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Electric vehicle conductive charging system – Part 23: DC electric vehicle supply equipment

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Part 23: DC electric vehicle supply equipment

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 61851-23 has been prepared by IEC technical committee 69: Electric 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 2014. This edition constitutes a technical revision.

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

a) the structure has been rearranged according to IEC 61851-1:2017;
b) electrical safety requirements in Clause 8 and Clause 12 have been revised based on the requirements in IEC 62477-1 and inspired by the hazard based safety approach of IEC 62368-1;

c) test methods for checking conformity to the stated requirements have been mostly added; general provisions for compliance tests have been specified in Clause 102;

d) specific requirements and/or information for the following functions have been added: energy transfer with thermal management system (101.2), bi-directional power transfer control (Annex DD), multi- side B separated EV supply equipment (Annex FF), and communication and energy transfer process (Annex GG);

e) Annex AA (system A), Annex BB (system B) and Annex CC (system C) have been updated including additions in conjunction with b) and c). This document has been limited to be applicable to system A, system B and system C;

f) the former Annex DD and Annex EE have been deleted. A new Annex EE, with the requirements for the artificial test load, has been added.

g) a new informative annex for the touch current and the touch impulse current (Annex HH) has been added.

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

Draft	Report on voting
69/907/FDIS	69/925/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 61851-1:2017.

The clauses of particular requirements in this document supplement or modify the corresponding clauses in IEC 61851-1:2017. Where the text of subsequent clauses indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of IEC 61851-1:2017, these changes are made to the relevant text of IEC 61851-1:2017, which then becomes part of this document. Where no change is necessary, the words "This clause of IEC 61851-1:2017 is applicable" are used. The new clauses which are not included in IEC 61851-1:2017 have a clause number starting from 101, for example 3.101, 101.1, etc. The annexes of this document are numbered using double-alphabet, for example Annex AA, to avoid confusion with the annexes in IEC 61851-1:2017.

In this document, the following print types are used:

– *test specifications: italic type*.

– notes: smaller roman type.

Figures in this document use L1 and N to represent the connection of the side A of the EV supply equipment to the AC supply network or DC supply network. This is only to simplify the figures and not to impose requirements.

A list of all parts in the IEC 61851 series, published under the general title *Electric vehicle conductive charging 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.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 23: DC electric vehicle supply equipment

1 Scope

This part of IEC 61851 applies to the EV supply equipment to provide energy transfer between the supply network and electric vehicles (EVs), with a rated maximum voltage at side A of up to 1 000 V AC or up to 1 500 V DC and a rated maximum voltage at side B up to 1 500 V DC.

This document specifies the EV supply equipment of system A, system B and system C as defined in Annex AA, Annex BB and Annex CC. Other systems are under consideration.

This document provides the requirements for bidirectional power transfer (BPT) EV supply equipment for system A, with a rated maximum voltage at side A up to 1 000 V AC or 1 500 V DC. The requirements for reverse power transfer (RPT) and BPT for system B and system C are under consideration and are not specified in this document.

Annex DD provides information about BPT.

This document does not cover all safety aspects related to maintenance.

Requirements for systems not providing simple separation or protective separation between side A and side B are under consideration.

The requirements for digital communication between EV supply equipment and the EV to control energy transfer are defined in IEC 61851-24.

Requirements for energy transfer with an automated connection device are given in IEC 61851-23-1[1].

Specific requirements for EV supply equipment with multiple vehicle connectors are provided in Annex FF.

General information about energy transfer control, signalling and digital communication is provided in Annex GG.

General information on the touch current and touch impulse current is provided in Annex HH.

Requirements for EV supply equipment without current, voltage and/or power control are under consideration.

EV supply equipment in compliance with this document are not intended to provide energy transfer to a single EV with

– multiple vehicle connectors of the same EV supply equipment, or
– multiple EV supply equipment.

Requirements for such use case are under consideration.

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[1] Under preparation. Stage at the time of publication: IEC AFDIS 61851-23-1:2023.

NOTE Requirements for EVs mated to an EV supply equipment are specified in ISO 17409:2020. ISO 17409 will be revised to the ISO 5474 series[2].

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 60038:2009, *IEC standard voltages*

IEC 60068-2-75:2014, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

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

IEC 60227-1:2007, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60245-1:2003, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*
IEC 60245-1:2003/AMD1:2007

IEC 60320-1, *Appliance couplers for household and similar general purposes – Part 1: General requirements*

IEC 60364-4-43:2008, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-5-53:2019, *Low-voltage electrical installations – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring*

IEC 60364-5-54:2011, *Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors*
IEC 60364-5-54:2011/AMD1:2021

IEC 60384-14, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60479-1:2018, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC 60479-2:2019, *Effects of current on human beings and livestock – Part 2: Special aspects*

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

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

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2 Under preparation.

IEC 60812:2018, *Failure modes and effects analysis (FMEA and FMECA)*

IEC 60990:2016, *Methods of measurement of touch current and protective conductor current*

IEC 61008-1:2010, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*
IEC 61008-1:2010/AMD1:2012
IEC 61008-1:2010/AMD2:2013

IEC 61009-1:2009, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*
IEC 61009-1:2009/AMD1:2012
IEC 61009-1:2009/AMD2:2013

IEC 60947-2:2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*
IEC 60947-2:2016/AMD1:2019

IEC 61140:2016, *Protection against electric shock – Common aspects for installation and equipment*

IEC 61439-1:2020, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

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*

IEC 61540:1997, *Electrical accessories – Portable residual current devices without integral overcurrent protection for household and similar use (PRCDs)*
IEC 61540:1997/AMD1:1998

IEC 61557-8:2014, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems*

IEC 61558-1:2017, *Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests*

IEC 61558-2-4:2021, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers for general applications*

IEC 61643 (all parts), *Low-voltage surge protective devices*

IEC 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*

IEC 61643-21, *Low voltage surge protective devices – Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods*

IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61851-21-2:2018, *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*

IEC 61851-24:2023, *Electric vehicle conductive charging system – Part 24: Digital communication between a DC EV charging station and an electric vehicle for control of DC charging*

IEC 62196-1:2022, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements*

IEC 62196-3:2022, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3: Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers*

IEC TS 62196-3-1:2020, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3-1: Vehicle connector, vehicle inlet and cable assembly for DC charging intended to be used with a thermal management system*

IEC 62368-1:2023, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 62423:2009, *Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses*

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

IEC 62477-1:2022*, Safety requirements for power electronic converter systems and equipment – Part 1: General*

IEC 62893-4-1:2020, *Charging cables for electric vehicles of rated voltages up to and including 0,6/1 kV – Part 4-1: Cables for DC charging according to mode 4 of IEC 61851-1 – DC charging without use of a thermal management system*

IEC Guide 115, *Application of measurement uncertainty to conformity assessment activities in the electrotechnical sector*

ISO 2719:2016, *Determination of flash point – Pensky-Martens closed cup method*

ISO 6469-3:2018 [3], *Electrically propelled road vehicles – Safety specifications – Part 3: Electrical safety*

ISO 7000, *Graphical symbols for use on equipment*, available at http://www.graphical-symbols.info/equipment

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*, available at https://www.iso.org/obp

ISO 15118-2:2014, *Road vehicles – Vehicle-to-grid communication interface – Part 2: Network and application protocol requirements*

ISO 15118-3, *Road vehicles – Vehicle to grid communication interface – Part 3: Physical and data link layer requirements*

ISO 17409:2020, *Electrically propelled road vehicles – Conductive power transfer – Safety requirements*

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3 This publication has been withdrawn. A new edition of ISO 6469-3 (4th edition) came out in 2021.

DIN SPEC 70121:2014, *Electromobility – Digital communication between a DC EV charging station and an electric vehicle for control of DC charging in the combined charging system*

OECD 301 B, *OECD Guideline for testing of chemicals*