



International  
Standard

**ISO 5474-1**

**Electrically propelled road  
vehicles — Functional and safety  
requirements for power transfer  
between vehicle and external  
electric circuit —**

**Part 1:  
General requirements for  
conductive power transfer**

*Véhicules routiers à propulsion électrique — Exigences  
fonctionnelles et exigences de sécurité pour le transfert de  
puissance entre le véhicule et le circuit électrique externe —*

*Partie 1: Exigences générales pour le transfert de puissance par  
conduction*

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## Foreword

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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 document 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)).

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This document was prepared by Technical Committee ISO/TC 22 *Road vehicles*, Subcommittee SC 37 *Electrically propelled vehicles*.

A list of all parts in the ISO 5474 series can be found on the ISO website.

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).

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## Introduction

The ISO 5474 series reorganizes, cancels and replaces ISO 17409:2020 and ISO 19363:2020, both standards have been technically revised.

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# Electrically propelled road vehicles — Functional and safety requirements for power transfer between vehicle and external electric circuit —

## Part 1:

## General requirements for conductive power transfer

### 1 Scope

This document specifies general requirements for conductive power transfer with a voltage up to 1 000 V a.c. (alternative current) and up to 1 500 V d.c. (direct current) between electrically propelled road vehicles and external electric circuits.

This document provides general requirements for conductive charging in modes 2, 3 and 4 according to IEC 61851-1, and for reverse power transfer. This document does not provide requirements for mode 1. For mode 4, this document provides requirements regarding the power transfer only with isolated DC EV supply equipment according to IEC 61851-23.

NOTE External electric circuits are not part of the vehicle.

This document applies to the vehicle power supply circuits.

This document does not provide;

- requirements for simultaneous operation of multiple EV plugs or vehicle inlets, and
- requirements for power transfer while driving (electric road systems),

but they are under consideration.

This document does not provide:

- requirements for mopeds and motorcycles (which are specified in ISO 18246), and
- comprehensive safety information for manufacturing, maintenance and repair personnel.

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

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

ISO 20653:2023, *Road vehicles — Degrees of protection (IP code) — Protection of electrical equipment against foreign objects, water and access*

IEC 60479-2:2019, *Effects of current on human beings and livestock — Part 2: Special aspects Low-voltage electrical installations*

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

IEC 61032, *Protection of persons and equipment by enclosures — Probes for verification*

IEC 62196 (all parts), *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles*

### 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

##### **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 60050-195:2021, 195-06-06, modified — The phrase “hazardous live parts” has been added.]

##### 3.1.2

##### **conductive part**

part which can carry electric current

[SOURCE: IEC 60050-195:2021, 195-01-06]

##### 3.1.3

##### **degree of protection**

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

[SOURCE: ISO 20653:2023, 3.2]

##### 3.1.4

##### **electrically propelled vehicle**

**EV**

vehicle with one or more *electric drive(s)* (3.1.6) for vehicle propulsion

Note 1 to entry: Electrically propelled vehicle is called electric vehicle in IEC standards.

[SOURCE: ISO 6469-3:2021, 3.15, modified — “EV” added as an equivalent term and Note 1 to entry added.]

##### 3.1.5

##### **electric chassis**

*conductive parts* (3.1.2) of a vehicle that are electrically connected and whose potential is taken as reference

[SOURCE: ISO 6469-3:2021, 3.12]

##### 3.1.6

##### **electric drive**

combination of traction motor, power electronics and their associated controls for the conversion of electric to mechanical power and vice versa

[SOURCE: ISO 6469-3:2021, 3.13]



### 3.1.7

#### **electric power source**

system that provides electric energy

Note 1 to entry: The electric power source can also be the power source for reverse power.

EXAMPLE *Rechargeable energy storage system (RESS)* (3.1.19), fuel cell system, photovoltaic system, motor/generator, *EV charging station* (3.2.6).

[SOURCE: ISO 6469-3:2021, 3.37, modified — Note 1 to entry added, EV charging station added in Example.]

### 3.1.8

#### **electric shock**

physiological effect resulting from an electric current through a human body or animal body

[SOURCE: IEC 60050-195:2021, 195-01-04, modified — “animal body” replaces “livestock”.]

### 3.1.9

#### **exposed conductive part**

*conductive part* (3.1.2) of equipment which can be touched and which is not normally live, but which can become live when *basic insulation* (3.1.1) fails

[SOURCE: IEC 60050-442:1998, 442-01-21, modified — “equipment” replaces “electric equipment” and Note 1 to entry deleted.]

### 3.1.10

#### **external electric circuit**

electric circuit external to the vehicle which exchanges energy with the vehicle

Note 1 to entry: The external electric circuit includes a *conductively connected external electric circuit* (3.2.5) and magnetically coupled external electric circuit.

### 3.1.11

#### **hazard**

potential source of harm

[SOURCE: ISO/IEC Guide 51:2014, 3.2]

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### 3.1.12

#### **insulation resistance**

resistance between *live parts* (3.1.14) of an electric circuit and the *electric chassis* (3.1.5) as well as other electric circuits which are insulated from this electric circuit

Note 1 to entry: In UN R100, the equivalent term for “insulation resistance” is “isolation resistance”.

[SOURCE: ISO 6469-3:2021, 3.23, modified — Equivalent term “isolation resistance” deleted, note 1 to entry added.]

### 3.1.13

#### **live conductor**

conductor which is energized in normal operation and capable of contributing to the transmission or distribution of electric energy

Note 1 to entry: Live conductors include line conductors (including DC+ conductors and DC– conductors) and neutral conductors.

### 3.1.14

#### **live part**

conductor or *conductive part* (3.1.2) intended to be energized in normal use, but by convention not the *electric chassis* (3.1.5)

[SOURCE: ISO 6469-3:2021, 3.25]

**3.1.15**

**overcurrent protection**

protection intended to operate when the current is in excess of a predetermined value

Note 1 to entry: A charge control function is not considered an overcurrent protection.

[SOURCE: IEC 60050-448:1995, 448-14-26, modified — Note 1 to entry added.]

**3.1.16**

**overload protection**

protection intended to operate in the event of overload on the protected section

[SOURCE: IEC 60050-448:1995, 448-14-31]

**3.1.17**

**protective conductor**

conductor provided for purposes of safety, for example, protection against *electric shock* ([3.1.8](#))

EXAMPLE Protective bonding conductor, protective earthing conductor and an earthing conductor when used for protection against electric shock.

[SOURCE: IEC 60050-581:2008, 581-27-26]

**3.1.18**

**rated current**

current assigned by the manufacturer for a specified operating condition

[SOURCE: IEC 60050-442:1998, 442-01-02, modified — The phrase “of an accessory” was removed from end of definition.]

**3.1.19**

**rechargeable energy storage system**

**RESS**

rechargeable system that stores energy for delivery of electric energy for the *electric drive* ([3.1.6](#))

EXAMPLE Battery, capacitor, flywheel.

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

**3.1.20**

**reverse power transfer**

supply of electric power from an *electrically propelled vehicle (EV)* ([3.1.4](#)) using the *EV plug* ([3.2.7](#)), the *vehicle inlet* ([3.2.17](#)) or on-board *standard socket-outlet* ([3.2.15](#)) conductively connected to a *vehicle power supply circuit* ([3.2.18](#)) to an *external electric circuit* ([3.1.10](#))

Note 1 to entry: Unintended power transfer flow from an EV to an external electric circuit is not considered as a reverse power transfer. (See [Clause 8](#).)

**3.1.21**

**simple separation**

separation between electric circuits or between an electric circuit and local earth by means of *basic insulation* ([3.1.1](#))

[SOURCE: IEC 60050-195:2021, 195-06-30]

**3.1.22**

**supply network**

any source of electric energy

EXAMPLE Mains or electric grid, distributed energy resources (DER), battery bank, PV installation generator.

[SOURCE: IEC 61851-1:2017, 3.7.1, modified — The information in the example was previously part of the definition.]