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Conductive charging for electric vehicles - Part 1: D.C. charging station

Konduktive Ladung von Elektrofahrzeugen - Teil 1: Gleichstrom-Ladestation

Charge conductive pour véhicules électriques - Partie 1: Borne de charge courant continu

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Conductive charging for electric vehicles - Part 1: D.C. charging station

Charge conductive
pour véhicules électriques -
Partie 1: Borne de charge courant continu

Konduktive Ladung
von Elektrofahrzeugen -
Teil 1: Gleichstrom-Ladestation

This Technical Specification was approved by CENELEC on 2007-03-01.

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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Foreword

This Technical Specification was prepared by the CENELEC Reporting Secretariat 69, Electric road vehicles and electric industrial trucks.

The text of the draft was submitted to vote in accordance with the Internal Regulations, Part 2, Subclause 11.3.3.3 and was approved by CENELEC as CLC/TS 50457-1 on 2007-03-01.

This Technical Specification is to be used in conjunction with EN 61851-1.

This Technical Specification supersedes ENV 50275-2-3:1998.

In the framework of the conversion of ENV 50275-2-3, Clause 2 has been updated and references to ENV 50275-1 have been replaced by references to EN 61851-1.

The following date was fixed:

– latest date by which the existence of the CLC/TS has to be announced at national level (doa) 2008-07-01

Contents

Introduction

This Technical Specification “Conductive charging for electric vehicles” is published in separate parts according to the following structure.

This Technical Specification covers the physical, electrical and performance requirements concerning devices for the charging system, when they are not already standardized.

Part 1: D.C. charging station.

Part 2: Communication protocol between off-board charger and electric vehicle.

1 Scope

This Technical Specification, together with EN 61851-1, gives the requirements for d.c. electric vehicle charging stations for conductive connection to the vehicle, with an a.c. supply voltage per IEC 60038, up to 690 V.

This Technical Specification does not cover all safety aspects related to maintenance.

This Technical Specification is not applicable to dedicated off-board charger.

2 Normative references

The following referenced documents are indispensable for the application 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.

EN 50160	1999	Voltage characteristics of electricity supplied by public distribution systems
EN 60068-2-1 + A1 + A2	1993 1993 1994	Environmental testing – Part 2: Tests - Tests A: Cold (IEC 60068-2-1:1990 + A1:1993 + A2:1994)
EN 60068-2-2 + A1 + A2	1993 1993 1994	Basic environmental testing procedures – Part 2: Tests - Tests B: Dry heat (IEC 60068-2-2:1974 + IEC 60068-2-2A:1976 + A1:1993 + A2:1994)
EN 60068-2-5	1999	Environmental testing – Part 2: Tests - Test Sa: Simulated solar radiation at ground level (IEC 60068-2-5:1975)
EN 60068-2-14	1999	Environmental testing – Part 2: Tests - Test N: Change of temperature (IEC 60068-2-14:1984 + A1:1986)
EN 60068-2-30	2005	Environmental testing – Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle) (IEC 60068-2-30:2005)
EN 60068-2-52	1996	Environmental testing – Part 2: Tests - Test Kb: Salt mist, cyclic (sodium chloride solution) (IEC 60068-2-52:1996)
EN 60068-2-62	1995	Environmental testing – Part 2: Test methods - Test Ef: Impact, pendulum hammer (IEC 60068-2-62:1991 + A1:1993)
EN 60068-2-78	2001	Environmental testing – Part 2-78: Tests - Test Cab: Damp heat, steady state (IEC 60068-2-78:2001)
EN 60309-1	1999	Plugs, socket-outlets and couplers for industrial purposes – Part 1: General requirements (IEC 60309-1:1999)
EN 60439-1 + A1	1999 2004	Low-voltage switchgear and controlgear assemblies – Part 1: Type-tested and partially type-tested assemblies (IEC 60439-1:1999 + A1:2004)
EN 60529 + corr. May	1991 1993	Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)
EN 60664-1	2007	Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests (IEC 60664-1:2007)

EN 61180-1	1994	High voltage test techniques for low-voltage equipment
EN 61851-1	2001	Electric vehicle conductive charging system – Part 1: General requirements (IEC 61851-1:2001)
EN 62052-11	2003	Electricity metering equipment (AC) - General requirements, tests and test conditions – Part 11: Metering equipment (IEC 62052-11:2003)
EN 62053-21	2003	Electricity metering equipment (a.c.) - Particular requirements – Part 21: Static meters for active energy (classes 1 and 2) (IEC 62053-21:2003)
HD 323.2.3	1999	Environmental testing – Part 2: Tests - Test N: Change of temperature (IEC 60068-2-14:1984 + A1:1986)
HD 384.4.43 S2	2001	Electrical installations of buildings – Part 4: Protection for safety Chapter 43: Protection against overcurrent (IEC 60364-4-43:1977+ A1:1997; modified)
HD 60364-5-54	2007	Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment - Earthing arrangements, protective conductors and protective bonding conductors (IEC 60364-5-54:2002; modified)
IEC 60038	1983	IEC standard voltages
IEC 60364-4-44	2001	Electrical installations of buildings – Part 4-44: Protection for safety - Protection against voltage disturbances and electromagnetic disturbances

3 Definitions

Clause 3 of EN 61851-1 applies with the following additional definition.

3.1
vehicle charging control unit (VCCU)
system embedded in the electric vehicle which controls the charging parameters of the off-board charger

4 General requirements

The d.c. electric vehicle charging station shall be connected to the electric vehicle so that in normal conditions the charging function operates safely, indoors or outdoors, causing no danger to persons or surroundings, even in the event of carelessness that may occur in normal use.

According to 6.2 of EN 61851-1, the EV charging mode is only mode 4 and the supply cable and connector are permanently attached to the charging station (case C).

In general, this is achieved by fulfilling the relevant requirements specified in this Technical Specification and compliance is checked by carrying out all relevant tests. General requirements for the d.c. charging station can also be found in EN 60439-1.

5 Standard conditions for operation in service and for installation

The rated value of the a.c. supply input voltage is 230/400 V. Allowed variation of the voltage and frequency are defined in EN 50160. Industrial a.c. voltage of 690 V may be used to supply d.c. charging station.

The reference operating temperature range is -20 °C to 40 °C. In some countries, different temperature range may apply.

The extreme limits of -25 °C and 60 °C are admissible during storage and transportation, and should be taken into account in the design of the device.

The relative humidity is between 5 % and 95 %.

The atmospheric pressure is between 860 hPa and 1 060 hPa.

6 Rating of the d.c. electric vehicle charging station

The preferred values of the rated input voltage of the d.c. charging station are 230/400 V and 400/690 V.

The preferred values of the rated output voltage of the d.c. charging station are 250 V, 500 V, 750 V.

NOTE The provision of this clause may be subject to revision.

The preferred values of the rated output current of the d.c. charging station are 200 A and 400 A.

7 General tests provisions

7.1 All tests in this Technical Specification are type tests.

7.2 Unless otherwise specified, type tests shall be carried out on a single specimen as delivered and configured in accordance with the manufacturer's instructions.

7.3 Unless otherwise specified, the tests shall be carried out in the order of the clauses and subclauses in this document.

7.4 The tests shall be carried out with the specimen or any movable part of it placed in the most unfavourable position which may occur in normal use.

7.5 The tests shall be carried out in a draught free location and in general, at an ambient temperature of 20 °C ± 5 °C, unless otherwise specified.

7.6 The characteristics of the test voltages shall comply with EN 61180-1.

8 Functional and constructional requirements

8.1 Control functions

The d.c. electric vehicle charging station provides part of control functions listed in 6.4 of EN 61851-1, for mode 4 charging.

8.2 Emergency service

If required by national rules, an emergency disconnection device shall be installed to isolate all active conductive parts off the d.c. electric vehicle charging station. Protection of the disconnection device should be provided in order to prevent accidental disconnection.

8.3 Permissible temperature

The maximum permissible temperature of parts of the d.c. electric vehicle charging station which may be touched but not hand grasped, at an ambient temperature of 40 °C, is:

– 60 °C for metal parts;

– 85 °C for non-metal parts.

8.4 Charging station Protection degree (IP)

The d.c. electric vehicle charging station shall conform to IP44 degree whether the station is energized or not, according to EN 60529.

Connecting means are dealt with in Clause 12 .

8.5 Location of the support of the connector

If a support is planned to house the connector when the charge is finished, it should be located at a height between 0,4 m and 1,5 m above ground.

8.6 Cable housing on the d.c. electric vehicle charging station

The design of the d.c. electric vehicle charging station shall encourage the user to store the cable correctly on the station after the disconnection.

8.7 Extension cable

The use of an extension cable for the connection of the electric vehicle to the d.c. charging station is to be prohibited.

8.8 Metering

Metering (if any) and the associated tests shall conform with EN 62053-21:2003.

8.9 Performance

8.9.1 Rated outputs and maximal output power

The d.c. charging station shall be able to deliver d.c. power in the voltage range [Vmin, Vmax] and the current range [Imin, Imax] within the limit of its maximal power (Pmax) at 40 °C.

8.9.2 Output voltage and current tolerances

The error between the output voltage and current of the d.c. charging station, compared to the setting point sent by the electric vehicle shall not be greater than 1 % for the voltage and 5 % for the current.

8.9.3 Periodic and random deviation

The ripple component of the output current shall not be greater than 10 % peak-to-peak, within the range [Imin, Imax] of the d.c. charging station.

8.9.4 Turn on (turn off) overshoot (a.c. or d.c. side)

Under consideration.

8.9.5 Turn on (turn off) inrush current

The inrush current inside the vehicle shall be less than I_{max} battery.

8.9.6 Response time to a setting point sent by the vehicle

The rise time of the outputs of the d.c. charging station to a step (rise time between 10 % and 90 % of the setting point) sent by the vehicle, shall be less than 2 s, with a unique overshoot less than 10 % during a few ms.

The fall time to 0 A of the d.c. charging station shall be less than 50 ms.

8.9.7 Transient response to load current changes

Under consideration.

8.9.8 Output overvoltage protection

An overvoltage protection with a time delay of 1 s shall be provided through switching off the d.c. charging station at Vmax battery.

8.9.9 Output overcurrent protection

An overcurrent protection with a time delay of 1 s shall be provided through switching off the d.c. charging station at Imax battery.

9 Electrical safety requirements for the d.c. charging station

The general requirements for electrical safety are dealt with in EN 61851-1. In addition, the following requirements apply.

9.1 Protection against electric shock in case of a fault (indirect contact)

RCD shall not be automatically reset. Manual reset may be accessible to the user. Automatic reset of other personnel protection devices should comply with national regulations.

9.2 Earthing electrode and continuity between the exposed conductive parts and the earthing circuit of the d.c. electric vehicle charging station

The tests for class I charging station earth electrode, where applicable, and earthing of the d.c. electric vehicle charging station shall be carried out in accordance with the rules and safety requirements for earthing of HD 60364-5-54.

The test of electrical continuity between the exposed conductive parts and the earthing circuit of the d.c. electric vehicle charging station shall be carried out with a d.c. ELV voltage source that generates a current of at least 16 A.

For class II charging station, there shall be a lead-through protective conductor.

9.3 Inspection of electrical continuity of the protective conductor of the electric vehicle

If the d.c. electric vehicle charging station detects failure in the electrical continuity of the protective conductor, the electrical supply to the vehicle shall be de-energized immediately.