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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 borne d'alimentation  
électrique externe*

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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 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](http://www.iso.org/iso/foreword.html).

This document was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Subcommittee SC 38, *Motorcycles and mopeds*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 301, *Electrically propelled road vehicles*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 18246:2015), which has been technically revised.

The main changes are as follows:

- terms and definitions have been updated;
- requirements for protection against electric shock ([Clause 7](#)) have been rewritten;
- descriptions for additional requirements and test procedure ([Clause 9](#)) have been simplified;
- requirements for the specific DC charging systems have been described in the Annexes (Annex B for IEC 61851-25 and Annex C for IEC TS 61851-3 series).

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](http://www.iso.org/members.html).

## Introduction

This document prescribes basic safety requirements for electrically propelled mopeds and motorcycles, which are called electrically propelled vehicles (EVs), for simplicity, while connected to an external electric power supply. The safety requirements for off-board appliances/equipment are not described in this document.<sup>1)</sup>

This document does not standardize specific charging method in the body text. The requirements for specific DC charging systems are described in [Annex B](#) and [Annex C](#).

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

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1) See IEC 60335-2-29, IEC 61851-25, and IEC TS 61851-3 series.

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

## 1 Scope

This document specifies safety requirements for conductive connection of electrically propelled mopeds and motorcycles (referred to as the EVs) to external electric circuits.

NOTE 1 External electric circuits include external electric power supplies and external electric loads.

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

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

NOTE 2 The requirements when not connected to external electric circuits are specified in the ISO 13063 series.

Requirements for bidirectional energy transfer DC to AC are under consideration and are not part of this document.

NOTE 3 The safety requirements for DC EV supply equipment where protection relies on electrical separation are specified in IEC 61851-25.

NOTE 4 The safety requirements for DC EV supply equipment where protection relies on double or reinforced insulation are specified in IEC TS 61851-3-1 and IEC TS 61851-3-2.

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## 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 6469-3:2021, *Electrically propelled road vehicles — Safety specifications — Part 3: Electrical safety*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 13063-3:2022, *Electrically propelled mopeds and motorcycles — Safety specifications — Part 3: Electrical safety*

ISO 17409:2020, *Electrically propelled road vehicles — Conductive power transfer — Safety requirements*

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

IEC 60664 SER, *Insulation coordination for equipment within low-voltage systems — All Parts*

IEC 61140:2016, *Protection against electric shock — Common aspects for installation and equipment*

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 61851-25:2020, *Electric vehicle conductive charging system — Part 25: DC EV supply equipment where protection relies on electrical separation*

IEC/TS 61851-3-1:—,<sup>2)</sup>*Electric Vehicles conductive charging system — Part 3-1: DC EV supply equipment where protection relies on double or reinforced insulation – General rules and requirements for stationary equipment*

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/TS 62196-4, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles — Part 4: Dimensional compatibility and interchangeability requirements for d.c. pin and contact-tube accessories for class II or class III applications*

IEC 62196-6, *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles — Part 6: Dimensional compatibility requirements for DC pin and contact-tube vehicle couplers for DC EV supply equipment where protection relies on electrical separation*

### 3 Terms and definitions

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

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

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

#### 3.1 General

##### 3.1.1 electrically propelled vehicle

**EV**  
vehicle with one or more electric drive(s) for vehicle propulsion

Note 1 to entry: In the context of this document, the term electrically propelled vehicle (EV) includes only moped or motorcycle.

[SOURCE: ISO 13063-3:2022, 3.14, modified — Terminological entry "EV" and note 1 to entry are added.]

##### 3.1.2 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 13063-3:2022, 3.23]

##### 3.1.3 removable RESS

RESS (3.1.2) that can be moved/removed from an EV (3.1.1) by hand (portable RESS) or with the assistance of an installation/device (mobile RESS)

[SOURCE: EN 50604-1:2016 +A1:2021, 3.18]

##### 3.1.4 indoor use

intended for operation under normal ambient conditions in a building

[SOURCE: IEC 61851-1:2017, 3.6.1]

2) Under preparation. Stage at the time of publication: IEC 69/845/DTS:2022.



**3.1.5****outdoor use**

capable of operating under specific range of outdoor conditions

[SOURCE: IEC 61851-1:2017, 3.6.2]

**3.1.6****maximum working voltage**

highest value of AC voltage (rms) or of DC voltage that can occur in an electric system under any normal operating conditions according to the manufacturers' specifications, disregarding transients and ripple

[SOURCE: ISO 13063-3:2022, 3.20]

**3.1.7****voltage class A**

classification of an electric component or circuit, if its *maximum working voltage* (3.1.6) 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.

**3.1.8****voltage class B**

classification of an electric component or circuit, if its *maximum working voltage* (3.1.6) 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.

**3.1.9****electric chassis**

conductive parts of a vehicle that are electrically connected and whose potential is taken as reference

[SOURCE: ISO 13063-3:2022, 3.11]

**3.1.10****accessible part**

part which can be touched by means of the standard test finger

[SOURCE: IEC 442-01-15, modified — "a" is deleted.]

**3.1.11****degree of protection**

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

EXAMPLE IPXXB (by test finger), IPXXC (by test rod), or IPXXD test wire (by test wire), in accordance with ISO 20653

[SOURCE: ISO 20653:2013, 3.2, modified — EXAMPLES are added.]

**3.1.12****single fault condition**

condition in which one means for protection against electric shock is defective or one fault is present which could cause a hazard

Note 1 to entry: If a single fault condition results in one or more other fault conditions, all are considered as one single fault condition.

[SOURCE: IEC 61140:2016, 3.1.4]

## 3.2 Charging

### 3.2.1

#### **EV charging system**

complete system including the *EV supply equipment* (3.2.5) and the EV functions that are required to supply electric energy to an *EV* (3.1.1) for the purpose of charging

[SOURCE: IEC 61851-1:2017, 3.1.4]

### 3.2.2

#### **on-board charging system**

on-board sections of *EV charging system* (3.2.1), which may have dedicated control functions used for the connection of the vehicle to an external electric circuit

### 3.2.3

#### **on-board charging equipment**

equipment or a combination of equipment in the *on-board charging system* (3.2.2)

### 3.2.4

#### **external electric power supply**

electric power source that is not part of the vehicle for supplying electric energy to an *EV* (3.1.1) using an *EV supply equipment* (3.2.5)

[SOURCE: ISO 17409:2020, 3.28]

### 3.2.5

#### **EV supply equipment**

equipment or a combination of equipment providing dedicated functions to supply electric energy from a fixed electrical installation or supply network to an *EV* (3.1.1) for the purpose of charging

[SOURCE: ISO 17409:2020, 3.25, modified — EXAMPLE 1 and 2 are not cited.]

### 3.2.6

#### **charger**

power converter that performs the necessary functions for charging a battery

### 3.2.7

#### **charger assembly**

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

### 3.2.8

#### **vehicle power supply circuit**

*voltage class B* (3.1.8) electric circuit which includes all parts that are galvanically connected to the vehicle inlet (case B, case C) or the plug (case A) and that is operational when connected to an *external electric power supply* (3.2.4)

Note 1 to entry: Case A, case B and case C are defined in IEC 61851-1.

### 3.2.9

#### **primary circuit**

circuit in the *charger* (3.2.6) intended to be galvanically connected to a supply network (mains)

### 3.2.10

#### **secondary circuit**

circuit that has no direct connection to a *primary circuit* (3.2.9) and derives its power from a transformer, converter or equivalent isolation device

[SOURCE: IEC 61851-23:2014, 3.112]

**3.2.11****RESS circuit**

electric circuit which includes all live parts that are galvanically connected to the *secondary circuits* (3.2.10) of the *charger* (3.2.6) and charging circuits of *RESS* (3.1.2), excluding propulsion circuits

**3.2.12****control pilot circuit**

circuit designed for the transmission of signals or communication between the *EV* (3.1.1) and the *EV supply equipment* (3.2.5)

[SOURCE: IEC 61851-1:2017, 3.3.2, modified — Note 1 to entry was deleted.]

**3.3 Connection****3.3.1****AC connection**

connection at a vehicle inlet or plug, with an external AC power supply

**3.3.2****DC connection**

connection at a vehicle inlet or plug, with an external DC power supply

**3.3.3****charging cable assembly**

assembly consisting of flexible cable or cord fitted with a plug and/or a vehicle connector, that is used to establish the connection between the *EV* (3.1.1) and the supply network or an EV charging station

Note 1 to entry: A cable assembly can be detachable or be a part of the EV or the EV charging station.

Note 2 to entry: A cable assembly can include one or more cables, with or without a fixed jacket, which can be in a flexible tube, conduit or wire way.

**3.3.4****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 61851-1:2017, 3.5.10]

**3.3.5****plug**

accessory having pins designed to engage with the contacts of a *socket-outlet* (3.3.4)

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

[SOURCE: IEC 61851-1:2017, 3.5.11, modified — The second part of sentence is moved to Note 1 to entry.]

**3.3.6****vehicle coupler**

means enabling the connection and disconnection at will, of a flexible cable to an *EV* (3.1.1)

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

**3.3.7****vehicle connector**

part integral with, or intended to be attached to, one flexible cable

[SOURCE: IEC 62196-1:2022, 3.56 modified — Terminological entry "electric vehicle connector" is not cited.]

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### 3.3.8 vehicle inlet

part incorporated in, or fixed to, the *EV* (3.1.1)

[SOURCE: IEC 62196-1:2022, 3.57 modified — Terminological entry "electric vehicle inlet" is not cited, and "electric vehicle" is replaced with "EV".]

### 3.3.9 RESS coupler

means enabling the connection and disconnection of *RESS* (3.1.2) to a flexible cable, an *EV* (3.1.1) or a *charger assembly* (3.2.7)

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

### 3.3.10 RESS connector

part of a *RESS coupler* (3.3.9) integral with, or intended to be attached to, a flexible cable, an *EV* (3.1.1) or a *charger assembly* (3.2.7)

### 3.3.11 RESS inlet

part of a *RESS coupler* (3.3.9) incorporated in, or fixed to, *RESS* (3.1.2)

### 3.3.12 terminal

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

[SOURCE: IEC 62196-1:2022, 3.50]

## 3.4 Electrical safety

### 3.4.1 live part

conductor or conductive part intended to be energized in normal use, but by convention, not the *electric chassis* (3.1.9)

[SOURCE: ISO 6469-1:2019, 3.16]

### 3.4.2 hazardous-live-part

*live part* (3.4.1) which, under certain conditions, can give a harmful electric shock

[SOURCE: IEC 826-12-13]

### 3.4.3 basic protection

protection against electric shock under fault-free conditions

[SOURCE: IEC 61140:2016, 3.1.1]

### 3.4.4 fault protection

protection against electric shock under *single-fault conditions* (3.1.12)

[SOURCE: IEC 61140:2016, 3.1.2]

### 3.4.5 additional protection

protection against electric shock in addition to *basic protection* (3.4.3) and/or *fault protection* (3.4.4)

[SOURCE: IEC 61140:2016, 3.1.3]

**3.4.6****basic insulation**

insulation of *hazardous-live-parts* (3.4.2) which provides *basic protection* (3.4.3)

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

[SOURCE: IEC 60364-4-41:2017, 411.1.1]

**3.4.7****supplementary insulation**

independent insulation applied in addition to *basic insulation* (3.4.6), for *fault protection* (3.4.4)

[SOURCE: IEC 60364-4-41:2017, 411.1.2]

**3.4.8****double insulation**

insulation comprising both *basic insulation* (3.4.6) and *supplementary insulation* (3.4.7)

[SOURCE: IEC 60364-4-41:2017, 411.1.3]

**3.4.9****reinforced insulation**

insulation of *hazardous-live-parts* (3.4.2) which provides a *degree of protection* (3.1.11) against electric shock equivalent to *double insulation* (3.4.8)

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

[SOURCE: IEC 60364-4-41:2017, 411.1.4]

**3.4.10****galvanic separation**

prevention of electric conduction between two electric circuits intended to exchange power and/or signals

Note 1 to entry: Galvanic separation can be provided e.g. by an isolating transformer or an opto-coupler.

[SOURCE: IEC 60364-4-41:2017, 411.1.5]

**3.4.11****simple separation**

separation between electric circuits or between an electric circuit and local earth by means of *basic insulation* (3.4.6)

[SOURCE: IEC 61140:2016, 3.23]

**3.4.12****protective separation****electrically protective separation**

separation of one electric circuit from another by means of:

- *double insulation* (3.4.8); or
- *basic insulation* (3.4.6) and electrically protective screening (shielding); or
- *reinforced insulation* (3.4.9)

[SOURCE: IEC 61140:2016, 3.24]