IEC 62196-6

Edition 1.0 2022-04

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles – Part 6: Dimensional compatibility requirements for DC pin and contact-tube vehicle couplers intended to be used for DC EV supply equipment where protection relies on electrical separation

Fiches, socles de prise de courant, prises mobiles de véhicule et socles de connecteurs de véhicule – Charge conductive des véhicules électriques – Partie 6: Exigences dimensionnelles de compatibilité pour les prises de courant de véhicules à broches et alvéoles à courant continu pour système d'alimentation pour véhicules électriques en courant continu lorsque la protection est réalisée par séparation électrique

IEC 62196-6:2022-04(en-fr)

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INTERNATIONAL
ELECTROTECHNICAL
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ELECTROTECHNIQUE
INTERNATIONALE

ICS 29.120.30; 43.120

ISBN 978-2-8322-1101-4

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

Part 6: Dimensional compatibility requirements for DC pin and contact-tube vehicle couplers intended to be used for DC EV supply equipment where protection relies on electrical separation

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International Standard IEC 62196-6 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.

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

Draft	Report on voting
23H/501/FDIS	23H/505/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, 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 Part 6 supplement or modify the corresponding clauses in Part 1. Where the text indicates "addition" to or "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 "Clause X of IEC 62196-1:2022 is applicable" are used.

Subclauses, figures or tables which are additional to those in IEC 62196-1:2022 are numbered starting from 601.

In this standard, 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

With the continued development and expansion of the use of electric power into other classes of electric vehicles (EV) and hybrid electric vehicles, the introduction and commercialization of electric powered two or three wheelers (hereafter e-PTWs) are being accelerated in the global market and responding to the global concerns on CO_2 reduction and energy saving.

In comparison with the passenger cars, e-PTWs have a shorter range per charge and need more charging possibilities, especially public DC charging stations. This document provides general and basic requirements for a compact interface for small sized DC EV supply equipment, which could be installed in various places such as convenience stores, newspaper stands, lottery shops, etc., and could help the diffusion of e-PTWs.

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

Part 6: Dimensional compatibility requirements for DC pin and contact-tube vehicle couplers intended to be used for DC EV supply equipment where protection relies on electrical separation

1 Scope

This part of IEC 62196 is applicable to vehicle connectors, vehicle inlets and cable assemblies for electric vehicle (EV), intended for use in conductive charging systems which incorporate control means, with a rated operating voltage up to 120 V DC and rated current up to 100 A.

These accessories are intended to be used for a DC interface of the conductive charging system according to IEC 61851-25:2020.

This document applies to accessories and cable assemblies to be used in an ambient temperature of between –30 °C and +40 °C.

The vehicle connector and vehicle inlets 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:

Addition:

IEC 61851-25:2020, *Electric vehicle conductive charging system – Part 25: DC EV supply equipment where protection relies on electrical separation*

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

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:

4.1 General requirements

Replacement of the first paragraph:

The accessories covered by this document shall only be used with DC EV supply equipment that complies with the requirements of IEC 61851-25.

5 Ratings

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

Replacement:

5.1 Preferred rated operating voltage ranges

The preferred rated operating voltage ranges are:

0 V to 30 V (signal or control purposes only)
120 V DC

5.2 Preferred rated currents

5.2.1 General

The DC rated current for vehicle coupler is 100 A.

The DC rated currents for cable assembly are:

16 A
20 A
50 A
70 A
100 A

6 Connection between the power supply and the electric vehicle

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

6.1 Interfaces

Replacement:

This clause provides a description of the physical conductive electrical interface requirements between the vehicle and the power supply for the DC interface.

6.2 Basic interface

Not applicable.

6.3 DC interface

Replacement:

The DC interface may contain up to 7 (power or signal) contacts, with only one physical configuration of contact positions. The electrical ratings and their function are described in Table 601. They shall be used in a system according to IEC 61851-25.

Table 601 – Overview of the DC vehicle interface

Position number [a]	U_{max} V	I_{max} A	Symbol	Function
1	120	100	DC +	DC +
2	120	100	DC –	DC –
3	30	2	CPW [b]	Control pilot
4	30	2	CAN HI	Communication (CAN) (+)
5	30	2	CAN LO	Communication (CAN) (−)
6	30	2	+12V	Auxiliary power supply (+)
7	30	2	0V	Auxiliary power supply (−)

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

[b] CPW stands for "control pilot wire".

6.4 Combined interface

Not applicable.

7 Classification of accessories

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

7.1 According to purpose

Replacement:

– vehicle connectors,
– vehicle inlets,
– cable assemblies.

7.5 According to interface

Replacement:

– DC

8 Marking

Clause 8 of IEC 62196-1:2022 applies.

9 Dimensions

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

Replacement of the first paragraph:

The vehicle connector and vehicle inlet shall comply with configuration shown in Standard Sheet 6.

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:

The contact sequence during the connection process shall be:

– DC power contacts
– Control pilot and other contacts (i.e. auxiliary power supply and communication)

During disconnection the order shall be reversed.

Accessories shall be so designed that

a) when inserting the vehicle connector, the control pilot and other contacts (i.e. auxiliary power supply and communication) connection are made after DC +/- contacts are made;
b) when withdrawing the vehicle connector, the control pilot and other contacts (i.e. auxiliary power supply and communication) connection are broken before DC +/- contacts are broken."

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

11 Size and colour of protective earthing and neutral conductors

Not applicable.

12 Provisions for earthing

Not applicable.

13 Terminals

Clause 13 of IEC 62196-1:2022 applies, except as follows:

Replacement of Table 1:

Table 1 – Size for conductors

Current rating	Internal connection	
Current	Flexible cables for vehicle connectors Solid or stranded cables for vehicle inlets [a]	
A	mm^2	AWG/MCM [b]
16 to 20	1,0 to 2,5	16 to 14
50	6 to 10	10 to 8
70	10 to 16	8 to 6
100	16 to 25	6 to 4

[a] Classification of conductors: according to IEC 60228.

[b] The nominal cross-sectional areas of conductors are given in square millimeters (mm^2). AWG/MCM values are considered as equivalent to mm^2 for the purpose of this document.

Reference IEC 60999-1:1999 (Annex A), IEC 60999-2:2003 (Annex C).

AWG: American Wire Gauge is a system of identifying wires in which the diameters are found in geometric progression between size 36 and size 0000.

MCM: Mille Circular Mils denotes circle surface unit. 1 MCM = 0,5 067 mm^2.

14 Interlocks

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

Replacement:

14.1.6 The vehicle inlet is fixed to the support of an apparatus as shown in Figure 14 a) so that the axis of separation is horizontal. With the latching devices holding the vehicle connector into the vehicle inlet in the engaged position, an axial pull is applied to the cable attached at an appropriate vehicle connector inserted in the vehicle inlet with interlock.

The contacts are wiped free from grease before test.

The test sample is inserted into and withdrawn from the vehicle inlet ten times. It is then again inserted with a mass being attached to it by means of a suitable clamp. The total mass of the vehicle connector, the clamp, the carrier, the principal and the supplementary weight shall exert a pull force of 750 N. The supplementary weight shall be such that it exerts a force equal to one-tenth of the withdrawal force. The retaining means, if any, shall be opened.

The principal weight is hung without jolting on the test vehicle connector, and the supplementary weight is allowed to fall from a height of 5 cm onto the principal weight.

After this test, the total weight shall be maintained for 60 s.

The test of 14.1.6 is repeated three times, rotating the vehicle inlet of 90° on the vertical plane each time (see Figure 14b))

During the tests of 14.1.6, the vehicle connector shall not come out of the vehicle inlet and the latching devices holding the vehicle connector in the vehicle inlet shall remain in locked position.

During the test the electrical continuity shall be maintained, and the cable shall not be damaged.

After the test, the vehicle connector with interlock shall show no damage or deformation which may impair the function of the product. The cable shall not have been displaced by more than the values indicated in Table 11. For rewirable accessories, the ends of the conductors shall not have moved noticeably in the terminals; for non-rewirable accessories, there shall be no break in the electrical connections.

For the measurement of the longitudinal displacement, a mark is made on the cable at a distance of approximately 2 cm from the end of the sample or the cable anchorage before starting the tests. If, for non-rewirable accessories, there is no definite end to the sample, an additional mark is made on the body of the sample.

After the tests, the displacement of the mark on the cable in relation to the sample or the cable anchorage is measured.

Compliance is checked by inspection and test.

14.4 Pilot contacts and auxiliary circuits

Replacement:

Pilot contacts and auxiliary circuits used for interlocks shall make after the DC+ and DC− are made.

Pilot contacts and auxiliary circuits used for interlocks shall break before the DC+ and DC− are broken.

Compliance is checked by inspection and by the test of 14.1.5.

Addition:

14.601 Latching function

The vehicle connector shall be provided with a latching device.

An example of latching device is given in the Standard Sheet 6-d.

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 in accordance with 14.1.5 and 14.1.6.

15 Resistance to ageing of rubber and thermoplastic material

Clause 15 of IEC 62196-1:2022 applies.

16 General construction

Clause 16 of IEC 62196-1:2022 applies, except as follows:

16.16

Replacement of the first paragraph:

The force to insert and withdraw a vehicle connector shall be less than 100 N. Means to facilitate the insertion and withdrawal of the vehicle connector from the vehicle inlet may be provided. If a vehicle coupler is equipped with an assist device to reduce this force (e.g. mechanical assist device), the operating force of assist device shall be less than 100 N.

17 Construction of EV socket-outlets

Clause 17 of IEC 62196-1:2022 does not apply.

18 Construction of EV plugs and of vehicle connectors

Clause 18 of IEC 62196-1:2022 applies, except as follows:

18.1

Addition, after the second paragraph:

A thermal cut-out in the vehicle connector is optional for DC charging.

19 Construction of vehicle inlets

Clause 19 of IEC 62196-1:2022 applies, except as follows:

19.2 *Not applicable.*

20 Degrees of protection

Clause 20 of IEC 62196-1:2022 applies, except as follows:

20.1 *Replacement of the first sentence:*

Accessories shall have the minimum degrees of protection as required in IEC 61851-25.

21 Insulation resistance and dielectric strength

Clause 21 of IEC 62196-1:2022 applies.

22 Breaking capacity

Clause 22 of IEC 62196-1:2022 does not apply.

23 Normal operation

Clause 23 of IEC 62196-1:2022 applies, except as follows: