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**Electrically propelled mopeds and  
motorcycles — Safety requirements  
for conductive connection to an  
external electric power supply**

*Cyclomoteurs et motocycles à propulsion électrique — Exigences  
de sécurité relatives au couplage conducteur à une station extérieure  
d'alimentation d'énergie*

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# Contents

	Page
Foreword.....	v
Introduction.....	vi
<b>1 Scope.....</b>	<b>1</b>
<b>2 Normative references.....</b>	<b>1</b>
<b>3 Terms and definitions.....</b>	<b>1</b>
<b>4 Environmental and operational conditions.....</b>	<b>6</b>
<b>5 General requirements.....</b>	<b>6</b>
<b>6 Connection between the plug or vehicle couplers and RESS of the vehicle.....</b>	<b>6</b>
6.1 General connection.....	6
6.1.1 Connections among charger, RESS, and vehicle.....	6
6.1.2 General requirements for connection.....	7
6.1.3 Requirements for connection or no connection to the earth.....	8
6.1.4 Service life of the vehicle inlet.....	14
6.1.5 Vehicle behaviour during charging.....	14
6.2 A.C. connection.....	15
6.2.1 Requirements for the connection to a.c. supply network (mains).....	15
6.2.2 Requirements of connection and/or disconnection process in a.c. contacts.....	15
6.2.3 Protection from unintended voltage for a.c. connection.....	15
6.3 D.C. connection.....	15
6.3.1 Requirements of connection and/or disconnection process in d.c. contacts.....	15
6.3.2 Protection from unintended voltage for d.c. connection.....	16
6.3.3 Specific requirements.....	16
<b>7 Protection of persons against electric shock.....</b>	<b>16</b>
7.1 General requirements.....	16
7.2 Requirements and measures for voltage class A on-board components.....	16
7.3 Requirements and measures for the voltage class B on-board charging system.....	16
7.3.1 Requirements for the on-board charging system.....	16
7.3.2 Protection under single failure conditions.....	17
7.3.3 Requirements of barrier/enclosures.....	17
7.3.4 Requirements of insulation.....	17
7.3.5 Requirements of potential equalization.....	17
7.4 Protection degrees.....	18
7.4.1 General.....	18
7.4.2 Requirements of the protection degree of barrier/enclosures against electric shock.....	18
<b>8 Other requirements for the on-board charging system.....</b>	<b>18</b>
8.1 General test requirements of on-board equipment.....	18
8.2 Degree of protection of on-board equipment.....	18
8.3 Dielectric withstand characteristics of on-board equipment.....	19
8.3.1 Test voltage not conductively connected to the parts.....	19
8.3.2 Dielectric withstand voltage of voltage class A direct current part.....	20
8.4 Isolation resistance requirements of on-board equipment.....	20
8.4.1 General.....	20
8.4.2 Additional protection measures for the a.c. circuit connected to the d.c. circuit of the on-board equipment.....	20
8.5 Creepage distance of on-board equipment.....	21
8.6 Clearance of on-board equipment.....	21
8.7 Touch current.....	22
8.8 Requirements for the emission of hazardous gases and other hazardous substances.....	22
8.9 Environmental tests.....	23
8.9.1 General.....	23

8.9.2	Ambient air temperature.....	23
8.9.3	Ambient humidity.....	23
8.9.4	Ambient air pressure.....	23
8.10	Permissible surface temperature.....	23
8.11	Environmental conditions.....	23
8.12	Unintentional charging system behaviour.....	24
8.13	Electromagnetic compatibility.....	24
8.13.1	Susceptibility.....	24
8.13.2	Emissions.....	24
8.14	Service.....	24
<b>9</b>	<b>Marking, instructions, and indications.....</b>	<b>24</b>
9.1	Marking.....	24
9.2	Legibility.....	24
9.3	Connection instructions.....	25
9.4	Indication.....	25
<b>Annex A (informative) Charging types.....</b>		<b>26</b>
<b>Bibliography.....</b>		<b>33</b>

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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](http://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](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: [Foreword - Supplementary information](http://standards.iteh.ai)

The committee responsible for this document is ISO/TC 22, *Road vehicles*, Subcommittee SC 38, *Motorcycles and mopeds*.

ISO 18246:2015

If there is any lack of requirements, especially for safety issues in this International Standard, the requirement in other relevant standards, such as ISO 17409, is adopted.

## Introduction

This International Standard prescribes basic safety requirements for electrically propelled mopeds and motorcycles, which are called electric vehicles, for simplicity, in this International Standard, while connected to an external electric power supply. The safety requirements for off-board chargers are described in IEC 60335-2-29 and will be described in the IEC 61851-3 series (under consideration).

This International Standard does not consider discharging from vehicle to grid.

This International standard does not standardize specific charging method.

Moped and motorcycle are defined in ISO 3833:1977, 3.4 and 3.5.

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# Electrically propelled mopeds and motorcycles — Safety requirements for conductive connection to an external electric power supply

## 1 Scope

This International Standard specifies safety requirements for conductive connection to an external electric power supply of electrically propelled mopeds and motorcycles.

It is not applicable to vehicles not in normal conditions, such as damaged vehicles and vehicles which have mechanical and/or electrical failure.

It applies only to on-board charging systems between the plug or vehicle couplers and RESS circuits.

The safety requirements for vehicles not connected to external power supply are specified in ISO 13063.

NOTE This International Standard does not contain requirements for bidirectional power flow.

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

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## 2 Normative references (standards.iteh.ai)

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.

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

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

IEC 60664-1 Ed. 2.0:2007, *Insulation coordination for equipment within low-voltage systems — Part 1: Principles, requirements and tests*

IEC 60950-1 Ed. 2.0:2005, *Information technology equipment — Safety — Part 1: General requirements*

## 3 Terms and definitions

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

### 3.1

#### basic insulation

insulation of hazardous-live-parts which provides basic protection

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

[SOURCE: IEC 195-06-06]

**3.2  
basic protection**

protection against electric shock under fault-free conditions

Note 1 to entry: For low-voltage installations, systems and equipment, basic protection generally corresponds to protection against direct contact as used in IEC 60364-4-41.

[SOURCE: IEC 61140:2009, 3.1.1]

**3.3  
charger**

power converter that performs the necessary functions for charging a battery

**3.3.1  
charger assembly**

power converter that performs the necessary functions for charging a battery, including cables

**3.4  
degree of protection**

protection provided by an enclosure against access, foreign objects and/or water and verified by standardized test methods

[SOURCE: ISO 20653:2013, 3.2]

**3.5  
double insulation**

insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 195-06-08]

**3.6  
electric vehicle**

moped or motorcycle with one or more electric drive(s) for propulsion (refer to Introduction)

[SOURCE: ISO 13063:2012, 3.19, modified — Terminological entry is changed from electrically propelled vehicle, and moped or motorcycle is changed from vehicle.]

**3.7  
equipotential bonding**

provision of electric connections between conductive parts, intended to achieve equipotentiality

[SOURCE: IEC 195-01-10]

**3.7.1  
equipotential bonding terminal**

terminal provided on equipment or on a device and intended for the electric connection with the equipotential bonding system

[SOURCE: IEC 195-02-32]

**3.8  
exposed conductive part**

conductive part of the electric equipment which can be touched by a test finger according to IPXXB (refer to ISO 20653) after removing barriers/enclosures that can be removed without using tools but which may become live under failure conditions

[SOURCE: ISO 6469-3:2011, 3.17, modified]

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**3.9****external electric power supply**

electric power source which is outboard of the vehicle for supplying electric energy to electric vehicle for electric propulsion

Note 1 to entry: The external electric power supplies include a.c. supply network (mains), grids and/or stationary external power sources.

[SOURCE: ISO 17409:2015, 3.23, modified]

**3.10****hazardous-live-part**

live part which, under certain conditions, can give a harmful electric shock

[SOURCE: IEC 826-12-13]

**3.11****indoor use**

equipment designed to be exclusively used in weather protected locations

[SOURCE: IEC 61851-1:2010, 3.28]

**3.12****live part**

conductor or conductive part intended to be electrically energized in normal use

Note 1 to entry: "Electrically energized" means that such a conductor or conductive part can have an electric potential.

[SOURCE: ISO 6469-1:2009, 3.14, modified]

**3.13****maximum working voltage**

highest value of a.c. voltage (r.m.s.) or of d.c. voltage that can occur in an electric system under any normal operating conditions according to the manufacturers' specifications, disregarding transients

[SOURCE: ISO 13063:2012, 3.26]

**3.14****outdoor use**

equipment designed to be allowed to be used in non weather protected locations

[SOURCE: IEC 61851-1:2010, 3.29]

**3.15****plug**

accessory having pins designed to engage with the contacts of a socket-outlet

Note 1 to entry: It also incorporate means for the electrical connection and mechanical retention of flexible cables or codes.

[SOURCE: IEC 442-03-02, modified]

**3.16****primary circuit**

circuit in the charger intended to be galvanically connected to a supply network (mains)

**3.17****protection degree**

protection provided by a barrier/enclosure related to the contact with live parts by a test probe, such as a test finger (IPXXB), a test rod (IPXXC), or a test wire (IPXXD), in accordance with ISO 20653

[SOURCE: ISO 6469-3:2011, 3.25]

**3.18**  
**protective conductor**  
**PE**

conductor provided for the purposes of safety

EXAMPLE Protection against electric shock.

Note 1 to entry: In an electrical installation, the conductor identified PE is normally also considered as protective earthing conductor.

[SOURCE: IEC 826-13-22, modified]

**3.19**  
**reinforced insulation**

insulation of hazardous-live-parts which provides a degree of protection against electric shock equivalent to double insulation

Note 1 to entry: Reinforced insulation may comprise several layers which cannot be tested singly as basic insulation or supplementary insulation.

[SOURCE: IEC 195-06-09]

**3.20**  
**residual current device**  
**RCD**

mechanical switching device designed to make, carry and break currents under normal service conditions and to cause the opening of the contacts when the residual current attains a given value under specified conditions

Note 1 to entry: A residual current device can be a combination of various separate elements designed to detect and evaluate the residual current and to make and break current.

[SOURCE: IEC 442-05-02] <https://standards.iteh.ai/catalog/standards/sist/76b2f152-bdf7-4875-b974-09e0ec2e52f4/iso-18246-2015>

**3.21**  
**rechargeable energy storage system**  
**RESS**

system that stores energy for delivery of electric energy and which is rechargeable

EXAMPLE Batteries, capacitors.

[SOURCE: ISO 13063:2012, 3.29]

**3.22**  
**RESS circuit**

electric circuit which includes all live parts that are galvanically connected to the secondary circuits of the charger and charging circuits of RESS, excluding propulsion circuits

**3.23**  
**RESS coupler**

means enabling the connection and disconnection of RESS to a flexible cable, an electric vehicle or a charger assembly

Note 1 to entry: It consists of two parts: a RESS connector and a RESS inlet.

**3.23.1**  
**RESS connector**

part of a RESS coupler integral with, or intended to be attached to, a flexible cable, an electric vehicle or a charger assembly

**3.23.2**  
**RESS inlet**

part of a RESS coupler incorporated in, or fixed to, RESS

**3.24****secondary circuit**

circuit in the charger intended to be galvanically connected to the RESS

**3.25****socket-outlet**

accessory having socket-contacts designed to engage with the pins of a plug and having terminals for the connection of cables or codes

[SOURCE: IEC 442-03-02]

**3.26****supplementary insulation**

independent insulation applied in addition to basic insulation, for failure protection

[SOURCE: IEC 195-06-07, modified — “fault” has been replaced with “failure”.]

**3.27****terminal**

conductive part provided for the connection of a conductor to an accessory

[SOURCE: IEC 62196-1:2014, 3.14]

**3.28****vehicle coupler**

means enabling the connection and disconnection at will, of a flexible cable to an electric vehicle.

Note 1 to entry: It consists of two parts: a vehicle connector and a vehicle inlet.

[SOURCE: IEC 62196-1:2014, 3.3, modified — “and disconnection” has been added.]

**3.28.1****vehicle connector**

part of a vehicle coupler integral with, or intended to be attached to, one flexible cable

[SOURCE: IEC 62196-1:2014, 3.3.1]

**3.28.2****vehicle inlet**

part of a vehicle coupler incorporated in, or fixed to, the electric vehicle

[SOURCE: IEC 62196-1:2014, 3.3.2]

**3.29****voltage class A**

classification of an electric component or circuit as belonging to voltage class A, if its maximum working voltage is  $\leq 30$  V a.c. or  $\leq 60$  V d.c., respectively

Note 1 to entry: The values 60 V d.c. and 30 V a.c. are selected taking into account humid weather conditions.

[SOURCE: ISO 13063:2012, 3.33, modified — Note 1 to entry is added from ISO 13063:2012, Table 1.]

**3.30****voltage class B**

classification of an electric component or circuit as belonging to voltage class B, if its maximum working voltage is  $> 30$  and  $\leq 1\,000$  V a.c. or  $> 60$  and  $\leq 1\,500$  V d.c., respectively

Note 1 to entry: The values 60 V d.c. and 30 V a.c. are selected taking into account humid weather conditions.

[SOURCE: ISO 13063:2012, 3.34, modified — Note 1 to entry is added from ISO 13063:2012, Table 1.]

## 4 Environmental and operational conditions

The requirements given in this International Standard shall be met across the range of environmental and operational conditions for which the electric vehicles are designed to be charged, as specified by the vehicle manufacturer.

## 5 General requirements

The on-board charging system shall be operated safely and properly in normal use.

The on-board charging system shall comprise safety means, such as protection against electric shock of rider and/or surroundings even under single failure condition.

The fail-safe design shall be considered for the on-board charging system.

The on-board charging assembly shall be designed so that, if it could lead to malfunction in a hazardous manner, it shall cut off power to the RESS or the traction battery for safety.

The information necessary for installation, operation, and maintenance of the charger and any components shall be supplied in appropriate forms such as drawings, diagrams, charts, tables, and instructions.

Compliance is checked with the relevant requirements and tests specified in this International Standard.

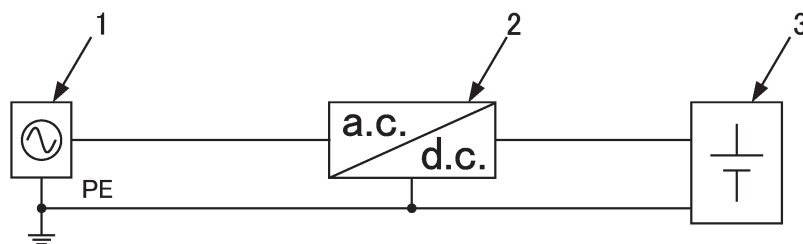
## 6 Connection between the plug or vehicle couplers and RESS of the vehicle

### 6.1 General connection

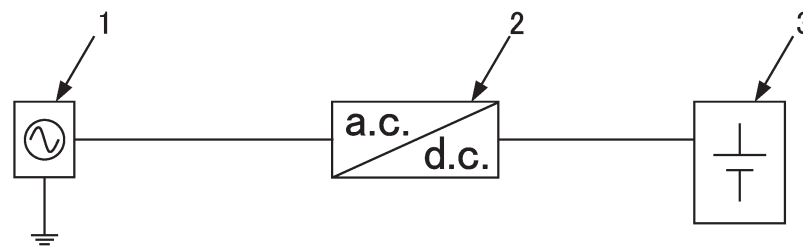
#### 6.1.1 Connections among charger, RESS, and vehicle

There are four ways in conductive charging systems regarding the connection to the earth. They are as follows.

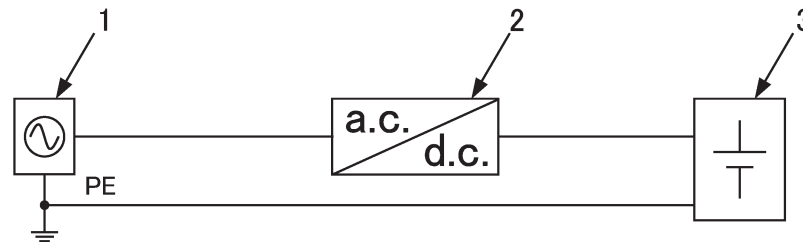
- a) Connection to the earth: It consists of the charger assembly and the vehicle/RESS, both of them connected to the earth for protection. The requirements are specified in [6.1.3.2](#).
- b) No connection to the earth: It consists of the charger assembly and the vehicle/RESS, neither of them connected to the earth for protection. The requirements are specified in [6.1.3.3](#).
- c) Separate connection to the earth: It consists of the charger assembly unconnected to the earth for protection and the vehicle/RESS connected to the earth for protection. The requirements are specified in [6.1.3.4](#).
- d) Partial connection to the earth: It consists of the charger assembly connected to the earth for protection and the vehicle/RESS unconnected to the earth for protection. The requirements are specified in [6.1.3.5](#).



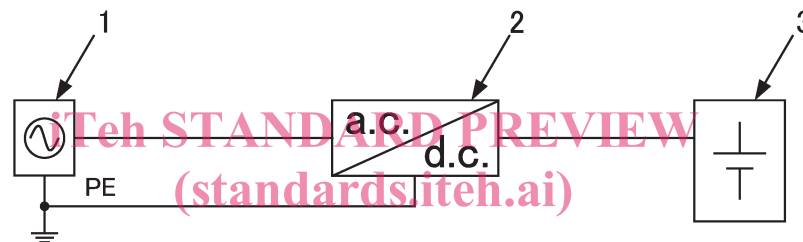
a) Connection to the earth



b) No connection to the earth



c) Separate connection to the earth



d) Partial connection to the earth

**Key**

- 1 a.c. supply network (mains)
- 2 charger
- 3 vehicle or detachable RESS

**Figure 1 — Construction of the connection to the earth**

[Figure 1](#) shows TN power supply systems. Other configurations including TT power supply systems also exist.

**6.1.2 General requirements for connection****6.1.2.1 Connection and disconnection**

It shall not be possible to engage couplers/plug with different voltage rating or current rating.

Vehicle couplers and RESS couplers as the parts of the on-board charging system shall not be compatible. In case of charging type B or C described in Annex A, vehicle connectors and RESS connectors may be compatible in accordance with vehicle manufacturer's guidance or relevant standards for connection.

When the vehicle connector is connected to charge the vehicle and/or disconnected, the means preventing access to the live parts from any usual direction shall be provided.

Connection or disconnection of the vehicle coupler shall not cause the overturn of the vehicle in the normal operating conditions.