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INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Electric vehicle wireless power transfer (WPT) systems – Part 3: Specific requirements for magnetic field wireless power transfer systems

Systèmes de transfert de puissance sans fil (WPT) pour véhicules électriques – Partie 3: Exigences spécifiques pour les systèmes de transfert de puissance sans fil par champ magnétique



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INTERNATIONAL STANDARD

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Electric vehicle wireless power transfer (WPT) systems – Part 3: Specific requirements for magnetic field wireless power transfer systems

Systèmes de transfert de puissance sans fil (WPT) pour véhicules électriques – Partie 3: Exigences spécifiques pour les systèmes de transfert de puissance sans fil par champ magnétique

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ELECTRIC VEHICLE WIRELESS POWER TRANSFER (WPT) SYSTEMS –

Part 3: Specific requirements for magnetic field wireless power transfer systems

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

Draft	Report on voting
69/857/FDIS	69/866/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/standardsdev/publications.

In this document, the following print types are used:

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The clauses of the particular requirements in this document supplement or modify the corresponding clauses in IEC 61980-1:2020. Where the text indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of IEC 61980-1:2020, these changes are made to the relevant text of IEC 61980-1:2020, which then becomes part of the standard. Where no change is necessary, the words "Clause/Subclause xx of IEC 61980-1:2020 is applicable" are used. Additional items to those of IEC 61980-1:2020 are numbered starting 101. Annexes are lettered from A onwards.

A list of all parts of the IEC 61980 series, published under the general title *Electric vehicle wireless power transfer (WPT) systems*, can be found on the IEC website.

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INTRODUCTION

The IEC 61980 series is published in separate parts according to the following structure:

– IEC 61980-1 covers general requirements for electric road vehicle (EV) wireless power transfer (WPT) systems including general background and definitions (e.g. efficiency, electrical safety, EMC, EMF);

– IEC 61980-2[1] specifically applies to magnetic field wireless power transfer (MF-WPT) for electric road vehicles (EV) and covers specific requirements for system activities and communication between the electric road vehicle side and the off-board side, including general background and definitions;

– IEC 61980-3 covers specific power transfer requirements for the off-board side of magnetic field wireless power transfer systems for electric road vehicles (e.g. efficiency, electrical safety, EMC, EMF).

Requirements for the on-board side of MF-WPT for electric road vehicles are covered in ISO 19363.

IEC 61980-3 follows the structure of IEC 61980-1:2020.

[1] Under preparation. Stage at the time of publication: IEC/AFDIS 61980-2:2022.

ELECTRIC VEHICLE WIRELESS POWER TRANSFER (WPT) SYSTEMS –

Part 3: Specific requirements for magnetic field wireless power transfer systems

1 Scope

This part of IEC 61980 applies to the off-board supply equipment for wireless power transfer via magnetic field (MF-WPT) to electric road vehicles for purposes of supplying electric energy to the RESS (rechargeable energy storage system) and/or other on-board electrical systems. The MF-WPT system operates at standard supply voltage ratings per IEC 60038 up to 1 000 V AC and up to 1 500 V DC from the supply network. The power transfer takes place while the electric vehicle (EV) is stationary.

Off-board supply equipment fulfilling the requirements in this document are intended to operate with EV devices fulfilling the requirements described in ISO 19363.

The aspects covered in this document include

– the characteristics and operating conditions,
– the required level of electrical safety,
– requirements for basic communication for safety and process matters if required by a MF-WPT system,
– requirements for positioning to assure efficient and safe MF-WPT power transfer, and
– specific EMC requirements for MF-WPT systems.

The following aspects are under consideration for future documents:

– requirements for MF-WPT systems for two- and three-wheel vehicles,
– requirements for MF-WPT systems supplying power to EVs in motion,
– requirements for bidirectional power transfer,
– requirements for flush mounted primary device,
– requirements for MF-WPT systems for heavy duty vehicle, and
– requirements for MF-WPT systems with inputs greater than 11,1 kVA.

This document does not apply to

– safety aspects related to maintenance, and
– trolley buses, rail vehicles and vehicles designed primarily for use off-road.

NOTE The terms used in this document are specifically for MF-WPT.

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

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

IEC 61439-7:2018, *Low-voltage switchgear and controlgear assemblies – Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations*

IEC 61980-1:2020, *Electric vehicle wireless power transfer (WPT) systems – Part 1: General requirements*

IEC 61980-2:—, *Electric vehicle wireless power transfer (WPT) systems – Part 2: Specific requirements for MF-WPT system communication and activities*[2]

ISO 19363:2020, *Electrically propelled road vehicles – Magnetic field wireless power transfer – Safety and interoperability requirements*

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

ICNIRP, *ICNIRP guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz – 100 kHz)*, Health Physics 99(6):818-836; 2010

Recommendation ITU-R SM.2110-1:2019, *Guidance on frequency ranges for operation of non-beam wireless power transmission for electric vehicles*

3 Terms and definitions

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

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

Clause 3 of IEC 61980-1:2020 is applicable.

Additional terms and definitions:

3.101
accessible part
part of equipment that can be touched without the use of a tool, excluding parts when under the vehicle

3.102
alignment
relative position in X- and Y- direction of the secondary device to the primary device for a given secondary device ground clearance

3.103
alignment tolerance area
intended WPT operating area in X- and Y- direction for a given secondary device ground clearance

———————

[2] Under preparation. Stage at the time of publication: IEC/AFDIS 61980-2:2022.

3.104
centre alignment point
spatial X, Y centre of the alignment tolerance area

Note 1 to entry: The centre alignment point is not a fixed point for any single coil. It only has relevance for a primary and secondary device combination and is specific for that combination.

3.105
charge session
period when the SECC is in the WPT_S_PTA or WPT_S_PT state as defined in IEC 61980-2

3.106
compatibility class A supply device
supply device that interoperates with compatibility class A EV devices

Note 1 to entry: See ISO 19363:2020, Clause 6.

Note 2 to entry: A compatibility class A supply device is interoperable with all normative reference EVPCs – see Annex A.

3.107
compatibility class B supply device
supply device that operates with at least one compatibility class B EV device and might interoperate with one or more compatibility class A EV devices

Note 1 to entry: See ISO 19363:2020, Clause 6.

Note 2 to entry: Interoperability with any of the normative reference EVPCs is optional.

3.108
connecting cable
cable which connects a physical unit containing portions of the SPC to another physical unit containing portions of the SPC

Note 1 to entry: Cables within a physical unit are not connecting cables.

3.109
DUT
device under test

3.110
electric vehicle communication controller
EVCC
embedded system within the vehicle that implements the communication between the vehicle and the SECC in order to support specific functions

Note 1 to entry: Such specific functions could be controlling input and output channels, encryption or data transfer between the vehicle and the SECC.

[SOURCE: ISO 15118-1:2019, 3.1.31]

3.111
EV power circuit
EVPC
on-board component assembly comprising the secondary device and EV power electronics as well as the mechanical connections

SEE: Figure 1.

3.112
EV power electronics
on-board component that converts the power and frequency from the secondary device to the DC output of the EVPC

EXAMPLE Impedance matching network (IMN), filter, rectifier, impedance converter

3.113
flush mounted
mounting of a primary device in such a manner that the top covering of the primary device is flush with the pavement

3.114
foreign object
object that is not an attached part of the vehicle or the WPT system

3.115
fundamental mutual inductance
mutual inductance of two specific coils at a specific physical position relative to each other

3.116
gauge device
test device to characterize magnetic fields associated with a coil

3.117
geometric centre
spatial X, Y centre of the primary coil or the secondary coil

3.118
MF-WPT power class
power class of a supply device of MF-WPT systems defined from the perspective of the maximum power drawn from the supply network in order to drive the supply device

3.119
magnetic field WPT
MF-WPT
transfer of electrical energy from a power source to an electrical load via a magnetic field without galvanic connection

3.120
magnetic resonance
magnetic field wireless power transfer (MF-WPT) that utilizes one or more high quality factor coils and one or more impedance matching networks or compensation networks operating at or near resonance

3.121
operating frequency
frequency used to transmit energy between the supply device and the EV device within the system frequency range

3.122
power transfer efficiency
ratio of the output power of the EVPC divided by the input power of the SPC

3.123
primary coil
component of the primary device comprising one or more electrical windings and magnetic materials that generate a magnetic field for MF-WPT

3.124
primary device
off-board component comprising the primary coil and its compensation network to generate and shape the magnetic field for MF-WPT

Note 1 to entry: Includes housings, covers and cabling.

3.125
reference EVPC
EVPC that serves for conformance testing purposes

3.126
reference SPC
SPC that serves for conformance testing purposes

3.127
remaining package
assembly package or packages which contain all of the components of the supply power circuit that are not contained in the under-vehicle package

3.128
secondary coil
component of the secondary device comprising one or more electrical windings and magnetic materials that capture a magnetic field for MF-WPT

3.129
secondary device
on-board component comprising the secondary coil and its compensating network to capture the magnetic field

Note 1 to entry: Includes housings, covers and cabling.

3.130
secondary device ground clearance
vertical distance between the ground surface and the lowest point of the secondary device, including the housing

Note 1 to entry: The lower surface may not be planar and may not be parallel to the ground surface.

3.131
supply equipment communication controller
SECC
off-board component that implements the communication with the EVCC(s)

Note 1 to entry: Functions of a supply equipment communication controller may control input and output channels, data encryption or data transfer between the vehicle and the SECC.

Note 2 to entry: One SECC can control multiple supply devices for certain configurations.

3.132
supply power circuit
SPC
off-board component assembly comprising the primary device and supply power electronics, as well as the electrical and mechanical connections

SEE Figure 1.

3.133
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

3.134
surface mounted
mounting of a primary device in such a manner that it protrudes above ground up to certain mounting height

3.135
system frequency range
frequency range over which the system is designed to transfer power

3.136
under-vehicle package
assembly package containing all of the components of the SPC which is intended to be located under the vehicle when it is in position to be charged

3.137
X
direction of travel of the vehicle per ISO 4130

3.138
Y
direction perpendicular to the direction of travel per ISO 4130

4 Abbreviated terms

Clause 4 of IEC 61980-1:2020 is applicable.

5 General

Clause 5 of IEC 61980-1:2020 is applicable.

6 Classification

Clause 6 of IEC 61980-1:2020 is applicable except as follows:

Addition:

6.101 Compatibility classes

The supply device is classified according to the compatibility class:

– compatibility class A supply device;
– compatibility class B supply device.

6.102 Transfer power classes

SPCs which are part of compatibility class A supply devices are classified according to MF-WPT classes as described in Table 101.

The manufacturer shall specify the rated input power of the supply power circuit.