IEC 61851-23-3

Edition 1.0 2026-08

INTERNATIONAL STANDARD

Electric vehicle conductive charging system - Part 23-3: DC electric vehicle supply equipment - Megawatt charging systems

ICS 43.120

ISBN 978-2-8327-1438-6

IEC 61851-23-3:2026-08(en)

IEC Secretariat
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 It also gives information on projects, replaced and withdrawn publications.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.

IEC Products & Services Portal - products.iec.ch
Discover our powerful search engine and read freely all the publications previews, graphical symbols and the glossary. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 500 terminological entries in English and French, with equivalent terms in 25 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

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

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

Electric vehicle conductive charging system - Part 23-3: DC electric vehicle supply equipment - Megawatt charging systems

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) IEC draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). IEC takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, IEC had not received notice of (a) patent(s), which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at https://patents.iec.ch. IEC shall not be held responsible for identifying any or all such patent rights.

IEC 61851-23-3 has been prepared by IEC technical committee 69: Electric power/energy transfer systems for electrically propelled road vehicles and industrial trucks. It is an International Standard.

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

Draft	Report on voting
69/1132/FDIS	69/1147/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/publications.

This document is to be read in conjunction with IEC 61851-1:2017 and IEC 61851-23:2023.

The clauses of particular requirements in this document supplement or modify the corresponding clauses in IEC 61851-23:2023 and IEC 61851-1:2017. Where the text of subsequent clauses indicates an "addition", an "amendment" to or a "replacement" of the relevant requirement, test specification or explanation of IEC 61851-23:2023 or IEC 61851-1:2017, these changes are made to the relevant text of IEC 61851-23:2023 or IEC 61851-1:2017, which then becomes part of this document. Where no change is necessary, the words "IEC 61851-23:2023, [clause], is applicable" are used, where [clause] indicated the relevant clause. Replaced tables and figures are numbered starting from 201. Any additional items (clause, subclause, figure, etc.), which are not included in IEC 61851-23:2023, have a number starting from 201, for example 3.201, 201.1, etc. The new annexes of this document are numbered using triple-alphabet, for example Annex AAA to avoid confusion with the annexes of IEC 61851-23:2023.

In this document, the following print types are used:

– *test specifications: italic type*.

– notes: smaller roman type.

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.

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, or

– revised.

INTRODUCTION

Responding to the global challenges of CO_2 reduction and energy security, the automobile industry has started the development and commercialization of heavy-duty electric vehicles (EV). These heavy duty EVs are equipped with significantly larger batteries than passenger cars or light commercial vehicles. The charging power provided by standards published before the publication of this document does not allow recharging of these batteries within the time needed for a commercial application of heavy duty EVs – especially considering long routes with limited time for intermediate charging. Consequently, this document allows for superior charging power up to several megawatts and describes the related safety and interoperability requirements. Table 201 shows the comparison between IEC 61851-23 and this document.

Table 201 – Comparison between IEC 61851-23 and IEC 61851-23-3

Topic	IEC 61851-23:2023	IEC 61851-23-3
Rated maximum voltage of the EV supply equipment at side B (EV side)	1 000 V	1 250 V
Rated continuous current of the EV supply equipment at side B (EV side)	Maximum as defined in IEC 62196-3	As defined in IEC TS 63379
Basic signalling	CP and PP (Annex CC)	CE and ID
Digital communication	HomePlug GreenPHY (IEC 61851-24) with ISO 15118-2, ISO 15118-20 or DIN SPEC 70121 as application layer	Ethernet 10BASE-T1S (ISO 15118-10) with ISO 15118-20 as application layer

Although the system described in this document has been developed for heavy duty EVs, its application is not limited practically to these.

1 Scope

This part of IEC 61851 applies to the EV supply equipment to provide energy transfer between the supply network and electric vehicles (EVs), with a rated maximum voltage at side A (supply network side) up to 1 000 V AC or up to 1 500 V DC and a rated maximum voltage at side B (EV side) up to 1 250 V DC.

NOTE A rated maximum voltage of the EV supply equipment at side B of up to 1 500 V DC is under consideration.

This document specifies the EV supply equipment of megawatt charging system (MCS) equipped with a coupler according to IEC TS 63379. Systems different to MCS using a coupler specified in IEC TS 63379 are under consideration.

The requirements for bidirectional power flow systems are under consideration.

This document does not cover all safety aspects related to maintenance.

This document specifies systems with protective separation between side A and side B.

The requirements for digital communication between the EV supply equipment and the EV for control of energy transfer are defined in ISO 15118-10 and ISO 15118-20.

EV supply equipment in compliance with this document is not intended to provide energy transfer to a single EV using

– multiple vehicle connectors of the same EV supply equipment, or
– multiple EV supply equipment.

The requirements for such use cases are not specified in this document but are under consideration.

The requirements for EVs mated to EV supply equipment according to this document are specified in ISO 5474-3:2024, Annex B.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 60364-4-43:2023, *Low-voltage electrical installations - Part 4-43: Protection for safety - Protection against overcurrent*

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

IEC 61851-23:2023, *Electric vehicle conductive charging system - Part 23: DC electric vehicle supply equipment*

IEC TS 63379:2026, *Vehicle connector, vehicle inlet and cable assembly for megawatt DC charging*

ISO 5474-3:2024, *Electrically propelled road vehicles - Functional and safety requirements for power transfer between vehicle and external electric circuit - Part 3: DC power transfer*

ISO 15118-10:2025, *Road vehicles - Vehicle-to-grid communication interface - Part 10: Physical layer and data link layer requirements for single-pair Ethernet*

ISO 15118-20:2022, *Road vehicles - Vehicle-to-grid communication interface - Part 2: 2nd generation network layer and application layer requirements*
ISO 15118-20:2022/AMD1:2026

IEEE 802.3-2022*, IEEE Standard for Ethernet*

10BASE-T1S channel and components requirements for link segments - Electrical requirements and measurements specification for 10BASE-T1S channels and components [online], Open Alliance Inc. Version 1.1, 2025, [viewed 2026-02-05]. Available at: https://opensig.org/wp-content/uploads/2025/06/10BASE-T1S-Channel-and-Component-Requirements-for-Link-Segments.pdf

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61851-23:2023 apply, except as follows.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

– IEC Electropedia: available at https://www.electropedia.org/
– ISO Online browsing platform: available at https://www.iso.org/obp

3.2 Insulation

Addition:

3.2.201
simple separation
separation between electric circuits or between an electric circuit and local earth by means of basic insulation

[SOURCE: IEC 60050-826:2021, 195-06-30]

3.3 Functions

3.3.1
control pilot conductor

Replacement:

charge enable conductor
CE
conductor incorporated in a cable assembly, which, together with the protective conductor, is part of the charge enable circuit

3.3.5
proximity function

Replacement:

insertion detection function
ID
electrical means to indicate the insertion state of the vehicle connector in the vehicle inlet of the EV

4 General requirements

IEC 61851-23:2023, Clause 4, is applicable, except as follows.

Addition:

System MCS shall have protective separation between side A and side B. See 8.105.1.

The specific requirements for EV supply equipment with multiple side Bs (EV sides) are provided in Annex FF.

General information on the touch current and touch impulse current is provided in Annex HH, unless otherwise specified in this document.

The following applies in addition:

– the requirements and tests for system C in IEC 61851-23:2023 apply for system MCS;
– all references in IEC 61851-23:2023 to "Annex CC" are replaced with "Annex CC of this document".

EV supply equipment with a rated continuous current at side B ≥ 500 A:

– in the voltage range: 500 V DC ≤ voltage at side B ≤ 1 250 V, the EV supply equipment shall provide the rated continuous current at side B or rated continuous power at side B;
– in the voltage range: 400 V DC ≤ voltage at side B < 500 V DC, the EV supply equipment shall be capable of continuously providing a current at side B ≥ 500 A.

EV supply equipment with a rated continuous current at side B < 500 A shall provide the rated continuous current at side B or rated continuous power at side B in the voltage range: 400 V DC ≤ voltage at side B ≤ 1 250 V.

5 Classification

IEC 61851-23:2023, Clause 5, is applicable, except as follows.

5.101 Characteristics of EV supply equipment

5.101.3 System

Replacement:

The EV supply equipment shall be classified according to the system:

– system MCS (see Annex CC).

6 Charging modes and functions

IEC 61851-23:2023, Clause 6, is applicable, except as follows.

6.3 Functions provided in Mode 4

6.3.1 Mandatory functions in Mode 4

6.3.1.1 General

Replacement, in the penultimate paragraph, of "ISO 17409" with "ISO 5474-3".

6.3.1.2 Continuous continuity checking of the protective conductor

Replacement, in the second paragraph, of "Compliance for system C is checked by CC.7.5.5":

Compliance for system MCS is checked by CC.7.5.5 of this document.

6.3.1.3 Verification that the EV is properly connected to the EV supply equipment

Replacement of the second paragraph:

Proper connection is assumed when the continuity of the charge enable circuit is detected.

6.3.1.4 Energization of the power supply to the EV

IEC 61851-1:2017, 6.3.1.4, is applicable, except as follows.

Replacement of the first paragraph:

The vehicle connector shall not be energized unless the charge enable function between EV supply equipment and EV has been established correctly with signal states allowing energization.

Amendment:

The third paragraph is not applicable.

IEC 61851-23:2023, 6.3.1.4, is applicable, except as follows.

Replacement of "The test setup for system C is shown in Figure 131" *with* "The test setup for system MCS is shown in Figure 207".

6.3.1.5 De-energization of the power supply to the EV

Replacement of the first paragraph:

If the insertion detection signal is interrupted, the EV supply equipment shall perform an emergency shutdown as indicated by system MCS.

6.3.1.101 DC supply for the EV

Replacement, in the first paragraph, of the first sentence:

The EV supply equipment shall provide a DC current and voltage to side B according to an EVCC request.

Replacement, in the first paragraph, of "101.1.1, 101.1.2, 101.1.3, 101.1.4, 101.1.5, and 101.1.6." *with* "101.1.1, 101.1.2, 101.1.3, 101.1.4 and 101.1.5 of this document, and 101.1.6 of IEC 61851-23:2023".

Replacement of the third paragraph:

Compliance is checked by the applicable tests in 101.1.1 through 101.1.5 of this document, and 101.1.6 of IEC 61851-23:2023.

6.3.1.103 Latching of the vehicle connector

Replacement of the last paragraph:

Vehicle connectors and vehicle inlets shall comply with the requirements of IEC TS 63379. See also 9.101 of this document.

6.3.1.106 Protection against overvoltage at side B between DC+ and DC–

6.3.1.106.1 General

Replacement of the third paragraph:

According to ISO 5474-1:2024, 6.2.8, when unmated, the EV can have a voltage > 60 V DC and > 30 V AC between DC+ and PE, and between DC− and PE. It is recommended that the EV does not have a common mode voltage > 60 V, as unbalanced insulation faults can generate differential voltages at side B > 60 V. For system MCS, the EV may try to use R_S6 and R_S7 in Figure CC.204 of the disabled side B circuit to limit this common mode voltage.

6.3.1.106.2 Protection against overvoltage at side B between DC+ and DC− by emergency shutdown

Replacement:

The EV supply equipment shall trigger an emergency shutdown in 1 ms or less if, during the energy transfer stage, the present voltage at side B between DC+ and DC− is more than the voltage thresholds specified in Table 202 for more than 9 consecutive ms.

Table 202 – Voltage threshold for emergency shutdown reaction

Negotiated maximum voltage at side B (U) V	Voltage threshold V
$U \leq 500$	550
$500 < U \leq 750$	825
$750 < U \leq 850$	935
$850 < U \leq 1\,000$	1 100
$1\,000 < U \leq 1250$	1 375

Compliance is checked by CC.7.5.7.1.

6.3.1.107 Verification of vehicle connector latching

IEC 61851-23:2023, 6.3.1.107, is not applicable.

6.3.1.112 Voltage limitation between side B live parts (DC+ and DC−) and protective conductor

6.3.1.112.1 Maximum voltage between side B live parts (DC+ and DC−) and protective conductor under normal operation

Replacement:

Under normal operation, the EV supply equipment shall limit the present voltage between side B live parts (DC+/DC−) and the protective conductor to U_2 (see Formula (201)). The voltage limit U_2 includes the additional voltage from an IMD (see Figure 201).

$$U_2 \leq \min(U_1;\max(614;0{,}5 \times U_1 + 75)) \quad (201)$$

where

U_1 is the present voltage at side B between DC+ and DC−, expressed in volts;

U_2 is the present voltage between side B live parts (DC+/DC−) and the protective conductor, expressed in volts.

NOTE 1 Transient overvoltages are not limited by voltage balancing.

NOTE 2 According to ISO 5474-3:2024, Annex B, the vehicle deactivates any means that actively impact the balance between DC+ and the protective conductor and between DC− and the protective conductor before closing its disconnection device.

NOTE 3 A balanced voltage between side B live parts (DC+/DC−) and the protective conductor minimizes the touch impulse current.

Infrequent short-term (< 10 s) voltages above the limit U_2 due to disturbances are permitted, for example at startup or due to load/source switching.

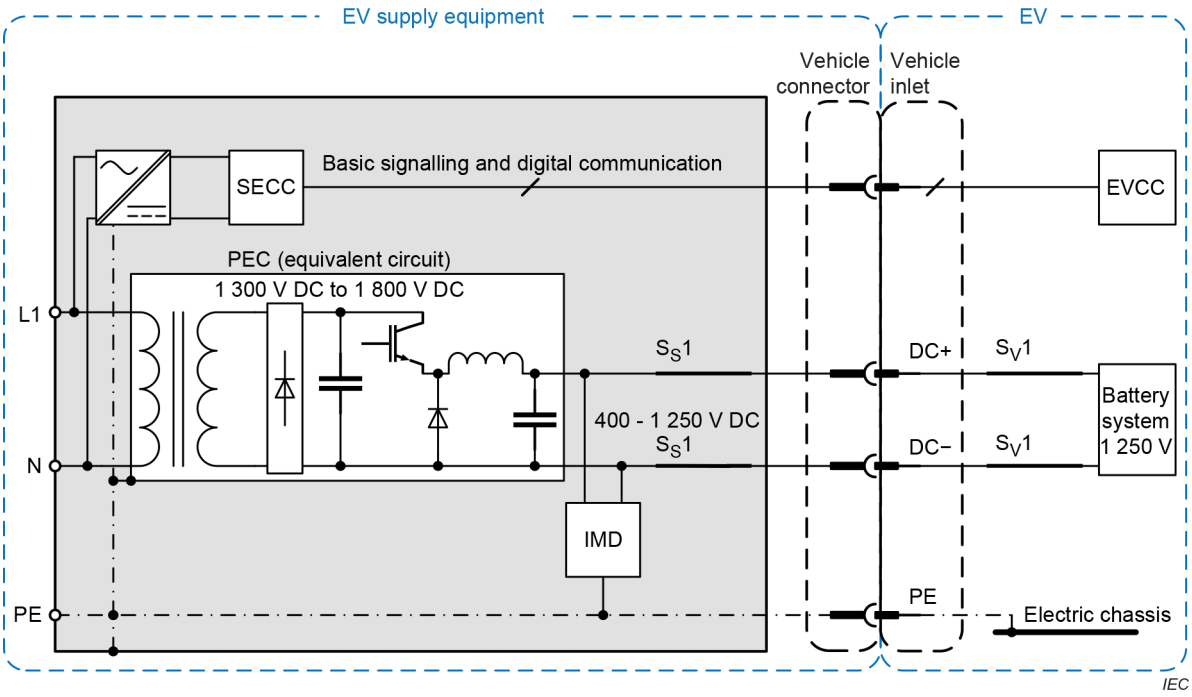
When the absolute value of the present voltage between side B live parts (DC+/DC–) and the protective conductor exceeds the limit U_2 Formula (201), the EV supply equipment shall reduce the absolute value of the present voltage below the limit U_2 within 10 s, and energy transfer shall not stop.

The EV supply equipment may employ passive or active techniques to minimize the touch impulse current, possibly in coordination with the IMD or earth fault monitor of the EV supply equipment.

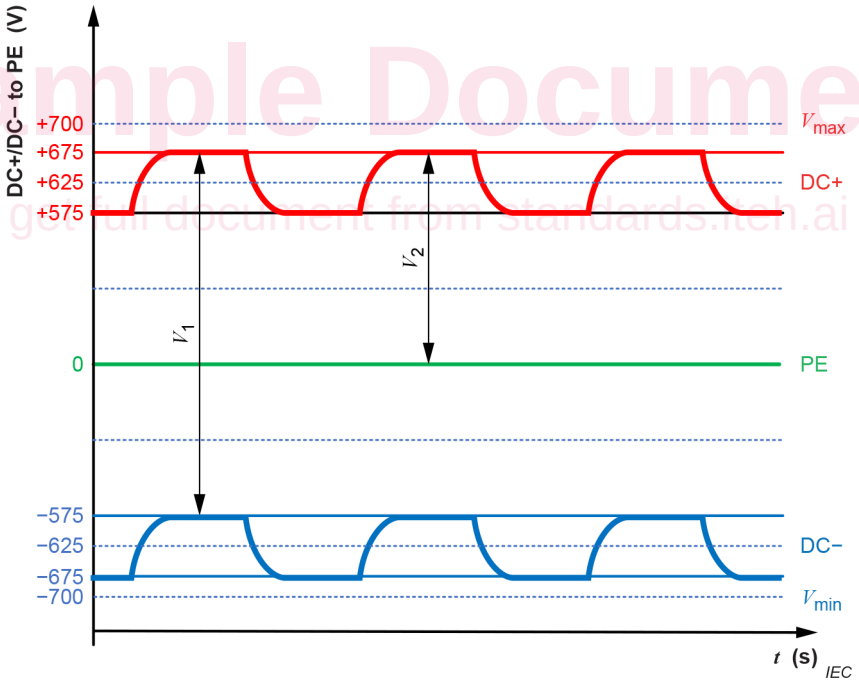
The steady-state touch current limits of 8.101.4 apply also under single fault conditions in the circuit that facilitates the voltage balancing.

Compliance is checked with design review.

Figure 201 a) and b) show an example of a correct implementation.



a) Typical IMD implementation



b) Waveform of an IMD implementation with a pulsed signal

Key

V_1	voltage at side B between DC+ and DC−	V_{max}	upper voltage limit for DC+ and DC−
V_2	maximum common mode voltage including IMD	V_{min}	lower voltage limit for DC+ and DC−

NOTE If the voltage between DC+/DC− and protective conductor exceeds U_2, the touch current limitation to the c1 curve specified as special protection in 8.105.1 cannot be met.

Figure 201 – Typical voltages between side B live parts (DC+/DC−) and protective conductor under normal operation