

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

**Electric vehicle battery swap system –
Part 3: Particular safety and interoperability requirements for battery swap
systems operating with removable RESS/battery systems**



THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2021 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Central Office
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

**Electric vehicle battery swap system –
Part 3: Particular safety and interoperability requirements for battery swap
systems operating with removable RESS/battery systems**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 43.120

ISBN 978-2-8322-1031-6

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	4
INTRODUCTION.....	6
1 Scope.....	7
2 Normative references	8
3 Terms and definitions	9
4 Abbreviated terms	12
5 General requirements	12
6 Classification.....	13
6.8 Automation level.....	13
7 Requirements for battery swap system	13
7.1 General.....	13
7.2 Battery swap station (BSS)	14
7.2.1 General	14
7.2.2 Lane systems	15
7.2.3 Handling system.....	15
7.2.4 Requirements for storage system	16
7.2.5 Charging system.....	18
7.2.6 Supervisory and control system.....	18
7.3 Supporting systems (optional).....	18
7.4 Removable battery systems	18
7.4.1 General	18
7.4.2 Interoperability requirements	19
7.5 Power supply system (optional).....	19
7.6 Interfaces.....	19
7.7 Zones of accessibility.....	19
8 Communications	20
9 Protection against electric shock	20
10 Specific requirements for accessories.....	20
11 Cable assembly requirements.....	20
12 DRI EV supply equipment constructional requirements and tests	20
12.3 IP degrees.....	20
13 Overload and short-circuit protection	20
14 Emergency switching or disconnect (optional)	20
15 Marking and instructions.....	21
15.1 Installation manual.....	21
Annex A (informative) Use cases	22
A.1 General.....	22
A.2 Use case description.....	22
A.2.1 Convenience store device (attended).....	22
A.2.2 Unattended locking compartment.....	23
A.2.3 Battery exchange box	26
A.2.4 Automatic battery exchange box	28
A.2.5 Automatic vehicle storage system.....	29
Annex B (informative) Examples of BSS wirings for removable battery systems	32
B.1 General.....	32

B.2	Example of a BSS wiring providing independent VCU for each battery system	32
B.3	Example of a BSS wiring providing common VCU for all battery systems	34
Annex C (informative)	Examples of BSS for stackable removable battery systems	35
C.1	General.....	35
C.2	Connection of battery systems connected together	35
Bibliography	38
Figure 1	– Composition of the battery swap system	14
Figure B.1	– Example of a removable battery system wiring (for information).....	32
Figure B.2	– Example of a BSS wiring providing independent VCU for each battery system	33
Figure B.3	– Example of a BSS wiring providing common VCU for all battery systems	34
Figure C.1	– Example of a stackable removable battery system wiring.....	35
Figure C.2	– Example of a BSS for stackable removable battery systems	36
Figure C.3	– Connection of battery systems connected together	37
Table 1	– Sub-systems mandatory for use-cases	14
Table 2	– Interoperability requirements	19
Table A.1	– UC convenience store device (attended)	22
Table A.2	– UC unattended locking compartment DC	24
Table A.3	– UC unattended locking compartment AC	25
Table A.4	– UC battery exchange box	27
Table A.5	– UC automatic battery exchange box	29
Table A.6	– UC automatic vehicle storage system	30

generated by EVS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLE BATTERY SWAP SYSTEM –

Part 3: Particular safety and interoperability requirements for battery swap systems operating with removable RESS/battery systems

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.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 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) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

A PAS is an intermediate specification made available to the public and needing a lower level of consensus than an International Standard to be approved by vote (simple majority).

IEC PAS 62840-3 has been processed by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles industrial trucks.

The text of this PAS is based on the following document:

This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document

Draft PAS	Report on voting
69/749/DPAS	69/772/RVDPAS

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 2 years starting from the publication date. The validity may be extended for a single period up to a maximum of 2 years, at the end of which it shall be published as another type of normative document, or shall be withdrawn.

In this document, the following print types are used:

- requirements: in roman type;
- *test specifications: in italic type*;
- notes: in small roman type.

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.

INTRODUCTION

The IEC 62840 series is published in separate parts according to the following structure:

IEC TS 62840-1: Electric vehicle battery swap system – Part 1: General and guidance

IEC 62840-2: Electric vehicle battery swap system – Part 2: Safety requirements

IEC PAS 62840-3: Electric vehicle battery swap system – Part 3: Particular safety and interoperability requirements for battery swap systems operating with removable RESS/battery systems

This document derives from IEC 61851-3 (all parts) and was established by IEC TC 69 WG10 as a referencing document to IEC TS 61851-3-1.

NOTE In this document, EV supply equipment configuration type F according to IEC TS 61851-3-1 for removable battery systems is named "battery swap station".

After moving of the document to IEC TC 69 WG13, IEC TC 69 decided to publish the document as PAS based on IEC TS 61851-3-3 as an intermediate specification, which responds to particular market needs according to 2.4.8 of ISO/IEC Directives, Part 1:2020, published prior to the development of a full International Standard.

For this reason, this document is to be used in conjunction with IEC 61851-3 (all parts).

By the upcoming revision of IEC 62840 (all parts), this document will be fully integrated into the IEC 62840 series.

ELECTRIC VEHICLE BATTERY SWAP SYSTEM –

Part 3: Particular safety and interoperability requirements for battery swap systems operating with removable RESS/battery systems

1 Scope

This document applies to battery swap systems for removable RESS of electric road vehicle when connected to the supply network, with a rated supply voltage up to 480 V AC or up to 400 V DC, for battery systems with a rated voltage up to 120 V DC.

NOTE 1 In the following countries, the acceptable nominal supply voltage is up to 600 V AC: CA, US.

This document applies to battery swap systems for removable RESS/EV where the removable RESS/EV is stored for the purpose of transfer power between the battery swap station and removable RESS/EV.

Requirements for bidirectional energy transfer DC to AC are under consideration and are not part of this document.

This document applies to:

- battery swap systems supplied from on-site storage systems (for example buffer batteries etc);
- manual, mechanically assisted and automatic systems;
- battery swap systems intended to supply removable battery systems having communication allowing to identify the battery system characteristics;
- battery swap systems intended to be installed at an altitude of up to 2 000 m.

The aspects covered in this document include:

- requirements for power transfer between the battery systems;
- additional requirements for communication;
- the connection to supply network.

Additional requirements may apply to special locations.

This document does not apply to:

- safety requirements for mechanical equipment covered by ISO 10218 (all parts);
- locking compartments systems providing AC socket-outlets for the use of manufacturer specific voltage converter units and manufacturer specific battery systems;
- safety aspects related to maintenance;
- electrical devices and components which are covered by their specific product standards;
- trolley buses, rail vehicles;
- any on-board equipment which is covered by ISO;
- EMC requirements for on-board equipment while connected to the supply, which are covered by IEC 61851-21-1.

Requirements for battery swap systems using protective measures as covered by 410 of IEC 60364-4-41:2005 other than double or reinforced insulation 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 60529:1989, *Degrees of protection provided by enclosures (IP Code)*

IEC 60529:1989/AMD1:1999

IEC 60529:1989/AMD2:2013

IEC TS 61851-3-1:—, *Electric vehicles conductive power supply system – Part 3-1: Particular requirements for EV supply equipment where protection relies on double or reinforced insulation – AC and DC conductive power supply systems*¹

IEC TS 61851-3-2: —, *Electric vehicles conductive power supply system – Part 3-2 Particular requirements for EV supply equipment where protection relies on double or reinforced insulation – Portable and mobile DRI EV supply equipment*²

IEC TS 61851-3-4: —, *Electric vehicles conductive power supply system – Part 3-4 Particular requirements for EV supply equipment where protection relies on double or reinforced insulation – General definitions and requirements for CANopen communication*³

IEC TS 61851-3-5: —, *Electric vehicles conductive power supply system – Part 3-5 Particular requirements for EV supply equipment where protection relies on double or reinforced insulation – Pre-defined communication parameters and general application objects*⁴

IEC TS 61851-3-6: —, *Electric vehicles conductive power supply system – Part 3-6: Particular requirements for EV supply equipment where protection relies on double or reinforced insulation – Voltage converter unit communication*⁵

IEC TS 61851-3-7: —, *Electric vehicles conductive power supply system – Part 3-7: Particular requirements for EV supply equipment where protection relies on double or reinforced insulation – Battery system communication*⁶

IEC TS 62196-4:—, *Plugs, socket-outlets, vehicle connectors and vehicles inlet – Conductive charging of electric vehicles – Part 4: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube accessories for class II or class III applications*⁷

IEC TS 62840-1:2016, *Electric vehicle battery swap system – Part 1: General and guidance*

IEC 62840-2:2016, *Electric vehicle battery swap system – Part 2: Safety requirements*

¹ Under preparation. Stage at the time of publication: IEC ADTS 61851-3-1:2021.

² Under preparation. Stage at the time of publication: IEC ADTS 61851-3-2:2021.

³ Under preparation. Stage at the time of publication: IEC RPUB 61851-3-4:2021.

⁴ Under preparation. Stage at the time of publication: IEC RPUB 61851-3-5:2021.

⁵ Under preparation. Stage at the time of publication: IEC RPUB 61851-3-6:2021.

⁶ Under preparation. Stage at the time of publication: IEC RPUB 61851-3-7:2021.

⁷ Under preparation. Stage at the time of publication: IEC BPUB TS 62196-4:2021.