratio = (H7) ÷ { [H × $\Sigma(45)_m$]+ C }

Where

- H is an adjustment factor for hot water use:

$H = h_1 \times h_2 \times h_3$

Where h1 is the electric showers adjustment factor taken from the following table:

Showers present in the property	h_1
Non-electric shower(s) only	1.29
Electric shower(s) only	0.64
Both electric and non-electric showers	1.00
No shower, bath only	1.09

h2 is the water efficient dwelling adjustment factor,

	h_2
Water efficient dwelling (compliant approved doc G)	0.95
Other dwellings	1.00

h3 =1.0

- C is the annual cylinder heat loss, taken from the following table:

Total Hot Water Storage Volume	litres	150	180	200	250	300	500
C	kWh/year	417	471	505	586	662	930

(f) Where the solar collector has been tested according to EN12975 or BS EN ISO 9806 performance values shall be taken from the test results. Where the solar hot water system has only been tested according to EN12976/1 and EN12976/2, SAP Table H1 default values as below may be used.

	TSPEC line reference			
	1.4	1.5	1.6	1.7
Collector type	Total aperture area = Gross collector area x ratio below	Zero loss collector efficiency (No)	Heat loss coefficient (a1)	Second order heat loss coefficient (a2)
Evacuated tube	0.72	0.60	3.0	0.008
Flat plate glazed	0.90	0.75	6.0	0.016
Flat plate unglazed	1.00	0.90	20.0	n/a

Perform the calculation as specified in Appendix H of SAP 2012 using the above amended box inputs.

The resulting annual solar energy input to the cylinder (kWh/year) calculated at (H17) is the deemed renewable heat for the purposes of the domestic RHI. This is the figure to be added into the MCS Installation Database (MID).

The additional fuel energy saving (based on the backup heater efficiency) is calculated using the solar efficiency factor, A_1, for the type of back-up heater in the building (see Appendix A).

Additional Fuel Energy Saving (kWh/year) = solar energy input to cylinder x { $(1/A_1) - 1$}

For evacuated tube collectors only:

a) Calculate the Incidence Angle Modifier Factor (IAM Factor) as the product of transverse and longitudinal IAM at 50 degrees from the product test report:

IAM factor = Kθ(50T) x Kθ (50L) or 1.0 whichever is the higher

b) Solar energy available, line (H7) becomes (H1) x (H2) x (H5) x (H6) x IAM factor

Additional estimates:

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.

3 PRE-SALE INFORMATION

3.1 Minimum technical information

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 3, where:

i. 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:

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.

ii. 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."*

iii. 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."*

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

Table 1 - Required 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

b) Manufacturers' datasheet(s) for the proposed solar heating product(s).

c) Manufacturers' product information for the proposed heat storage tank(s) and controller(s).

d) A drawing of the proposed solar heating array layout and a drawing of the solar heating system configuration.

APPENDIX A – BOILER EFFICIENCY

The annual energy performance calculation (derived from SAP Appendix H) above predicts the solar output to the hot water cylinder, but takes no account of boiler efficiency. The fuel saved by the customer may be considerably greater, due to poorer boiler efficiency when heating hot water only, such as in the summer months.

Contractors shall assess the existing boiler system and categorise it according to Table C1 below. The calculated annual energy performance (from SAP Appendix H calculation) shall be divided by the appropriate factor to determine the estimated annual fuel saving from the solar system.

The predicted solar output (from SAP Appendix H calculation) and the estimated fuel saving shall both be presented to the client at quotation stage.

Notes:

(1) Attention is drawn to Section 4.4 of MIS3001 whereby existing boiler controls must be upgraded wherever possible (e.g. fitting of cylinder thermostats and appropriate control valves etc to prevent excessive cylinder heating by gravity circulation).

(2) A "best fit" approach should be used. For range cookers, use floor mounted boiler figures.

Table A1 - Seasonal efficiency for backup heating used with solar systems.

Regular or system boilers	Solar efficiency factor (A_1)
Gas, post 1998, condensing with automatic ignition	0.768
Gas, post 1998, non-condensing with automatic ignition	0.668
Gas, pre 1998, fan flue	0.618
Gas, 1979 - 1997, open or balanced flue, floor mounted	0.588
Gas, pre 1979, open or balanced flue, floor mounted	0.488
Oil, condensing	0.754
Oil, standard, post 1998	0.714
Oil, standard, 1985 - 1997	0.624
Oil, standard, pre 1985	0.574
Combi boilers	
Gas, post 1998, condensing with automatic ignition	0.775
Gas, post 1998, non-condensing with automatic ignition	0.675

Gas, pre 1998, fan flue	0.645
Oil, pre 1998	0.645
Oil, post 1998	0.705
Other backup heaters	
Wood chip/pellet independent boiler	0.63
Closed room heater with boiler to radiators	0.65
Manual feed independent boiler	0.55
Immersion heater within DHW tank back up heating zone	1.00
Electric boiler separate from DHW tank	0.85
Ground to water heat pump	1.50
Air to water heat pump	1.43

Background to the Solar Efficiency Factor

The table presents a simplified list of the more common boilers listed in Table 4b of SAP 2009. The solar efficiency factor is derived from the SAP summer and winter efficiencies in the ratio 28% winter and 72% summer. This ratio is taken from the monthly solar gain in SAP 2009 Table H3 for a collector tilt angle of 30°:

Table A2 - Simplified list of the more common boilers listed in Table 4b of SAP 2009.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.35	0.63	0.92	1.3	1.58	1.68	1.62	1.39	1.08	0.74	0.43	0.29
3%	5%	8%	11%	13%	14%	13%	12%	9%	6%	4%	2%
Heating season			Non- heating season						Heating season		

The blue coloured bars (row 4) represent when the household is almost certain to have a space heating demand so the winter boiler efficiency should be used without doubt. The orange bar represents when the space heating demand is likely to be small or zero (depending on the user, location and the building insulation qualities etc) so the boiler is likely to operate closer to the summer efficiency. Adding the monthly percentages for heating and non-heating seasons gives 72% non-heating and 28% heating season.

Hence, the boiler efficiency used in the "displaced fuel" calculation is weighted 72% summer, 28% winter. If preferred, independent laboratory results may be used if they are available.

Note: Solid fuel boilers

Two efficiency columns are presented in SAP2009, column A for HETAS approved appliances and column B for others. Section 9.2.4, p.21, states "Values from column (B) should be used for appliances, particularly those already installed in dwellings, for which efficiency data are not

available" and efficiency values for summer and winter efficiency are not provided. Hence if manufacturer summer/winter efficiency data is not available, the column B efficiency should be used as the solar efficiency factor. For manual feed boilers, the assumed value is that of a boiler in an unheated space (since the case losses are not useful for heating water).

Note: Heat pumps

SAP section 9.2.7 states "If the heat pump provides domestic hot water heating an electric immersion should be assumed to operate in conjunction with the heat pump unless it is known that the heat pump can provide 100% of the water heating requirement, using an efficiency for water heating given by {equation 9}.

The calculated water heating efficiencies are 152% ground to water, 150% ground to water with auxiliary heater and 143% for air to water.

Note: Electric boilers and immersion heaters

For immersion heaters within the hot water store assume 100% efficiency. Direct acting electric boilers (i.e. those fitted within a pumped heating circuit with primary pipe losses) should assume 85% efficiency as the pipe losses are not useful for water heating. The primary pipework must be insulated as far as practicable.

APPENDIX B - WORKED EXAMPLES

SAP appendix H calculated solar input [Qs] of 1600 kWh, condensing gas boiler, post 1998

Condensing gas boiler, from Table 1, solar efficiency = 76.8%. Predicted Qs solar yield = 1600 kWh

Fuel saved = solar yield (Qs) divided by 0.768 = 2083 kWh annual fuel saving.

Calculated solar input Qs of 1600 kWh, pre-1979 floor mounted gas boiler

Pre 1979 floor mounted boiler, from Table 1, solar efficiency = 48.8%.

Fuel saved = solar yield (Qs) divided by 0.488 = 3279 kWh annual fuel saving.

Calculated solar input Qs of 1600 kWh, ground to water heat pump

Ground to water heat pump, from Table 1, solar efficiency = 150%.

Fuel saved = solar yield (Qs) divided by 1.50 = 1067 kWh annual fuel saving.