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Interested committees:

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Part 23-3: DC electric vehicle supply equipment for Megawatt charging systems

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

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Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx
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1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex (e.g. 3.1)	Paragraph/Figure/ Table/Note	Type of comment	Commend (justification for change) by the MB	Proposed change by the MB	Secretariat observations on each comment submitted
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	



69/912/CD

COMMITTEE DRAFT (CD)

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69/787/NP, 69/799/RVN

IEC TC 69 : ELECTRICAL POWER/ENERGY TRANSFER SYSTEMS FOR ELECTRICALLY PROPELLED ROAD VEHICLES AND INDUSTRIAL TRUCKS

SECRETARIAT:
Belgium

SECRETARY:
Mr Peter Van den Bossche

OF INTEREST TO THE FOLLOWING COMMITTEES:
SC 23H

PROPOSED HORIZONTAL STANDARD:



Other TC/SCs are requested to indicate their interest, if any, in this CD to the secretary.

FUNCTIONS CONCERNED:

☐ EMC

☐ ENVIRONMENT

☐ QUALITY ASSURANCE

☒ SAFETY

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TITLE:

<p>Electric vehicle conductive charging system - Part 23-3: DC electric vehicle supply equipment for Megawatt charging systems</p>

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 23-3: DC electric vehicle supply equipment for Megawatt charging systems

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International Standard 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.

320 The text of this document is based on the following documents:

XXX	Report on voting
69/XX/XXX	69/XX/RVD

321
322 Full information on the voting for the approval of this document can be found in the report on
323 voting indicated in the above table.

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

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

326 The clauses of particular requirements in this document supplement or modify the
327 corresponding clauses in IEC 61851-23:2023. Where the text of subsequent clauses indicates
328 an "addition" to or a "replacement" of the relevant requirement, test specification or explanation
329 of IEC 61851-23:2023, these changes are made to the relevant text of IEC 61851-23:2023,
330 which then becomes part of this document. Where no change is necessary, the words "IEC
331 61851-23:2023, [clause] is applicable" are used, where [clause] indicated the relevant clause.
332 The new clauses, which are not included in IEC 61851-23:2023, have a clause number starting
333 from 201, for example 3.201, 201.1, etc. The new annexes of this document are numbered
334 using triple-alphabet, for example Annex III, to avoid confusion with the annexes in IEC 61851-
335 1:2017 and IEC 61851-23:2023.

336 In this document, the following print types are used:

337 – *test specifications: italic type.*

338 – notes: smaller roman type.

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

341 The committee has decided that the contents of this publication will remain unchanged until the
342 stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to
343 the specific publication. At this date, the publication will be

- 344 – reconfirmed,
- 345 – withdrawn,
- 346 – replaced by a revised edition, or
- 347 – amended.

348

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Introduction

Responding to the global challenges of CO₂ reduction and energy safety, the automobile industries have been accelerating the development and commercialization of electric vehicles (EV) and hybrid electric vehicles. Plug-in hybrid vehicles and battery electric vehicles are all mass-marketed today and continue to gain market share in all vehicle categories. To support the broad diffusion of such vehicles, this document provides the standard requirements for interoperability and safety to be used in conductive charging of electric vehicles, taking the most frequent charging situations into consideration. To meet the market demand for the electric road vehicle industry to quickly charge electric heavy-duty vehicles withing a reasonable time, a new solution for high-power commercial vehicle charging is needed. Enabling rapid charging of these expensive assets increases vehicle flexibility and enables fleet owners to optimize their total cost of ownership (TCO). Other industries will also benefit from this quick charging solution. Other electric vehicles may also use this charging system to fulfil their high-power charging needs. All of these applications will focus on power in the range of 1 Megawatt and above, which implies cooling measures and direct current usage only. In order to enable this charging rate, batteries with larger capacities need to be integrated. To rapidly charge those large-capacity batteries, overall charging power needs to be increased. In order to boost the charging power, both charging current and voltage need to be increased. The larger charging current implies either larger values for operating parameters of the EV supply equipment, conductor cross-sections for the cable assembly, according to existing standards, or additional measures for testing and service. A mandatory use of a handling support for these accessories shall not be necessary.

Many manufacturers of large vehicles are already developing and testing electrically powered prototypes and production vehicles. Ideally, a standardized charging system with its accessory can be used for all applications. Due to the necessary high charging voltage and charging currents, the previously standardized systems are not suitable. Therefore, it is necessary to develop a new charging system with a new accessory. New normative solutions are to be followed for the technologies used so far to meet high-power requirements safely, economically and comfortably.

The following table serves to illustrate some of the differences in the standards. This is to illustrate that the development of the standard IEC 61851-23-3 is a necessary addition and does not compete with existing standards.

Topic	IEC 61851-23	IEC 61851-23-3
Maximum rated voltage	1 000 V	1 250 V
Maximum rated current	500 A (Annex CC)	3 000 A
Thermal sensing with requirements and tests	Above 200 A (Annex CC)	Yes
Thermal transport on the connector side	Optional (Annex CC)	Optional
Thermal transport on the inlet side	No	Optional
Protective earthing conductors	I2t methodology, no damage allowed	I2t methodology, components to be replaced
Basic signalling	CP and PP (Annex CC)	CE and ID
Digital communication	HomePlug GreenPHY (Annex CC)	10BASE-T1S

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 23-3: DC electric vehicle supply equipment for Megawatt charging systems

1 Scope

Replacement:

This part of the IEC 61851 series, together with [IEC 61851-1 Ed. 3] and [IEC 61851-23, Ed. 2.0] applies to the EV supply equipment for conductive charging electric road vehicles with a charging power in the range of Megawatts, with a rated supply voltage up to 1 000 V AC or up to 1 500 V DC. The system described by this document is limited to a rated maximum voltage of the EV supply equipment at side B of 1 250 V DC. A rated maximum voltage of the EV supply equipment at side B of 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. Requirements for systems that do not comply with MCS are not covered by this document.

Requirements for bidirectional power flow systems are under consideration.

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

The requirements in this document only apply for systems with separated EV supply equipments.

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.

This document includes information on EV for conductive connection but is limited to the necessary content for describing the power and signalling interface.

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

General information of communication and the energy transfer process is described in Annex GG.

General information on the touch current and touch impulse current is provided in Annex HH.

EV supply equipments in compliance with this document are not intended to provide energy transfer to a single EV with:

- multiple vehicle connectors of the same EV supply equipment; or
- multiple EV supply equipments.

Requirements for such use case are not specified in this document, but are under consideration.

NOTE 1 The safety requirements of vehicle during charging are specified in ISO 5474 series.

NOTE 2 Requirements for an optional automated connection of MCS are under preparation in IEC 61851-27.

EVs considered in this document are capable of megawatt energy transfer according to Annex B of ISO 5474-3:2023.

2 Normative references

IEC 61851-23:2023, Clause 2 is applicable, except as follows:

Addition:

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

ISO 15118-10:202X, *Road vehicles – Vehicle-to-grid communication interface – Part 10: Physical layer and data link layer requirements for wired ethernet communication*

ISO 15118-20:202X, *Road vehicles – Vehicle-to-grid communication interface – Part 2: 2nd generation network layer and application layer requirements*

3 Terms and definitions

IEC 61851-23:2023, Clause 3, is applicable except as follows:

3.3 Functions

3.3.1

Replacement:

charge enable conductor (identification: CE)

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

3.3.5

Replacement:

insertion detection function (identification: ID)

electrical or mechanical means to indicate the insertion state of the vehicle connector in the vehicle inlet of the EV and/or to indicate the insertion state of the EV plug in the EV socket-outlet of the EV supply equipment

4 General requirements

IEC 61851-23:202X, Clause 4 is applicable, except as follows:

Addition:

Unless otherwise specified in this document, the requirements and tests for system C in IEC 61851-23:2023 apply for MCS.

Replacement of all references of "Annex CC" by "Annex CC of IEC 61851-23-3:—".

5 Classification

IEC 61851-23:202X, Clause 5 is applicable, except as follows:

Replacement:

5.101 Category**5.101.3 System**

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

- Megawatt Charging System (MCS) (see Annex CC).

6 Charging modes and functions

IEC 61851-23:202X, 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:

The EV supply equipment shall supply a DC current and voltage to the EV battery system according to an EVCC request.

The following functions shall be provided by EV supply equipment as given below:

- continuous continuity checking of the protective conductor according to 6.3.1.2;
- verification that the EV is properly connected to the EV supply equipment according to 6.3.1.3;
- energization of the power supply to the EV according to 6.3.1.4;
- de-energization of the power supply to the EV according to 6.3.1.5;
- maximum allowable current according to 6.3.1.6;
- DC supply for the EV according to 6.3.1.101;
- measuring current and voltage according to 6.3.1.102;
- latching of the vehicle connector according to 6.3.1.103;
- compatibility check according to 6.3.1.104;
- insulation resistance check before energy transfer according to 6.3.1.105;
- protection against overvoltage between DC+ and DC- according to 6.3.1.106;
- verification of vehicle connector latching according to 6.3.1.107;
- control circuit supply integrity according to 6.3.1.108;
- short-circuit check before energy transfer according to 6.3.1.109;
- user initiated shutdown according to 6.3.1.110;
- overload protection for parallel conductors (conditional function) according to 6.3.1.111;
- voltage limitation between side B live parts (DC+ and DC-) and protective conductor according to 6.3.1.112;
- shutdown of EV supply equipment according to 6.3.1.113.

The vehicle manufacturer should consider the requirements for overvoltage and overcurrent according to this document and ISO 5474-3.

If the EV supply equipment can supply more than one vehicle simultaneously, the EV supply equipment shall provide all functions listed above independently at each vehicle connector.

6.3.1.2 Continuous continuity checking of the protective conductor

IEC 61851-23:2023, 6.3.1.2 is applicable, except as follows:

Replacement of “CC.4.7” by “CC.4.7 of IEC 61851-23-3:202X” and “CC.7.5.5” by “CC.7.5.5 of IEC 61851-23-3:202X”.

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

IEC 61851-23:2023, 6.3.1.3 is applicable.

6.3.1.4 Energization of the power supply to the EV

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

Replacement of “CC.3.2” by “CC.3.2 of IEC 61851-23-3:202X”.

6.3.1.5 De-energization of the power supply to the EV

IEC 61851-23:2023, 6.3.1.5 is applicable, except as follows:

Replacement of “CC.7.5.8” by “CC.7.5.8 of IEC 61851-23-3:202X”.

6.3.1.5.101 De-energization in case of failure in control circuit

IEC 61851-23:2023, 6.3.1.5.101 is applicable.

6.3.1.6 Maximum allowable current

IEC 61851-23:2023, 6.3.1.6 is applicable.

6.3.1.101 DC supply for the EV

IEC 61851-23:2023, 6.3.1.102 is applicable.

6.3.1.102 Measuring current and voltage

IEC 61851-23:2023, 6.3.1.102 is applicable, except as follows:

Replacement of “CC.6.3” by “CC.6.3, of IEC 61851-23-3:202X”.

Replacement of “CC.7.5.11, CC.7.5.12, CC.7.5.19” by “CC.7.5.11, CC.7.5.12, CC.7.5.19 of IEC 61851-23-3:202X”.

6.3.1.103 Latching of the vehicle connector

IEC 61851-23:2023, 6.3.1.103 is applicable, except as follows:

Replacement of the last sentence by “Vehicle connectors and vehicle inlets shall comply with the requirements of IEC TS 63379. See also clause 9.101 of IEC 61851-23-3:202X”.

Replacement of “CC.4.2” by “CC.4.2 of IEC 61851-23-3:202X”.

6.3.1.104 Compatibility check

IEC 61851-23:2023, 6.3.1.104 is applicable, except as follows:

Replacement of “CC.5.6” by “CC.5.6 of IEC 61851-23-3:202X”.

Replacement of “CC.7.5.1” by “CC.7.5.1 of IEC 61851-23-3:202X”.

secNOTE: The minimum and maximum voltage range (at least for public charging) could be specified.

6.3.1.105 Insulation resistance check before energy transfer

IEC 61851-23:2023, 6.3.1.105 is applicable, except as follows:

Replacement of “CC.4.1.3” by “CC.4.1.3 of IEC 61851-23-3:202X”.

Replacement of “CC.7.5.15.1” by “CC.7.5.15.1 of IEC 61851-23-3:202X”.

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

6.3.1.106.1 General

IEC 61851-23:2023, 6.3.1.106.1 is applicable, except for the following:

Replacement of the first sentence of Note 1 by “According to 6.1.7 of ISO 5474-1:2023, when unmated, the EV may have a voltage > 60 V DC and > 30 V AC between DC+ and PE, and between DC- and PE”.

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 201 for more than 9 consecutive ms.

Table 201 – Voltage threshold for emergency shutdown reaction

Negotiated maximum voltage at side B (U)	Voltage threshold V
$U \leq 500 \text{ V}$	550
$500 \text{ V} < U \leq 750 \text{ V}$	825
$750 \text{ V} < U \leq 850 \text{ V}$	935
$850 \text{ V} < U \leq 1\,000 \text{ V}$	1 100
$1\,000 \text{ V} < U \leq 1\,250 \text{ V}$	1 375

Compliance is checked by CC.7.5.7.1.

6.3.1.106.3 Protection against overvoltage at side B between DC+ and DC- by error shutdown

IEC 61851-23:2023, 6.3.1.106.3 is applicable, except as follows:

Replacement in Table 105 of “CC.7.5.7.2” by “CC.7.5.7.2 of IEC 61851-23-3:202X”.

Replacement in Table 105 of “CC.7.5.7.3” by “CC.7.5.7.3 of IEC 61851-23-3:202X”.

Replacement in Table 105 of “CC.7.5.7.4” by “CC.7.5.7.4 of IEC 61851-23-3:202X”.

6.3.1.107 Verification of vehicle connector latching

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

6.3.1.108 Control circuit supply integrity

IEC 61851-23:2023, 6.3.1.108 is applicable, except as follows:

Replacement in Table 109 of “CC.7.5.166” by “CC.7.5.16 of IEC 61851-23-3:X”.

Replacement in Table 109 of “CC.7.5.18” by “CC.7.5.18 of IEC 61851-23-3:X”.

6.3.1.109 Short-circuit check before energy transfer

IEC 61851-23:2023, 6.3.1.109 is applicable, except as follows:

Replacement of “CC.7.5.22” by “CC.7.5.22 of IEC 61851-23-3:X”.

6.3.1.110 User initiated shutdown

IEC 61851-23:2023, 6.3.1.110 is applicable, except as follows:

Replacement of “CC.7.5.22” by “CC.7.5.22 of IEC 61851-23-3:X”.

6.3.1.111 Overload protection for parallel conductors (conditional function)

IEC 61851-23:2023, 6.3.1.111 is 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 use active symmetrization to limit the present voltage between side B live parts (DC+/DC-) and the protective conductor to less than 50% of the present voltage at side B between DC+ and DC- + 75 V DC. The voltage limit includes the addition of maximum 50 V DC from an IMD. See Figure 201.

NOTE 1 Transient overvoltages are not limited by symmetrization.

Consideration shall be made on common mode voltage offsets caused by the measurement circuits connection point and the chosen IMD implementation. See clause 6.3.1.112.1 in IEC 61851-23:2023.

Components of the EV supply equipment, for example, an IMD, may superimpose a common mode voltage to protective conductor onto the present voltage at side B. This may shift the voltage between side B live parts (DC+/DC-) and the protective conductor up to present voltage at side B plus 50 V DC.

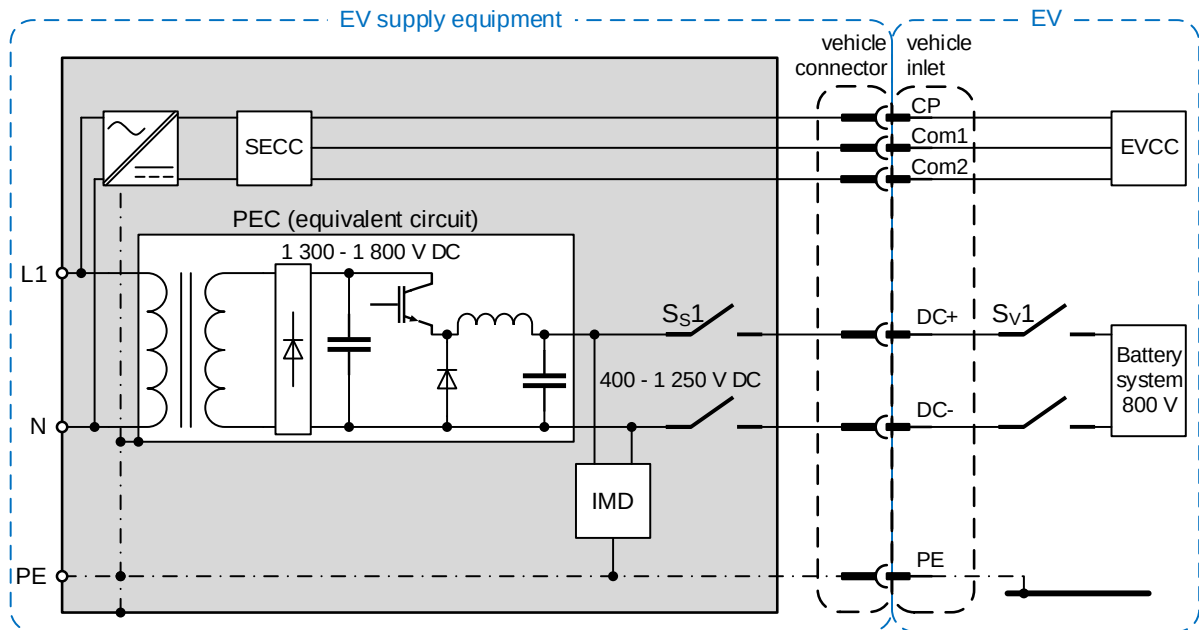
Components of the EV supply equipment, for example, resistors, may shift each side B live part (DC+/DC-) up to protective conductor through a resistor, which results in a large common mode side B voltage swing.

The measurement circuits might introduce a larger common mode voltage offset if connected to an intermediate bus voltage. These circuits shall not cause a voltage shift that is more than the requirements in this clause.

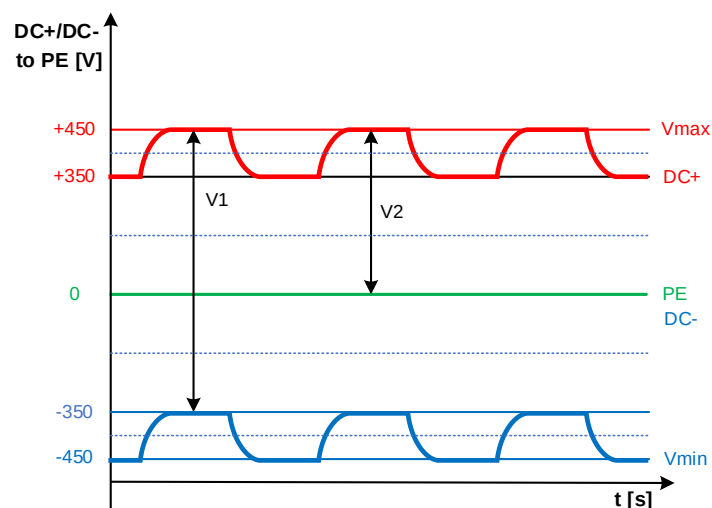
The EV supply equipment may employ passive and/or active techniques to minimize the touch impulse current, possibly in coordination with the IMD or earth fault monitor of the EV supply equipment.

NOTE 2 To minimize the touch impulse current, the voltages between side B live parts (DC+/DC-) and the protective conductor must stay close to symmetrical.

Figure 201 shows an example of a correct implementation.



a) Typical IMD implementation



b) Waveform of an IMD implementation with a pulsed signal

Key

V1	Voltage at side B between DC+ and DC-	V_{max}	Upper voltage limit for DC+ and DC-
V2	Maximum common mode voltage (that is, with reference to PE) including IMD	V_{min}	Lower voltage limit for DC+ and DC-

NOTE 1 If the voltage between DC+/DC- and protective conductor is > 704 V DC, the required C1 impulse current limitation 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

secNOTE: Open items:

- Transient voltage 1000 V max asymmetric, but covered by symmetrization requirement for higher y caps (addition in 12.7.102)

Compliance is checked by the following test:

The test setup for system MCS is shown in Figure 205.

1) *Preconditions for the test:*

- The EV simulator shall use the following limits $V_{EV_rated_max} = V_{EVSE_rated_max_sideB}$ and $I_{EV_rated_max} = I_{EVSE_rated_boost_sideB}$ during the compatibility check (see 6.3.1.104) in order to not limit the operating range.
- The EV simulator shall draw current during this test, in order to reach and maintain power transfer.

2) *The following voltage and current values shall be applied:*

- $V_{EV\ simulator} = 0,8 \times V_{EVSE_rated_max_sideB}$
- $I_{EVSE\ intended} = I_{EV_trg} = I_{EVSE_rated_boost_sideB} / 2$

3) *Perform the following actions:*

- i) *The FPT sequence is to be successfully done until $t = t8$ according to Figure CC.103, including the message "PowerDeliveryReq"*
- ii) *Wait until $A_{T1} \geq 80\%$ of I_{EV_trg} for 5 s.*
- iii) *Measure V_{T6} , V_{T7} and V_{T8} continuously for 100 s.*

NOTE 3 Low pass filter should be applied, in order to filter out transients. Recommended cut-off frequency: 10 Hz to 200 Hz.

4) *Check the expected results:*

- V_{T6} and V_{T7} shall be less than or equal to the following limit:
- $$|V_{T6}| \leq V_{T8} + 50\text{ V DC and } |V_{T7}| \leq V_{T8} + 50\text{ V DC}$$

6.3.1.112.2 Maximum voltage between side B live parts (DC+/DC-) and the protective conductor in case of an insulation fault at side B to the protective conductor

Replacement:

The insulation requirements between side B of the EV supply equipment and the protective conductor, excluding the side B cable assembly, depend on the working voltage. See 8.105.5.

Case 1: For a side B with a working voltage of $\leq 1\,250\text{ V DC}$, basic protection shall be provided between this part of the circuit and the protective conductor.

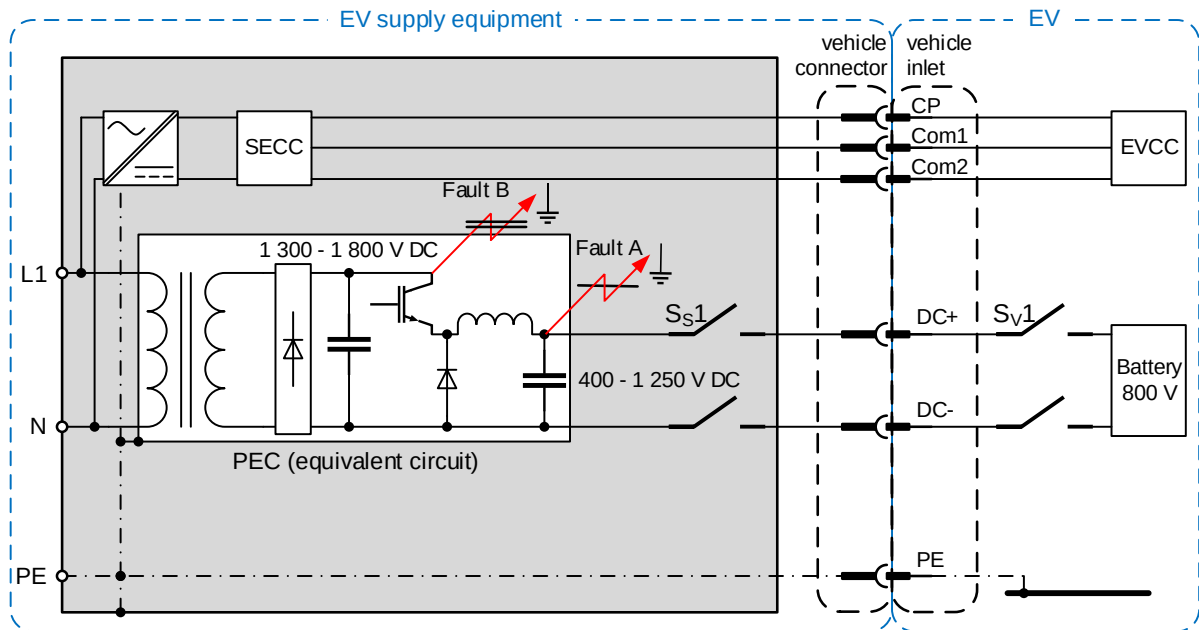
Compliance is checked by inspection.

Case 2: For a side B with a working voltage of $> 1\,250\text{ V DC}$, if a fault to the protective conductor causes a voltage between side B live parts (DC+/DC-) and protective conductor of less than or equal to 110 % of the present voltage at side B, basic protection shall be provided between this part of the circuit and the protective conductor. See fault A in Figure 202.

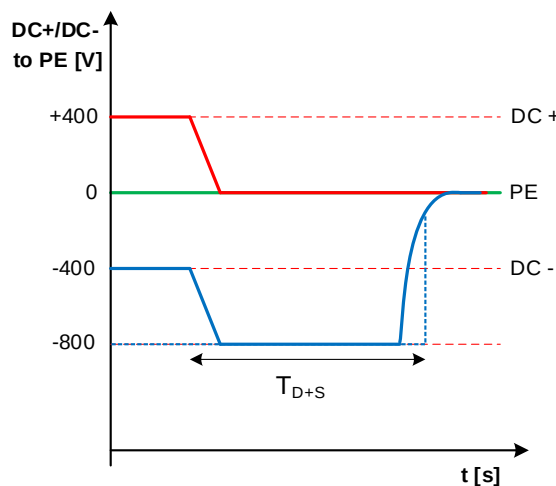
Compliance is checked by inspection.

Case 3: For a side B with a working voltage of $> 1\,250\text{ V DC}$, if a fault to the protective conductor causes a voltage between side B live parts (DC+/DC-) and the protective conductor of more than 110 % of the present voltage at side B between DC+ and DC-, double or reinforced protection shall be provided between this part of the circuit and the protective conductor. See fault B in Figure 202.

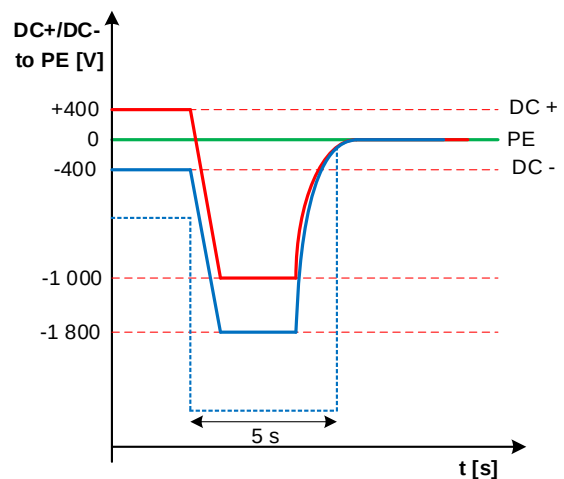
Compliance is checked by inspection.



a) Fault locations



b) Waveform of fault A



c) Waveform of fault B

Key

- PE Protective conductor
- T_{D+S} Detection time of the IMD/earth leakage current monitoring device plus the error shutdown time
- (single line) Basic insulation (see fault A)
- (double lines) Double insulation or basic insulation and electrically protective screening (shielding) or reinforced insulation (see fault B)

Figure 202 – Examples of a fault between the secondary circuit and the protective conductor

The following requirements apply under a fault to the protective conductor.

For EV supply equipment based on Case 3: if a voltage more than 110 % of the present voltage at side B between DC+ and DC- is present for more than 1 s between side B live parts (DC+/DC-) and the protective conductor, the EV supply equipment shall trigger and complete an error shutdown in 4 s or less. See Figure 202.

In 5 s or less after a fault to the protective conductor, the EV supply equipment shall limit the temporary overvoltage V_{tov} between side B live parts (DC+/DC-) and the protective conductor to 1 800 V DC.

Compliance is checked by the following tests:

The test setup for system MCS is shown in Figure 205.

Test between DC- and the protective conductor:

- 1) *Connect the EV supply equipment to a test load with dedicated EV simulator for each system.*
- 2) *Measure voltages V_{T6} , V_{T7} , V_{T8} and current A_{T1} .*
- 3) *Start energy transfer with the procedure specified by the EV supply equipment manufacturer.*
- 4) *Confirm that the operating point is at OP2 as specified in Figure 133 of IEC 61851-23:2023.*
- 5) *Preconditions for the fault condition:*
 - a) *R_{T4} shall be 150 k Ω*
 - b) *U_{T2} shall be set in order that, when S_{T10} is closed, V_{T7} is $0,1 \times V_{EVSE_rated_max_sideB}$*
- 6) *Close S_{T10} .*
- 7) *Check that the EV supply equipment performs an error shutdown.*
- 8) *Check that V_{T6} and V_{T7} are < 60 V DC in 5 s or less after closing S_{T10} .*

Test between DC+ and the protective conductor.

- 1) *Connect the EV supply equipment to a test load with dedicated EV simulator for each system.*
- 2) *Measure voltages V_{T6} , V_{T7} , V_{T8} and current A_{T1} .*
- 3) *Start energy transfer with the procedure specified by the EV supply equipment manufacturer.*
- 4) *Confirm that the operating point is at OP2 as specified in Figure 133 of IEC 61851-23:2023.*
- 5) *Preconditions for the fault condition:*
 - a) *R_{T3} shall be 150 k Ω*
 - b) *U_{T1} shall be set in order that, when S_{T9} is closed, V_{T6} is $-(0,1 \times V_{EVSE_rated_max_sideB})$*
- 6) *Close S_{T9} .*
- 7) *Check that the EV supply equipment performs an error shutdown.*
- 8) *Check that V_{T6} and V_{T7} are < 60 V DC in 5 s or less after closing S_{T9} .*

NOTE 3 The tests simulate a fault that can either be in the EV supply equipment or EV

6.3.1.113 Shutdown of the EV supply equipment**6.3.1.113.1 General**

IEC 61851-23:2023, 6.3.1.113.1 is applicable.

6.3.1.113.2 Normal shutdown

IEC 61851-23:2023, 6.3.1.113.2 is applicable, except as follows:

Replacement of “CC.3.3” by “CC.3.3 of IEC 61851-23-3:202X”.

6.3.1.113.3 Error shutdown

IEC 61851-23:2023, 6.3.1.113.3 is applicable, except as follows:

Replacement of “CC.3.4” by “CC.3.4 of IEC 61851-23-3:202X”.

6.3.1.113.4 Emergency shutdown

IEC 61851-23:2023, 6.3.1.113.4 is applicable, except as follows:

Replacement of “CC.3.4” by “CC.3.4 of IEC 61851-23-3:202X”.

Replacement of “CC.7.5.4 and CC.7.5.8” by “CC.7.5.4 and CC.7.5.8 of IEC 61851-23-3:202X”.

6.3.2 Optional functions for Mode 4**6.3.2.1 General**

IEC 61851-23:2023, 6.3.2.1 is applicable, except as follows:

Ventilation during supply of energy according to IEC 61851-23:202X, 6.3.2.2 is not applicable.

Mode 4 using system C according to IEC 61851-23:202X, 6.3.2.4 is not applicable.

6.3.2.101 Sleep mode of the EV supply equipment

IEC 61851-23:2023, 6.3.2.101 is applicable, except as follows:

Replacement of “CC.5.2” by “CC.5.2 of IEC 61851-23-3:202X”.

6.3.2.102 Detection/adjustment of the applicable maximum current of the EV supply equipment at side B

IEC 61851-23:2023, 6.3.2.102 is applicable, except as follows:

Replacement of “CC.5.5” by “CC.5.5 of IEC 61851-23-3:202X”.

7 Communications

IEC 61851-23:2023, Clause 7 is applicable, except as follows:

7.1 Digital communication between the EV supply equipment and the EV

IEC 61851-23:2023, 7.1 is applicable, except as follows:

713 *The 2nd and 3rd paragraphs are not applicable.*

714 *Addition:*

715 Clause CC.2 provides the system MCS requirements for digital communication between the EV
716 supply equipment and the EV.

717 **7.1.101 Basic communication interface**

718 *Replacement:*

719 Requirements and typical basic communication interfaces (including charge enable function
720 and insertion detection function) of system MCS are specified in Annex CC.

721 **8 Protection against electric shock**

722 IEC 61851-23:2023, Clause 8 is applicable, except as follows:

723 **8.101 General provisions**

724 **8.101.1 General**

725 IEC 61851-23:2023, 8.101.1 is applicable, except as follows:

726 *Replacement of “CC.4.1” by “CC.4.1 of IEC 61851-23-3:202X”.*

727 **8.101.2 Intended use and reasonably foreseeable misuse**

728 IEC 61851-23:2023, 8.101.2 is applicable.

729 **8.101.3 Limitation of touch current or touch voltage**

730 IEC 61851-23:2023, 8.101.3 is applicable.

731 **8.101.4 Threshold of perception and startle reaction**

732 IEC 61851-23:2023, 8.101.4 is applicable, except as follows:

733 *Replacement of “the maximum Y-capacitances of the EV according to ISO 17409:2020” by “the*
734 *maximum Y-capacitances of the EV according to Annex B of ISO 5474-3:2023”.*

735 *Replacement of “the maximum Y-capacitances of the EV according to ISO 17409:2020” by “the*
736 *maximum Y-capacitances of the EV according to Annex B of ISO 5474-3:2023”.*

737 *Replacement in step c) of “The test setup shall have the maximum EV Y-capacitance (C_{T7}/C_{T8})*
738 *for the operating point specified in step b), as specified by ISO 17409” by “The test setup shall*
739 *have the maximum EV Y-capacitance (C_{T7}/C_{T8}) for the operating point specified in step b), as*
740 *specified Annex B of IEC 5474-3:2023”.*

741 *Replacement in step e) of “CC.7.4” by “CC.7.4 of IEC 61851-23-3:202X”.*

742 **8.102 Basic protection**

743 **8.102.1 General**

744 IEC 61851-23:2023, 8.102.1 is applicable.

8.102.2 Protection by means of basic insulation of live parts

IEC 61851-23:2023, 8.102.2 is applicable.

8.102.3 Protection by means of enclosures or barriers

IEC 61851-23:2023, 8.102.3 is applicable.

8.102.4 Protection by means of limitation of voltage

IEC 61851-23:2023, 8.102.4 is applicable.

8.102.5 Protection by means of limitation of steady-state touch current

IEC 61851-23:2023, 8.102.5 is applicable

8.103 Fault protection**8.103.1 General**

IEC 61851-23:2023, 8.103.1 is applicable.

8.103.2 Protective-equipotential-bonding

IEC 61851-23:2023, 8.103.2 is applicable

8.103.3 Effective protective conductor continuity between the enclosure and the external protective circuit

IEC 61851-23:2023, 8.103.3 is applicable.

8.103.4 Automatic disconnection of supply

IEC 61851-23:2023, 8.103.4 is applicable.

8.103.5 Supplementary insulation

IEC 61851-23:2023, 8.103.5 is applicable.

8.103.6 Electrically protective screening

IEC 61851-23:2023, 8.103.6 is applicable.

8.104 Enhanced protective provision**8.104.1 General**

IEC 61851-23:2023, 8.104.1 is applicable.

8.104.2 Double or reinforced insulation

IEC 61851-23:2023, 8.104.2 is applicable.

8.104.3 Protective separation between circuits

IEC 61851-23:2023, 8.104.3 is applicable.

8.105 Requirements for separated EV supply equipment

8.105.1 General

IEC 61851-23:2023, 8.105.1 is applicable, except as follows:

Replacement in "Table 112, column "Provisions for special protection" of "Limitation of Y-capacitance to < 500 nF per rail a, b (8.105.3)" by "Limitation of Y-capacitance according to Table 202 of IEC 61851-23-3:202X".

Replacement of "CC.4.1" by "CC.4.1 of IEC 61851-23-3:202X"

Addition in "Table 112, column "Provisions for special protection" of "Perform an error shutdown if the present voltage between side B live parts (DC+/DC-) and the protective conductor exceed the limits according to 6.3.1.112.1".

Addition:

Table 202 – Maximum Y-capacitance of the EV supply equipment at side B

Rated maximum voltage of the EV supply equipment at side B between DC+ and DC- V DC	Maximum y-capacitance of EV supply equipment at side B ^{a, b} µF
$\geq 1\,126$ and $\leq 1\,250$ ^c	$0,5 * \frac{\ln((0,5 * U + 75)/758)}{-0,007}$ where U is the maximum voltage of the on-board section of the vehicle power supply circuit between DC+ and DC- under normal operation
$\geq 1\,004$ and $< 1\,126$ ^d	$0,5 * \frac{5}{0,5 * (0,5 * U + 75)^2 * 10^6}$ where U is the maximum voltage of the on-board section of the vehicle power supply circuit between DC+ and DC- under normal operation
$< 1\,004$ ^e	$0,5 * 30$

^a Halving the values is due to the equal distribution of maximum total y-capacitance between EV and EV supply equipment.

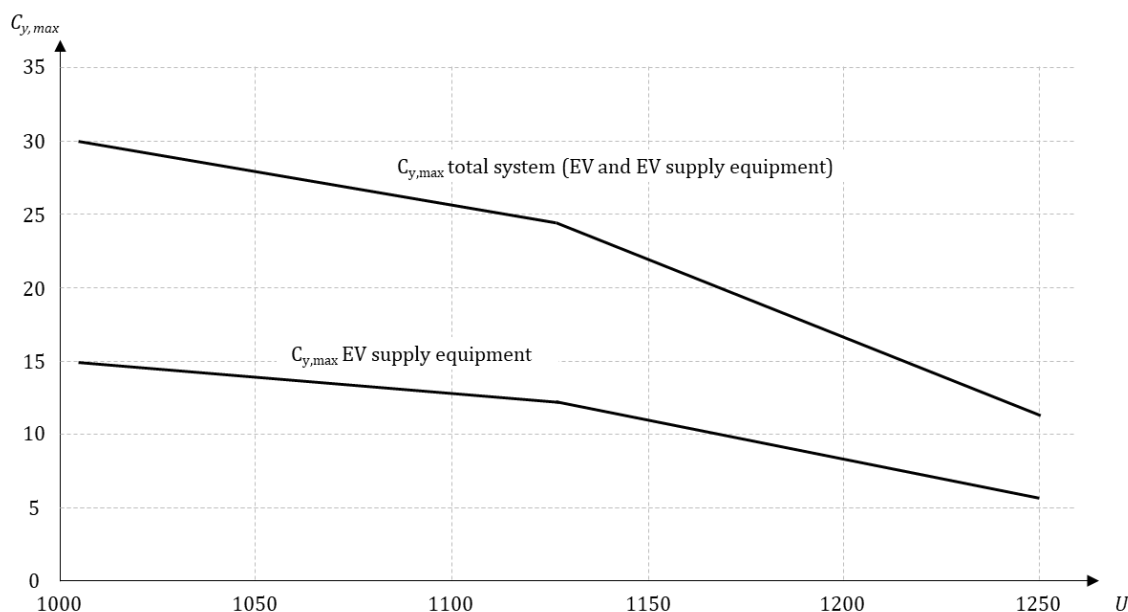
^b The limits specify the maximum combined Y-capacitance of all rails, including parasitic capacitance, at side B of the EV supply equipment. The distribution of the Y-capacitance per rail of the EV supply equipment is up to the discretion of the EV supply equipment manufacturer.

^c Allows for keeping the c1 limit according to IEC 60479-1, Figure 22, assuming active balancing on the EV supply equipment.

^d Allows for keeping the 5 J limit according to IEC 60335-2-76, assuming active balancing on the EV supply equipment.

^e Allows for keeping the c1 limit according to IEC 60479-1, Figure 22, assuming passive balancing on the EV supply equipment.

Figure 203 gives an overview of the values according to the formulas from Table 5.



Key

$C_{y,max}$ Maximum Y-capacitance

U Maximum voltage of the on-board section of the vehicle power supply circuit between DC+ and DC- under normal operation

Figure 203 – Overview of the maximum Y-capacitance

8.105.2 Equipotential bonding on side B

IEC 61851-23:2023, 8.105.2 is applicable, except as follows:

Replacement of “CC.4.1.3” by “CC.4.1.3 of IEC 61851-23-3:202X”.

Replacement of “IEC 62196” by “IEC 63379”.

secNOTE: TBD on adding RPT requirements before they are included in the next IEC 61851-23 Ed3.

secNOTE: Question for JP experts: Should we keep Note 1 for system MCS?

8.105.3 Impedance to protective conductor on side B

IEC 61851-23:2023, 8.105.3 is applicable, except as follows:

Replacement of “CC.4.1.6” by “CC.4.1.6 of IEC 61851-23-3:202X”.

Replacement of “In the side B circuit, the Y-capacitance between DC+ and the protective conductor shall be < 500 nF. In the side B circuit, the Y-capacitance between DC- and the protective conductor shall be < 500 nF.” by “In the side B circuit, the Y-capacitance between DC+ and the protective conductor shall be according to Table 202 of IEC 61851-23-3:202X. In the side B circuit, the Y-capacitance between DC- and the protective conductor shall be according to Table 202 of IEC 61851-23-3:202X.”

Note 4 and Note 4 are not applicable.

Replacement of paragraph “The special protection required in 8.101.4 may be provided by limited impedance between side B live parts (DC+/DC-) and the protective conductor, including

the connected EV" by "The special protection required in 8.101.4 shall be provided by limited impedance between side B live parts (DC+/DC-) and the protective conductor according to 6.3.1.112.1, including the connected EV".

Replacement of "CC.7.4" by "CC.7.4 of IEC 61851-23-3:202X".

Replacement in step 4) of "Check that, after subtracting the Y-capacitance of the EV simulator (precondition c)), the maximum total parallel Y-capacitance is < 1 uF." by "Check that, after subtracting the Y-capacitance of the EV simulator (precondition c)), the maximum total parallel Y-capacitance is according to Table 202 of IEC 61851-23-3:202X."

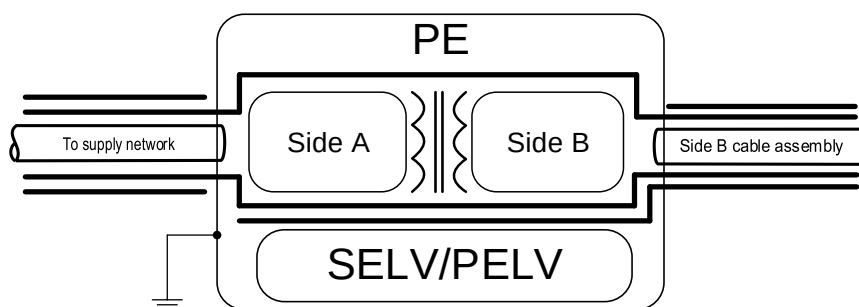
8.105.4 Degrees of protection against access to hazardous-live-parts

IEC 61851-23:2023, 8.105.4 is applicable.

8.105.5 Insulation barriers

Replacement:

The EV supply equipment shall have insulation barriers as shown in Figure 204. The EV supply equipment shall provide the minimum protective measures as defined in Table 203.



Key

PE	Protective conductor
(single line)	Basic insulation
(double lines)	Double insulation or basic insulation and electrically protective screening (shielding) or reinforced insulation

Figure 204 – Insulation barriers

Table 203 gives the required property (with respect to protection) of barriers between the type of circuits given in the first column of this table and the type of circuits, or persons, given in the first row of this table.

Table 203 – Minimum protective measures

Side B	SELV/PELV	Protective conductor	Ordinary person
--------	-----------	----------------------	-----------------

Side A	Protective separation	Protective separation	Basic insulation ^a	– Double/reinforced insulation, or – Basic insulation and electrically protective screening (shielding), or – A combination of both
Side B	n.a	Protective separation ^b	Basic insulation	– Double/reinforced insulation, or – Basic insulation and electrically protective screening (shielding), or – A combination of both
SELV	n.a	n.a	Functional insulation ^c	None
Protective conductor	n.a	n.a	n.a	None
^a Local regulations may require double insulation. In some countries, extra monitoring of protective conductor is required when using basic insulation. For some systems, for example, TT systems, double insulation to protective conductor is required up to the RCD, if one is installed in the EV supply equipment ^b In accordance with Table 2, Clause 4.4.3.5, Clause 4.4.5.5 of IEC 62477:2022, if all of the following conditions are met: – the PELV circuit is connected to the protective conductor; – no hazardous voltage or touch current occurs (see 8.101.3) in the PELV circuit due to an insulation fault between the PELV circuit and the DC circuit; – the IMD or earth leakage current monitoring device detects this insulation fault between the PELV circuit and side B, and triggers an error or emergency shutdown; then basic insulation between side B and PELV is allowed. ^c If SELV is not connected to the protective conductor, a 500 V AC RMS test voltage may be applied to test the insulation.				

835

836 Outside of a fire enclosure, the live parts (DC+/DC-) of the side B circuit shall be separated by
837 double or reinforced insulation from each other and other circuits.

838 *Compliance is checked by inspection.*

839 **8.105.6 Stored energy**

840 **8.105.6.1 Disconnection of plug-and-cable-connected EV supply equipment**

841 IEC 61851-23:2023, 8.105.6.1 is applicable, except as follows:

842 *Replacement of “ISO 17409:2020” by “ISO 5474-3”*

843 **8.105.6.2 Loss of supply voltage to permanently-connected EV supply equipment**

844 IEC 61851-23:2023, 8.105.6.2 is applicable.

845 **8.105.7 Disconnection from vehicle**

846 IEC 61851-23:2023, 8.105.7 is applicable.

847 **8.105.8 Protective (earthing) conductor from the supply network**

848 IEC 61851-23:2023, 8.105.8 is applicable.

8.105.9 Residual current protective devices

IEC 61851-23:2023, 8.105.9 is applicable.

8.105.10 Safety requirements for auxiliary circuits between the EV supply equipment and the EV

IEC 61851-23:2023, 8.105.10 is applicable.

8.105.11 Protective conductor dimension cross-sectional area

Replacement:

The protective earthing conductor or protective conductor of side B of the EV supply equipment shall:

- comply with the requirements of 543.1.2 of IEC 60364-5-54:2011; and
- be designed according to CC.4.6.
- the prospective fault current is equivalent to the rating of the protective devices. See 13.101.

NOTE In the following countries, the size and rating of a protective earthing conductor is specified in national code and regulation: US, CA.

Compliance is checked by inspection and measurement...

9 Conductive electrical interface requirements

IEC 61851-23:2023, Clause 9 is applicable, except as follows:

9.1 General

IEC 61851-23:2023, 9.1 is applicable, except as follows:

Replacement of "IEC 62196-3 or IEC TS 62196-3-1" by "IEC 63379".

9.5 Functional description of the DC interface

Replacement:

General requirements and ratings shall be in accordance with the requirements specified in IEC 63379.

The DC interface, configurations and ratings are specified in Clause 6 of IEC 63379:202X.

9.6 Functional description of the combined interface

IEC 61851-23:2023, 9.6 is not applicable.

9.101 Avoidance of breaking under load

IEC 61851-23:202X, 9.101 is applicable, except the following:

Replacement of the 2nd sentence of the 2nd paragraph, starting with "This turn-off time shall comply with the value", by "This turn-off time shall comply with the value specified in CC.4.3 of IEC 61851-23-3:202X and CC.4.4 of IEC 61851-23-3:202X, using a speed of separation of the vehicle connector of 0,8 m/s ± 0,1 m/s according to IEC 63379".

10 Requirements for adaptors

Replacement:

Any type of adaptors shall not be used for system MCS.

11 Cable assembly requirements

IEC 61851-23:2023, Clause 11 is applicable, except as follows.

11.1 General

IEC 61851-23:2023, 11.1 is applicable.

11.6 Strain relief

IEC 61851-23:2023, 11.6 is applicable.

11.6.101 Strain relief of the side B cable assembly of the EV supply equipment

IEC 61851-23:2023, 11.6.101 is applicable.

11.6.102 Test of the anchorage of the side B cable assembly

IEC 61851-23:2023, 11.6.102 is applicable.

11.7 Cable management and storage means for cables assemblies

IEC 61851-23:2023, 11.7 is applicable, except as follows.

Addition:

If the damage done to the side B cable assembly by a moving vehicle can result in any harmful electrical risk, the EV supply equipment shall provide appropriate countermeasures to reduce such risk.

11.101 Cable breakaway

IEC 61851-23:2023, 11.101 is applicable.

11.102 Surface temperature of the charging cable assembly

IEC 61851-23:2023, 11.102 is applicable.

12 EV supply equipment constructional requirements and tests

IEC 61851-23:2023, Clause 12 is applicable, except as follows:

12.1 General

IEC 61851-23:2023, 12.1 is applicable.

12.2 Characteristics of mechanical switching devices

12.2.5 Relays

IEC 61851-23:2023, 12.2.5 is applicable.

912 **12.3 Clearances and creepage distances**

913 IEC 61851-23:2023, 12.3 is applicable.

914 **12.4 IP degrees**

915 **12.4.1 Degrees of protection against solid foreign objects and water for the**
916 **enclosures**

917 IEC 61851-23:2023, 12.4.1 is applicable.

918 **12.5 Insulation resistance**

919 IEC 61851-23:2023, 12.5 is applicable.

920 **12.6 Touch current**

921 **12.6.101 Touch current limit**

922 IEC 61851-23:2023, 12.6.101 is applicable.

923 **12.6.102 Test**

924 **12.6.102.1 Test configuration**

925 IEC 61851-23:2023, 12.6.102.1 is applicable.

926 **12.6.102.2 Application of measuring network**

927 IEC 61851-23:2023, 12.6.102.2 is applicable.

928 **12.6.102.3 Test condition**

929 IEC 61851-23:2023, 12.6.102.3 is applicable.

930 **12.6.102.4 Test measurements**

931 IEC 61851-23:2023, 12.6.102.4 is applicable.

932 **12.6.103 Protection measures for the test touch current exceeding 3,5 mA**

933 IEC 61851-23:2023, 12.6.103 is applicable.

934 **12.7 Dielectric withstand voltage**

935 **12.7.2 Impulse dielectric withstand (1,2 µs/50 µs)**

936 IEC 61851-23:2023, 12.7.1 is applicable.

937 **12.7.101 Suppression of transient overvoltage at input (insulation coordination)**

938 IEC 61851-23:2023, 12.7.101 is applicable.

939 **12.7.102 Protection against transient overvoltages of atmospheric origin or due to**
940 **switching**

941 IEC 61851-23:2023, 12.7.102 is applicable, except as follows:

942 *Replacement of the 1st sentence in the 6th paragraph, starting with "The EV supply equipment*
943 *shall provide a protection level at the vehicle connector" by "The EV supply equipment shall*

944 *provide a protection level at the vehicle connector for system MCS with an rated maximum*
945 *voltage of the EV supply equipment at side B $\leq 1\,250\text{ V DC}$ "*

946 *Replacement of the 1st sentence in the 7th paragraph, starting with "SPDs and other clamping*
947 *devices limiting the voltage at the side B circuit, between live parts (DC+/DC-) and the protective*
948 *conductor," by "SPDs and other clamping devices limiting the voltage at the side B circuit,*
949 *between live parts (DC+/DC-) and the protective conductor, shall have high impedance with a*
950 *rated DC withstand voltage of $\geq 1\,250\text{ V DC}$ ".*

951 *Replacement of the item V_{S5} in the key of Figure 114 by "Worst case: Permanent unbalanced*
952 *voltage between DC+ and PE $\leq 1\,250\text{ V}$ ".*

953 *Replacement of the item V_{S6} in the key of Figure 114 by "Worst case: Permanent unbalanced*
954 *voltage between DC- and PE $\leq 1\,250\text{ V}$ ".*

955 *Replacement of the item V_{S4} in the key of Figure 114 by "Maximum side B voltage between*
956 *DC+ and DC- of $1\,250\text{ V DC}$ ".*

957 **12.8 Temperature rise**

958 IEC 61851-23:2023, 12.8 is applicable.

959 **12.9 Damp heat functional test**

960 IEC 61851-23:2023, 12.9 is applicable.

961 **12.10 Minimum temperature functional test**

962 IEC 61851-23:2023, 12.10 is applicable.

963 **12.11 Mechanical strength**

964 IEC 61851-23:2023, 12.11 is applicable.

965 **12.101 Side A current**

966 IEC 61851-23:2023, 12.101 is applicable.

967 **12.102 Power supply cords**

968 **12.102.1 General**

969 IEC 61851-23:2023, 12.102.1 is applicable.

970 **12.102.2 Cross sectional area**

971 IEC 61851-23:2023, 12.102.2 is applicable.

972 **12.102.3 Cord anchorages and strain relief for non-detachable power supply cords**

973 **12.102.3.1 Cord strain relief**

974 **12.102.3.1.1 General**

975 IEC 61851-23:2023, 12.102.3.1.1 is applicable.

976 **12.102.3.1.2 Strain relief mechanism failure**

977 IEC 61851-23:2023, 12.102.3.1.2 is applicable.

- 978 **12.102.3.1.3 Cord sheath or jacket position**
- 979 IEC 61851-23:2023, 12.102.3.1.3 is applicable.
- 980 **12.102.3.1.4 Strain relief and cord anchorage material**
- 981 IEC 61851-23:2023, 12.102.3.1.4 is applicable.
- 982 **12.103 Stress relief test**
- 983 IEC 61851-23:2023, 12.103 is applicable.
- 984 **12.104 Abnormal operation and simulated fault condition tests**
- 985 **12.104.1 General**
- 986 IEC 61851-23:2023, 12.104.1 is applicable.
- 987 **12.104.2 Pass criteria**
- 988 IEC 61851-23:2023, 12.104.2 is applicable.
- 989 **12.104.3 Breakdown of components test**
- 990 **12.104.3.1 Load conditions**
- 991 IEC 61851-23:2023, 12.104.3.1 is applicable.
- 992 **12.104.3.2 Application of short-circuit or open circuit**
- 993 IEC 61851-23:2023, 12.104.3.2 is applicable.
- 994 **12.104.3.3 Test sequence**
- 995 IEC 61851-23:2023, 12.104.3.3 is applicable.
- 996 **12.104.4 Loss of AC supply phase test**
- 997 IEC 61851-23:2023, 12.104.4 is applicable.
- 998 **12.104.5 Inoperative blower/fan motor test**
- 999 IEC 61851-23:2023, 12.104.5 is applicable.
- 1000 **12.104.6 Clogged filter test**
- 1001 IEC 61851-23:2023, 12.104.6 is applicable.
- 1002 **12.105 Protection against electrically caused fire**
- 1003 **12.105.1 General**
- 1004 IEC 61851-23:2023, 12.105.1 is applicable.
- 1005 **12.105.2 Fire enclosure**
- 1006 IEC 61851-23:2023, 12.105.2 is applicable.

1007 **12.106 Protection against chemical hazards**

1008 **12.106.1 Type of coolant**

1009 IEC 61851-23:2023, 12.106.1 is applicable.

1010 **12.106.2 Flammability**

1011 IEC 61851-23:2023, 12.106.2 is applicable.

1012 **12.106.3 Material compatibility**

1013 IEC 61851-23:2023, 12.106.3 is applicable.

1014 **12.107 Enclosures**

1015 **12.107.1 General**

1016 IEC 61851-23:2023, 12.107.1 is applicable.

1017 **12.107.2 Strength of materials and parts**

1018 **12.107.2.1 General**

1019 IEC 61851-23:2023, 12.107.2.1 is applicable.

1020 **12.107.2.2 Properties of insulating materials**

1021 **12.107.2.2.1 Thermal stability**

1022 IEC 61851-23:2023, 12.107.2.2.1 is applicable.

1023 **12.107.2.2.2 Resistance of insulating materials to heat and fire**

1024 IEC 61851-23:2023, 12.107.2.2.2 is applicable.

1025 **12.107.3 Enclosure integrity tests**

1026 IEC 61851-23:2023, 12.107.3 is applicable.

1027 **12.108 Components bridging insulation**

1028 **12.108.1 General**

1029 IEC 61851-23:2023, 12.108.1 is applicable, except as follows:

1030 *Replacement of the 3rd paragraph by "SPDs and other clamping devices limiting the voltage at*
1031 *the side B circuit, between live parts (DC+/DC-) and the protective conductor, shall have a rated*
1032 *DC withstand voltage of $\geq 1\,250\text{ V}$ ".*

1033 *Replacement of NOTE 3 by "Due to the requirements for a double or reinforced insulation for*
1034 *working voltages $> 550\text{ V DC}$ (see 8.105.5) in case of a single earth fault, temporary*
1035 *overvoltages $> 1\,250\text{ V DC}$ between side B live parts (DC+/DC-) and the protective conductor*
1036 *do not occur."*

1037 **12.108.2 Capacitors**

1038 IEC 61851-23:2023, 12.108.2 is applicable.

12.109 Isolating transformers

IEC 61851-23:2023, 12.109 is applicable.

13 Overload and short-circuit protection

IEC 61851-23:2023, Clause 13 is applicable, except as follows:

13.1 General

IEC 61851-23:2023, 13.1 is applicable

13.101 Short-circuit protection of the DC connection during energy transfer

Replacement:

The EV supply equipment shall fulfil all the requirements a) to c) below, for a short-circuit current supplied by the EV supply equipment due to any of the following fault conditions:

- fault condition 1: a short-circuit between side B live parts (DC+ and DC–);
- fault condition 2: a failure in the PEC, for example, a permanently fully conductive switching element in a buck converter.

the DC EV supply equipment shall fulfil all the following requirements:

a) at side B live parts (DC+ and DC–) at the vehicle connector:

- limit the peak current to ≤ 30 kA, and
- limit the I^2t value to $\leq 1\,000\,000$ A²s,
- switch off the supply to the vehicle within 4 ms after start of the short circuit condition.

If the short-circuit current supplied by the EV supply equipment is not sufficient to trip a fuse, if any, within the required time to limit the I^2t value, the EV supply equipment shall provide an alternative means to interrupt the short-circuit current.

b) trigger an emergency shutdown within 1 s after the start of the short-circuit condition as specified in the respective test.

For fault condition 1, the compliance with requirements a) and b) is tested according to CC.7.5.17. For fault condition 2, the compliance with requirements a) and b) is demonstrated through design review.

c) The protective conductor of the EV supply equipment at side B shall have the following characteristics:

- withstand a maximum short circuit peak current of 55 kA, and
- withstand a maximum I^2t value of $11\,000\,000$ A²s.

These values are based on the following assumptions:

- Simultaneous short circuit in the EV supply equipment (max. 30 kA) and in the EV (max. 70 kA) including a minimum impedance of the cable assembly (minimum cable length of 2 m),
- a fault resistance of $R_{\text{fault}} = 5\text{m}\Omega$ for each fault,
- a fault inductance of $L_{\text{fault}} = 2\text{ }\mu\text{H}$ for each fault, and
- both, the EV supply equipment and the EV, switch off the supply within 4 ms after start of the short circuit condition.

NOTE 2 The current peak is a result of the discharge of the capacitance of the EV supply equipment. The capacitive discharge is a transient phenomenon in the range of milliseconds.

NOTE 3 Requirements for short-circuit check before charging are given in 6.3.1.109.

1080 For a short-circuit current supplied by the EV, the requirements in d) or e) shall be fulfilled.

1081 d) At the vehicle connector, the EV supply equipment shall have a short-circuit current
1082 withstand rating (I_{2t}) and shall withstand a peak current according to the values as specified
1083 in ISO 5474-3 specified for system MCS. The minimum cross-sectional area of the line
1084 conductors shall be calculated according to IEC 60364-4-43:2008, Equation (3).

1085 e) For sections of the side B which are not designed according to the withstand rating (I_{2t}) and
1086 the peak current according to d), an overcurrent protection device shall be provided. The
1087 section of the side B which is protected by this protection device shall be designed according
1088 to the characteristics of this overcurrent protection device.

1089 *Compliance for requirements c), d) and e) is checked by inspection.*

1090 **14 Automatic reclosing of protective devices**

1091 IEC 61851-23:2023, Clause 14 is applicable.

1092 **15 Emergency switching or disconnect (optional)**

1093 IEC 61851-23:2023, Clause 15 is applicable.

1094 **16 Marking and instructions**

1095 IEC 61851-23:2023, Clause 16 is applicable.

1096 **16.1 Installation manual of EV charging stations**

1097 IEC 61851-23:2023, 16.1 is applicable.

1098 **16.2 User manual for EV supply equipment**

1099 IEC 61851-23:2023, 16.2 is applicable.

1100 **16.3 Marking of EV supply equipment**

1101 IEC 61851-23:2023, 16.3 is applicable.

1102 **16.4 Marking of charging cable assemblies case B**

1103 IEC 61851-23:2023, 16.4 is applicable.

1104 **101 Specific requirements for EV supply equipment**

1105 **101.1 Specific requirements for separated EV supply equipment**

1106 **101.1.1 Operating ranges for voltage, current, and power at side B**

1107 IEC 61851-23:2023, 101.1.1 is applicable, except as follows:

1108 *Replacement in Note 1 from "IEC 61851-24" to "ISO 15118-20".*

1109 **101.1.2 Voltage and current tolerance at side B**

1110 **101.1.2.1 Side B current regulation in CCM**

1111 IEC 61851-23:2023, 101.1.2.1 is applicable, except as follows:

1112 Replacement of "CC.6.2" by "CC.6.2 of IEC 61851-23-3:202X".

1113 Replacement of "CC.7.5.11" by "CC.7.5.11 of IEC 61851-23-3:202X".

1114 101.1.2.2 Side B voltage regulation in CVM

1115 IEC 61851-23:2023, 101.1.2.2 is applicable, except as follows:

1116 Replacement of "CC.7.5.12" by "CC.7.5.12 of IEC 61851-23-3:202X".

1117 Replacement in Note 1 of "ISO 17409" by "ISO 5474".

1118 Replacement of "30 V DC at 1 000 V DC" by "37,5 V DC at 1 250 V DC"

1119 101.1.3 Control delay of present current at side B in CCM

1120 IEC 61851-23:2023, 101.1.3 is applicable, except as follows:

1121 Replacement of "IEC 61851-24" by "ISO 5474".

1122 Replacement of "CC.7.5.14" by "CC.7.5.14 of IEC 61851-23-3:202X".

1123 101.1.4 Descending rate of present current at side B

1124 IEC 61851-23:2023, 101.1.4 is applicable, except as follows:

1125 Replacement of "CC.3.4" by "CC.3.4 of IEC 61851-23-3:202X".

1126 Replacement of "Table CC.10" by "Table CC.112 of IEC 61851-23-3:202X".

1127 101.1.5 Periodic and random deviation (current ripple at side B during CCM)

1128 IEC 61851-23:2023, 101.1.5 is applicable, except as follows:

1129 Replacement of "CC.3.4" by "CC.3.4 of IEC 61851-23-3:202X".

1130 Replacement of "Table 118" by "Table 204 of IEC 61851-23-3:202X".

1131 Replacement of "CC.7.5.11" by "CC.7.5.11 of IEC 61851-23-3:202X".

1132 secNOTE: Experts are asked to provide input to improve the current ripple ranges, as IEC
1133 61851-23 Ed2 has requirements for > 400 A, and MCS systems can have a rated boost current
1134 at side B of up to 3 000 A.

1135 Table 204 – Current ripple limit of the EV supply equipment

Frequency ^a	Present current at side B (I)		
	I ≤ 200 A DC ^d	200 A DC < I ≤ 400 A DC	I > 400 A DC
10 Hz	1,5 ^c	I x 0,75 % ^c	3,0 ^b
			I x 0,75 % ^c
5 kHz	(I x 1,5 % + 3) ^b	6,0 ^c	I x 1,5 % ^c
	6,0 ^c		
150 kHz	9,0 ^c	I x 4,5 % ^c	18,0 ^b

			I x 4,5 % ^c
a	Cut-off frequency of the first order low pass filter.		
b	Recommended limit in A _{peak-to-peak} .		
c	Absolute maximum limit in A _{peak-to-peak} .		
d	For system B, ≤ 250 A DC		
NOTE 1	System A supports a present current at side B ≤ 400 A DC.		
NOTE 2	System B supports a present current at side B ≤ 250 A DC.		

1137

1138

1139 **101.1.6 Periodic and random deviation (voltage ripple at side B during CVM)**

1140 IEC 61851-23:2023, 101.1.6 is applicable, except as follows:

1141 *Replacement of "CC.7.5.12" by "CC.7.5.12 of IEC 61851-23-3:202X".*1142 **101.1.7 Load dump**

1143 IEC 61851-23:2023, 101.1.7 is applicable, except as follows:

1144 *Replacement of "CC.6.1" by "CC.6.1 of IEC 61851-23-3:202X".*1145 *Replacement of "CC.7.5.9" by "CC.7.5.9 of IEC 61851-23-3:202X".*1146 **101.1.8 Side B inductance**

1147 IEC 61851-23:2023, 101.1.8 is applicable.

1148 **101.2 Specific requirement for energy transfer with a thermal management system or**
1149 **thermal sensing only**1150 **101.2.1 General**

1151 IEC 61851-23:2023, 101.2 is applicable, except as follows:

1152 *Replacement of "IEC TS 62196-3-1" by "IEC 63379".*1153 **101.2.2 Temperature limits and self-diagnostics**1154 **101.2.2.1 Temperature of the DC contact assembly of the vehicle connector**

1155 IEC 61851-23:2023, 101.2.2.1 is applicable, except as follows:

1156 *Replacement of "IEC 62196-1:2014" by "IEC 63379".*1157 **101.2.2.2 Requirements for self-diagnostics function for thermal management system**

1158 IEC 61851-23:2023, 101.2.2.2 is applicable.

1159

1160 **101.2.3 Temperature monitoring**

1161 **101.2.3.1 General**

1162 IEC 61851-23:2023, 101.2.3.1 is applicable.

1163 **101.2.3.2 Overtemperature handling**

1164 *Replacement:*

1165 If the contact temperature of the DC contact accessory is > 100 °C for 8 consecutive seconds,
1166 the EV supply equipment shall trigger an error shutdown in 1 s or less according CC.3.4 for
1167 system MCS.

1168 If the contact temperature of the DC contact accessory is > 105 °C for 1 s, the EV supply
1169 equipment shall trigger an error shutdown in 1 s or less.

1170 *Compliance is checked by test in 101.2.3.3.*

1171 **101.2.3.3 Check of the plausibility of the values provided by the thermal sensing**
1172 **devices**

1173 IEC 61851-23:2023, 101.2.3.3 is applicable, except as follows:

1174 *Replacement of "CC.3.4" by "'CC.3.4 of IEC 61851-23-3:202X"*

1175 **101.2.4 Tests for thermal management system performance of the EV supply equipment**

1176 **101.2.4.1 General**

1177 IEC 61851-23:2023, 101.2.4.1 is applicable, except as follows:

1178 *Replacement of "standard sheet 3-1a of IEC TS 62196-3-1:2020" by "standard sheet of*
1179 *configuration HH of IEC 63379:202X"*

1180 *secNOTE: Expert input is needed to align the Reference devices and Test arrangements to the*
1181 *ones specified in IEC 63379, and to update the values in Table 119 of IEC 61851-23:2023.*

1182

1183 **101.2.4.2 Thermal management system performance test**

1184 IEC 61851-23:2023, 101.2.4.2 is applicable, except as follows:

1185 *Replacement of "90 °C " by "100 °C".*

1186 *Replacement of "IEC 62196-1:2014, 16.5 " by "IEC 63379, 16.5".*

1187 *secNOTE: The references figures will be updated according to the changes in 101.2.3.1.*

1188 **101.2.4.3 Tests of overtemperature handling**

1189 IEC 61851-23:2023, 101.2.4.3 is applicable, except as follows:

1190 *Replacement in step 4) of "perform an error shutdown sequence according to AA.4.3.5 for*
1191 *system A and CC.3.4 for system C in 9 s or less after the reference temperature sensor signals*
1192 *a temperature of > 90 °C" by "perform an error shutdown sequence according CC.3.4 for system*
1193 *MCS in 9 s or less after the reference temperature sensor signals a temperature of > 100 °C"*

1194 *Replacement in step 4) of “reduce the present current at side B to 2 A DC before the*
1195 *temperature measured by the reference temperature sensor reaches 90 °C.” by “reduce the*
1196 *present current at side B to 2 A DC before the temperature measured by the reference*
1197 *temperature sensor reaches 95 °C”.*

1198 *Replacement of “IEC 62196-1:2014, 16.5 ” by “IEC 63379, 16.5”.*

1199 **101.2.4.4 Test for self-diagnostics function for thermal management system**

1200 IEC 61851-23:2023, 101.2.4.4 is applicable, except as follows:

1201 *Replacement in step 5) of “the measured temperatures by the reference temperature sensors*
1202 *are ≤ 90 °C” by “the measured temperatures by the reference temperature sensors are ≤ 100 °C”.*

1203 *Replacement of “IEC 62196-1:2014, 16.5 ” by “IEC 63379, 16.5”.*

1204 **101.2.4.5 Test for availability of thermal sensing devices**

1205 **101.2.4.5.1 General**

1206 IEC 61851-23:2023, 101.2.4.5.1 is applicable.

1207 **101.2.4.5.2 Test for availability of thermal sensing devices before energy transfer**

1208 IEC 61851-23:2023, 101.2.4.5.2 is applicable.

1209 **101.2.4.5.3 Test for availability of thermal sensing devices during energy transfer**

1210 IEC 61851-23:2023, 101.2.4.5.3 is applicable, except as follows:

1211 *Replacement in step 3) of “CC.3.4” by “CC.3.4 of IEC 61851-23:2023”.*

1212 **101.3 Specific requirements for temperature-controlled energy transfer**

1213 IEC 61851-23:2023, 101.3 is applicable, except as follows:

1214 *Replacement of “IEC TS 62196-3-1” by “IEC 63379”.*

1215 **102 Test methods**

1216 **102.1 Technical data**

1217 IEC 61851-23:2023, 102.1 is applicable.

1218 **102.2 General test conditions**

1219 **102.2.1 Ambient test conditions**

1220 **102.2.1.1 Environmental conditions**

1221 IEC 61851-23:2023, 101.2.1.1 is applicable.

1222 **102.2.1.2 Test power requirements**

1223 IEC 61851-23:2023, 101.2.1.2 is applicable.