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Responsible committee: PEL/23/4 Protected type plugs and sockets

Interested committees:

Title: Draft BS EN 62196-1 Ed. 5.0. Plugs, socket-outlets, vehicle connectors and vehicle inlets - Conductive charging of electric vehicles -

Part 1: General requirements

Please notify the secretary if you are aware of any keywords that might assist in classifying or identifying the standard or if the content of this standard

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- ii) affects other national standard(s)
- iii) requires additional national guidance or information

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



23H/534/CD

COMMITTEE DRAFT (CD)

PROJECT NUMBER:

IEC 62196-1 ED5

DATE OF CIRCULATION:

2023-06-23

CLOSING DATE FOR COMMENTS:

2023-09-15

SUPERSEDES DOCUMENTS:

23H/530/RR

IEC SC 23H : PLUGS, SOCKET-OUTLETS AND COUPLERS FOR INDUSTRIAL AND SIMILAR APPLICATIONS, AND FOR ELECTRIC VEHICLES

SECRETARIAT:

France

SECRETARY:

Mrs Anne Le Guennec

OF INTEREST TO THE FOLLOWING COMMITTEES:

TC 69

PROPOSED HORIZONTAL STANDARD:

☐

Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☒ SAFETY

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Recipients of this document are invited to submit, with their comments, notification of any local regulations or technical reasons that may exist and should be considered should this proposal proceed, recognizing that failure to address such requirements could result in the need for new or existing "In Some Countries" clauses. (SEE [AC/22/2007](#) OR [NEW GUIDANCE DOC](#)).

TITLE:

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

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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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IEC 62196-1 has been prepared by subcommittee 23H: Plugs, socket-outlets and couplers for industrial and similar applications, and for electric vehicles, of IEC technical committee 23: Electrical accessories. It is an International Standard.

This fifth edition cancels and replaces the fourth edition published in 2022. This edition constitutes a technical revision.

Sec note: The following list of changes will be subject to change

This edition includes the following significant technical changes with respect to the previous edition:

- a) addition of new tests for latching devices;

The text of this International Standard is based on the following documents:

Draft	Report on voting
23H/499/FDIS	23H/503/RVD

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

The language used for the development of this International Standard is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

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

Subsequent parts of IEC 62196 deal with the requirements of particular types of accessories. The clauses of those particular requirements supplement or modify the corresponding clauses in this document.

In this document, the following print types are used:

- requirements proper: in roman type;
- *test specifications: in italic type*;
- notes: in smaller roman type.

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

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

IMPORTANT – The "colour inside" logo on the cover page of this document 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

IEC 61851 (all parts) specifies requirements for electric vehicle (EV) conductive charging systems.

IEC 62196 (all parts) specifies the requirements for plugs, socket-outlets, vehicle connectors, vehicle inlets and cable assemblies as described in the IEC 61851 series.

Some charging can be achieved by direct connection from an electric vehicle to standard socket-outlets connected to a supply network (mains or electrical grid).

Some modes of charging require a dedicated supply and charging equipment incorporating control and communication circuits.

IEC 62196 (all parts) covers the mechanical, electrical and performance requirements for plugs, socket-outlets, vehicle connectors and vehicle inlets for the connection between the EV supply equipment and the electric vehicle.

The IEC 62196 series consists of the following parts:

- Part 1: General requirements, comprising clauses of a general character.
- Part 2: Dimensional compatibility and interchangeability requirements for AC pin and contact-tube accessories.
- Part 3: Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers.
- Part 3-1: Vehicle connector, vehicle inlet and cable assembly intended to be used with a thermal management system for DC charging.
- Part 4¹: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube accessories for Class II or Class III applications.
- Part 6: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube couplers for applications using a system of protective electrical separation.

¹ Pending publication.

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 EV plugs, EV socket-outlets, vehicle connectors, vehicle inlets, herein referred to as "accessories", and to cable assemblies for electric vehicles (EV) intended for use in conductive charging systems which incorporate control means, with a rated operating voltage not exceeding:

- 690 V AC 50 Hz to 60 Hz, at a rated current not exceeding 250 A;
- 1 500 V DC at a rated current not exceeding 800 A.

These accessories and cable assemblies are intended to be installed by instructed persons (IEV 195-04-02) or skilled persons (IEV 195-04-01) only.

These accessories and cable assemblies are intended to be used for circuits specified in IEC 61851 (all parts), which operate at different voltages and frequencies, and which can include extra-low voltage and communication signals.

These accessories and cable assemblies are anticipated to be used at an ambient temperature between $-30\text{ }^{\circ}\text{C}$ and $+40\text{ }^{\circ}\text{C}$.

NOTE 1 In some countries, other requirements can apply.

NOTE 2 In the following country, $-35\text{ }^{\circ}\text{C}$ applies: SE.

NOTE 3 The manufacturer can enlarge the temperature range on the condition that the specified range information is provided.

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

The accessories covered by this document are intended for use in electric vehicle supply equipment in accordance with IEC 61851 (all parts).

This document does not apply to standard plug and socket-outlets used for mode 1 and mode 2 according to IEC 61851-1:2017, 6.2.

NOTE 4 In the following countries, mode 1 is not allowed: UK, US, CA, SG.

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.

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

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

- 327 IEC 60112, *Method for the determination of the proof and the comparative tracking indices of*
328 *solid insulating materials*
- 329 IEC 60227 (all parts), *Polyvinyl chloride insulated cables of rated voltages up to and including*
330 *450/750 V*
- 331 IEC 60228:2004, *Conductors of insulated cables*
- 332 IEC 60245-4, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4:*
333 *Cords and flexible cables*
- 334 IEC 60269-1, *Low-voltage fuses – Part 1: General requirements*
- 335 IEC 60269-2, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by*
336 *authorized persons (fuses mainly for industrial application) – Examples of standardized systems*
337 *of fuses A to K*
- 338 IEC 60309-4:2021, *Plugs, fixed or portable socket-outlets and appliance inlets for industrial*
339 *purposes – Part 4: Switched socket-outlets with or without interlock*
- 340 IEC 60529:1989, *Degrees of protection provided by enclosures (IP code)*
341 IEC 60529:1989/AMD1:1999
342 IEC 60529:1989/AMD2:2013
- 343 IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems –*
344 *Part 1: Principles, requirements and tests*
- 345 IEC 60664-3, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of*
346 *coating, potting or moulding for protection against pollution*
- 347 IEC 60695-2-11, *Fire hazard testing – Part 2-11: Glowing/hot-wire based test methods –*
348 *Glow-wire flammability test method for end-products (GWEPT)*
- 349 IEC 60695-10-2, *Fire hazard testing – Part 10-2: Abnormal heat – Ball pressure test method*
- 350 IEC 60947-3:2020, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors,*
351 *switch-disconnectors and fuse-combination units*
- 352 IEC 60947-5-1, *Low-voltage switchgear and controlgear – Part 5-1: Control circuit devices and*
353 *switching elements – Electromechanical control circuit devices*
- 354 IEC 61032:1997, *Protection of persons and equipment by enclosures – Probes for verification*
- 355 IEC 61058-1:2016, *Switches for appliances – Part 1: General requirements*
- 356 IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*
- 357 IEC 61851-23:—², *Electric vehicle conductive charging system – Part 23: DC electric vehicle*
358 *supply equipment*

² Second edition under preparation. Stage at the time of publication: IEC PRVC 61851-23:2022

IEC 62196-2:2022, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 2: Dimensional compatibility requirements for AC pin and contact-tube accessories*

IEC 62196-3:2022, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3: Dimensional compatibility requirements for DC and AC/DC pin and contact-tube vehicle couplers*

IEC Guide 117:2010. *Electrotechnical equipment – Temperatures of touchable hot surfaces*

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*

ISO 4521:2008, *Metallic and other inorganic coatings – Electrodeposited silver and silver alloy coatings for engineering purposes – Specification and test methods*

3 Terms and definitions

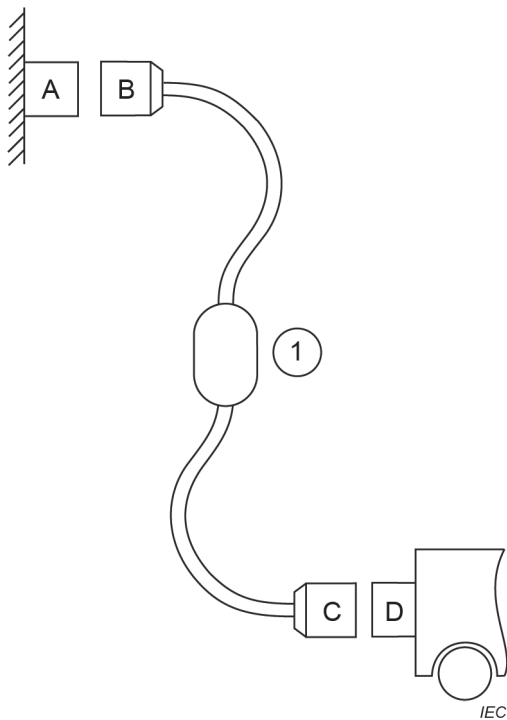
For the purposes of this document, the following terms and definitions apply.

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

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

NOTE 1 Where the terms "voltage" and "current" are used, they imply root mean square (RMS) values, unless otherwise specified.

NOTE 2 The application of accessories is shown in Figure 1.



- Key**
- 1 In-cable control and protective device (IC-CPD)
 - A Standard socket-outlet or EV socket-outlet
 - B Standard plug or EV plug
 - C Vehicle connector
 - D Vehicle inlet

Figure 1 – Diagram showing the use of the accessories

3.1
accessory
EV plug, EV socket-outlet, vehicle connector or vehicle inlet, without or without cable forming a cable assembly, for use in conductive charging systems for electric vehicles

3.1.1
auxiliary power
electrical energy provision from an external source used for purposes other than charging of the electric vehicle propulsion battery

Note 1 to entry: In French, the resulting assembly when a plug is inserted into a socket-outlet is called "prise de courant".

3.2
cable assembly
assembly consisting of flexible cable or cord fitted with a standard plug or EV plug and/or a vehicle connector, that is used to establish the connection between the EV 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 of 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.

[SOURCE: IEC 61851-1:2017, 3.5.2, modified – "plug" has been replaced with "standard plug or EV plug".]

3.3**cap**

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

3.4**clamping unit**

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

3.5**compatibility****compatible**

ability of accessories to join together and be functional

Note 1 to entry: Non-compatible accessories can physically join together, but not be functional.

3.6**conditional short-circuit current**

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

[SOURCE: IEC 60050-441:1984, 441-17-20, modified – The concept of current-limiting device has been broadened into a short-circuit protective device, the function of which is not only to limit the current.]

3.7**conductive part**

part that can carry electric current

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

3.8**connection**

single conductive path

3.9**cord extension set**

assembly consisting of a flexible cable or cord fitted with an EV plug that is intended to mate with a vehicle connector as covered by the IEC 62196 series

3.10**control circuit device**

electrical device intended for the controlling, signalling, interlocking, etc. of switchgear and controlgear

Note 1 to entry: See IEC 60947-1:2020, 3.4.16.

[SOURCE: IEC 60309-4:2021, 3.406]

3.11**cover**

means providing the degree of protection of an accessory when it is not engaged with a standard or EV socket-outlet or vehicle connector

Note 1 to entry: A cover can be used as the retaining means or as part of the retaining means.

Note 2 to entry: Caps, lids, shutters and similar devices can perform the function of a cover.

3.12**double insulation**

insulation comprising both basic insulation and supplementary insulation

[SOURCE IEC 60050-195:2021, 195-06-08]

3.13**electric vehicle****EV****(electric road vehicle)**

any vehicle propelled by an electric motor drawing current from an RESS intended primarily for use on public roads

[SOURCE: IEC 61851-1:2017, 3.4.1, modified – The note has been omitted.]

3.14**EV plug**

accessory connected to the end of the cable assembly and intended to mate with the EV socket-outlet at the output of equipment

Note 1 to entry: An EV plug is not intended to connect directly to standard socket-outlets provided in the building installation.

3.15**EV socket-outlet**

accessory located at the output of infrastructure equipment and intended to be mated with an EV plug in order to connect a cable assembly

Note 1 to entry: An EV socket-outlet is not intended to be installed as a standard socket-outlet in building installations and is not intended to connect to standard plugs.

3.16**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 for the purpose of charging

[SOURCE: IEC 61851-1:2017, 3.1.1, modified – The examples have been omitted.]

3.17**extra-low voltage****ELV**

voltage not exceeding the relevant voltage limit as specified in IEC 61140

3.18**field-serviceable accessory**

accessory constructed so that it can only be rewired, repaired or replaced by the manufacturer's authorized personnel or a skilled person in accordance with national regulations

3.19**hazardous-live-part**

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

[SOURCE: IEC 60050-195:2021, 195-06-05, modified – The Note to entry has been omitted.]

3.20**IC-CPD**

Mode 2 cable assembly that complies with IEC 62752

[SOURCE: IEC 61851-1:2017, 3.5.6]

3.21**insulated end cap**

part made of insulating material, located at the tip of a contact, ensuring a protection against access to hazardous-live-parts

3.22**insulation**

all the materials and parts used to insulate conductive elements of a device, or a set of properties which characterize the ability of an insulation to provide its function

[SOURCE: IEC 60050-151:2001, 151-15-41 and 151-15-42, modified – both definitions are combined together into one definition and joined by "or a".]

3.23**interlock**

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

3.24**isolation monitor****IM**

electrical circuit to monitor the vehicle to EV supply equipment earth isolation function

3.25**latching device**

part of the interlock mechanism provided to hold an EV plug in the EV socket-outlet or to hold a vehicle connector in the vehicle inlet and to prevent its intentional or unintentional withdrawal

EXAMPLE See Standard Sheets 2-II and 2-IIId in IEC 62196-2:2022 and 3-IIId in IEC 62196-3:2022.

3.26**lid**

means to ensure the degree of protection on an accessory

Note 1 to entry: A lid is generally hinged.

3.27**live part**

conductive part intended to be energized under normal operating conditions, including the neutral conductor and mid-point conductor, but excluding the PEN conductor, PEM conductor and PEL conductor

[SOURCE: IEC 60050-195:2021, 195-02-19]

3.28**locking mechanism**

means intended to reduce the likelihood of tampering with, or an unauthorized removal of, the accessories

EXAMPLE A provision for padlocking.

3.29**lug terminal**

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

SEE: Figure 2.

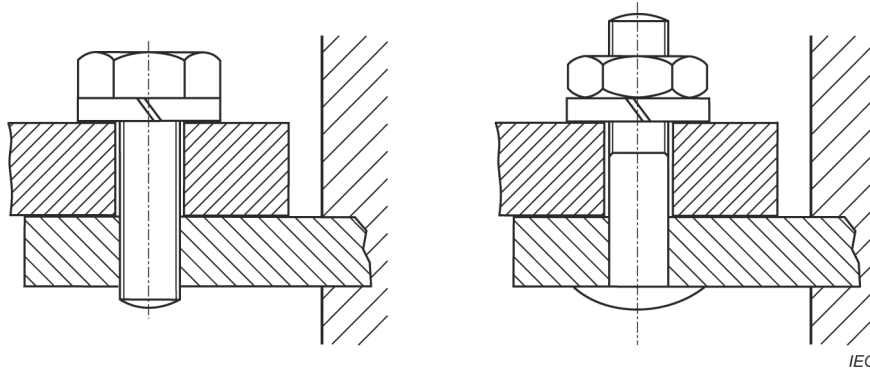


Figure 2 – Lug terminals

3.30

mantle terminal

terminal in which the conductor is clamped against the base of a slot in a threaded stud by means of a nut

Note 1 to entry: 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.

SEE: Figure 3.

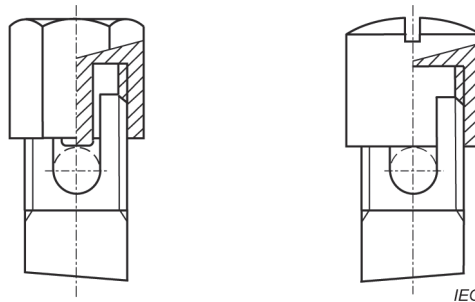


Figure 3 – Mantle terminals

3.31

maximum allowed pressure

maximum pressure assigned by the manufacturer to the thermal transport coolant liquid of a cable assembly

3.31.1

mechanical switching device

switching device designed to close and open one or more electric circuits by means of separable contacts

[SOURCE: IEC 60050-441:1984, 441-14-02, modified – The note has been removed.]

3.32

non-rewirable accessory

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

EXAMPLE An EV plug which is integrally moulded to the cable is an example of non-rewirable accessory.

[SOURCE: IEC 60050-581:2008, 581-26-33, modified – "connector" has been replaced with "accessory" and "wiring" has been added to the definition; an example has also been added.]

3.33**pillar terminal**

terminal in which the conductor is inserted into a hole or cavity, where it is clamped under the shank of the screw or screws

SEE: Figure 4.

Note 1 to entry: The clamping pressure can 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.

[SOURCE: IEC 60050-442:1998, 442-06-22, modified – In the definition "screw-type terminal" has been replaced with "terminal" and "or screws" has been added; in Note 1, "part" has been replaced with "clamping member" and Figure 4 has been added.]

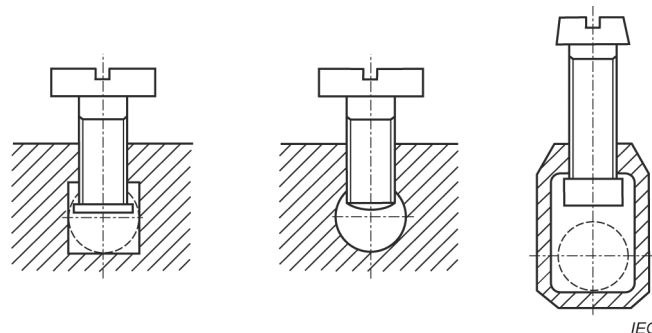


Figure 4 – Pillar terminals

3.34**pilot contact**

auxiliary electric contact for use in a control, signalling, monitoring or interlock function

Note 1 to entry: Pilot contact is not considered to be a pole.

[SOURCE: IEC 60309-1:2021, 3.25]

3.35**protective conductor**

conductor provided for purposes of safety, for example protection against electric shock

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

[SOURCE: IEC 60050-826:2004, 826-13-22, modified – The examples have been added and the note has been removed.]

3.36**protective earthing****protective grounding (US)**

earthing for purposes of electrical safety

[SOURCE: IEC 60050-195:2021, 195-01-11]

3.37**protective earthing conductor****PE conductor****protective grounding conductor (US)**

protective conductor provided for protective earthing

[SOURCE: IEC 60050-195:2021, 195-02-11]

3.38**rated current**

current assigned to the accessory by the manufacturer for a specified operating condition of an accessory

3.39**rated operating voltage**

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

3.40**rated pressure**

maximum pressure assigned by the manufacturer to the thermal transport coolant liquid of a cable assembly under normal and continuous operating conditions

3.40.1**reinforced insulation**

insulation that provides a degree of protection against electric shock equivalent to double insulation

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

[SOURCE IEC 60050-195:2021, 195-06-09]

3.41**retaining means**

device (e.g. mechanical or electromechanical) which holds an EV plug or vehicle connector in position when it is in proper engagement, and prevents its unintentional withdrawal

EXAMPLE See standard sheets in IEC 62196-2:2022 and in IEC 62196-3:2022.

3.42**rewirable accessory**

accessory so constructed that the supply flexible cable, cord or wiring can be replaced

[SOURCE: IEC 60050-442:1998, 442-01-17, modified – "wiring" has been added to the definition.]

3.43**saddle terminal**

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

SEE: Figure 5.

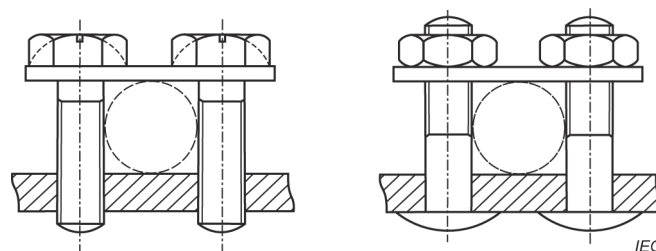


Figure 5 – Saddle terminals

3.44**safety extra-low voltage system****SELV system**

electric system in which the voltage cannot exceed the value of extra-low voltage:

- under normal conditions and
- under single fault conditions, including earth faults in other electric circuits

[SOURCE: IEC 60050-826:2004, 826-12-31, modified – The term "safety extra-low voltage system" has been added and the note omitted.]

3.45**screw terminal**

terminal in which the conductor is clamped under the head of the screw

SEE: Figure 6

Note 1 to entry: The clamping pressure can be applied directly by the head of the screw or through an intermediate part, such as a washer, clamping plate or anti-spread device.

[SOURCE: IEC 60050-442:1998, 442-06-08, modified – The second half of the definition has been included in Note 1 and Figure 6 has been added.]

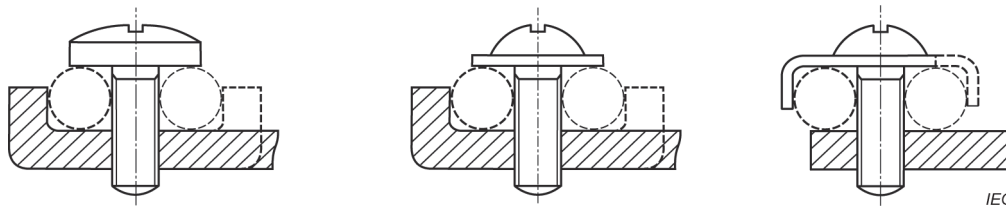


Figure 6 – Screw-type terminals

3.46**shutter**

movable part incorporated into an accessory arranged to automatically shield at least the live contacts when the accessory is withdrawn from the complementary accessory

3.47**standard plug and socket-outlet**

plug and socket-outlet which meets the requirements of any IEC and/or any national standard that provides interchangeability by standard sheets, excluding the specific EV accessories as defined in the IEC 62196 series

Note 1 to entry: IEC 60309-1, IEC 60309-2, IEC 60884-1 and IEC TR 60083 define standard plugs and socket-outlets.

[SOURCE: IEC 61851-1:2017, 3.5.11]

3.48**stud terminal**

terminal in which the conductor is clamped under a nut

SEE: Figure 7.

Note 1 to entry: The clamping pressure can be applied directly by a suitably shaped nut or through an intermediate part, such as a washer, clamping plate or anti-spread device.

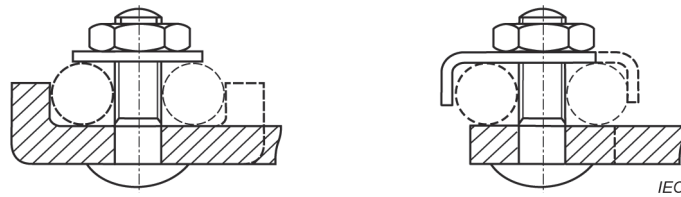


Figure 7 – Stud terminals

3.49

switching device

device designed to make or break the current in one or more electric circuits

[SOURCE: IEC 60050-441:1984, 441-14-01]

3.50

terminal

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

3.51

termination

part of an accessory to which a conductor is permanently attached

[SOURCE: IEC 60050-442:1998, 442-06-06]

3.52

thermal cut-out

temperature sensitive device which limits the temperature of an accessory, or of parts of it, during operation by automatically opening the circuit or by reducing the current, and which is so constructed that its settings cannot be altered by the user

3.53

thermal exchange

method for cooling and dissipating thermal energy from the thermal transport

3.54

thermal exchange device

means for cooling of dissipating thermal energy form the thermal transport

3.55

thermal management system

combination of thermal sensing, thermal transport and thermal exchange in order to regulate temperature

3.56

thermal sensing

method for obtaining temperature data of accessories, cable assemblies, or parts thereof

3.57

thermal sensing device

means for providing temperature data of accessories, cable assemblies or parts thereof

3.58

thermal transport

method of managing the heat dissipation of accessories, cable assemblies, or parts thereof, independent of changing the current

3.59**thermal transport device**

means of managing the heat dissipation of accessories, cable assemblies, or parts thereof, independent of changing the current

3.60**user**

party who will specify, purchase, use and/or operate the EV supply equipment, or someone acting on their behalf

[SOURCE: IEC 61439-1:2020, 3.11, modified – "assembly" has been replaced by "EV supply equipment".]

3.61**user-serviceable accessory**

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

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

3.62**vehicle connector****electric vehicle connector**

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

3.63**vehicle inlet****electric vehicle inlet**

part incorporated in, or fixed to, the electric vehicle

Note 1 to entry: The resulting assembly when a vehicle connector is inserted into a vehicle inlet is called a "vehicle coupler".

4 General**4.1 General requirements**

The accessories covered by this document shall only be used with EV supply equipment that complies with the requirements of IEC 61851-1:2017 and/or IEC 61851-23:—³.

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 the relevant requirements and tests specified.

Accessories shall be designed and constructed such that it is not possible for them to be used as a cord extension set. The EV plug and the vehicle connector shall not be compatible.

Compliance is checked by a manual test.

³ Second edition under preparation. Stage at the time of publication: IEC PRVC 61851-23:2022

4.2 Components

4.2.1 Ratings

A component shall be used in accordance with its rating established for the intended conditions of use.

Compliance is checked by inspection.

4.2.2 Mechanical assembly

Loosening of parts in an accessory as a result of vibration due to storage, handling and operation shall not result in a risk of fire, electric shock, injury to persons.

Compliance is checked by inspection.

4.2.3 Current-carrying parts of incorporated components

Any component uninsulated live part shall be so secured to the base or mounting surface, or otherwise insulated that the part does not turn or shift in position resulting in a reduction of creepage distances, clearances and distances below the minimum required values in Clause 28.

Compliance is checked by inspection.

4.2.4 Electrical connections

4.2.4.1 The requirements described in 4.2.4.2 to 4.2.4.4 apply to connections of internal wiring that are factory installed in the accessory.

Compliance is checked by inspection.

4.2.4.2 A splice or connection shall be mechanically secure and shall make electrical contact.

Compliance is checked by inspection.

4.2.4.3 A soldered connection is determined to be mechanically secure when the lead is:

- wrapped one full turn around a terminal; or
- bent at a right angle after being passed through an eyelet or opening, except on printed wiring boards where components are inserted or secured (as in a surface-mounted component) and wave- or lap-soldered; or
- twisted with other conductors, or
- an equivalent means shall be used.

Compliance is checked by inspection.

4.2.4.4 A splice shall be provided with insulation equivalent to that of the wires involved unless permanent clearance and creepage distances are maintained between the splice and other metal parts. Insulation over the splice is not prohibited from having:

- a splicing device such as a pressure wire connector, having suitable voltage and temperature ratings,
- insulating tubing or sleeving used to cover a splice.

Compliance is checked by inspection.

4.3 General notes on tests

Tests according to this document are type tests. If a part of an accessory has previously passed tests for a given degree of severity, the relevant type tests shall not be repeated if the severity is not greater.

Unless otherwise specified, the samples shall be tested as delivered and under normal conditions of use, at an ambient temperature of $(20 \pm 5) ^\circ\text{C}$; the tests shall be made at rated frequency.

When the tests are carried out with conductors, they shall be copper or copper alloy and comply with IEC 60227 (all parts), IEC 60228:2004, Clause 3 (which provides a classification of conductors: solid (class 1), stranded (class 2), flexible (classes 5 and 6)), and IEC 60245-4.

Tests are grouped in test sequences A to J. Each sequence shall be performed in accordance with the test sequences indicated in Table 1 to Table 11 with new sets of samples for each sequence. On request of the manufacturer the same set of samples may be subjected to more than one of these test sequences.

Further, tests indicated as "to be checked by inspection" and not included in the test sequences shall be performed. These tests may use samples already used in tests mentioned in the test sequence tables.

The test sequence tables are intended to give an overview of applicable tests. However, the requirements are contained within the clauses of this document.

Table 1 – Test sequence A

Test sequence A No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	9	Dimensions and engagement	X	X	X	X
2	10	Protection against electric shock	X	X	X	X
3	12.2	Earthing test	X	X	X	X
4	13.1.9	Stranded Conductor Test	X	X	X	X
5	14.1.3	Actuator Force without latch	X	X	X	X
6	14.1.4	Actuator Force with latch	X	X	X	X
7	14.1.5	Actuator force with latch and retaining means, straight pull	X	X	X	X
8	14.1.6	Actuator force with latch and retaining means, 90 degree pull	X	X	X	X
9	14.1.7	Force on latch from retaining means	X	X	X	X
10	14.1.8	Force on connector switch	X	X	X	X
11	14.1.9	Proximity switch closure test	X	X	X	X
12	15	Resistance to aging for rubber and thermoplastic materials	X	X	X	X
13	16.9	Retaining means pull test	X	X	X	X

14	16.16	Insertion and withdrawal forces	X	X	X	X
15	20.3	Humidity Conditioning	X	X	X	X
16	21.2	Insulation resistance test	X	X	X	X
17	21.3	Dielectric strength test	X	X	X	X
18	8.7	Permanence of marking	X	X	X	X
19	24.1	Temperature rise test	X	X	X	X
20	24.2	Surface temperature test	X	X	X	X
21	25.3	Strain relief	X		X	
22	12.3	Short time test currents	X	X	X	X
23	26.2	Ball impact	X	X	X	X
24	26.3	Drop test	X		X	
25	26.4	Flexing Test	X		X	
26	26.5	Cable Gland	X	X	X	X
27	26.6	Shutters	X	X	X	X
28	26.7	Insulated end caps	X	X	X	X
29	27.1	Screws transmitting contact pressure	X	X	X	X
30	29.2	Mold Stress	X	X	X	X
31	29.3	Ball pressure	X	X	X	X
32	29.5	Glow Wire	X	X	X	X
33	30	Corrosion test	X	X	X	X
34	32.1	Immunity	X	X	X	X
35	32.2	Emissions	X	X	X	X
36	33	Vehicle Drive Over	X		X	

805

806

Table 2 – Test sequence B1

Test sequence B1 No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	22.2	Breaking capacity	X	X	X	X
2	23.2	Endurance with load	X	X	X	X

807

808

Table 3 – Test sequence B2

Test sequence B2 No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					

1	22.3	Breaking capacity	X	X	X	X
2	23.3	No load endurance	X	X	X	X

Table 4 – Test sequence C

Test sequence C No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	31	Conditional Short Circuit	X	X	X	X

Table 5 – Test sequence D

Test sequence D No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	34	Thermal Cycling	X	X	X	X

Table 6 – Test sequence E

Test sequence E No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	35	Humidity Cycling	X	X	X	X

Table 7 – Test sequence F

Test sequence F No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	36	Misalignment	X	X	X	X

Table 8 – Test sequence G

Test sequence G No. of samples: 3			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	37	Contact Endurance	X	X	X	X

Table 9 – Test sequence H

Test sequence H No. of samples: 3 sets of terminals			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	13.2.1	Terminal sizing	X	X	X	X
2	13.3	Mechanical Tests on Terminals	X	X	X	X

Table 10 – Test sequence I

Test sequence I No. of samples: 3 samples of the latching mechanism			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	14.1.10	Latching device force test	X	X	X	X

Table 11 – Test sequence J

Test sequence J No. of samples: 3 samples of contacts			EV Plug	EV Socket Outlet	Vehicle Connector	Vehicle Inlet
Order	Subclause					
1	16.7	Silver plating thickness test	X	X	X	X

5 Ratings

5.1 Preferred rated operating voltage ranges

The preferred rated operating voltage ranges are:

0 V	to	30 V (signal or control purposes only)
100 V AC	to	130 V AC
200 V AC	to	250 V AC
380 V AC	to	480 V AC
600 V AC	to	690 V AC
480 V DC		
600 V DC		
750 V DC		
1 000 V DC		
1 500 V DC		

5.2 Preferred rated currents

5.2.1 General

The preferred rated currents are:

5 A	
13 A	
16 A	to 20 A
30 A	to 32 A
60 A	to 63 A
70 A	
80 A	DC only
125 A	
200 A	DC only
250 A	
400 A	DC only
500 A	DC only
600 A	DC only
630 A	DC only
800 A	DC only

NOTE 1 In the following country, the branch circuit overcurrent protection device is based upon 125 % of the accessory rating: US.

NOTE 2 Throughout this document, reference to a 16 A to 20 A or 30 A to 32 A or 60 A to 63 A rating is made in accordance with national requirements.

5.2.2 Rated current for signal or control purposes

Rated current for signal or control purposes is 2 A.

5.2.3 Accessories not suitable for making and breaking an electrical circuit under load

An accessory rated 250 V AC or above shall be classified as not suitable for making and breaking an electrical circuit under load.

An accessory rated above 30 V DC shall be classified as not suitable for making and breaking an electrical circuit under load.

NOTE In the following country, "not suitable for making and breaking an electric circuit under load" is considered "disconnect use only": CA.

5.2.4 Accessories suitable for, or not suitable for, making and breaking an electrical circuit under load

An accessory, with a pilot circuit contact, may be classified as suitable for, or not suitable for, making and breaking an electrical circuit under load. See 7.4.

6 Connection between the power supply and the electric vehicle

6.1 Interfaces

This Clause 6 provides a description of the physical conductive electrical interface requirements between the vehicle and the power supply, which allows different types at the vehicle interface:

- a basic interface for mode 1, 2 and 3 charging only,
- DC interface,
- a combined interface.

6.2 Basic interface

The description and requirements for basic interface are given in IEC 62196-2.

6.3 DC interface

The description and requirements for DC configuration are given in IEC 62196-3.

6.4 Combined interface

The description and requirements for combined interface are given in IEC 62196-3.

7 Classification of accessories

7.1 According to purpose

- EV plugs;
- EV socket-outlets;
- vehicle connectors;
- vehicle inlets;
- cable assemblies.

7.2 According to the method of connecting the conductors

- rewirable accessories;
- non-rewirable accessories.

7.3 According to serviceability

- field-serviceable accessories;

- 877 – user-serviceable accessories;
- 878 – non-serviceable accessories.

879 **7.4 According to electrical operation**

- 880 – accessories suitable for making and breaking an electrical circuit under load;
- 881 – accessories not suitable for making and breaking an electrical circuit under load.

882 **7.5 According to interface**

883 Interface is specified in Clause 6:

- 884 – basic;
- 885 – DC;
- 886 – combined.

887 **7.6 According to locking facilities**

- 888 – non-lockable accessories;
- 889 – lockable accessories.

890 **7.7 According to interlock facilities**

- 891 – accessories without an interlock;
- 892 – accessories with an interlock
 - 893 • with latching device (mechanical interlock);
 - 894 • without latching device (electrical interlock).

895 **7.8 According to the presence of shutter(s)**

- 896 – accessories without shutter(s);
- 897 – accessories with shutter(s).

898 **8 Marking**

899 **8.1** Accessories shall be marked with:

- 900 – rated current(s) in amperes;
- 901 – rated maximum operating voltage(s) in volts;
- 902 – the relevant symbol for degree of protection;
- 903 – either the name or trademark of the manufacturer or of the responsible vendor;
- 904 – type reference, which may be a catalogue number.

905

906 NOTE For vehicle inlets, the IP degree of protection can be specified depending on the direction of exposure. The
907 specification is made according to the following scheme: IP [mating site] / [back side] e.g.: IP: 44 / 21. In this case,
908 both IP protection levels must be clearly described in the data sheet. E.g.: IP mating site = IP 44, IP back side = IP
909 21.

910 *Compliance is checked by inspection.*

911 **8.2** When symbols are used, they shall be as follows:

A		ampere
V		volt
Hz		hertz

		protective earth	IEC 60417-5019 (2006-08)
		alternating current	IEC 60417-5032 (2002-10)
		direct current	IEC 60417-5031 (2002-10)

912

913 *Compliance is checked by inspection.*

914 **8.3** For EV plugs and vehicle connectors, the marking for either the name or trademark of
915 the manufacturer or the responsible vendor and the type reference, catalogue number or
916 designation shall also be on the outside of the accessory, visible to the user.

917 **8.4** For all accessories, the marking for the maximum rated operating voltage range and rated
918 current shall be in a place which is visible before installation of the accessory. For EV socket-
919 outlets and vehicle inlets, the marking for either the name or trademark of the manufacturer or
920 the responsible vendor and the type reference, catalogue number or designation shall be in a
921 place which is visible before installation of the accessory. It need not be visible after installation.

922 *Compliance is checked by inspection.*923 **8.5** For rewirable accessories, the contacts shall be indicated by the following symbols:

- 924 – for three-pole, the symbols L1, L2, L3 and N for neutral, if any, and the symbol  for
925 protective earth;
- 926 – for two-pole, the symbols L1, L2 or N for neutral, if any, and the symbol  for protective
927 earth;
- 928 – CP for control pilot;
- 929 – PP for proximity contact;
- 930 – CS for connection switch;
- 931 – L1, L2, L3 (or 1, 2, 3), for high power AC;
- 932 – DC +, DC – for DC, if any;
- 933 – COM1, COM2 for communication contact, if any;
- 934 – CDE for clean data earth, if any;
- 935 – CC for connection confirm.

936 These symbols shall be placed close to the relevant terminals; they shall not be placed on
937 screws, removable washers, or other removable parts.

938 *Compliance is checked by inspection.*939 **8.6** For rewirable accessories, wiring instructions shall be provided.940 *Compliance is checked by inspection.*941 **8.7** Markings shall be easily legible.

942 *Compliance is checked by inspection, using normal or corrected vision, without additional*
943 *magnification.*

944 Marking shall be durable and indelible.

Compliance is checked by the following test to be performed after the humidity treatment of 20.3.

Laser marking directly on the product and marking made by moulding, pressing or engraving are considered to be durable and indelible and they are not subjected to this test.

The test is made by rubbing the marking for 15 s with a piece of cotton cloth soaked with water and again for 15 s with a piece of cotton cloth soaked with *n*-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3).

NOTE *n*-hexane 95 % (Chemical Abstracts Service Registry Number, CAS RN, 110-54-3) is available from a variety of chemical suppliers as a high-pressure liquid chromatography (HPLC) solvent.

When using the liquid specified for the test, precautions as stated in the relative material safety data sheet provided by the chemical supplier shall be taken to safeguard the laboratory technicians.

The marking surface to be tested shall be dried after the test with water.

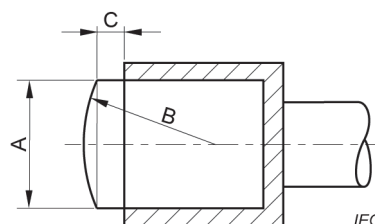
Rubbing shall commence immediately after soaking the piece of cotton, applying a compression force of (5 ± 1) N at a rate of about one cycle per second (a cycle comprising forward and backward movement along the length of the marking). For markings longer than 20 mm, rubbing can be limited to a part of the marking, over a path at least 20 mm long.

The compression force is applied by means of a test piston which is wrapped with cotton comprising cotton wool covered by a piece of cotton medical gauze.

The test piston shall have the dimensions specified in Figure 8 and shall be made of an elastic material which is inert against the test liquids and has a Shore-A hardness of 47 ± 5 (for example synthetic rubber).

The tolerances to dimensions A, B and C as shown in Figure 8 apply.

When it is not possible to carry out the test on the specimens due to the shape/size of the product, a suitable piece having the same characteristics as the product can be submitted to the test.



Dimension and tolerances mm		
A	B	C
20 ⁺² ₀	20 ± 0,5	2 ⁺¹ ₀

Figure 8 – Test piston

8.8 Cable assemblies comprised of the cable and one accessory shall be provided with information to identify the wire terminations, terminals, etc., to provide wiring and installation instructions.

977 The unwired end of a cable assembly intended for connection to a rewirable accessory shall be
978 marked to identify the conductors.

979 *Compliance is checked by inspection.*

980 **9 Dimensions**

981 Accessories shall comply with the appropriate standard sheets, if any. If no standard sheet is
982 available, the accessories shall comply with the specifications provided by the manufacturer.

983 Accessories shall be compatible only with other standardized accessories of the same type.

984 It shall not be possible to make single-pole connections between EV plugs and EV socket-
985 outlets or vehicle connectors, or between vehicle inlets and vehicle connectors.

986 *Compliance is checked by inspection and manual test.*

987 It shall not be possible to engage EV plugs or vehicle connectors with EV socket-outlets or
988 vehicle inlets having different ratings or having different contact combinations unless safe
989 operation is ensured, or other means are provided to ensure safe operation.

990 In addition, improper connections between different electric vehicle accessories shall not be
991 possible between:

- 992 – signal and control contacts and a live (power) contact;
- 993 – the protective earth and/or pilot contact of an EV plug and a live EV socket-outlet contact,
994 or a live EV plug contact and the protective earth and/or pilot contact of an EV socket-outlet;
- 995 – the phase contacts of an EV plug and the neutral contact, if any, of an EV socket-outlet;
- 996 – a neutral contact of an EV plug and a phase contact of an EV socket-outlet.

997 *Compliance is checked by inspection and the following manual test:*

998 *Insertion of the appropriate accessory is tested for 1 min with a force of 150 N for accessories*
999 *with a rated current not exceeding 16 A, or 250 N for other accessories.*

1000 *Where the use of elastomeric or thermoplastic material is likely to influence the result of the*
1001 *test, it is carried out at an ambient temperature of (50 ± 2) °C, both the accessories being*
1002 *conditioned at this temperature.*

1003 **10 Protection against electric shock**

1004 **10.1 General**

1005 Accessories shall be so designed that live parts of EV socket-outlets and vehicle connectors,
1006 when they are wired as in normal use, and live parts of EV plugs and vehicle inlets, when they
1007 are in partial or complete engagement with the complementary accessories, are not accessible.

1008 NOTE 1 In the following countries, IPXXD shutters are compulsory on live (phase and neutral) contact holes of EV
1009 socket-outlets when these EV socket-outlets are accessible to uninstructed persons (ordinary persons BA1,
1010 handicapped persons BA2 or children BA3): FR, PT, DK, IT.

1011 NOTE 2 In the following countries, IPXXD shutters are compulsory on live (phase and neutral) contact holes of
1012 vehicle connectors when these vehicle connectors are permanently wired to the fixed installation and are accessible
1013 to uninstructed persons (ordinary persons BA1, handicapped persons BA2 or children BA3): FR, PT.

1014 NOTE 3 In the following country, in locations where access is restricted to skilled persons, EV socket-outlets and
1015 vehicle connectors without shutters may be accepted: PT.

1016 NOTE 4 In the following country, for installations in dwellings and for 16 A applications, wiring rules require the use
1017 of EV socket-outlets with shutters: ES.

1018 NOTE 5 In the following countries, for installations in dwellings, wiring rules require the use of EV socket-outlets
1019 with shutters: FR, SG, IT.

1020 In addition, it shall not be possible to make contact between a live part of a plug or vehicle inlet
1021 and a live part of a socket-outlet or vehicle connector while any live part is accessible.

1022 NOTE 6 Neutral contacts of socket-outlets and vehicle connectors are deemed to be live parts. Pilot contacts,
1023 signal, data earth, protective earth contacts are not considered live parts.

1024 This Subclause 10.1 does not apply to contacts and conductors used for signal, data,
1025 communications, and control circuits.

1026 The standard test finger, probe B according to IEC 61032, is applied in every possible position,
1027 with an electrical indicator at a voltage not less than 40 V, used to show contact with the relevant
1028 part.

1029 NOTE 7 In the following country, the standard test finger probe defined in UL 2251 is also used: US.

1030 *Compliance is checked by inspection and, if necessary, by a test on the sample wired as in*
1031 *normal use.*

1032 **10.2 Accessories with shutters**

1033 For accessories provided with shutters, the shutters shall be constructed such that live parts
1034 are not accessible without a plug-in engagement, with the gauges shown in Figure 9 and in
1035 Figure 10.

1036 *The gauges shall be applied to the entry holes corresponding to the live contacts and to any*
1037 *other opening of the engagement surface. The gauges shall not touch any live part.*

1038 NOTE Neutral contacts of EV socket-outlets and vehicle connectors are deemed to be live parts. Pilot contacts,
1039 signal, data earth, and protective earth contacts are not considered live parts.

1040 To ensure this degree of protection, accessories shall be so constructed that live contacts are
1041 automatically screened when complementary accessories are withdrawn.

1042 The means for achieving this shall be such that they cannot easily be operated by anything
1043 other than complementary accessories and shall not depend upon parts which are liable to be
1044 lost.

1045 An electrical indicator with a voltage between 40 V and 50 V included is used to show contact
1046 with the relevant part.

1047 *Compliance is checked by inspection and for EV socket-outlets with an EV plug completely*
1048 *withdrawn by applying the gauges shown in Figure 9 and in Figure 10 as follows.*

1049 *The gauge according to Figure 9 is applied to the entry holes corresponding to the live contacts*
1050 *and to any other opening of the engagement surface with a force of 20 N.*

1051 *The gauge is applied to the shutters in the most unfavourable position, successively in three*
1052 *directions, to the same place for approximately 5 s in each of the three directions.*

1053 *During each application the gauge shall not be rotated, and it shall be applied in such a way*
1054 *that the 20 N force is maintained. When moving the gauge from one direction to the next, no*
1055 *force is applied but the gauge shall not be withdrawn.*