

INTERNATIONAL STANDARD



**Electric vehicle conductive charging system –
Part 23: DC electric vehicle supply equipment**

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Part 23: DC electric vehicle supply equipment**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –**Part 23: DC electric vehicle supply equipment**

FOREWORD

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IEC 61851-23 has been prepared by IEC technical committee 69: Electric power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is an International Standard.

This second edition cancels and replaces the first edition published in 2014. This edition constitutes a technical revision.

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

- a) the structure has been rearranged according to IEC 61851-1:2017;
- b) electrical safety requirements in Clause 8 and Clause 12 have been revised based on the requirements in IEC 62477-1 and inspired by the hazard based safety approach of IEC 62368-1;

- c) test methods for checking conformity to the stated requirements have been mostly added; general provisions for compliance tests have been specified in Clause 102;
- d) specific requirements and/or information for the following functions have been added: energy transfer with thermal management system (101.2), bi-directional power transfer control (Annex DD), multi- side B separated EV supply equipment (Annex FF), and communication and energy transfer process (Annex GG);
- e) Annex AA (system A), Annex BB (system B) and Annex CC (system C) have been updated including additions in conjunction with b) and c). This document has been limited to be applicable to system A, system B and system C;
- f) the former Annex DD and Annex EE have been deleted. A new Annex EE, with the requirements for the artificial test load, has been added.
- g) a new informative annex for the touch current and the touch impulse current (Annex HH) has been added.

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

Draft	Report on voting
69/907/FDIS	69/925/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/publications.

This document is to be read in conjunction with IEC 61851-1:2017.

The clauses of particular requirements in this document supplement or modify the corresponding clauses in IEC 61851-1:2017. Where the text of subsequent clauses indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of IEC 61851-1:2017, these changes are made to the relevant text of IEC 61851-1:2017, which then becomes part of this document. Where no change is necessary, the words "This clause of IEC 61851-1:2017 is applicable" are used. The new clauses which are not included in IEC 61851-1:2017 have a clause number starting from 101, for example 3.101, 101.1, etc. The annexes of this document are numbered using double-alphabet, for example Annex AA, to avoid confusion with the annexes in IEC 61851-1:2017.

In this document, the following print types are used:

- *test specifications: italic type.*
- notes: smaller roman type.

Figures in this document use L1 and N to represent the connection of the side A of the EV supply equipment to the AC supply network or DC supply network. This is only to simplify the figures and not to impose requirements.

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

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, or
- revised.

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ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 23: DC electric vehicle supply equipment

1 Scope

This part of IEC 61851 applies to the EV supply equipment to provide energy transfer between the supply network and electric vehicles (EVs), with a rated maximum voltage at side A of up to 1 000 V AC or up to 1 500 V DC and a rated maximum voltage at side B up to 1 500 V DC.

This document specifies the EV supply equipment of system A, system B and system C as defined in Annex AA, Annex BB and Annex CC. Other systems are under consideration.

This document provides the requirements for bidirectional power transfer (BPT) EV supply equipment for system A, with a rated maximum voltage at side A up to 1 000 V AC or 1 500 V DC. The requirements for reverse power transfer (RPT) and BPT for system B and system C are under consideration and are not specified in this document.

Annex DD provides information about BPT.

This document does not cover all safety aspects related to maintenance.

Requirements for systems not providing simple separation or protective separation between side A and side B are under consideration.

The requirements for digital communication between EV supply equipment and the EV to control energy transfer are defined in IEC 61851-24.

Requirements for energy transfer with an automated connection device are given in IEC 61851-23-1¹.

Specific requirements for EV supply equipment with multiple vehicle connectors are provided in Annex FF.

General information about energy transfer control, signalling and digital communication is provided in Annex GG.

General information on the touch current and touch impulse current is provided in Annex HH.

Requirements for EV supply equipment without current, voltage and/or power control are under consideration.

EV supply equipment in compliance with this document are not intended to provide energy transfer to a single EV with

- multiple vehicle connectors of the same EV supply equipment, or
- multiple EV supply equipment.

Requirements for such use case are under consideration.

¹ Under preparation. Stage at the time of publication: IEC AFDIS 61851-23-1:2023.

NOTE Requirements for EVs mated to an EV supply equipment are specified in ISO 17409:2020. ISO 17409 will be revised to the ISO 5474 series².

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 60038:2009, *IEC standard voltages*

IEC 60068-2-75:2014, *Environmental testing – Part 2-75: Tests – Test Eh: Hammer tests*

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

IEC 60227-1:2007, *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V – Part 1: General requirements*

IEC 60245-1:2003, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 1: General requirements*
IEC 60245-1:2003/AMD1:2007

IEC 60320-1, *Appliance couplers for household and similar general purposes – Part 1: General requirements*

IEC 60364-4-43:2008, *Low-voltage electrical installations – Part 4-43: Protection for safety – Protection against overcurrent*

IEC 60364-5-53:2019, *Low-voltage electrical installations – Part 5-53: Selection and erection of electrical equipment – Devices for protection for safety, isolation, switching, control and monitoring*

IEC 60364-5-54:2011, *Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors*
IEC 60364-5-54:2011/AMD1:2021

IEC 60384-14, *Fixed capacitors for use in electronic equipment – Part 14: Sectional specification – Fixed capacitors for electromagnetic interference suppression and connection to the supply mains*

IEC 60479-1:2018, *Effects of current on human beings and livestock – Part 1: General aspects*

IEC 60479-2:2019, *Effects of current on human beings and livestock – Part 2: Special aspects*

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

IEC 60664-1:2020, *Insulation coordination for equipment within low-voltage supply systems – Part 1: Principles, requirements and tests*

IEC 60811-501, *Electric and optical fibre cables – Test methods for non-metallic materials – Part 501: Mechanical tests – Tests for determining the mechanical properties of insulating and sheathing compounds*

² Under preparation.

IEC 60812:2018, *Failure modes and effects analysis (FMEA and FMECA)*

IEC 60990:2016, *Methods of measurement of touch current and protective conductor current*

IEC 61008-1:2010, *Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs) – Part 1: General rules*

IEC 61008-1:2010/AMD1:2012

IEC 61008-1:2010/AMD2:2013

IEC 61009-1:2009, *Residual current operated circuit-breakers with integral overcurrent protection for household and similar uses (RCBOs) – Part 1: General rules*

IEC 61009-1:2009/AMD1:2012

IEC 61009-1:2009/AMD2:2013

IEC 60947-2:2016, *Low-voltage switchgear and controlgear – Part 2: Circuit-breakers*

IEC 60947-2:2016/AMD1:2019

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

IEC 61439-1:2020, *Low-voltage switchgear and controlgear assemblies – Part 1: General rules*

IEC 61439-7:2022, *Low-voltage switchgear and controlgear assemblies – Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations*

IEC 61540:1997, *Electrical accessories – Portable residual current devices without integral overcurrent protection for household and similar use (PRCDs)*

IEC 61540:1997/AMD1:1998

IEC 61557-8:2014, *Electrical safety in low voltage distribution systems up to 1 000 V a.c. and 1 500 V DC – Equipment for testing, measuring or monitoring of protective measures – Part 8: Insulation monitoring devices for IT systems*

IEC 61558-1:2017, *Safety of transformers, reactors, power supply units and combinations thereof – Part 1: General requirements and tests*

IEC 61558-2-4:2021, *Safety of transformers, reactors, power supply units and combinations thereof – Part 2-4: Particular requirements and tests for isolating transformers and power supply units incorporating isolating transformers for general applications*

IEC 61643 (all parts), *Low-voltage surge protective devices*

IEC 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*

IEC 61643-21, *Low voltage surge protective devices – Part 21: Surge protective devices connected to telecommunications and signalling networks – Performance requirements and testing methods*

IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 61851-21-2:2018, *Electric vehicle conductive charging system – Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply – EMC requirements for off-board electric vehicle charging systems*

IEC 61851-24:2023, *Electric vehicle conductive charging system – Part 24: Digital communication between a DC EV charging station and an electric vehicle for control of DC charging*

IEC 62196-1:2022, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 1: General requirements*

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

IEC TS 62196-3-1:2020, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 3-1: Vehicle connector, vehicle inlet and cable assembly for DC charging intended to be used with a thermal management system*

IEC 62368-1:2023, *Audio/video, information and communication technology equipment – Part 1: Safety requirements*

IEC 62423:2009, *Type F and type B residual current operated circuit-breakers with and without integral overcurrent protection for household and similar uses*

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

IEC 62477-1:2022, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

IEC 62893-4-1:2020, *Charging cables for electric vehicles of rated voltages up to and including 0,6/1 kV – Part 4-1: Cables for DC charging according to mode 4 of IEC 61851-1 – DC charging without use of a thermal management system*

IEC Guide 115, *Application of measurement uncertainty to conformity assessment activities in the electrotechnical sector*

ISO 2719:2016, *Determination of flash point – Pensky-Martens closed cup method*

ISO 6469-3:2018³, *Electrically propelled road vehicles – Safety specifications – Part 3: Electrical safety*

ISO 7000, *Graphical symbols for use on equipment*, available at <http://www.graphical-symbols.info/equipment>

ISO 7010, *Graphical symbols – Safety colours and safety signs – Registered safety signs*, available at <https://www.iso.org/obp>

ISO 15118-2:2014, *Road vehicles – Vehicle-to-grid communication interface – Part 2: Network and application protocol requirements*

ISO 15118-3, *Road vehicles – Vehicle to grid communication interface – Part 3: Physical and data link layer requirements*

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

³ This publication has been withdrawn. A new edition of ISO 6469-3 (4th edition) came out in 2021.

DIN SPEC 70121:2014, *Electromobility – Digital communication between a DC EV charging station and an electric vehicle for control of DC charging in the combined charging system*

OECD 301 B, *OECD Guideline for testing of chemicals*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61851-1:2017 apply, except as follows.

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>

Addition:

NOTE The definitions included in this document are those having general application herein. Definitions applying to isolating transformers, safety isolating transformers, switch mode power supplies, and their construction are included in IEC 61558-1.

3.1 Electric supply equipment

Additional terms and definitions:

3.1.101

separated EV supply equipment

EV supply equipment where the side B circuit is separated from all other circuits

Note 1 to entry: See Clause 8 for the requirements of separation between each circuit.

3.1.102

non-separated EV supply equipment

EV supply equipment where the side B circuit is not separated from one or more other circuits

Note 1 to entry: See Clause 8 for the requirements of separation between each circuit.

3.1.103

energy transfer

power transfer

DEPRECATED: charging

delivery of energy, in either direction, between parts of a system

Note 1 to entry: The direction of the energy transfer is defined by the application.

3.2 Insulation

3.2.1

basic insulation

Addition:

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

3.2.8

insulation

Replacement:

all the materials and parts used to insulate conductive elements of a device



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

Additional terms and definitions:

3.2.101

asymmetrical insulation faults

asymmetrical faults

defect in the insulation of an electric installation or equipment creating a resistive path to protective conductor having different resistances from the live conductors to protective conductor

[SOURCE: IEC 61557-8:2014, 3.1.20, modification – Words "phase conductors" replaced with "live conductors", and "earth" with "protective conductor".]

3.2.102

dead, adj

de-energized, adj

qualifies a conductive part when it is not energized

[SOURCE: IEC 60050-151:2001, 151-15-59, modified – Term "de-energized" added.]

3.2.103

live, adj

energized, adj

qualifies a conductive part having an electric potential difference with respect to a relevant reference

Note 1 to entry: The reference potential is usually the Earth or an equipotential frame.

Note 2 to entry: A live part may be temporarily dead when it is not energized. A neutral conductor is considered as live but earthing conductors are not.

Note 3 to entry: A part is energized (live) when it is electrically connected to a source of electric energy. It can also be energized (live) when it is electrically charged and/or under the influence of an electric or magnetic field.

Note 4 to entry: See IEC 60050-651:2014, 651-21-08.

[SOURCE: IEC 60050-151:2001, 151-15-58, modified – Term "live" added, as well as Notes 2 and 3 to entry.]

3.2.104

leakage current monitoring device

DEPRECATED: leakage measuring device

passive electrical device for monitoring insulation resistance of separated DC system by measuring leakage current between live parts and exposed conductive part or the protective conductor

3.2.105

enhanced protective provision

protective provision having a reliability of protection not less than that provided by two independent protective provisions

[SOURCE: IEC 60050-195:2021, 195-06-27]

3.2.106

fault protection

protection against electric shock under single-fault conditions

[SOURCE: IEC 60050-195:2021, 195-06-02]

3.2.107

insulation

set of properties which characterize the ability of insulation to provide its function

Note 1 to entry: Examples of relevant properties are: resistance, breakdown voltage.

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

3.2.108

insulation monitoring device

IMD

device which permanently monitors the insulation resistance to protective conductor of separated AC IT systems, AC IT systems with galvanically connected DC circuits having nominal voltages less than or equal to 1 000 V AC, as well as monitoring the insulation resistance of a separated DC IT systems with voltages less than or equal to 1 500 V DC, independent from the method of measuring

[SOURCE: IEC 61557-8:2014, 3.1.14, modified – Word "earth" replaced with "protective conductor" and "unearthed" with "separated".]

3.2.109

live part

<in electrical installations and equipment> 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

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

[SOURCE: IEC 60050-195:2021, 195-02-19, modified – Note to entry added.]

3.2.110

PELV system

electric system in which the voltage cannot be more than the value of extra low voltage:

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

Note 1 to entry: PELV is the abbreviation for protective extra low voltage.

[SOURCE: IEC 60050-826:2022, 826-12-32]

3.2.111

protective conductor

PE

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

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

[SOURCE: IEC 60050-826:2022, 826-13-22, modified – Word "electrical" deleted and example added in the definition. The Note to entry 1 has been deleted, and the example added.]

3.2.112

protective-equipotential-bonding

equipotential bonding for purposes of safety

EXAMPLE Protection against electric shock.

[SOURCE: IEC 60050-826:2022, 826-13-20, modified – Word "electrical" deleted in the definition and example added.]

3.2.113**protective screening**

protective shielding <electrically> US

<electrically> separation of electric circuits and/or conductors from hazardous-live-parts by an electrically protective screen connected to the protective equipotential bonding system and intended to provide protection against electric shock

[SOURCE: IEC 60050-195:2021, 195-06-18]

3.2.114**protective separation**

<electrically> separation of one electric circuit from another by means of:

- double insulation, or
- basic insulation and electrically protective screening, or
- reinforced insulation

[SOURCE: IEC 60050-826:2022, 826-12-29]

3.2.115**rated DC withstand voltage**

value of a DC withstand voltage declared by the manufacturer to characterize the isolating behaviour of a surge protective device (SPD)

[SOURCE: IEC 62561-3:2017, 3.8, modified – Words "an ISG" replaced with "a surge protective device (SPD)".]

3.2.116**single fault condition**

condition in which there is a fault of a single protective provision that is not an enhanced protective provision

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

3.2.117**startle reaction**

physiological reaction due to a minimum derived value of touch voltage for a population for which a current flowing through the body is just enough to cause involuntary muscular contraction to the person through which it is flowing

3.2.118**touch impulse current**

impulse current, or the corresponding charge or energy, dissipated in a human body or through livestock when it touches either a live part, or a hazardous-live-part or an exposed-conductive part of an installation or of equipment under certain conditions

Note 1 to entry: The impulse current has an RMS magnitude and duration associated with it in accordance with IEC 60479-2:2019, Clause 11.

Note 2 to entry: Capacitive coupling between side B live parts and protective conductor usually results from Y-capacitance, used for electromagnetic compatibility reasons, or from parasitic capacitive coupling.

3.2.119**touch voltage**

<effective> voltage between conductive parts when touched simultaneously by a person or an animal

Note 1 to entry: The value of the effective touch voltage may be appreciably influenced by the impedance of the person or the animal in electric contact with these conductive parts.

[SOURCE: IEC 60050-826:2022, 826-11-05, modified – Words "a human being or a livestock" replaced with "a person or an animal, and note to entry added.]

3.2.120

SELV system

electric system in which the voltage cannot be more than the value of extra-low voltage:

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

Note 1 to entry: SELV is the abbreviation for safety extra-low voltage.

[SOURCE: IEC 60050-195:2021, 195-06-28]

3.2.121

surge protective device

SPD

device that is intended to protect the electrical apparatus from transient overvoltages and to divert surge currents

Note 1 to entry: A surge protective device contains at least one non-linear component.

[SOURCE: IEC 60050-614:2016, 614-03-48]

3.2.122

symmetrical insulation fault

symmetrical fault

defect in the insulation of an electric installation or equipment creating a resistive path to protective conductor having approximately the same resistance from all live conductors to protective conductor

[SOURCE: IEC 61557-8:2014, 3.1.19, modified – Words "symmetrical fault" added in the term and "phase" is replaced by "live"]

3.2.123

Y-capacitance

total capacitance bridging the insulation barriers of the DC+ and DC– of side B to other circuits and protective conductor

Note 1 to entry: The capacitors are of a type suitable for use in situations where failure of the capacitor could lead to electric shock.

Note 2 to entry: The total capacitance is commonly distributed equally over the live conductors.

Note 3 to entry: For more information, see IEC 60384-14.

3.3 Functions

3.3.1

control pilot conductor

Replacement:

control pilot conductor

CP

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

3.3.5 proximity function

Replacement:

proximity function

PP

DEPRECATED: proximity pilot

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

Note 1 to entry: The acronym PP is based on "plug present".

Additional terms and definitions:

3.3.101

coupling session

DEPRECATED: charging session

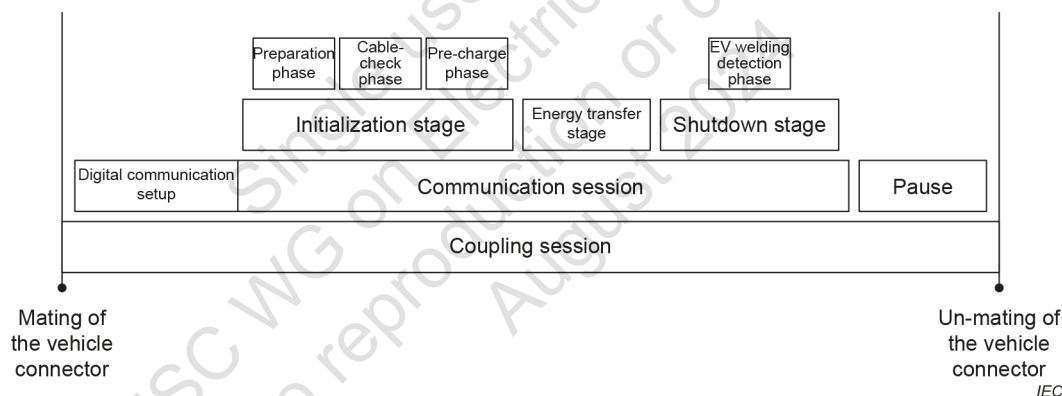
DEPRECATED: charge session

DEPRECATED: supply session

session that starts when the vehicle connector is mated to the vehicle inlet and terminates when the vehicle connector is un-mated from the vehicle inlet

Note 1 to entry: A coupling session can have zero, one or multiple communication sessions.

Note 2 to entry: See Figure 101.



NOTE 1 Figure 101 shows the naming of the sessions, stages and phases. This is not a timing or sequence diagram. Sequence diagrams are specified for each system in the respective annex.

NOTE 2 Details about the digital communication setup are specified in IEC 61851-24.

Figure 101 – Example of a coupling session

3.3.102

communication session

session that includes the initialization stage, energy transfer stage, and the shutdown stage

Note 1 to entry: Multiple consecutive communication sessions can occur in a coupling session.

Note 2 to entry: A communication session can include only the initialization stage and shutdown stage, if the EV supply equipment is unable to perform energy transfer.

3.3.103

pause

period of time between communication sessions where the EV supply equipment does not perform energy transfer

Note 1 to entry: The EV supply equipment and/or the EV may enable sleep mode during a pause.

3.3.104

sleep mode

state of a device or equipment to reduce energy consumption

3.3.105

initialization stage

stage at the beginning of a communication session to set, check and confirm parameters for the purpose of energy transfer

Note 1 to entry: An initialization stage can be triggered by the user, wake-up/re-initialization triggered by the EV or EV supply equipment after sleep, a pause or a power outage.

3.3.106

energy transfer stage

stage to perform energy transfer between the EV and the EV supply equipment

3.3.107

shutdown stage

stage at the end of a communication session to reach a safe state

EXAMPLE Normal shutdown, error shutdown and emergency shutdown.

3.3.108

preparation phase

phase during which an EV and EV supply equipment interact to set, check and confirm parameters and working conditions

EXAMPLE Perform compatibility check, verification of smart charging conditions.

3.3.109

cable-check phase

phase to check if the side B can safely become live, based on the parameters exchanged by basic signalling and digital communication

3.3.110

pre-charge phase

phase for the EV supply equipment or EV to limit the inrush current at side B

3.3.111

EV welding detection phase

phase for the EV to check if the EV disconnection device is not welded

Note 1 to entry: EV welding detection phase is optional.

3.3.112

normal shutdown

termination of the energy transfer initiated by the user, by the EV or by the EV supply equipment

3.3.113

error shutdown

termination of the energy transfer caused by a failure detected by the EV supply equipment or the EV

3.3.114

emergency shutdown

urgent termination of the energy transfer caused by a failure detected by the EV supply equipment or the EV

Note 1 to entry: An emergency shutdown may be performed by disconnecting the EV supply equipment from the supply network.

3.3.115**controlled current mode****CCM**

DEPRECATED: CCC

DEPRECATED: CCCM

<EV supply equipment> control mode of the EV supply equipment to control the present current at side B according to the target current of the EV supply equipment

3.3.116**controlled voltage mode****CVM**

DEPRECATED: CVC

DEPRECATED: CVCM

<EV supply equipment> control mode of the EV supply equipment to control the present voltage at side B according to the target voltage of the EV supply equipment

3.3.117**controlled power mode****CPM**

DEPRECATED: CPCM

<EV supply equipment> control mode of the EV supply equipment to control the present power at side B according to the target power of the EV supply equipment

3.3.118**thermal exchange**

function dissipating thermal energy from the thermal transport

[SOURCE: IEC TS 62196-3-1:2020, 3.105, modified – Words "method for cooling and" replaced with "function".]

3.3.119**thermal exchange device**

means for dissipating thermal energy from the thermal transport

[SOURCE: IEC TS 62196-3-1:2020, 3.106, modified – Words "cooling and" removed.]

3.3.120**thermal sensing**

function to provide a signal or measurement for obtaining temperature data of cable assemblies or parts thereof

[SOURCE: IEC TS 62196-3-1:2020, 3.101, modified – Word "method" replaced with "function to provide a signal or measurement", and "accessories" removed.]

3.3.121**thermal sensing device**

means for thermal sensing

[SOURCE: IEC TS 62196-3-1:2020, 3.102, modified – Words "providing temperature data of accessories, cable assemblies or parts thereof" replaced with "thermal sensing".]

3.3.122**thermal transport**

function for managing the thermal energy dissipation of cable assemblies or parts thereof by heat transfer

[SOURCE: IEC TS 62196-3-1:2020, 3.103, modified – Word "method" replaced with "function", "heat dissipation of accessories" replaced with "thermal energy dissipation of", and "independent of changing the current" replaced with "by heat transfer".]

3.3.123

thermal transport device

means for managing thermal energy dissipation of cable assemblies or parts thereof

[SOURCE: IEC TS 62196-3-1:2020, 3.104, modified – Words "the heat dissipation of accessories" replaced with "thermal energy dissipation of", and "independent of changing the current" removed.]

3.3.124

forward power transfer

forward energy transfer

FPT

DEPRECATED: charging

distribution of electricity from the supply network to an EV

3.3.125

reverse power transfer

reverse energy transfer

RPT

distribution of electricity from an EV to the supply network or to a load

Note 1 to entry: Household appliances are covered by the IEC 60335 series.

Note 2 to entry: Load according to IEC 60050-151:2001, 151-15-15, means a device intended to absorb power supplied by another device or an electric power system.

3.3.126

bidirectional power transfer

bidirectional energy transfer

BPT

DEPRECATED: bi-directional power transfer

combination of forward power transfer (FPT) and reverse power transfer (RPT)

Note 1 to entry: BPT can only be FPT, RPT or (free) floating between FPT and RPT, depending on the agreement with or request of DSO/CSO.

3.4 Vehicle

3.4.1

electric vehicle

EV

(electric road vehicle)

Replacement:

electrically propelled vehicle

EV

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

[SOURCE: ISO 6469-3:2021, 3.15]

3.4.3 rechargeable energy storage system RESS

Replacement:

battery system

DEPRECATED: RESS

DEPRECATED: EV battery

DEPRECATED: vehicle battery

DEPRECATED: vehicle/traction battery

DEPRECATED: traction battery

<EV> energy storage device that includes cells, cell assemblies or battery pack(s) as well as electrical circuits and electronics

Note 1 to entry: Battery system components can also be distributed in different devices (battery packs) within the vehicle.

Note 2 to entry: Examples of electronics are the battery control unit and contactors.

Additional terms and definitions:

3.4.101

EV disconnection device

dedicated disconnect or equivalent device(s) for energy transfer located in the vehicle power supply circuit between the vehicle inlet and the EV battery system

Note 1 to entry: The EV disconnection device is controlled during the communication session in accordance with the system specific sequence diagram between the EV supply equipment and the EV.

3.4.102

vehicle power supply circuit

voltage class B electric circuit which includes all parts that are conductively connected to the vehicle inlet that are mounted on the EV and that is energized during the energy transfer

Note 1 to entry: The definition is different from that in ISO 17409:2020. In the ISO 5474 series, the vehicle power supply circuit does not include anything off-board of the EV.

[SOURCE: ISO 5474-1:—, 3.2.21, modified – Definition reformulated and Note 1 to entry added.]

3.5 Cords, cables and connection means

3.5.13

Replacement:

vehicle connector

electric vehicle connector

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

[SOURCE: IEC 62196-1:2022, 3.56]

3.5.14

vehicle inlet

electric vehicle inlet

Replacement:

vehicle inlet

electric vehicle inlet

part incorporated in, or fixed to, the EV

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

[SOURCE: IEC 62196-1:2022, 3.57, modified – Words "electric vehicle" replaced with "EV".]

Additional terms and definitions:

3.5.101

cable assembly

<side B> assembly consisting of flexible cable fitted with a vehicle connector, and that is used to connect the EV to the EV supply equipment

3.6 Service and usage

3.6.10

user

Replacement:

person who uses or benefits from, or uses and benefits from, devices, systems or services

EXAMPLE Device or system may be HMI, EV or EV supply equipment; service may be energy transfer between EV and EV supply equipment.

[SOURCE: IEC 60050-871:2018, 871-02-05, modified – Term "active assisted living user" removed, abbreviated term "AAL" removed in the entry, and example added.]

3.6.111

ordinary person

person who is neither a skilled person nor an instructed person

Note 1 to entry: Ordinary persons include users of the EV supply equipment, persons who may have access to the EV supply equipment, and who may be in the vicinity of the EV supply equipment. Under normal operating conditions, ordinary persons should not be exposed to energy sources causing startle reaction, pain or injury.

[SOURCE: IEC 60050-826:2022, 826-18-03, modified – Note 1 to entry added.]

3.6.112

skilled person

<electrically> person with relevant education and experience to perceive risks and to avoid hazards which electricity can create

[SOURCE: IEC 60050-826:2022, 826-18-01, modified – Second preferred term "electrically skilled person" removed.]

3.6.113

instructed person

<electrically> person adequately advised or supervised by electrically skilled persons to perceive risks and to avoid hazards which electricity can create

[SOURCE: IEC 60050-826:2021, 826-18-02, modified – Second preferred term "electrically instructed person" removed.]

3.6.114

human machine interface

HMI

DEPRECATED: user interface

device/means that allows user interaction, interface between operator, operating staff or end user and the instrumentation and computer systems connected to the EVCC/EMS

EXAMPLE Display or user communication system, mobile phone interface.

Note 1 to entry: The HMI can be connected to an EVCC, an energy management system or another controller depending on the communication system used.

3.7 General terms

Additional terms and definitions:

3.7.101

fire enclosure

enclosure intended as protection against the spread of fire from within the enclosure to outside the enclosure

Note 1 to entry: Some standards use the term "safeguard" instead of "protection".

[SOURCE: IEC 60050-903:2014, 903-04-10]

3.7.102

side A

supply network side

DEPRECATED: input

DEPRECATED: primary circuit

side of the EV supply equipment connected to the supply network

3.7.103

side B

EV side

DEPRECATED: output

DEPRECATED: DC output circuit

DEPRECATED: secondary circuit

side of the EV supply equipment connected to the EV

3.7.104

side B circuit

electrical circuit at side B which includes all parts of the EV supply equipment that are conductively connected to the DC+ or DC– of the vehicle connector

3.7.105

supply network

system for the distribution of electricity connected to side A

Note 1 to entry: The following terms are also used frequently in this context: system for distribution of electricity to the public, public distribution network, public network, prosumer's electrical installation (PEI), distributed energy resources (DER), battery bank, PV installation, generator, mains or electric grid, etc.

3.7.106

load dump

spontaneous disconnection, during the energy transfer stage, of the battery system or other loads connected to side B

Note 1 to entry: Load dump can be caused by the load for the purpose of protection, or by a fault.

3.7.107

power electronics converter

PEC

DEPRECATED: power electronic converter system

device or part thereof for the purpose of electronic power conversion

Note 1 to entry: PEC can include signalling, measurement, control circuitries and other parts, if essential for the power conversion function.

3.7.108

ripple

<current or voltage> set of unwanted periodic deviations with respect to the average value of the measured or supplied quantity

EXAMPLE Ripple occurring at frequencies which can be related to that of the supply network, or of some other definite source, such as a power-electronics converters (PECs).

Note 1 to entry: Ripple is determined under specified conditions and is a part of periodic and/or random deviation (PARD) – IEC 60050-312:2001, 312-07-01.

[SOURCE: IEC 60050-312:2001, 312-07-02, modified – Example added, which comes from the definition, and note clarified.]

3.7.109

transient, adj

pertaining to a phenomenon or quantity which passes from one steady state to another consecutive steady state

Note 1 to entry: The term "transient" is also used as a noun to mean a transient phenomenon or quantity.

[SOURCE: IEC 60050-312:2009, 103-05-02]

3.7.110

transient, noun

<current or voltage> phenomenon or quantity which varies between two consecutive steady states during a time interval short compared to the timescale of interest

[SOURCE: IEC 60050-702:2019, 702-07-781]

3.7.111

applicable maximum current

upper limit of the current that is used during the energy transfer stage, and which may dynamically be changed throughout the energy transfer stage

Note 1 to entry: On side B, there is an applicable maximum current of the EV supply equipment as well as an applicable maximum current of the EV.

Note 2 to entry: On side B, this limit may be changed by digital communication.

3.7.112

applicable maximum power

upper limit of the power that is used during the energy transfer stage, and which may dynamically be changed throughout the energy transfer stage

Note 1 to entry: On side B, there is an applicable maximum power of the EV supply equipment as well as an applicable maximum power of the EV.

Note 2 to entry: On side B, this limit may be changed by digital communication.

3.7.113

applicable maximum voltage

upper limit of the voltage between live parts that is used during the energy transfer stage, and which may dynamically be changed throughout the energy transfer stage

Note 1 to entry: On side B, there is an applicable maximum voltage of the EV supply equipment as well as an applicable maximum voltage of the EV.

Note 2 to entry: On side B, this limit may be changed by digital communication.

Note 3 to entry: For DC, the voltage between DC+ and DC–. For AC, the voltage between L1, L2, L3 and N as needed by the configuration.

3.7.114**applicable minimum current**

lower limit of the current that is used during the energy transfer stage, and which may dynamically be changed throughout the energy transfer stage

Note 1 to entry: On side B, there is an applicable minimum current of the EV supply equipment as well as an applicable minimum current of the EV.

Note 2 to entry: On side B, this limit may be changed by digital communication.

3.7.115**applicable minimum power**

lower limit of the power that is used during the energy transfer stage, and which may dynamically be changed throughout the energy transfer stage

Note 1 to entry: On side B, there is an applicable minimum power of the EV supply equipment as well as an applicable minimum power of the EV.

Note 2 to entry: On side B, this limit may be changed by digital communication.

3.7.116**applicable minimum voltage**

lower limit of the voltage between live parts that is used during the energy transfer stage, and which may dynamically be changed throughout energy transfer

Note 1 to entry: On side B, there is an applicable minimum voltage of the EV supply equipment as well as an applicable minimum voltage of the EV.

Note 2 to entry: On side B, this limit may be changed by digital communication.

Note 3 to entry: For DC, the voltage between DC+ and DC-. For AC the voltage between L1, L2, L3 and N as needed by the configuration.

3.7.117**measured current**

result of a measurement of the present current measured under certain measurement conditions

Note 1 to entry: Measurement conditions can be applying a filter, having an uncertainty in measurement, etc.

3.7.118**measured voltage**

result of a measurement of the present voltage measured under certain measurement conditions

Note 1 to entry: Measurement conditions can be applying a filter, having an uncertainty in measurement, etc.

3.7.119**measured power**

result of a measurement of the present power measured under certain measurement conditions

Note 1 to entry: Measurement conditions can be applying a filter, having an uncertainty in measurement, etc.

3.7.120**negotiated maximum current**

<at side B> upper limit of the current operating range agreed upon during the initialization stage between the EV supply equipment and the EV

Note 1 to entry: At side B, this limit is negotiated between the EV supply equipment and the EV by digital communication and can be changed in a new initialization stage.

3.7.121

negotiated maximum power

<at side B> upper limit of the power operating range agreed upon during the initialization stage between the EV supply equipment and the EV

Note 1 to entry: At side B, this limit is negotiated between the EV supply equipment and the EV by digital communication and can be changed in a new initialization stage.

3.7.122

negotiated maximum voltage

<at side B> upper limit of the voltage operating range between live parts agreed upon during the initialization stage between the EV supply equipment and the EV

Note 1 to entry: At side B, this limit is negotiated between the EV supply equipment and the EV by digital communication and can be changed in a new initialization stage.

3.7.123

negotiated minimum current

<at side B> lower limit of the current operating range agreed upon during the initialization stage between the EV supply equipment and the EV

Note 1 to entry: At side B, this limit is negotiated between the EV supply equipment and the EV by digital communication, and can be changed in a new initialization stage.

3.7.124

negotiated minimum power

<at side B> lower limit of the power operating range agreed upon during the initialization stage between the EV supply equipment and the EV

Note 1 to entry: At side B, this limit is negotiated between the EV supply equipment and the EV by digital communication, and can be changed in a new initialization stage.

3.7.125

negotiated minimum voltage

<at side B> lower limit of the voltage operating range between live parts agreed upon during the initialization stage between the EV supply equipment and the EV

Note 1 to entry: At side B, this limit is negotiated between the EV supply equipment and the EV by digital communication, and can be changed in a new initialization stage.

3.7.126

present current

instantaneous physical value of the current

Note 1 to entry: The present current is the instantaneous value of the current which would be acquired by an ideal/perfect measurement device in a single sample without any filtering and without any measurement tolerance/error.

3.7.127

present voltage

instantaneous physical value of the voltage

Note 1 to entry: The present voltage is the instantaneous value of the voltage which would be acquired by an ideal/perfect measurement device in a single sample without any filtering and without any measurement tolerance/error.

3.7.128

present power

instantaneous physical value of the power

Note 1 to entry: The present power is the instantaneous value of the power which would be acquired by an ideal/perfect measurement device in a single sample without any filtering and without any measurement tolerance/error.

3.7.129**rated boost current**

<side B> upper limit of the current specified by the manufacturer up to which the EV supply equipment has been designed to operate for a limited period of time

Note 1 to entry: The rated boost current is more than or equal to the rated continuous current.

Note 2 to entry: The rated boost current of the side B cable assembly is under consideration in IEC 62196-1, IEC 62196-3 and IEC 62196-3-1. For more information, see 101.3.

3.7.130**rated current**

<side A> current under normal operating conditions assigned by the manufacturer

3.7.131**rated continuous current**

<side B> upper limit of the current specified by the manufacturer up to which the EV supply equipment has been designed to operate continuously

Note 1 to entry: In the IEC 62196 (published before 2023) series, the rated continuous current is called "rated current".

3.7.132**rated boost power**

<side B> upper limit of the power specified by the manufacturer up to which the EV supply equipment has been designed to operate for a limited period of time

Note 1 to entry: The rated boost power is greater than or equal to the rated continuous power.

3.7.133**rated continuous power**

<side B> upper limit of the power specified by the manufacturer up to which the EV supply equipment has been designed to operate continuously

3.7.134**rated maximum power**

<side A> upper limit of the power specified by the manufacturer up to which the EV supply equipment has been designed to operate

3.7.135**rated maximum voltage**

<side A or side B> upper limit of the voltage between live parts specified by the manufacturer up to which the EV supply equipment has been designed to operate

3.7.136**rated minimum current**

<side A or side B> lower limit of the current specified by the manufacturer down to which the EV supply equipment has been designed to operate

3.7.137**rated minimum power**

<side A or side B> lower limit of the power specified by the manufacturer down to which the EV supply equipment has been designed to operate

3.7.138**rated minimum voltage**

<side A or side B> lower limit of the voltage between live parts specified by the manufacturer down to which the EV supply equipment has been designed to operate

3.7.139

target current

<EV> requested current to the EV supply equipment, which may dynamically be changed by digital communication

Note 1 to entry: On side B, this target current is requested by the EV only.

3.7.140

target power

<EV> requested power to the EV supply equipment, which may dynamically be changed by digital communication

Note 1 to entry: On side B, this target power is requested by the EV only.

3.7.141

target voltage

<EV> requested voltage to the EV supply equipment, which may dynamically be changed by digital communication

Note 1 to entry: On side B, this target voltage is requested by the EV only.

3.7.142

target current

<EV supply equipment> value of current that the EV supply equipment attempts to reach

Note 1 to entry: The target current of the EV supply equipment at side B is dynamically calculated based on certain values, for example, the target values of the EV, the negotiated limits of side B or applicable limits of side B or of side A.

Note 2 to entry: The target current of the EV supply equipment at side B is not communicated to the EV by digital communication.

Note 3 to entry: The target current of the EV supply equipment at side A is following the grid code of the DSO.

3.7.143

target power

<EV supply equipment> value of power that the EV supply equipment attempts to reach

Note 1 to entry: The side B target power of the EV supply equipment is dynamically calculated based on certain values, for example, the target values of the EV, the negotiated limits of side B or applicable limits of side B or of side A.

Note 2 to entry: The side B target power of the EV supply equipment is not communicated to the EV by digital communication.

Note 3 to entry: The side A target power of the EV supply equipment is following the grid code of the DSO.

3.7.144

target voltage

<EV supply equipment> value of voltage that the EV supply equipment attempts to reach

Note 1 to entry: The side B target voltage of the EV supply equipment is dynamically calculated based on certain values, for example, the target values of the EV, the negotiated limits of side B or applicable limits of side B or of side A.

Note 2 to entry: The side B target voltage of the EV supply equipment is not communicated to the EV by digital communication.

Note 3 to entry: The side A target voltage of the EV supply equipment is following the grid code of the DSO.

3.7.145**auxiliary circuit**

auxiliary power supply

classification of an electric component or circuit with a maximum working voltage of ≤ 30 V AC (RMS) or ≤ 60 V DC, respectively

Note 1 to entry: Circuit(s) for signalling, digital communication, and for the management and control of energy transfer.

3.7.146**EV communication controller**

EVCC

DEPRECATED: vehicle charging control function

DEPRECATED: VCCF

DEPRECATED: vehicle charging/discharging control function

DEPRECATED: VCDCF

embedded system, within the EV, which implements the communication between the EV and the SECC in order to support specific functions

Note 1 to entry: Such specific functions could be, for example, controlling input and output channels, encryption, or data transfer between EV and SECC.

3.7.147**supply equipment communication controller**

SECC

entity which implements the communication to one or multiple EVCC(s)

Note 1 to entry: Further details regarding possible architectures are given in Annex A of ISO 15118-1:2019.

Note 2 to entry: Functions of a supply equipment communication controller may control input and output channels, data encryption, or digital communication between EVCC and SECC.

[SOURCE: ISO 15118-1:2019, 3.1.68, modified – Words "and which may be able to interact with secondary actors" deleted, Note 1 to entry deleted, and word "vehicle" replaced with EVCC in Note 3 to entry.]

3.7.148**digital communication**

exchange of digitally encoded information

Note 1 to entry: HLC in the ISO 15118 series is compliant with the term digital communication in SAE J1772, SAE 2836, SAE 2847 and SAE 2931.

Note 2 to entry: See also IEC 61851-24 for additional information about digital communication exchanged between EV supply equipment and an EV.

[SOURCE: ISO 15118-1:2019, 3.1.47, modified, Note 2 to entry added]

3.7.149**working voltage**

highest RMS value of the AC or DC voltage across any particular insulation which can occur when the equipment is supplied at rated maximum voltage of the EV supply equipment at side A and operated at the rated maximum voltage of the EV supply equipment at side B

Note 1 to entry: Transient overvoltages are disregarded.

Note 2 to entry: Both open-circuit conditions and normal operating conditions are taken into account.

[SOURCE: IEC 60050-851:2008, 851-12-31, modified – Words "rated voltage" replaced with the end of the definition starting with "rated maximum voltage".]

4 General requirements

IEC 61851-1:2017, Clause 4, is applicable, except as follows.

The following sentence is not applicable:

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

Addition:

NOTE In the following countries, the EV supply equipment is designed to be used at an altitude $\leq 1\,000$ m according to the national standard: JP.

5 Classification

IEC 61851-1:2017, Clause 5, is applicable, except as follows.

Additional subclauses:

5.101 Characteristics of EV supply equipment

5.101.1 Separation type

The EV supply equipment shall be classified according to the type of separation between side A and side B:

- separated EV supply equipment;
- non-separated EV supply equipment (under consideration)

5.101.2 Control system

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

- regulated EV supply equipment:
 - a) controlled current mode;
 - b) controlled voltage mode;
 - c) combination of a) and b);
- non-regulated EV supply equipment (under consideration).

5.101.3 System

The EV supply equipment shall be classified according to the system:

- system A (see Annex AA);
- system B (see Annex BB);
- system C (see Annex CC).

5.101.4 Thermal management system

The EV supply equipment shall be classified according to the thermal management system of the side B cable assembly:

- using thermal sensing;
- using thermal sensing and thermal transport;
- none.

5.101.5 Power distribution system

The EV supply equipment shall be classified according to the power distribution system to which the EV supply equipment is intended to be connected in its final application:

- single-phase equipment on star TN or TT system;
- single-phase equipment on centre-earthed TN or TT system;
- single-phase equipment connected line-to-line on star TN or TT system;
- single-phase equipment connected line-to-neutral on star IT system;
- single-phase equipment connected line-to-line on star IT system;
- three-phase equipment on star TN or TT system;
- three-phase equipment on star IT system;
- three-phase equipment on unearthed delta system;
- three-phase equipment on centre-earthed delta system.

6 Charging modes and functions

IEC 61851-1:2017, Clause 6, is applicable, except as follows.

6.2 Charging modes

6.2.1 Mode 1

IEC 61851-1:2017, 6.2.1, is not applicable.

6.2.2 Mode 2

IEC 61851-1:2017, 6.2.2, is not applicable.

6.2.3 Mode 3

IEC 61851-1:2017, 6.2.3, is not applicable.

6.3 Functions provided in Modes 2, 3 and 4

Replacement of the title of this subclause:

6.3 Functions provided in Mode 4

6.3.1 Mandatory functions in Modes 2, 3 and 4

Replacement of the title of this subclause:

6.3.1 Mandatory functions in Mode 4

6.3.1.1 General

Replacement:

The EV supply equipment shall supply a DC current and voltage to the EV battery system according to an EVCC request.

The following functions shall be provided by 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;
- DC supply for EV according to 6.3.1.101;
- measuring current and voltage according to 6.3.1.102;
- latching of the vehicle coupler according to 6.3.1.103;
- compatibility check according to 6.3.1.104;
- insulation resistance check before energy transfer according to 6.3.1.105;
- protection against overvoltage between DC+ and DC– according to 6.3.1.106;
- verification of vehicle connector latching according to 6.3.1.107;
- control circuit supply integrity according to 6.3.1.108;
- short-circuit check before energy transfer according to 6.3.1.109;
- user initiated shutdown according to 6.3.1.110;
- overload protection for parallel conductors (conditional function) according to 6.3.1.111;
- voltage limitation between side B live parts (DC+ and DC–) and protective conductor according to 6.3.1.112;
- shutdown of EV supply equipment according to 6.3.1.113.

The EV manufacturer should consider the requirements for overvoltage and overcurrent according to this document and ISO 17409.

If the EV supply equipment can supply more than one EV simultaneously, the EV supply equipment shall provide all functions listed above independently at each vehicle connector.

6.3.1.2 Continuous continuity checking of the protective conductor

Replacement:

The protective conductor continuity between the EV supply equipment and the EV shall be monitored continuously. The EV supply equipment shall trigger and complete an emergency shutdown according to 6.3.1.113.4 and according to:

- AA.3.8.2 for system A;
- BB.5.1 for system B;
- CC.4.7 for system C;

after a loss of electrical continuity of the protective conductor between the EV supply equipment and EV.

NOTE Protective conductor continuity is monitored by the control pilot function.

Compliance for system A and system B is checked by the following test. Compliance for system C is checked by CC.7.5.5.

The test setup for system A is shown in Figure 129. The test setup for system B is shown in Figure 130.

The test shall be performed according to the following procedure.

- 1) *Connect the EV supply equipment to a test load with a dedicated EV simulator for each system.*
- 2) *Measure V_{T8} and A_{T1} continuously.*
- 3) *Start a communication session with the procedure specified by the EV supply equipment manufacturer.*
- 4) *Confirm that side B is at OP4, specified in Figure 133.*
- 5) *Open S_{T15} .*
- 6) *Check that the EV supply equipment triggered and completed an emergency shutdown.*
- 7) *Check the result in Table 101.*

Table 101 – Verification criterion

System	Verification criterion
A	See Table AA.8.
B	The present current at side B (A_{T1}) is ≤ 5 A DC in t_{pe} or less after the loss of protective conductor continuity. The t_{pe} includes the detection time and fall time of the current. See Table BB.3 for the specific time.

Confirm that $V_{T8} \leq 60$ V DC.

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

This subclause of IEC 61851-1:2017 is applicable.

6.3.1.4 Energization of the power supply to the EV

Addition:

Further requirements for normal startup are given in CC.3.2 for system C.

Compliance is checked by the following test.

The test setup for system A is shown in Figure 129. The test setup for system B is shown in Figure 130. The test setup for system C is shown in Figure 131.

The test shall be performed according to the following procedure.

- 1) *Connect the EV supply equipment to a test load with a dedicated EV simulator for each system.*
- 2) *Measure V_{T8} continuously.*
- 3) *Simulate the open circuit of the control pilot by opening the switch for each system shown below:*
 - system A: S_{T5} ;
 - system B: S_{T4} ;
 - system C: S_{T3} ;
- 4) *Start a communication session with the procedure specified by the EV supply equipment manufacturer.*
- 5) *Confirm that $V_{T8} \leq 60$ V DC.*

6.3.1.5 De-energization of the power supply to the EV

Replacement:

If the pilot signal is interrupted, the EV supply equipment shall perform a shutdown as indicated for each system.

Compliance is checked for system A by the test in AA.3.2, for system B by the test in BB.5.5, and for system C by the test in CC.7.5.8.

Additional subclause:

6.3.1.5.101 De-energization in case of failure in control circuit

In case of failure in the control circuit of the EV supply equipment, such as short-circuit, earth leakage current, SECC failure or excess temperature, the EV supply equipment shall terminate the supply of current at side B. The EV supply equipment manufacturer shall perform a failure modes and effects analysis (FMEA) according to IEC 60812 to show conformity with the above requirement.

Compliance is checked by inspection.

6.3.1.6 Maximum allowable current

Replacement:

A means shall be provided to inform the EV of the value of the applicable maximum current of the EV supply equipment at side B. The value of the applicable maximum current of the EV supply equipment at side B shall be communicated and shall be less than or equal to the rated boost current of the EV supply equipment at side B.

The communicated value may change, without being more than the rated boost current of the EV supply equipment at side B, to adapt to power limitations, for example, for load management.

Compliance is checked by design review for system A, system B and system C.

Additional subclauses:

6.3.1.101 DC supply for the EV

The EV supply equipment shall supply controlled DC voltage or current (not simultaneously, but as requested by the EV during the communication session) to the EV according to the EVCC requests. Requirements for energy transfer performance of regulated DC voltage or current are given in 101.1.1, 101.1.2, 101.1.3, 101.1.4, 101.1.5, and 101.1.6.

In either case mentioned above, the supplied regulated values shall be less than or equal to the maximum ratings of the EV supply equipment.

Compliance is checked by the applicable tests in 101.1.1 through 101.1.6.

The EV can change the target current of the EV and/or the target voltage of the EV.

NOTE EVs are equipped with different technologies and battery systems with different voltages. In order to avoid any error during energy transfer and to guarantee that the EV supply equipment will be able to transfer energy to all existing and future battery systems, any communication session is controlled by the EV. Any EV that is to be connected to a EV supply equipment is equipped with an EVCC for controlling the communication session.

6.3.1.102 Measuring current and voltage

The EV supply equipment shall measure the present current and the present voltage at side B. The accuracy of these measurements shall meet the defined accuracy for each system in AA.4.4, BB.4.2 and CC.6.3.

The measured values of present voltage and present current at side B shall be provided by the EV supply equipment to the EV through digital communication.

Compliance for system A and system B is checked by the following test. Compliance for system C is checked by CC.7.5.11, CC.7.5.12, and CC.7.5.19.

The test setup for system A is shown in Figure 129. The test setup for system B is shown in Figure 130.

For system A:

The test shall be performed according to the following procedure.

- 1) *Connect the EV supply equipment to a test load with a dedicated EV simulator for the system under test.*

NOTE 1 Test load indicated in Figure 132 unless otherwise specified.

- 2) *Start a communication session with the procedure specified by the EV supply equipment manufacturer.*
- 3) *Set the target current of the EV simulator at $I_{EVSE_rated_boost_sideB}$, I_{Avg} and I_{Min} of the EV supply equipment which are defined as:*

$I_{EVSE_rated_boost_sideB}$ = rated boost current of the EV supply equipment at side B

$I_{Avg} = I_{EVSE_rated_boost_sideB} / 2$

$I_{Min} = 5 \text{ A}$

- 4) *Set the target voltage of the EV simulator at $V_{EVSE_rated_max_sideB}$, V_{Avg} and $V_{EVSE_rated_min_sideB}$ of the EV supply equipment which are defined as:*

$V_{EVSE_rated_max_sideB}$ = rated maximum voltage of the EV supply equipment at side B

$V_{Avg} = (V_{EVSE_rated_max_sideB} + V_{EVSE_rated_min_sideB}) / 2$

$V_{EVSE_rated_min_sideB}$ = rated minimum voltage of the EV supply equipment at side B

The side B voltage is set to $V_{EVSE_rated_max_sideB}$, V_{Avg} and $V_{EVSE_rated_min_sideB}$ of the EV supply equipment by one of the following measures:

- *A_{T1} shall be adjusted to set V_{T8} at $V_{EVSE_rated_max_sideB}$, V_{Avg} and V_{Min} of the EV supply equipment with either the electronic load U_{T5} operating at constant resistance or using the resistors R_{T10} and R_{T11} to set the voltage point;*
- *electronic load U_{T5} shall be operated under the constant voltage mode.*

- 5) *Trend a chart of V_{T8} and A_{T1} .*

- 6) *Check that the difference between the measured current and voltage of the EV supply equipment at side B and the values measured with V_{T8} and A_{T1} are between the limits specified in AA.4.4.*

For system B:

- 1) *Connect the EV supply equipment to a test load with a dedicated EV simulator for the system under test.*

NOTE 2 Test load indicated in Figure 132 unless otherwise specified.

- 2) Start a communication session with the procedure specified by the EV supply equipment manufacturer.
- 3) Set the target current of the EV simulator at $I_{EVSE_rated_boost_sideB}$, I_{Med} and I_{Min} of the EV supply equipment which are defined as:

$I_{EVSE_rated_boost_sideB}$ = rated boost current of the EV supply equipment at side B

$I_{Med} = (I_{EVSE_rated_boost_sideB} + I_{Min}) / 2$

I_{Min} = the higher value between 5 A and rated minimum current specified of the EV supply equipment at side B

- 4) Set the target voltage of the EV simulator at $V_{EVSE_rated_max_sideB}$, V_{Med} and $V_{EVSE_rated_min_sideB}$ of the EV supply equipment which are defined as:

$V_{EVSE_rated_max_sideB}$ = rated maximum voltage of the EV supply equipment at side B

$V_{Med} = (V_{EVSE_rated_max_sideB} + V_{EVSE_rated_min_sideB}) / 2$

$V_{EVSE_rated_min_sideB}$ = rated minimum voltage of the EV supply equipment at side B

- 5) Trend a chart of V_{T8} and A_{T1} .
- 6) Check that the difference between the measured current and voltage of the EV supply equipment at side B and the values measured with V_{T8} and A_{T1} are between the limits specified in BB.4.2.

6.3.1.103 Latching of the vehicle connector

The requirements for latching the vehicle connector are defined in Annex AA, Annex BB and Annex CC for each system.

Once latched, the vehicle connector shall remain latched until the present voltage at side B between DC+ and DC– is < 60 V DC. This voltage limit applies throughout the coupling session including after the energy transfer stage. In case of an EV supply equipment malfunction, a means for disconnection may be provided, but if provided, that disconnection means shall be safe according to this document.

NOTE 1 The actuation portion of the latching function can be in either the vehicle connector or the vehicle inlet.

NOTE 2 Voltage criteria for latching/unlatching function can be < 60 V DC; for example, 30 V DC in system A.

The EV supply equipment shall have the following functions when the latching is done by the EV supply equipment:

- electrical or mechanical latching function to retain the latched status;
- function to detect the disconnection of the electrical circuits for the latching function.

Additional requirements are given in AA.3.6, BB.5.9 and CC.4.2. Specific voltage for system A is specified in AA.3.3.

Compliance is checked by the following tests a) and b).

a) Normal condition test

Simulate a normal coupling session. Check that the vehicle connector is latched on the vehicle inlet whenever the present voltage at side B between DC+ and DC– is ≥ 60 V DC.

b) Abnormal condition test

Simulate a condition in which the present voltage at side B between DC+ and DC– remains ≥ 60 V DC after the end of the energy transfer stage, for example, by keeping the EV disconnection device closed. Check that the vehicle connector is latched on the vehicle inlet whenever the present voltage at side B between DC+ and DC– ≥ 60 V DC.

Vehicle connectors and vehicle inlets shall comply with the requirements of IEC 62196-1 and IEC 62196-3. See also 9.101.

6.3.1.104 Compatibility check

Compatibility between the EV and the EV supply equipment shall be checked with the information exchanged at the preparation phase.

For system A, the EV supply equipment shall check if target voltage and rated minimum voltage of the EV ("target battery voltage" and "minimum battery voltage" in IEC 61851-24) are between the rated maximum and rated minimum voltage of the EV supply equipment at side B. In case this condition is not met, the EV supply equipment shall trigger an error shutdown.

For system B, the EV supply equipment checks that rated minimum voltage of the EV supply equipment at side B is less than the maximum permissible charge voltage. In case this condition is not met, the EV supply equipment shall trigger an error shutdown.

For system C, see CC.5.6.

Compliance for system A and system B is checked by the following test. Compliance for system C is checked by CC.7.5.1.

The test setup for system A is shown in Figure 129. The test setup for system B is shown in Figure 130.

- 1) *Connect the EV supply equipment to a test load with a dedicated EV simulator for the system under test.*
- 2) *Start energy transfer with the procedure specified by the EV supply equipment manufacturer.*
- 3) *Using the EV simulator, communicate the data or message in Table 102 to the EV supply equipment via digital communication.*

Table 102 – Data/message for the compatibility check test

System	Data/Message (refer to IEC 61851-24)	Value
A (case 1)	Target battery voltage	420 V
	Maximum battery voltage	410 V
A (case 2)	Target battery voltage	Rated maximum voltage of the EV supply equipment at side B + 10 V
	Maximum battery voltage	600 V
A (case 3)	Target battery voltage	Rated minimum voltage of the EV supply equipment at side B – 10 V
	Maximum battery voltage	Rated maximum voltage of the EV supply equipment at side B
B	Maximum permissible charge voltage of battery system	Rated minimum voltage of the EV supply equipment at side B – 10 V

- 4) *For each case, check that the EV supply equipment triggers an error shutdown, displaying a relevant alarm or error information, if any. For system A, perform the test separately for each case.*
- 5) *Confirm that V_{T6} , V_{T7} and V_{T8} are < 60 V DC.*

6.3.1.105 Insulation resistance check before energy transfer

The EV supply equipment shall check the insulation resistance between side B live parts (DC+/DC–) and protective conductor to the vehicle chassis, including any exposed conductive part of the EV supply equipment, before the EV disconnection device are allowed to close.

If the insulation resistance is less than the system specific limit or it cannot be determined in the specified time or less, the EV supply equipment shall trigger an error shutdown and indicate to the EV that energy transfer is not allowed.

For system A and system B, when the insulation resistance R does not fulfil Formula (1), the EV supply equipment shall trigger an error shutdown:

$$R \geq 100 \frac{\Omega}{V} \times U \quad (1)$$

where

U is the rated maximum voltage of the EV supply equipment at side B, expressed in volts. Details are specified in AA.4.3.3 and BB.8.

For system C, see CC.4.1.4.

Compliance is checked by the tests in AA.4.3.3, BB.8 and CC.7.5.15.

6.3.1.106 Protection against overvoltage at side B between DC+ and DC–

6.3.1.106.1 General

The EV supply equipment shall detect an overvoltage between DC+ and DC– at the vehicle connector and perform an emergency shutdown or error shutdown if an overvoltage is detected, according to 6.3.1.106.2 and 6.3.1.106.3.

When the vehicle connector is being mated to the vehicle inlet, the EV supply equipment and the EV shall not trigger a shutdown due to a present voltage at side B (positive or negative voltage), between DC+ and DC–, between DC+ and PE or between DC– and PE, unless otherwise specified in 6.3.1.112, Annex AA, Annex BB and Annex CC.

According to ISO 17409:2020, 6.5.2, when unmated, the EV can have a voltage > 60 V DC and > 30 V AC between DC+ and PE, and between DC– and PE. It is recommended that the EV does not have a common mode voltage > 60 V, as unbalanced insulation faults can generate differential voltages at side B > 60 V. For system C, the EV may try to use R_{s6} and R_{s7} in Figure CC.3 of the disabled side B circuit to limit this common mode voltage.

Overvoltage protection during the initialization stage, cable-check phase and pre-charge phase is under consideration.

6.3.1.106.2 Protection against overvoltage at side B between DC+ and DC– by emergency shutdown

For system A, the EV supply equipment shall fulfil the overvoltage protection requirements in AA.3.12.

For system B and system C, the EV supply equipment shall trigger an emergency shutdown in 1 ms or less if, during the energy transfer stage, the present voltage at side B between DC+ and DC– is more than the voltage thresholds specified in Table 103 for more than 9 consecutive ms.