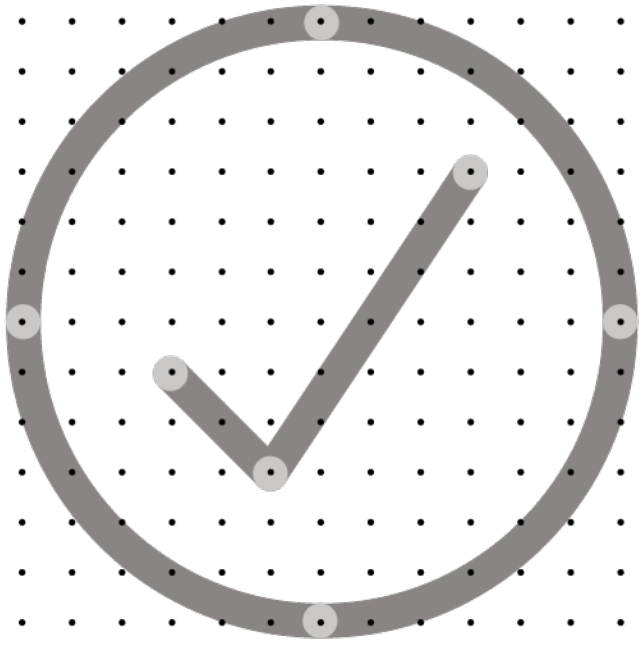
STANDARDS DOCUMENT

MIS 3012: 2025 ISSUE 1.0

MCS 2025

Battery: Installation Standard



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The MCS Service Company Ltd
First Floor
Violet 3
Sci-Tech Daresbury,
Keckwick Lane,
Cheshire WA4 4AB

www.mcscertified.com
hello@mcscertified.com
0333 103 8130

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ABOUT MCS

MCS: Giving everyone confidence in home-grown energy

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

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

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

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

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CHANGES TO STANDARDS

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

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

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

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

Amendments issued since publication

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

FOREWORD

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

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

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

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

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

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

1 PURPOSE & SCOPE

This Standard specifies the requirements for MCS contractors undertaking the supply, design, installation, set to work and commissioning of electrical energy (battery) storage systems (EESS) for permanent buildings with a maximum power output of up to 50 kW in the use cases described in the table below. This Standard must be read in conjunction with the IET Code of Practice (CoP) for Electrical Energy Storage Systems.

Use Case	In or out of scope
EESS connected to a building's distribution board via its own dedicated DC to AC inverter and on the consumer's side of the supply meter (see Figure 3.1, Page 21, Figure 3.2, Page 22, and Figure 3.4, Page 23 of the IET CoP).	IN
EESS connected to the DC terminals of a DC to AC inverter which is simultaneously serving another form of generation (e.g. solar PV inverter) and on the consumer's side the supply meter (see Figure 3.5, Page 24, and 3.6, Page 24 of the IET CoP).	IN
As above in buildings **with** other forms of generation (e.g. wind turbine) (see Figure 3.4, Page 23 of the IET CoP).	IN
As above in buildings **without** other forms of generation (see Figure 3.1, Page 21 of the IET CoP).	IN
Primary batteries	OUT
Traction and vehicle starter batteries in vehicles	OUT
Secondary batteries in mobile and transportable units as described in Section 717 of BS 7671	OUT
EESS not connected behind a supply meter (otherwise known as "in-front of the meter" systems).	OUT
EESS in buildings without a permanent and normally live connection to the electricity distribution network ("off-grid")	OUT
Uninterruptible Power Supplies serving specific critical systems (e.g. IT systems, emergency systems etc)	OUT
Central power supplies and central battery units for emergency lighting systems	OUT
Primary batteries and secondary batteries in appliances; fire detection, alarm, indicating and annunciating equipment; security systems and equipment; and control and monitoring systems equipment (including BMS and HBES)	OUT

Use Case	In or out of scope
Secondary batteries in caravans, motorhomes and leisure accommodation vehicles as described in Section 721 of BS 7671	OUT

2 DEFINITIONS

2.1 GENERAL

Refer to Scheme Rules for general definitions (not specific to EESS). For technical definitions please see below and the Glossary (Appendix A) of the IET Code of Practice for Electrical Energy Storage Systems.

Term	Definition
Electrical Energy (Battery) Storage Systems (EESS)	A system which converts electrical energy into a form of energy which can stored, the storing of that energy, and the subsequent reconversion, in a controllable manner, of that energy back into electrical energy.
Backup isolator	Isolator which disconnects the live conductors of the grid supply from the EESS, maintained circuits, and maintained loads, when the system is operating in island mode. Disconnection could be achieved by an isolation relay or manual changeover switch. See section 9 of the IET Code of Practice for Electrical Energy Storage Systems.
Commercial off-the-shelf packaged EESS	An EESS supplied by a single manufacturer as a system package with relevant installation, commissioning, and system tuning, instructions, and complying with relevant British and/or Harmonised standards, to which a single manufacturer or importer declares conformity. A packaged EESS may comprise more than one component.
Composite EESS	An EESS that is assembled on site from discrete components from different manufacturers, described in the Code of Practice as a "discrete-component (bespoke) EESS"
EESS Design	As design and, in addition, the process of selecting and matching components to components and systems to premises and application to maximise performance, safety

	and durability of the installation. Design of composite EESS should be undertaken with particular care and requires specialist competency.
Maintained circuit	Circuit which continued to receive power from an EESS operating in island-mode.
Maintained load	Load which continues to receive power from an EESS operating in island-mode.
Neutral-earth bond relay	Relay which connects the neutral of an EESS in island mode to a means of earthing and disconnects the neutral from the means of earthing immediately prior to reconnecting the maintained loads to the grid supply. See section 9 of the IET Code of Practice for Electrical Energy Storage Systems.
Self-consumption	The amount of electricity generated on-site which is subsequently used within the building and not exported to the distribution network.

2.2 SYSTEM CLASSIFICATION

Systems are classified based on the characteristics in Table 2.1. Examples of different classes of systems are shown in Figures 2.1 to 2.5 (note: there are other possible arrangements).

Table 2.1: Classification of EESS for the purposes of MIS 3012

System classification	Battery and PCE	Islanding arrangement (where appropriate)
Class 1	Battery, BMS, PCE and islanding arrangement housed in same manufacturer-provided enclosure. PCE is G98 / G99 type tested as appropriate. No DC cabling outside manufacturer-provided enclosures. Single manufacturer or importer is responsible for performance, safety and warranty of all component products.	Islanding arrangement is housed in the same enclosure as the battery and PCE. Islanding arrangement is G98 / G99 type tested as appropriate Single manufacturer or importer is responsible for performance, safety and warranty of all component products.
Class 2	PCE is housed in a different enclosure to the storage battery and/or BMS. PCE is G98 / G99 type tested as appropriate. DC cabling may exist outside manufacturer-provided enclosures. Single manufacturer or importer is responsible for performance, safety and warranty of the component products.	Islanding arrangement may be housed in a separate enclosure to the PCE. PCE manufacturer or importer is responsible for the performance, safety and warranty of the islanding arrangement. Islanding arrangement is G98 / G99 type tested as appropriate
Class 3	PCE is housed in a different enclosure to the storage battery and/or BMS. PCE is G98 / G99 type tested as appropriate. DC cabling may exist outside manufacturer-provided enclosures. PCE manufacturer is responsible for performance, safety and warranty of the PCE. PCE is G98 / G99 type tested as appropriate. BMS manufacturer responsible for performance, safety and warranty of the battery and BMS products. The competent person is responsible for confirming compatibility between PCE and BMS.	Islanding arrangement may be housed in a separate enclosure to the PCE. PCE manufacturer responsible for the performance, safety and warranty of the islanding arrangement. Islanding arrangement is G98 / G99 type tested as appropriate
Class 4	Battery, BMS and PCE may all be from different manufacturers. System does not fall within the definitions of Class 1, Class 2 or Class 3 systems. The competent person is responsible for (or for arranging by others) system performance compliance, safety and warranty of the component products.	The competent person is responsible for performance, safety and warranty of the islanding arrangement and its integration with the system controls. Where not type-tested, installer is responsible for performing DNO-witnessed tests and obtaining DNO approvals.

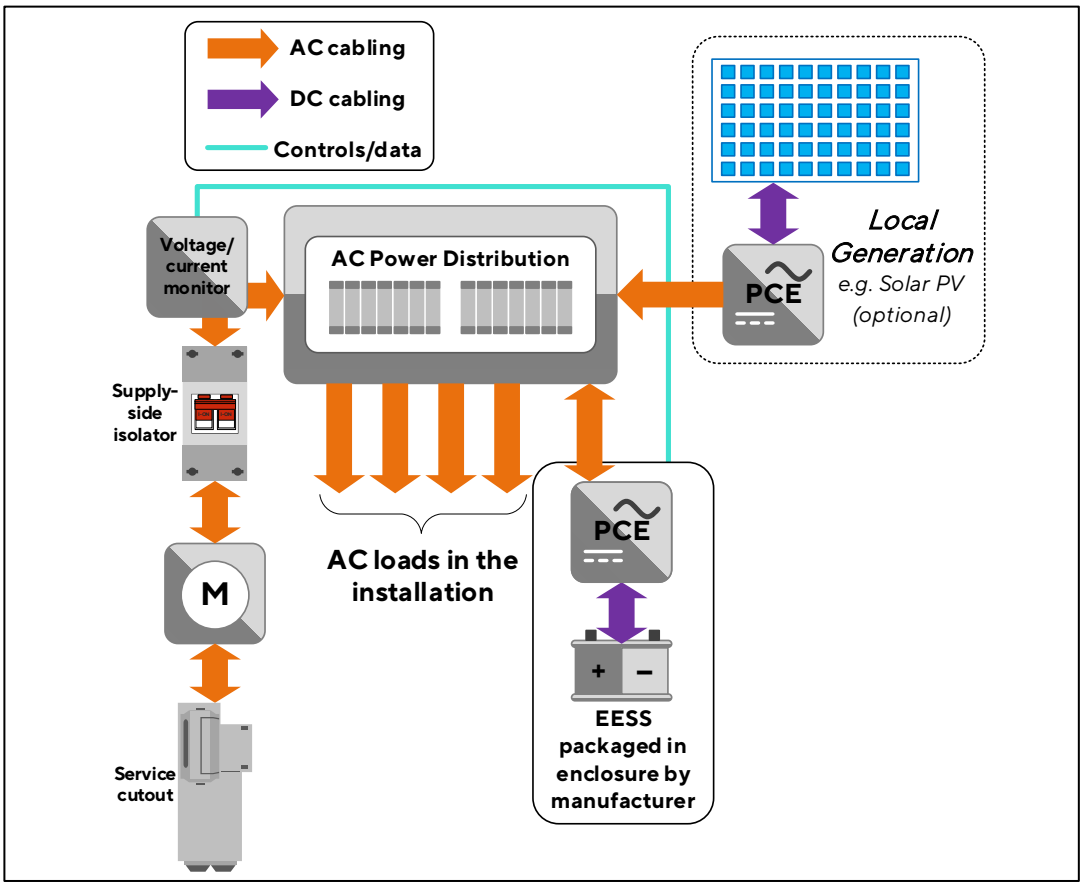

Figure 2.1 Example of Class 1 system without islanding arrangement

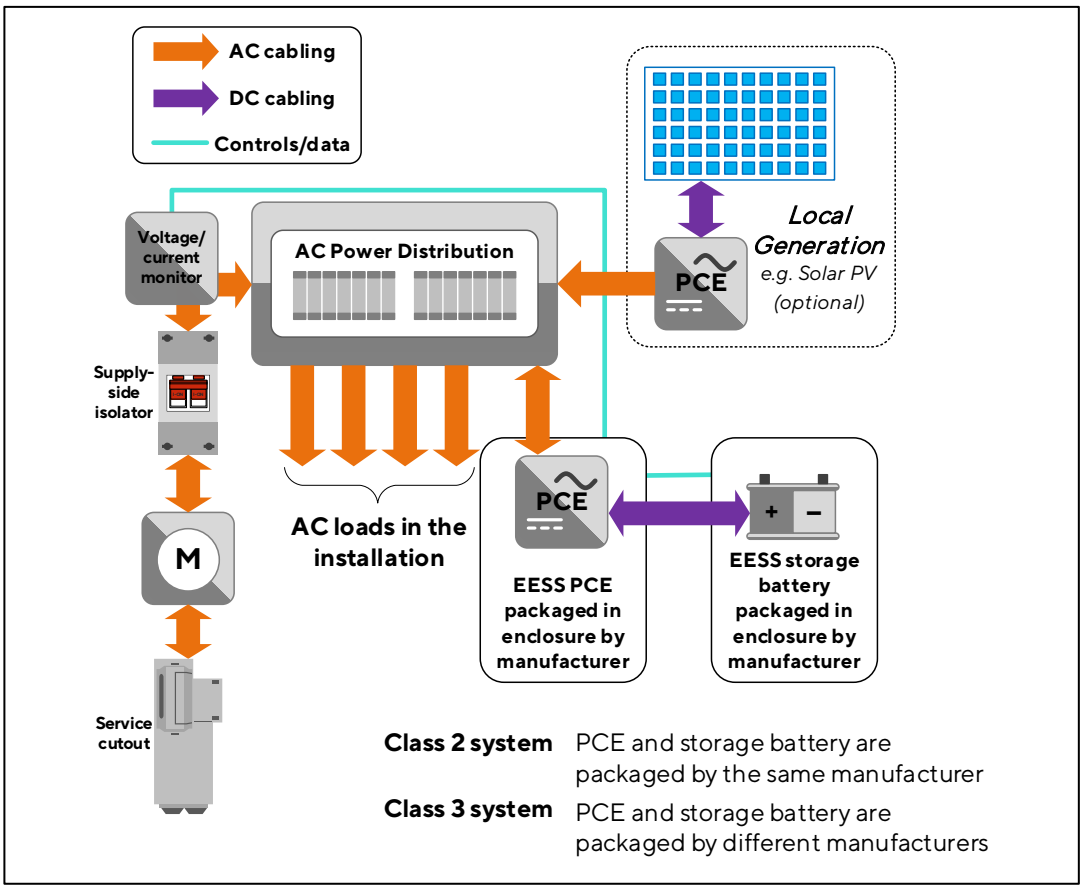

Figure 2.2 Example of Class 2 or Class 3 system without islanding arrangement

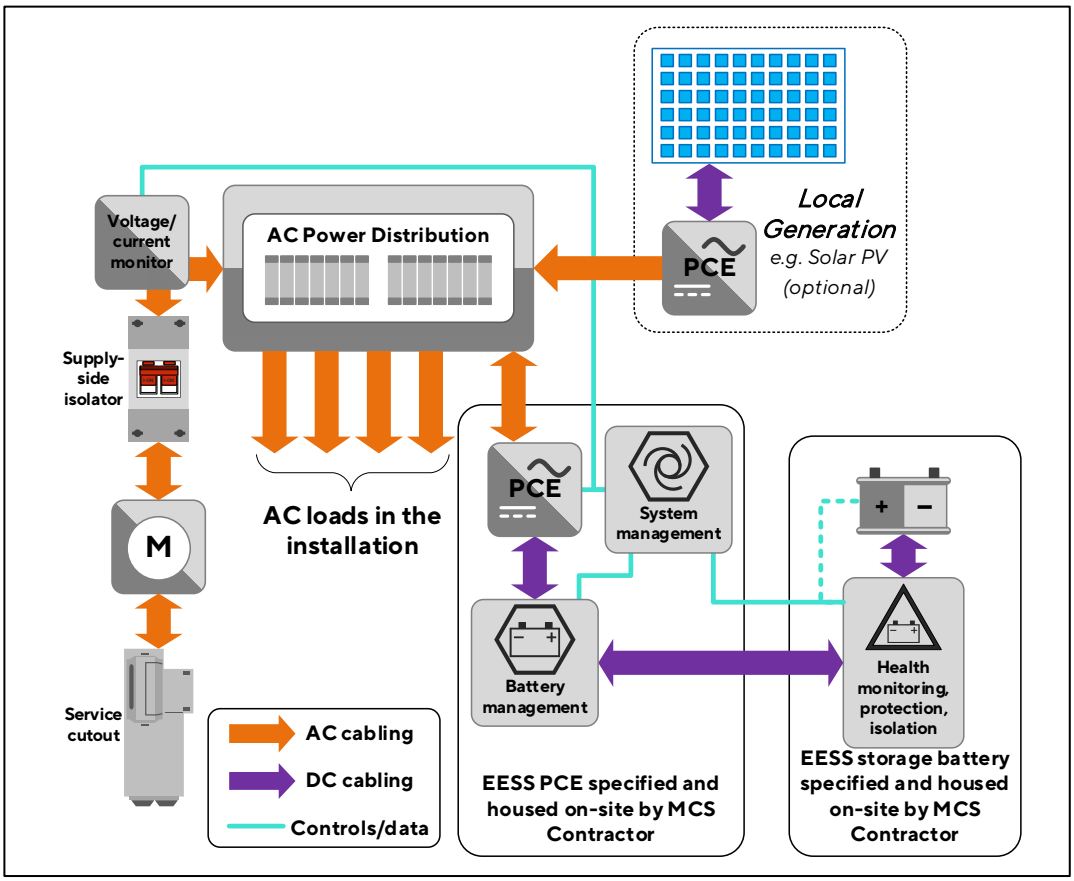

Figure 2.3 Example of Class 4 system without islanding arrangement

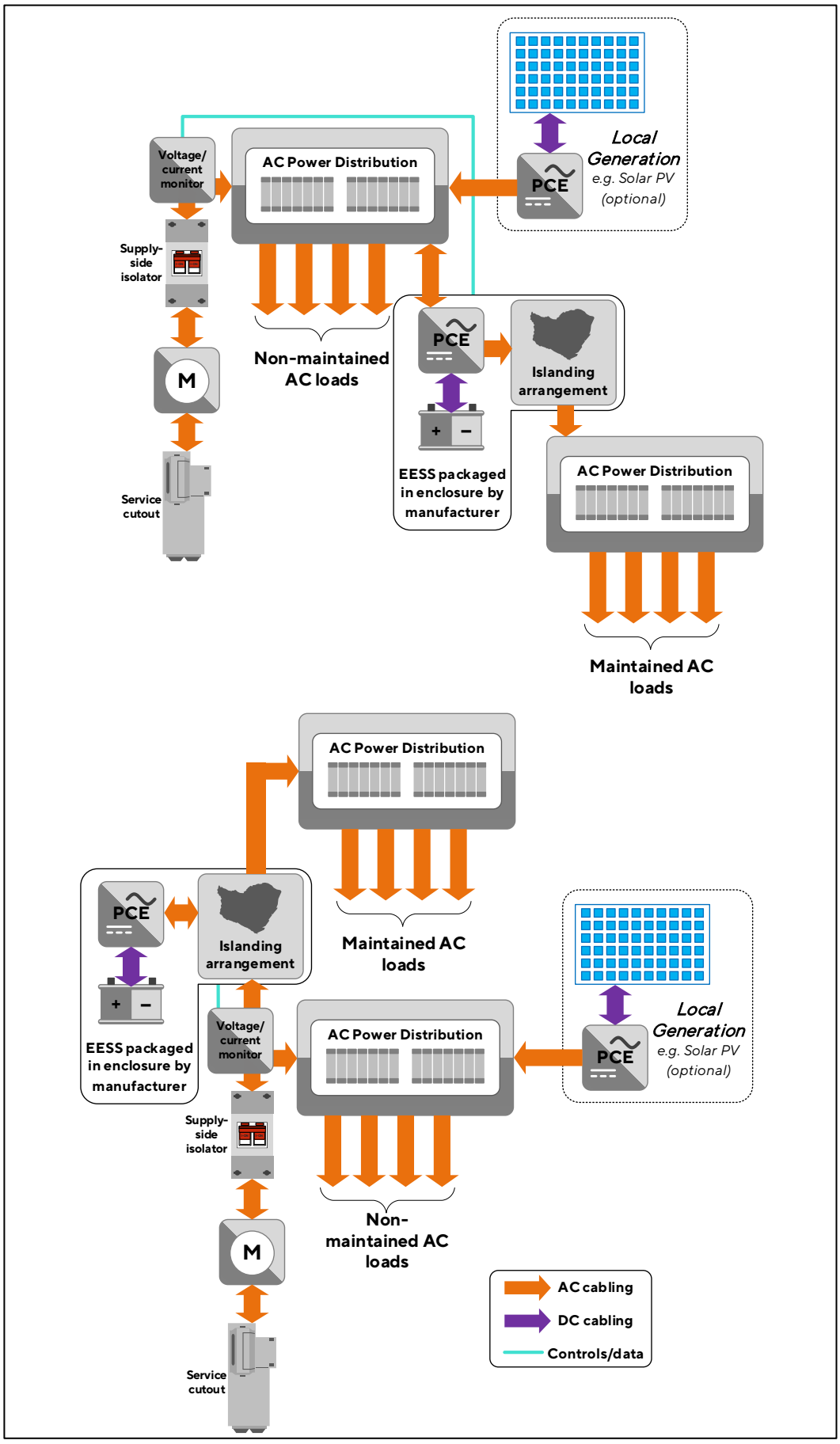

Figure 2.4 Examples of Class 1 systems with islanding arrangement

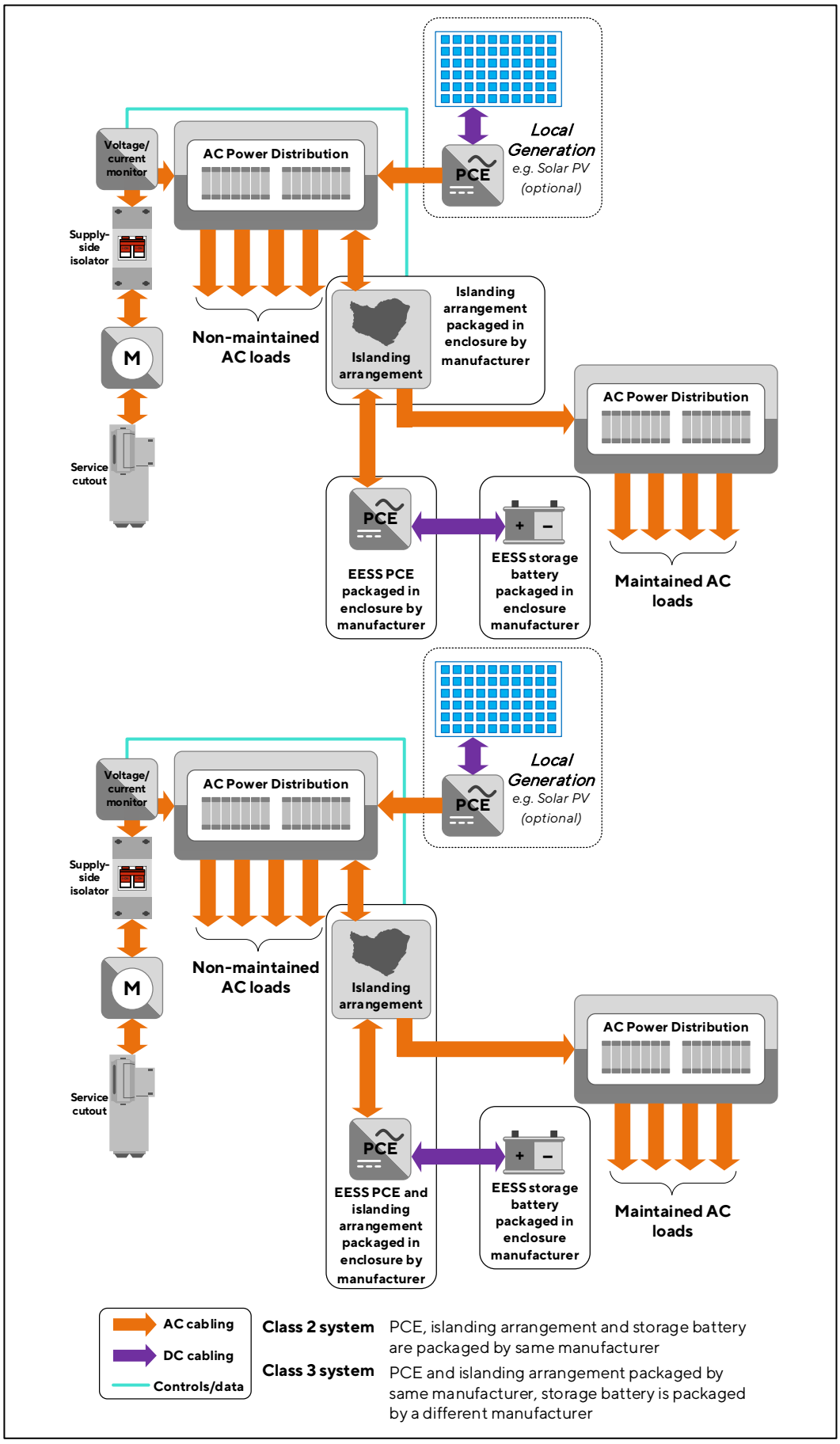

Figure 2.5 Examples of Class 2 and Class 3 systems with islanding arrangement

3 DESIGN & INSTALLATION REQUIREMENTS

3.1 LEGISLATION

3.1.1 All applicable legislation must be met in full.

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

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

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

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

3.1.5 A Construction Phase Plan in accordance with the Construction (Design and Management) Regulations 2015 shall be drawn up before work on site commences.

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

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

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

3.1.7 The MCS Contractor must ensure the installation is compliant with the Electrical Safety, Quality and Continuity Regulations 2002 and, in accordance with Regulation 22(2)(c), must follow the technical requirements and procedures:

a) In Engineering Recommendation (EREC) G98 for installations up to and including 16 A per phase
b) In EREC G99 for installations exceeding 16 A per phase.
c) In EREC G100 where the export of power is to be limited

3.1.8 Notification to the distribution network operator in accordance with the procedures set out in EREC G98 or EREC G99 (full or fast-track process as appropriate) shall be undertaken by the MCS Contractor.

Note: the 16 A per phase threshold is the total aggregated AC output of all generators. For example, a 3 kW solar PV system and a 3 kW electrical energy (battery) storage system are connected in parallel to the same single-phase AC supply, gives a combined maximum theoretical output greater than 16 A. In this case EREC G99 applies.

3.2 STANDARDS AND INDUSTRY PRACTICES

3.2.1 EESS shall be designed and installed in accordance with the latest edition of the IET Code of Practice for Electrical Energy Storage Systems – hereafter referred to as the Code of Practice – and paragraphs 3.5 to 4.1.3 below.

3.2.2 For a particular installation, should a conflict arise between specific requirements, then the latest version of BS 7671 shall take precedence over paragraphs 3.5 to 4.1.3 below, which in turn shall take precedence over the Code of Practice.

3.2.3 All references in both this standard, and the Code of Practice, to Designated Standards for demonstration of conformity to relevant legislation shall be read as a version of that standard in the current Lists of Designated Standards available on the UK Government website, or any designated replacement standard should that standard have been removed from the list.

Note: at the time of publishing this Standard, the Lists of Designated Standards are available at the following Web address: https://www.gov.uk/guidance/designated-standards

3.2.4 All references in both this Standard, and the Code of Practice, to other national or international standards shall be read as the latest version of that national or international standard, or any superseding standard should the standard be withdrawn.

3.2.5 References in the Code of Practice to ERECs G98 and G99 shall be read as the latest version of those ERECS.

3.3 MANUFACTURER'S INSTRUCTIONS

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

3.3.2 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 system or the manufacturer's warranty would be made void.

3.4 EQUIPMENT CERTIFICATION AND LISTING

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

3.4.2 Generating plants (inverters) must be fully type-tested to the latest standards required by the Energy Networks Association recommendations. Refer to Clause 5 "Publications for Reference and Further Reading" for details of the changes to the Engineering Network Codes.

3.4.3 All batteries and equipment should comply with relevant British or Harmonised standards:

3.4.3.1 Components and assemblies should comply with relevant standards accepted by relevant UK legislation. Where applicable, the requirements of EREC G98 and G99 apply.

3.4.3.2 EESS shall meet the requirements of the Electromagnetic Compatibility Regulations 2016. The compatibility of all selected components for Class 3 and Class 4 systems shall be ensured.

3.5 DESIGN AND INSTALLATION

General

3.5.1 Means of protection against electric shock, overcurrent and overload current according to BS 7671 shall be provided for all modes of operation.

3.5.2 Any earth electrodes provided for or utilised by the EESS shall meet the requirements of BS 7671 and BS 7430.

System control

3.5.3 Controls shall be designed and configured to avoid jitter, and nuisance-switching between operating modes.

3.5.4 The storage battery shall cease delivering power before it exceeds its maximum recommended depth of discharge.

Island mode operation

3.5.5 When the system switches to island-mode:

a) All line conductors and neutral of the island mode part of the electrical installation, shall be isolated from the grid supply using an island mode isolator.
b) The protective earth of the grid supply shall not be isolated.
c) The neutral of the island mode part of the installation shall be connected, at one point only, through an N-E bond relay , to a means of earthing having a maximum earth electrode resistance Z_{EE} selected in accordance with Figure 9.10 of the Code of Practice.
d) Any required neutral-earth bond shall be made immediately after the island mode isolator opens.

3.5.6 When the system switches out of island mode any neutral-earth bond shall be broken immediately before the island mode isolator opens.

3.5.7 When operating in island-mode, means of protection against electric shock shall not rely on the distributor's means of earthing (for example, the earth terminal or conductor provided by the distributor for TN-S and TN-C-S supplies). Where necessary, an earth electrode shall be provided.

3.5.8 The preferred earthing arrangement for island-mode operation shall be TN-S.

3.5.9 Where it is not practicable for a TN-S earthing arrangement to be achieved in island-mode operation, TT shall be used.

3.5.10 The use of IT systems in island-mode shall be limited to systems that are maintained by contractor, and due assessment has been made of the connected loads. IT systems shall be designed to disconnect after first fault, unless the installation is under the constant supervision of a responsible person.

Note 1: Certain common appliances and items of electrical equipment are not compatible with IT systems.
Note 2: BS 7671 strongly recommends against IT systems with distributed neutrals.

3.5.11 The designer and installer shall verify that protection against electric shock is provided for all maintained circuits in accordance with BS 7671 and the Code of Practice.

3.5.12 The circuit connecting the EESS generator to the installation must be designed so that it is protected against electric shock, fault current and overload current in accordance with BS 7671.

3.5.13 In circuits that are energised in island mode, where an RCD is used to achieve the disconnection time for automatic disconnection required by BS 7671, the residual current rating must be selected taking into account the resistance of the island-mode earth electrode, in accordance with the Code of Practice.

3.5.14 Where automatic disconnection using a protective device is not feasible, the output of all power converting equipment supplying the installation in island-mode shall comply with regulation 419.2 of BS 7671.

3.5.15 The designer shall, as far as practicable, ensure selectivity between protective devices of final circuits for maintained loads, and the devices or equipment used to achieve the requirements in paragraphs 3.5.12, 3.5.13 and 3.5.14. Where selectivity is not practicable, so that a single fault may cause interruption of power to all maintained loads, this shall be clearly highlighted in the contract, and documented in the user instructions.

3.5.16 The island mode isolator and N-E bond relay shall be rated in accordance with the Code of Practice.

<u>Storage batteries</u>

3.5.17 Storage batteries shall not be located where they are at risk of accidental damage for which their enclosure is not designed.

3.5.18 All storage batteries intended for use in dwellings shall comprise, or be housed in, a suitable enclosure meeting at least IP2X as defined in BS EN 60529, with top surfaces at least IP4X as defined in BS EN 60529. Battery terminals and electrical connections shall be protected to at least IP3X, or shall be inaccessible without the use of a tool. Where BS 7671 requires a higher ingress protection rating for the location, BS 7671 requirements shall take precedence. Access to monoblocs or cells shall be by tool only.

3.5.19 Regardless of operating voltage, batteries, and any wiring system and means of connection, shall not be considered SELV or PELV unless the manufacturer of all power converting equipment connected to the storage battery confirms that the requirements of SELV or PELV are met.

3.5.20 In Class 2, Class 3 and Class 4 systems, all electrical equipment for use in DC circuits must be rated for DC use. Conductors terminated by the Contractor shall be identified in accordance with BS 7671.

Current transformers

3.5.21 Current transformers and wiring connecting them to shunt devices shall be considered to operate at low voltage (Band II) unless the manufacturer of the current transformer confirms it meets the requirements for SELV or PELV.

3.5.22 Current transformers shall be housed and connected so that accidental removal of the current transformer does not affect export limitation or load curtailment arrangements in the installation.

Additional requirements for class 4 EESS

Note: the clauses in this section (5.5.17 to 5.5.31 inclusive) do ***not*** *apply to Class 1, Class 2 and Class 3 EESS.*

3.5.23 All storage battery and charging equipment installations shall be designed in accordance with BS 7671, BS EN IEC 62485-1 and BS EN IEC 62485-2 and, where lithium battery chemistries are used, BS EN IEC 52485-5, taking into account specific recommendations of the storage battery manufacturer for accommodation.

3.5.24 All AC electrical equipment shall be capable of safe operation in line with the most onerous conditions of utilisation voltage presented by BS EN 50160, BS 7671 and EREC G98 or G99 as appropriate.

3.5.25 Conductors and terminals in pre-manufactured assemblies shall be identified in accordance with BS EN IEC 60445.

3.5.26 Charge management equipment shall comply with the storage battery manufacturer's recommendations for charge management and monitoring.

3.5.27 Charging shall cease when the storage battery voltages, currents or temperatures when charging move outside safe parameters published by the storage battery manufacturer.

3.5.28 Charging equipment shall identify the health of the storage battery. When the storage battery health is in question, the storage battery shall neither be charged or discharged, and a fault indication raised to the user, and indicated on an accessible control or indication panel.

3.5.29 PCE used for charging storage batteries shall match the electrical properties of the storage battery as specified by the battery manufacturer.

3.5.30 PCE shall not be used in a manner that exceeds its electrical ratings.

3.5.31 Except for commercial and industrial applications that are designed for fully-staffed operation, adjustment and regulation of charge voltages and currents to the profiles recommended by the storage battery manufacturer shall be automatic and require no user intervention.

3.5.32 All battery enclosures and/or battery rooms shall comply with BS 7671 and BS EN IEC 62485-1 and BS EN IEC 62485-2, and, where lithium battery chemistries are used, BS EN IEC 62485-5, and shall contain provisions appropriate to the battery chemistries involved.

3.5.33 When covers are removed from storage battery enclosures, or within battery rooms, terminals of battery components shall be protected to at least IP2X as defined in BS EN 60529, and/or have some form of plastic cover to prevent inadvertent short-circuits during inspection, testing, fault-finding and maintenance operations. Storage batteries shall be arranged so that, during access to the enclosure or battery room, it is not possible to inadvertently make simultaneous contact with a potential difference exceeding 120 V.

3.5.34 All storage batteries shall incorporate a means of overcurrent protection within, or as close as possible to, the output terminals, of the storage battery or its enclosure.

3.5.35 All storage batteries shall incorporate a means of isolation as close as possible to the output terminals of the storage battery enclosure.

3.5.36 Where the system incorporates export limitation or load curtailment, the system shall monitor for faults or removal of load and export monitoring current transformers. The system shall be arranged so that a faulty or disconnected current transformer does not lead to the export limit or the installation maximum demand being exceeded.

3.6 METERING & COMMUNICATION

Metering

3.6.1 Where energy is taken from the grid to be stored in the EESS and later returned to the grid or installation, that energy shall not affect the veracity of any meters recording energy generated, imported or exported and where those meters are used for billing or payment.

Note: An example would include the meter recording total generation of a solar PV system where the recorded energy is used for payment of financial incentives such as the Feed-in Tariff. Any error in that reading could cause a claim for payment to be inaccurate and fraudulent. For the avoidance of doubt this clause allows for the correct recording by the supply meter of the energy taken from the grid to be stored in the EESS.

Data communication & security

3.6.2 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 relayed to the customer
- Relevant components in the EESS shall comply with the technical specification ETSI Technical Specification 103 645 Cyber Security for Consumer Internet of Things.

3.6.3 Installations requiring local area network, home area network, and/or internet access in commercial and industrial premises shall comply with the client organisation's information technology and information security policies and procedures.

3.7 SAFETY AND COMPONENT LOCATION

General

3.7.1 All components shall be located so that escape routes from the premises are not impeded.

3.7.2 Storage batteries shall be located so that a fire in the battery does not compromise protected escape routes.

3.7.3 All storage battery enclosures, battery rooms, and locations in which battery enclosures are installed, shall have adequate ventilation to prevent overheating during charging operations, and, where necessitated by the battery chemistry, to prevent explosive concentrations of evolved gasses.

3.7.4 Except where the entire battery enclosure is intended to be returned to a manufacturer's designated repair facility, maintenance instructions for the battery shall be provided, which include details of arc flash working procedures and the required personal protective equipment. If the information is not available from the battery manufacturer, the information shall be provided after completing and documenting an arc flash risk assessment in accordance with Appendix E of the Code of Practice.

3.7.5 Storage batteries shall be located and housed in an appropriate location for the arc flash incident energy of all batteries in the location. Where the battery manufacturer does not provide specific information for location of an enclosed battery, or where monoblocs or multiple batteries are connected on-site, an arc flash risk assessment shall be completed in accordance with Appendix E of the Code of Practice, to determine an appropriate location for the battery or batteries.

Weight and accessibility

3.7.6 All components shall be mounted on surfaces that are structurally sound and can support the weight of all components mounted on them. Both point loading and weight distribution shall be taken into consideration. If there is any doubt whatsoever then a qualified structural engineer shall be consulted.

3.7.7 The means of wall mounting for converters, batteries and similar components shall comply with the wall-mounting requirements of BS EN 62109-1.

3.7.8 Where reinforcement of walls and floors is required, the requirements and responsibility for these works shall be identified as part of the Contract.

3.7.9 Storage batteries and other components of the system shall be located so that any installation, commissioning and maintenance operations can be carried out safely, considering the weight of components and any lifting and manual handling operations required.

3.7.10 All components shall be located so that there is adequate workspace, and access for installation, commissioning and maintenance operations. Space should also be available for temporary task lighting for such operations, where permanent lighting is not present in the location.

3.8 SITE SPECIFIC ISSUES

3.8.1 Storage battery chemistry shall be selected taking into account any fire suppression systems that are currently installed, or planned to be installed, in the location in which the storage battery is to be installed.

3.8.2 Storage batteries shall not be subject to submersion during foreseeable flood and inundation conditions.

Note: Certain battery chemistries must not come into contact with water.

3.8.3 Where power converting equipment and/or storage batteries are located in a rarely visited part of any premises, appropriate fire detection equipment should be installed in that location, complying with BS 5839-1 or BS 5839-6 as appropriate. Any fire detection equipment should be integrated with any existing fire detection and alarm system in the premises, and the means of integration shall comply with BS 5839-1 or BS 5839-6 as appropriate.

4 COMMISSIONING

4.1 COMMISSIONING

4.1.1 The EESS 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: An example of a suitable commissioning checklist, based on the checklists in Section 12 of the Code of Practice, is shown in Appendix A. This should be provided in addition to any certification and schedules required by BS 7671.

4.1.2 See also Sections 12 and 13 of the Code of Practice.

4.1.3 Earth fault loop impedance and prospective fault current shall be verified for all operating modes. Tests representing the installation operating in charging mode shall be made with all inverters and bi-directional converters in the installation disconnected.

Note: the IET Code of Practice contains recommendations for determining prospective fault current and earth fault loop impedance in installations containing EESS.

4.2 LABELLING

4.2.1 Documentation and labelling shall comply with BS EN IEC/IEEE 82079-1.

4.2.2 Appropriate labels should be used as detailed in Appendix C of the Code of Practice with the exception of those described in Figures C.2 and C.5 which shall be used in all circumstances. The label given in Figure C.3 shall be used for DC coupled and bespoke systems where the DC terminals are not concealed within the enclosure of a packaged AC system. Labels required by BS 7671 and any other relevant standards should also be provided.

5 PUBLICATIONS, REFERENCE AND FURTHER READING

The below lists are provided so that users of this standard 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:

- BS 7671:2018+A1:2020 Requirements for Electrical Installations (IET Wiring Regulations Eighteenth Edition).
- IET Code of Practice for Electrical Energy Storage Systems (IET publication ISBN 978-1-83953-041-8 Paperback, 978-1-83953-389-1 Electronic)
- Engineering Recommendation G99 Issue 1 – Amendment 8 published 1 September 2021 - 'Requirements for the connection of generation equipment in parallel with public distribution networks on or after 27 April 2019'
- Engineering Recommendation G98 Issue 1 – Amendment 8 published 1 September 2021 - 'Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks on or after 27 April 2019'
- IET Code of Practice for Electric Vehicle Charging Equipment Installation (IET publication ISBN 978-1-78561-680-8 Paperback, 978-1-78561-681-5 Electronic)
- BS 5839-1:2017 Fire detection and fire alarm systems for buildings. Code of practice for design, installation, commissioning and maintenance of systems in non-domestic premises. Available from British Standards Institution (BSI)

- BS 5839-6:2019+A1:2020 Fire detection and fire alarm systems for buildings. Code of practice for the design, installation, commissioning and maintenance of fire detection and fire alarm systems in domestic premises.
- BS 7430:2011+A1:2015 Code of practice for protective earthing of electrical installations. Available from British Standards Institution (BSI)
- BS 7671:2018+A1:2020, Requirements for Electrical Installations (IET Wiring Regulations Eighteenth Edition).
- BS EN 50160:2010+A3:2019 Voltage characteristics of electricity supplied by public electricity networks. Available from British Standards Institution (BSI.
- BS EN 60529:1992+A2:2013 Degrees of protection provided by enclosures (IP Code). Available from British Standards Institution (BSI).
- BS EN IEC 62485-1:2018 Safety requirements for secondary batteries and battery installations. General safety information.
- BS EN IEC 62485-2:2018 Safety requirements for secondary batteries and battery installations. Stationary batteries.
- BS EN IEC 62485-5 Safety requirements for secondary batteries and battery installations. Safe operation of stationary lithium ion batteries.
- ETSI TS 103 645 Cyber Security for Consumer Internet of Things.

APPENDIX A – COMMISSIONING CHECKLIST

Commissioning Checklist		
Installation address	Reference:	
	Date:	
	Test Instruments:	
PART 1: SYSTEM INSPECTION		
A System design/equipment selection and connection		Y / N / n/a
General check to confirm equipment complies with relevant standards.		[ ]
System installed in accordance with design.		[ ]
Equipment correctly selected and erected – according to standards and manufacturer's instructions.		[ ]
Equipment undamaged.		[ ]
Conductors correctly connected, identified and routed.		[ ]
Wiring systems and cables suitably supported in accordance with BS 7671		[ ]
Conductors suitably selected for voltage and current requirements.		[ ]
Switchgear and ancillary devices suitable for voltage and current requirements.		[ ]
Switchgear and ancillary devices correctly installed and connected.		[ ]
Components selected and erected to suit the location and any external influences.		[ ]
B Protection against electric shock		
i Basic protection (prevention of contact with live parts)		
Insulation of live parts (e.g. conductors) – correctly applied and suitable.		[ ]
Use of barriers or enclosures – suitable and with an appropriate IP rating.		[ ]
ii Additional protection (additional protection measures)		
Protection by the use of an RCD not exceeding 30 mA.		[ ]
Supplementary bonding.		[ ]
iii Other methods of protection		
SELV or PELV		[ ]
Double or reinforced insulation (Class II or equivalent equipment and circuits).		[ ]
iv Automatic disconnection of supply		
Suitable main earth provided.		[ ]
Earth connections suitably installed.		[ ]
Main protective bonding suitably installed.		[ ]
RCDs provided for fault protection.		[ ]
C General		
Equipment and circuits deployed to prevent mutual detrimental influence.		[ ]
Equipment located to allow suitable access arrangements.		[ ]
Labels and signs (including safety signs) displayed and durable.		[ ]

	Systems that provide back-up or island mode power supply	
	Isolation of grid supply current-carrying conductors (Section 9.4 of IET CoP).	[ ]
	Provision of consumer's earth electrode (see Section 9.4.10 of IET CoP).	[ ]
	Additional protection by RCDs to supplement overcurrent protective devices to ensure adequate disconnection times are met (see Section 9.4.11 of IET CoP).	[ ]
	Provision of surge protection devices (see Section 9.7 of the IET CoP).	[ ]
	Staggered start/load-shedding on change-over (see Sections 9.8 and 9.9 of IET CoP).	[ ]
E	EESS location	
	Location/room has ventilation arrangements suitable for EESS and ancillary equipment.	[ ]
	Location selected suitable for IP rating of EESS components.	[ ]
	Fire prevention and detection measures implemented – as necessary for EESS technology.	[ ]
	Equipment located to minimise risk of mechanical damage (for example vehicle impact in a garage or near driveway).	[ ]
	Site safety signs displayed and durable – as necessary to meet EESS technology.	[ ]
F	EESS equipment	
	Equipment installed to manufacturer's requirements.	[ ]
	Clearance from adjacent objects meets manufacturer's specifications.	[ ]
	Ventilation of equipment meets manufacturer's requirements and remains unobstructed.	[ ]
	Clearance from any external heat sources acceptable – as relevant.	[ ]
	EESS equipment suitably accessible for maintenance and operation.	[ ]
	EESS labelling displayed and durable (e.g. 'dual supply' signs, other safety signs).	[ ]
Part 1: Notes and observations		

PART 2: TESTS ACCORDING TO BS 7671		
Tests carried out		[ ]
Part 2 BS 7671 certificate and schedule references		
Part 2: Notes and observations		
PART 3: EQUIPMENT AND SYSTEMS TESTS		
Data acquisition & control	Tests to ensure that the EESS data acquisition and control systems are performing correctly.	[ ]
Internet connectivity	Tests to ensure that the EESS is correctly configured and communicating.	[ ]
Displays/alarms	Checks to ensure correct function of any user displays or alarm mechanisms.	[ ]
Charge-discharge	Checks that EESS can correctly operate charge and discharge functions. Functional checks of batteries as recommended by the manufacturer or relevant standards (e.g. BS EN 61427-1 recommends battery capacity tests during commissioning).	[ ]
Thermal management	Checks to ensure correct function of any thermal management systems.	[ ]
Ventilation	Checks to ensure correct function of any ventilation systems and controls.	[ ]
Fire systems	Checks to ensure correct function of any fire detection or management systems.	[ ]
Wet chemical checks	Test to validate correct status of any liquids contained within the EESS (e.g. using hydrometer to check a lead-acid battery).	[ ]
Ancillary equipment	Checks to ensure correct function of any ancillary equipment forming part of the EESS (e.g. pumps, control valves etc.).	[ ]
Manufacturer's commissioning test report/schedule reference(s) (where appropriate)		
Part 3: Notes and observations		

PART 4: APPLICATION TESTS		
G98/G99	Tests for EESS that can operate in parallel to the grid ('grid connected'). At the most basic these tests may simply be a 'loss of mains test' to ensure that the system operates correctly when the mains supply is lost. For larger systems, a longer test sequence, such as G99 'injection testing', may be required.	[ ]
Export limitation (G100)	Where the EESS is part of a system that has been specified to control site export to a specific limit (export from on-site generation or the battery), a suite of tests will be required to prove the correction function of these systems. The commissioning tests expected by a DNO during the commissioning of an export limitation system are described in Engineering Recommendation G100.	[ ]
Ancillary services	Where a system is providing services to support the grid, specific commissioning tests will be required to prove that the system meets the requirements of that service. These tests typically involve simulating specific grid conditions and then monitoring the EESS to ensure it responds in the correct manner. An example of these tests would be where a test set is used to inject a specific grid frequency change – and then the EESS is monitored to ensure that it has a suitable charge/ discharge ramp response.	[ ]
Revenue metering/monitoring	Where an EESS derives income from providing a service, metering and data acquisition systems are deployed to monitor the EESS and allow revenue to be collected. The correct operation and accuracy of these systems may need to be tested during commissioning. These tests may also be required for other meters in the system, such as those utilized to determine EESS usage as part of any warranty conditions.	[ ]
Back-up – power quality	Where an EESS provides a back-up or an island mode power supply, the quality of that supply may need to be verified during commissioning. These tests may vary from simple checks of voltage and frequency to a more detailed examination of wave-shape and harmonic content.	[ ]
Backup – changeover	Where an EESS provides a back-up power supply, the transition between on-grid and island mode operation may require functional testing. Information on the requirements for systems providing back-up functionality is provided in Sections 8.3 and 9.4. Commissioning tests need to determine the correct function of the measures adopted and may include: • correct function of changeover switches/relays; • correct function of neutral-earth switching; • correct separation of essential and non-essential supplies; and • measurement of earth electrode resistance for the consumer's earth electrode.	[ ]
Manufacturer's commissioning test report/schedule reference(s) (where appropriate)		
Part 4: Notes and observations		