IEC 61851-25

Edition 1.0 2020-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Electric vehicle conductive charging system –
Part 25: DC EV supply equipment where protection relies on electrical separation

Systeme de charge par conduction pour véhicules électriques –
Partie 25: Système d'alimentation en courant continu pour véhicules électriques dont la protection s'appuie sur la séparation électrique

IEC 61851-25:2020-12(en-fr)

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ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 25: DC EV supply equipment where protection relies on electrical separation

FOREWORD

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International Standard IEC 61851-25 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks.

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

FDIS	Report on voting
69/735/FDIS	69/740/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

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

This document supplements or modifies 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 "Clause X of IEC 61851-1:2017 is applicable" are used. Additional clauses, tables and figures which are not included in IEC 61851-1:2017 have a number starting from 101. Additional annexes are lettered AA, BB, etc.

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.

In this document, the following print types are used:

– *test specifications: italic type*.

– notes: smaller roman type.

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

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- withdrawn,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

INTRODUCTION

This document describes the specific requirements for DC EV supply equipment whose secondary circuit and EV are protected from the primary power supply circuit by electrical separation as defined in IEC 61140, where the connection to the separated circuit is limited to a single connection.

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 25: DC EV supply equipment where protection relies on electrical separation

1 Scope

This document applies to the DC EV supply equipment for charging electric road vehicles with a rated supply voltage of up to 480 V AC or up to 600 V DC, with rated output voltage not exceeding 120 V DC and output currents not exceeding 100 A DC.

This document provides the requirements for the DC EV supply equipment where the secondary circuit is protected from the primary circuit by electrical separation.

Requirements for bi-directional power flow are not covered in this document.

This document also provides the requirements for the control and the communication between DC EV supply equipment and an EV.

This document also applies to DC EV supply equipment supplied from on-site storage systems.

The aspects covered in this document include:

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

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

- DC 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;
- DC EV supply equipment designed to be installed at an altitude of more than 2 000 m;
- DC EV supply equipment intended to be used on-board ships.

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

This document 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 the RESS off-board the EV.

NOTE In the following countries electrical separation can only be handled by skilled people: CH

2 Normative references

Clause 2 of IEC 61851-1:2017 is applicable with the following additions.

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

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

IEC 61180:2016, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

IEC 61439-7:2018, *Low-voltage switchgear and controlgear assemblies –Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations*

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

IEC 62477-1:2012, *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*

ISO 3297:2017, *Information and documentation – International standard serial number (ISSN)*

ISO 11898-1:2015, *Road vehicles – Controller area network (CAN) – Part 1: Data link layer and physical signalling*

ISO 11898-2:2016, *Road vehicles – Controller area network (CAN) – Part 2: High-speed medium access unit*

3 Terms and definitions

Clause 3 of IEC 61851-1:2017 is applicable with the following additions to 3.2, 3.3 and 3.7.

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

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

3.2 Insulation

3.2.101
electrical separation
protective measure in which hazardous-live-parts are insulated from all other electric circuits and parts, from local earth and from touch

[SOURCE: IEC 60050-826:2004, 826-12-27]

3.3 Functions

3.3.101
normal start-up sequence
beginning of an energy transfer sequence with the commands and parameters that are used to transfer energy to an EV when no error condition arises during the energy transfer sequence

3.3.102
normal shutdown
termination of the energy transfer process initiated by the user, by the EV or by the DC EV supply equipment, and not caused by a failure

3.3.103
error shutdown
termination of the energy transfer process caused by a failure detected by the DC EV supply equipment or the EV

3.3.104
emergency shutdown
termination of the energy transfer process caused by a failure detected by the DC EV supply equipment or the EV that may present a safety hazard

3.3.105
control pilot wire
insulated wire incorporated in a cable assembly which is part of the control pilot circuit

3.3.106
digital communication
digitally encoded information exchanged between DC EV supply equipment and an EV, as well as the method by which it is exchanged

[SOURCE: IEC 61851-24:2014, 3.1, modified – The term "charging station" has been replaced with "supply equipment".]

3.3.107
signal
data element that is communicated between DC EV supply equipment and an EV using any means other than digital communication

[SOURCE: IEC 61851-24:2014, 3.2, modified – The term "charging station" has been replaced with "supply equipment".]

3.3.108
device under test
DUT
sample of DC EV supply equipment that is submitted for testing

3.7 General terms

3.7.101
available DC output power
maximum DC output power that the DC EV supply equipment can supply

3.7.102
available DC output power parameter
parameter transmitted to the EV indicating the available DC output power

3.7.103
DC output current
DC current supplied to the EV by the DC EV supply equipment

3.7.104
available DC output current
value of the highest DC current that the DC EV supply equipment can supply to the EV at a given time

3.7.105
available DC output current parameter
parameter sent by the EV supply equipment to the vehicle that indicates the highest current that can be supplied to the EV

3.7.106
rated DC output current
output current assigned to the DC EV supply equipment by the manufacturer under normal operating conditions

3.7.107
requested DC output current
value of the DC output current that is requested by the EV

3.7.108
requested DC output current parameter
parameter sent by the EV to the DC EV supply equipment indicating the requested DC output current

3.7.109
DC output voltage
voltage present between the DC+ and DC− terminals at the vehicle connector

3.7.110
rated DC output voltage
output voltage assigned to the DC EV supply equipment by the manufacturer

3.7.111
rated DC output voltage parameter
parameter sent by the DC EV supply equipment to indicate the rated DC output voltage

3.7.112
DC output voltage target parameter
value sent by the EV to the DC EV supply equipment that indicates the requested value of the DC output voltage

3.7.113
DC output voltage limit parameter
value sent by the EV to the DC EV supply equipment that indicates the allowable DC output voltage

4 General requirements

Clause 4 of IEC 61851-1:2017 is applicable.

5 Classification

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

5.1.2 Characteristics of power supply output

Replacement:

The EV supply equipment shall be classified as DC EV supply equipment.

5.6 Protection against electric shock

Subclause 5.6 of IEC 61851-1:2017 is not applicable.

5.7 Charging modes

Subclause 5.7 of IEC 61851-1:2017 is not applicable.

6 Charging modes and functions

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

6.1 General

Replacement:

Clause 6 describes the functions for energy transfer to EVs.

6.2 Charging modes

Subclause 6.2 of IEC 61851-1:2017 is not applicable.

6.3 Functions provided in Mode 2, 3 and 4

Subclause 6.3 of IEC 61851-1:2017 is replaced by the following:

6.3 Mandatory functions

6.3.1 General

The DC EV supply equipment shall supply a DC output current to the EV in accordance with the requested DC output current parameter from the EV, subject to the requirements of the mandatory functions as indicated below.

NOTE The DC EV supply equipment acts as a slave to the EV. Further details are given in Annex AA, Annex BB and Annex EE.

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

- verification that the EV is properly connected to the DC EV supply equipment in accordance with 6.3.2;
- verification of the latching of the vehicle coupler in accordance with 6.3.3;
- latching and unlatching of the vehicle coupler in accordance with 6.3.4;
- communication with the vehicle in accordance with 6.3.5;
- monitoring of the continuity of the control pilot circuit in accordance with 6.3.6;
- verification function before energy transfer in accordance with 6.3.7;

- energization and control of the power supply to the EV in accordance with 6.3.8;
- protection against overvoltage in accordance with 6.3.9;
- de-energization of the power supply to the EV in accordance with 6.3.10;
- shutdown of DC EV supply equipment in accordance with 6.3.10.2, 6.3.10.3 and 6.3.10.4.

Values, timing and tolerances for the DC output current and the DC output voltages shall be tested in accordance with Annex BB.

6.3.2 Verification that the EV is properly connected to the DC EV supply equipment

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

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

Compliance is checked in accordance with DD.3.1.

6.3.3 Verification of the latching of the vehicle coupler

The DC EV supply equipment shall determine that the vehicle connector is properly latched to the vehicle inlet.

The DC EV supply equipment shall not energize the conductors in the cable assembly when the vehicle connector is not latched to a vehicle inlet.

The DC EV supply equipment shall enter into an emergency shutdown if the vehicle connector is disconnected from the vehicle inlet while under power.

Compliance is checked in accordance with DD.3.8.6.

6.3.4 Latching and unlatching of the vehicle coupler

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

Compliance is checked by inspection.

6.3.5 Communication with the EV

6.3.5.1 General

Digital communication shall be established between the EV and the DC EV supply equipment to validate and control the energy transfer.

The DC EV supply equipment shall be able to receive and interpret all mandatory digital communication data as described in Annex FF.

Compliance is checked in accordance with Clause DD.3.

The vehicle connector shall not be energized until the compatibility assessment is successfully completed in accordance with 6.3.7.2.

Compliance is checked by the test in Annex DD applying the messages defined in Table FF.2 and Table FF.3 of Annex FF.

6.3.5.2 Available DC output current parameter

The EV supply equipment shall inform the EV of the value of the available DC output current that can be provided by the EV supply equipment.

The value may be changed and retransmitted during energy transfer, to adapt to power limitations, (e.g. for load management), without exceeding the rated DC output current.

The DC EV supply equipment shall limit the DC output current to the available output current parameter or interrupt the energy supply if the DC output current drawn by the EV exceeds the available DC output current parameter.

Compliance is checked in accordance with DD.3.7 and DD.3.8.

6.3.5.3 Available DC output power parameter

A means shall be provided to inform the EV on the available DC output power of the DC EV supply equipment.

The DC EV supply equipment may decrease the DC output current if the power demand exceeds this value.

Compliance is checked in accordance with DD.3.7.

NOTE Available DC output power is indicated before the beginning of energy transfer. Dynamic power limitation due to the AC supply network limitations is an option that could modify the available DC output power during energy transfer on some DC EV supply equipment (see Clause EE.5).

6.3.5.4 DC output voltage target parameter and DC output voltage limit parameter

The DC EV supply equipment shall compare the DC output voltage with the values of the DC output voltage target parameter and the DC output voltage limit parameter received from the EV, and with the rated DC output voltage.

Shutdown conditions are in accordance with 6.3.10 if one of these values is exceeded.

Timing and tolerances that are applicable are indicated in Annex BB.

NOTE The values of the DC output voltage target parameter and the DC output voltage limit parameter are set before the beginning of the energy transfer. They can be modified during energy transfer.

6.3.5.5 Monitoring of energy transfer requirements of the EV and adjustment of energy supply conditions

A means shall be provided to continuously monitor the data transmitted by the EV and to adjust the DC output current and/or DC output voltage and all associated parameters.

The DC EV supply equipment shall initiate an error shutdown if valid data is not received for more than 1 s. An energy transfer cycle can be reinitiated by the EV after such shutdown.

The DC EV supply equipment shall be able to deliver DC output power up to the rated DC output voltage and up to the rated DC output current within the limit of its rated DC output power at the ambient temperature 0 °C to 40 °C below 2 000 m above sea level. The DC EV supply equipment shall not exceed its available DC output power, even if the power requested by the EV is higher than the available DC output power. Outside this operating range the DC EV supply equipment is allowed to reduce the power.

NOTE 1 National or industrial codes and regulations can require different operating temperature ranges.

NOTE 2 Tolerances and timing for the DC output current are given in Annex BB.