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BSI Standards Publication

Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles

Part 2: Dimensional compatibility and
interchangeability requirements for a.c.
pin and contact-tube accessories

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National foreword

This British Standard is the UK implementation of EN 62196-2:2012+A12:2014, incorporating corrigendum October 2014. It is identical to IEC 62196-2:2011. It supersedes BS EN 62196-2:2012+A11:2013, which will be withdrawn on 16 June 2017.

Where a common modification has been introduced by amendment, the tags carry the number of the amendment. For example, the common modifications introduced by CENELEC amendment A11 are indicated by  .

The UK participation in its preparation was entrusted by Technical Committee PEL/23, Electrical accessories, to Subcommittee PEL/23/4, Protected type plugs and sockets.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

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Date	Text affected
30 September 2012	Inserted missing pages (pp.23-63)
30 June 2013	Implementation of CENELEC amendment A11:2013
30 September 2014	Implementation of CENELEC amendment A12:2014: STANDARD SHEET 2-IIa (Sheet 1) and STANDARD SHEET 2-IIa (Sheet 2) updated
30 November 2014	Implementation of CENELEC corrigendum October 2014: STANDARD SHEET 2-IIa (Sheet 1) replaced

**Plugs, socket-outlets, vehicle connectors and vehicle inlets -
Conductive charging of electric vehicles -
Part 2: Dimensional compatibility and interchangeability requirements for
a.c. pin and contact-tube accessories
(IEC 62196-2:2011)**

Fiches, socles de prise de courant, prises
mobiles et socles de connecteurs de
véhicule -
Charge conductive des véhicules
électriques -
Partie 2: Exigences dimensionnelles de
compatibilité et d'interchangeabilité pour
les appareils à broches et alvéoles pour
courant alternatif
(CEI 62196-2:2011)

Stecker, Steckdosen,
Fahrzeugkupplungen und
Fahrzeugstecker -
Konduktives Laden von
Elektrofahrzeugen -
Teil 2: Anforderungen und Hauptmaße für
die Kompatibilität und Austauschbarkeit
von Stift- und Buchsensteckvorrichtungen
für Wechselstrom
(IEC 62196-2:2011)

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CENELEC

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

Management Centre: Avenue Marnix 17, B - 1000 Brussels

Foreword

The text of document 23H/267/FDIS, future edition 1 of IEC 62196-2, prepared by SC 23H, "Industrial plugs and socket-outlets", of IEC TC 23, "Electrical accessories" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62196-2:2012.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2012-11-01
- latest date by which the national standards conflicting with the document have to be withdrawn (dow) 2015-02-01

EN 62196-2 is to be read in conjunction with EN 62196-1. The clauses of the particular requirements in Part 2 supplement or modify the corresponding clauses in Part 1. Where the text 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 the standard. Where no change is necessary, the words "This clause of Part 1 is applicable" are used.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62196-2:2011 was approved by CENELEC as a European Standard without any modification.

Foreword to amendment A11

This document (EN 62196-2:2012/A11:2013) has been prepared by CLC/TC 23BX "Switches, boxes and enclosures for household and similar purposes, plugs and socket outlets for d.c. and for the charging of electrical vehicles including their connectors".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2013-10-15
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2017-10-15

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This document has been prepared under a mandate given to CENELEC by the European Commission and the European Free Trade Association.

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

Foreword to amendment A12

This document (EN 62196-2:2012/A12:2014) has been prepared by CLC/TC 23BX "Switches, boxes and enclosures for household and similar purposes, plugs and socket outlets for d.c. and for the charging of electrical vehicles including their connectors".

The following dates are fixed:

- latest date by which this document has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2015-06-16
- latest date by which the national standards conflicting with this document have to be withdrawn (dow) 2017-06-16

This standard covers the Principle Elements of the Safety Objectives for Electrical Equipment Designed for Use within Certain Voltage Limits (LVD - 2006/95/EC).

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Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Addition to Annex ZA of EN 62196-1:2012:

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60068-2-14	-	Environmental testing - Part 2-14: Tests - Test N: Change of temperature	EN 60068-2-14	-

 Annex ZB
(normative)

Special national conditions

Special national condition: National characteristic or practice that cannot be changed even over a long period, e.g. climatic conditions, electrical earthing conditions.

NOTE If it affects harmonization, it forms part of the European Standard / Harmonization Document.

For the countries in which the relevant special national conditions apply these provisions are normative, for other countries they are informative.

<u>Clause</u>	<u>Special national condition</u>
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6.1	United Kingdom
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Mode 1 will not be used in the United Kingdom.

10.101	France
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Add a 2nd paragraph: When plugs & socket-outlets are used and socket-outlets are accessible to uninstructed persons, they shall be provided with shutters (as presently defined in Type 3).

10.101	Portugal
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Shutters are compulsory on live (phase and neutral) contact holes of socket-outlets and connectors not exceeding 16 A when these accessories are accessible to uninstructed persons (ordinary persons BA1, handicapped persons BA2 or children BA3).

In locations with restricted access to skilled persons, socket-outlets and connectors without shutters may be accepted. 

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INTRODUCTION

Responding to global challenges of CO₂ reduction and energy security, the automobile industries have been accelerating the development and commercialization of electric vehicles and hybrid electric vehicles. In addition to the prevailing hybrid electric vehicles, battery electric vehicles including plug-in hybrid electric vehicles are going to be mass-marketed. To support the diffusion of such vehicles, this standard provides the standard interface configurations of a.c. vehicle couplers and accessories to be used in conductive charging of electric vehicles, taking the most frequent charging situations into consideration.

IEC 62196 is divided into several parts:

Part 1: General requirements

Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories

Part 3: Dimensional compatibility and interchangeability requirements for pin and contact-tube accessories for dedicated d.c. charging or for combined a.c./d.c.charging (under consideration)

PLUGS, SOCKET-OUTLETS, VEHICLE CONNECTORS AND VEHICLE INLETS – CONDUCTIVE CHARGING OF ELECTRIC VEHICLES –

Part 2: Dimensional compatibility and interchangeability requirements for a.c. pin and contact-tube accessories

1 Scope

This standard applies to plugs, socket-outlets, vehicle connectors and vehicle inlets with pins and contact-tubes of standardized configurations, herein referred to as accessories. They have a nominal rated operating voltage not exceeding 500 V a.c., 50 to 60 Hz, and a rated current not exceeding 63 A three-phase or 70 A single phase, for use in conductive charging of electric vehicles.

This standard covers the basic interface accessories for vehicle supply as specified in IEC 62196-1, and intended for use in conductive charging systems for circuits specified in IEC 61851-1:2010.

Electric vehicles covers all road vehicles, including plug-in hybrid road vehicles (PHEV), that derive all or part of their energy from on-board batteries.

NOTE 1 These accessories may provide a contact that can be used for the proximity contact function.

These accessories are intended to be used for circuits specified in IEC 61851-1:2010 which operate at different voltages and frequencies and which may include ELV and communication signals.

These accessories may be used for bidirectional energy transmission (under consideration).

This standard applies to the accessories to be used in an ambient temperature of between – 30 °C and + 50 °C.

 text deleted 

These accessories are intended to be connected only to cables with copper or copper-alloy conductors.

Vehicle inlet and vehicle connector to this standard are intended to be used for charging in modes 1, 2 and 3, cases B and C. The socket-outlets and plugs covered by this standard are intended to be used for charging mode 3 only, case A and B.

The modes and permissible connections are specified in Part 1.

2 Normative references

This clause of Part 1 is applicable except as follows:

Addition:

IEC 60068-2-14, *Environmental testing – Part 2-14: Tests – Test N: Change of temperature*

3 Terms and definitions

This clause of Part 1 is applicable.

4 General

This clause of Part 1 is applicable, except as follows:

Addition at the end of the subclause:

Accessories according to this standard are intended for modes 1, 2 and 3, cases A to C. The socket-outlets and plugs covered by this standard shall be used only in mode 3.

5 Ratings

This clause of Part 1 is applicable except as follows:

5.1 Replacement:

Rated operating voltage range:

0 to 30 V (signal or control purposes only);

200 to 250 V a.c.

380 to 480 V a.c.

5.2 Replacement:

2 A (signal or control purposes only)

13 A single phase

16 A single and three-phase

20 A single and three-phase

30-32 A single and three-phase

60-63 A single and three-phase

70 A single phase, only

☐₁₁ text deleted ☐₁₁

6 Connection between the power supply and the electric vehicle

This clause of Part 1 is applicable except as follows:

6.1 Replacement:

This section provides a description of the physical conductive electrical interface requirements between the vehicle and the power supply, which allows the following design at the vehicle interface:

a basic interface that provides for current ratings up to 63 A a.c. three-phase and up to 70 A a.c. single phase.

Different configuration types for the basic interface may allow different application of mode and current ratings. See introduction to relevant standard sheets for more details.

 text deleted 

6.2 Replacement:

There shall be the following type of vehicle inlets:

basic

6.3 Replacement:

There shall be the following type of vehicle connectors:

basic

6.4 Not applicable

6.5 Replacement:

The basic interface may contain up to 7 power or signal contacts, with unique physical configurations of contact positions for single or three phases. The electrical ratings and their function are described in Table 101. The electrical ratings and their function are described in the Standard Sheets.

Each vehicle inlet shall only mate with the corresponding type of vehicle connector. Each plug shall only mate with the corresponding type of socket-outlet.

The accessories, configuration Types 1, 2 or 3 are rated as follows:

- configuration Type 1 vehicle coupler is rated 250 V, 32 A single phase;
- configuration Type 2 vehicle coupler, socket-outlet and plug are rated:
 - 250 V, 13 A or 20 A or 32 A or 63 A or 70 A single phase,
 - 380-480 V, 13 A or 20 A or 32 A or 63 A, three-phase.
- configuration Type 3 vehicle coupler is rated:
 - 250 V, 16 A or 32 A, single phase,
 - 380-480 V, 32 A, or 63 A three-phase.
- Configuration Type 3 socket-outlet and plug are rated:
 - 250 V, 16 A or 32 A single phase,
 - 380-480 V, 32 A, or 63 A three-phase.

**Table 101 – Overview of the basic vehicle interface,
configuration Type 1, single phase**

Position number ^a	a.c.	Functions ^c
1	250 V 32 A	L1 (mains 1)
2	250 V 32 A	L2 (mains 2)/N(neutral)
3	Rated for fault	PE (ground/earth)
4	30 V 2 A	CP (Control pilot)
5	30 V 2 A	CS (Connection)
^a Position number does not refer to the location and/or identification of the contact in the accessory. ~~Ⓒ11~~ Note deleted ~~Ⓒ11~~ ^c For contacts 4 and 5, environmental conditions may demand larger conductor cross-sections.		

**Table 102 – Overview of the basic vehicle interface,
configuration Types 2 and 3, three-phase or single phase**

Position number ^f	Three phase			Single phase		Functions
	$U_{\max}$	$I_{\max}$		$I_{\max}$		
	V a.c.	A		A		
		Type 2	Type 3	Type 2 ^b	Type 3	
1	480	63		70	63	L1 (mains 1) ^b
2	480	63		— ^c	— ^c	L2 (mains 2)
3	480	63		— ^c	— ^c	L3 (mains 3)
4	480	63		70	63	N (neutral) ^{b, e}
5	—	Rated for fault				PE (ground/earth)
6	30	2				CP (Control pilot)
7	30	2				PP (Proximity) ^d or CS (Connection switch) ^d

C11

Note deleted

C11

^b For single phase charging, contacts 1 and 4 shall be used.

^c Unused contacts need not to be installed. Not provided for standard sheets 2-IIIa and 2-IIIb.

^d Not provided for standard sheet 2-IIIa.

^e For single phase system supply phase to phase this contact can be used for L2 (mains 2).

^f Position number does not refer to the location and/or identification of the contact in the accessory

6.6 This subclause of Part 1 is not applicable.

6.101 Communication and control pilot function

The control pilot and proximity detection, or connection contacts shall be used in accordance with IEC 61851-1:2010.

7 Classification of accessories

This clause of Part 1 is applicable except as follows:

7.4 *Replacement:*

According to electrical operation

- Suitable for making and breaking an electrical circuit under load for configuration Types 1 and 3 up to 32 A;
- Not suitable for making and breaking an electrical circuit under load for configurations Type 2 rated 63 A and 70 A and Type 3, rated 63 A.

NOTE Communication circuits to this standard are deemed not to make or break load in the purpose of this clause.

7.5 *Replacement:*

According to the function as specified in Clause 6

- Basic type only.

Addition:

7.101 According to the Standard Sheet used

- Configuration Type 1;
- Configuration Type 2;
- Configuration Type 3.

8 Marking

This clause of Part 1 is applicable.

9 Dimensions

This clause of Part 1 is applicable except as follows:

9.1 *Replacement:*

Accessories shall comply with the relevant standard sheets as specified below and in Table 103:

Configuration Type 1

- Vehicle couplers not exceeding 250 V, 32 A single phase: standard sheet 2-I.
- Optional locking system: standard sheet 2-Ia.

 text deleted 

Configuration Type 2

- Accessories not exceeding 480 V, 63 A three-phase or 70 A single phase: standard sheets 2-II, IIa, IIb, IIc, IId, IIe, IIg and IIh.

Configuration Type 3

- Accessories not exceeding 250 V, 16 A single phase, one pilot: standard sheet 2-IIIa;
- Accessories not exceeding 250 V, 32 A single phase, two pilots: standard sheet 2-IIIb.

- Accessories not exceeding 480 V, 63 A three phase, two pilots: standard sheet 2-IIIc;
- Retaining means and packaging room: standard sheet 2-IIId.

Table 103 – Configuration types and standard sheets

Configuration Type	Standard Sheet	Applicable accessories	Rated voltage V	Rated current A	Phase
1	2-I	Vehicle couplers	Not exceeding 250	32	Single-phase
2	2-II	Accessories	Not exceeding 480	70	Single-phase
				63	Three-phase
3	2-III	Accessories	Not exceeding 250	16	Single-phase
			Not exceeding 250	32	Single-phase
			Not exceeding 480	63	Three-phase

10 Protection against electric shock

This clause of Part 1 is applicable except as follows:

Addition:

10.101 Accessories of configuration Type 3 shall be provided with shutters. Accessories of other configuration types may be provided with shutters.

Compliance is checked by inspection.

11 Size and colour of earthing conductors

This clause of Part 1 is applicable except as follows:

Replacement:

The core connected to the earthing terminal shall be identified by the colour combination green-and-yellow. The nominal cross/sectional area of the earthing conductor and of the neutral conductor, if any, shall be at least equal to that of the phase conductors.

C11 text deleted C11

12 Provision for earthing

This clause of Part 1 is applicable.

13 Terminals

This clause of Part 1 is applicable.

14 Interlocks

This clause of Part 1 is applicable for configuration Type 1.

Addition for configuration Types 2 and 3:

Accessories shall be provided with a latching device according to standard sheets 2-II or 2-IIIId to prevent the connection to be separated unintentionally or by unauthorized persons.

The interlock function shall be performed by the proper functioning of the latching device.

A means shall be provided to indicate that the interlock is properly engaged.

Compliance is checked by inspection and manual test.

15 Resistance to ageing of rubber and thermoplastic material

This clause of Part 1 is applicable.

16 General construction

This clause of Part 1 is applicable.

17 Construction of socket-outlets

This clause of Part 1 is applicable

18 Construction of plugs and vehicle connectors

This clause of Part 1 is applicable.

19 Construction of vehicle inlets

This clause of Part 1 is applicable.

20 Degrees of protection

This clause of Part 1 is applicable.

21 Insulation resistance and dielectric strength

This clause of Part 1 is applicable.

22 Breaking capacity

This clause of Part 1 is applicable.

23 Normal operation

This clause of Part 1 is applicable.

24 Temperature rise

This clause of Part 1 is applicable except as follows:

24.1 Addition after the seventh paragraph:

For accessories dependent upon a coding resistor to establish the accessory's assigned current rating, the test shall be repeated using a set of samples for each coding resistor value and tested at the maximum current corresponding to that coding resistor value.

25 Flexible cables and their connection

This clause of Part 1 is applicable.

26 Mechanical strength

This clause of Part 1 is applicable except as follows.

Addition:

26.101 Isolating caps, if any, shall be fixed sufficiently to the contact pins so that they withstand the mechanical force and abuse to which the accessories may be exposed in normal use. They shall be subjected to the tests of 26.103 and 26.104.

26.102 After each of the following tests, the samples shall show no damage as follows:

- no part shall become detached;
- no part shall have moved, loosened or deformed to the extent that the samples no longer function or operate as intended.
- no uninsulated live part shall become accessible with the probe illustrated in Part 1, Figure 2.
- no reduction shall occur of creepage and clearance between uninsulated live parts of opposite polarity, uninsulated live parts and accessible dead or grounded metal parts, below the minimum acceptable values.
- no other evidence of damage shall result, that could increase the risk of fire or electric shock.

26.103 Change of temperature test

Accessories with isolating caps on the contacts shall not be adversely affected by the temperature stress conditions which may occur in normal use.

Compliance is checked by conditioning the accessories, while mated with their complementary accessory, as specified in this subclause. Test specimens of the largest and smallest size caps shall be tested.

The specimens are mated with their complimentary accessory and subjected to the change of temperature test of IEC 60068-2-14 with following parameters:

- Test procedure Nb

- *Lower temperature* *TA* -30 °C
- *Higher temperature* *TB* +100 °C
- *Slew rate* *3 K/min*
- *Exposure time* *t1* 1 h
- *Number of cycles* *5*

26.104 A set of six contact assemblies with isolating caps shall be subjected to a pull test. A force of 20 N is applied for 1 min and it shall be applied in a direction opposite from the pin or contact, along the pin or contact axis. The pulling force shall be applied in a way where it causes no effect on the fixing area of the part.

NOTE The force can be applied by a drilling in the isolated cap, rectangular to the pin axis, close to the end.

27 Screws, current-carrying parts and connections

This clause of Part 1 is applicable.

28 Creepage distances, clearances and distances

This clause of Part 1 is applicable.

29 Resistance to heat, to fire and to tracking

This clause of Part 1 is applicable.

30 Corrosion and resistance to rusting

This clause of Part 1 is applicable.

31 Conditional short-circuit current withstand test

This clause of Part 1 is applicable.

32 Electromagnetic compatibility (EMC)

This clause of Part 1 is applicable.

33 Vehicle driveover

This clause of Part 1 is applicable except as follows:

33.3 Not applicable

33.4. Not applicable

101 Components

101.1 Ratings

A component shall be used in accordance with its rating established for the intended conditions of use.

Compliance is checked by inspection.

101.2 Mechanical assembly

Loosening of parts in an accessory as a result of vibration due to storage, handling and operation shall not result in a risk of fire, electric shock, injury to persons, or electrical energy – high current levels.

Compliance is checked by inspection

101.3 Current-carrying parts

An uninsulated live part, or a component that has uninsulated live parts shall be so secured to the base or mounting surface, or otherwise insulated that the part does not turn or shift in position resulting in a reduction of creepage distances, clearances and distances below the minimum required values of Part 1, Clause 28.

Compliance is checked by inspection.

101.4 Electrical connections

101.4.1 The requirements described in 101.4.2 to 101.4.4 apply to connections of internal wiring that are factory installed in the accessory.

Compliance is checked by inspection.

101.4.2 A splice or connection shall be mechanically secure and shall make electrical contact.

Compliance is checked by inspection.

101.4.3 A soldered connection is determined to be mechanically secure when the lead is

- wrapped one full turn around a terminal,
- bent at a right angle after being passed through an eyelet or opening, except on printed wiring boards where components are inserted or secured (as in a surface-mounted component) and wave- or lap-soldered, or
- twisted with other conductors.

Compliance is checked by inspection.

101.4.4 A splice shall be provided with insulation equivalent to that of the wires involved unless permanent clearance and creepage distances are maintained between the splice and other metal parts. Insulation over the splice is not prohibited from having

- a splicing device such as a pressure wire connector, having suitable voltage and temperature ratings;
- insulating tubing or sleeving used to cover a splice.

Compliance is checked by inspection.

102 Coding resistors

The vehicle connector and plug of configurations Type 2 and Type 3b and 3c shall be provided with a coding resistor (R_c) to define the maximum current capability of the cable assembly and vehicle connector and plug.