IEC 62196-3

Edition 2.0 2022-10

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

Fiches, socles de prise de courant, prises mobiles de véhicule et socles de connecteurs de véhicule – Charge conductive des véhicules électriques – Partie 3: Exigences dimensionnelles de compatibilité pour les prises de courant de véhicule à broches et alvéoles pour courant continu et pour courants alternatif et continu

IEC 62196-3:2022-10(en-fr)

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

Part 3: Dimensional compatibility requirements for DC and AC/DC pin and contact-tube vehicle couplers

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IEC 62196-3 has been prepared by subcommittee 23H: Plugs, socket-outlets, and couplers for industrial and similar applications, and for electric vehicles, of IEC technical committee 23: Electrical accessories. 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) interchangeability requirements have been removed from the title of Part 3;
b) increased ratings for all configurations;
c) reference to new tests in IEC 62196-1 (Clauses 34, 35, 36 and 37).

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

Draft	Report on voting
23H/500/FDIS	23H/504/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/standardsdev/publications.

A list of all the parts in the IEC 62196 series, published under the general title *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles*, can be found on the IEC website.

This document is to be read in conjunction with IEC 62196-1:2022. The clauses of the particular requirements in this document supplement or modify the corresponding clauses in IEC 62196-1:2022. Where the text indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of IEC 62196-1:2022, these changes are made to the relevant text of IEC 62196-1:2022, which then becomes part of this document. Where no change is necessary, the words "Clause X of IEC 62196-1:2022 is applicable" are used.

Subclauses, figures, tables, or notes which are additional to those in IEC 62196-1:2022 are numbered starting from 301.

In this document, the following print types are used:

– requirements proper: in roman type;

– *test specifications: in italic type*;

– notes: in 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 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

IEC 61851 (all parts) specifies requirements for electric vehicle (EV) conductive supply equipment.

IEC 62196 (all parts) specifies the requirements for plugs, socket-outlets, vehicle connectors, vehicle inlets and cable assemblies as described in IEC 61851 (all parts).

Charging using off-board DC charging equipment can be achieved by the direct connection of an electric vehicle to DC EV supply equipment incorporating control and communication circuits.

To support the connection of DC power for such vehicles, this document provides the standard interface configurations of DC 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 as follows:

– Part 1: General requirements, comprising clauses of a general character.
– Part 2: Dimensional compatibility requirements for AC pin and contact-tube accessories.
– Part 3: Dimensional compatibility requirements for DC and AC/DC pin and contact-tube vehicle couplers.
– Part 3-1: Vehicle connector, vehicle inlet and cable assembly intended to be used with a thermal management system for DC charging.
– Part 4: Dimensional compatibility requirements for DC pin and contact-tube accessories for Class II or Class III applications.
– Part 6: Dimensional compatibility requirements for DC pin and contact-tube couplers for applications using a system of protective electrical separation.

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

Part 3: Dimensional compatibility requirements for DC and AC/DC pin and contact-tube vehicle couplers

1 Scope

This part of IEC 62196 is applicable to vehicle couplers with pins and contact tubes of standardized configuration, herein also referred to as "accessories", intended for use in electric vehicle conductive charging systems which incorporate control means, with rated operating voltage and current in accordance with IEC 62196-1:2022.

This document applies to high power DC interfaces and combined AC/DC interfaces of vehicle couplers that are intended for use in conductive charging systems for circuits specified in IEC 61851-1:2017 and IEC 61851-23:—[1].

The DC vehicle connectors and inlets covered by this document are used only in charging mode 4, according to IEC 61851-1:2017, 6.2.4, and case C, as shown in IEC 61851-1:2017, Figure 3.

These vehicle couplers are intended to be used for circuits specified in IEC 61851-23:— which operate at different voltages, and which can include ELV and communication signals.

This document applies to the vehicle couplers to be used in an ambient temperature between –30 °C and +40 °C.

NOTE 1 In some countries, other requirements may apply.

NOTE 2 In the following country, −35 °C applies: SE.

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

2 Normative references

Clause 2 of IEC 62196-1:2022 applies, except as follows.

Additional normative references:

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

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

IEC 62196-2:2022, *Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 2: Dimensional compatibility requirements for AC pin and contact-tube accessories*

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1 Second edition under preparation. Stage at the time of publication: IEC PRVC 61851-23:2022.

3 Terms and definitions

Clause 3 of IEC 62196-1:2022 applies.

4 General

Clause 4 of IEC 62196-1:2022 applies except as follows:

Addition:

Accessories of the combined interface for AC/DC type intended for use with AC shall comply with the ratings and requirements of IEC 62196-2:2022.

5 Ratings

Clause 5 of IEC 62196-1:2022 applies, except as follows:

Addition:

5.2.2 Rated current for signal or control purposes

Add the following text at the end of Subclause 5.2.2:

For configuration AA, control pilot contacts are rated 30 V, 10 A. The auxiliary power supply may consist of a safety extra-low voltage system circuit.

Add the following new subclause:

5.301 Rated current for auxiliary power supply contacts

For configuration BB, auxiliary power supply contacts are rated 30 V, 20 A. The auxiliary power supply may consist of a safety extra-low voltage system circuit.

6 Connection between the power supply and the electric vehicle

Clause 6 of IEC 62196-1:2022 applies, except as follows:

6.2 Basic interface

Not applicable.

6.3 DC interface

Replacement:

Replace the existing text of IEC 62196-1:2022, 6.3 with the following:

The DC interface may contain up to 12 power or signal contacts, with only one physical configuration of contact positions. The electrical ratings and contact functions are described in Table 301.

Table 301 – Overview of the DC vehicle interface

Position number [a]	Configuration					
	AA		BB			
	U_{max} V	I_{max} A	U_{max} V	I_{max} A	Symbol	Function
1	1 000	400	950	250	DC +	DC +
2	1 000	400	950	250	DC −	DC −
3	30	10	30	2	CP	Control Pilot 1
4	30	10	30	2	CP2	Control Pilot 2
5	30	10	-	-	CP3	Control Pilot 3
6	30	2	30	2	COM1	Communication 1 (+)
7	30	2	30	2	COM2	Communication 1 (−)
8	30	2	-	-	IM	Isolation Monitor
9	-	-	950	Rated for fault [b]	PE	Protective earth
10	30	2	-	-	PP or CS	Proximity detection or connection switch
11	30[c]	10[c]	30	20	AUX1	Auxiliary Power Supply 1 (+)
12	-	-	30	20	AUX2	Auxiliary Power Supply 1 (−)

[a] Position number does not refer to the location and/or identification of the contact in the accessory.

[b] "Rated for fault" means "rated for the highest fault current".

[c] For system AA, position 11 is optional.

DC vehicle interfaces shall be used in a system according to IEC 61851-23:—, Annex AA "DC EV supply equipment of System A" or Annex BB "DC EV supply equipment of System B", respectively. See the corresponding standard sheets for additional interface details.

For use with non-isolated DC EV supply equipment, the interface shall be provided with a contact for protective earthing conductors.

For use with isolated DC EV supply equipment, the interface may be provided with a contact for protective earthing conductors.

6.4 Combined interface

Replacement:

Replace the existing text of IEC 62196-1:2022, 6.4 with the following:

A combined interface extends the use of a basic interface for AC and DC charging.

The combined interface permits AC or DC energy through separate power contacts. The electrical ratings and their function are described in Table 302.

Table 302 – Overview of the combined AC/DC vehicle interface

Position number [a]	Configuration EE				Configuration FF			
	U_{max} V	I_{max} A	Symbol	Function	U_{max} V	I_{max} A	Symbol	Function
1	250 [b]	32 [b]	L1	L1	480 [c]	63 [c,e]	L1	L1
2	250 [b]	32 [b]	L2	L2/N	480 [c]	63 [c]	L2	L2
3	–	–	–	–	480 [c]	63 [c]	L3	L3
4	–	–	–	–	480 [c]	63 [c,e]	N	Neutral
5	–	–[f]	PE	Protective earth	–	–[f]	PE	Protective earth
6	30 [d]	2 [d]	CP	Control pilot	30 [d]	2 [d]	CP	Control pilot
7	30 [d]	2 [d]	PP or CS	Proximity detection or connection switch	30 [d]	2 [d]	PP or CS	Proximity detection or connection switch
8	1 000	400	DC+	DC+	1 000	400	DC+	DC+
9	1 000	400	DC−	DC−	1 000	400	DC−	DC−

[a] Position number does not refer to the location and/or identification of the contact in the accessory.

[b] These contacts are only available in Configuration EE single-phase vehicle inlet. They may be used as portion of basic interface, see IEC 62196-2:2022, Standard Sheets 2-I.

[c] These contacts are optional in Configuration FF. They may be used as a portion of basic interface, see IEC 62196-2:2022, Standard Sheets 2-II.

[d] These contacts may be used as basic interface. For requirements for basic interface see IEC 62196-2:2022, Standard Sheets 2-I and 2-II.

[e] Contacts 1 and 4 for single phase rated I_{max} = 70 A.

[f] Conductor size dependent upon system requirements.

The basic portion of the combined vehicle inlet can be used with a basic connector for either AC charging or with a combined vehicle connector for DC charging.

Combined couplers shall only be used for DC charging with the "DC EV supply equipment of System C" described in IEC 61851-23:—, Annex CC.

NOTE 1 Implementation of all aspects (i.e., topology and communication) according to IEC 61851-23:—, Annex CC ensures that:

This system allows DC charging but prevents AC and DC charging at the same time.

– AC chargeable EVs with a basic vehicle inlet do not need any means to protect themselves against DC voltage at the inlet. This protection is provided by the DC charging system.

– Vehicle protection against mischarging in case of fault is provided in accordance with ISO 17409:2020.

NOTE 2 If the AC or DC ratings of a mating connector and inlet differ, the coupler (mating pair) is used at the lower rating of either the vehicle connector or vehicle inlet of the mating accessory.

7 Classification of accessories

Clause 7 of IEC 62196-1:2022 applies, except as follows:

7.1 According to purpose

Replacement:

Replace the existing text of IEC 62196-1:2022, 7.1 with the following:

– vehicle connectors;
– vehicle inlets.

7.5 According to interface

Replacement:

Replace the existing text of IEC 62196-1:2022, 7.5 with the following:

As specified in Clause 6 of this document and in IEC 61851-1:2017:

– combined interface;
– DC interface.

Addition:

Additional subclause:

7.301 According to the standard sheets used

– Configuration AA;
– Configuration BB;
– Configuration EE and AC corresponding to Type 1 in IEC 62196-2:2022;
– Configuration FF and AC corresponding to Type 2 in IEC 62196-2:2022.

8 Marking

Clause 8 of IEC 62196-1:2022 applies.

9 Dimensions

Clause 9 of IEC 62196-1:2022 applies, except as follows:

Addition:

Add the following text at the end of Clause 9 of IEC 62196-1:2022.

The vehicle connector and vehicle inlet shall comply with the relevant configuration shown in Table 303.

Table 303 – Interface overview

Configuration	Dimensions described in:	Max. rated voltage V DC	Max. rated current A DC	Shall only be used with DC charging station according to the following annexes in IEC 61851-23:—
AA	Standard Sheets 3-I	1 000	400	Annex AA
BB	Standard Sheets 3-II	950	250	Annex BB
EE [a]	Standard Sheets 3-III	1 000	400	Annex CC
FF [b]	Standard Sheets 3-IV	1 000	400	Annex CC

[a] AC ratings are in accordance with IEC 62196-2:2022, 6.2, type 1.

[b] AC ratings are in accordance with IEC 62196-2:2022, 6.2, type 2.

10 Protection against electric shock

Clause 10 of IEC 62196-1:2022 applies, except as follows:

10.3 Contact sequencing and order of contact insertion and withdrawal

Replacement:

Replace the existing text of IEC 62196-1:2022, 10.3 with the following:

For all DC interfaces, the contact sequence during the connection process shall be:

– protective earth (if any),
– DC power contacts,
– isolation monitor contacts,
– control pilot contact.

The isolation monitor contacts and the control pilot contacts shall mate in the sequence shown or can mate simultaneously.

The proximity contact or the connection switch contact, if any, shall mate after the protective earth contact and before or simultaneously with the control pilot contact.

During disconnection the order shall be reversed.

Accessories shall be so designed that:

a) when inserting the vehicle connector:
   1) the protective earth connection is made before the DC power contacts, if any, are made;
   2) the control pilot connection, if any, is made after the DC power contacts are made;
   3) the proximity contact or connection switch contact, if any, is made after the protective earth contact and before or simultaneously as the control pilot is made.

b) when withdrawing the vehicle connector:
   1) the DC power contacts are broken before the protective earth connection is broken;
   2) the control pilot connection, if any, is broken before the DC power contacts are broken;
   3) the proximity contact or connection switch contact, if any, is broken before the protective earth contact and after or simultaneously as the control pilot is opened.

Compliance is checked by inspection and manual test, if required.

11 Size and colour of protective earthing and neutral conductors

Clause 11 of IEC 62196-1:2022 applies for the AC portion.

Additional subclauses:

11.301 For the DC portion, the following applies.

The protective earthing conductor shall be of sufficient cross-sectional area calculated by the I^2t-methodology according to the formula in IEC 60364-5-54:2011, 543.1.2.

The I^2t-values for the respective system, used in the calculation above, shall be according to the manufacturer's data sheet.

NOTE 1 In the following country, the size and rating of the protective conductor is specified in national codes and regulations: CA.

NOTE 2 At the time of publication of this document, ISO 17409 provides higher I^2t-values. For example, for conductors with a crosslinked insulation and a maximum short circuit temperature of 250 °C, a minimum cross-section of 25 mm^2 appplies.

The conductor connected to the protective earthing terminal shall be identified by the colour combination green-and-yellow.

NOTE 3 In the following countries, the colour green may be used to identify the earthing conductor: JP, US, CA.

12 Provisions for earthing

Clause 12 of IEC 62196-1:2022 applies, except as follows:

12.1 This subclause is not applicable for configuration AA.

12.2 This subclause is not applicable for configuration AA.

12.3 This subclause is not applicable for configuration AA.

12.4 This subclause is not applicable for configuration AA.

13 Terminals

Clause 13 of IEC 62196-1:2022 applies.

14 Interlocks

Clause 14 of IEC 62196-1:2022 applies, except as follows:

Additional subclause:

14.301 Latching function

Accessories shall be provided with a latching device to prevent the connection from being separated unintentionally or by unauthorized persons.