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Electrically propelled road vehicles — Magnetic field wireless power transfer — Safety and interoperability requirements

Véhicules routiers électriques — Transmission d'énergie sans fil par champ magnétique — Exigences de sécurité et d'interopérabilité

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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 by Technical Committee ISO/TC 22, *Road vehicles*, SC 37, *Electrically propelled vehicles*.

This first edition cancels and replaces ISO/PAS 19363:2017, which has been technically revised. The main changes compared to the previous edition are as follows:

— MF-WPT classes and z- classes eliminated;

— compatibility classes introduced;

— reference devices changed to off-board devices and description updated;

— communication and functional requirements deleted.

Any feedback or questions on this document should be directed to the user’s national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

This document prescribes the usage of the wireless power transfer technology to charge electrically propelled road vehicles and has been developed based on ISO/PAS 19363.

Status of technological development:

This document specifies requirements for on-board components of a wireless power transfer systems. It gives guidance in terms of safety and performance and additionally addresses interoperability to off-board components from different manufacturers to, for example support the development of public wireless charging infrastructure. Even if the technology itself is well known, the implementation in a vehicle is new and demands to meet the very specific requirements of the automotive industry. This document is based on limited experience with series development and production. Current and future product developments will continuously prove (and disprove) the applicability of this document to further improve the contents, especially regarding the interoperability between systems from different manufacturers.

Cooperation during document development:

This document has been developed in intense cooperation with IEC/TC 69 WG7, which is establishing the IEC 61980 series. The IEC 61980 series covers the requirements for the off-board components in correspondence to the application of on-board components according to this document. Furthermore, SAE J2954 is standardising wireless power transfer systems in the United States of America. An exchange between the groups was continuously sustained during the document development. Even though there is no complete harmonization at this stage, several contents are comparable.

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Electrically propelled road vehicles — Magnetic field wireless power transfer — Safety and interoperability requirements

1 Scope

This document defines the requirements and operation of the on-board vehicle equipment that enables magnetic field wireless power transfer (MF-WPT) for traction battery charging of electric vehicles. It is intended to be used for passenger cars and light duty vehicles.

This document addresses the following aspects for an EV device:

— safety requirements;

— transferred power and power transfer efficiency;

— ground clearance of the EV device;

— functionality with associated off-board systems under various conditions and independent of manufacturer;

— test procedures.

EV devices that fulfil the requirements in this document are intended to operate with supply devices that fulfil the MF-WPT related requirements in the IEC 61980 series.

NOTE 1 Charging of a vehicle in motion is not considered in this edition.

NOTE 2 Bi-directional power transfer is not considered in this edition.

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 6469-3:2018, *Electrically propelled road vehicles — Safety specifications — Part 3: Electrical safety*

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

IEC 61980-2, *Electric vehicle wireless power transfer (WPT) Systems — Part 2: specific requirements for communication between electric road vehicle (EV) and infrastructure with respect to wireless power transfer (WPT) systems*

IEC 61980-3, *Electric vehicle wireless power transfer (WPT) systems — Part 3: Specific requirements for the magnetic field power transfer systems*

ICNIRP 2010, *Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz – 100 kHz)*

CISPR 11, *Industrial, scientific and medical equipment — Radio-frequency disturbance characteristics — Limits and methods of measurement*

IEC 60664 (all parts), *Insulation coordination for equipment within low-voltage systems*

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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
alignment
relative position in x- and y-direction of the *secondary device* (3.15) to the *primary device* (3.9) for a given *secondary device ground clearance* (3.16)

Note 1 to entry: The coordinate system conforms with ISO 4130.

3.2
alignment tolerance area
intended *WPT* (3.22) operating area in x- and y-direction for a given *secondary device ground clearance* (3.16)

3.3
centre alignment point
geometrical centre of the *alignment tolerance area* (3.2)

Note 1 to entry: The position of the centre alignment point of an *MF-WPT system* (3.8) depends on the specific centre alignment points of the *primary device* (3.9) and *secondary device* (3.15).

3.4
electrically propelled vehicle
EV
vehicle with one or more electric drive(s) for vehicle propulsion

[SOURCE: ISO 6469-3:2018, 3.15, modified — The abbreviation "EV" has been added.]

3.5
EV device
on-board component assembly of *WPT system* (3.23)

Note 1 to entry: See Figure 1.

3.6
EV power circuit
EVPC
on-board component assembly, comprising the *secondary device* (3.15) and *EV power electronics* (3.7), as well as the electrical and mechanical connections

Note 1 to entry: See Figure 1.

3.7
EV power electronics
on-board component that converts the power and frequency from the *secondary device* (3.15) to the DC power output of the *EVPC* (3.6)

Note 1 to entry: See Figure 1.

3.8
magnetic field WPT system
MF-WPT system
WPT system (3.23) using magnetic field

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3.9
primary device
off-board component that generates and shapes the magnetic field for *WPT* (3.22)

Note 1 to entry: See Figure 1.

3.10
protection area
volume in and around the vehicle that has uniform requirements with regard to effects of exposure to electromagnetic fields

3.11
rated output power
maximum power the *EVPC* (3.6) is designed to deliver consistently during a charging cycle

3.12
rechargeable energy storage system
RESS
rechargeable system that stores energy for delivery of electric energy for the electric drive

EXAMPLE Battery, capacitor, flywheel.

[SOURCE: ISO 6469-1:2019, 3.22]

3.13
reference EVPC
EVPC (3.6) that serves for testing purposes

3.14
reference supply power circuit
supply power circuit (3.19) that serves for testing purposes

3.15
secondary device
on-board component that captures the magnetic field

Note 1 to entry: See Figure 1.

3.16
secondary device ground clearance
vertical distance between the ground surface and the lowest point of the *secondary device* (3.15) including the housing

Note 1 to entry: Note to entry: The lower surface does not need to be planar or parallel to the ground surface

3.17
steady state
state of a system at which all state and output variables remain constant in time while all input variables are constant

[SOURCE: IEC 60050-351:2006, 351-24-09]

3.18
supply device
off-board component assembly of *WPT system* (3.23)

Note 1 to entry: See Figure 1.

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3.19
supply power circuit
off-board component assembly, comprising the *primary device* (3.9) and *supply power electronics* (3.20), as well as the electrical and mechanical connections

Note 1 to entry: See Figure 1.

3.20
supply power electronics
off-board component that converts the power and frequency from the supply network to the power and frequency needed by the *primary device* (3.9)

Note 1 to entry: See Figure 1.

3.21
voltage class B
classification of an electric component or circuit with a maximum working voltage of (>30 and ≤1 000) V AC (rms) or (>60 and ≤1 500) V DC, respectively

3.22
wireless power transfer
WPT
transfer of electrical energy from a power source to an electrical load without galvanic connection

3.23
WPT system
system comprising all necessary components for *WPT* (3.22) and control

4 System structure

To establish a general baseline for the requirements defined in this document, in IEC 61980-2 and in IEC 61980-3, the MF-WPT system is structured into functional entities. Figure 1 shows this structure of functional entities in an exemplary architecture.

NOTE Figure 1 is not meant to give an indication on hardware packaging.

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