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Electrically propelled road vehicles — Conductive power transfer — Safety requirements

Véhicules routiers à propulsion électrique — Transfert d'énergie conductive — Exigences de sécurité

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared jointly by Technical Committee ISO/TC 22, *Road vehicles,* Subcommittee SC 37, *Electrically propelled road vehicles*, and Technical Committee IEC/ TC 69, *Electric road vehicles and electric industrial trucks*.

This second edition replaces the first edition (ISO 17409:2015), which has been technically revised. The main changes compared to the previous edition are as follows:

— terms and definitions have been updated,

— requirements for mode 1 have been removed because it is no longer relevant for new designs,

— requirements for reverse power transfer have been added,

— requirements for a DC connection with a thermal management system have been added,

— short circuit during DC charging has been reworked, and

— requirements for charging with pantograph have been added.

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Electrically propelled road vehicles — Conductive power transfer — Safety requirements

1 Scope

This document specifies electric safety requirements for conductive connection of electrically propelled road vehicles to external electric circuits. External electric circuits include external electric power supplies and external electric loads. This document provides requirements for the charging modes 2, 3, 4, as defined in IEC 61851-1, and reverse power transfer. For mode 4, this document provides requirements regarding the connection to an isolated DC EV charging station according to IEC 61851-23.

NOTE 1 This edition does not provide requirements for mode 1.

NOTE 2 External electric circuits are not part of the vehicle.

This document applies to the on-board sections of vehicle power supply circuits. It applies also to dedicated power supply control functions used for the connection of the vehicle to an external electric circuit.

It does not provide comprehensive safety information for manufacturing, maintenance and repair personnel.

NOTE 3 ISO 6469-3 provides general electrical safety requirements for electrically propelled road vehicles.

NOTE 4 With this edition of this document the limitation of y-capacitance for protection against electric shock under single failure conditions is no longer applicable as a fault protection provision when the vehicle has a conductive DC connection to an external electric circuit.

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.

ISO 6469-3, *Electrically propelled road vehicles — Safety specifications — Part 3: Electrical safety*

ISO 15118 (all parts), *Road vehicles — Vehicle to grid communication interface*

ISO 20653, *Road vehicles — Degrees of protection (IP code) — Protection of electrical equipment against foreign objects, water and access*

ISO 26262 (all parts), *Road vehicles — Functional safety*

IEC 60038, *IEC standard voltages*

IEC 60364-4-41:2005, *Low-voltage electrical installations — Part 4-41: Protection for safety — Protection against electric shock*

IEC 60364-4-43:2008, *Electrical installations of buildings — Part 4-43: Protection for safety — Protection against overcurrent*

IEC 60364-5-54, *Low-voltage electrical installations — Part 5-54: Selection and erection of electrical equipment — Earthing arrangements and protective conductors*

IEC 60364-6, *Low-voltage electrical installations — Part 6: Verification*

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

IEC 61000-3-3, *Electromagnetic compatibility (EMC) — Part 3-3: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤16 A per phase and not subject to conditional connection*

IEC 61000-3-11, *Electromagnetic compatibility (EMC) — Part 3-11: Limits — Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems — Equipment with rated current ≤ 75 A and subject to conditional connection*

IEC 61032, *Protection of persons and equipment by enclosures — Probes for verification*

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

IEC 61851-23:—, *Electric vehicle conductive charging system — Part 23: DC electric vehicle charging station*

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

IEC 62196-2, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles — Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories*

IEC 62196-3:2015, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — conductive charging of electric vehicles — Part 3: Dimensional compatibility and interchangeability requirements for dedicated d.c. and combined a.c./d.c. pin and contact-tube vehicle couplers*

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

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
active factor
cos φ
for a two-terminal element or a two-terminal circuit under sinusoidal conditions, ratio of the active power to the apparent power

[SOURCE: IEC 60050-131:2001, 131-11-49, modified — The symbol “cos φ” was added and the note deleted.]

3.2
automated connection device
ACD
active device where the physical connection between *EV supply equipment* (3.25) and vehicle is made and broken without user interaction providing an electromechanical interface

[SOURCE: IEC 61851-23-1:—[1)], 3.1.203, modified — The phrase “and broken” was added.]

1) Under preparation. Stage at the time of publication: IEC/ACDV 61851-23-1:2020.

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3.3
ACD counterpart
passive device which is used in combination with an *ACD* (3.2) to make and break the physical connection between *EV supply equipment* (3.25) and vehicle providing an electromechanical interface without user interaction

[SOURCE: IEC 61851-23-1:—[1)], 3.1.204, modified — The phrase “and break” was added.]

3.4
automatic coupler
system comprising an *ACD* (3.2) and *ACD counterpart* (3.3)

[SOURCE: IEC 61851-23-1:—[1)], 3.1.205, modified — The word “of” was deleted.]

3.5
basic insulation
insulation of *hazardous live parts* (3.30) which provides basic protection

Note 1 to entry: This concept does not apply to insulation used exclusively for functional purposes.

[SOURCE: ISO 6469-3:2018, 3.3, modified — Note 2 to entry removed.]

3.6
case A
connection of an *EV* (3.19) to the *supply network* (3.53) with a *plug* (3.43) and cable permanently attached to the EV

Note 1 to entry: The cable assembly is part of the vehicle.

[SOURCE: IEC 61851-1:2017, 3.1.10]

3.7
case B
connection of an *EV* (3.19) to the *supply network* (3.53) with a cable assembly detachable at both ends

Note 1 to entry: The cable assembly is not part of the vehicle or the *EV charging station* (3.23).

[SOURCE: IEC 61851-1:2017, 3.1.11]

3.8
case C
connection of an *EV* (3.19) to the *supply network* (3.53) utilizing a cable and *vehicle connector* (3.58) permanently attached to the *EV charging station* (3.23).

Note 1 to entry: The cable assembly is part of the EV charging station.

[SOURCE: IEC 61851-1:2017, 3.1.12]

3.9
case D
connection of an *EV* (3.19) to a *supply network* (3.53) utilizing an *automatic coupler* (3.4) which has an *ACD* (3.2) on the *EV supply equipment* (3.25)

[SOURCE: IEC 61851-23-1:—[1)], 3.1.201]

3.10
case E
connection of an *EV* (3.19) to a *supply network* (3.53) utilizing an *automatic coupler* (3.4) which has an *ACD* (3.2) on the EV

[SOURCE: IEC 61851-23-1:—[1)], 3.1.202]

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