

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Système de charge par conduction pour véhicules électriques –
Partie 25: Système d'alimentation en courant continu pour véhicules électriques
dont la protection s'appuie sur la séparation électrique**





THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 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.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office
3, rue de Varembé
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 It also gives information on projects, replaced and withdrawn publications.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 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.

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.

Electropedia - www.electropedia.org

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

IEC Glossary - std.iec.ch/glossary

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

Electropedia - www.electropedia.org

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

Glossaire IEC - std.iec.ch/glossary

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.



IEC 61851-25

Edition 1.0 2020-12

INTERNATIONAL STANDARD

NORME INTERNATIONALE

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

**Système de charge par conduction pour véhicules électriques –
Partie 25: Système d'alimentation en courant continu pour véhicules électriques
dont la protection s'appuie sur la séparation électrique**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 43.120

ISBN 978-2-8322-9122-1

**Warning! Make sure that you obtained this publication from an authorized distributor.
Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	8
3 Terms and definitions	8
4 General requirements	10
5 Classification	11
6 Charging modes and functions	11
7 Communications	17
8 Protection against electric shock	18
9 Conductive electrical interface requirements	19
10 Requirements for adaptors	20
11 Cable assembly requirements	20
12 EV supply equipment constructional requirements and tests	21
13 Overload and short-circuit protection	26
14 Automatic reclosing of protective devices	27
15 Emergency switching or disconnect (optional)	27
16 Marking and instructions	27
Annex AA (normative) Interface between DC EV supply equipment and EV	29
Annex BB (normative) Level, timing and tolerance of DC output current and DC output voltage	32
Annex CC (normative) Description of test equipment, test reporting and test environment	38
Annex DD (normative) Compliance tests	42
Annex EE (normative) Energy transfer process and communication	51
Annex FF (normative) Digital communication for control of energy transfer	57
Bibliography	65
 Figure 1 – Measuring network for touch current evaluation weighted for perception or reaction	24
Figure 2 – Example of warning label	28
Figure AA.1 – Interface circuit for energy transfer control showing isolation barriers	31
Figure BB.1 – Step response for constant value control	33
Figure BB.2 – Example of DC output current flow controlled by the DC EV supply equipment and the corresponding terminal voltage using a simple battery model	35
Figure BB.3 – Example of current limiting followed by voltage limiting for resistive load	36
Figure CC.1 – Example of test circuit for DUT using a computer and external EV simulation circuit	38
Figure CC.2 – Example of test load	39
Figure CC.3 – Operation points	41
Figure EE.1 – State transition diagram of charging process	53
Figure EE.2 – Sequence diagram of energy transfer	54
Figure FF.1 – Transmission cycle	57

Table 1 – Normal shutdown events and conditions	16
Table 2 – Error shutdown events and conditions	16
Table AA.1 – Voltage of control pilot circuit.....	29
Table AA.2 – Parameter values for interface circuit.....	31
Table BB.1 – Requirements for the output response performance of DC EV supply equipment.....	34
Table BB.2 – Current ripple limit of DC EV supply equipment.....	37
Table DD.1 – Correspondence between requirements and test descriptions	42
Table DD.2 – Initial switch and parameter values for a normal start-up sequence	43
Table DD.3 – The test value for control pilot circuit.....	46
Table DD.4 – Shutdown requirements	49
Table EE.1– Energy transfer state of DC EV supply equipment.....	51
Table FF.1 – Physical/data link layer specification	57
Table FF.2 – Received parameters during energy transfer (1 of 3)	59
Table FF.3 – Transmitted parameters during DC charging (1 of 2)	62

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –**Part 25: DC EV supply equipment where protection
relies on electrical separation****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.

International Standard IEC 61851-25 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically propelled road vehicles and industrial trucks.

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

FDIS	Report on voting
69/735/FDIS	69/740/RVD

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

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

This document is to be read in conjunction with IEC 61851-1:2017.

This document supplements or modifies clauses in IEC 61851-1:2017. Where the text of subsequent clauses indicates an "*addition*" to or a "*replacement*" of the relevant requirement, test specification or explanation of IEC 61851-1:2017, these changes are made to the relevant text of IEC 61851-1:2017, which then becomes part of this document. Where no change is necessary, the words "*Clause X of IEC 61851-1:2017 is applicable*" are used. Additional clauses, tables and figures which are not included in IEC 61851-1:2017 have a number starting from 101. Additional annexes are lettered AA, BB, etc.

A list of all parts in the IEC 61851 series, published under the general title *Electric vehicle conductive charging system*, can be found on the IEC website.

In this document, the following print types are used:

- *test specifications*: italic type.
- notes: 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 "<http://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

This document describes the specific requirements for DC EV supply equipment whose secondary circuit and EV are protected from the primary power supply circuit by electrical separation as defined in IEC 61140, where the connection to the separated circuit is limited to a single connection.

This document is a preview generated by EVS

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –**Part 25: DC EV supply equipment where protection
relies on electrical separation****1 Scope**

This document applies to the DC EV supply equipment for charging electric road vehicles with a rated supply voltage of up to 480 V AC or up to 600 V DC, with rated output voltage not exceeding 120 V DC and output currents not exceeding 100 A DC.

This document provides the requirements for the DC EV supply equipment where the secondary circuit is protected from the primary circuit by electrical separation.

Requirements for bi-directional power flow are not covered in this document.

This document also provides the requirements for the control and the communication between DC EV supply equipment and an EV.

This document also applies to DC EV supply equipment supplied from on-site storage systems.

The aspects covered in this document include:

- characteristics and operating conditions of the DC EV supply equipment;
- specification of the connection between the DC EV supply equipment and the EV;
- requirements for electrical safety for the DC EV supply equipment.

Additional requirements can apply to equipment designed for specific environments or conditions, for example:

- DC EV supply equipment located in hazardous areas where flammable gas or vapour and/or combustible materials, fuels or other combustible, or explosive materials are present;
- DC EV supply equipment designed to be installed at an altitude of more than 2 000 m;
- DC EV supply equipment intended to be used on-board ships.

Requirements for electrical devices and components used in DC EV supply equipment are not included in this document and are covered by their specific product standards.

This document does not apply to:

- safety aspects related to maintenance;
- charging of trolley buses, rail vehicles, industrial trucks and vehicles designed primarily for use off-road;
- equipment on the EV;
- EMC requirements for equipment on the EV while connected, which are covered in IEC 61851-21-1;
- charging the RESS off-board the EV.

NOTE In the following countries electrical separation can only be handled by skilled people: CH

2 Normative references

Clause 2 of IEC 61851-1:2017 is applicable with the following additions.

IEC 60068-2-30:2005, *Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)*

IEC 61140:2016, *Protection against electric shock – Common aspects for installations and equipment*

IEC 61180:2016, *High-voltage test techniques for low-voltage equipment – Definitions, test and procedure requirements, test equipment*

IEC 61439-7:2018, *Low-voltage switchgear and controlgear assemblies –Part 7: Assemblies for specific applications such as marinas, camping sites, market squares, electric vehicle charging stations*

IEC 61851-1:2017, *Electric vehicle conductive charging system – Part 1: General requirements*

IEC 62477-1:2012, *Safety requirements for power electronic converter systems and equipment – Part 1: General*

IEC 62893-4-1:2020, *Charging cables for electric vehicles of rated voltages up to and including 0,6/1 kV – Part 4-1: Cables for DC charging according to mode 4 of IEC 61851-1 – DC charging without use of a thermal management system*

ISO 3297:2017, *Information and documentation – International standard serial number (ISSN)*

ISO 11898-1:2015, *Road vehicles – Controller area network (CAN) – Part 1: Data link layer and physical signalling*

ISO 11898-2:2016, *Road vehicles – Controller area network (CAN) – Part 2: High-speed medium access unit*

3 Terms and definitions

Clause 3 of IEC 61851-1:2017 is applicable with the following additions to 3.2, 3.3 and 3.7.

ISO and IEC maintain terminological data bases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.2 Insulation

3.2.101

electrical separation

protective measure in which hazardous-live-parts are insulated from all other electric circuits and parts, from local earth and from touch

[SOURCE: IEC 60050-826:2004, 826-12-27]