IEC 61851-23

Edition 1.0 2014-03

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Electric vehicle conductive charging system –
Part 23: DC electric vehicle charging station

Système de charge conductive pour véhicules électriques –
Partie 23: Borne de charge en courant continu pour véhicules électriques

IEC 61851-23:2014-03(en-fr)

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ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 23: DC electric vehicle charging station

FOREWORD

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International Standard IEC 61851-23 has been prepared by IEC technical committee 69: Electric road vehicles and electric industrial trucks.

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

FDIS	Report on voting
69/272/FDIS	69/279/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.

This standard is to be read in conjunction with IEC 61851-1:2010. It was established on the basis of the second edition (2010) of that standard.

The clauses of particular requirements in this standard supplement or modify the corresponding clauses in IEC 61851-1:2010. Where the text of subsequent clauses indicates an "*addition*" to or a "*replacement*" of the relevant requirement, test specification or explanation of Part 1, these changes are made to the relevant text of Part 1, which then becomes part of this standard. Where no change is necessary, the words "This clause of Part 1 is applicable" are used. Additional clauses, tables and figures which are not included in Part 1, 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 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 web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,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

The contents of the corrigendum of May 2016 have been included in this copy.

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INTRODUCTION

The introduction and commercialisation of electric vehicles has been accelerated in the global market, responding to the global concerns on CO_2 reduction and energy security. Concurrently, the development of charging infrastructure for electric vehicles has also been expanding. As a complement to the a.c. charging system, d.c. charging is recognized as an effective solution to extend the available range of electric vehicles. The international standardization of charging infrastructure is indispensable for the diffusion of electric vehicles, and this standard is developed for the manufacturers' convenience by providing general and basic requirements for d.c. EV charging stations for conductive connection to the vehicle.

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 23: DC electric vehicle charging station

1 Scope

This part of IEC 61851, together with IEC 61851-1:2010, gives the requirements for d.c. electric vehicle (EV) charging stations, herein also referred to as "DC charger", for conductive connection to the vehicle, with an a.c. or d.c. input voltage up to 1 000 V a.c. and up to 1 500 V d.c. according to IEC 60038.

NOTE 1 This standard includes information on EV for conductive connection, but limited to the necessary content for describing the power and signaling interface.

This part covers d.c. output voltages up to 1 500 V.

Requirements for bi-directional power flow are under consideration.

NOTE 2 Typical diagrams and variation of d.c. charging systems are shown in Annex DD.

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

This part specifies the d.c. charging systems A, B and C as defined in Annexes AA, BB and CC.

NOTE 3 Typical configuration of d.c. EV charging system is shown in Annex EE.

EMC requirements for d.c. EV charging stations are defined in IEC 61851-21-2.

This standard provides the general requirements for the control communication between a d.c. EV charging station and an EV. The requirements for digital communication between d.c. EV charging station and electric vehicle for control of d.c. charging are defined in IEC 61851-24.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

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

IEC/TS 60479-1:2005, *Effects of current on human beings and livestock - Part 1: General aspects*

IEC 60950-1:2005, *Information technology equipment - Safety - Part 1: General requirements*
Amendment 1:2009
Amendment 2:2013

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

IEC 61439-1:2011, *Low voltage switchgear and controlgear assemblies – Part 1: General rules*

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

IEC 61558-1:2005, *Safety of power transformers, power supplies, reactors and similar products – Part 1: General requirements and tests*

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

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 62052-11, *Electricity metering equipment (AC) – General requirements, tests and test conditions – Part 11: Metering equipment*

IEC 62053-21, *Electricity metering equipment (a.c.) – Particular requirements – Part 21: Static meters for active energy (classes 1 and 2)*

IEC 62196-3:—[1], *Plugs, socket-outlets, and vehicle couplers – Conductive charging of electric vehicles – Part 3: Dimensional compatibility and interchangeability requirements for d.c. and a.c./d.c. pin and tube-type contact vehicle couplers*

ISO/IEC 15118-2:—[1], *Road Vehicles – Vehicle to grid communication interface – Part 2: Technical protocol description and Open Systems Interconnections (OSI) layer requirements*

ISO/IEC 15118-3:—[1], *Road Vehicles – Vehicle to grid communication interface – Part 3: Physical layer and data link layer requirements*

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

DIN SPEC 70121, *Electromobility – Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging in the Combined Charging System*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61851-1 and IEC 61668-1, as well as the following apply.

NOTE The definitions included in this part 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.

3.101

d.c. EV charging system
system composed of a DC charger, cable assembly and the equipment on EV that is required to fulfil the charging function including digital communication for charging control

3.102
isolated d.c. EV charging station
d.c. EV charging station with d.c. circuit on output side which is electrically separated by at least basic insulation from a.c. circuit on power system side

3.103
non-isolated d.c. EV charging station
d.c. EV charging station with d.c. circuit on output side which is not electrically separated by at least basic insulation from the supply system

3.104
regulated d.c. EV charging station
d.c. EV charging station that supplies vehicle battery with a charging current or charging voltage in accordance with the request from vehicle

3.105
non-regulated d.c. EV charging station
under consideration

3.106
d.c. charging control function
DCCCF
function embedded in a d.c. EV charging station which controls d.c. power output following VCCF direction

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

3.107
vehicle charging control function
VCCF
function in a vehicle which controls the charging parameters of off-board d.c. EV charging station

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

3.108
CCC
controlled current charging
energy transfer method that the d.c. EV charging station regulates charging current according to the current value requested by the vehicle

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

3.109
CVC
controlled voltage charging
energy transfer method that the d.c. EV charging station regulates charging voltage according to the voltage value requested by the vehicle

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

3.110
control circuit
circuit for signal and digital communication with vehicle, and for the management of charging control process

3.111
primary circuit
a circuit that is directly connected to the a.c. mains supply, and includes the primary windings of transformers, other loading devices and the means of connection to the a.c. mains supply

3.112
secondary circuit
circuit that has no direct connection to a primary circuit and derives its power from a transformer, converter or equivalent isolation device

3.113
insulation
all the materials and parts used to insulate conductive elements of a device, or a set of properties which characterize the ability of an insulation to provide its function

[SOURCE: IEC 60050-151:2001, 151.15.41 and IEC 60050-151:2001, 151.15.42, modified — Both these definitions have been combined and the note to entry has been deleted.]

3.114
isolation
function intended to make dead for reasons of safety all or a discrete section of the electrical installation by separating the electrical installation or section from every source of electric energy

[SOURCE: IEC 60050-826:2004, 826.17.01]

3.115
maximum voltage limit
upper limit value of charging voltage that is notified by the vehicle to the d.c. EV charging station, and is used for overvoltage protection of vehicle battery

3.116
protective conductor
PE
conductor provided for purposes of safety, for example protection against electric shock

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

[SOURCE: IEC 60050-195:1998, 195.02.09]

3.117
charging state
physical status of d.c. EV charging system

3.118
emergency shutdown
shutdown of d.c. EV charging station that results in the termination of charging, caused by a failure detected by the d.c. EV charging station or the vehicle.

4 General requirements

This clause of Part 1 is applicable.

5 Rating of the supply a.c. voltage

This clause of Part 1 is applicable.

6 General system requirement and interface

This clause of Part 1 is applicable except as follows:

6.2 EV charging mode

Replacement:

EV charging mode of this standard is Mode 4.

Mode 4 charging in this part means the connection of the EV to the supply network utilizing a d.c. EV charging station (e.g. off-board charger) where the control pilot function extends to the d.c. EV charging station.

Pluggable d.c. EV charging stations, which are intended to be connected to the a.c. supply network (mains) using standard plugs and socket outlets, shall be compatible with residual current device with characteristics of type A. The pluggable d.c. EV charging station shall be provided with an RCD, and may be equipped with an overcurrent protection device.

Further requirements for pluggable d.c. EV charging stations are under consideration.

NOTE 1 In some countries, the use of an RCD of Type AC for d.c. EV charging station (a.c. mains) is allowed: JP.

NOTE 2 In some countries, US and CA, the use of a system of protection is required that is intended to interrupt the electric circuit to the load when:

a) 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,

b) the earthing (grounding) path becomes open-circuited or of excessively high impedance, or

c) a path to earth (ground) is detected on an isolated (ungrounded) system.

Replacement:

6.3 Types of EV connection

Replacement:

6.3.1 General description

The connection of EVs using cables shall be carried out in case of C connection as specified in Part 1.

6.3.3 Adaptors

Replacement:

Adaptors shall not be used to connect a vehicle connector to a vehicle inlet.

Replacement:

6.4 Functions provided in d.c. charging

The d.c. EV charging station shall supply a d.c. current or voltage to the vehicle battery in accordance with a VCCF request.

For non-regulated charging: under consideration.

Replacement:

6.4.1 Mode 4 charging functions

These functions shall be provided by d.c. charging system as given below:

– verification that the vehicle is properly connected;
– protective conductor continuity checking (6.4.3.2);
– energization of the system;
– de-energization of the system (6.4.3.4);
– d.c supply for EV (6.4.3.101);
– measuring current and voltage (6.4.3.102);
– retaining / releasing coupler (6.4.3.103);
– locking of the coupler (6.4.3.104);
– compatibility assessment (6.4.3.105);
– insulation test before charging (6.4.3.106);
– protection against overvoltage at the battery (6.4.3.107);
– verification of vehicle connector voltage (6.4.3.108);
– control circuit supply integrity (6.4.3.109);
– short circuit test before charging (6.4.3.110);
– user initiated shutdown (6.4.3.111);
– overload protection for parallel conductors (conditional function) (6.4.3.112);
– protection against temporary overvoltage (6.4.3.113);
– emergency shutdown (6.4.3.114).

Replacement:

6.4.2 Optional functions

These functions, if provided, should be provided by d.c. charging system as optional as given below:

– determination of ventilation requirements of the charging area;
– detection/adjustment of the real time available load current of the DC charger;
– selection of charging current;
– wake up of d.c. EV charging station by EV (6.4.4.101);
– indicating means to notify users of locked status of vehicle coupler.

Other additional functions may be provided.

NOTE 1 Un-intentional live disconnect avoidance functions may be incorporated in the latching function interlock system.

NOTE 2 A positive means to prevent unintentional disconnect is required in some countries: US

NOTE 3 Primary protection against overvoltage and overcurrent of vehicle battery is the responsibility of the vehicle.

Replacement:

6.4.3 Details of functions for DC charging

Replacement:

6.4.3.2 Protective conductor continuity checking

For isolated systems, protective conductor continuity between the d.c. EV charging station and the vehicle shall be monitored. For the rated voltage of d.c. 60 V or higher, the d.c. EV

charging station shall perform an emergency shutdown (see 6.4.3.114) within 10 s after a loss of electrical continuity of the protective conductor between d.c. EV charging station and EV (emergency shutdown).

For non-isolated systems, in case of loss of earthing conductor continuity, the non-isolated d.c. EV charging station shall be disconnected from a.c supply network (mains). Earthing conductor continuity between the d.c. EV charging station and the vehicle shall be monitored. For the rated voltage of d.c. 60 V or higher, the d.c. EV charging station shall perform an emergency shutdown within 5 s after a loss of electrical continuity of the protective conductor between d.c. EV charging station and EV.

NOTE The isolated d.c. EV charging station can be disconnected from a.c. mains when protective conductor continuity is lost.

6.4.3.4 De-energization of the system

Addition:

In the case of failure in control circuit of d.c. EV charging station, such as short-circuit, earth leakage, CPU failure or excess temperature, the d.c. EV charging station shall terminate the supply of charging current, and disconnect the supply of control circuit. In addition, the conductor, in which earth fault or overcurrent is detected, shall be disconnected from its supply.

Requirement for disconnection of EV is defined in 7.2.3.1.

Compliance check: under consideration.

Addition:

6.4.3.101 DC supply for EV

The d.c. EV charging station shall supply d.c. voltage and current to the vehicle battery in accordance with VCCF's controlling.

For regulated systems, the d.c. EV charging station shall supply regulated d.c. voltage or current (not simultaneously, but as requested by the vehicle during charging) to the vehicle battery in accordance with VCCF's controlling. Requirements for charging performance of regulated d.c. current / voltage are given in 101.2.1.1, 101.2.1.2 and 101.2.1.3 and 101.2.1.4.

In either case mentioned above, the maximum ratings of the d.c EV charging station shall not be exceeded.

The vehicle can change the requested current and/or requested voltage.

6.4.3.102 Measuring current and voltage

The d.c. EV charging station shall measure the output current and output voltage. The accuracy of output measurement is defined for each system in Annexes AA, BB and CC.

6.4.3.103 Retaining/releasing coupler

A means shall be provided to retain and release the vehicle coupler. Such means may be mechanical, electrical interlock, or combination of interlock and latch.