PAS 63100:2024

Electrical installations – Protection against fire of battery energy storage systems for use in dwellings – Specification

Department for Energy Security & Net Zero

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Foreword

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Presentational conventions

The provisions of this PAS are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is "shall".

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the *Shorter Oxford English Dictionary* is used (e.g. "organization" rather than "organisation").

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In particular, attention is drawn to the following specific regulations:

- The Electricity Safety, Quality and Continuity Regulations 2002, Part VI: Generation, 21. Switched alternate sources of energy and 22. Parallel operation [1]; and
- The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG) [2].

0 Introduction

Electrical energy (battery) storage forms a key part of renewable energy strategies. Given the benefits of electrical energy storage systems (EESSs) to consumers and electricity providers, and their ability to maximize the effectiveness of renewable energy technologies such as solar photovoltaic (PV) systems, it is expected that there will be a sharp rise in the number of EESSs being installed.

This specification aims to help installers manage fire safety related hazards associated with EESSs in homes in the United Kingdom. The provisions are intended to reduce the risk of batteries in dwellings becoming a source of ignition, and limit the impact of a battery fire should one occur.

Regarding battery location, the basic premise is that the best place for storage batteries is outside dwellings and away from habitable rooms. Where it is not practicable to locate batteries outdoors, some basic requirements are provided for locations containing storage batteries, based on the principles that:

- batteries are separated from habitable rooms, and means of escape for inhabitants, by suitable fire compartmentation;
- fire detection is provided for the battery location, interlinked to a fire alarm system to warn inhabitants of a detected fire; and
- means of escape for inhabitants are not inhibited.

Whilst battery fires, at the time of writing, are low frequency, they have a high impact due to their behaviour in fire. Since some batteries can exhibit focussed jet-like flaming, a higher degree of fire compartmentation should be considered. Fire compartmentation requirements might need to be assessed in future editions of this standard, as there are currently gaps in the knowledge of how fire compartmentation resists lithium battery fires.

This specification is also based on the premise that electrical energy storage systems competent persons are defined in accordance with the Building Regulations Approved Documents of England or the relevant devolved national equivalents in Wales, Scotland and Northern Ireland.

The United States National Fire Protection Association (NFPA) document, NFPA 855, *Standard for the installation of stationary energy storage systems* [3] was used as a guide when developing requirements for storage battery installation locations, and maximum values of stored energy.

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1 Scope

This PAS specifies requirements for fire safety in the installation of small-scale electrical energy storage systems (EESSs) in domestic dwellings that utilize stationary secondary batteries as the medium for energy storage.

The PAS defines fire safety requirements for the installation of EESS components including:

- physical requirements for battery units;
- battery management;
- power conversion equipment (PCE); and
- fault management and fail-to-safe operation of all control and monitoring functions.

The PAS covers installation requirements for:

- installation location in respect of safety and external factors that affect fire safety; and
- protection against fire.

The PAS does not cover:

- battery systems with nominal voltages on the AC and/or DC side exceeding low voltage as defined in BS 7671;
- secondary batteries with total capacity not exceeding 150 Wh incorporated into products or systems that are the subject of harmonized or designated standards (e.g. intruder alarm systems, carbon monoxide alarm systems, fire detection and alarm systems, pluggable uninterruptible power systems, portable appliances, audio/video and information technology equipment);
- domestic dwellings exceeding 200 m^2 in floor area;
- transportation of batteries;
- systems incorporating second life batteries;
- EESSs that use alternative forms of energy storage;
- EESSs in high risk residential buildings; and
- EESSs connected before a distributor's cut-out or a consumer's meter (collective PEI).

NOTE 1 *Existing regulations, The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG)[2], cover the transportation of batteries.*

NOTE 2 *Attention is drawn to BS 7671, Section 511 regarding the product standards for selected electrical equipment and its intended use.*

NOTE 3 *The fire safety principles can also be applied to domestic dwellings exceeding 200 m^2; however, it is recommended that a fire safety expert is consulted.*

NOTE 4 *Second life batteries are excluded because there are currently no standards in place to address safety of repurposed batteries. Aligning with BS 7671, this PAS requires batteries to conform to a suitable safety standard relevant for the application (see **6.4**). At the time of development of this PAS, the typical application for second life batteries for domestic storage systems comprises second-life electric vehicle traction batteries, and the designer of an electrical installation (perhaps the installer for domestic installations) would therefore be required to make a suitable declaration regarding safety according to Regulation 511.2 of BS 7671.*

The PAS is of use to suitably competent designers and installers of EESSs forming part of electrical installations of dwellings and similar simple electrical installations.

This PAS might be of interest to manufacturers of products forming part of an installed EESS and bodies providing independent certification of products, design and installation of an EESS.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this PAS. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS 476 series, *Fire tests on building materials and structures*

BS 5839 series, *Fire detection and fire alarm systems for buildings*[1)]

BS 7671, *Requirements for electrical installations*

BS EN 54 series, *Fire detection and fire alarm systems*

BS EN 13501 series, *Fire classification of construction products and building elements*

BS EN 60073, *Basic and safety principles for man-machine interface, marking and identification – Coding principles for indicators and actuators*

BS EN 60529, *Degrees of protection provided by enclosures (IP Code)*

BS EN 60622, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Sealed nickel-cadmium prismatic rechargeable single cells*

BS EN 60623, *Secondary cells and batteries containing alkaline or other non-acid electrolytes – Vented Nickel-cadmium prismatic rechargeable single cells*

BS EN 61427-1, *Secondary cells and batteries for renewable energy storage – Part 1: General requirements and methods of test – Photovoltaic off-grid application*

BS EN 61427-2, *Secondary cells and batteries for renewable energy storage – Part 2: General requirements and methods of test – On-grid applications*

BS EN 62109-2, *Safety of power converters for use in photovoltaic power systems – Part 2: Particular requirements for inverters*

BS EN 62116, *Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures*

BS EN 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

BS EN 62477-1, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

BS EN IEC 61204-3, *Low-voltage switch mode power supplies – Part 3: Electromagnetic compatibility (EMC)*

BS EN IEC 61204-7, *Low-voltage switch mode power supplies – Part 7: Safety requirements*

BS EN IEC 62485-1, *Safety requirements for secondary batteries and battery installations – Part 1: General safety information*

BS EN IEC 62485-2, *Safety requirements for secondary batteries and battery installations – Part 2: Stationary batteries*

[1)] This document also gives a normative reference to BS 5839-6.

BS EN IEC 62485-5, *Safety requirements for secondary batteries and battery installations – Part 5: Safe operation of stationary lithium ion batteries*

BS EN IEC 62933-5-2, *Electrical energy storage (EES) systems. Part 5-2: Safety requirements for grid-integrated EES systems – Electrochemical-based systems*

BS EN IEC/IEEE 82079-1, *Preparation of information for use (instructions for use) of products – Part 1: Principles and general requirements*

IEC 60417, *Graphical symbols for use on equipment*

ISO 7000, *Graphical symbols for use on equipment*

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

For the purposes of this PAS, the following terms and definitions apply.

3.1.1 battery

one or more cells fitted with devices necessary for use, for example; case, terminals, marking and protective devices

[SOURCE: IEC 60050, IEV Ref 482-01-04]

3.1.2 battery monitoring and management system (BMMS)

system comprising different equipment and devices in the installation for the purpose of monitoring and managing the charging, discharging and health state of a battery

3.1.3 cell

basic functional unit, consisting of an assembly of electrodes, electrolyte, container, terminals and usually separators, that is a source of electric energy obtained by direct conversion of chemical energy

[SOURCE: IEC 60050, IEV Ref 482-01-01]

3.1.4 collective PEI

several consuming electrical installations connected to the same public distribution network and sharing one common set of local power supplies and energy storage equipment

[SOURCE: BS HD 60364-8-2]

3.1.5 consumer

<of electricity> entity or party which uses electricity for its own needs

[SOURCE: BS HD 60364-8-2]

3.1.6 dwelling

unit of residential accommodation occupied (whether or not as a sole or main residence):

a) by a single person or by people living together as a family; or

b) by not more than six residents living together as a single household, including a household where care is provided for residents; or

c) by persons who do not live together as a family, but who live in self-contained single-family flats, maisonettes or bedsits within the unit; or

d) as a shared house.

[SOURCE: BS 5839-6, modified, Note omitted]

3.1.7 individual PEI

single consuming and/or producing electrical installation

[SOURCE: BS HD 60364-8-2]

3.1.8 monobloc battery

battery with multiple separate but electrically connected cell compartments each of which is designed to house an assembly of electrodes, electrolyte, terminals or interconnections and possible separators

NOTE 1 *The cells in a monobloc battery can be connected in series or in parallel.*

[SOURCE: IEC 60050, IEV Ref 482-02-17]

NOTE 2 *Monobloc batteries for some battery chemistries might contain some protective measures, for example cell monitoring and charge control features, but do not typically include internal protection against overcurrent. Where all features are provided, including protection against overcurrent, the term "battery" is used in this PAS.*

3.1.9 power conversion equipment (PCE)

electrical device converting one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and frequency

NOTE *Examples include AC-DC converters, DC-AC converters, DC-DC charge controllers, frequency converters, and hybrid devices that carry out a combination of such functions.*

[SOURCE: BS EN 62109-1, **3.66,** Note modified]

3.1.10 producer

<of electricity> party generating electrical energy

[SOURCE: IEC 60050-617:2009, IEV Ref 617-02-01]

3.1.11 prosumer

entity or party which can be both a producer and a consumer of electrical energy

[SOURCE: BS HD 60364-8-2]

3.1.12 prosumer's electrical installation (PEI)

low-voltage electrical installation connected or not to a public distribution network able to operate:

- with local power supplies, and/or
- with local storage units,

and that monitors and controls the energy from the connected sources delivering it to:

- current-using equipment, and/or
- local storage units, and/or
- public distribution network.

[SOURCE: BS HD 60364-8-2]

3.1.13 secondary cell

cell which is designed to be electrically recharged

NOTE *The recharge is accomplished by way of a reversible chemical reaction.*

[SOURCE: IEC 60050-482: IEV Ref 482-01-03]

3.1.14 shared PEI

several consuming and/or producing electrical installations similar to an individual PEI connected to the same low-voltage public distribution network and sharing their individual power supplies and energy storage equipment between themselves

[SOURCE: BS HD 60364-8-2]

3.1.15 smart grid

electric power system that utilizes information exchange and control technologies, distributed computing and associated sensors and actuators, for purposes such as:

- to integrate the behaviour and actions of the network users and other stakeholders; and
- to efficiently deliver sustainable, economic and secure electricity supplies.

[SOURCE : IEC 60050-617:2011, IEV Ref 617-04-13]

3.2 Abbreviated terms

For the purposes of this PAS, the following abbreviated terms apply.

IK international mechanical impact protection code (in accordance with BS EN 62262)

IP international ingress protection code (in accordance with BS EN 60529)

4 Electrical installation

4.1 General requirements

4.1.1 The battery shall be selected and erected in accordance with BS 7671.

NOTE *Guidance on installations incorporating electrical energy storage, and the application of BS 7671 to such systems, is given in the IET Code of practice for electrical energy storage systems [4].*

4.1.2 Where battery assemblies are connected in parallel strings, and are in one or more separate enclosures, common protection against overcurrent shall be provided.

4.2 Prevention of fire and burns from DC arcs

*COMMENTARY ON **4.2***

The provisions of this subclause are intended to prevent persons without requisite electrical knowledge unintentionally or intentionally causing an electrical arc, which might lead to fire and burns.

4.2.1 It shall not be possible to remove DC power cable connections without:

a) the use of a tool; or

b) removing a cover secured by the use of a tool.

4.2.2 Fuses for DC circuits of batteries shall be:

a) accessible only by the use of a tool; or

b) arranged so that fuses are only capable of being removed after opening an isolator suitable for on-load isolation.

5 System controls and integration

5.1 System controls

5.1.1 System controls shall conform to BS EN IEC 62933-5-2.

5.1.2 The system shall include a battery management and monitoring system (BMMS).

5.2 Failure modes

Where the system manufacturer has included monitoring of the battery, it shall monitor for suitable conditions to detect the failure modes, and undertake appropriate actions.

For those systems that are installed within a dwelling, an audible warning shall be used for battery persistent dangerous condition. For systems installed outdoors, remote monitoring via an app may be used.

NOTE 1 *Examples of system failure mode monitoring and actions are listed in Table 1.*

NOTE 2 *Refer to* ***6.5*** *for information on requirements for fire detection and fire alarm.*

Table 1 – Examples of system failure mode monitoring and actions

Condition or failure mode	Indication	System action
Battery internal fault (conditions based on manufacturer's risk assessments)	Visual indication	Battery should be disconnected from PCE
Battery dangerous condition (for example, battery overtemperature, or other condition that could lead to fire, thermal runaway, or evolution of explosive vapours or gases)	Visual warning and audible warning	Battery should be disconnected from PCE
Battery persistent dangerous condition (for example, battery overtemperature and temperature not falling after a period of 2 minutes following disconnection of PCE, or other condition that indicates a thermal runaway dependent on battery chemistry.)	Visual warning and audible warning	Battery fire suppression should be activated (if provided as part of the system)

5.3 Identification of controls, indications and warnings

Controls, indications and warnings (including audible warnings) shall follow the principles of BS EN 60073. Symbols or icons shall be selected from ISO 7000 or IEC 60417.

5.4 Battery management and monitoring system (BMMS) fire safety functions

Interfaces with fire detection and alarm systems and fire suppression systems shall conform to relevant parts of BS 5839 series and BS EN 54 series.

6 Storage batteries

6.1 Access and basic mechanical protection

6.1.1 Batteries shall comprise non-combustible enclosures containing the overcurrent protection with the cells/monoblocs.

NOTE 1 *Ferrous metal, e.g. steel, is deemed to be an example of a non-combustible material.*

NOTE 2 *Figure 1 shows examples of conformant and non-conformant arrangement of cells and monoblocs.*

6.1.2 Access to the interior of the battery enclosure shall be possible only by use of a tool. When installed, the top surface of battery enclosures shall meet IP4X or IPXX/D in accordance with BS EN 60529.

6.1.3 The total energy stored by batteries within a single enclosure shall not exceed 20 kWh.

6.2 General safety requirements

6.2.1 Battery enclosure assemblies shall conform to BS EN IEC 62485-1, BS EN IEC 62933-5-2, and:

a) BS EN IEC 62485-2 for lead-acid, nickel metal hydride and nickel cadmium battery chemistries; and

b) BS EN IEC 62485-5 for lithium-ion battery chemistries.

6.2.2 Storage battery systems shall be installed in accordance with BS 7671. Interconnections between separate enclosures in accordance with BS 7671 shall be provided, where necessary, for:

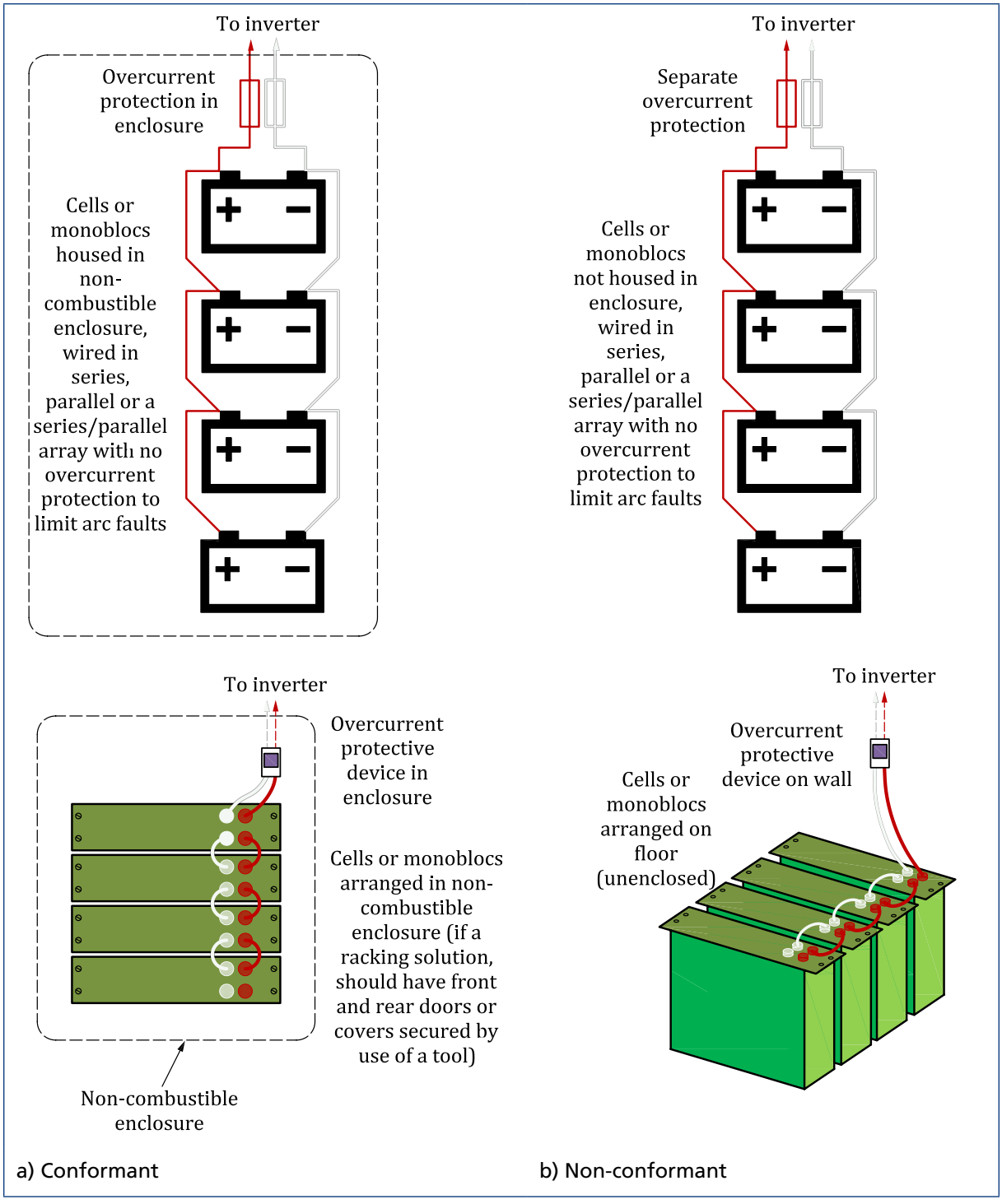
a) batteries and PCE; and

b) batteries.

NOTE 1 *Guidance on installations incorporating electrical energy storage, and the application of BS 7671 to such systems, is given in the IET Code of practice for electrical energy storage systems [4].*

NOTE 2 *Recommended working practices to reduce the risk of fire and explosion are provided in Annex A.*

Figure 1 – Examples of conformant and non-conformant arrangement of batteries



a) Conformant

b) Non-conformant

6.3 Safety of battery assemblies for protection against fire and burns

6.3.1 The battery assembly shall be selected from products where the manufacturer has undertaken an assessment of arc flash, fire and explosion risk in accordance with a recognized methodology, and declared the arc flash incident energy in the installation instructions for the battery.

NOTE 1 *A methodology for the assessment of arc flash incident energy and arc flash boundary is provided in AS/NZS 5139.*

NOTE 2 *The battery manufacturer should conduct this assessment, rather than the installer, and make a suitable declaration in the installation instructions for the battery.*

6.3.2 The battery assembly shall conform to the stated requirements for the determined arc flash incident energy levels shown in Table 2.

Table 2 – Battery enclosure requirements based on determined arc flash incident energy

Incident energy (cal/cm^2)	Battery enclosure requirements
≥8.0	Battery assemblies with incident energy exceeding 8.0 cal/cm^2 are not considered suitable for electrical installations associated with dwellings and shall not be intentionally supplied for such purpose.
≥4.0, <8.0	The battery shall be capable of being isolated into blocks, each having incident energy <4.0 cal/cm^2. The battery enclosure shall have an equivalent fire protection rating of at least REI 60 to BS EN 13501 series (60 min to BS 476 series for loadbearing capacity and integrity).
≥1.2, <4.0	Access to cells and monobloc batteries shall be possible only with the use of a tool.
NOTE *All relevant provisions based on the incident arc flash energy apply.*	

6.3.3 The installation location of battery assemblies shall be based on the determined arc flash incident energy in accordance with Table 3.

Table 3 – Installation location requirements of assemblies based on determined arc flash incident energy

Incident energy (cal/cm²)	Installation requirements
≥8.0	Battery assemblies with incident energy exceeding 8.0 cal/cm² shall not be installed in electrical installations associated with dwellings. The installation instructions shall contain the following warning, accompanied by the arc flash warning symbol ISO 7010-7010-W042:  **WARNING**. Risk of electrical arc flash. This battery must **not** be installed in electrical installations associated with dwellings.
≥4.0, <8.0	The battery installation instructions shall include the following statement: Where this battery is installed in a building, it is recommended that a means of fire detection and alarm, that is interconnected with the fire detection and alarm system of the rest of the building, is installed in the relevant location. Where the building does not already incorporate an interlinked fire detection and alarm system, it is strongly recommended that one is fitted when this battery is installed. Such systems are subject to the provisions of the relevant UK devolved national Approved Codes of Practice and guidance on building regulations, and the relevant parts of BS 5839.
***NOTE** All relevant provisions based on the incident arc flash energy apply.*	

6.4 Safety of cells and monobloc batteries

Cells and monobloc batteries shall conform to the relevant safety standards dependent on battery chemistry as shown in Table 4.

Table 4 – Standards for cells and monobloc batteries

Battery chemistry	Applicable standard(s)
Lithium	BS EN IEC 62281
Nickel-cadmium	BS EN 60622; or BS EN 60623; or BS EN 62259.
Nickel-metal hydride	BS EN 62675
Lead-acid	BS EN 61056-1; and BS EN 61056-2.

6.5 Protection against fire

6.5.1 Where practicable, storage batteries shall be installed outdoors. Where it is not practicable to install storage batteries outdoors, batteries shall only be installed indoors at a location:

a) not precluded by **6.5.5**;

b) with ventilation according to **6.5.4**; and

c) with fire resisting separation where required by **6.5.3**.

***NOTE** Outdoors can be an out building not intended for habitation that is detached or separated by main wall with a minimum fire performance of REI 120 to BS EN 13501.*

6.5.2 Where a battery energy storage system (BESS) is installed on the external wall of the building it shall not compromise the fire performance of the external wall. Service penetrations shall be adequately fire stopped and internal combustible substrates shall not become exposed by the installation. Where wall cavities exist, cavity barriers shall be provided for services passing through the wall.

***NOTE** In certain cases, equipment mounted on an external wall could require planning consent, and/or be notifiable in accordance with local authority building control procedures.*

6.5.3 Any indoor location in which storage batteries or storage battery enclosures are installed shall have fire resisting separation from indoor locations identified in **6.5.5** by walls, ceilings and floors with a fire performance of at least REI 30 to BS EN 13501 series (30 min to BS 476 series for loadbearing capacity, integrity and insulation).

***NOTE 1** As per Building Regulations Approved Documents in England and Wales, and Scottish Building Technical Handbooks, all services passing through the fire resisting enclosure where a storage battery or storage battery enclosure are installed should be adequately fire stopped to maintain the fire resisting separation. See also Regulation 527.2 of BS 7671.*

***NOTE 2** Fire compartmentation requirements might need to be assessed in future editions of this standard, as there are currently gaps in the knowledge of how fire compartmentation resists lithium battery fires.*

6.5.4 All indoor locations which contain storage batteries shall have fresh-air ventilation to outdoors. Ventilation systems for the location shall not compromise the fire resistance of the enclosure. The edges of outdoor port for such ventilation shall be at least 1 m from the edges of:

a) doors;

b) windows; or

c) ventilation ports for other locations.

***NOTE 1** Guidance on and further requirements for ventilation are provided in BS EN IEC 62485 series.*

***NOTE 2** Air tightness requirements for dwellings might preclude batteries being installed in habitable parts off a dwelling.*

6.5.5 Batteries shall not be installed in any of the following locations:

a) rooms in which persons are intended to sleep;

b) routes used as a means of escape that are not defined as protected escape routes, including landings, staircases and corridors;

c) corridors, shafts, stairs or lobbies of protected escape routes;

d) firefighting lobbies, shafts or staircases;

e) storage cupboards, enclosures or spaces opening into rooms in which persons are intended to sleep;

f) outdoors (ground-mounted or wall-mounted in a suitable enclosure) within 1 m of:

   1) escape routes;

   2) doors;

   3) windows; or

   4) ventilation ports.

g) voids, roof spaces or lofts;

h) within 2 m of stored flammable materials and fuel storage tanks or cylinders; and

i) cellars or basements that have no access to the outside of the building.

6.5.6 Where batteries are installed in locations in dwellings that are infrequently visited, such as store cupboards, a smoke detector/alarm or multi-sensor fire detector/fire alarm shall be installed in that location, and shall be interlinked with a fire detection and fire alarm system in the remainder of the dwelling. Fire detection and alarm systems shall conform to BS 5839-6.

***NOTE** 1 Premises whose electrical installation incorporates a BESS should have an appropriate fire detection and fire alarm system of at least Grade D2, Category LD2. In existing premises, this might involve provision of a new system, or upgrade to an existing system, when a BESS is installed.*

***NOTE** 2 A Category LD2 system incorporates smoke detector/alarms or multi-sensor fire detector/fire alarms covering any specified rooms or areas that present a high fire risk to occupants in addition to covering means of escape..*

***NOTE** 3 The designer of the fire alarm system should provide for adequate fire detection coverage to detect smoke and/or heat due to a fire in a battery installed indoors.*

6.5.7 The total stored energy of all units in an individual dwelling house shall not exceed:

a) 80 kWh where batteries are installed in one of the following locations:

   1) detached garage or outbuilding;

   2) outdoors (ground-mounted or wall-mounted); or

   3) attached garage or outbuilding that has a fire separation with a performance of at least REI 60 to BS EN 13501 series (60 min to BS 476 series for loadbearing capacity, integrity and insulation); or

b) 40 kWh in all other cases.

***NOTE** The fire resistance in this requirement is related to the actual stored energy in the installation. The focus of the fire safety principles is to provide an early warning rather than improving the compartmentation.*

6.6 Additional protection against mechanical impact

Storage batteries installed in the locations listed in Table 5 shall have a minimum degree of protection against external mechanical impact of IK10 in accordance with the requirements of BS EN 62262, or be provided with equivalent protection by general local mechanical impact protection.

***NOTE** Examples of general local mechanical impact protection include impact barriers, or enclosures offering equivalent mechanical protection.*

Table 5 – Locations requiring protection against mechanical impact

Outdoor locations (ground-mounted, or wall-mounted at a height not exceeding 5.8 m)	**Indoor locations (floor-mounted or wall-mounted)**
Adjacent to a driveway or other vehicle parking or movement area	Within an attached or detached garage
On walls adjoining public highways	Adjacent to other indoor car parking spaces
***NOTE 1** This table references mechanical impact described in **6.7** and **7.3**.* ***NOTE 2** Installation of battery storage equipment and/or general local impact protection in some of the locations listed in this table might be subject to planning restrictions. This might make the location unsuitable for installation of storage batteries, and another location should be selected.*	

7 Power conversion equipment (PCE)

7.1 Product safety and performance

PCE shall conform to the following standards:

a) Inverters:

   1) BS EN 62109-2.

b) DC-DC converters and battery charging equipment (other than that incorporated into an inverter):

   1) BS EN 62477-1; or

   2) BS EN IEC 61204-7 and BS EN IEC 61204-3.

7.2 Protection against fire

Where PCE is installed in loft spaces, store cupboards or other infrequently visited locations, a smoke detector/alarm or multi-sensor fire detector/fire alarm shall be installed in that location, and interlinked with a fire detection and fire alarm system in the remainder of the dwelling. Fire detection and alarm systems shall conform to BS EN 5839-6.

NOTE 1 *Premises whose electrical installation incorporates a BESS should have an appropriate fire detection and fire alarm system of at least Grade D2, Category LD2. In existing premises, this might involve provision of a new system, or upgrade to an existing system, when a battery EESS is installed.*

NOTE 2 *A Category LD2 system incorporates smoke detector/alarms or multi-sensor fire detector/fire alarms covering any specified rooms or areas that present a high fire risk to occupants in addition to covering means of escape.*

7.3 Additional protection against mechanical impact

PCE installed in the locations listed in Table 5 shall have a minimum degree of protection against external mechanical impact of IK08 in accordance with the requirements of BS EN 62262, or be provided with equivalent protection by general local mechanical impact protection.

NOTE *Examples of general local mechanical impact protection include barriers or enclosures offering equivalent mechanical protection.*

8 System marking, notices and instructions

8.1 Marking of components

All system components shall be marked in accordance with their respective product standard.

8.2 System installation warnings and notices

8.2.1 Warning notices and user instruction notices shall be provided in accordance with BS 7671.

8.2.2 An instruction notice indicating the presence of a battery storage system shall be fixed:

a) at the origin of the electrical installation;

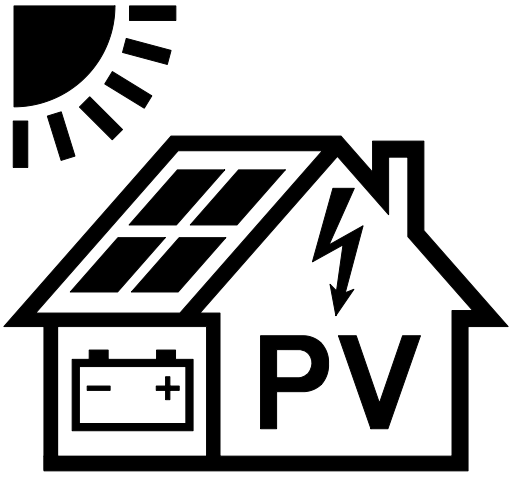
b) at the metering position, if remote from the origin; and

c) at the consumer unit or distribution board to which the AC supply from the inverter is connected.

The instruction notice shall conform to BS EN IEC/IEEE 82079-1, and incorporate one of the symbols shown in Figure 2 and Figure 3.

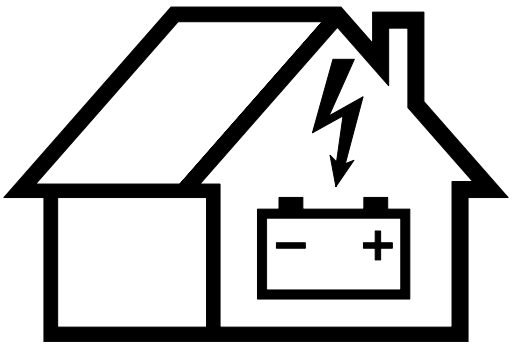
NOTE *Examples of instruction notices are shown in Figure 4.*

Figure 2 – Symbol indicating the presence of both solar PV and BESS in a building



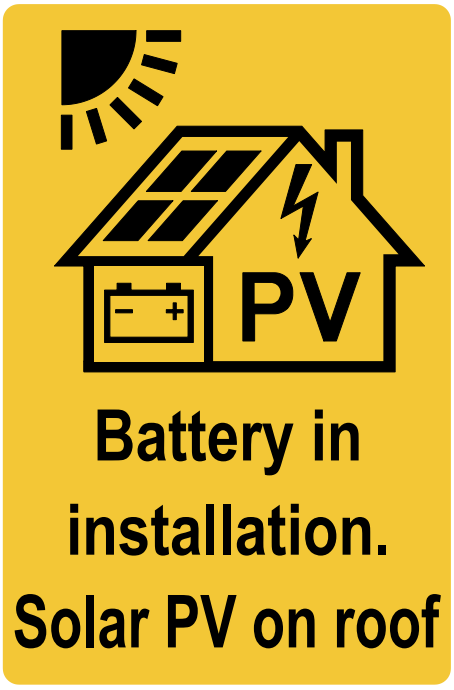
NOTE *Adapted from IEC 60417-6400 and ISO 7000-0242.*

Figure 3 – Symbol indicating the presence of BESS in a building

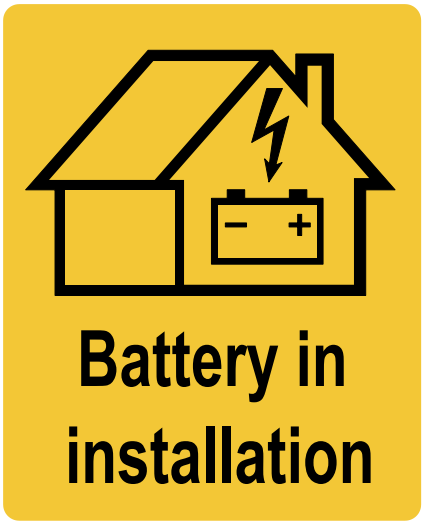


NOTE *Adapted from IEC 60417-6400 and ISO 7000-0242.*

Figure 4 – Examples of instruction notices required by 8.2.2



a) Notice indicating the presence of both solar PV and BESS in a building



b) Notice indicating the presence of BESS in a building.

8.3 User instructions for the system

User instructions shall conform to BS EN IEC/IEEE 82079-1. They shall contain, as a minimum, the information shown in Table 6.

Table 6 – Requirements for system user instructions

Subject	Information to be provided
Operational procedures	Start-up procedures Shutdown procedures Meaning of indications, alarms and fault codes Contact details for help, repair, maintenance and warranty
Emergency procedures	Procedure for safe shutdown by users Procedure for users in case of battery fire
Products	Manufacturer's user instructions
Installation	Initial verification checklist and associated documentation

9 Verification

9.1 Initial verification

The installer of the battery storage system shall provide a statement of conformity against this PAS following initial verification which shall be appended to the certification for initial verification in accordance with BS 7671.

NOTE 1 *An example of a checklist for initial verification against the requirements of this PAS is included in Annex B.*

NOTE 2 *A suggested statement of conformity is provided in Annex C.*

Annex A (informative) Recommended working practices to reduce the risk of fire and explosion

A.1 Electrical work on batteries, and DC circuits supplied by batteries

In order to minimize the risk of arcs and overheating by short-circuit when working on batteries or DC circuits supplied by batteries, appropriate safe working practices should be adopted regardless of the operating voltage. Considerations include:

a) safe isolation procedures, as far as practicable;

b) separation of strings when working in battery enclosures to reduce the risk of arc flash;

c) use of insulated tools;

d) use of suitable fused test leads and fused test equipment; and

e) observing safe working distances from monobloc batteries and cells, and use of personal protective equipment against arc flash, selected for the appropriate arc flash incident energy level.

A.2 Transportation of battery assemblies

Prior to transportation for repair, replacement or recycling, batteries should be discharged in accordance with the manufacturer's instructions.

Where battery assemblies are transported, the battery manufacturer's instructions should be taken into account.

A.3 Transportation of cells and monobloc batteries not part of a battery assembly

Prior to transportation for repair, replacement or recycling, cells and monobloc batteries should be discharged in accordance with the manufacturer's instructions.

Cells or monobloc batteries should be transported in transport packaging selected taking into account the battery manufacturer's instructions.

A.4 Securing batteries in a vehicle during transportation

Battery assemblies, and packaging should be secured in a vehicle in which it is being transported, to reduce the risk of damage due to movement and impact in transit.

NOTE *The battery manufacturer's instructions might provide guidance on securing the battery in transit.*

Annex B (informative)
Example checklist for verification against PAS 63100

The checklist in Table B.1 may be used for initial verification of a battery storage system according to the requirements of PAS 63100.

Table B.1 – PAS 63100 verification checklist

Clause	Subject	Means of verification	Confo-rmant	Non-conformant	Not applicable	Verifier notes
4 Electrical installation						
4.1.1	Battery installed in accordance with BS 7671	Inspection and test in accordance with BS 7671. An Electrical Installation Certificate and associated schedules of circuit details and test results should be provided ***NOTE*** *Details of the extent of the installation, and installation location, should be provided on the Electrical Installation Certificate produced in accordance with the guidance in BS 7671, Appendix 6 and referenced in "Verifier notes"*	☐	☐		*Insert reference(s) of documentation:* ....
4.1.2	Overcurrent protection of parallel strings of batteries	Inspection	☐	☐	☐	
4.2.1	Access to DC connections	Inspection	☐	☐		
4.2.2	Access to DC fuses	Inspection	☐	☐	☐	
5 System controls and integration						
5.1.1	System controls to BS EN IEC 62933-5-2	Inspection or manufacturer conformity statement provided	☐	☐		
5.1.2	System includes a BMMS	Functional test or manufacturer conformity statement provided	☐	☐		

Table B.1 – PAS 63100 verification checklist *(continued)*

Clause	Subject	Means of verification	Confo-rmant	Non-conformant	Not applicable	Verifier notes
5.2	Failure mode indications and warnings	Functional test or manufacturer conformity statement provided	☐	☐		
5.3	Identification of controls, indications and warnings	Inspection or manufacturer conformity statement provided	☐	☐		
5.4	Interfaces with fire detection and alarm and fire suppression systems	Manufacturer conformity statement provided	☐	☐		
6 Storage batteries						
6.1.1	Batteries housed in non-combustible enclosures including overcurrent protection	Inspection	☐	☐		
6.1.2	Enclosure accessible only by key or tool, with top surface being IP4X or IPXX/D	Inspection	☐	☐		
6.1.3	Single enclosures not to exceed 20 kWh of storage	Inspection or manufacturer conformity statement provided	☐	☐		
6.2.1	Battery enclosure assemblies conform to BS EN IEC 62933-5-2 and relevant parts of BS EN IEC 62485 series	Inspection of manufacturer's documentation, or conformity statement provided	☐	☐		
6.2.2	Storage battery systems installed in accordance with BS 7671	*Verified under 4.1.1*				
6.3.1	Arc flash risk assessment	Inspection of manufacturer's documentation, or conformity statement provided	☐	☐		

Table B.1 – PAS 63100 verification checklist *(continued)*

Clause	Subject	Means of verification	Confo-rmant	Non-conformant	Not applicable	Verifier notes
6.3.2	Arc flash incident energy level	Inspection	☐	☐		
6.3.3	Battery location based on arc flash risk assessment	Inspection	☐	☐		
6.4	Battery cell and/or monobloc standard.	Inspection of manufacturer's documentation or conformity statement provided	☐	☐		
6.5.1	Battery located outdoors where practicable	Inspection (If it is not practicable to install batteries in accordance with this requirement, the verifier should provide a reference to the reasons given by the installer)	☐	☐	☐	
6.5.2	Batteries on external wall not to compromise fire performance of external wall	Inspection	☐	☐		
6.5.3	Fire resistance of locations where batteries are installed if they cannot be installed outdoors	Inspection	☐	☐		
6.5.4	Ventilation of battery locations if installed indoors	Inspection (not applicable if installed outdoors)	☐	☐	☐	
6.5.5	Batteries not to be installed in certain locations	Inspection	☐	☐		
6.5.6	Provision of fire detection and fire alarm systems	Inspection (not applicable if batteries are not located in a location visited infrequently)	☐	☐	☐	
6.5.7	Limitation of total stored energy in batteries based on location	Inspection	☐	☐		

Table B.1 – PAS 63100 verification checklist *(continued)*

Clause	Subject	Means of verification	Confo-rmant	Non-conformant	Not applicable	Verifier notes
6.6	Mechanical impact protection	Inspection of manufacturer's documentation or conformity statement (not applicable if batteries are not installed in a location listed in Table 5)	☐	☐	☐	
7 Power conversion equipment (PCE)						
7.1	Product standard for power conversion equipment	Inspection of manufacturer's documentation or conformity statement provided	☐	☐		
7.2	Fire detection and fire alarm for PCE installed in certain locations	Inspection (not applicable if PCE is not located in a location visited infrequently)	☐	☐	☐	
7.3	Mechanical impact requirements for PCE installed in certain locations	Inspection of manufacturer's documentation, or conformity statement provided (not applicable if batteries are not installed in a location listed in Table 5)	☐	☐	☐	
8 System marking, notices and instructions						
8.1	Marking of component products	Inspection of manufacturer's documentation, or conformity statement provided	☐	☐		
8.2.1	Warning and user instruction notices provided in accordance with BS 7671	*Verified under 4.1.1*				
8.2.2	Instruction notice for the presence of a battery storage system	Inspection	☐	☐		

Table B.1 – PAS 63100 verification checklist *(continued)*

Clause	Subject	Means of verification	Confo-rmant	Non-conformant	Not applicable	Verifier notes
8.3	System user instructions	Inspection	☐	☐		

Signed: ..... For and on behalf of: .....

Print name: ....

Date: ....

Annex C (informative)
Suggested statement of conformity

Table C.1 contains a suggested format of a statement of conformity to PAS 63100 (see **9.1**)

Table C.1 – PAS 63100 suggested statement of conformity

Installation address: ....
Description of battery storage system installed: ....

Table C.1 – PAS 63100 suggested statement of conformity *(continued)*

I declare that the above-described battery storage system has been verified against the requirements of PAS 63100 and conforms to the requirements of that standard with the following exceptions: …… …… …… ……	
Signed: …… Print name: …… Date: ……	For and on behalf of …… …… ……

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Further reading

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