

TECHNICAL SPECIFICATION

**Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles –
Part 4: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube accessories for Class II or Class III applications**

[IEC TS 62196-4:2022](https://standards.iteh.ai/catalog/standards/sist/b94f4603-aceb-4777-9eb0-4018ae1b00c8/iec-ts-62196-4-2022)

<https://standards.iteh.ai/catalog/standards/sist/b94f4603-aceb-4777-9eb0-4018ae1b00c8/iec-ts-62196-4-2022>



THIS PUBLICATION IS COPYRIGHT PROTECTED
Copyright © 2022 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

IEC Secretariat
3, rue de Varembe
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, ...). It also gives information on projects, replaced and withdrawn publications.

IEC Products & Services Portal - products.iec.ch

Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

IEC Just Published - webstore.iec.ch/justpublished

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 300 terminological entries in English and French, with equivalent terms in 19 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Customer Service Centre - webstore.iec.ch/csc

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

[IEC TS 62196-4:2022](https://standards.iteh.ai/catalog/standards/sist/69414603-aceb-4777-9eb0-4018ae1b00c8/iec-ts-62196-4-2022)

<https://standards.iteh.ai/catalog/standards/sist/69414603-aceb-4777-9eb0-4018ae1b00c8/iec-ts-62196-4-2022>

TECHNICAL SPECIFICATION

**Plugs, socket-outlets, vehicle connectors and vehicle inlets – Conductive charging of electric vehicles –
Part 4: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube accessories for Class II or Class III applications**

[IEC TS 62196-4:2022](https://standards.iteh.ai/catalog/standards/sist/b94f4603-aceb-4777-9eb0-4018ae1b00c8/iec-ts-62196-4-2022)

<https://standards.iteh.ai/catalog/standards/sist/b94f4603-aceb-4777-9eb0-4018ae1b00c8/iec-ts-62196-4-2022>

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 29.120.30; 43.120

ISBN 978-2-8322-5370-0

Warning! Make sure that you obtained this publication from an authorized distributor.

CONTENTS

FOREWORD.....	3
INTRODUCTION.....	5
1 Scope.....	6
2 Normative references	6
3 Terms and definitions	7
4 General	7
5 Ratings.....	7
6 Connection between the power supply and the electric vehicle.....	8
7 Classification of accessories.....	10
8 Marking	10
9 Dimensions.....	10
10 Protection against electric shock	10
11 Size and colour of protective earthing conductors.....	11
12 Provisions for protective earthing.....	11
13 Terminals	12
14 Interlocks.....	12
15 Resistance to ageing of rubber and thermoplastic material	12
16 General construction	12
17 Construction of socket-outlets	12
18 Construction of plugs and of vehicle connectors	13
19 Construction of vehicle inlets	13
20 Degrees of protection	13
21 Insulation resistance and dielectric strength	13
22 Breaking capacity	14
23 Normal operation	14
24 Temperature rise	14
25 Flexible cables and their connection.....	14
26 Mechanical strength	14
27 Screws, current-carrying parts and connections.....	15
28 Creepage distances, clearances and distances	15
29 Resistance to heat, to fire and to tracking.....	15
30 Corrosion and resistance to rusting	15
31 Conditional short-circuit current withstand test.....	15
32 Electromagnetic compatibility	15
33 Vehicle driveover.....	15
STANDARD SHEETS 4-I	16
STANDARD SHEETS 4-II	24
STANDARD SHEETS 4-III	37
STANDARD SHEETS 4-IV	45
Bibliography.....	56
Table 401 – Overview of the rated voltages and currents	8
Table 402 – Overview of the DC vehicle coupler	9

INTERNATIONAL ELECTROTECHNICAL COMMISSION

—————

**PLUGS, SOCKET-OUTLETS, VEHICLE CONNECTORS AND VEHICLE
INLETS – CONDUCTIVE CHARGING OF ELECTRIC VEHICLES –**
**Part 4: Dimensional compatibility and interchangeability requirements for
DC pin and contact-tube accessories for Class II or Class III applications**

FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

IEC TS 62196-4 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 a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
23H/382/DTS	23H/385B/RVDTS 23H/385A/RVDTS 23H/385/RVDTS

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 Technical Specification 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/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 part of IEC 62196 is to be read in conjunction with IEC 62196-1:2014. The clauses of the particular requirements in Part 4 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.

Subclauses, figures, tables or notes which are additional to those in IEC 62196-1 are numbered starting from 401.

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 2022

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

INTRODUCTION

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).

Some conductive transfer of electric power can be achieved by direct connection from an electric vehicle to common mains socket-outlets.

IEC 62196-4 covers the mechanical, electrical and performance requirements for dedicated accessories for conductive transfer of electric power between the supply network and a light electric road vehicle according to IEC TS 61851-3 (all parts).

IEC 62196 is divided into several parts:

- Part 1: General requirements, comprising clauses of a general character;
- Part 2: Dimensional compatibility and interchangeability requirements for AC pin and contact-tube accessories;
- Part 3: Dimensional compatibility and interchangeability requirements for DC and AC/DC pin and contact-tube vehicle couplers;
- Part 4: Dimensional compatibility and interchangeability requirements for dedicated DC pin and contact-tube accessories for Class II or Class III applications.

The International Electrotechnical Commission (IEC) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent no. EP1537632 B1 concerning Standard sheets 4-1.

IEC takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured the IEC that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with IEC. Information may be obtained from:

Rosenberger Hochfrequenztechnik GmbH & Co. KG

Hauptstraße 1, 83413 Fridolfing, Germany

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

Part 4: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube accessories for Class II or Class III applications

1 Scope

This part of IEC 62196 is applicable to plugs, socket-outlets, vehicle connectors and vehicle inlets, herein referred to as “accessories”, of standardized configuration for DC power supply of electric road vehicles, where the protection against electric shocks relies on double or reinforced insulation between all AC and DC inputs and outputs of the EV supply equipment, intended for use in conductive power supply systems which can incorporate control means, with a maximum operating voltage up to 120 V DC, not exceeding 60 A.

These accessories are intended to be used for circuits specified in IEC 61851-3 (all parts).

The accessories covered by this part of IEC 62196 are intended to be used only with electric vehicles that provide a vehicle power supply circuit with double or reinforced insulation or battery systems covered by IEC 61851-3 (all parts).

These accessories and cable assemblies are intended to be used in an ambient temperature of between –30 °C and +50 °C.

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

2 Normative references

Clause 2 of IEC 62196-1:2014 applies except as follows:

Addition:

NOTE All EMC related standard references are given in IEC 61851-21-1 and IEC 61851-21-2.

IEC TS 61851-3-1:–¹, *Electric vehicle conductive charging system – Part 3-1: DC EV supply equipment where protection relies on double or reinforced insulation – General rules and requirements for stationary equipment*

IEC TS 61851-3-2:–², *Electric vehicle conductive charging system – Part 3-2: DC EV supply equipment where protection relies on double or reinforced insulation – Particular requirements for portable and mobile equipment*

IEC TS 61851-3-4:–³, *Electric vehicle conductive charging system – Part 3-4: DC EV supply equipment where protection relies on double or reinforced insulation – General definitions and requirements for CANopen communication*

¹ Under preparation. Stage at the time of publication: IEC DTS 61851-3-1:2022.

² Under preparation. Stage at the time of publication: IEC DTS 61851-3-2:2022.

³ Under preparation. Stage at the time of publication: IEC TS 61851-3-4:2022.

IEC 61851-21-1, *Electric vehicle conductive charging system – Part 21-1 Electric vehicle on-board charger EMC requirements for conductive connection to AC/DC supply*

ISO 17409, *Electrically propelled road vehicles – Connection to an external electric power supply – Safety requirements*

3 Terms and definitions

Clause 3 of IEC 62196-1:2014 applies except as follows:

Addition:

3.401

communication contact

auxiliary electric contact for use in a communication and its power supply, if any

4 General

Clause 4 of IEC 62196-1:2014 applies except as follows:

4.1 General requirements

Replacement:

The accessories covered by this document shall only be used with electric vehicles that provide a vehicle power supply circuit with double or reinforced insulation or battery systems that comply with the requirements of IEC 61851-3 (all parts).

Accessories shall be so designed and constructed that in normal use their performance is reliable and minimises the risk of danger to the user or surroundings.

Compliance is checked by meeting all of the relevant requirements and tests specified.

Accessories shall be so designed and constructed that it is not possible to make a cord extension set. The plug and the vehicle connector shall not be compatible.

Compliance is checked by a manual test.

5 Ratings

Clause 5 of IEC 62196-1:2014 is not applicable.

Replacement:

For voltage and corresponding rated currents, see Table 401.

Voltage classes shall be according to ISO 17409.

Table 401 – Overview of the rated voltages and currents

Rated volt V	Rated current A	DC	ISO voltage-class	Sheet
60	5	X	A	4-I
60	60	X	A	4-IIa/4-IIc
120	60	X	B	4-IIa/4-IIb
60/120	60	X	A/B	4-IIa (only socket-outlet)
60	60	X	A	4-III
120	60	X	B	4-IV

NOTE 1 Communication contacts (if any) are rated for 15 V and 2 A DC.

NOTE 2 Nominal system output voltages, see IEC TS 61851-3-1.

An accessory rated above 60 V DC and above 5 A shall be classified as not suitable for making and breaking an electrical circuit under load.

NOTE In Canada, "not suitable for making and breaking an electric circuit under load" is considered "disconnect use only".

6 Connection between the power supply and the electric vehicle

Clause 6 of IEC 62196-1:2014 is not applicable.

Replacement:

[IEC TS 62196-4:2022](https://standards.iteh.ai/catalog/standards/sist/b94f4603-aceb-4777-9eb0-4018ae1b00c8/iec-ts-62196-4-2022)

6.401 General

Clause 6 provides a description of the different types of accessories.

Table 402 gives an overview of the types of accessories.

Table 402 – Overview of the DC vehicle coupler

Pos no.	4-I	4-IIa ^c 4-IIc ^d	4-IIa ^c 4-IIb ^d	4-IIa ^e	4-III	4-IV	Functions
	60 V	60 V	120 V	60/120 V	60 V	120 V	
1	5 A	60 A	--	60 A	60 A	--	DC +60 V
2	--	--	60 A	60 A	--	60 A	DC –120 V
3	5 A	60 A	60 A	60 A	60 A	60 A	DC 0 V
4	2 A ^a	NA ^b	NA ^b	NA ^b	2 A ^a	2 A ^a	CAN Hi
5	2 A ^a	NA ^b	NA ^b	NA ^b	2 A ^a	2 A ^a	CAN Lo
6	2 A ^a	NA ^b	NA ^b	NA ^b	2 A ^a	2 A ^a	AUX +12 V
7	2 A ^a	NA ^b	NA ^b	NA ^b	2 A ^a	2 A ^a	AUX 0 V

^a For contacts 4 to 7, 15 V DC.

^b Communication contacts provided by near field communication (NFC).

^c Socket-outlets/vehicle inlets.

^d Plug/vehicle connectors.

^e Only used for socket-outlets.

6.402 Types of vehicle inlets

There are different types of vehicle inlets:

- 5 A and 60 V DC;
- 60 A and 60 V DC;
- 60 A and 120 V DC.

6.403 Types of vehicle connectors

There are different types of vehicle connectors:

- 5 A and 60 V DC;
- 60 A and 60 V DC;
- 60 A and 120 V DC.

6.404 Types of socket-outlets

There are different types of socket-outlets:

- 5 A and 60 V DC;
- 60 A and 60 V DC;
- 60 A and 120 V DC.

6.405 Types of plugs

There are different types of plugs:

- 5 A and 60 V DC;
- 60 A and 60 V DC;
- 60 A and 120 V DC.

6.406 Contact sequencing

The contact sequence during the connection process shall be:

- power contacts: “DC 0 V”, “DC +60 V”, “DC –120 V” (if provided);
- communication contacts (if provided);
- proximity detection (if provided).

During disconnection, the order shall be reversed.

7 Classification of accessories

Clause 7 of IEC 62196-1:2014 applies except as follows:

7.5 *Not applicable.*

8 Marking

Clause 8 of IEC 62196-1:2014 applies except as follows:

8.5 *Replacement:*

For rewirable accessories, the contacts shall be indicated by the following symbols:

- DC +60 V or +, DC –120 V or –, DC 0 V or 0 V for DC, if any;
- CAN Hi or 4;
- CAN Lo or 5;
- AUX +12 V or 6;
- AUX 0 V or 7.

These symbols shall be placed close to the relevant terminals; they shall not be placed on screws, removable washers or other removable parts.

If numbers are used, a pin description shall be stated in the documentation.

Compliance is checked by inspection.

9 Dimensions

Clause 9 of IEC 62196-1:2014 applies.

10 Protection against electric shock

Clause 10 of IEC 62196-1:2014 applies except as follows:

10.1 *Replacement:*

Accessories shall be so designed that hazardous live parts of accessories, when they are wired as in normal use, are not accessible.

In addition, it shall not be possible to make contact between a live part of a plug or vehicle connector and a live part of a socket-outlet or vehicle inlet while any live part is accessible.

NOTE DC 0 V contacts of vehicle connectors and plugs are deemed to be live parts; communication contacts are not considered to be live parts.

This does not apply to contacts and conductors used for signal, data, communications and control circuits.

Compliance is checked by inspection and, if necessary, by a test on the sample wired as in normal use.

The standard test finger shown in Figure 3 of IEC 62196-1:2014 is applied in every possible position, an electrical indicator, with a voltage not less than 40 V, being used to show contact with the relevant part.

10.3 Replacement:

Accessories shall be so designed that:

- a) when inserting the plug or the vehicle connector,
 - 1) communication connection, if any, is made after the DC +60 V, DC –120 V, DC 0 V connections, if any, are made;
 - 2) the proximity contact or the connection switch contact, if any, is made after or at the same time as the communication connections if any are made.
- b) when withdrawing the plug or the vehicle connector,
 - 1) communication connection if any, is broken before the DC +60 V, DC –120 V, DC 0 V connections, if any, are broken;
 - 2) the proximity contact or connection switch contact, if any, is broken before or at the same time as the communication connections are broken.

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

10.4 Replacement:

It shall not be possible to inadvertently assemble:

- either the part that carries the contacts of a socket-outlet or of a vehicle inlet into the enclosure of a plug or of a vehicle connector,
- or the part that carries the contacts of a plug or of a vehicle connector into the enclosure of a socket-outlet or of a vehicle inlet.

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

11 Size and colour of protective earthing conductors

Clause 11 of IEC 62196-1:2014 is not applicable.

12 Provisions for protective earthing

Clause 12 of IEC 62196-1:2014 is not applicable.

13 Terminals

Clause 13 of IEC 62196-1:2014 applies except as follows:

13.1.2 Addition:

Add the following lines to Table 7:

5	1	16	N.A.	1	16	N.A.
60	6 to 16	10 to 6	N.A.	6 to 25	10 to 4	N.A.

14 Interlocks

Clause 14 of IEC 62196-1:2014 applies.

15 Resistance to ageing of rubber and thermoplastic material

Clause 15 of IEC 62196-1:2014 applies.

16 General construction

Clause 16 of IEC 62196-1:2014 applies except as follows:

16.8 Replacement:

IEC TS 62196-4:2022

With the retaining means in place, the mating accessory shall be pulled with a force equal to the weight of the accessory and a cable of 1,5 m in length with the maximum size conductors as specified in Table 7 of IEC 62196-1:2014. The retaining means shall not release.

17 Construction of socket-outlets

Clause 17 of IEC 62196-1:2014 applies except as follows:

17.2 Contact tubes

17.2.1 Addition:

Add the following line to Table 12:

4	3,85	2,5
---	------	-----

17.2.2 Addition:

Add the following line to Table 13:

4	4,00
---	------

Add the following lines to Table 14:

up to and including 5	100
from 6 up to and including 60	275

18 Construction of plugs and of vehicle connectors

Clause 18 of IEC 62196-1:2014 applies.

19 Construction of vehicle inlets

Clause 19 of IEC 62196-1:2014 applies except as follows:

19.2 *Not applicable.*

20 Degrees of protection

Clause 20 of IEC 62196-1:2014 applies except as follows:

20.1 *Replacement of the first paragraph:*

Accessories shall have the minimum degrees of protection as required in IEC TS 61851-3-1.

21 Insulation resistance and dielectric strength

Clause 21 of IEC 62196-1:2014 applies except as follows:

21.1 *Replacement:*

Replace the NOTE with the following NOTE:

NOTE For the purpose of these tests, the communications contacts, if any, are connected together and deemed as one pole.

21.3 *Replacement of the second and third paragraphs:*

For the parts indicated in 21.2 a) (first dashed item) and 21.2 b) (first dashed item) of IEC 62196-1:2014, which are used in non-power circuits for energy management system (EMS) communication according to IEC TS 61851-3-4, each circuit may be tested separately, using a test voltage based on the highest voltage in the circuit.

For the parts indicated in 21.2 a) (second dashed item) and 21.2 b) (second dashed item) of IEC 62196-1:2014, which are used in non-power circuits for energy management system (EMS) communication according to IEC TS 61851-3-4, the test voltage between these circuits and the power circuits shall be based on the voltage of the power circuit.