

INTERNATIONAL STANDARD

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**Electric vehicle conductive charging system –
Part 1: General requirements**

**Système de charge conductive pour véhicules électriques –
Partie 1: Exigences générales**



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Part 1: General requirements**

**Système de charge conductive pour véhicules électriques –
Partie 1: Exigences générales**

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ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –**Part 1: General requirements****FOREWORD**

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International Standard IEC 61851-1 has been prepared by IEC technical committee 69: Electric road vehicles and electric industrial trucks.

This third edition cancels and replaces the second edition published in 2010. It constitutes a technical revision.

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

- a) The contents of IEC 61851-1:2010 have been re-ordered. Numbering of clauses has changed as new clauses were introduced and some contents moved for easy reading. The following lines give an insight to the new ordering in addition to the main technical changes.
- b) All requirements from IEC 61851-22 have been moved to this standard, as work on IEC 61851-22 has ceased.

- c) Any requirements that concern EMC have been removed from the text and are expected to be part of the future version of 61851-21-2¹.
- d) Clause 4 contains the original text from IEC 61851-1:2010 and all general requirements from Clause 6 of IEC 61851-1:2010.
- e) Clause 5 has been introduced to provide classifications for EV supply equipment.
- f) Previous general requirements of Clause 6 have been integrated into Clause 4. Clause 6 contains all Mode descriptions and control requirements. Specific requirements for the combined use of AC and DC on the same contacts are included.
- g) Clause 9 is derived from previous Clause 8. Adaptation of the description of DC accessories to allow for the DC charging modes that have only recently been proposed by industry and based on the standards IEC 61851-23, IEC 61851-24 as well as IEC 62196-1, IEC 62196-2 and IEC 62196-3. Information and tables contained in the IEC 62196 series standards have been removed from this standard.
- h) Clause 10 specifically concerns the requirements for adaptors, initially in Clause 6.
- i) Clause 11 includes new requirements for the protection of the cable.
- j) Specific requirements for equipment that is not covered in the IEC 62752 remain in the present document.
- k) Previous Clause 11 is now treated in Clauses 12 to 13. The requirements in 61851-1 cover the EV supply equipment of both mode 2 and mode 3 types, with the exception in-cable control and protection devices for mode 2 charging of electric road vehicles (IC-CPD) which are covered by IEC 62752.
- l) Clause 14 gives requirements on automatic reclosing of protection equipment.
- m) Clause 16 gives requirements for the marking of equipment and the contents of the installation and user manual. This makes specific mention of the need to maintain coherence with the standards for the fixed installation. It also contains an important text on the markings for temperature ratings.
- n) Annex A has been reviewed to introduce complete sequences and tests and to make the exact cycles explicit. Annex A in this edition supersedes IEC TS 62763 (Edition 1).
- o) Annex B is normative and has requirements for proximity circuits with and without current coding.
- p) Previous Annex C has been removed and informative descriptions of pilot function and proximity function implementations initially in Annex B are moved to Annex C.
- q) New informative Annex D describing an alternative pilot function system has been introduced.
- r) Dimensional requirements for free space to be left around socket-outlets used for EV energy supply are given in the informative Annex E.
- s) The inclusion of protection devices within the EV supply equipment could, in some cases, contribute to the protection against electric shock as required by the installation. This is covered by the information required for the installation of EV supply equipment in Clause 16 (Marking).

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

FDIS	Report on voting
69/436/FDIS	69/469/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.

¹ Under preparation.

A list of all parts of the IEC 61851 series, under the general title *Electric vehicle conductive charging system* can be found on the IEC website.

In this standard, the following print types are used:

- *test specifications and instructions regarding application of Part 1: italic type.*
- notes: smaller roman type.

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

- reconfirmed,
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INTRODUCTION

This standard is the first part of the IEC 61851 series of standards that gives the general requirements for the supply² of electric energy to Electric road vehicles³. It is to be noted that the vehicle and the EV supply equipment² make up a complete system that is covered by a number of IEC and ISO standards.

IEC 61851 covers the mechanical, electrical, communications, EMC and performance requirements for EV supply equipment used to charge electric vehicles, including light electric vehicles.

IEC 61851 is divided into several parts as follows:

- *Part 1: General Requirements*,
This document gives the general requirements that serve as a basis for all the subsequent standards in the series. It includes the requirements for AC EV supply equipment.
- *Part 21-1⁴: Electric vehicle onboard charger EMC requirements for conductive connection to an AC/DC supply*. This part will cover requirements for EMC onboard the vehicle.
- *Part 21-2⁵: EMC requirements for OFF board electric vehicle charging systems*. This part will cover all requirements for AC and DC EV supply equipment. EMC requirements for wireless power transfer systems (WPT) will not be included.
- *Part 23: DC electric vehicle charging station (2014)*. This part covers the requirements for DC charging stations both permanently wired and cable and plug connected.
- *Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging (2014)*. This part provides the requirements for communication between the vehicle and the DC charging stations of Part 23.

IEC 61851-3 subseries is under development and is intended to cover EV supply equipment with a DC output not exceeding 120 V where reinforced or double insulation or class III is used as the principal means of protection against electric shock (information on scope as available on 3/2016).

- *Part 3-1: Electric vehicles conductive power supply system – Part 3-1: General Requirements for Light Electric Vehicles (LEV) AC and DC conductive power supply systems*.
- *Part 3-2: Electric vehicles conductive power supply system – Part 3-2: Requirements for Light Electric Vehicles (LEV) DC off-board conductive power supply systems*.
- *Part 3-3: Electric vehicles conductive power supply system – Part 3-3: Requirements for Light Electric Vehicles (LEV) battery swap systems*.
- *Part 3-4: Electric vehicles conductive power supply system – Part 3-4: Requirements for Light Electric Vehicles (LEV) communication*.
- *Part 3-5: Electric vehicles conductive power supply system – Part 3-5: Requirements for Light Electric Vehicles communication – Pre-defined communication parameters*.
- *Part 3-6: Electric vehicles conductive power supply system – Part 3-6: Requirements for Light Electric Vehicles communication – Voltage converter unit*.
- *Part 3-7: Electric vehicles conductive power supply system – Part 3-7: Requirements for Light Electric Vehicles communication – Battery system*.

² The term “supply or electric energy” is used to designate energy flow to and from the electric vehicle. The term “charging” used in the title is also used to designate such energy flow.

³ The reader is advised to refer to the definitions clause 3 for this and all subsequent terms that are used in this document.

⁴ Under preparation.

⁵ Under preparation.

Documents directly related to the present document:

- ISO 17409:2015, *Electrically propelled road vehicles – Connection to an external electric power supply – Safety requirements*.

This document gives requirements for electric vehicle that is to be connected to the EV supply equipment. It covers all the classes of vehicles that are in the scope of ISO/TC 22/SC 37.

- IEC 62752:2016, *In-cable control and protection device for mode 2 charging of electric road vehicles (IC-CPD)*.

This product standard gives the requirements for Mode 2 cable assemblies that include supplementary protective and control devices that allow the safe connection of a vehicle to a mains socket-outlet of an installation.

- ISO/IEC 15118 (all parts), *Road vehicles — Vehicle to grid communication interface*

This series of documents gives the description and the requirements for high level data communication between the EV and the EV supply equipment.

Requirements for wireless power transfer systems are given in IEC 61980-1.

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 1: General requirements

1 Scope

This part of IEC 61851 applies to EV supply equipment for charging electric road vehicles, with a rated supply voltage up to 1 000 V AC or up to 1 500 V DC, and a rated output voltage up to 1 000 V AC, or up to 1 500 V DC.

Electric road vehicles (EV) cover all road vehicles, including plug-in hybrid road vehicles (PHEV), that derive all or part of their energy from on-board rechargeable energy storage systems (RESS).

This standard also applies to EV supply equipment supplied from on-site storage systems (e.g. buffer batteries).

The aspects covered in this standard include:

- the characteristics and operating conditions of the EV supply equipment;
- the specification of the connection between the EV supply equipment and the EV;
- the requirements for electrical safety for the EV supply equipment.

Additional requirements may apply to equipment designed for specific environments or conditions, for example:

- EV supply equipment located in hazardous areas where flammable gas or vapour and/or combustible materials, fuels or other combustible, or explosive materials are present;
- EV supply equipment designed to be installed at an altitude of more than 2 000 m;
- EV supply equipment intended to be used on board on ships;

Requirements for electrical devices and components used in EV supply equipment are not included in this standard and are covered by their specific product standards.

EMC requirements for EV supply equipment are expected to be covered in the future IEC 61851-21-2⁶.

Requirements for bi-directional energy transfer are under consideration and are not in this edition of IEC 61851-1.

This standard does not apply to:

- safety aspects related to maintenance;
- charging of trolley buses, rail vehicles, industrial trucks and vehicles designed primarily for use off-road;
- equipment on the EV;
- EMC requirements for equipment on the EV while connected, which are covered in IEC 61851-21-1;
- Charging RESS off board of the EV;

⁶ Under consideration.

- DC EV supply equipment that relies specifically on double/reinforced insulation or class III protection against electric shock. See IEC 61851-23 or the future IEC 61851-3 series.

The IEC 61851 series covers all EV supply equipment with the exception of in-cable control and protection devices for mode 2 charging of electric road vehicles (IC-CPD) which are covered by IEC 62752.

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 60038, *IEC standard voltages*

IEC 60068-2-1, *Environmental testing – Part 2-1: Tests – Test A: Cold*

IEC 60068-2-78, *Environmental testing – Part 2-78: Tests – Test Cab: Damp heat, steady state*

IEC 60309-1, *Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements*

IEC 60309-2, *Plugs, socket-outlets and couplers for industrial purposes – Part 2: Dimensional interchangeability requirements for pin and contact-tube accessories*

IEC 60364-4-41, *Low-voltage electrical installations – Part 4-41: Protection for safety – Protection against electric shock*

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

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

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

IEC 60884-1, *Plugs and socket-outlets for household and similar purposes – Part 1: General requirements*

IEC 60898 (all parts), *Circuit-breakers for overcurrent protection for household and similar installations*

IEC 60898-1, *Electrical accessories – Circuit-breakers for overcurrent protection for household and similar installations – Part 1: Circuit-breakers for a.c. operation*

IEC 60947-2, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-3, *Low-voltage switchgear and controlgear – Part 3: Switches, disconnectors, switch-disconnectors and fuse-combination units*

IEC 60947-4-1, *Low voltage switchgear and controlgear – Part 4-1: Contactors and motor-starters – Electromechanical contactors and motor-starters*

IEC 60947-6-2, *Low-voltage switchgear and controlgear – Part 6-2: Multiple function equipment – Control and protective switching devices (or equipment) (CPS)*

IEC 60950-1:2005, *Information technology equipment – Safety – Part 1: General requirements*

IEC 60990, *Methods of measurement of touch current and protective conductor current*

IEC 61008-1, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

IEC 61009-1, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

IEC 61180, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

IEC 61316:1999, *Industrial cable reels*

IEC TS 61439-7:2014, *Low-voltage switchgear and controlgear assemblies – Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicles charging stations*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61558-1, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*

IEC 61558-2-4, *Safety of transformers, reactors, power supply units and similar products for supply voltages up to 1 100 V – Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers*

IEC 61810-1, *Electromechanical elementary relays – Part 1: General and safety requirements*

IEC 61851 (all parts), *Electric vehicle conductive charging system*

IEC 61851-23:2014, *Electric vehicle conductive charging system – Part 23: DC electric vehicle charging station*

IEC 61851-24:2014, *Electric vehicle conductive charging system – Part 24: Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging*

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

IEC 62196-1:2014, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements*

IEC 62196-2:2016, *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 62196-3:2014, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3: Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and contact-tube vehicle couplers*

IEC 62262, *Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)*

IEC 62423, *Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses*

IEC 62752, *In-Cable Control and Protection Device for mode 2 charging of electric road vehicles (IC-CPD)*

ISO 17409:2015, *Electrically propelled road vehicles – Connection to an external electric power supply – Safety requirements*

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>

3.1 Electric supply equipment

3.1.1

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

EXAMPLE 1: For Mode 3 case B, the EV supply equipment consists of the charging station and the cable assembly.

EXAMPLE 2: For Mode 3 case C, the EV supply equipment consists of the charging station with its cable assembly.

3.1.2

AC EV supply equipment

EV supply equipment that supplies alternating current to an EV

3.1.3

DC EV supply equipment

EV supply equipment that supplies direct current to an EV

3.1.4

EV charging system

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

3.1.5

EV charging station

stationary part of EV supply equipment connected to the supply network

Note 1 to entry: For case C, the cable assembly is part of the EV charging station.

3.1.6

DC EV charging station

EV charging station that supplies direct current to an EV

3.1.7

AC EV charging station

EV charging station that supplies alternating current to an EV

3.1.8

charging

all functions necessary to condition voltage and/or current provided by the AC or DC supply network to assure the supply of electric energy to the RESS

3.1.9

charging mode

method for connection of an EV to the supply network to supply energy to the vehicle

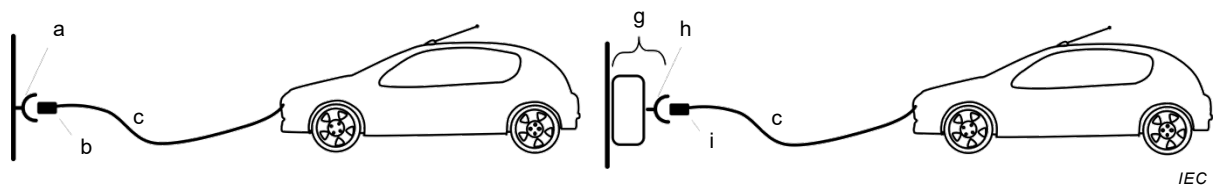
Note 1 to entry: Mode 1, mode 2, mode 3 and mode 4 are described in Clause 6.

3.1.10

case A

connection of an EV to the supply network with a plug and cable permanently attached to the EV

SEE: Figure 1



Note 1 to entry: The cable assembly is part of the vehicle.

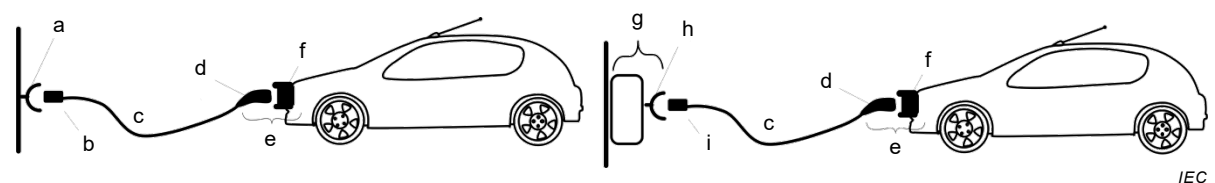
Figure 1 – Case A connection

3.1.11

case B

connection of an EV to a supply network with a cable assembly detachable at both ends

SEE: Figure 2



Note 1 to entry: The detachable cable assembly is not part of the vehicle or the charging station.

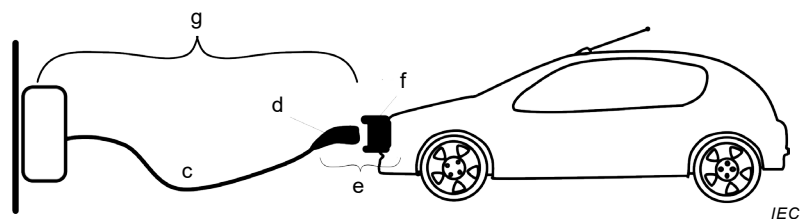
Figure 2 – Case B connection

3.1.12

case C

connection of an EV to a supply network utilizing a cable and vehicle connector permanently attached to the EV charging station.

SEE: Figure 3



Note 1 to entry: The cable assembly is part of the EV charging station.

Figure 3 – Case C connection

Key for Figures 1 to 3

- | | |
|-----------------------|----------------------|
| (a) Socket-outlet | (f) Vehicle inlet |
| (b) Plug | (g) Charging station |
| (c) Cable | (h) EV socket-outlet |
| (d) Vehicle connector | (i) EV plug |
| (e) Vehicle coupler | |

3.2 Insulation

3.2.1

basic insulation

insulation of hazardous-live-parts which provides basic protection

[SOURCE: IEC 60050-826:2004, 826-12-14]

3.2.2

direct contact

electrical contact of persons or animals with live parts

[SOURCE: IEC 60050-195:1998, 195-06-03]

3.2.3

double insulation

insulation comprising both basic insulation and supplementary insulation

[SOURCE: IEC 60050-826:2004, 826-12-16]

3.2.4

conductive part

part which can carry electric current

[SOURCE: IEC 60050-195:1998, 195-01-06]

3.2.5

exposed conductive part

conductive part of electrical equipment, which can be touched and which is not normally live, but which can become live when basic insulation fails

Note 1 to entry: A conductive part of electrical equipment which can only become live through contact with an exposed-conductive-part which has become live is not considered to be an exposed-conductive-part itself.

[SOURCE: IEC 60050-441:1998, 442-01-21]

3.2.6

hazardous-live-part

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

[SOURCE: IEC 60050-195:1998, 195-06-05]

3.2.7

fault protection

protection against shock under single-fault conditions

[SOURCE: IEC 60050-195:1998/AMD1:2001, 195-06-02]

3.2.8

insulation

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

[SOURCE: IEC 60050-151:2001, 151-15-41, modified and 151-15-42, modified]

3.2.9

live part

conductor or conductive part intended to be energized in normal operation, including a neutral conductor, but by convention not a PEN conductor or PEM conductor or PEL conductor

Note 1 to entry: This concept does not necessarily imply a risk of electric shock.

[SOURCE: IEC 60050-195:1998, 195-02-19]

3.2.10

reinforced insulation

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

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

[SOURCE: IEC 60050-195:1998, 195-06-09]

3.2.11

supplementary insulation

independent insulation applied in addition to basic insulation for fault protection

[SOURCE: IEC 60050-826:2004, 826-12-15]

3.3 Functions

3.3.1

control pilot conductor

insulated conductor incorporated in a cable assembly, which, together with the protective conductor, is part of the control pilot circuit

3.3.2

control pilot circuit

circuit designed for the transmission of signals or communication between the EV and the EV supply equipment

Note 1 to entry: for Mode 2 it is between the EV and the ICCB or IC-CPD.

3.3.3**control pilot function**

function used to monitor and control the interaction between the EV and the EV supply equipment

3.3.4**control pilot function controller
CPFC**

device in the EV supply equipment and the EV responsible for the control pilot function and the generation of the PWM signal

Note 1 to entry: This note applies to the French language only.

3.3.5**proximity function**

electrical or mechanical means to indicate the insertion state of the vehicle connector in the vehicle inlet to the EV and/or to indicate the insertion state of the plug in the socket-outlet of the EV charging station

3.4 Vehicle**3.4.1****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

Note 1 to entry: In this standard, these terms refer only to those vehicles that can be charged from an external electrical source.

[SOURCE: ISO 17409]

3.4.2**plug in hybrid electric road vehicle
PHEV**

electrical vehicle that can charge the rechargeable electrical energy storage device from an external electric source and also derives part of its energy from another on-board source

Note 1 to entry: This note applies to the French language only.

3.4.3**rechargeable energy storage system
RESS**

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

EXAMPLE: batteries, capacitors

Note 1 to entry: This note applies to the French language only.

[SOURCE: ISO 17409]

3.5 Cords, cables and connection means**3.5.1****adaptor**

portable accessory constructed as an integral unit incorporating both a plug portion and one socket-outlet portion

[SOURCE: IEC 60050-442:1998, 442-03-19, modified]

3.5.2

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 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.

[SOURCE: IEC 62196-1:2014, 3.1, modified]

3.5.3

cable management system

one or more devices that is intended to protect a cable assembly from mechanical damage and/or to facilitate its handling

EXAMPLE: Cable suspension device.

3.5.4

cord extension set

assembly consisting of a flexible cable or cord fitted with plug and a portable socket-outlet or connector which can match each other

Note 1 to entry: The cord is called an “adapter cord” when the plug and socket-outlet do not match.

Note 2 to entry: A Mode 1, Mode 2 or Mode 3 cable assembly is not considered as a cord extension set.

[SOURCE: IEC 60050-461:2008, 461-06-17, modified]

3.5.5

in-cable control box

ICCB

device incorporated in the Mode 2 cable assembly, which performs control functions and safety functions

Note 1 to entry: The “ICCB” is called “function box” in IEC 62752.

Note 2 to entry: This note applies to the French language only.

3.5.6

IC-CPD

Mode 2 cable assembly that complies with IEC 62752

3.5.7

EV socket-outlet

specific socket-outlet intended to be used as part of EV supply equipment and defined in the IEC 62196 series

3.5.8

EV plug

specific plug intended to be used as part of EV supply equipment and defined in the IEC 62196 series

3.5.9

plug

accessory having contacts designed to engage with the contacts of a socket-outlet, also incorporating means for the electrical connection and mechanical retention of flexible cables or cords

[SOURCE: IEC 60050-442:1998, 442-03-01, modified – The word "pins" has been replaced by "contacts" in the definition.]

3.5.10

socket-outlet

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

[SOURCE: IEC 60050-442:1998, 442-03-02, modified – The word "pins" has been replaced by "contacts" in the definition.]

3.5.11

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

3.5.12

vehicle coupler

electric vehicle coupler

means of enabling the connection at will of a flexible cable to an electric vehicle

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

[SOURCE: IEC 62196-1:2014, 3.3]

3.5.13

vehicle connector

electric vehicle connector

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

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

3.5.14

vehicle inlet

electric vehicle inlet

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

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

3.5.15

connecting point

point where one electric vehicle is connected to the fixed installation

Note 1 to entry: The connecting point for Modes 1 and 2 is the point where one electric vehicle is connected to the fixed installation or supply network.

Note 2 to entry: The connecting point for Modes 3 and 4 is the point where one electric vehicle is connected to the EV charging station

Note 3 to entry: The connecting point for Mode 1, Mode 2 and Mode 4, connected by a cable and plug is the standard socket-outlet.

Note 4 to entry: The connecting point for Mode 3 and permanently connected Mode 4 is the EV socket-outlet (case A and case B) or the EV connector (case C).

3.5.16

interlock

device or combination of devices that prevents the power 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/vehicle connector from being withdrawn while its power contacts are live or makes the power contacts dead before separation

3.5.17

retaining means

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

[SOURCE: IEC 62196-1:2014, 3.9]

3.5.18

latching device

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

EXAMPLE See standard sheets 2-II and 2-IIId in IEC 62196-2:2014 and 3-IIId in IEC 62196-3:2014.

[SOURCE: IEC 62196-1:2014, 3.10, modified]

3.5.19

locking mechanism

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

[SOURCE: IEC 62196-1:2014, 3.11, modified]

3.5.20

vehicle adaptor

portable accessories constructed as an integral unit incorporating both vehicle inlet portion and vehicle connector portion

3.6 Service and usage

3.6.1

indoor use

intended for operation under normal ambient conditions in a building

[SOURCE: IEC 60050-151:2001, 151-16-06, modified – The term "indoor" has been replaced by "indoor use".]

3.6.2

outdoor use

capable of operating under specific range of outdoor conditions

[SOURCE: IEC 60050-151:2001, 151-16-05, modified – The term "outdoor" has been replaced by "outdoor use".]

3.6.3

equipment for locations with restricted access

equipment accessible to all persons who are authorized to have access to the location (e.g. equipment located in private housing, private parking areas or similar places)

[SOURCE: IEC 60050-195:1998, 195-04-04, modified]

3.6.4**equipment for locations with non-restricted access**

equipment accessible for all persons, e.g. access available in a public area

3.6.5**portable equipment**

cord and plug connected equipment, cable assembly, adaptors or other accessories that are capable to be carried by one person and designed and intended to be carried within the EV

3.6.6**mobile equipment**

electric equipment which is moved while in operation or which can easily be moved from one place to another while connected to the supply.

[SOURCE: IEC 60050-826:2004, 826-16-04]

3.6.7**stationary equipment**

equipment or electric equipment not provided with a carrying handle and having such a mass that it cannot easily be moved

Note 1 to entry: Stationary equipment is intended to be either permanently connected to the supply network or connected to the supply network by a cable and plug.

[SOURCE: IEC 60050-826:2004, 826-16-06, modified]

3.6.8**ground mounted**

equipment with a part intended to be embedded or attached to the ground

3.6.9**permanently connected EV supply equipment**

EV supply equipment that can only be connected to, or disconnected from, the AC or DC supply network by the use of a tool

[SOURCE: IEC 60050-151:2001/AMD2:2014, 151-11-29, modified]

3.6.10**user**

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

[SOURCE: IEC 61439-1:2011, 3.10.3, modified]

3.7 General terms**3.7.1****supply network**

any source of electric energy (eg. mains or electric grid, distributed energy resources (DER), battery bank, PV installation, generator, etc.)

3.7.2**protective conductor**

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

EXAMPLE Examples of a protective conductor include a protective bonding conductor, protective earthing conductor and an earthing conductor when used for protection against electric shock.

[SOURCE: IEC 60050-826:2004, 826-13-22, modified]

3.7.3

protective earthing conductor

protective grounding conductor (US, CA)

equipment grounding conductor (US, CA)

protective conductor provided for protective earthing

Note 1 to entry: In the U.S.A. and in CA, the term "ground" is used instead of "earth".

[SOURCE: IEC 60050-195:1998, 195-02-11, modified – The third term and Note 1 have been added.]

3.7.4

earthing terminal

grounding terminal (US, CA)

terminal provided on equipment or on a device and intended for the electric connection with the earthing arrangement

[SOURCE: IEC 60050-195:1998, 195-02-31]

3.7.5

protective earthing

protective grounding (US, CA)

earthing a point or points in a system or in an installation or in equipment for purposes of electrical safety

[SOURCE: IEC 60050-195:1998/AMD1:2001, 195-01-11]

3.7.6

residual current device

RCD

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

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

[SOURCE: IEC 60050-442:1998, 442-05-02]

3.7.7

leakage current

electric current in an unwanted conductive path under normal operating conditions

[SOURCE: IEC 60050-195:1998, 195-05-15]

3.7.8

switching device

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

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

3.7.9

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.]

3.7.10

touch current

electric current passing through a human body or through an animal body when it touches one or more accessible parts of an electrical installation or electrical equipment

[SOURCE: IEC 60050-826:2004, 826-11-12]

4 General requirements

The EV supply equipment shall be so constructed that an EV can be connected to the EV supply equipment so that in normal conditions of use, the energy transfer operates safely, and its performance is reliable and minimises the risk of danger to the user or surroundings.

Compliance is checked by meeting all of the relevant requirements of the IEC 61851 series.

Unless otherwise stated all tests indicated in this document are type tests.

Unless otherwise stated, all tests required by this standard may be conducted on separate samples. They may be done on the same samples at the manufacturer's agreement.

Unless otherwise stated, each test is conducted once.

Unless otherwise specified, all tests shall be carried out in a draught-free location and at an ambient temperature of $20^{\circ} \pm 5^{\circ} \text{C}$.

The EV supply equipment shall be rated for one or more of standard nominal voltages and frequencies as given in IEC 60038.

NOTE In the following countries, national standards or regulations provide different requirements for frequency: JP.

Assemblies for EV supply equipment shall comply with IEC TS 61439-7 with the exceptions or additions as indicated in Clause 13.

The standard applies to equipment that is designed to be used at an altitude up to 2 000 m.

For equipment designed to be used at altitudes above 2 000 m, it is necessary to take into account the reduction of the dielectric strength and the cooling effect of the air. Electrical equipment intended to operate under these conditions shall be designed or used in accordance with an agreement between manufacturer and user.

5 Classification

5.1 Characteristics of power supply and output

5.1.1 Characteristics of power supply input

The EV supply equipment shall be classified according to the supply network system that it is intended to be connected to:

- EV supply equipment connected to AC supply network;
- EV supply equipment connected to DC supply network.

The EV supply equipment shall be classified according to the electric connection method:

- Plug and cable connected;
- Permanently connected.

5.1.2 Characteristics of power supply output

The EV supply equipment shall be classified according to the type of current the EV supply equipment delivers:

- AC EV supply equipment;
- DC EV supply equipment;
- AC and/or DC EV supply equipment.

5.2 Normal environmental conditions

The EV supply equipment shall be classified according to the environmental conditions and use:

- indoor use;
- outdoor use.

NOTE The conditions that define indoor and outdoor use are given in 7.1.1 of IEC 61439-1:2011.

5.3 Special environmental conditions

The EV supply equipment may be classified according to their suitability for use in special environmental conditions other than those specified in this document, if declared so by the manufacturer.

5.4 Access

The EV supply equipment shall be classified according to the location they are intended for:

- equipment for locations with restricted access;
- equipment for locations with non-restricted access.

5.5 Mounting method

The EV supply equipment shall be classified according to the type of mounting:

- a) stationary equipment;
 - mounted on walls, poles or equivalent positions:
 - flush mounted;
 - surface mounted.
 - pole/column/pipe-mounted
 - floor mounted
 - ground mounted.
- b) non stationary equipment
 - portable equipment;
 - mobile equipment.

NOTE More than one classification can apply.

5.6 Protection against electric shock

The equipment shall be classified according to the protection against electric shock:

- class I equipment;
- class II equipment;
- class III equipment.

NOTE Class I, Class II and Class III descriptions can be found in IEC 61140:2016, 7.3, 7.4 and 7.5.

5.7 Charging modes

The EV supply equipment shall be classified according to 6.2:

- Mode 1;
- Mode 2;
- Mode 3;
- Mode 4.

NOTE EV supply equipment with multiple outputs can be classified as supporting more than one mode.

6 Charging modes and functions

6.1 General

Clause 6 describes the different charging modes and functions for energy transfer to EVs.

6.2 Charging modes

6.2.1 Mode 1

Mode 1 is a method for the connection of an EV to a standard socket-outlet of an AC supply network, utilizing a cable and plug, both of which are not fitted with any supplementary pilot or auxiliary contacts.

The rated values for current and voltage shall not exceed:

- 16 A and 250 V AC, single-phase,
- 16 A and 480 V AC, three-phase.

EV supply equipment intended for Mode 1 charging shall provide a protective earthing conductor from the standard plug to the vehicle connector.

Current limitations are also subject to the standard socket-outlet ratings described in 9.2.

NOTE 1 In the following countries, Mode 1 charging is prohibited by national codes: US, IL, UK

NOTE 2 In the following countries, Mode 1 charging is prohibited in public areas by national codes: IT

NOTE 3 In the following countries, Mode 1 charging without integral ground fault leakage interruption is not permitted: CA

NOTE 4 In the following countries, plugs and socket-outlets according to IEC 60309-2 are recommended for Mode 1 connections for more than 8 A (2 kVA): CH.

NOTE 5 In the following countries, for EV supply equipment equipped with a plug for household and similar use, repeated continuous loads of long duration, shall be limited to 6 A: DK

NOTE 6 In the following countries, EV supply equipment equipped with a plug for household and similar use, if the charging cycle can exceed 2 hours, the maximum rated current is 10 A: NO

NOTE 7 In the following countries, EV supply equipment equipped with a plug for household and similar use, if the charging cycle can exceed 2 hours, the maximum rated current is 8 A: FR

NOTE 8 In the following countries, Mode 1 cable assembly without PCRD shall not be used but only Mode 1 cables with a PCRD: DE

- (Due to Article 14 in the constitutional law of Germany which frames the preservation of status quo of existing electrical installations it cannot be ensured that fixed electrical installations at all times provide an RCD in Germany).

6.2.2 Mode 2

Mode 2 is a method for the connection of an EV to a standard socket-outlet of an AC supply network utilizing an AC EV supply equipment with a cable and plug, with a control pilot function and system for personal protection against electric shock placed between the standard plug and the EV.

The rated values for current and voltage shall not exceed:

- 32 A and 250 V AC single-phase;
- 32 A and 480 V AC three-phase.

Current limitations are also subject to the standard socket-outlet ratings described in 9.2.

EV supply equipment intended for Mode 2 charging shall provide a protective earthing conductor from the standard plug to the vehicle connector.

Mode 2 equipment that is destined to be mounted on a wall but is detachable by the user, or to be used in a shock resistant enclosure shall use protection equipment as required by IEC 62752.

NOTE 1 In the following countries, Mode 2 charging is limited by national codes to 250 V maximum: US, CA.

NOTE 2 In the following countries, Mode 2 is not allowed in public areas: IT.

NOTE 3 In the following countries, Mode 2 shall not exceed 16 A and not exceed 250 V AC in single phase systems: CH.

NOTE 4 In the following countries, the use of IEC 60309-2 accessories is recommended for Mode 2 connections for more than 8 A (2 kVA): CH.

NOTE 5 In the following countries, for EV supply equipment equipped with a plug for household and similar use, repeated continuous loads of long duration, shall be limited to 6 A: DK

NOTE 6 In the following countries, EV supply equipment equipped with a plug for household and similar use, if the charging cycle can exceed 2 hours, the maximum rated current is 8 A: FR

NOTE 7 In the following countries, EV supply equipment equipped with a plug for household and similar use, if the charging cycle can exceed 2 hours, the maximum rated current is 10 A: NO

NOTE 8 In the following countries, the use of IEC 60309-2 accessories is recommended for Mode 2 connections for more than 10 A: IT

6.2.3 Mode 3

Mode 3 is a method for the connection of an EV to an AC EV supply equipment permanently connected to an AC supply network, with a control pilot function that extends from the AC EV supply equipment to the EV.

EV supply equipment intended for Mode 3 charging shall provide a protective earthing conductor to the EV socket-outlet and/or to the vehicle connector.

6.2.4 Mode 4

Mode 4 is a method for the connection of an EV to an AC or DC supply network utilizing a DC EV supply equipment, with a control pilot function that extends from the DC EV supply equipment to the EV.

Mode 4 equipment may be either permanently connected or connected by a cable and plug to the supply network.

EV supply equipment intended for Mode 4 charging shall provide a protective earthing conductor or protective conductor to the vehicle connector.

Additional requirements for DC EV supply equipment are given in IEC 61851-23.

6.3 Functions provided in Mode 2, 3 and 4

6.3.1 Mandatory functions in Modes 2, 3, and 4

6.3.1.1 General

The following control pilot functions shall be provided by the EV supply equipment:

- Continuous continuity checking of the protective conductor according to 6.3.1.2;
- Verification that the EV is properly connected to the EV supply equipment according to 6.3.1.3;
- Energization of the power supply to the EV according to 6.3.1.4;
- De-energization of the power supply to the EV according to 6.3.1.5;
- Maximum allowable current according to 6.3.1.6.

Compliance is checked by inspection and test where applicable.

If EV supply equipment can supply more than one vehicle simultaneously, it shall ensure that the control pilot function performs the above functions independently at each connecting point.

NOTE The control pilot functions can be achieved using a PWM signal and a control pilot as described in Annex A or by any other non PWM system that provides the same results and is compatible with Annex A. An example is given in informative Annex D.

EV supply equipment designed for Mode 2 or Mode 3, using the control pilot conductor and utilizing accessories according to IEC 62196-2, shall be provided with control pilot function according to Annex A.

6.3.1.2 Continuous continuity checking of the protective conductor

While charging in Mode 2, the electrical continuity of the protective earthing conductor between the ICCB and the respective EV contact shall be continuously monitored by the ICCB.

While charging in Mode 3, the electrical continuity of the protective earthing conductor between the EV charging station and the respective EV contact shall be continuously monitored by the EV supply equipment.

While charging in Mode 4, the electrical continuity of the protective conductor between the EV charging station and the respective EV contact shall be continuously monitored by the EV supply equipment.

The EV supply equipment shall disconnect the supply to the EV in case of:

- loss of electrical continuity of the protective conductor (i.e. open control pilot circuit), within 100 ms.
- incapacity to verify the continuity of the protective conductor (e.g. short circuit between pilot wire and protective conductor), within 3 s.

6.3.1.3 Verification that the EV is properly connected to the EV supply equipment

The EV supply equipment shall be able to determine that the EV is properly connected to the EV supply equipment.

Proper connection is assumed when the continuity of the control pilot circuit is detected.

6.3.1.4 Energization of the power supply to the EV

The EV socket-outlet or the vehicle connector shall not be energized unless the control pilot function between EV supply equipment and EV has been established correctly with signal states allowing energization.

The presence of such states does not imply that energy will be transferred between the EV supply equipment and the EV as this may be subject to other external conditions, e.g. energy management system.

If the EV requests ventilation, the EV supply equipment shall only energize the system if such ventilation is provided by the installation or the premises.

6.3.1.5 De-energization of the power supply to the EV

If the control pilot signal is interrupted the power supply to the EV shall be interrupted according to 6.3.1.2.

If the control pilot signal status no longer allows energization, the power supply to the EV shall be interrupted but the control pilot signalling may remain in operation.

6.3.1.6 Maximum allowable current

A means shall be provided to inform the EV of the value of the maximum current it is allowed to draw. The value of the maximum current permitted shall be transmitted and shall not exceed any of the following:

- the rated output current of the EV supply equipment,
- the rated current of the cable assembly.

NOTE The cable assembly includes Mode 2 and Mode 3 cable assemblies.

The transmitted value may change, without exceeding the maximum allowed current, to adapt to power limitations, e.g. for load management.

The EV supply equipment may interrupt the energy supply if the current drawn by the EV exceeds the transmitted value.

6.3.2 Optional functions for Modes 2, 3 and 4

6.3.2.1 General

The optional functions that are implemented shall be indicated in the manual and shall fulfil the requirements of 6.3.2.

Other functions can be provided.

Compliance is checked by inspection and test where applicable.

6.3.2.2 Ventilation during supply of energy

EV supply equipment can exchange information with installation regarding the request and presence for ventilation.

NOTE 1 Ventilation requirements might be subject to local or national regulation or standard.

NOTE 2 In the following countries national regulations may require ventilation for some situations for indoor charging under certain conditions: CA.

NOTE 3 This is mainly a requirement for indoor charging.

6.3.2.3 Intentional and unintentional disconnection of the vehicle connector and/or the EV plug

A mechanical or electromechanical means shall be provided to prevent intentional and unintentional disconnection under load of the vehicle connector and/or plug according to IEC 62196-1.

NOTE 1 IEC 62196-1:2014 defines three levels of prevention of disconnection as given in the definitions 3.9, 3.10 and 3.11 in the order of increasing constraints, as follows:

- Unintentional disconnection prevention -> retaining means,
- Unintentional and intentional disconnection prevention -> latching device,
- Unintentional, intentional disconnection and tampering prevention -> locking mechanism.

NOTE 2 In the following countries a means to prevent unintentional disconnect of the EV accessories is required: CA, US.

6.3.2.4 Mode 4 using the combined charging system

The combined charging system as described in Annex CC of IEC 61851-23:2014 and ISO 17409 shall be so designed that:

- AC chargeable EVs with a basic vehicle inlet do not require any means to protect the EV against DC voltage at the inlet.
- AC EV supply equipment does not require any means to be self-protected against DC voltage coming from the EV.

NOTE 1 Standard Sheets for configuration EE and FF of IEC 62196-3 gives dimensions, rating and relevant mechanical functions of the interfaces EE and FF for DC. EV charging system C is described in Annex CC of IEC 61851-23:2014.

For DC charging, digital communication shall be established between the vehicle and the DC EV charging station that validates the DC energy transfer. The DC supply to the vehicle shall not be connected until such complete validation from the vehicle is achieved.

A combined interface extends the use of a basic interface for AC and DC charging.

DC charging can be achieved by using separate and additional DC power contacts to supply DC energy to the EV or by using power contacts placed at the position of the AC power contacts of a basic interface, if the vehicle connector and the vehicle inlet are both suitable for DC.

The basic portion of the combined vehicle inlet can be used with a basic connector for AC charging only or with a combined connector having separate contacts for AC or DC charging.

AC and DC power transfer shall not occur through the combined interface at the same time.

The combined interface used for DC charging shall only be used with the “Combined Charging System” described in Annex CC of IEC 61851-23:2014.

Analysis and design of the EV supply equipment using a basic interface for DC shall apply a risk analysis according to IEC 61508 (all parts) applying a severity level of at least S2 for the function preventing the risk of unintended DC voltage output.

NOTE 2 Such analysis includes the effect of vehicle faults on EV supply equipment.

7 Communications

7.1 Digital communication between the EV supply equipment and the EV

Digital communication is optional for Modes 1, 2 and 3.

For Mode 4 the digital communication as described in IEC 61851-24 shall be provided to allow the EV to control the EV supply equipment.

NOTE 1 Digital communication as described in ISO/IEC 15118 series is also called high level communication.

NOTE 2 Annex D also provides information on digital communication.

7.2 Digital communication between the EV supply equipment and the management system

Telecommunication network or telecommunication port of the EV supply equipment, connected to the telecommunication network, if any, shall comply with the requirements for connection to telecommunication networks according to Clause 6 of IEC 60950-1:2005.

8 Protection against electric shock

8.1 Degrees of protection against access to hazardous-live-parts

The different parts of the EV supply equipment as mentioned shall fulfil the following requirements:

- IP ratings for enclosures shall be at least IPXXC;
- vehicle connector when mated with vehicle inlet: IPXXD;
- plug mated with socket-outlet: IPXXD;
- vehicle connector intended for Mode 1 use, not mated: IPXXD;
- vehicle connector intended for Mode 2 use, not mated: IPXXB and fulfilling the following:
Minimum opening of the contact equal to the clearance according to IEC 60664-1 considering overvoltage category 2 (e.g. the value given in IEC 60664-1 for 230 V/400 V is 2,5 kV rated impulse voltage withstand that implies 1,5 mm separation of contacts) and inhibits the charging and warns the user in case of welded contact.
- vehicle connector and EV socket-outlet intended for Mode 3 use, not mated: IPXXB provided it is associated directly upstream with a mechanical switching device (see also 12.3) and fulfilling one of the following:
 - a) minimum opening of the contact equal to the clearance according to IEC 60664-1 considering overvoltage category 3 (e.g. the value given in IEC 60664-1 for 230 V/400 V is 4 kV rated impulse voltage withstand that implies at least 3 mm separation of contacts);
 - b) presence of monitoring of the switching contacts associated with a means to operate another mechanical switching device providing isolating function upstream the above in case of fault of operation of the switching device upstream the accessory;
 - c) presence of shutters on live entry hole of the socket-outlets or connectors for case C.

NOTE 1 In the following countries, IPXXB is required for Mode 1: JP, SE, CH, AT, DE, BE, FI

NOTE 2 In the following countries options a and b are only acceptable if both options are used together: NL, IT

NOTE 3 In the following countries the option b alone is not allowed: BE, CH

NOTE 4 In following countries socket-outlets are equipped with shutters where they are mandatory in residential and public locations: FR, UK

NOTE 5 In following countries standard socket-outlets are equipped with shutters where they are mandatory in residential and public locations: DK

NOTE 6 In the following countries, for installations in dwellings and for 16 A applications, Wiring Rules prescribe the use of socket-outlets with shutters: ES

NOTE 7 In the following countries national regulations require shutters or equivalent protection methods with equivalent safety levels. For example: installation heights, blocking objects against touch ability, interlocking, locking cover etc. SE

NOTE 8 In the following countries the use of software controlled means cannot be used to control isolating devices: UK

Compliance is checked by inspection and measurement.

8.2 Stored energy

8.2.1 Disconnection of plug connected EV supply equipment

For plug connected EV supply equipment, where the connection pins are accessible after unplugging, one second after disconnecting the standard plug from the standard socket-outlet, the voltage between any combination of accessible contacts of the standard plug shall be less than or equal to 60 V DC or the stored charge available shall be less than 50 μC .

Compliance is checked by inspection and by test with the EV disconnected according to 2.1.1.5 of IEC 60950-1:2005.

NOTE Requirements for the EV are specified in ISO 17409.

8.2.2 Loss of supply voltage to permanently connected EV supply equipment

The voltage between power lines or power lines and protective earthing conductor, when measured at the input supply terminals of the EV supply equipment, shall be less than or equal to 60 V DC or the stored energy shall be less than or equal to 0,2 J within 5 seconds after disconnecting the power supply voltage to the EV supply equipment.

Compliance is checked by inspection and by test with no EV connected to the EV supply equipment according to 2.1.1.7 of IEC 60950-1:2005.

8.3 Fault protection

Fault protection shall consist of one or more protective measures as permitted according to IEC 60364-4-41:

- automatic disconnection of supply;
- double or reinforced insulation;
- electrical separation if limited to the supply of one item of current-using equipment;
- extra low-voltage (SELV and PELV).

Electric separation is fulfilled if there is one electrically separated circuit for each EV.

Compliance is checked by inspection.

8.4 Protective conductor

The protective earthing conductor and the protective conductor shall be of sufficient rating in accordance with requirements of IEC TS 61439-7.

NOTE In the following countries, the size and rating of the protective earthing conductor are determined by national codes and regulations: CA, US, JP

For Modes 1, 2 and 3, a protective earthing conductor shall be provided between the AC supply input earthing terminal of the EV supply equipment and the EV.

Mode 4 EV supply equipment shall provide either:

- a) a protective earthing conductor from the input earthing terminal of the AC supply network to the EV
- or

- b) a protective conductor from the EV supply equipment to the EV if fault protection is based on electric separation.

For Modes 3 and 4 permanently connected EV supply equipment, protective earthing conductors shall not be switched.

Compliance is checked by inspection.

8.5 Residual current protective devices

EV supply equipment can have one or more connecting points to supply energy to EVs.

Where connecting points can be used simultaneously and are connected to a common input terminal of the EV supply equipment, they shall have individual protection incorporated in the EV supply equipment.

If the EV supply equipment has more than one connecting point that cannot be used simultaneously then such connecting points can have common protection devices.

EV supply equipment that includes an RCD and that does not use the protective measure of electrical separation shall comply with the following:

- The connecting point of the EV supply equipment shall be protected by an RCD having a rated residual operating current not exceeding 30 mA;
- RCD(s) protecting connecting points shall be at least type A;
- RCDs shall comply with one of the following standards: IEC 61008-1, IEC 61009-1, IEC 60947-2 and IEC 62423;
- RCDs shall disconnect all live conductors.

NOTE 1 This applies to single-phase or three-phase connecting points.

Where the EV supply equipment is equipped with a socket-outlet or vehicle connector for AC use in accordance with IEC 62196 (all parts), protective measures against DC fault current shall be taken. The appropriate measures shall be:

- RCD type B or
- RCD Type A and appropriate equipment that ensures the disconnection of the supply in case of DC fault current above 6 mA.

NOTE 2 An example of appropriate equipment that ensures the disconnection of the supply in case of DC fault is expected in the future IEC 62955⁷.

NOTE 3 The RCDs or the appropriate equipment that ensure the disconnection of the supply in case of DC fault can be provided inside the EV supply equipment, in the installation or in both places.

NOTE 4 Selectivity can be maintained between the RCD protecting a connecting point and an RCD installed upstream when required for service purposes.

NOTE 5 In the following countries, as the installations are equipped with RCD of Type AC, a means for the protection of fault current with a performance at least equal to Type A in addition to appropriate equipment that ensures the disconnection of the supply in case of DC fault current above 6 mA is provided by the EV supply equipment: JP.

NOTE 6 In the following country, the use of a system of protection is required that is intended to interrupt the electric circuit to the load when:

- a fault current to earth (ground) exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit,
- the earthing (grounding) path becomes open circuited or becomes an excessively high impedance, or a path to earth (ground) is detected on an isolated (ungrounded) system: US, CA.

⁷ Under preparation.

NOTE 7 In the following countries the use of a RCD of type AC for EVs connected by Mode 1 to domestic installations is allowed: JP, SE, UK, CA.

NOTE 8 In some countries, a device which measures leakage current using a frequency sensitive network and trips at predefined levels of leakage current up to 20 mA, based upon the frequency is required: US, CA.

NOTE 9 A PRCD as described in IEC 61540 or IEC 62335, can be used to improve protection for connection to existing AC power supply networks in Mode 1.

8.6 Safety requirements for signalling circuits between the EV supply equipment and the EV

Any circuit for signalling, which extends beyond the EV supply equipment enclosure for connection with the EV (e.g. control pilot circuit), shall be extra low voltage (SELV or PELV) according to IEC 60364-4-41.

8.7 Isolating transformers

Isolating transformers (excluding safety isolating transformers used for signalling) shall comply with the requirements of IEC 61558-1 and IEC 61558-2-4.

Compliance is checked by inspection.

9 Conductive electrical interface requirements

9.1 General

Clause 9 provides a description of the conductive electrical interface requirements.

9.2 Functional description of standard accessories

Standard accessories used for EV supply equipment shall be in accordance with IEC 60309-1, IEC 60309-2 or IEC 60884-1 or the national standard. Standard accessories that are intermateable with interfaces described in the IEC 60320 series shall not be used for EV supply equipment.

Compliance is checked by inspection.

NOTE 1 In the following countries, IEC 60884-1, IEC 60884-2-5 and all other parts of the IEC 60884 series of standards are not indispensable and not applicable. National standards apply to plugs and socket-outlets for household use: UK.

Socket-outlets and plugs designed for household and similar use might not be designed for extended current draw or continuous use at maximum rated currents and might be subject to national regulations and standards for supply of energy to an EV.

NOTE 2 In the following countries the branch circuit overcurrent protection is based on 125 % of the rated current: US, CA.

NOTE 3 In the following countries, specific requirements may apply for the use of such accessories for EV energy supply: US.

NOTE 4 In the following countries EV supply equipment equipped with a plug for household and similar use the maximum rated current is 8 A, if the charging cycle can exceed 2 hours: FR.

NOTE 5 In the following countries, EV supply equipment equipped with a plug for household and similar use, if the charging cycle can exceed 2 hours, the maximum rated current is 10 A: NO.

NOTE 6 In the following countries, for EV supply equipment equipped with a plug for household and similar use, repeated continuous loads of long duration, shall be limited to 6 A: DK.

NOTE 7 In the following countries, plugs and socket-outlets, according to IEC 60309-2 are recommended for Mode 1 and Mode 2 connections for more than 8 A (2 kVA): CH.

NOTE 8 In the following country, 20 A socket-outlet is recommended for AC 200 V: JP.

9.3 Functional description of the basic interface

General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1.

The basic interface is specified in 6.5 of IEC 62196-1:2014.

The following contacts are indicated:

- up to three phases (L1, L2, L3);
- neutral (N);
- protective conductor (PE);
- control pilot (CP);
- proximity contact (PP).

It may be used either for single-phase or for three-phase or both.

Ratings and requirements for the use of the basic interface shall be in accordance with the requirements specified in IEC 62196-2.

9.4 Functional description of the universal interface

General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1.

The universal interface is specified in 6.4 and Table 2 of IEC 62196-1:2014.

9.5 Functional description of the DC interface

General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1.

The DC interface, configurations and ratings are specified in 6.6 and Table 4 of IEC 62196-1:2014.

Ratings and requirements for the use of DC interface shall be in accordance with the requirements specified in IEC 62196-3.

9.6 Functional description of the combined interface

The combined interface is specified in 6.7 and Table 5 of IEC 62196-1:2014.

General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1.

Ratings and requirements for the use of the combined interface with alternating current shall be in accordance with the requirements specified in IEC 62196-2.

Ratings and requirements for the use of the combined interface with direct current shall be in accordance with the requirements specified in IEC 62196-3.

9.7 Wiring of the neutral conductor

Where accessories according to IEC 62196 are used for three phase supply the neutral conductor shall always be wired to the accessories.

Where accessories according to IEC 62196 are used for single phase supply, the terminals L (L1) and N (Neutral) shall always be wired.

Compliance is checked by inspection.

NOTE In the following countries certain AC supply networks do not provide a neutral conductor: US, BE, IT, CA, JP, CH, NO.

Wiring instructions shall be provided in the manual (see 16.1).

10 Requirements for adaptors

Vehicle adaptors shall not be used to connect a vehicle connector to a vehicle inlet.

Adaptors between the EV socket-outlet and the EV plug shall only be used if specifically designated and approved by the vehicle manufacturer or by the EV supply equipment manufacturer and in accordance with national requirements, if any (see 16.2).

Such adaptors shall comply with the requirements of this standard, and the other relevant standards governing either the EV plug or EV socket-outlet portions of the adaptor. The adaptors shall be marked to indicate the specific conditions of use allowed by the manufacturer, e.g. IEC 62196 series.

Such adaptors shall not allow transitions from one mode to another.

NOTE 1 In the following countries, the use of adaptors from standard socket-outlets to Mode 3 vehicle cable assembly, that maintain the overall safety requirements of this standard is allowed: IT, SE, BE, CH.

NOTE 2 In the following countries, the use of adaptors from standard socket-outlets to cable assembly with a basic or universal interface that maintains the overall safety requirements of this standard is allowed: FR, IT.

NOTE 3 In the following countries, for Mode 1 and Mode 2, a short cord extension set of less than 30 cm in length and with a standard plug and no Mode change, is permitted for use on the EV supply equipment: SE.

NOTE 4 In the following countries, the use of adapter cable assembly with a plug according to IEC 60884 and a socket-outlet according to IEC 60309, with no Mode change, of less than 30 cm and an overcurrent protection of 8 A in the plug portion, is allowed: CH.

11 Cable assembly requirements

11.1 General

The cable assembly shall be provided with a cable that is suitable for the application.

NOTE IEC 62893 (under consideration) is a standard for some types of cables for the EV supply equipment.

Cable assemblies shall not allow transitions from one mode to another. This does not concern Mode 2 cable assemblies that are constructed according to IEC 62752.

11.2 Electrical rating

For case C, the voltage and current ratings of the cable assembly shall be compatible with the rating of the EV supply equipment.

For accessories requiring current coding according to Annex B and IEC 62196-2, the maximum value of the current coding as indicated in Clause B.2 shall be in accordance with the current rating of the cable assembly.

Cables used with accessories according to IEC 62196-2 for Mode 3 case B, shall have a minimum withstand I^2t value of 75 000 A²s.

Compliance is checked by inspection.

NOTE 1 IEC 62893 standard for EV charging cables is under consideration.

NOTE 2 In following countries, specific cable types for cable assemblies are required by national regulations: US (type cable EV, EVJ families), JP (VCT, etc.).

NOTE 3 The I^2t value can be evaluated according to 434.5.2 of IEC 60364-4-43:2008.

11.3 Dielectric withstand characteristics

Dielectric withstand characteristics of the cable assembly shall be as indicated for the EV supply equipment in 12.7.

For Class I equipment: between live part and earth with test voltage for Class I equipment;

For Class II equipment: between live part and exposed conductive parts with test voltage for Class II equipment.

11.4 Construction requirements

A cable assembly shall be so constructed that it cannot be used as a cord extension set.

NOTE As in IEC 62196-1, plugs and connectors are designed not to match each other.

A cable assembly may include one or more cables, which may be in a flexible tube, conduit or wire way.

The cable may be fitted with an earth-connected metal shielding.

The cable insulation shall be wear resistant and maintain flexibility over the full temperature range required by the classification of the EV supply equipment.

Compliance is checked by inspection.

11.5 Cable dimensions

The maximum cable length shall be in accordance with the national codes if any.

NOTE 1 In the following countries, the overall length of the EV supply cable does not exceed 7,5 m unless equipped with a cable management system as required by national codes and regulations: US.

NOTE 2 In the following countries, the overall length of the EV supply cable does not exceed 5 m unless equipped with a cable management system as required by national codes and regulations: CH.

Compliance is checked by inspection.

11.6 Strain relief

The strain relief of the cable in the vehicle connector, EV plug or in the standard plug shall be as specified in the relevant product standard (e.g. IEC 62196-1, IEC 60309-1 or IEC 60884-1).

For case C the strain relief at the EV supply equipment shall be in accordance with the requirements in IEC 62196-1.

11.7 Cable management and storage means for cables assemblies

For case C EV supply equipment, a storage means shall be provided for the vehicle connector when not in use.

For case C EV supply equipment the lowest point of the vehicle connector when stored shall be located at a height between 0,5 m and 1,5 m above ground level.

NOTE In the following countries, requirements related to people with disabilities are covered by national regulations: US.

For case C EV charging stations with cables of more than 7,5 m, a cable management system shall be provided. The free cable length shall not exceed 7,5 m when not in use.

Prevention of overheating of cables or cable assemblies used in stored or partially stored position shall be ensured.

Compliance is checked according to Clause 22 of IEC 61316:1999 for cable reel storage.

12 EV supply equipment constructional requirements and tests

12.1 General

The control means and the protection means in Mode 2 EV supply equipment that is intended to be used both as stationary equipment and as portable equipment shall comply with IEC 61851-1 and with IEC 62752.

For case C EV supply equipment, the output cable assembly is considered part of the assembly for testing purpose.

Electric devices and components of EV supply equipment shall comply with their relevant standards. The tests of devices and components shall be carried out with the specimen, or any movable part of it, placed in the most unfavourable position that can occur in normal use.

For extreme environment or other special service conditions, see IEC TS 61439-7.

NOTE 1 In the following countries, there are other requirements to be met for EV supply equipment: JP, US, CA.

NOTE 2 In the following countries, as exception to 10.2.101 and 10.2.102 of IEC TS 61439-7:2014, the product shall fulfil a minimum requirement of IP XXB after the test: SE.

12.2 Characteristics of mechanical switching devices

12.2.1 General

Switching devices within EV supply equipment intended to supply the connecting points shall comply with their relevant standards, with at least the characteristics as given in 12.2.

12.2.2 Switch and switch-disconnector

Switches and switch-disconnectors shall comply with IEC 60947-3.

For AC applications, switches and switch-disconnectors shall have a rated current, at a utilization category of at least AC-22A, not less than the rated current of the circuit that they are intended to operate in.

For DC applications, switches and switch-disconnectors shall have a rated current, at a utilization category of at least DC-21A, not less than the rated current of the circuit that they are intended to operate in.

Compliance is checked by inspection.

NOTE In the following countries, national standards or regulations provide different requirements: JP

12.2.3 Contactor

Contactors shall comply with IEC 60947-4-1.

For AC applications, contactors shall have a rated current, at a utilization category of at least AC-1, not less than the rated current of the circuit that they are intended to operate in.

For DC applications, contactors shall have a rated current, at a utilization category of at least DC-1, not less than the rated current of the circuit that they are intended to operate in.

Compliance is checked by inspection.

NOTE In the following countries, national standards or regulations provide different requirements: JP.

12.2.4 Circuit-breaker

Circuit breakers, if any, shall comply with IEC 60898-1 or IEC 60947-2 or IEC 61009-1.

Compliance is checked by inspection.

NOTE In the following countries, national standards or regulations provide different requirements: JP.

12.2.5 Relays

Relays used to switch the main current path shall comply with IEC 61810-1 with the following minimum characteristics:

- 50 000 cycles,
- contact category: CC 2.

12.2.6 Inrush current

AC EV supply equipment shall withstand the inrush current according to 8.2.2 of ISO 17409:2015.

The following values are specified in ISO 17409:

- After closing the contactor in the EV supply equipment at the peak value of the supply voltage, the EV supply equipment shall be able to withstand 230 A peak within the duration of 100 μ s.
- During the next second the EV supply equipment shall be able to withstand 30 A (rms).

Compliance to this requirement can be verified by test on the complete EV supply equipment or on the individual switching device according IEC TS 61439-7.

NOTE An example of a test is given in 9.8 of IEC 62752:2016.

The protection means shall be selected not to trip for inrush current.

12.2.7 Residual direct current monitoring device (RDC MD)

This will be covered in the future IEC 62955 (under consideration).

12.3 Clearances and creepage distances

The clearances and creepage distances in the EV supply equipment, installed as intended by the manufacturer, shall be in accordance with the requirements specified in IEC 60664-1.

Parts of the EV supply equipment directly connected to the public AC supply network shall be designed according to overvoltage category IV.

Permanently connected EV supply equipment shall be designed according to a minimum overvoltage category III except for the socket-outlet or the vehicle connector in case C where a minimum overvoltage category II applies.

EV supply equipment supplied through a cable and plug shall be designed according to a minimum overvoltage category II.

Equipment that is intended to be used under the conditions of a higher overvoltage category shall include appropriate overvoltage protective device (see 4.3.3.6 of IEC 60664-1:2007).

12.4 IP degrees

12.4.1 Degrees of protection against solid foreign objects and water for the enclosures

Enclosures of the EV supply equipment shall have an IP degree, according to IEC 60529 as follows:

- indoor use: at least IP41;
- outdoor use: at least IP44.

Compliance is checked by test in accordance with IEC 60529.

The minimum IP degree for socket-outlets and the vehicle connectors shall be in accordance with their appropriate standards.

IPX4 may be obtained by the combination of the socket-outlet or connector and the lid or cap, EV supply equipment enclosure or EV enclosure.

12.4.2 Degrees of protection against solid foreign objects and water for basic, universal and combined and DC interfaces

The minimum IP degrees for ingress of objects and liquids shall be:

- Indoor use:
 - vehicle connector when mated with vehicle inlet: IP21;
 - EV plug mated with EV socket-outlet: IP21;
 - vehicle connector for case C when not mated: IP21;
 - vehicle connector for case B when not mated: IP24.
- Outdoor use:
 - vehicle connector when mated with vehicle inlet: IP44;
 - EV plug mated with EV socket-outlet: IP44;
 - vehicle connector when not mated: IP24;
 - vehicle connector for case B when not mated: IP24;
 - socket-outlet when not mated: IP24.

Compliance is checked by test in accordance with IEC 60529.

IPX4 may be obtained by the combination of the socket-outlet or connector and the lid or cap, EV supply equipment enclosure or EV enclosure.

NOTE In the following countries, the UL articulated finger probe is used according to national regulations: US, CA.

12.5 Insulation resistance

The insulation resistance measured with a 500 V DC voltage applied between all inputs/outputs connected together (power source included) and the accessible parts shall be:

- for a class I EV supply equipment: $R > 1 \text{ M}\Omega$;
- for a class II EV supply equipment: $R > 7 \text{ M}\Omega$.

For this test all extra low voltage (ELV) circuits shall be connected to the accessible parts during the test. The measurement of insulation resistance shall be carried out with the protective impedances disconnected, and after applying the test voltage for the duration of 1 min and immediately after the damp heat continuous test of IEC 60068-2-78, test Ca, at $40^\circ\text{C} \pm 2^\circ\text{C}$ and 93 % relative humidity for four days.

The conditioning test for the insulation test and the touch current can be avoided if the conditioning for test of 12.9 followed by test of 12.5, 12.6 and final test of 12.9, are conducted sequentially in that order.

12.6 Touch current

The touch current between any AC supply network poles and the accessible metal parts connected with each other, and with a metal foil covering insulated external parts, is measured in accordance with IEC 60990 and shall not exceed the values indicated in Table 1.

The touch current shall be measured within one hour after the damp heat continuous test of IEC 60068-2-78, test Ca, at $40^\circ\text{C} \pm 2^\circ\text{C}$ and 93 % relative humidity for four days, with the electric vehicle charging station connected to AC supply network in accordance with IEC 60990.

The test voltage shall be 1,1 times the maximum rated voltage.

Table 1 – Touch current limits

	Class I	Class II
Between any network poles and the accessible metal parts connected with each other and a metal foil covering insulated external parts	3,5 mA	0,25 mA
Between any network poles and the metal inaccessible parts normally non-activated (in the case of double insulation)	Not applicable	3,5 mA
Between inaccessible and accessible parts connected with each other and a metal foil covering insulated external parts (additional insulation)	Not applicable	0,5 mA

This test shall be made when the EV supply equipment is functioning with a resistive load at rated output power.

Circuitry that is connected through a fixed resistance or referenced to earth (for example, proximity function and control pilot function) are disconnected before this test.

The equipment is fed through an isolating transformer or installed in such a manner that it is isolated from the earth.

12.7 Dielectric withstand voltage

12.7.1 AC withstand voltage

The dielectric withstand voltage, at power frequency of 50 Hz or 60 Hz, shall be applied for 1 min as follows:

- 1) For a class I EV supply equipment.

($U_n + 1\,200\text{ V}$) (r.m.s.) in common mode (all circuits in relation to the exposed conductive parts) and differential mode (between each electrically independent circuit and all other exposed conductive parts or circuits) as specified in 5.3.3.2 of IEC 60664-1:2007.

NOTE 1 U_n is the nominal line to neutral voltage of the neutral-earthed supply system.

- 2) For a class II EV supply equipment.

2 times ($U_n + 1\,200\text{ V}$) (r.m.s.) in common mode (all circuits in relation to the exposed conductive parts) and differential mode (between each electrically independent circuit and all other exposed conductive parts or circuits) as specified in 5.3.3.2.3 of IEC 60664-1:2007.

- 3) For both class I and class II AC EV supply equipment where the insulation between the AC supply network and the extra low voltage circuit is double or reinforced insulation, 2 times ($U_n + 1\,200\text{ V}$) (r.m.s.) shall be applied to the insulation.

Alternatively the test can be carried out using a DC voltage equal to the AC peak values.

For this test, all the electrical equipment shall be connected, except those items of apparatus which, according to the relevant specifications, are designed for a lower test voltage; current-consuming apparatus (e.g. windings, measuring instruments, voltage surge suppression devices) in which the application of the test voltage would cause the flow of a current, shall be disconnected. Such apparatus shall be disconnected at one of their terminals unless they are not designed to withstand the full test voltage, in which case all terminals may be disconnected.

NOTE 2 For test voltage tolerances and the selection of test equipment, see IEC 61180.

12.7.2 Impulse dielectric withstand (1,2 μs /50 μs)

The dielectric withstand of the power circuits at impulse test shall be tested according to IEC 60664-1.

The impulse voltage shall be applied to live parts and exposed conductive parts.

The test shall be carried out in accordance with the requirements of IEC 61180.

Parts of the EV supply equipment directly connected to the public AC supply network shall be tested according to overvoltage category IV.

Permanently connected EV supply equipment shall be tested according to an overvoltage category III except for the socket-outlet or the vehicle connector in case C where an overvoltage category II applies.

EV supply equipment supplied through a cable and plug shall be tested according to an overvoltage category II.

12.8 Temperature rise

EV supply equipment shall comply with IEC TS 61439-7.

12.9 Damp heat functional test

Following the conditioning defined below, the EV supply equipment is deemed to pass the test, if, it passes the normal sequences test according to A.4.7 of Annex A. The precision of the timing does not need to be verified.

Conditioning:

- For indoor units, 6 cycles of 24 h each to a damp heat cycling test according to IEC 60068-2-30 (Test Db) at (40 ± 3) °C and relative humidity of 95 %;
- For outdoor units, two 12 day periods, with each period consisting of 5 cycles of 24 h each to a damp heat cycling test according to IEC 60068-2-30 (Test Db) at (40 ± 3) °C and relative humidity of 95 %.

12.10 Minimum temperature functional test

The EV supply equipment shall be pre-conditioned in accordance with IEC 60068-2-1, test Ab, at the minimum operating temperature (either -5 °C for indoor, -25 °C outdoor or lower values declared by the manufacturer ± 3 K) for (16 ± 1) h.

The EV supply equipment is deemed to pass the test, if, immediately after the pre-conditioning, it passes the sequences test according to A.4.7 of Annex A while at the minimum operating temperature. The precision of the timing does not need to be verified.

12.11 Mechanical strength

For Mode 2 EV supply equipment the minimum degree of protection of the external enclosure against mechanical impact shall be IK08 according to IEC 62262.

After the test, the samples shall show that:

- the IP degree according to 12.5 is not impaired;
- no part has moved, loosened, detached or deformed to the extent that any safety functions are impaired;
- the test did not cause a condition that results in the equipment not complying with the strain relief requirements, if applicable;
- the test did not result in a reduction of creepage and clearance between uninsulated live parts of opposite polarity, uninsulated live parts and accessible dead or grounded metal below the minimum acceptable values;
- the test did not result in any other evidence of damage that could increase the risk of fire or electric shock.

13 Overload and short-circuit protection

13.1 General

Where connecting points can be used simultaneously and are intended to be supplied from the same input line, they shall have individual protection incorporated in the EV supply equipment.

If the EV supply equipment presents more than one connecting point then such connecting points may have common overload protection means and may have common short-circuit protection means, if those protection means provide the required protection for each of the connecting points (e.g. the common protection device shall have a rating no higher than the lowest rating of the connecting points).

NOTE 1 Such a configuration might have an impact on availability, which could be resolved by adequate load management (eg. load sharing).

If the EV supply equipment presents more than one connecting point that cannot be used simultaneously then such connecting points can have common protection means.

Such overcurrent protective devices shall comply with IEC 60947-2, IEC 60947-6-2 or IEC 61009-1 or with the relevant parts of IEC 60898 series or IEC 60269 series.

NOTE 2 In the following countries, the methods of protection against overcurrent and overvoltage are in accordance with national codes: US, JP, CA.

NOTE 3 In the following countries, the branch circuit overcurrent protection is based upon 125 % of the equipment rating: US, CA.

NOTE 4 In the following countries, EV charging is considered a continuous load and is limited to 80 % of the branch circuit fuse or circuit breaker rating by National rules: US, CA.

NOTE 5 Protection devices can be provided inside the EV supply equipment, in the fixed installation or in both places.

NOTE 6 In the following countries, the equipment earthing path complies with the test requirement in national standard: JP.

13.2 Overload protection of the cable assembly

The EV charging stations or Mode 2 EV supply equipment shall provide overload protection for all cases for all intended cable conductor sizes if not provided by the upstream supply network.

The overload protection may be provided by a circuit breaker, fuse or combination thereof.

If overload protection is provided by a means other than a circuit breaker, fuse or combination thereof, such means shall trip within 1 min if the current exceeds 1,3 times the rated current of the cable assembly.

13.3 Short-circuit protection of the charging cable

The EV charging stations or Mode 2 EV supply equipment shall provide short-circuit current protection for the cable assembly if not provided by the supply network.

In case of short-circuit, the value of I^2t at the EV socket-outlet of the Mode 3 charging station shall not exceed 75 000 A²s.

In case of short-circuit, the value of I^2t at the vehicle connector (Case C) of the Mode 3 charging station shall not exceed 80 000 A²s.

NOTE 1 This can either be achieved by integrating the appropriate short-circuit protection device in the EV charging station or by providing the relevant information in the installation manual.

NOTE 2 Protection against short-circuit can be provided inside the EV charging station, in the fixed installation or in both places.

NOTE 3 The value of 80 000 A²s is identical to that indicated to ISO 17409:2015.

The real value of the prospective short-circuit current is evaluated at the point where the cable assembly is connected.

14 Automatic reclosing of protective devices

The automatic or remote reclosing of protective devices after tripping in the EV supply equipment shall only be possible in case the following requirement is fulfilled:

- the socket-outlet shall not be mated to a plug. This shall be checked by the EV supply equipment.

For automatic or remote reclosing automatic reclosing devices (ARDs) with an assessment means may be used.

The EV supply equipment may close the contactor during an automatic or remote reset cycle to establish conductivity between the protection device and the socket-outlet.

By this procedure the EV supply equipment can check the circuit up to the socket-outlet to be free of fault current.

NOTE In the following countries automatic reclosing of protection means is not allowed: DK, UK, FR, CH.

For case C the EV supply equipment shall not provide automatic or remote reclosing of protective devices.

15 Emergency switching or disconnect (optional)

Emergency switching or disconnect equipment shall be used either to disconnect the supply network from EV supply equipment or to disconnect the socket-outlet(s) or the cable assembly(ies) from the supply network.

Such equipment shall be installed in accordance with national rules.

Such equipment may be part of the supply network or either the EV charging station or the Mode 2 supply equipment.

NOTE In the following countries emergency disconnecting means are provided in an accessible location for some EV supply equipment rated more than 60 A or more than 150 V to ground according to national rules: US, CA.

16 Marking and instructions

16.1 Installation manual of EV charging stations

The installation manual of EV charging stations shall indicate the classification as given in Clause 5.

The EV supply equipment manufacturer shall state the interface characteristics specified in Clause 5 of IEC TS 61439-7:2014 in the manual where applicable. Wiring instructions shall be provided.

If protective devices are included in the EV charging station, the manual shall indicate the characteristics of those protection devices explicitly describing the type and rating. The information may be provided in a detailed electric diagram.

If the protective devices are not in the EV charging station, the manual shall indicate all information necessary for the installation of external protection explicitly describing the type and rating of the devices to be used.

It is recommended that the installation manual be made available to future customers.

If the EV charging station has more than one connection of the equipment to the AC supply network, and does not have individual protection for each connecting point to the vehicles, then the installation manual shall indicate that each connection of the equipment to the AC supply network requires individual protection.

The installation manual shall indicate if the optional function for ventilation is supported by the charging station (6.3.2.2).