BSI Standards Publication

Electric vehicle battery swap system

Part 2: Safety requirements

bsi.

National foreword

This British Standard is the UK implementation of EN IEC 62840-2:2025. It is identical to IEC 62840-2:2025. It supersedes BS EN IEC 62840-2:2019, which will be withdrawn on 31 October 2028.

The UK participation in its preparation was entrusted to Technical Committee PEL/69, Electric vehicles.

A list of organizations represented on this committee can be obtained on request to its committee manager.

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Amendments/corrigenda issued since publication

Date	Text affected

EUROPEAN STANDARD **EN IEC 62840-2**

EUROPÄISCHE NORM

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English Version

Electric vehicle battery swap system - Part 2: Safety requirements (IEC 62840-2:2025)

Système d'échange de batterie de véhicule électrique - Partie 2: Exigences de sécurité (IEC 62840-2:2025)

Batteriewechselsysteme für Elektrofahrzeuge - Teil 2: Sicherheitsanforderungen (IEC 62840-2:2025)

This European Standard was approved by CENELEC on 2025-08-11. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CENELEC member.

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European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

CEN-CENELEC Management Centre: Rue de la Science 23, B-1040 Brussels

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European foreword

The text of document 69/1046/FDIS, future edition 2 of IEC 62840-2, prepared by TC 69 "Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN IEC 62840-2:2025.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2026-10-31
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2028-10-31

This document supersedes EN IEC 62840-2:2019 and all of its amendments and corrigenda (if any).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC shall not be held responsible for identifying any or all such patent rights.

This document is read in conjunction with EN IEC 62840-1:2025.

This document has been prepared under a standardization request addressed to CENELEC by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

Any feedback and questions on this document should be directed to the users' national committee. A complete listing of these bodies can be found on the CENELEC website.

Endorsement notice

The text of the International Standard IEC 62840-2:2025 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standard indicated:

IEC 60050 (series)	NOTE	Approved as EN IEC 60050 (series)
IEC 60364-7-722	NOTE	Approved as HD 60364-7-722
IEC 60947-5-1	NOTE	Approved as EN IEC 60947-5-1
IEC 61000 (series)	NOTE	Approved as EN IEC 61000 (series)
IEC 62196 (series)	NOTE	Approved as EN IEC 62196 (series)
ISO 4413	NOTE	Approved as EN ISO 4413
ISO 4414	NOTE	Approved as EN ISO 4414

(normative)

Normative references to international publications with their corresponding European publications

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

NOTE 1 Where an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cencenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 60038	-	IEC standard voltages	EN 60038	-
IEC 60068-2-1	-	Environmental testing - Part 2-1: Tests - Test A: Cold	EN 60068-2-1	-
IEC 60068-2-78	-	Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state	EN 60068-2-78	-
IEC 60112	-	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN IEC 60112	-
IEC 60127	series	Miniature fuses	EN IEC 60127	series
IEC 60204-1	-	Safety of machinery - Electrical equipment of machines - Part 1: General requirements	EN 60204-1	-
IEC 60269	series	Low-voltage fuses	EN IEC 60269	series
IEC 60364	series	Low-voltage electrical installations	HD 60364	series
IEC 60364-4-41 (mod)	2005	Low-voltage electrical installations - Part 4-41: Protection for safety - Protection against electric shock	HD 60364-4-41	2017
+ A1	2017			
-	-		+ A11	2017
-	-		+ A12	2019
IEC 60364-5-54	-	Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors	HD 60364-5-54	-
IEC 60479	series	Effects of current on human beings and livestock	-	series
IEC 60529	-	Degrees of protection provided by enclosures (IP Code)	EN 60529	-
IEC 60664-1	2020	Insulation coordination for equipment within low-voltage supply systems - Part 1: Principles, requirements and tests	EN IEC 60664-1	2020

IEC 60695-2-11	-	Fire hazard testing - Part 2-11: Glowing/hot-wire based test methods - Glow-wire flammability test method for end products (GWEPT)	EN IEC 60695-2-11	-
IEC 60695-10-2	-	Fire hazard testing - Part 10-2: Abnormal heat - Ball pressure test method	EN 60695-10-2	-
IEC 60755	-	General safety requirements for residual current operated protective devices	-	-
IEC 60898	series	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations	EN 60898	series
IEC 60898-1	-	Electrical accessories - Circuit-breakers for overcurrent protection for household and similar installations - Part 1: Circuit-breakers for a.c. operation	EN 60898-1	-
IEC 60947-2	-	Low-voltage switchgear and controlgear - Part 2: Circuit-breakers	EN IEC 60947-2	-
IEC 60947-3	-	Low-voltage switchgear and controlgear - Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units	EN IEC 60947-3	-
IEC 60947-4-1	-	Low-voltage switchgear and controlgear - Part 4-1: Contactors and motor-starters - Electromechanical contactors and motor-starters	EN IEC 60947-4-1	-
IEC 60947-6-2	-	Low-voltage switchgear and controlgear - Part 6-2: Multiple function equipment - Control and protective switching devices (or equipment) (CPS)	EN IEC 60947-6-2	-
IEC 60990	-	Methods of measurement of touch current and protective conductor current	EN 60990	-
IEC 61000-6-7	-	Electromagnetic compatibility (EMC) - Part 6-7: Generic standards - Immunity requirements for equipment intended to perform functions in a safety-related system (functional safety) in industrial locations	EN 61000-6-7	-
IEC 61008	series	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)	EN 61008	series
IEC 61008-1	-	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) ¿ Part 1: General rules	EN 61008-1	-
IEC 61009	series	Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs)	EN 61009	series
IEC 61009-1	-	Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) - Part 1: General rules	EN 61009-1	-
IEC 61140	-	Protection against electric shock - Common aspects for installation and equipment	EN 61140	-

IEC 61439-1	2020	Low-voltage switchgear and controlgear assemblies - Part 1: General rules	EN IEC 61439-1	2021
IEC 61439-7	2022	Low-voltage switchgear and controlgear assemblies - Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations	EN IEC 61439-7	2023
IEC 61508-1	-	Functional safety of electrical/electronic/programmable electronic safety-related systems - Part 1: General requirements (see Functional Safety and IEC 61508)	EN 61508-1	-
IEC 61511-1	-	Functional safety - Safety instrumented systems for the process industry sector - Part 1: Framework, definitions, system, hardware and application programming requirements	EN 61511-1	-
IEC 61784-3	-	Industrial communication networks - Profiles - Part 3: Functional safety fieldbuses - General rules and profile definitions	EN IEC 61784-3	-
IEC 61810-1	-	Electromechanical elementary relays - Part 1: General and safety requirements	EN 61810-1	-
IEC 61851-1	2017	Electric vehicle conductive charging system - Part 1: General requirements	EN IEC 61851-1	2019
IEC 61851-21-2	-	Electric vehicle conductive charging system - Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply - EMC requirements for off board electric vehicle charging systems	EN IEC 61851-21-2	-
IEC 61851-23	2023	Electric vehicle conductive charging system - Part 23: DC electric vehicle supply equipment	EN IEC 61851-23	—[1]
IEC 62052-11	-	Electricity metering equipment - General requirements, tests and test conditions - Part 11: Metering equipment	EN IEC 62052-11	-
IEC 62262	-	Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)	EN 62262	-
IEC 62368-1	2023	Audio/video, information and communication technology equipment - Part 1: Safety requirements	EN IEC 62368-1	2024
IEC 62423	-	Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses	EN 62423	-
IEC 62477-1	2022	Safety requirements for power electronic converter systems and equipment - Part 1: General	EN IEC 62477-1	2023
IEC 62840-1	2025	Electric vehicle battery swap system - Part 1: General and guidance	EN IEC 62840-1	2025

[1] Under preparation. Stage at the time of publication: FprEN IEC 61851-23:2025.

IEC 63066	—[2]	Low-voltage docking connectors for removable energy storage units	EN IEC 63066	—[3]
ISO 10218-1	2011	Robots and robotic devices - Safety requirements for industrial robots - Part 1: Robots	-	-
ISO 10218-2	2011	Robots and robotic devices - Safety requirements for industrial robots - Part 2: Robot systems and integration	-	-
ISO 13849-1	-	Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design	EN ISO 13849-1	-
ISO 14119	-	Safety of machinery - Interlocking devices associated with guards - Principles for design and selection	EN ISO 14119	-
ISO 19353	2019	Safety of machinery - Fire prevention and fire protection	EN ISO 19353	2019

[2] Under preparation. Stage at the time of publication: IEC CCDV 63066:2024.

[3] Under preparation. Stage at the time of publication: prEN IEC 63066:2024.

Electric vehicle battery swap system - Part 2: Safety requirements

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
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8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 62840-2 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is an International Standard.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) expands the scope to encompass both swappable battery systems (SBS) and handheld swappable battery systems (HBS);
b) introduces stricter interoperability requirements through detailed system interface specifications and defined state transition protocols;
c) enhances data security by defining safety message transmission protocols and integrating telecom network requirements;

capacitor discharge time limits to mitigate electric shock risks;

e) introduces enhanced mechanical safety requirements for automated battery handling systems, with technical alignment to ISO 10218-1 and ISO 10218-2;

f) strengthens overload and short-circuit protection for BSS through standardized testing methods and overcurrent protection specifications;

g) defines upgraded electromagnetic compatibility (EMC) standards to ensure system resilience against external interference, supplemented with EMC-related functional safety measures.

The text of this International Standard is based on the following documents:

Draft	Report on voting
69/1046/FDIS	69/1062/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

This document is to be read in conjunction with IEC 62840-1:2025.

In this document, the following print types are used:

– *test specifications: in italic type;*

The following differing practices of a less permanent nature exist in the countries indicated below:

– 7.5.4: the battery passport defines the necessary data to be transmitted (EU).

– 7.6.1: RCDs of type AC may be used (JP).

– 7.6.1: a device which measures leakage current over a range of frequencies and trips at pre-defined levels of leakage current, based upon the frequency, is required (US).

– 9.4: the size and rating of the protective conductor is determined by national codes and regulations (CA, US, JP).

– 9.5.1: RCDs of type AC may be used (JP).

– 9.5.1: a device which measures leakage current over a range of frequencies and trips at pre-defined levels of leakage current, based upon the frequency, is required (US).

– 12.2.1: national standards or regulations provide the different requirements (JP).

– 12.2.2: national standards or regulations provide the different requirements (JP).

– Clause 13: the methods of protection against overcurrent and overvoltage are in accordance with national codes (US, JP, CA).

– Clause 13: the branch circuit overcurrent protection is based upon 125 % of the equipment rating (US, CA).

– Clause 13: EV charging is considered a continuous load and is limited to 80 % of the branch circuit fuse or circuit breaker rating by national rules (US, CA).

– Clause 13: the equipment earthing path complies with the test requirement in national standard (JP).

– 16.5: the use of specific language(s) is covered by legal requirements (CN).

A list of all parts in the IEC 62840 series, published under the general title *Electric vehicle battery swap system*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn, or
- revised.

The purpose of the battery swap system is to provide energy partly or in total to electric vehicles (EV) through fast replacement of their swappable battery systems (SBS) or handheld-swappable battery systems (HBS). The battery swap system aims to provide energy to electric road vehicles by quickly replacing their swappable battery system or handheld-swappable battery system. This may help alleviate range anxiety and make longer distance travel more convenient.

As there is a possibility to charge the batteries after their removal from the vehicle in various ways, the impact of this process on the critical infrastructure of the electrical grid is minimized.

Battery swap stations mainly include one or more of the following functions:

- swap of EV SBS or HBS;
- storage of EV SBS or HBS;
- charging and cooling of EV SBS or HBS;
- testing, maintenance and safety management of EV SBS or HBS.

This document serves as a generic approach for safety during the lifecycle of battery swap systems and stations for electric vehicles.

This document contains the general safety requirements for battery swap system of SBS/HBS. The specific safety requirements for dedicated system are described in other parts of the IEC 62840 series.

This part of IEC 62840 provides the safety requirements for a battery swap system, for the purposes of swapping swappable battery system (SBS)/handheld-swappable battery system (HBS) of electric vehicles. The battery swap system is intended to be connected to the supply network. The power supply is up to 1 000 V AC or up to 1 500 V DC in accordance with IEC 60038.

This document also applies to battery swap systems supplied from on-site storage systems (e.g. buffer batteries).

Aspects covered in this document:

- safety requirements of the battery swap system and its subsystems;
- security requirements for communication;
- electromagnetic compatibility (EMC);
- marking and instructions;
- protection against electric shock and other hazards.

This document is applicable to battery swap systems for EV equipped with one or more SBS/HBS.

This document is not applicable to

- aspects related to maintenance and service of the battery swap station (BSS),
- trolley buses, rail vehicles and vehicles designed primarily for use off-road, and
- maintenance and service of EVs.

Requirements for bidirectional energy transfer are under consideration.

2 Normative references

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

IEC 60038, *IEC standard voltages*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60127 (all parts), *Miniature fuses*

IEC 60204-1, *Safety of machinery – Electrical equipment of machines – General requirements*

IEC 60269 (all parts), *Low-voltage fuses*

IEC 60364 (all parts), *Low-voltage electrical installations*