

INTERNATIONAL STANDARD

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

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

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

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CONTENTS

FOREWORD	4
INTRODUCTION	6
1 Scope	7
2 Normative references	7
3 Terms and definitions	8
4 General requirements	9
5 Classification	9
6 Charging modes and functions	9
7 Communications	18
8 Protection against electric shock	19
9 Conductive electrical interface requirements	23
10 Requirements for adaptors	24
11 Cable assembly requirements	24
12 EV supply equipment constructional requirements and tests	24
13 Overload and short-circuit protection	25
14 Automatic reclosing of protective devices	26
15 Emergency switching or disconnect (optional)	26
16 Marking and instructions	26
101 Specific requirements for EV supply equipment	27
102 Test methods	33
Annexes	37
Annex AA (normative) EV supply equipment of system A	38
Annex BB (normative) EV supply equipment of system B	39
Annex CC (normative) EV supply equipment of system C	40
Annex EE (normative) Test load impedance verification	135
Annex FF (normative) Multi-side B separated EV supply equipment	137
Annex GG (informative) Communication and energy transfer process between the EV supply equipment and the EV	139
Annex HH (informative) Touch current and touch impulse current	140
Annex AAA (informative) Auxiliary power supply through the insertion detection circuit	144
Bibliography	147
Figure 201 – Typical voltages between side B live parts (DC+/DC–) and protective conductor under normal operation	13
Figure 202 – Measurement of the touch leakage current	15
Figure 203 – Examples of a fault between the secondary circuit and the protective conductor	16
Figure 204 – Example of the voltage range for active and passive voltage balancing with a system Y-capacitance according to Table 203	20
Figure 205 – Insulation barriers	21
Figure 206 – Test arrangement MCS_0	30
Figure 207 – General test setup for system MCS	34
Figure 208 – Test load example	35

Figure CC.201 – Circuit diagram for an EV supply equipment of configuration HH.....	42
Figure CC.202 – Example of a filtering circuit for the charge enable circuit.....	47
Figure CC.203 – Example of a filtering circuit for the insertion detection circuit.....	47
Figure CC.204 – Equivalent disabled side B of the EV supply equipment	49
Figure CC.205 – Sequence diagram for normal start up.....	53
Figure CC.206 – Sequence diagram for normal shutdown during energy transfer by EV or EV supply equipment	58
Figure CC.207 – Sequence diagram for EV supply equipment and EV initiated error shutdown.....	62
Figure CC.208 – Sequence diagram for an emergency shutdown executed by the EV	66
Figure CC.209 – Sequence diagram for an emergency shutdown executed by the EV supply equipment	68
Figure CC.210 – Sequence diagram for pause before cable-check phase by EV supply equipment using ISO 15118-20:2022 and ISO 15118-20:2022/AMD1:2026.....	71
Figure CC.211 – Sequence diagram for pause after pre-charge phase and before energy transfer stage by the EV supply equipment using ISO 15118-20:2022 and ISO 15118-20:2022/AMD1:2026.....	75
Figure CC.212 – Worst case equivalent circuit during pre-charge	85
Figure CC.213 – Restart methods sequence for the EV supply equipment.....	87
Figure CC.214 – Restart verification method on the EV supply equipment.....	88
Figure CC.215 – Example of a CE state B0 – B transition	88
Figure CC.216 – Restart methods sequence for the EV	89
Figure CC.217 – Example of a B0 – EC – B0 toggle.....	90
Figure CC.218 – Approaching a single test point TP in CCM (example 1).....	95
Figure CC.219 – Approaching multiple test points TP _n CCM (example 2).....	95
Figure CC.26 – Voltage at the vehicle connector.....	107
Figure CC.220 – Test setup for IMD measurement connections.....	131
Figure EE.201 – Magnitude of the impedance of the test load between DC+ and DC– for system MCS.....	135
Figure HH.201 – C ₁ limit: Y-capacitance considering a human body resistance of 575 Ω	142
Table 201 – Comparison between IEC 61851-23 and IEC 61851-23-3.....	6
Table 202 – Voltage threshold for emergency shutdown reaction.....	11
Table 203 – Maximum Y-capacitance of the EV supply equipment at side B	19
Table 204 – Minimum protective measures.....	22
Table 205 – Current ripple limit of the EV supply equipment.....	27
Table 206 – Recommended circuit parameters of the test load	36
Table CC.201 – EV supply equipment component values and tolerances for configuration HH	42
Table CC.202 – EV component values and tolerances for configuration HH.....	43
Table CC.203 – System states of configuration HH based on the CE voltage.....	44
Table CC.204 – Charge enable states and voltage ranges for the EV supply equipment	44
Table CC.205 – Charge enable states and voltage ranges for the EV.....	45
Table CC.206 – Insertion detection states and voltage ranges for the EV supply equipment	45

Table CC.207 – Insertion detection states and voltage ranges for the EV	46
Table CC.208 – EV supply equipment components for charge enable and insertion detection filtering.....	48
Table CC.209 – EV components for charge enable and insertion detection filtering	48
Table CC.210 – Component limits for the disabled side B of the EV supply equipment.....	50
Table CC.211 – Message code mapping for sequence diagram.....	52
Table CC.212 – Sequence description for normal start up.....	54
Table CC.213 – Sequence description for normal shutdown during energy transfer by EV or EV supply equipment	59
Table CC.214 – Overview of error and emergency shutdown cases	61
Table CC.215 – Sequence description for EV supply equipment and EV initiated error shutdown.....	63
Table CC.216 – Sequence diagram for an emergency shutdown executed by the EV.....	67
Table CC.217 – Sequence diagram an emergency shutdown executed by the EV supply equipment	69
Table CC.218 – Sequence description for pause before cable-check phase by EV supply equipment using ISO 15118-20:2022 and ISO 15118-20:2022/AMD1:2026.....	72
Table CC.219 – Sequence description for pause after pre-charge phase and before energy transfer stage by the EV supply equipment using ISO 15118-20:2022 and ISO 15118-20:2022/AMD1:2026.....	76
Table CC.220 – Insulation states and EV supply equipment reaction based on the insulation resistance	82
Table CC.221 – Values to design the EV supply equipment during pre-charge based on Figure CC.212.....	85
Table CC.222 – Current ripple limits.....	104
Table CC.223 – Component valued for the inrush current limit test.....	109
Table CC.224 – Current ripple limits	111
Table CC.225 – Test setup values to measure side B voltage regulation in CVM during pre-charge	112
Table CC.226 – Current ripple limits.....	114
Table CC.227 – EV simulator characteristics	125
Table EE.201 – Test load parameters for system MCS	135
Table AAA.1 – Auxiliary voltage source of the EV supply equipment X_{S1}	144
Table AAA.2 – Auxiliary voltage source of the EV X_{V2}	146

INTERNATIONAL ELECTROTECHNICAL COMMISSION

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

FOREWORD

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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 CO₂ 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.

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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: $500 \text{ V DC} \leq \text{voltage at side B} \leq 1\,250 \text{ V}$, the EV supply equipment shall provide the rated continuous current at side B or rated continuous power at side B;
- in the voltage range: $400 \text{ V DC} \leq \text{voltage at side B} < 500 \text{ V DC}$, 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: $400 \text{ V DC} \leq \text{voltage at side B} \leq 1\,250 \text{ V}$.

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.

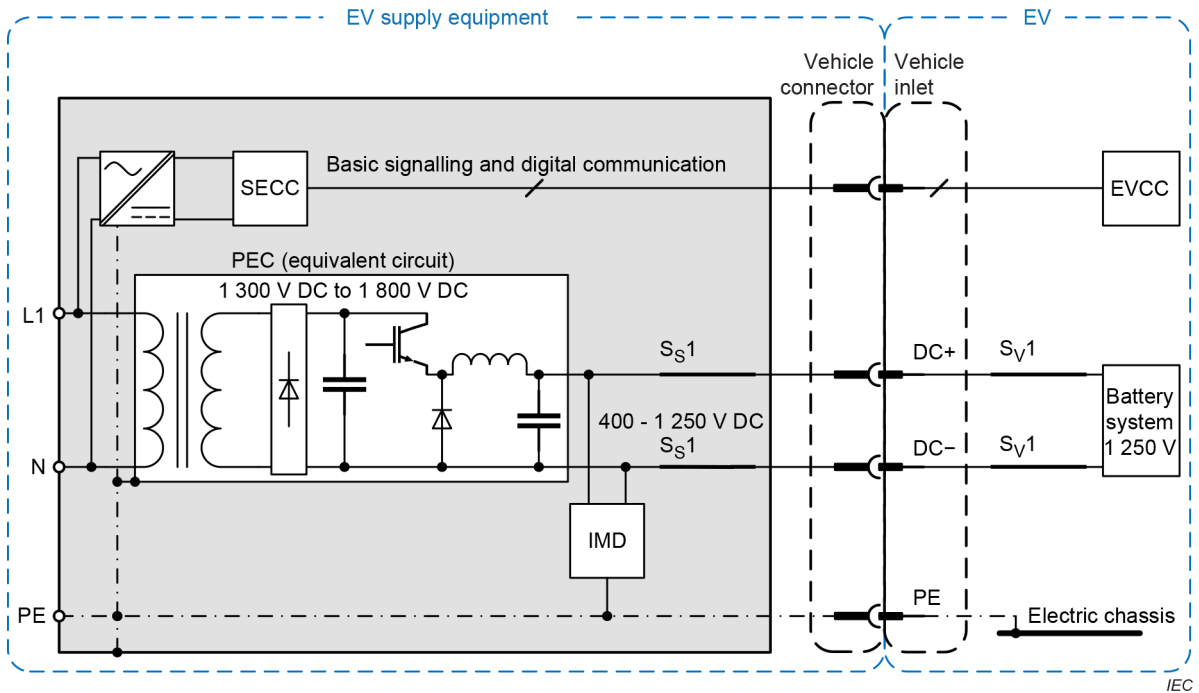
When the absolute value of the present voltage between side B live parts (DC+/DC–) and the protective conductor exceeds the limit U_2 Formula (201), the EV supply equipment shall reduce the absolute value of the present voltage below the limit U_2 within 10 s, and energy transfer shall not stop.

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.

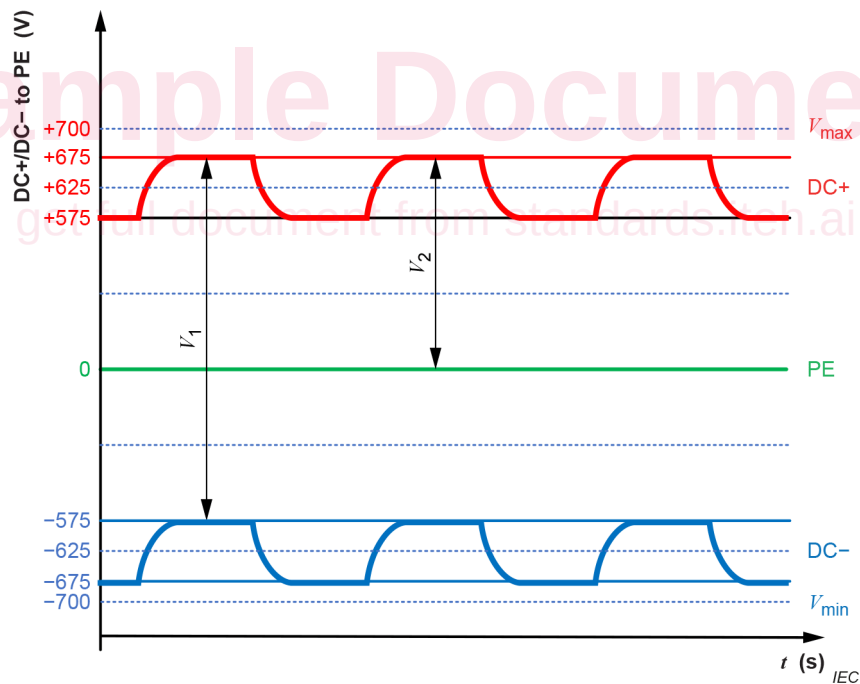
The steady-state touch current limits of 8.101.4 apply also under single fault conditions in the circuit that facilitates the voltage balancing.

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