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**(istoveten EN 62196-1:2003)**

Plugs, socket-outlets, vehicle couplers and vehicle inlets - Conductive charging of electric vehicles - Part 1: Charging of electric vehicles up to 250 A a.c. and 400 A d.c. (IEC 62196-1:2003)

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EUROPEAN STANDARD

**EN 62196-1**

NORME EUROPÉENNE

EUROPÄISCHE NORM

September 2003

ICS 29.120.30; 43.120

English version

**Plugs, socket-outlets, vehicle couplers and vehicle inlets –  
Conductive charging of electric vehicles  
Part 1: Charging of electric vehicles up to 250 A a.c. and 400 A d.c.  
(IEC 62196-1:2003)**

Fiches, socles de prise de courant,  
prises mobiles et socles de connecteur  
pour véhicule –

Charge conductive des véhicules  
électriques

Partie 1: Charge des véhicules électriques

jusqu'à 250 A c.a. et 400 A c.c.  
(CEI 62196-1:2003)

Stecker, Steckdosen,  
Fahrzeugsteckvorrichtungen  
und Fahrzeugstecker –

Ladung von Elektrofahrzeugen

Teil 1: Leitungsgebundenes Laden  
von Elektrofahrzeugen bis 250 A

Wechselstrom und 400 A Gleichstrom  
(IEC 62196-1:2003)

This European Standard was approved by CENELEC on 2003-09-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CENELEC member into its own language and notified to the Central Secretariat has the same status as the official versions.

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

**Central Secretariat: rue de Stassart 35, B - 1050 Brussels**

## Foreword

The text of document 23H/132/FDIS, future edition 1 of IEC 62196-1, prepared by SC 23H, Industrial plugs and socket-outlets, of IEC TC 23, Electrical accessories, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62196-1 on 2003-09-01.

The following dates were fixed:

- latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement (dop) 2004-06-01
- latest date by which the national standards conflicting with the EN have to be withdrawn (dow) 2006-09-01

Annexes designated "normative" are part of the body of the standard.  
Annexes designated "informative" are given for information only.  
In this standard, annex ZA is normative and annex A is informative.  
Annex ZA has been added by CENELEC.

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### Endorsement notice

The text of the International Standard IEC 62196-1:2003 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following note has to be added for the standard indicated:

IEC 60068-2-75 NOTE Harmonized as EN 60068-2-75:1997 (not modified).

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## Annex ZA (normative)

### Normative references to international publications with their corresponding European publications

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

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

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60112	- 1)	Method for the determination of the proof and the comparative tracking indices of solid insulating materials	EN 60112	2003 2)
IEC 60227 (mod)	Series	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V	HD 21	Series
IEC 60228 (mod)	1978	Conductors of insulated cables - First supplement: Guide to the dimensional limits of circular conductors	HD 383 S2 3)	1986
IEC 60245-4 (mod)	1994	Cables of rated voltages up to and including 450/750 V and having cross-linked insulation Part 4: Cords and flexible cables	HD 22.4 S3	1995
IEC 60269-1	1998	Low-voltage fuses Part 1: General requirements	EN 60269-1	1998
IEC 60269-2	1986	Part 2: Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)	EN 60269-2	1995
IEC 60529	- 1)	Degrees of protection provided by enclosures (IP Code)	EN 60529 + corr. May	1991 2) 1993
IEC 60664-1	1992	Insulation coordination for equipment within low-voltage systems Part 1: Principles, requirements and tests	EN 60664-1 4)	2003

1) Undated reference.

2) Valid edition at date of issue.

3) HD 383 S2 includes supplement A:1982 to IEC 60228.

4) EN 60664-1 includes A1:2000 + A2:2002 to IEC 60664-1.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
IEC 60664-3	1992	Part 3: Use of coatings to achieve insulation coordination of printed board assemblies	HD 625.3 S1 <sup>5)</sup>	1997
IEC 60695-2-10	- <sup>1)</sup>	Fire hazard testing Part 2-10: Glowing/hot-wire based test methods - Glow-wire apparatus and common test procedure	EN 60695-2-10	2001 <sup>2)</sup>
IEC 60999-1	1999	Connecting devices - Electrical copper conductors - Safety requirements for screw-type and screwless-type clamping units Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm <sup>2</sup> up to 35 mm <sup>2</sup> (included)	EN 60999-1	2000
IEC 60999-2	2003	Part 2: Particular requirements for clamping units for conductors above 35 mm <sup>2</sup> up to 300 mm <sup>2</sup> (included)	EN 60999-2	2003
IEC 61851-1	2001	Electric vehicle conductive charging system Part 1: General requirements	EN 61851-1	2001

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<sup>5)</sup> HD 625.3 S1 is superseded by EN 60664-3:2003 which is based on IEC 60664-3:2003.

# INTERNATIONAL STANDARD

**IEC**  
**62196-1**

First edition  
2003-04

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## Plugs, socket-outlets, vehicle couplers and vehicle inlets – Conductive charging of electric vehicles –

### Part 1:

**Charging of electric vehicles up to 250 A a.c.  
and 400 A d.c.**  
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**Fiches, socles de prise de courant, prises mobiles  
et socles de connecteur pour véhicule –  
Charge conductive des véhicules électriques –**

### Partie 1:

**Charge des véhicules électriques jusqu'à 250 A c.a.  
et 400 A c.c.**

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International Electrotechnical Commission  
Международная Электротехническая Комиссия

PRICE CODE **XB**

For price, see current catalogue

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# INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

### Part 1: Charging of electric vehicles up to 250 A a.c. and 400 A d.c.

#### FOREWORD

- 1) The IEC (International Electrotechnical Commission) is a worldwide organisation for standardisation comprising all national electrotechnical committees (IEC National Committees). The object of the IEC is to promote international co-operation on all questions concerning standardisation in the electrical and electronic fields. To this end and in addition to other activities, the IEC publishes International Standards. 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 nongovernmental organisations liaising with the IEC also participate in this preparation. The IEC collaborates closely with the International Organisation for Standardisation (ISO) in accordance with conditions determined by agreement between the two organisations.
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- 3) The documents produced have the form of recommendations for international use and are published in the form of standards, technical specifications, technical reports or guides and they are accepted by the National Committees in that sense.
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International Standard IEC 62196-1 has been prepared by IEC subcommittee 23H: Industrial plugs and socket-outlets, of IEC technical committee 23: Electrical accessories.

The text of this standard is based on the following documents:

FDIS	Report on voting
23H/132/FDIS	23H/135/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until 2006. At this date, the publication will be

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

A bilingual edition of this standard may be issued at a later date.

## INTRODUCTION

IEC 61851-1 specifies electric vehicle conductive charging equipment. This International Standard, referred to as the IEC 60309 series in IEC 61851-1, specifies the requirements for plugs, socket-outlets, connectors, inlets and cable assemblies as described in IEC 61851-1. Some charging can be achieved by direct connection from an electric vehicle to common mains socket outlets. Some modes of charging require a dedicated supply and charging equipment incorporating control and communication circuits. This standard covers the mechanical, electrical and performance requirements for dedicated plugs, socket outlets, vehicle connectors and vehicle inlets for interfacing between such dedicated charging equipment and the electric vehicle.

This International Standard may be published in several parts, as necessary, including this Part 1, comprising clauses of a general character, and subsequent parts, presenting particular requirements for individual types.

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

## Part 1: Charging of electric vehicles up to 250 A a.c. and 400 A d.c.

### 1 Scope

This part of IEC 62196 is applicable to plugs, socket-outlets, connectors, inlets and cable assemblies for electric vehicles, intended for use in conductive charging systems which incorporate control means, with a rated operating voltage not exceeding:

- 690 V a.c., 50 – 60 Hz, at a rated current not exceeding 250 A;
- 600 V d.c., at a rated current not exceeding 400 A.

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

These accessories and cable assemblies are to be used in an ambient temperature of between  $-30\text{ }^{\circ}\text{C}$  and  $+50\text{ }^{\circ}\text{C}$ . In some countries, other requirements may apply.

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

The accessories covered by this standard are for use in certain modes of charging EV's. These modes are defined in IEC 61851-1. These definitions and a description of the types of connection (cases A, B and C), also described in IEC 61851-1, are reproduced herein as Annex A.

Table 1 illustrates the types of accessories (B,  $U_{32}$ ,  $U_A$ ,  $U_D$ ) permitted for each charging situation (mode and case) and identifies where it is mandatory to use the accessories covered by this standard. These are indicated by the entries in the columns headed "62196" in Table 1.

The table also describes situations in which either an accessory covered by this standard, or other standardized accessories, are permitted to be used. They are identified by an entry in the column headed "62196" and the word "Any" under the column headed "Type".

This standard does not apply to those standardised accessories used in charging systems where the use of such accessories constructed to the requirements of other standards is permitted (e.g. in mode 1 and mode 2). Such standardized accessories may be used for those situations (mode and case) identified in Table 1 by the word "Any" under the column headed "Type" and with no corresponding entry under the column headed "62196".

This standard can be used as a guide for accessories with a lesser number of contacts and lower ratings for use with light duty vehicles.

Table 1 – Modes and permissible connections specified in IEC 61851-1

Amps	Phases	Plug & socket					EV connector & inlet					Comments	
		Power pins used & prot. earth	Control pins incl. pilot	Type	62196	Case	In line control box	Power pins used & prot. earth	Control pins incl. pilot	Type	62196		Case
16	1	1+N, or 2	None	Any	B or U <sub>32</sub>	A		1+N, or 2	None	Any	B or U <sub>32</sub>	A	See Note 1
				Any		B						B	
	3	3 + N	None	Any	B or U <sub>32</sub>	A		3 + N	None	Any	B or U <sub>32</sub>	A	
				Any		B						B	
32	1	1+N, or 2	None	Any	B or U <sub>32</sub>	B	yes	1+N, or 2 3 + N	1	B or U <sub>32</sub>	B	Uses in-line control box	
	3	3 + N	None	Any	B or U <sub>32</sub>	B	yes	3 + N	1	B or U <sub>32</sub>	B	Uses in-line control box	
32	1	1+N, or 2	4	B or U <sub>32</sub>	B or U <sub>32</sub>	A		1+N, or 2 3 + N	4	B or U <sub>32</sub>	A		
						B					B		
	3	3 + N	4	B or U <sub>32</sub>	B or U <sub>32</sub>	A		3 + N	4	B or U <sub>32</sub>	A		
						B					B		
250	1	1+N, or 2	None	Any	B or U <sub>32</sub>	A		1+N, or 2 @ 32A 1+N, or 2 @ 250A	4	U <sub>A</sub>	C		
													3
	3	3 @ 32A + N 3 @ 250A	4	U <sub>A</sub>	C								
						3	3 @ 32A + N 3 @ 250A	4	U <sub>A</sub>	C			
400	-	-	-	-	-						-	-	-
						-	-	-	-	-			

≡ 1 Restrictions regarding load less than 16 A should be recognized by the vehicle maker.

≡ 2 In the column headed "62196", the items listed are defined as:

B Basic

U<sub>32</sub> Universal interface rated for 32 A a.c. only

U<sub>A</sub> Universal interface rated for 32/250 A a.c. only

U<sub>D</sub> Universal interface prepared for 32/400 A d.c. only

≡ 3 In the column headed "Type", the word "Any" indicates that any IEC standard plug/socket-outlet interface can be used.

≡ 4 Either "L<sub>1</sub> with N" or "L<sub>1</sub> with L<sub>2</sub>" are used for single-phase to match the supply.

≡ 5 Earth-contact is mandatory in all accessories, pilot contact is mandatory in accessories in modes 2, 3, and 4. The other contacts are provided as required by the user.

## 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.

IEC 60112, *Method for the determination of the proof and the comparative tracking indices of solid insulating materials*

IEC 60227 (all parts): *Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V*

IEC 60228:1978, *Conductors of insulated cables*

IEC 60245-4:1994, *Rubber insulated cables – Rated voltages up to and including 450/750 V – Part 4: Cords and flexible cables*

IEC 60269-1:1998, *Low-voltage fuses – Part 1: General requirements*

IEC 60269-2:1986, *Low-voltage fuses – Part 2: Supplementary requirements for fuses for use by authorised persons (fuses mainly for industrial application)*

IEC 60529, *Degrees of protection provided by enclosures (IP code)*

IEC 60664-1:1992, *Insulation coordination for equipment within low-voltage systems – Part 1: Principles, requirements and tests*<sup>1</sup>

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IEC 60664-3:1992, *Insulation coordination for equipment within low-voltage systems – Part 3: Use of coatings to achieve insulation coordination of printed board assemblies*

IEC 60695-2-10, *Fire hazard testing – Part 2-10: Glowing/hot-wire based test methods – Glow-wire apparatus and common test procedure*

IEC 60999-1:1999, *Connecting devices – Electrical copper conductors – Safety requirements for screw-type and screwless-type clamping units – Part 1: General requirements and particular requirements for clamping units for conductors from 0,2 mm<sup>2</sup> up to 35 mm<sup>2</sup> (included)*

IEC 60999-2:1999, *Connecting devices – Safety requirements for screw-type and screwless-type clamping units for electrical copper conductors – Part 2: Particular requirements for conductors from 35 mm<sup>2</sup> up to 300 mm<sup>2</sup>*

IEC 61851-1:2001, *Electric vehicle conductive charging system – Part 1: General requirements*

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<sup>1</sup> There exists a consolidated edition 1.2 (2002) including edition 1.0 and its Amendments 1 (2000) and 2 (2002).

### 3 Definitions

For the purpose of this document, the following terms and definitions apply. Additional definitions may be found in IEC 61851-1.

Where the terms voltage and current are used, they imply r.m.s. values, unless otherwise specified.

Throughout this standard, the word "earthing" is used for "protective earthing".

NOTE 1 The terms "basic interface" and "universal interface" refer to terms described in IEC 61851-1.

The application of accessories is shown in Figure 1.

NOTE 2 The term "accessory" is used as a generic term covering plugs, socket-outlets, vehicle connectors, vehicle inlets and cable assemblies.

#### 3.1

##### **basic insulation**

insulation necessary for the proper functioning of the accessory and for basic protection against electric shock

#### 3.2

##### **cable assembly**

piece of equipment which is used to establish the connection between the electric vehicle and the electric vehicle supply equipment. It may be either fixed to and included in one of these devices, or detachable. It includes the flexible cable, the vehicle connector and/or plug that are required for proper connection

NOTE A cable assembly may include one or more cables, with or without a fixed jacket, which may be in a flexible tube, conduit or wire way.

#### 3.3

##### **cable management system**

device which is intended to protect a cable assembly from mechanical damage and/or to facilitate its handling

NOTE A cable suspension device is an example of a cable management system.

#### 3.4

##### **cap**

part separated or attached, which may be used to provide the degree of protection of a plug or vehicle inlet, when it is not engaged with a socket-outlet or connector

#### 3.5

##### **clamping unit**

part of a terminal necessary for the clamping and the electrical connection of the conductor

#### 3.6

##### **conditional short-circuit current**

prospective current that an accessory, protected by a specified short-circuit protective device, can withstand satisfactorily for the total operating time of that device under specified conditions of use and behaviour

NOTE This definition differs from IEC 441-17-20 by broadening the concept of current-limiting device into a short-circuit protective device, the function of which is not only to limit the current.