

# INTERNATIONAL STANDARD

## NORME INTERNATIONALE

**Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements**

**Fiches, socles de prise de courant, prises mobiles et socles de connecteur de véhicule – Charge conductive des véhicules électriques – Partie 1: Règles générales**



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IEC Central Office  
3, rue de Varembe  
CH-1211 Geneva 20  
Switzerland  
Email: [inmail@iec.ch](mailto:inmail@iec.ch)  
Web: [www.iec.ch](http://www.iec.ch)

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**Fiches, socles de prise de courant, prises mobiles et socles de connecteur de véhicule – Charge conductive des véhicules électriques – Partie 1: Règles générales**

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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## PLUGS, SOCKET-OUTLETS, VEHICLE CONNECTORS AND VEHICLE INLETS – CONDUCTIVE CHARGING OF ELECTRIC VEHICLES –

### Part 1: General requirements

#### FOREWORD

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International Standard IEC 62196-1 has been prepared by IEC subcommittee 23H: Industrial plugs and socket-outlets, of IEC technical committee 23: Electrical accessories.

This second edition cancels and replaces the first edition published in 2003 and constitutes a technical revision. The main changes from the previous edition are as follows:

- increase in d.c.voltage for accessories;
- permitted use of accessories with vehicles complying with Subclause 7.2.3.1 of 61851-1:2010;
- minor changes to definitions;
- additional voltage and current ratings (Clause 5) and test values (Clause 12, 13,) ;
- removal of markings to identify generic types of vehicle inlets and connectors;
- addition of a "high power d.c." to the type of accessories covered by the Standard;

- modification of the description of “universal” and “basic” interfaces based on changes to 61851-1:2010;
- simplification of the marking requirements (Clause 8);
- additional requirements for accessories with shutters;
- division of Clause 9 to create Clauses 9 and 11;
- Clause 9: specific requirements for inlet, plug and socket–outlet;
- Clause 11: EVSE (Electric Vehicle Supply Equipment) requirements: the basic generic requirements for charging stations;
- renumbering of annexes.

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

FDIS	Report on voting
23H/266/FDIS	23H/269/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.

A list of all the parts in the IEC 62196 series, under the general title *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles*, can be found on the IEC website.

In this standard, the following print types are used:

- *compliance statements: in italic type.*

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site 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.



## INTRODUCTION

IEC 61851-1:2010 specifies Electric Vehicle Conductive Charging Equipment. This International Standard, referred to as IEC 62196 series in IEC 61851-1:2010, specifies the requirements for plugs, socket-outlets, vehicle connectors, vehicle inlets and cable assemblies as described in IEC 61851-1:2010. Some charging can be achieved by direct connection from an electric vehicle to common mains socket-outlets. Some modes of charging require a dedicated supply and charging equipment incorporating control and communication circuits. This standard covers the mechanical, electrical and performance requirements for dedicated plugs, socket outlets, vehicle connectors and vehicle inlets for interfacing between such dedicated charging equipment and the electric vehicle.

This standard may be divided into several parts as necessary, as follows:

- Part 1: General requirements, comprising clauses of a general character.

Subsequent parts: Particular requirements dealing with particular types of accessories. The clauses of these particular requirements supplement or modify the corresponding clauses in Part 1. Where the text of subsequent parts indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of Part 1, these changes are made to the relevant text of Part 1, which then becomes part of the standard. Where no change is necessary, the words "This clause of Part 1 is applicable" are used.

- Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories.
- Part 3: Dimensional compatibility and interchangeability requirements for pin and contact-tube accessories for dedicated d.c. charging or for combined a.c./d.c. charging (under consideration)

<https://standards.iteh.org/standards/sls/0124-b665-43e8-a36e-b409701c7999/iec-62196-1-2011>

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# PLUGS, SOCKET-OUTLETS, VEHICLE CONNECTORS AND VEHICLE INLETS – CONDUCTIVE CHARGING OF ELECTRIC VEHICLES –

## Part 1: General requirements

### 1 Scope

This part of IEC 62196 is applicable to plugs, socket-outlets, connectors, inlets and cable assemblies for electric vehicles (EV), herein referred to as “accessories”, intended for use in conductive charging systems which incorporate control means, with a rated operating voltage not exceeding

- 690 V a.c. 50 Hz – 60 Hz, at a rated current not exceeding 250 A,
- 1 500 V d.c. at a rated current not exceeding 400 A.

These accessories and cable assemblies are intended to be used for circuits specified in IEC 61851-1:2010 which operate at different voltages and frequencies and which may include ELV and communication signals.

The accessories covered by this standard are intended only to be used with vehicles that comply with the requirements of 7.2.3.1 of IEC 61851-1:2010.

These accessories and cable assemblies are to be used in an ambient temperature of between –30 °C and +50 °C.

NOTE In some countries, other requirements may apply.

These accessories are intended to be connected only to cables with copper or copper-alloy conductors.

The accessories covered by this standard are for use in certain modes of charging EVs. These modes are defined in IEC 61851-1:2010. These definitions and a description of the types of connection (cases A, B and C), also described in IEC 61851-1:2010, are reproduced herein as Annex A.

NOTE In the following country, Mode 1 will not be allowed: UK.

This standard does not apply to those standardised accessories used in charging systems where the use of such accessories constructed to the requirements of other standards is permitted (e.g. in mode 1 and mode 2). Such standardized accessories may be used for those situations (mode and case) identified in IEC 61851-1:2010.

This standard can be used as a guide for accessories with a lesser number of contacts and lower ratings for use with light duty vehicles.

### 2 Normative references

The following referenced documents are indispensable for the application 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 60112:2003, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*  
Amendment 1 (2009)<sup>1</sup>

IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60228:2004, *Conductors of insulated cables*

IEC 60245-4:1994, *Rubber insulated cables of rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*  
Amendment 1 (1997)  
Amendment 2 (2003)<sup>2</sup>

IEC 60269-1:2006, *Low-voltage fuses – Part 1: General requirements*  
Amendment 1 (2009)<sup>3</sup>

IEC 60269-2:2010, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorised persons (fuses mainly for industrial application) – Examples of standardized systems of fuses A to J*

IEC 60309-4, *Plugs, socket-outlets and couplers for industrial purposes – Part 4: Switched socket-outlets and connectors with or without interlock*

IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*  
Amendment 1 (1999)<sup>4</sup>

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

IEC 60664-3:2003, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coating, potting or moulding for protection against pollution*

IEC 60695-2-11:2004, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods – Glow-wire flammability test method for end-products*

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

IEC 60947-1, *Low-voltage switchgear and controlgear – Part 1: General rules*

IEC 60999 -1:1999, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for conductors from 0,2 mm<sup>2</sup> up to 35 mm<sup>2</sup> (included)*

IEC 60999 -2:2003, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 2: Particular requirements for clamping units for conductors above 35 mm<sup>2</sup> up to 300 mm<sup>2</sup> (included)*

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<sup>1</sup> There exists a consolidated edition (2009) that includes IEC 60112 (1993) and its Amendment 1 (2009).

<sup>2</sup> There exists a consolidated edition (2004) that includes IEC 60245-4 (1994) and its Amendments 1 (1997) and 2 (2003).

<sup>3</sup> There exists a consolidated edition (2009) that includes IEC 60269-1 (2006) and its Amendment 1 (2009).

<sup>4</sup> There exists a consolidated edition (2001) that includes IEC 60529 (1989) and its Amendment 1 (1999).

IEC 61851-1:2010, *Electric vehicle conductive charging system – Part 1: General requirement*

ISO 1456, *Metallic and other inorganic coatings – Electrodeposited coatings of nickel, nickel plus chromium, copper plus nickel and of copper plus nickel plus chromium*

ISO 2081, *Metallic and other inorganic coatings – Electroplated coatings of zinc with supplementary treatments on iron or steel*

ISO 2093, *Electroplated coatings of tin – Specification and test methods*

### 3 Terms and definitions

For the purposes of this document, the terms and definitions in IEC 61851-1:2010 as well as the following apply.

NOTE 1 Where the terms voltage and current are used, they imply r.m.s. values, unless otherwise specified.

NOTE 2 Throughout this standard, the word «earthing» is used for «protective earthing» unless otherwise specified.

NOTE 3 The terms «basic interface» and «universal interface» refer to terms described in IEC 61851-1.

NOTE 4 The application of accessories is shown in Figure 1.

#### 3.1 cable assembly

piece of equipment which is used to establish the connection between the electric vehicle and the electric vehicle supply equipment (EVSE). It may be either fixed to and included in one of these devices, or detachable. It includes the flexible cable, the vehicle connector and/or plug that are required for proper connection

NOTE A cable assembly may include one or more cables, with or without a fixed jacket, which may be in a flexible tube, conduit or wire way.

#### 3.2 cable management system

a device which is intended to protect a cable assembly from mechanical damage and/or to facilitate its handling

NOTE A cable suspension device is an example of cable management system.

#### 3.3 cap

a part separated or attached, which may be used to provide the degree of protection of a plug or vehicle inlet, when it is not engaged with a socket-outlet or connector

#### 3.4 clamping unit

the part of a terminal necessary for the clamping and the electrical connection of the conductor

#### 3.5 compatibility, compatible

the ability of accessories to join together with the complementary accessories they are intended to be used with, and be functional

NOTE Non-compatible accessories may physically join together, but not be functional.

**3.6****conditional short-circuit current**

the prospective current that an accessory, protected by a specified short-circuit protective device, can withstand satisfactorily for the total operating time of that device under specified conditions of use and behaviour

NOTE This definition differs from IEC 60050-441 definition 17-20 by broadening the concept of current-limiting device into a short-circuit protective device, the function of which is not only to limit the current.

**3.7****connection**

a single conductive path

**3.8****cover**

a means providing the degree of protection of an accessory when it is not engaged with a socket-outlet or vehicle connector. It can be used as the retaining means or a part of the retaining means

NOTE Caps, lids, shutters and similar devices can perform the function of a cover.

**3.9****domestic**

intended for household and similar purposes, up to a maximum current rating of 30 to 32 A a.c.

**3.10****double insulation**

insulation comprising both basic insulation and supplementary insulation

**3.11****electric vehicle  
EV**

any vehicle propelled by an electric motor drawing current from a rechargeable storage battery or from other portable energy storage devices (rechargeable using energy from a source off the vehicle such as residential or public electric service), which is manufactured primarily for use on public streets, roads or highways

**3.12****EV supply equipment  
EVSE**

conductors, including the phase, neutral and protective earth conductors, the EV couplers, attachment plugs, and all other accessories, devices, power outlets or apparatuses installed specifically for the purpose of delivering energy from the premises wiring to the EV and allowing communication between them if required

**3.13****in-cable control box**

a device which is incorporated in the cable assembly and which performs control functions

NOTE The location of the in-cable control box is defined in IEC 61851-1:2010.

**3.14****insulation voltage**

the voltage assigned to the accessory by the manufacturer and to which dielectric tests, clearances and creepage distances are referred

**3.15****interchangeability, interchangeable**

ability of an accessory to replace another, without any modification

NOTE Interchangeable accessories generally have similar outer dimensions, fixing centers, etc.

**3.16  
interlock**

a device, either electrical or mechanical, which prevents the contacts of a socket-outlet/vehicle connector from becoming live before it is in proper engagement with a plug/vehicle inlet, and which either prevents the plug/inlet from being withdrawn while its contacts are live or makes the contacts dead before separation

**3.17  
lid**

a means to ensure the degree of protection on a socket-outlet or a vehicle connector

NOTE A lid is generally hinged.

**3.18  
locking mechanism**

a means to allow engagement of a device intended to reduce the likelihood of tampering with, or an unauthorised removal of, the accessories

**3.19  
non-rewireable accessory**

an accessory so constructed that the cable or wiring cannot be separated from the accessory without making it permanently useless

NOTE A plug which is integrally moulded to the cable is an example of non-rewireable accessory.

**3.20  
plug and socket-outlet**

a means enabling the connection at will of a flexible cable to fixed wiring. It consists of two parts: a socket-outlet and a plug

**3.20.1  
plug**

the part of a plug and a socket-outlet integral with or intended to be attached to one flexible cable connected to the electric vehicle or to a vehicle connector. It may include mechanical, electrical or electronic components and circuitry, which perform control functions

**3.20.2  
socket-outlet**

the part of a plug and a socket-outlet intended to be installed with the fixed wiring or incorporated in equipment

**3.21  
rated current(s)**

the current assigned to the accessory by the manufacturer

**3.22  
rated operating voltage**

the nominal voltage of the supply(ies) for which the pole of the accessory is intended to be used

**3.23  
reinforced insulation**

an improved basic insulation with such mechanical and electrical qualities that it provides the same degree of protection against electric shock as double insulation

### 3.24

#### **retaining means, retaining device (latch)**

a mechanical arrangement which holds a plug or vehicle connector in position when it is in proper engagement, and prevents its unintentional withdrawal

### 3.25

#### **rewireable accessory**

an accessory so constructed that the cable or wiring can be replaced. It can be either a user-serviceable accessory or a field-serviceable accessory

#### 3.25.1

##### **user-serviceable accessory**

an accessory so constructed that it can be rewired, or parts can be replaced, using commonly available tools and without having to replace individual parts of the accessory

NOTE An ordinary plug, which can be disassembled and wired using a common screwdriver, is an example of user-serviceable accessory.

#### 3.25.2

##### **field-serviceable accessory**

an accessory so constructed that it can only be rewired, repaired or replaced by manufacturer's authorised personnel or skilled person according to national regulation

### 3.26

#### **terminal**

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

#### 3.26.1

##### **pillar terminal**

a terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws. The clamping pressure may be applied directly by the shank of the screw or through an intermediate clamping member to which pressure is applied by the shank of the screw

NOTE See Figure 9a.

#### 3.26.2

##### **screw terminal**

a terminal in which the conductor is clamped under the head of the screw. The clamping pressure may be applied directly by the head of the screw or through an intermediate part, such as a washer, clamping plate or anti-spread device

NOTE See Figures 9b and 9c.

#### 3.26.3

##### **stud terminal**

a terminal in which the conductor is clamped under a nut. The clamping pressure may be applied directly by a suitably shaped nut or through an intermediate part, such as a washer, clamping plate or anti-spread device

NOTE See Figure 9d.

#### 3.26.4

##### **saddle terminal**

a terminal in which the conductor is clamped under a saddle by means of two or more screws or nuts

NOTE See Figure 9e.

**3.26.5****lug terminal**

a screw terminal or a stud terminal, designed for clamping a cable lug or bar by means of a screw or nut

NOTE See Figure 9f.

**3.26.6****mantle terminal**

a terminal in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut. The conductor is clamped against the base of the slot by a suitably shaped washer under the nut, by a central peg if the nut is a cap nut, or by equally effective means for transmitting the pressure from the nut to the conductor within the slot

NOTE See Figure 9g.

**3.27****vehicle coupler****EV coupler**

a means enabling the connection at will of a flexible cable to an electric vehicle. It consists of two parts: a vehicle connector and a vehicle inlet

**3.27.1****connector****vehicle connector****EV connector**

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

**3.27.2****vehicle inlet****EV inlet**

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

**4 General****4.1 General requirements**

Accessories shall be so designed and constructed that in normal use their performance is reliable and minimises the risk of danger to the user or surroundings.

*Compliance is checked by meeting all of the relevant requirements and tests specified.*

Accessories shall be so designed and constructed that it is not possible to make a cord extension set (see IEC 61851-1:2010). The plug and the vehicle connector shall not be compatible.

*Compliance is checked by a manual test.*