

INTERNATIONAL STANDARD



**Electric vehicle wireless power transfer (WPT) systems –
Part 1: General requirements**

(<https://standards.iteh.ai>)
Document Preview

IEC 61980-1:2015

<https://standards.iteh.ai/catalog/standards/iec/65569568-1a67-48ad-872d-ff5b26288e0f/iec-61980-1-2015>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2015 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
Fax: +41 22 919 03 00
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 corrigenda or an amendment might have been published.

IEC Catalogue - webstore.iec.ch/catalogue

The stand-alone application for consulting the entire bibliographical information on IEC International Standards, Technical Specifications, Technical Reports and other documents. Available for PC, Mac OS, Android Tablets and iPad.

IEC publications search - www.iec.ch/searchpub

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 It also gives information on projects, replaced and withdrawn publications.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 also once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary of electronic and electrical terms containing more than 30 000 terms and definitions in English and French, with equivalent terms in 15 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

More than 60 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

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: csc@iec.ch.

INTERNATIONAL STANDARD



**Electric vehicle wireless power transfer (WPT) systems –
Part 1: General requirements**

Document Preview
(<https://standards.iteh.ai>)

IEC 61980-1:2015

<https://standards.iteh.ai> / <https://standards.iteh.ai/standards/iec/65569568-1a67-48ad-872d-ff5b26288e0f/iec-61980-1-2015>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 43.120

ISBN 978-2-8322-2814-2

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

CONTENTS

FOREWORD.....	7
INTRODUCTION.....	9
1 Scope.....	10
2 Normative references.....	10
3 Terms and definitions	14
4 Abbreviations	16
5 General.....	17
6 Classification.....	17
6.1 General.....	17
6.2 Transfer technologies.....	17
6.3 Transfer power classes	18
6.4 Environmental conditions	18
6.5 Installation	18
7 Interoperability	18
8 General system requirements	19
8.1 General.....	19
8.2 Efficiency.....	20
8.3 Measurement convention.....	21
8.3.1 General	21
8.3.2 Orientation.....	21
8.3.3 Measurement convention of the parking space.....	21
8.3.4 Measurement convention of offset	22
8.3.5 Measurement convention of the primary device.....	23
8.3.6 Distance between the primary and secondary device (mechanical air gap).....	23
8.3.7 Primary device mounting.....	24
8.3.8 In-ground-mounting.....	24
8.3.9 On-ground-mounting.....	24
8.4 Primary and secondary device construction	25
9 Communication.....	25
9.1 Command and control communication.....	25
9.2 High level communication.....	25
10 Protection against electric shock.....	26
10.1 General requirements.....	26
10.2 Protection against direct contact.....	26
10.2.1 Degrees of protection against access to hazardous parts	26
10.2.2 IP degrees for the enclosures.....	26
10.2.3 IP degrees for primary device.....	26
10.3 Stored energy – discharge of capacitors	26
10.4 Fault protection.....	27
10.5 Protective conductor dimensions	27
10.6 Supplementary measures.....	27
10.6.1 Additional protection	27
10.6.2 Manual/automatic reset.....	28
10.7 Telecommunication network	28
11 Specific requirements for WPT systems	28

11.1	General.....	28
11.2	Leakage – touch current.....	28
11.3	Insulation resistance	29
11.4	Dielectric withstand characteristic.....	29
11.4.1	Dielectric withstand voltage	29
11.4.2	Impulse dielectric withstand (1,2/50 μ s).....	29
11.5	Overload protection and short circuit withstand	30
11.5.1	General	30
11.5.2	Earthing electrode and continuity test	30
11.5.3	Earthing path test.....	30
11.5.4	Short circuit withstand strength	30
11.6	Temperature rise and protection against thermal incidents	30
11.6.1	General	30
11.6.2	Permissible surface temperature of accessible parts of the WPT system	31
11.6.3	Temperature limits for materials	32
11.6.4	Protection against burns from heating of foreign objects	33
11.7	Heat, fire and tracking	34
11.8	Protection against mechanical incident	34
11.8.1	Incidents induced by sharp edge	34
11.8.2	Incidents induced by steps from flat ground	34
11.9	Areas of protection	34
11.10	Protection from electro-magnetic field.....	35
11.11	Operational safety	35
11.12	Emergency service disconnect (optional).....	35
12	Power cable assembly requirements	35
13	Constructional requirements	36
13.1	General.....	36
13.2	Breaking capacity of switching devices	36
13.2.1	General	36
13.2.2	Switch and switch-disconnector.....	36
13.2.3	Contactors.....	36
13.2.4	Circuit-breaker.....	36
13.2.5	Relays.....	36
13.3	Clearance and creepage distances	36
13.4	Protection measures	37
14	Strength of materials and parts	37
14.1	General.....	37
14.2	Stability/Mechanical impact	37
14.2.1	Locations with restricted access	37
14.2.2	Locations with non-restricted access	38
14.2.3	Vehicle drive-over	38
14.2.4	Lateral force by thrust power	38
14.3	Mechanical load	38
14.3.1	General	38
14.3.2	Static load	38
14.3.3	Shock load.....	39
14.3.4	Torsional stress	39
14.3.5	Strength of doors	39
14.3.6	Mechanical shock impacts induced by sharp edged objects.....	39

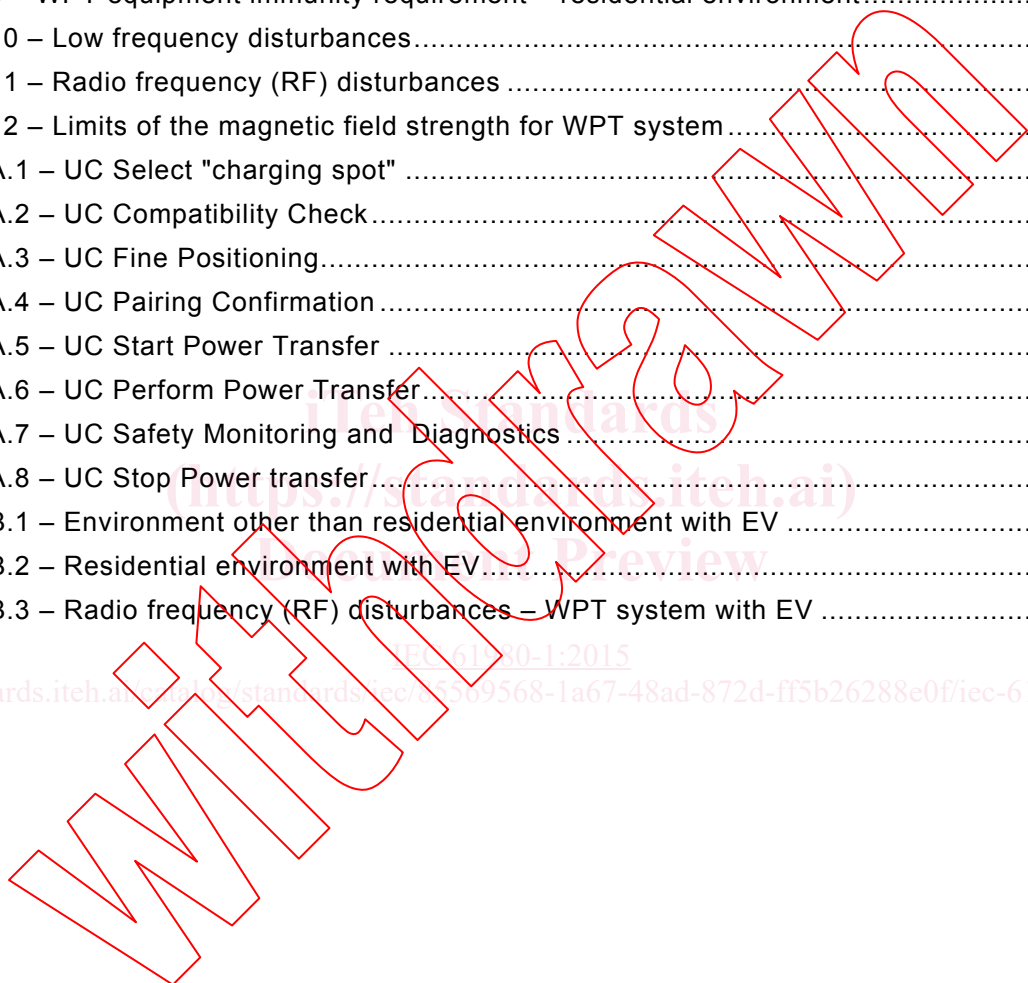
14.4	Strength of materials and parts.....	39
14.4.1	Protection against corrosion.....	39
14.4.2	Test criteria.....	39
14.5	Environmental conditions.....	40
14.6	Properties of insulating materials.....	40
14.6.1	Verification of thermal stability of enclosures.....	40
14.6.2	Resistance to fire (Glow wire).....	40
14.6.3	Ball pressure test.....	40
14.6.4	Resistance to tracking.....	40
14.6.5	Resistance to ultra-violet radiation.....	41
14.7	Static strength and stability.....	41
14.8	Vibration.....	41
15	Service and test conditions.....	41
15.1	General.....	41
15.2	Environmental test.....	41
15.2.1	Ambient air temperature.....	41
15.2.2	Ambient humidity.....	42
15.2.3	Ambient air pressure.....	42
15.2.4	Altitude.....	42
15.2.5	Pollution degree.....	43
15.2.6	Dry heat.....	43
15.2.7	Cold test.....	43
15.3	Special service conditions.....	43
15.4	Conditions during transport, storage and installation.....	43
15.5	Outdoor exposure.....	44
15.5.1	Cold test for extreme cold climates.....	44
15.5.2	Heat test under solar radiation.....	44
15.6	Damp and salt mist test for marine and coastal environments.....	44
15.7	Condensation within the assembly.....	44
15.8	Vibration and shock.....	44
15.9	Safety specifications.....	44
16	Electromagnetic Compatibility (EMC).....	44
16.1	Immunity requirements.....	44
16.2	Disturbance requirement.....	46
16.2.1	Load and operating conditions.....	46
16.2.2	Disturbance limits.....	47
17	Marking and instructions.....	50
17.1	General.....	50
17.2	Marking of EV supply equipment.....	51
17.3	Legibility.....	51
17.4	Connection instructions.....	51
Annex A	(informative) Use cases.....	52
A.1	General.....	52
A.2	Use case descriptions.....	53
A.2.1	UC Select "charging spot".....	53
A.2.2	UC Compatibility Check.....	54
A.2.3	UC Fine Positioning.....	55
A.2.4	UC Pairing Confirmation.....	56

A.2.5	UC Start Power Transfer	57
A.2.6	UC Perform Power Transfer	59
A.2.7	UC Safety Monitoring and Diagnostics (see Table A.7)	61
A.2.8	UC Stop Power transfer.....	61
Annex B (informative)	EMC tables, EV connected to an WPT system	63
B.1	General.....	63
B.2	WPT equipment immunity requirement (informative).....	63
B.3	Radio frequency (RF) disturbances.....	63
B.4	WPT system with EV included (radiated disturbances in the range 30 MHz to 1 000 MHz)	64
Annex C (informative)	EMF, protection from electromagnetic field.....	66
C.1	Protection from electromagnetic field.....	66
C.2	Assessment of electronic and electrical equipment.....	66
C.3	EMF measurement procedure.....	66
C.4	Measurement points.....	68
C.4.1	Area 3 measurement points of nominal position.....	68
C.4.2	Area 3 measurement points of offset positions.....	69
C.4.3	Area 4 measurement points.....	69
Bibliography	70
Figure 1	– Installation	18
Figure 2	– Wireless Power Transfer system.....	20
Figure 3	– Position of axes relative to orientation.....	21
Figure 4	– Position of the primary device.....	22
Figure 5	– X and Y maximum offset.....	23
Figure 6	– In-ground-mounting.....	24
Figure 7	– On-ground-mounting.....	25
Figure 8	– Qualitative example of material temperature	31
Figure 9	– Example for areas of protection, for ground mounted systems	35
Figure A.1	– Use cases particularly for wireless power transfer.....	52
Figure A.2	– Use cases from ISO/IEC 15118-1 reusable for WPT systems	53
Figure A.3	– Activity diagram for UC Select "Charging Spot".....	54
Figure A.4	– Activity diagram for UC Compatibility Check	55
Figure A.5	– Activity diagram for UC Fine Positioning	56
Figure A.6	– Activity diagram fur UC Pairing Confirmation.....	57
Figure A.7	– Activity diagram for UC Start Power Transfer	59
Figure A.8	– Activity diagram for UC Perform Power Transfer	60
Figure A.9	– Activity diagram for UC Stop Power Transfer	62
Figure B.1	– EV model for the radiated emission measurement (top view).....	64
Figure B.2	– EV model for radiated emission measurements (side view)	65
Figure C.1	– Top view.....	68
Figure C.2	– Front view.....	68
Figure C.3	– Seats position.....	69
Figure C.4	– Measurement points of seats.....	69

Table 1 – Transfer technologies	17
Table 2 – Position of primary device.....	22
Table 3 – Offset.....	23
Table 4 – Primary device	23
Table 5 – Mechanical air gap	24
Table 6 – Touch currents	28
Table 7 – Values of temperature rise in normal use	33
Table 8 – WPT equipment immunity requirement – Environment other than residential	45
Table 9 – WPT equipment immunity requirement – residential environment.....	46
Table 10 – Low frequency disturbances.....	48
Table 11 – Radio frequency (RF) disturbances	49
Table 12 – Limits of the magnetic field strength for WPT system.....	50
Table A.1 – UC Select "charging spot"	53
Table A.2 – UC Compatibility Check.....	55
Table A.3 – UC Fine Positioning.....	56
Table A.4 – UC Pairing Confirmation.....	57
Table A.5 – UC Start Power Transfer	58
Table A.6 – UC Perform Power Transfer.....	60
Table A.7 – UC Safety Monitoring and Diagnostics	61
Table A.8 – UC Stop Power transfer.....	61
Table B.1 – Environment other than residential environment with EV	63
Table B.2 – Residential environment with EV.....	63
Table B.3 – Radio frequency (RF) disturbances – WPT system with EV	63

IEC 61980-1:2015

<https://standards.iteh.ai/en/standards/iec/85569568-1a67-48ad-872d-ff5b26288e0f/iec-61980-1-2015>



INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLE WIRELESS POWER TRANSFER (WPT) SYSTEMS –

Part 1: General requirements

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.

International Standard IEC 61980-1 has been prepared by Technical Committee 69: Electric road vehicles and electric industrial trucks.

The text of this standard is based on the following documents:

FDIS	Report on voting
69/370/FDIS	69/380/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

This part is to be used in conjunction with the appropriate part of IEC 61980 series.

NOTE The following print types are used:

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

The contents of the corrigendum of January 2017 have been included in this copy.

IMPORTANT – The 'colour inside' logo on the cover page of this publication 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.

INTRODUCTION

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

Part 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).

Future Part 2 will cover specific requirements for communication between electric road vehicle (EV) and wireless power transfer (WPT) systems including general background and definitions.

Future Part 3 will cover specific requirements for electric road vehicle (EV) magnetic field wireless power transfer (MF-WPT) systems including general background and definitions (e.g. efficiency, electrical safety, EMC, EMF).

The requirements described in Part 1 are general. The technical requirements for the various wireless power transfer (WPT) technologies are very different, they will be treated in technology specific parts of the 61980 series. A list of possible WPT technologies can be seen in 6.2. The requirements for magnetic field-wireless power transfer systems (MF-WPT) will be described in future Part 3. Further parts of this series will describe other technologies such as power transfer via electric field wireless power transfer systems (EF-WPT) or electromagnetic field-WPT systems also named microwave-WPT systems (MW-WPT).

Reference to "technology specific parts" always refer to the technology specific future Part 3 and further technology specific parts of this series. The structure of the "technology specific parts" will follow the structure of Part 1.

Electric road vehicle (EV) will be covered by ISO 193631.

¹ Under consideration.

ELECTRIC VEHICLE WIRELESS POWER TRANSFER (WPT) SYSTEMS –

Part 1: General requirements

1 Scope

This part of IEC 61980 applies to the equipment for the wireless transfer of electric power from the supply network to electric road vehicles for purposes of supplying electric energy to the RESS (Rechargeable energy storage system) and/or other on-board electrical systems in an operational state when connected to the supply network, at standard supply voltages ratings per IEC 60038 up to 1 000 V a.c. and up to 1 500 V d.c.

This standard also applies to Wireless Power Transfer (WPT) equipment supplied from on-site storage systems (e.g. buffer batteries, etc.).

The aspects covered in this standard include:

- the characteristics and operating conditions;
- the specification for required level of electrical safety;
- requirements for basic communication for safety and process matters if required by a WPT system;
- requirements for basic positioning, efficiency and process matters if required by a WPT system;
- requirements for two- and three-wheel vehicles (under consideration);
- requirements for WPT system while driving (under consideration);
- requirements for bidirectional power transfer (under consideration);
- specific EMC requirements for WPT systems.

This standard does not apply to:

- safety aspects related to maintenance;
- trolley buses, rail vehicles and vehicles designed primarily for use off-road;
- WPT vehicle power supply circuit, which is covered by ISO 6469 series, ISO 19363²;
- EMC requirements for on-board equipment while connected, which are covered in IEC 61851-21-1³;
- high level communication which are covered in ISO/IEC 15118 series.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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*

² Under consideration.

³ Under consideration.

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-2, *Environmental testing – Part 2-2: Tests – Test B: Dry heat*

IEC 60068-2-5, *Environmental testing – Part 2-5: Tests – Test Sa: Simulated solar radiation at ground level and guidance for solar radiation testing*

IEC 60068-2-11, *Environmental testing – Part 2-11: Tests – Test Ka: Salt mist*

IEC 60068-2-30, *Environmental testing – Part 2-30: Tests – Test Db and guidance: Damp heat, cyclic (12 + 12-hour cycle)*

IEC 60085, *Electrical insulation – Thermal evaluation and designation*

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60216 (all parts), *Electrical insulating materials – Thermal endurance properties*

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

IEC 60364-4-42, *Low-voltage electrical installations – Part 4-42: Protection for safety – Protection against thermal effects*

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

IEC 60364-4-44, *Low-voltage electrical installations – Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances*

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

IEC 60364-7-722⁴, *Low-voltage electrical installations – Part 7-722: Requirements for special installations or locations – Supply of electric vehicles*

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

IEC 60664-1:2007, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*

IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products (GWEPT)*

IEC 60695-10-2, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method*

IEC 60898-1, *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations – Part 1: Circuit-breakers for a.c. operation*

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

⁴ To be published.

IEC 60947-3, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 60947-4-1, *Low-voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*
Amendment 1:2009
Amendment 2:2013

IEC 60990:1999, *Methods of measurement of touch current and protective conductor current*

IEC 61000-3-2, *Electromagnetic compatibility (EMC) – Part 3-2: Limits – Limits for harmonic current emissions (equipment input current \leq 16 A per phase)*

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 \leq 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 \leq 75 A and subject to conditional connection*

IEC 61000-3-12, *Electromagnetic compatibility (EMC) – Part 3-12: Limits – Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current $>$ 16 A and \leq 75 A per phase*

IEC 61000-4-2, *Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test*

IEC 61000-4-3, *Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test*

IEC 61000-4-4, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

IEC 61000-4-5, *Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test*

IEC 61000-4-6, *Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields*

IEC 61000-4-8, *Electromagnetic compatibility (EMC) – Part 4-8: Testing and measurement techniques – Power frequency magnetic field immunity test*

61000-4-11, *Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests*

61000-4-34, *Electromagnetic compatibility (EMC) – Part 4-34: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests for equipment with input current more than 16 A per phase*

IEC 61000-6-1, *Electromagnetic compatibility (EMC) – Part 6-1: Generic standards – Immunity for residential, commercial and light-industrial environments*