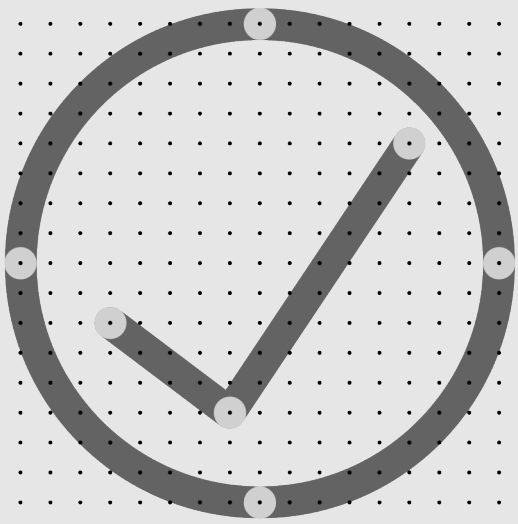
STANDARDS DOCUMENT

MIS XXX ISSUE 1.0

The Thermal Energy Storage System (TESS) Standard

(Design and Installation)



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ABOUT MCS

Giving you confidence in home-grown energy

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

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

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

About

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

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

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

Vision

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

Mission

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

Values

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

CHANGES TO STANDARDS

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

Technical or other significant changes which affect the requirements for the approval or certification of the product or service will result in a new issue. Minor or administrative changes (e.g. corrections of spelling and typographical errors, changes to address and copyright details, the addition of notes for clarification etc.) may be made as amendments.

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

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

Amendments issued since publication

Issue No.	Amendment Details	Date
1.0	First Publication	XX/XX/2025

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).

Compliance with this update is mandatory for MCS Contractors certified in accordance with MIS XXX from the date of implementation (XXXX).

This Standard describes the MCS requirements for the assessment, approval and listing of contractors undertaking the supply, design, installation, set to work and commissioning and handover of heat energy storage systems. The listing and approval is based on evidence acceptable to the certification body that the system or service meets the Standard.

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.

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.

1 PURPOSE & SCOPE

1.1 This Standard specifies the requirements for contractors undertaking the design and installation of electrically charged thermal energy storage systems (TESS) supplying space heating (with or without the provision of domestic hot water) to permanent buildings.

1.2 This Standard covers TESS installed as a central heating system whether hydronic (e.g radiators) or air-driven (e.g. ducted).

1.3 For the purposes of this Standard, microgeneration TESS are defined as those having a thermal output not exceeding 45 Kilowatt (kW_{th}).

1.4 Multiple TESS 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 TESS shall exceed an output of 45kW_{th}.

1.5 The following technologies are currently excluded from this version of the Standard:

- Domestic hot water only systems
- Thermal energy storage systems charged by a combustion source
- Decentral heating systems
- Electrical energy storage systems

Note: See Appendix A for nomenclature of TESS technologies. Those in green are currently in scope of this Standard.

2 DEFINITIONS

Refer to MCS 001 for general definitions (not specific to Thermal Energy Storage Systems). For technical definitions please see below.

Term	Definition
Charging	Means adding energy to the TESS from the heat source
Discharging	Means controlled release of heat from the TESS
Thermal Energy Storage System (TESS)	Is equipment specifically installed and maintained to utilise time of use tariffs by storing energy as heat for later use. This includes systems designed to provide space heating and/or hot water by storing heat in a medium, where the heat is then later discharged.
Dynamic time of use electricity tariff	Means a tariff where the unit rate for electricity changes each day or each half-hour depending on the electricity wholesale market.
TESS for space heating	As per the definition above for 'TESS' specifically supplying the building's space heating.
TESS for hot water	As per the definition above for 'TESS' specifically supplying the building's sanitary hot water.
Static time of use electricity tariff	Means a tariff with a set time for when electricity is available at peak and off-peak unit rates.
Time of use electricity tariff	Means a tariff with more than one unit rate for electricity that varies by time of day. This includes static and dynamic time of use tariffs.
Centralised heating system	Means a system with a main heat source that distribtutes its heat through a whole house system through pipes and emitters.
Decentralised heating system	Means individual units that heat specific parts of a building as and when there is a demand.
Standalone TESS	Thermal energy storage with an external heat source e.g. an electrically operated flow boiler. Standalone systems can either be retrofitted with an existing heat source, or can be installed together as part of the installation.
Integrated TESS	Those with a heat source (heating element) and thermal storage encased as one unit.

3 REQUIREMENTS OF THE MCS CONTRACTOR

3.1 CAPABILITY

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

3.1.2 Where MCS contractors do not engage in the design or supply of TESS, 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 MCS001 to ensure every TESS design meets this Standard.

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

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

4 PRE-SALE INFORMATION

4.1 PERFORMANCE ESTIMATION – SEE CONSULTATION QUESTION IN THE MCS TESS PRE-SALE SPE RESPONSE FORM

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

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

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

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

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

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

4.2 MINIMUM TECHNICAL INFORMATION

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

a) The result of the performance estimate calculated in accordance with Section 4.1:
b) Manufacturer's datasheet for the proposed TESS
c) Manufacturer's datasheet for the sanitary hot water store (if applicable)
d) Manufacturer's datasheet for any proposed separate heat source (if applicable)
e) Any other requirements stipulated by the Consumer Code (if applicable)
f) Details of any subcontractors proposed to undertake installation

5 DESIGN

5.1 TIMESCALES

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

5.2 LEGISLATION

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

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

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

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

5.2.4 The contractor shall ensure the building (including curtilage) is assessed by a competent professional experienced in TESS 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 safety) is not compromised.

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

Note: This should include a structural load assessment of where the TESS is to be located to ensure that the structure can safely withstand the weight of the equipment. Assessment of access routes to the installation location should also be completed to ensure safe handling of the TESS equipment.

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

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

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.

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

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

5.3 MANUFACTURER'S INSTRUCTIONS

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

5.3.2 Where the manufacturer's instructions conflict with the requirements of this Standard then the requirements of this Standard take precedence unless it can be demonstrated that the manufacturer's instructions will result in an improved systems or the manufacturer's warranty would be make void.

5.4 EQUIPMENT CERTIFICATION AND LISTING

5.4.1 All equipment specified:

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

Note: for example, this means the CE/UKCA mark

5.4.2 All installed equipment should be suitable for its application and have a manufacturer's declaration of conformity for the appropriate standard.

5.4.3 All equipment should comply with relevant British or Harmonised standards:

- All components and assemblies should comply with relevant standards accepted by relevant UK legislation.
- MCS Contractors shall ensure that equipment meets the requirements of the Electromagnetic Compatibility Regulations 2016 (where applicable).

5.5 GENERAL DESIGN CONSIDERATIONS

5.5.1 The contractor shall ensure that the electricity supply is adequate for the size of the TESS specified.

5.5.2 For hydronic systems supplying space heating where the full existing heating system is being replaced, the system should be designed to a flow temperature of 55°C or below unless the application requires a flow temperature higher than this.

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

Note: Water stored for domestic hot water purposes may be higher than 55°C.

5.6 SPACE HEATING DESIGN – HEAT SOURCE SIZING

5.6.1 The following procedure shall be followed when designing the heat source for TESS providing space heating:

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.

Note: The MCS Heat Load Calculator found on the MCS website can be used by MCS contractors to carry out BS EN 12831-1:2017 calculation.

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).

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.

5.6.2 A heat source shall be selected where the power output will provide at least 100% of the calculated heat load of the building (as calculated by clause 5.6.1).

Note: Where there are multiple heat sources available to the same building, the combination of output of all heat sources shall be no less than 100% of the calculated heat load of the building.

5.7 SPACE HEATING DESIGN – STORAGE SIZING

See consultation questions 5, 6, 7, 8 and 9 in the TESS Design and Installation Consultation Form

5.8 DOMESTIC HOT WATER DESIGN

5.8.1 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.

5.8.2 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.

5.8.3 Using the daily hot water demand and proposed TESS's heating capacity, an appropriately sized TESS for hot water, should be specified.

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

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

5.8.5 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 TESS (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 TESS 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 TESS manufacturer's requirements

5.8.6 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.

5.8.7 TESS 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 TESS shall not deplete the heat in the inhabited building space (thus increasing the space heating requirement).

5.9 POST DESIGN INFORMATION

5.9.1 Prior to the installation commencing, the customer shall be provided in writing with:

a) An updated system performance estimate based on the calculated heat load of the building

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

c) Percentage of annual space heating demand to be met using off-peak electricity (assuming X-hour off-peak period)

d) Anticipated peak tariff kilowatt hour usage per year shall be presented

e) Details of the tariffs used in the design

f) If the provision of domestic hot water is included in the TESS design, the percentage of storage capacity used by the average daily hot water use

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

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

h) The calculated daily hot water demand (if applicable)

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

j) The specification of any new TESS for hot water, and its recovery rate

k) The design flow temperature of the water leaving the TESS and before any blending valves

l) The proportion of the building's space heating design load that has been designed to be provided by the TESS

5.10 INSTALLATION

5.10.1 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.

5.11 METERING & COMMUNICATION

Metering

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

Data Communication & Security

5.11.2 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 TESS system should comply with the technical specification ETSI Technical Specification 103 645 Cyber Security for Consumer Internet of Things.

5.11.3 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.

5.12 SITE SPECIFIC ISSUES

5.12.1 TESS should be located according to the manufacturer's instructions.

5.12.2 TESS shall be located in a suitable area, considering weight, weather protection and temperature.

5.12.3 TESS shall be located to enable safe access for installation and routine maintenance of the system, considering weight and manoeuvrability.

5.12.4 Where high-pressure hot water is [used] within the device, any pressure relief discharge must be terminated in a safe and appropriate manner.

5.12.5 The TESS should be installed within the building envelope to minimise standing losses.

6 COMMISSIONING

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

Note: Suitable commissioning checklists can include those provided by the TESS manufacturer and the example given in Appendix B.

7 DOCUMENTATION & HANDOVER

7.1 DOCUMENTATION

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

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

7.2 HANDOVER

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

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

Note: See Appendix C for a model handover document.

7.2.2 As the TESS can be controlled to respond to time of use electricity tariffs, the installer shall communicate to the customer whether this:

- is a manual process, with the customer manually setting charge times
- can be automated, such that charge times change automatically when tariffs change
- can be controlled remotely by the manufacturer or another entity

Note: Discharge of the TESS is controlled by heating controls, e.g. via a thermostat, the external temperature and any other incentives available to the customer.

7.2.3 It shall be agreed with the customer the most effective way to control the system to optimise performance and minimise running costs.

Note: An example of this could be using any 'smart charging' features of appliances or control systems installed as part of the overall heating system.

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

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

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

7.2.7 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.

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

8 MAINTENANCE

8.1 System design should allow safe access of all components necessary for commissioning and maintenance.

8.2 For recommended maintenance requirements see Appendix E.

9 ROLES & COMPETENCY

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

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

- Design personnel - Shall be able to demonstrate a thorough technical knowledge of the technologies involved and the interaction of associated technologies and be able to deliver a compliant design to the requirements of 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 MIS XXX, applicable codes of practice, manufacturer's instructions and Statutory Regulations.

Note: As a minimum MCS Contractors should have personnel with demonstrable training and / or experience of TESS's in accordance with the requirements of this Standard.

10 REGIONAL OFFICES

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

11 PUBLICATIONS, REFERENCE AND FURTHER READING

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

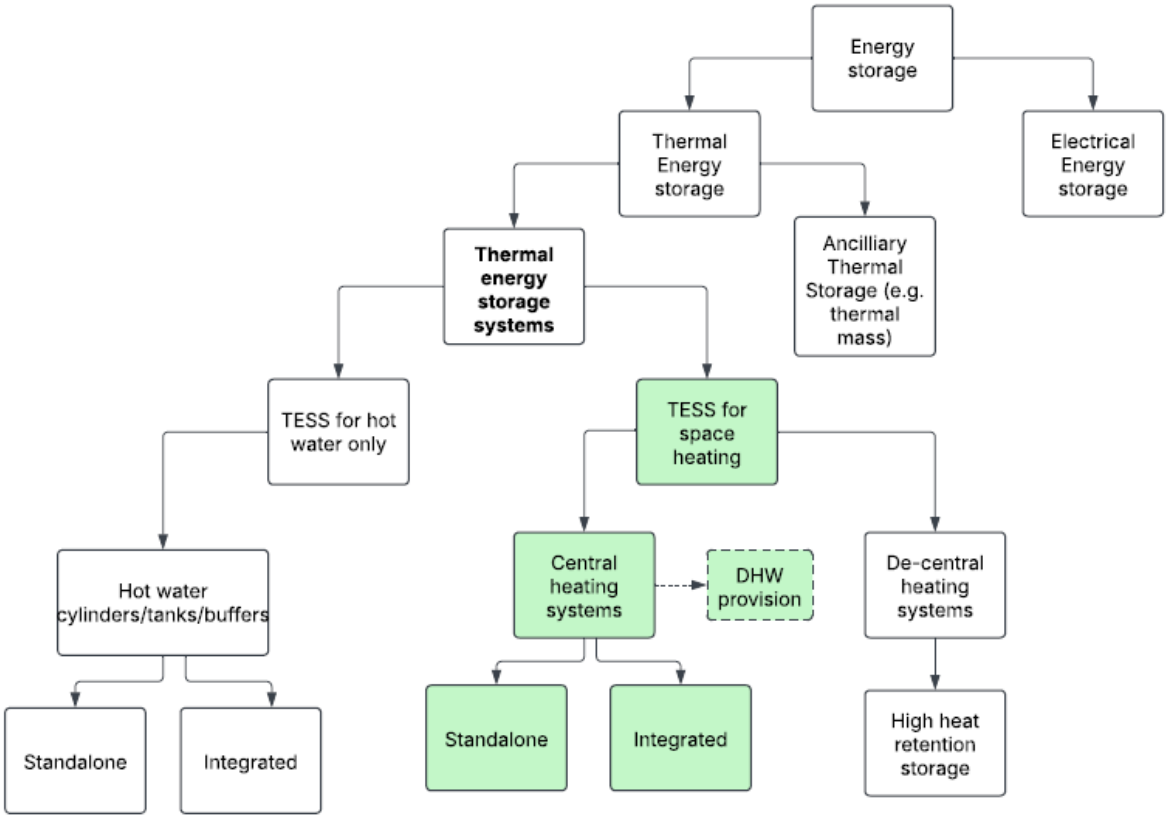
11.1.2 It is a scheme requirement for MCS Contractors to own or have immediate access to at least one copy of the following documents in each office or regional office undertaking design, installation and commissioning work:

- MIS XXX
- MIS XXX
- MCS XXX

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

- Approved Document G3 "Hot Water Supply and Systems" (England and Wales)
- BS EN 12831-1:2017 Heating systems in buildings
- CIBSE Domestic Heating Design Guide
- Requirements for Electrical Installations (IET Wiring Regulations Eighteenth Edition). Available from BSI or IET

APPENDIX A - NOMENCLATURE



APPENDIX B – KEY FACTS

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

System Performance Estimate

The System Performance Estimate is a theoretical indication of the anticipated efficiency of a thermal storage system over a whole year using standard (i.e. not local) climate data. It is used to give a guide to how much of the electricity consumed for heating should be consumed during an "off peak" period on a time-of-use tariff, averaged over a year, to compare the relative suitability of different storage systems for a given property's heat demand. Off-peak periods on time-of-use electricity tariffs vary by energy supplier and prices vary by local area. Some tariffs have more than one off-peak period, which could increase the cost efficiency of a TESS. However, the most common structure of time-of-use electricity tariffs is a single overnight off-peak period, usually between 5 and 9 hour duration. For this standard, a X hour off-peak overnight window is assumed.

Energy Performance Certificate

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

Identifying the uncertainties of energy predictions for heating systems

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

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

Advice on electricity tariffs

All TESS work most cost effectively with a time-of-use electricity tariff. It is not recommended to install a TESS, particularly for space heating, without having access to a time-of-use electricity tariff, usually with a Smart Meter.

Time-of-Use tariffs come in many different structures. The most common form is a single cheaper period overnight, while other options can have two or three discounted periods throughout the day. Some energy suppliers offer smart tariffs that vary the price of electricity every half hour, with prices changing each day. Finding the best tariff depends on your lifestyle and what other technologies you have, like an electric vehicle or battery electrical storage system.

A single overnight off-peak period is the most common structure of tariff, so this Standard assumes that a single off-peak period is available with a maximum of 7 hours of cheaper electricity. A tariff with more off-peak periods, may be able to reduce the running costs of a thermal storage system, as the system can recharge at lower prices throughout the day on days when there is higher demand (e.g. when the weather is colder). It is the responsibility of the billpayer to determine which electricity tariff is suitable for their circumstances, although the MCS Contractor or thermal storage equipment manufacturer may be able to offer advice.

Factor	Impact
'Fixed' which include:	
Energy Assessment via the EPC (e.g. assumptions as to fabric construction and levels of insulation; the variation in knowledge and experience of Energy Assessors)	Energy Required
'Variable' which are affected by the system design and include:	
Accuracy of sizing of the TESS- i.e. closeness of storage capacity (kW) to daily heat demand (kW)	System Efficiency
Design space and ambient (external) temperatures	Energy Required
Type of heat emitter (e.g. under-floor; natural convector (e.g. 'radiator'), fan convector etc.)	System Efficiency
Control strategy for TESS (e.g. ability to learn from historic demand and take into account weather forecasts)	System Efficiency
'Random' which cannot be anticipated and include:	
Energy tariff (e.g. the number and timing of off-peak hours, and ratio of off-peak price compared to peak prices)	System Efficiency
User behaviour:	
• Room temperature settings	Energy Required
• Hot water usage and temperature settings	Energy Required
• Occupancy patterns/times	Energy Required
• Ventilation (i.e. opening windows)	Energy Required
Annual climatic variations (i.e. warmer and colder years than average)	Energy Required

Key:

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

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

System Efficiency: For TESS, this typically refers to the ability of the TESS to meet the heat demand only/mostly using off-peak periods of charging. If the system design means the TESS needs to charge more frequently, this could lead to more periods of peak charging and therefore increased running costs.

APPENDIX C – EXAMPLE COMMISSIONING CHECKLIST

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

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

Product Information			
TESS type:		Manufacturer:	
TESS Model No:		Serial No:	
Installed as per manufacturer's instructions:			

Pre-commissioning Checks – Electrical			
Electrical wiring complete – suitably rated for voltage and current, installed according to BS 7671		Electrical supply tested – confirm suitably rated MCB protection	
Local electrical isolation provided and suitably rated		Heating controls wiring fitted and tested	
RCD protection provided, not exceeding 30mA		Suitable main earth provided	
Earth connections and protective bonding suitably installed		Earth continuity checked	
Electrical supply (single/three phase):			

		Incoming Voltage					
Resistance to earth (L-E):	Ω	L1-N	v	L1-E	v	N-E	v
Short circuit test (L-N):	Ω	L2-N	v	L2-E	v	L1-L2	v
Visual condition of installation:		L3-N	v	L3-E	v	L1-L3	v

All sensors checked and reading correctly:				L2-L3	v

System Checks (where applicable)

System Pressure:	Bar	Power Supply	kW	Legionella cycle heat source (1):	
Min Power Supply:	kW			Type of auxiliary heating (1):	
Max flow temp (MAX):	°C	Return temp:		Max auxiliary power (1):	kW
Target water flow rate:	l/h	Water Flow Rate:	l/h	Auxiliary bi-valent point:	°C
Min flow temp (MIN):	°C	:	°C	Aux heat meter reading (kWh):	
Target Pump Overrun Water Flow Rate:	l/h	Pump Overrun Water Flow Rate:	l/h		
Target Flow Setpoint:	°C	Legionella freq (days):			

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

Central Heating System

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

TESS controls (charging)

Is the TESS 'smart':		TESS charge control integrated or standalone device?	
Has an appropriate internet connection been made and tested:		Wired or wireless internet connection?	
Have the charging controls been demonstrated and explained to the customer?		Have offline controls been demonstrated and explained to the customer?	
Charging profile set up (e.g. smart, scheduled/timer)			

TESS controls (discharging)

Type of HTG controls installed:			
Have the controls been setup as per design:		HTG control (HP or 3rd party):	
Have the controls been demonstrated and explained to the customer?		DHW control (HP or 3rd party):	
Has the customer been provided with all documentation required by MIS XXX?			

Has the customer been provided with all documentation required by MIS XXX?

Technicians comments

Technicians Signature:		Date:	
Customers Signature:		Date:	

APPENDIX D – MODEL HANDOVER DOCUMENT

Thermal Energy Storage System (TESS)Handover Document	□ Initial verification □ Periodic verification

Client	
Installation Address	
Test Date	

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

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

Design, Construction, Inspection and Testing

I/we being the person(s) responsible for the design, construction, inspection and testing of the TESS 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 XXX.

Signature(s):	Next inspection recommended after not more than:	Years

Name(s): Date: (The extent of liability of the signatory(s) is limited to the work described above)	Comments:

APPENDIX E – EXAMPLE MAINTENANCE CHECKLIST

TESS Service Record			
Occupier name and address (inc Postcode)		If Applicable - Landlord/agent name and address (inc Postcode)	
Service details			
Service provider name and address (inc postcode)		Company Tel No.	
		Inspection date	
		Technician name	
		Technician Signature	
Appliance Owner	Homeowner / Tenant / Landlord / Agent	TESS location	
TESS make		TESS model	
TESS serial number			

TESS Service Schedule				
Required Checks		Pass	Fail	Comments
Electrical switches and wiring condition (isolation and thermal cutout)				
Internal components and fans (clean as necessary)				
Overall condition, support and location clear of obstruction/s				
Hydraulic circuits condition/insulation/leaks/damage				
Check/clean strainers and filters in hydraulic circuits				
Verify inhibitor levels and top up to manufacturers specification as necessary				
User controls operation in HW and CH modes verified				
Hydraulic circulation, controls, and vent system as necessary				
System Pressure as per manufacturers instructions				Pressure (bar)
Heating Element continuity as per manufacturers instructions				
Power supply when charging as per manufacturers instructions				kW
Appliance serviced in accordance with the manufacturers instructions				
Hot Water Storage and Hydraulic System				
Hot water storage make		Hot water storage model		
Hot water storage location		Hot water storage capacity (ltr)		
Incoming CWM pressure (bar)		PRV setting (bar)		

DHW flow rate (ltr/m)		DHW temp at primary outlet (°C)	

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

Additional Comments and remedial action required