

TECHNICAL SPECIFICATION

**Electric vehicle conductive charging system –
Part 3-2: DC EV supply equipment where protection relies on double or
reinforced insulation – Particular requirements for portable and mobile
equipment**

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equipment**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –**Part 3-2: DC EV supply equipment where protection relies
on double or reinforced insulation – Particular requirements
for portable and mobile equipment**

FOREWORD

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IEC TS 61851-3-2 has been prepared by IEC technical committee 69: Electrical power/energy transfer systems for electrically road vehicles and industrial trucks. It is a Technical Specification.

The text of this Technical Specification is based on the following documents:

Draft	Report on voting
69/846/DTS	69/883/RVDTS

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 Technical Specification 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 part is to be used in conjunction with IEC 60335-2-29:2016 and IEC 60335-1:2020.

The clauses of the particular requirements in this document supplement or modify the corresponding clauses of IEC 60335-2-29:2016 and IEC 60335-1:2020. Where the text indicates an "addition" to or a "replacement" of the relevant requirement, test specification or explanation of IEC 60335-2-29:2016 and IEC 60335-1:2020, these changes are made to the relevant text of IEC 60335-2-29:2016 and IEC 60335-1:2020, which then becomes part of this document. Where no change is necessary, the words "The xxx of portable and mobile DRI EV supply equipment shall be in accordance with the relevant requirements (for class II appliances or heating appliances) of IEC 60335-2-29:2016" are used, where "xxx" represents the relevant title of the clause referred to. See also Annex DD. Additional annexes are lettered AA, BB, CC and DD.

In this document, the following print types are used:

- requirements: in roman type;
- *test specifications*: in italic type;
- notes: in small roman type.

A list of all parts in the IEC 61851 all parts, published under the general title *Electric vehicles 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,
- replaced by a revised edition, or
- amended.

INTRODUCTION

This document is published in separate parts according to the following structure:

IEC TS 61851-3-1, *Electric vehicle conductive charging system – Part 3-1: DC EV supply equipment where protection relies on double or reinforced insulation – General rules and requirements for stationary equipment*

IEC TS 61851-3-2, *Electric vehicle conductive charging system – Part 3-2: DC EV supply equipment where protection relies on double or reinforced insulation – Particular requirements for portable and mobile equipment*

IEC TS 61851-3-4, *Electric vehicle conductive charging system – Part 3-4: DC EV supply equipment where protection relies on double or reinforced insulation – General definitions and requirements for CANopen communication*

IEC TS 61851-3-5, *Electric vehicle conductive charging system – Part 3-5: DC EV supply equipment where protection relies on double or reinforced insulation – Pre-defined communication parameters and general application objects*

IEC TS 61851-3-6, *Electric vehicle conductive charging system – Part 3-6: DC EV supply equipment where protection relies on double or reinforced insulation – Voltage converter unit communication*

IEC TS 61851-3-7, *Electric vehicle conductive charging system – Part 3-7: DC EV supply equipment where protection relies on double or reinforced insulation – Battery system communication*

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ELECTRIC VEHICLE CONDUCTIVE CHARGING SYSTEM –

Part 3-2: DC EV supply equipment where protection relies on double or reinforced insulation – Particular requirements for portable and mobile equipment

1 Scope

This part of IEC 61851, which is a Technical Specification, applies to the portable and mobile DRI EV supply equipment where the protection against electric shocks relies on double or reinforced insulation, and with double or reinforced insulation between all AC and DC inputs and outputs with a rated input voltage being not more than 250 V AC and output voltages not more than 120 V DC.

NOTE 1 In the following countries, the acceptable nominal supply voltage is up to 600 V AC: CA, US.

NOTE 2 These specified rated input and output voltages supersede all references.

This document applies to

- VCU's intended to be a part of portable and mobile DRI EV supply equipment,
- portable and mobile DRI EV supply equipment according to the IEC 61851-3 series intended to be installed and/or used at an altitude of up to 2 000 m, and
- portable and mobile DRI EV supply equipment for the conductive transfer of electric power between the supply network and an electric road vehicle/RESS according to the IEC 61851-3 series intended to be connected to vehicles where the vehicle power supply circuit is protected against electric shock by double or reinforced insulation.

NOTE 3 For information regarding protection against electric shock by double or reinforced insulation of the EV or of the vehicle power supply circuit, see ISO 18246:2023, 6.1.1 b) and Table 3.

The aspects covered in this document include

- the characteristics and operating conditions of the portable and mobile DRI EV supply equipment,
- the specification for required level of electrical safety for the portable and mobile DRI EV supply equipment,
- requirements for bidirectional power transfer from DC to DC, and
- requirements for command and control basic communication for safety and process matters, if required.

This document does not apply to

- safety aspects related to maintenance, and
- electrical devices and components, which are covered by their specific product standards.

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 60038, *IEC standard voltages*

IEC 60335-1:2020, *Household and similar electrical appliances – Safety – Part 1: General requirements*

IEC 60335-2-29:2016, *Household and similar electrical appliances – Safety – Part 2-29: Particular requirements for battery chargers*
IEC 60335-2-29:2016/AMD1:2019

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

IEC TS 61851-3-1:2023, *Electric vehicle conductive charging system – Part 3-1: DC EV supply equipment where protection relies on double or reinforced insulation – General rules and requirements for stationary equipment*

IEC TS 62196-4:2022, *Plugs, socket-outlets, vehicle connectors and vehicles inlets – Conductive charging of electric vehicles – Part 4: Dimensional compatibility and interchangeability requirements for DC pin and contact-tube accessories for class II or class III applications*

CiA 454-12, *CANopen application profile for energy management systems – Part 12: Gateway unit*, available at www.can-cia.org¹

3 Terms, definitions, symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 61851-3-1:2023 apply.

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

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

3.1.1

protective impedance

impedance connected between live parts and accessible conductive parts of class II constructions so that the current, in normal use and under likely fault conditions in the appliance, is limited to a safe value

[SOURCE: IEC 60335-1:2020, 3.3.6]

¹ Under preparation.

3.2 Symbols and abbreviated terms

AC	alternating current
DC	direct current
EMS	energy management system
EMSC	energy management system controller
IMD	insulation monitoring device
EV	electric vehicle
NFC	near field communication
VCU	voltage converter unit

4 General requirements

Portable and mobile DRI EV supply equipment shall be constructed so that, in normal use, they function safely so as to cause no danger to persons or surroundings, even in the event of carelessness that may occur in normal use.

Compliance is checked by meeting all of the relevant requirements of this document.

Annex DD provides references to applicable requirements and tests to the relevant clauses of IEC 60335-2-29:2016.

The portable and mobile DRI EV supply equipment may have one or more "connecting points" according to IEC 60364-7-722:2018 that are used for energy supply to electric vehicle. This includes socket-outlets (case A or case B) and/or cord sets attached with vehicle connectors (case C). Each connecting point shall have its own dedicated protection means.

Each connecting point shall be supplied by its own safety isolating transformer according to IEC TS 61851-3-1:2023, 7.1.1.

Measures for fault protection are specified in IEC TS 61851-3-1:2023, 9.3.

Unless otherwise specified, the tests are carried out in accordance with Clause 5.

Unless otherwise specified, all tests indicated in this document are type tests.

NOTE 1 Routine tests are carried out for portable and mobile DRI EV supply equipment, according to IEC 60335-1:2020, Annex A.

Unless otherwise specified, all tests shall be carried out in the order of the clauses and subclauses in this document.

The tests of IEC 60335-2-29:2016, Clause 5, are carried out on one sample (portable and mobile DRI EV supply equipment) that shall withstand all the relevant tests.

The DRI EV supply equipment shall be rated for one or a range of standard nominal voltages as given in IEC 60038.

For the purpose of portable and mobile DRI EV supply equipment, IEC TS 61851-3-1:2023, Clause 7 and Clause 8, apply.

NOTE 2 IEC TS 61851-3-1:2023, Figure 1, shows EV supply system configuration type A, B and D covering portable and mobile DRI EV supply equipment.

Compliance is tested according to IEC TS 61851-3-1:2023, Clause 7 and Clause 8.

5 Classification

For the purposes of this document, the classifications as given in IEC TS 61851-3-1:2023 apply.

6 Requirements for voltage converter units (VCUs)

6.1 General

Clause 6 covers requirements for VCUs for AC/DC or DC/DC conversion of electric power used within the DRI EV supply equipment.

6.2 Rated voltages and currents

Standard ratings of voltages and currents shall be in accordance with IEC TS 61851-3-1:2023, 7.2.

Compliance shall be verified by inspection.

NOTE Current and voltage regulation is shown in Annex CC.

6.3 Requirement for AC/DC VCU for portable and mobile DRI EV supply equipment

The AC/DC VCU for portable and mobile DRI EV supply equipment provides AC input voltage (side A) according to IEC TS 61851-3-1:2023, Table 2, and DC output voltages (side B) according to IEC TS 61851-3-1:2023, Table 3.

AC/DC VCUs for portable and mobile DRI EV supply equipment provides AUX voltage for AUX supply circuit at side B.

AC/DC VCUs for portable and mobile DRI EV supply equipment intended for maximum output voltage of +60 V DC to the DC power circuits on side B by the following connection:

- DC +60 V;
- DC 0 V.

AC/DC VCUs for portable and mobile DRI EV supply equipment intended for maximum output voltage of –120 V DC to the DC power circuits on side B by the following connection:

- DC 0 V;
- DC –120 V.

NOTE Example for wiring and insulation of AC/DC VCU for portable and mobile DRI EV supply equipment is shown in Figure BB.1.

6.4 Built-in DC/DC VCU for battery systems

6.4.1 Built-in DC/DC VCU for battery systems (only AUX supply circuit)

DC/DC VCUs for battery systems provides AUX voltage for AUX supply circuit at side A. Providing AUX voltage for AUX supply circuit at side B is optional.

NOTE Example for wiring and insulation of built-in DC/DC VCU for battery systems is shown in Figure BB.2.

6.4.2 Built-in DC/DC VCU for removable battery systems (IEC PAS 62840-3)

The built-in DC/DC VCU for removable battery systems provides DC output voltage (side A) according to Annex AA and DC battery system maximum voltage (side B) according to the specification of the manufacturer.

Built-in DC/DC VCUs for removable battery systems provides AUX voltage for AUX supply circuit at side A. Providing AUX voltage for AUX supply circuit at side B is optional.

NOTE Example for wiring and insulation of built-in DC/DC VCU for removable battery systems is shown in Figure BB.3.

7 Marking and instructions

IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 7, applies.

Compliance is tested in accordance with IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 7.

See also Table DD.1.

8 Protection against access to live parts

The protection against access to live parts of portable and mobile DRI EV supply equipment shall be in accordance with requirements for class II appliances of IEC 60335-2-29 and IEC 60335-2-29:2016/AMD1:2019, Clause 8.

See also Table DD.1.

IEC 60335-1:2020, Clause 8, applies, except as follows.

8.1.4

Replacement:

8.1.4.1 An accessible live part is not considered to be live if

- the part is supplied at safety extra-low voltage, provided that,
 - for AC, the RMS value of the voltage does not exceed 30 V, and
 - for DC, the voltage does not exceed 60 V, or
- the part is separated from live parts by protective impedance.

If protective impedance is used, the current between the part and the supply source shall not exceed 2 mA for DC; its peak value shall not exceed 0,7 mA for AC and

- for voltages having a peak value over 42,4 V up to and including 450 V, the capacitance shall not exceed 0,1 μF ;
- for voltages having a RMS value over 450 V up to and including 15 kV, the discharge shall not exceed 45 μC .

Compliance is checked by measurement, the appliance being supplied at rated voltage.

Voltages and currents are measured between the relevant parts and each pole of the supply source. Discharges are measured immediately after the interruption of the supply. The quantity of electricity and energy in the discharge is measured using a resistor having a nominal non-inductive resistance of 2 000 Ω .

NOTE 1 Details of a suitable circuit for measuring the current are given in IEC 60990:2016, Figure 4.

NOTE 2 The quantity of electricity is calculated from the sum of all areas recorded on the voltage/time graph without taking voltage polarity into account.

8.1.4.2 VCUs

Live parts of VCUs delivered in separate units shall be protected at least by basic insulation before integrating into DRI EV supply equipment and are tested as a complete assembly according to IEC TS 61851-3-1.

9 Starting of motor-operated appliances

Clause 9 of IEC 60335-2-29:2016 and IEC 60335-1:2010 is not applicable.

10 Power input and current

Clause 10 of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, and IEC 60335-1:2020 is not applicable.

11 Heating

The relevant requirements for heating appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 11, apply.

Compliance is tested in accordance with the relevant requirements for heating appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019. See also Table DD.1.

12 Void

13 Leakage current and electric strength at operating temperature

The relevant requirements for class II appliances of IEC 60335-2-29:2016, Clause 13, apply.

Compliance is tested in accordance with the relevant clause for class II appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019. See also Table DD.1.

14 Transient overvoltages

Clause 14 of IEC 60335-2-29:2016 and IEC 60335-1:2020 is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016, Clause 14. See also Table DD.1.

15 Moisture resistance

The relevant requirements of IEC 60335-2-29:2016, Clause 15, apply.

Compliance is tested in accordance with the relevant clause of IEC 60335-2-29:2016. See also Table DD.1.

IEC 60335-1:2020, Clause 15, is applicable, except as follows.

15.1.1

Replacement:

15.1.1 Protection against ingress of water

Portable and mobile DRI EV supply equipment is subjected to the tests of IEC 60529 as follows:

- for portable or mobile DRI EV supply equipment, at least IPX5 is required.

Compliance is tested in accordance with the relevant clause of IEC 60529. See also Table DD.1.

16 Leakage current and electric strength

The relevant requirements for class II appliances of IEC 60335-2-29:2016, Clause 16, apply.

Compliance is tested in accordance with the relevant clause for class II appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019. See also Table DD.1.

17 Overload protection of transformers and associated circuits

Clause 17 of IEC 60335-2-29:2016 and IEC 60335-1:2020 is applicable.

Compliance is tested in accordance with the relevant clause of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019. See also Table DD.1.

18 Endurance

Clause 18 of IEC 60335-2-29:2016 and IEC 60335-1:2020 is not applicable.

19 Abnormal operation

IEC 60335-2-29:2016, Clause 19, is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016, Clause 19. See also Table DD.1.

20 Stability and mechanical hazards

IEC 60335-2-29:2016, Clause 20, is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016, Clause 20. See also Table DD.1.

21 Mechanical strength

IEC 60335-2-29:2016, Clause 21, is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 21. See also Table DD.1.

22 Construction

IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 22, is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 22. See also Table DD.1.

23 Internal wiring

The relevant requirements for class II appliances of IEC 60335-2-29:2016, Clause 23, apply.

Compliance is tested in accordance with the relevant requirements for class II appliances of IEC 60335-2-29:2016. See also Table DD.1.

24 Components

The relevant requirements for class II appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 24, apply.

Compliance is tested in accordance with the relevant requirements for class II appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019. See also Table DD.1.

IEC 60335-1:2020, Clause 24, is applicable, except as follows.

24.4

Replacement:

24.4 Plugs and socket-outlets and vehicle couplers

Plugs and socket-outlets and vehicle couplers for EV supply systems type A to F shall be in accordance with the relevant requirements of IEC TS 61851-3-1:2023, 7.1.

Compliance is checked by inspection.

25 Supply connection and external flexible cords

The relevant requirements for class II appliances of IEC 60335-2-29:2016, Clause 25, apply.

Compliance is tested in accordance with the relevant requirements for class II appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019. See also Table DD.1.

IEC 60335-1:2020, Clause 25, is applicable, except as follows.

25.1

Replacement:

25.1 Portable and mobile DRI EV supply equipment

Portable and mobile DRI EV supply equipment, other than those intended to be permanently connected to fixed wiring, shall be provided with one of the following means for connection to the supply mains:

- at the side A (e.g. see Figure BB.1), supply cord fitted with a plug according to the relevant requirements of IEC TS 61851-3-1:2023, 7.1, the current rating and voltage rating of the plug and the supply cord being not less than the corresponding ratings of its associated portable and mobile DRI EV supply equipment;

- at the side B (e.g. see Figure BB.1), cord fitted with a vehicle connector according to IEC TS 62196-4:2022, the current rating and voltage rating of the vehicle connector and the supply cord being not less than the corresponding ratings of its associated portable and mobile DRI EV supply equipment;
- the length of the cord shall comply with the relevant requirements of IEC TS 61851-3-1:2023, 11.3.

All cables connected to the portable and mobile DRI EV supply equipment shall in addition comply with IEC TS 61851-3-1:2023, 11.3.

Compliance is checked by inspection.

Replacement of 25.22, 25.23 and 25.24:

25.22 Portable and mobile DRI EV supply equipment inlets and interconnection cords

Portable and mobile DRI EV supply equipment inlets and interconnection cords shall not be used at the portable and mobile DRI EV supply equipment in accordance with the relevant requirements for EV supply systems configuration type "A", "B" and "D" according to IEC TS 61851-3-1:2023, 7.1

Compliance is checked by inspection.

26 Terminals for external conductors

The relevant requirements for class II appliances of IEC 60335-2-29:2016, Clause 26, apply.

Compliance is tested in accordance with the relevant requirements for class II appliances of IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019. See also Table DD.1.

27 Provision for earthing

IEC 60335-2-29:2016, Clause 27, is not applicable.

28 Screws and connections

IEC 60335-2-29:2016, Clause 28, is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016, Clause 28. See also Table DD.1.

29 Clearances, creepage distances and solid insulation

IEC 60335-2-29:2016, Clause 29, is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 29. See also Table DD.1.

30 Resistance to heat and fire

IEC 60335-2-29:2016, Clause 30, is applicable.

Compliance is tested in accordance with IEC 60335-2-29:2016 and IEC 60335-2-29:2016/AMD1:2019, Clause 30. See also Table DD.1.

31 Resistance to rusting

IEC 60335-2-29:2016, Clause 31, is not applicable.

32 Radiation, toxicity and similar hazards

IEC 60335-2-29:2016, Clause 32, is not applicable.

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Annexes

The annexes of IEC 60335-1:2020 are applicable except as follows.

Additional annexes:

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Annex AA (normative)

Supply systems circuit diagrams

AA.1 Standard supply systems circuit diagrams using NFC

AA.1.1 General

The supply system circuit diagrams are based on the description of EV supply system configuration according to IEC TS 61851-3-1:2023, 6.7 and 7.1. For information regarding NFC, see also IEC TS 61851-3-4:2023, Annex F.

If the EV supports power transfer from/to a portable or mobile DRI EV supply equipment additionally, it may have both a plug and a vehicle inlet. Only one shall be active at the same time.

DC 0 V and AUX 0 V connection according to Figure AA.1, key 31, shall not be used for supply systems with maximum voltages higher than 60 V. For supply systems with maximum voltages equal or lower 60 V, DC 0 V and AUX 0 V connection is optional.

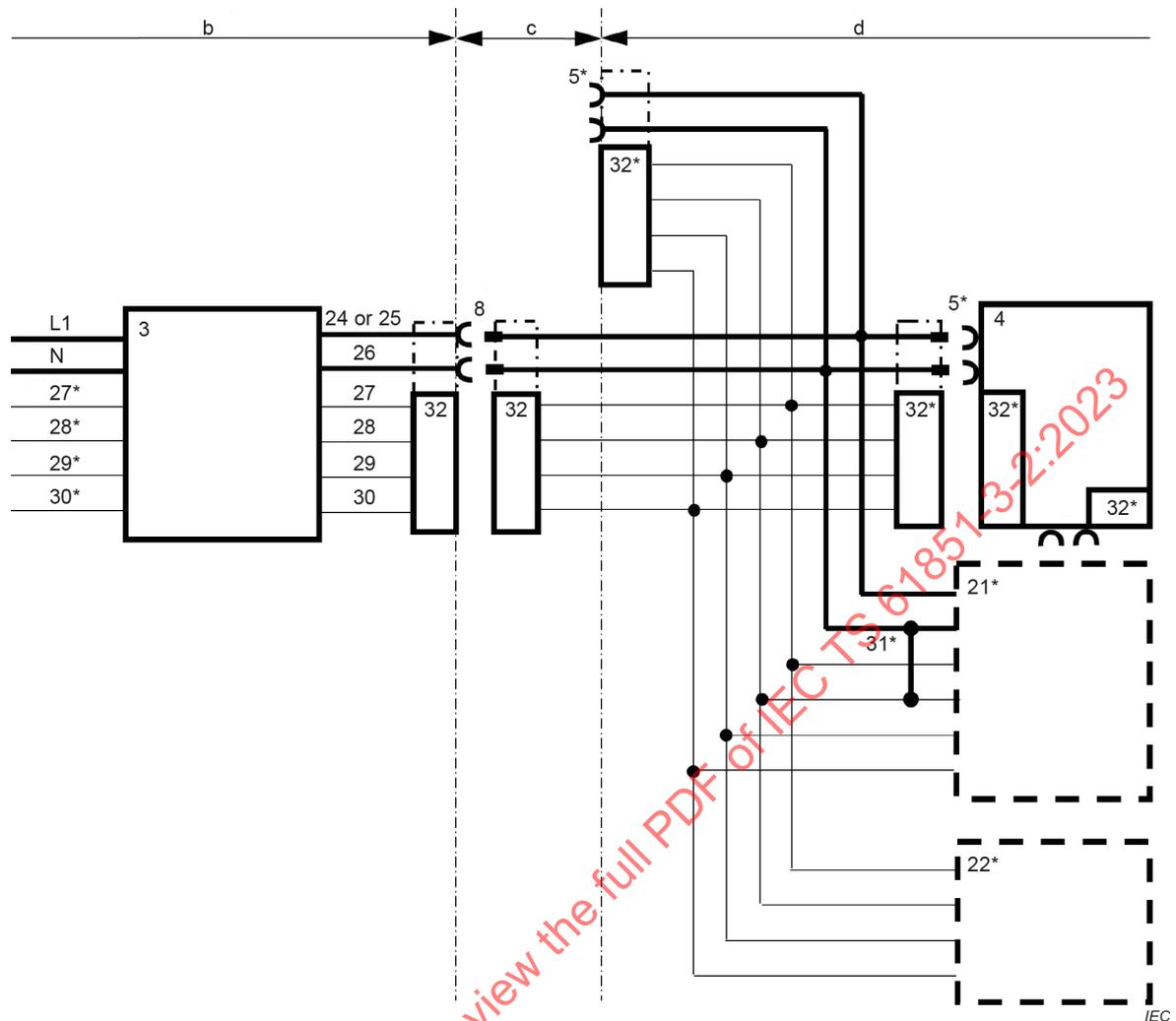
Compliance shall be verified by inspection.

AA.1.2 EV supply system configuration type C, case A, accessories 4-II

Figure AA.1 shows the circuit diagram for standard system using accessories 4-II according to IEC TS 62196-4:2022. An EV using case A is connected to the DRI EV supply equipment.

If the EV supports power transfer from/to a DRI EV supply equipment additionally, it may have both a plug and a vehicle inlet. Only one shall be active at the same time.

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**Key**

b	stationary equipment (see IEC TS 61851-3-1:2023, 6.7)	21	active device
c	portable or mobile equipment (see IEC TS 61851-3-1:2023, 6.7)	22	passive device
d	EV (located inside of the electric vehicle)	24	DC –120 V
2	portable or mobile DRI EV supply equipment	25	DC +60 V
3	stationary DRI EV supply equipment	26	DC 0 V
4	removable or non-removable RESS (battery system)	27	AUX +12 V
5	vehicle coupler DC (according to IEC TS 62196-4)	28	AUX 0 V
7	standard plug and socket-outlet (AC) (according to the IEC 60884 or IEC 60309 series)	29	CAN Hi
8	dedicated plug and socket-outlet (DC) (according to IEC TS 62196-4)	30	CAN Lo
9	A/B coupler (manufacturer specific)	31	DC 0 V and AUX 0 V connection (only once)
16	manufacturer specific battery system	32	NFC unit
18	conversion device	33	manufacturer specific battery system coupler
*	optional	L1	AC supply network (L2, L3)
		N	neutral line ^a

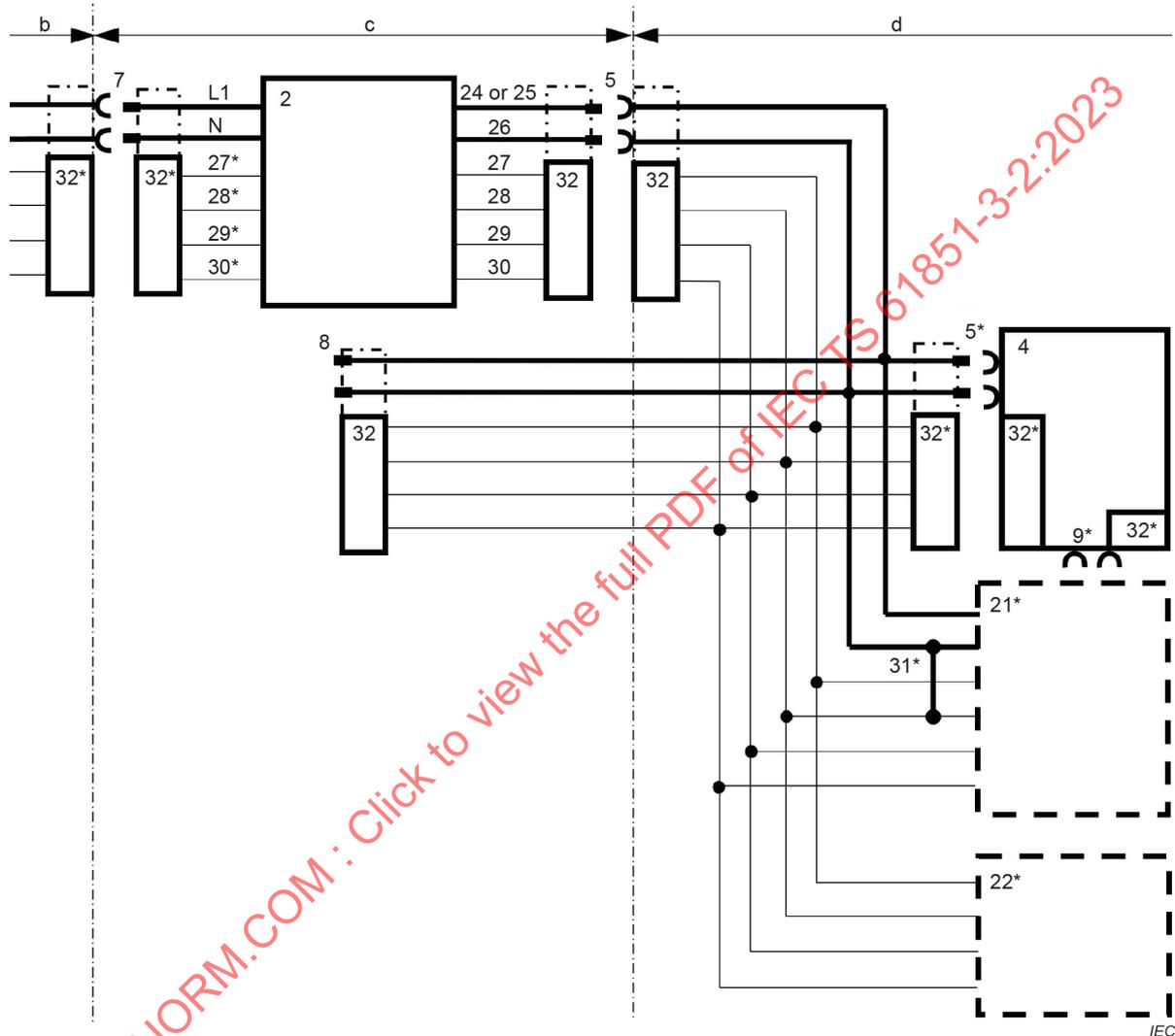
^a Can also be used to connect L2 in some countries.

Figure AA.1 – EV supply system configuration type C, case A, accessories 4-II

AA.1.3 EV supply system configuration type B, case B portable or mobile DRI EV supply equipment, accessories 4-II

Figure AA.2 shows the circuit diagram for standard system using accessories 4-II according to IEC TS 62196-4:2022. A portable or mobile DRI EV supply equipment is connected to the EV.

If the EV supports power transfer from/to a DRI EV supply equipment additionally, it may have both a plug and a vehicle inlet. Only one shall be active at the same time.

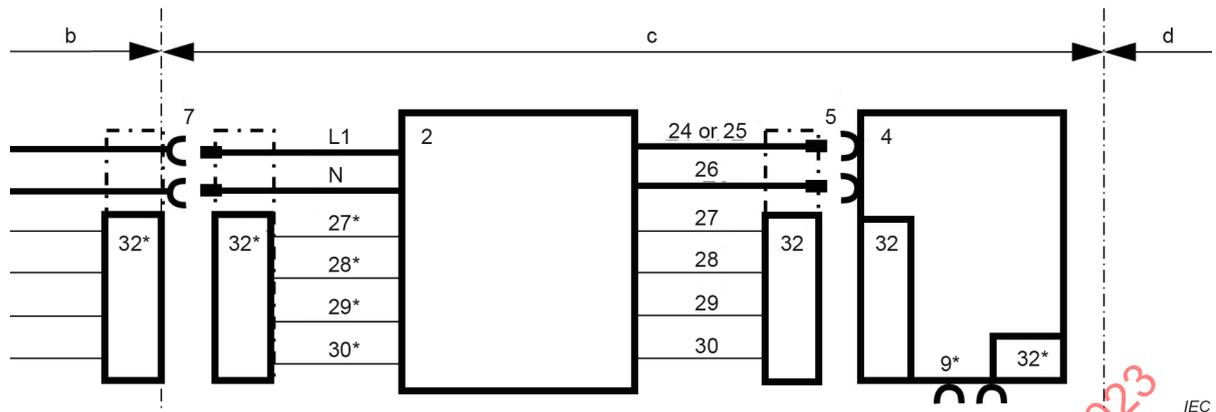


NOTE For the key, see Figure AA.1.

Figure AA.2 – EV supply system configuration type B, case B portable or mobile DRI EV supply equipment, accessories 4-II

AA.1.4 EV supply system configuration type D, accessories 4-II

Figure AA.3 shows the circuit diagram for standard system using accessories 4-II according to IEC TS 62196-4:2022. A portable or mobile DRI EV supply equipment is connected to a removed battery system.

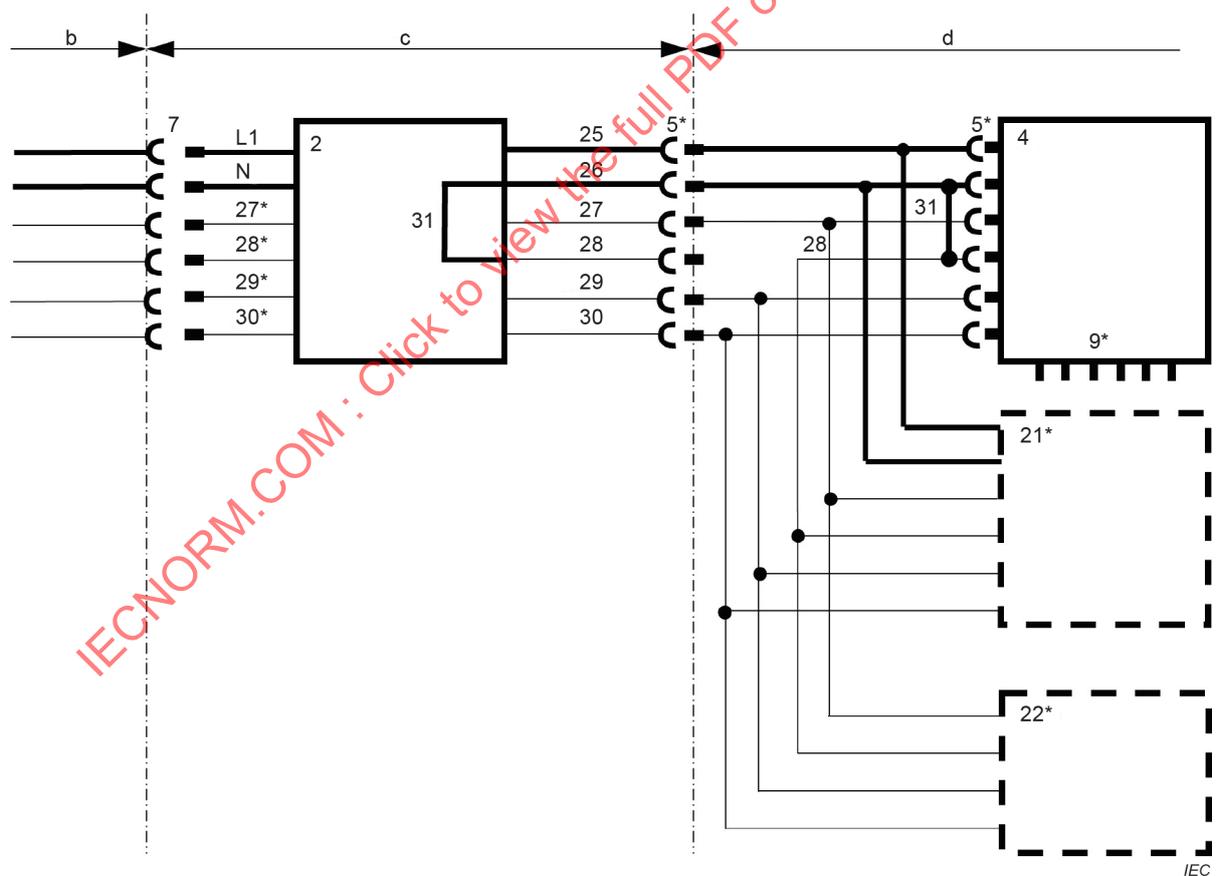


NOTE For the key, see Figure AA.1.

Figure AA.3 – EV supply system configuration type D, accessories 4-II

AA.2 EV supply system configuration type B, case B, coupler 4-I and 4-III

Figure AA.4 shows the circuit diagram for system using coupler 4-I and 4-III according to IEC TS 62196-4:2022.



NOTE For the key, see Figure AA.1.

Figure AA.4 – EV supply system configuration type B, case B, coupler 4-I and 4-III

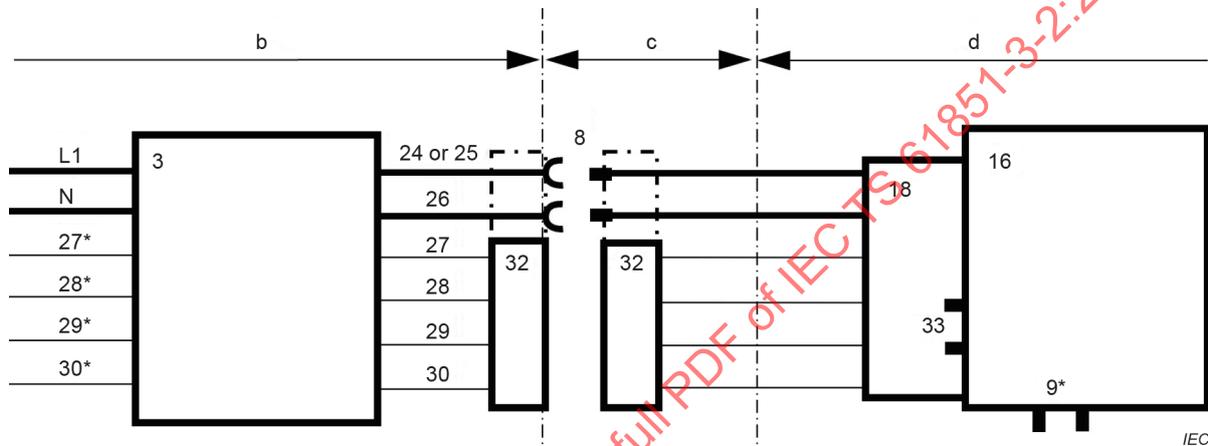
AA.3 EV supply system conversion device using NFC

AA.3.1 EV supply system configuration type C, case A, type 4-II, EV supply system conversion device

Figure AA.5 shows the circuit diagram for standard system using accessories 4-II according to IEC TS 62196-4:2022. An EV with conversion device using case A is connected to the DRI EV supply equipment.

If the EV supports power transfer from/to a DRI EV supply equipment additionally, it may have both a plug and a vehicle inlet. Only one shall be active at the same time.

Compliance shall be verified by inspection.

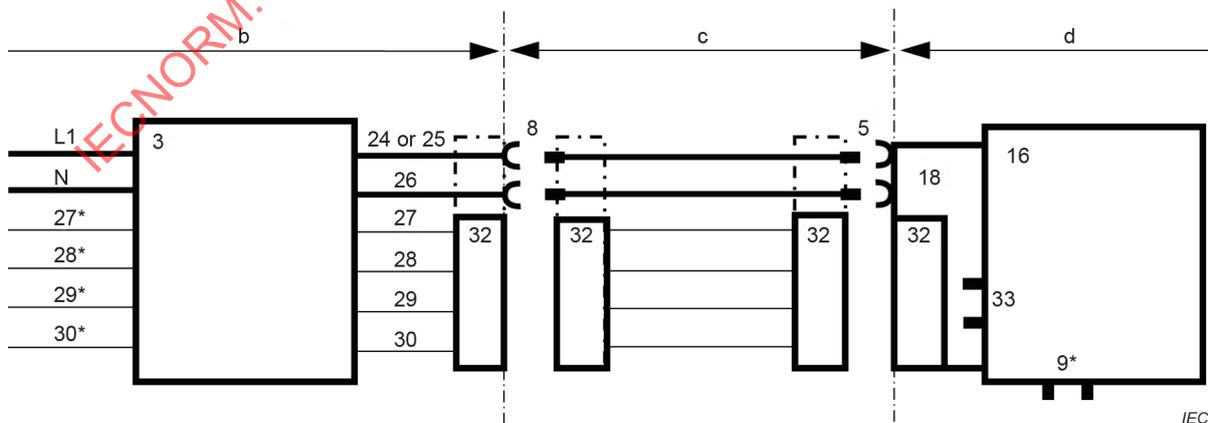


NOTE For the key, see Figure AA.1.

Figure AA.5 – EV supply system configuration type C, case A, accessories 4-II, EV supply system conversion device

AA.3.2 EV supply system configuration type C, case B, accessories 4-II, EV supply system conversion device

Figure AA.6 shows the circuit diagram for standard system using accessories 4-II according to IEC TS 62196-4:2022. A DRI EV supply equipment is connected to the EV with EV supply system conversion device.

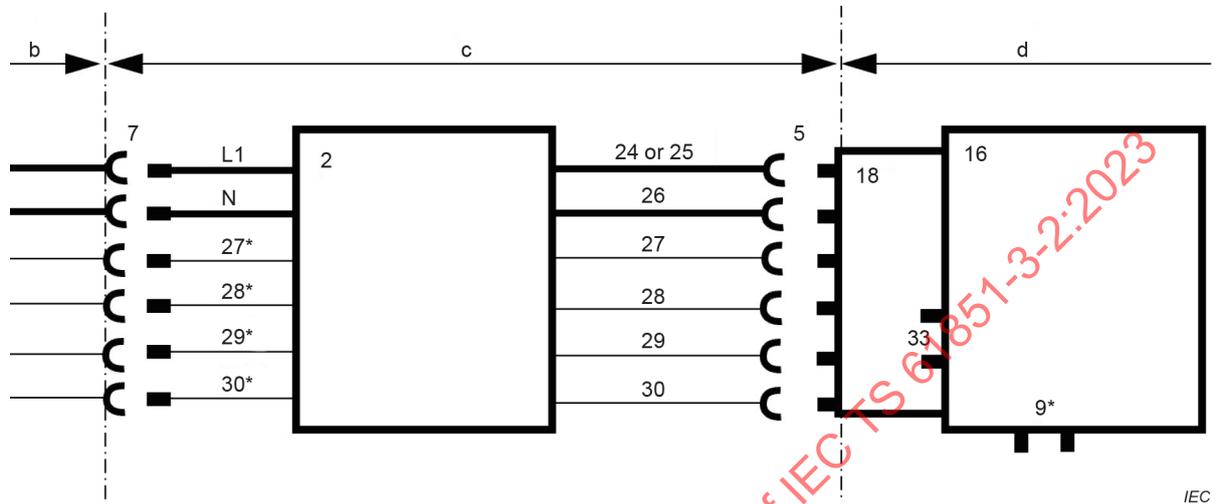


NOTE For the key, see Figure AA.1.

Figure AA.6 – EV supply system configuration type C, case B, accessories 4-II, manufacturer device

AA.4 EV supply system conversion device configuration type B, case B, type 4-I and 4-III

Figure AA.7 shows the circuit diagram for specific system using couplers 4-I and 4-III according to IEC TS 62196-4:2022 only. A portable or mobile DRI EV supply equipment is connected to an EV with EV supply system conversion device.



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NOTE For the key, see Figure AA.1.

Figure AA.7 – EV supply system conversion device configuration type B, case B, 4-I and 4-III

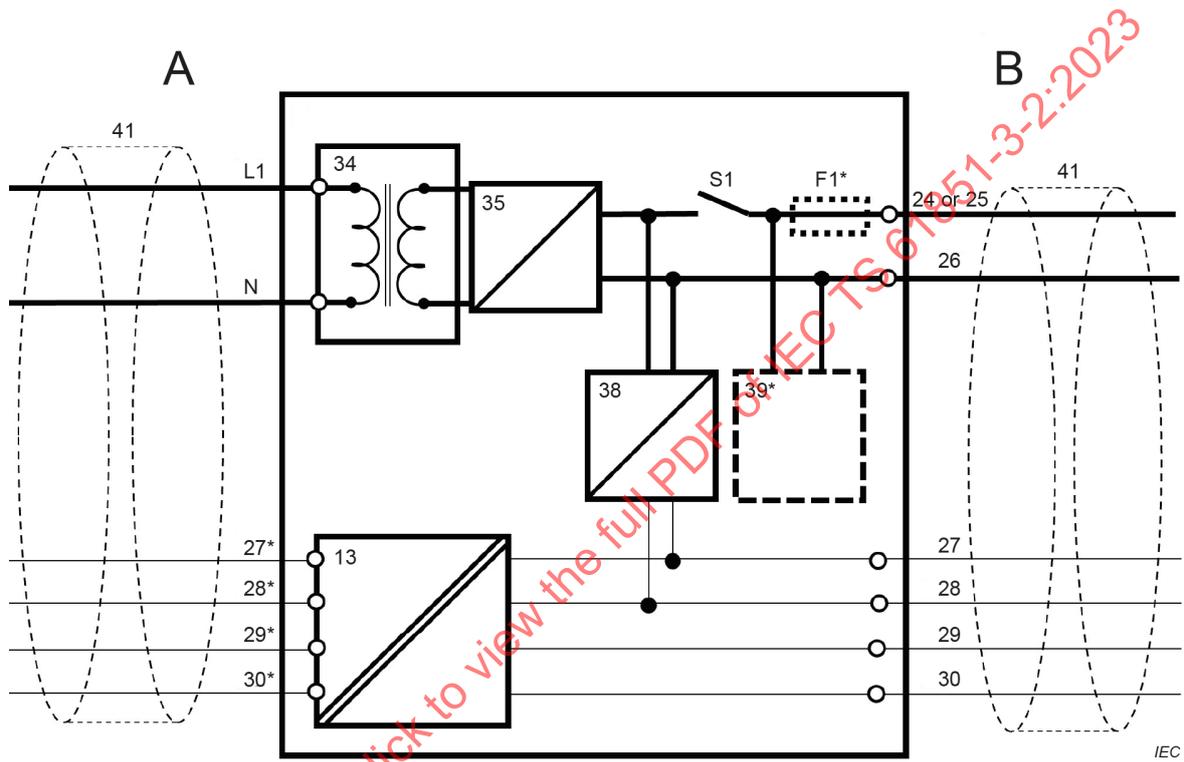
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Annex BB (informative)

Examples of VCU wirings

BB.1 AC/DC VCU for portable or mobile DRI EV supply equipment

Figure BB.1 shows wiring and insulation of AC/DC VCU for portable and mobile DRI EV supply equipment.



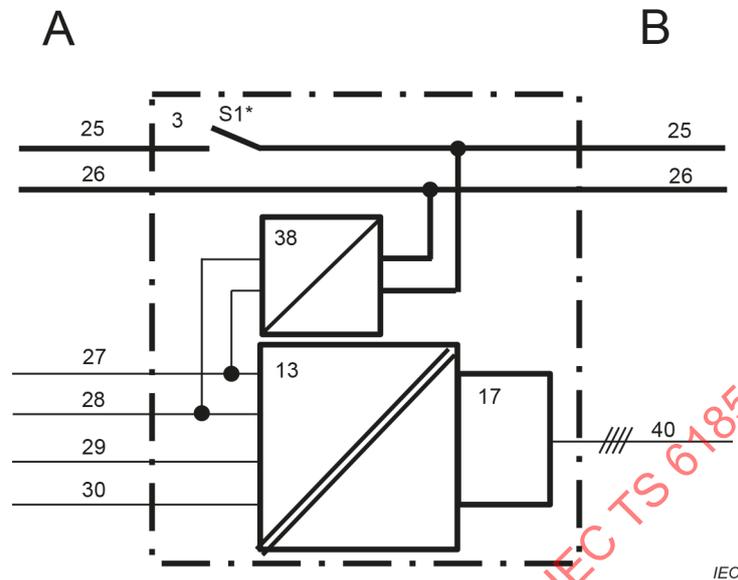
Key

2	portable or mobile DRI EV supply equipment	34	isolating transformer
3	stationary DRI EV supply equipment	35	rectifier/inverter
13	microcontroller with local EMS and optionally EMSC in VCU	36	AUX rectifier/inverter
17	gateway according CiA 454-12	37	DC/DC converter
23	DC 60 to 400 V	38	AUX DC/DC converter
24	DC –120 V	39	IMD (insulation monitoring device)
25	DC +60 V	40	manufacturer specific communication circuit
26	DC 0 V	41	cable or cord
27	AUX +12 V	F1	fuse
28	AUX 0 V	L1	AC supply network (L2, L3)
29	CAN Hi	N	neutral line (can also be used to connect L2 in some countries)
30	CAN Lo	S1/S2	switch (avoid simultaneous connection of +60 V and –120 V)
*	optional	A	input
		B	output

Figure BB.1 – AC/DC VCU for portable and mobile DRI EV supply equipment, +60 V or –120 V output

BB.2 Built-in DC/DC VCU for battery systems (only AUX supply circuit)

Figure BB.2 shows wiring and insulation of built-in DC/DC VCU for battery systems.

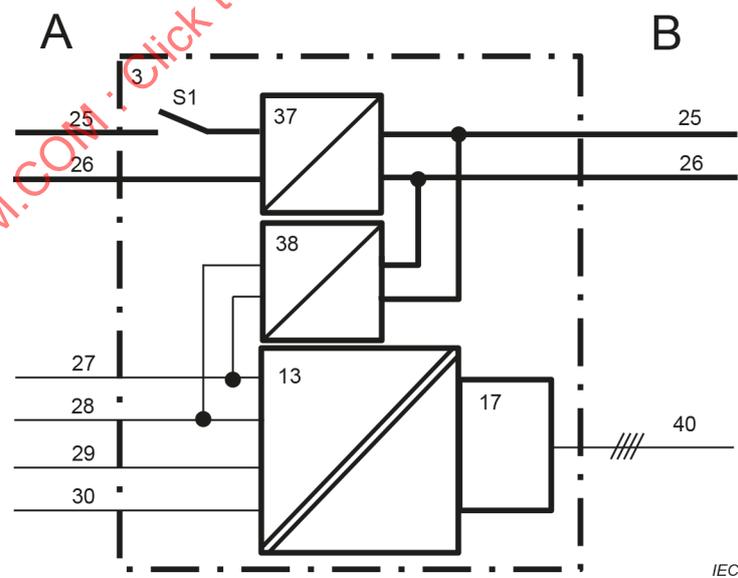


NOTE For the key, see Figure BB.1.

**Figure BB.2 – Built-in DC/DC VCU: battery system
(generation of internal AUX supply circuit)**

BB.3 Built-in DC/DC VCU for removable battery systems (IEC PAS 62840-3)

Figure BB.3 shows wiring and insulation of Built-in DC/DC VCU for removable battery systems.



NOTE For the key, see Figure BB.1.

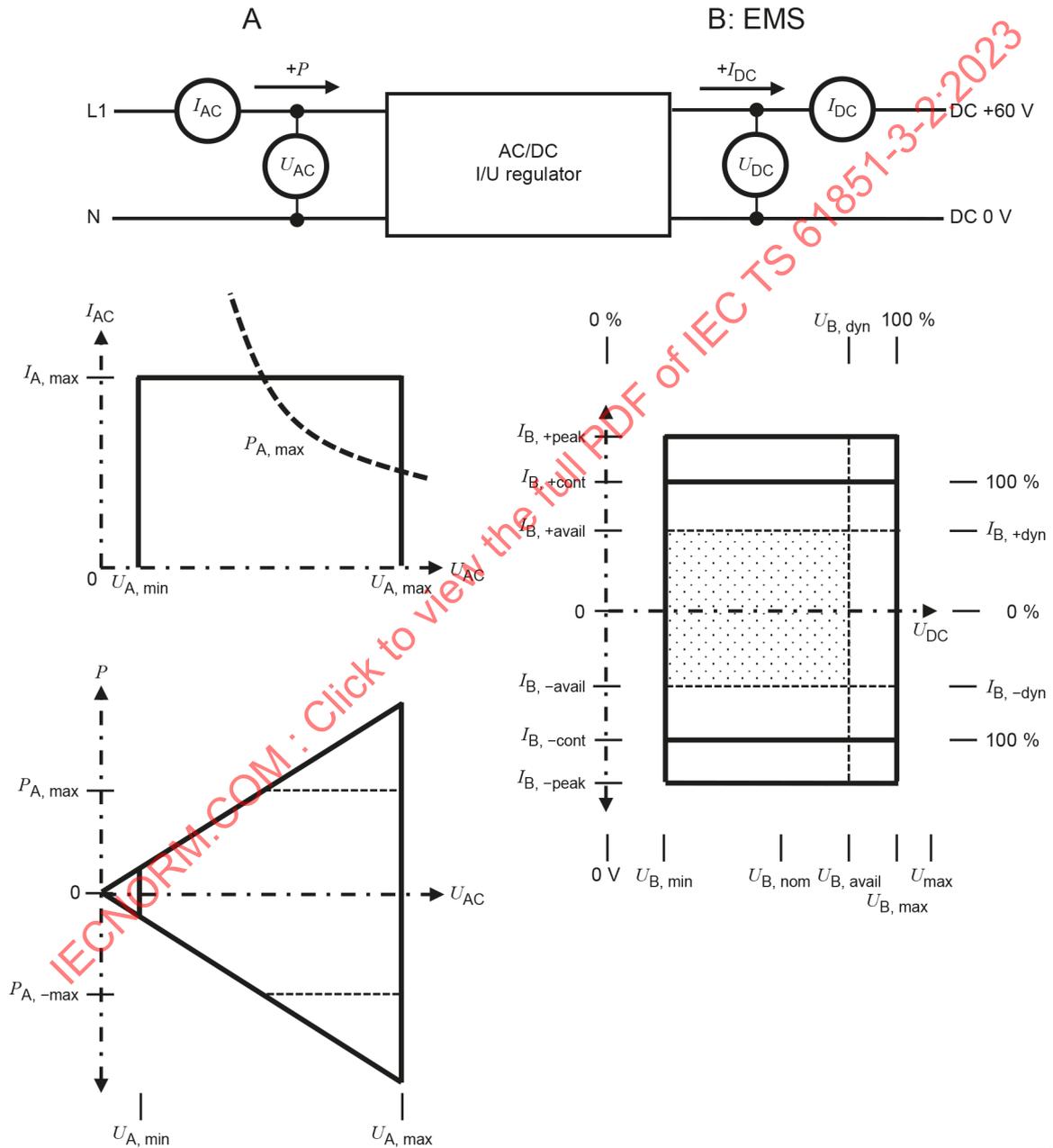
**Figure BB.3 – Built-in DC/DC VCU for removable
battery systems (IEC PAS 62840-3)**

Annex CC (informative)

Current and voltage regulation

CC.1 Current and voltage regulation, AC/DC VCU

Figure CC.1 shows the diagram for current and voltage regulation of an AC/DC VCU.



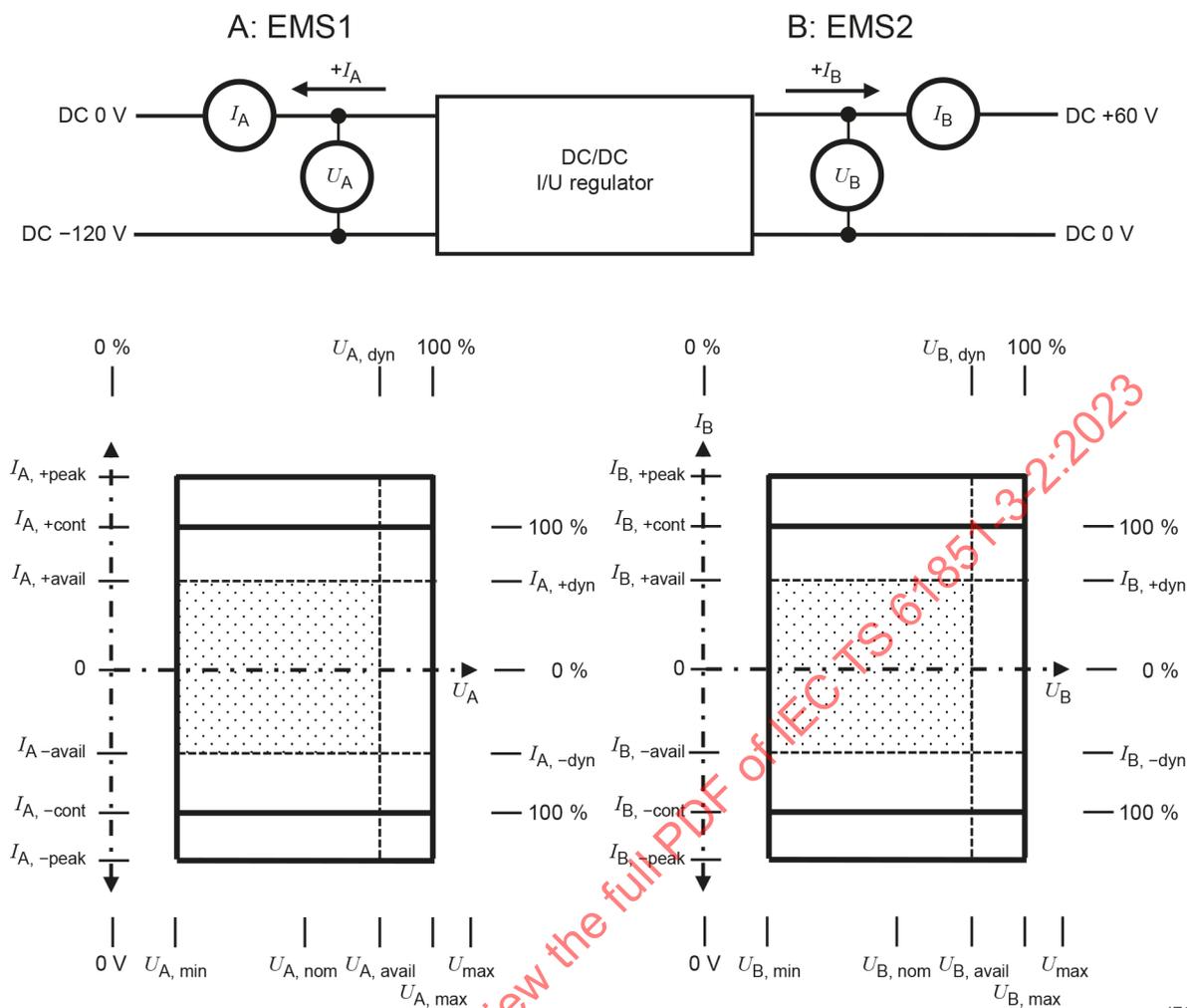
Key	Object ^a [hex]	Document	Description	Category
$U_{A,min}$	60A1	IEC TS 61851-3-6	AC-DC converter minimum AC voltage	optional
$U_{A,max}$	60A2	IEC TS 61851-3-6	AC-DC converter maximum AC voltage	optional
$I_{A,max}$	60A3	IEC TS 61851-3-6	AC-DC converter maximum AC current	optional
$P_{A,max}$	60A4	IEC TS 61851-3-6	AC-DC converter maximum AC power	Optional
	60BE	IEC TS 61851-3-6	AC-DC converter set maximum AC power	Optional
$P_{A,-max}$			Under consideration	
U_{max}	6000	IEC TS 61851-3-5	Supported virtual devices	Mandatory
$U_{B,nom}$	6008	IEC TS 61851-3-5	Device nominal voltage	Mandatory
$U_{B,dyn}$	6020	IEC TS 61851-3-5	Device request dynamic voltage limitation	Mandatory
$I_{B,+dyn}$	6022	IEC TS 61851-3-5	Device request dynamic current input limitation	Mandatory
$I_{B,-dyn}$	6023	IEC TS 61851-3-5	Device request dynamic current output limitation	Mandatory
$I_{B,+cont}$	6024	IEC TS 61851-3-5	Device maximum continuous input current	Mandatory
	604A	IEC TS 61851-3-5	Device set maximum continuous input current	Mandatory
$I_{B,-cont}$	6025	IEC TS 61851-3-5	Device maximum continuous output current	Mandatory
	604B	IEC TS 61851-3-5	Device set maximum continuous output current	Mandatory
$U_{B,max}$	6026	IEC TS 61851-3-5	Device maximum voltage	Mandatory
	6046	IEC TS 61851-3-5	Device set maximum voltage	Mandatory
$U_{B,min}$	6027	IEC TS 61851-3-5	Device minimum voltage	Mandatory
	6047	IEC TS 61851-3-5	Device set minimum voltage	Mandatory
$I_{B,+peak}$	603A	IEC TS 61851-3-5	Device peak input current	Mandatory
	604C	IEC TS 61851-3-5	Device set maximum peak input current	Mandatory
$I_{B,-peak}$	603C	IEC TS 61851-3-5	Device peak output current	Mandatory
	604E	IEC TS 61851-3-5	Device set maximum peak output current	Mandatory
$U_{B,+avail}$	6072	IEC TS 61851-3-5	Device available output voltage	Mandatory
$I_{B,+avail}$	6073	IEC TS 61851-3-5	Device available output current	Mandatory
$I_{B,-avail}$	6074	IEC TS 61851-3-5	Device available input current	Optional
NOTE Further objects for bidirectional AC/DC power transfer are under consideration.				
^a As defined in the IEC 61851-3 series.				

Figure CC.1 – Current and voltage regulation, AC/DC VCU

Compliance shall be tested by measurement on installed equipment in IEC TS 61851-3-1:2023.

CC.2 Current and voltage regulation, DC/DC VCU

Figure CC.2 shows the diagram for current and voltage regulation of a DC/DC VCU.



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Key	Object ^a [hex]	Document	Description	Category
U_{max}	6000	IEC TS 61851-3-5	Supported virtual devices	Mandatory
$U_{A,dyn} / U_{B,dyn}$	6020	IEC TS 61851-3-5	Device request dynamic voltage limitation	Mandatory
$I_{A,+dyn} / I_{B,+dyn}$	6022	IEC TS 61851-3-5	Device request dynamic current input limitation	Mandatory
$I_{A,-dyn} / I_{B,-dyn}$	6023	IEC TS 61851-3-5	Device request dynamic current output limitation	Mandatory
$I_{A,+cont} / I_{B,+cont}$	6024	IEC TS 61851-3-5	Device maximum continuous input current	Mandatory
	604A	IEC TS 61851-3-5	Device set maximum continuous input current	Mandatory
$I_{A,-cont} / I_{B,-cont}$	6025	IEC TS 61851-3-5	Device maximum continuous output current	Mandatory
	604B	IEC TS 61851-3-5	Device set maximum continuous output current	Mandatory
$U_{A,max} / U_{B,max}$	6026	IEC TS 61851-3-5	Device maximum voltage	Mandatory
	6046	IEC TS 61851-3-5	Device set maximum voltage	Mandatory
$U_{A,min} / U_{B,min}$	6027	IEC TS 61851-3-5	Device minimum voltage	Mandatory
	6047	IEC TS 61851-3-5	Device set minimum voltage	Mandatory
$I_{A,+peak} / I_{B,+peak}$	603A	IEC TS 61851-3-5	Device peak input current	Mandatory
	604C	IEC TS 61851-3-5	Device set maximum peak input current	Mandatory

Key	Object ^a [hex]	Document	Description	Category
$I_{A,-peak} / I_{B,-peak}$	603C	IEC TS 61851-3-5	Device peak output current	Mandatory
	604E	IEC TS 61851-3-5	Device set maximum peak output current	Mandatory
$U_{A,avail} / U_{B,avail}$	6072	IEC TS 61851-3-5	Device available output voltage	Mandatory
$I_{A,avail} / I_{B,avail}$	6073	IEC TS 61851-3-5	Device available output current	Mandatory
$I_{B,-avail}$	6074	IEC TS 61851-3-5	Device available input current	Optional

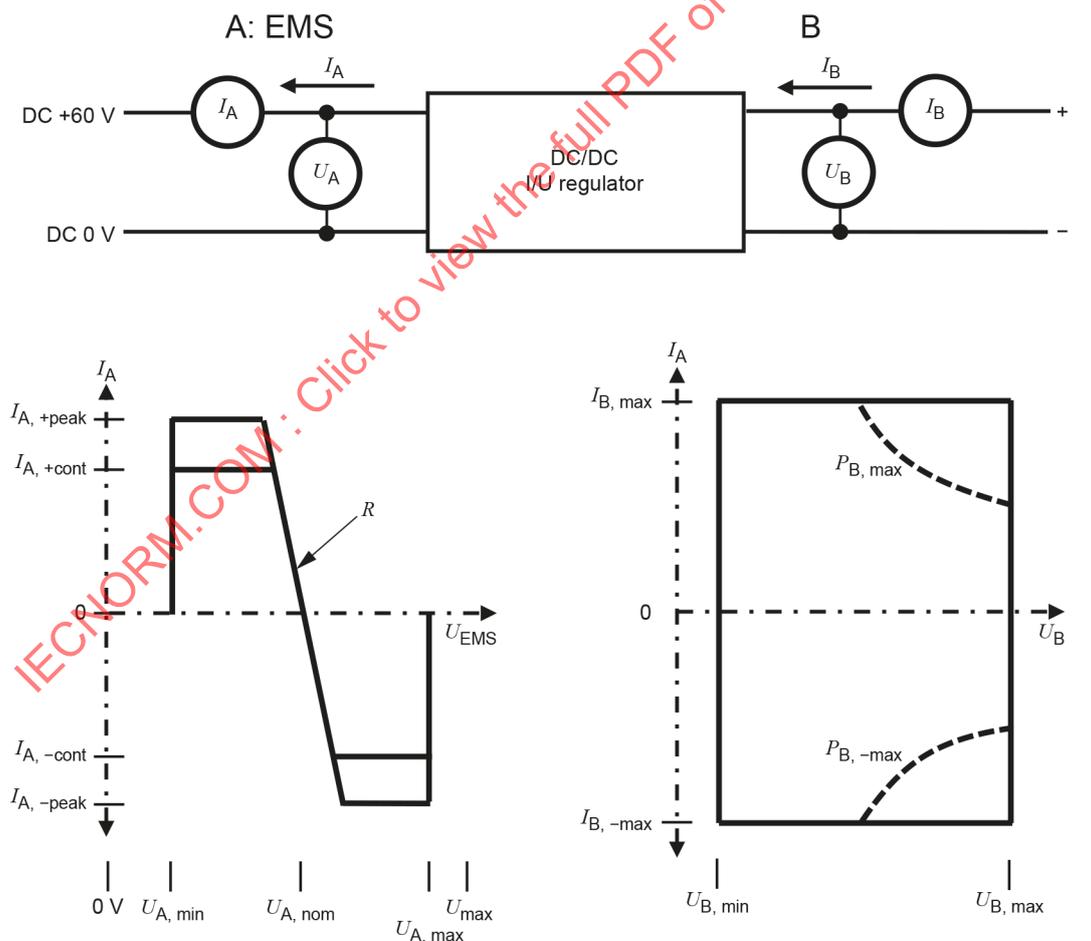
^a As defined in the IEC 61851-3.

Figure CC.2 – Current and voltage regulation, DC/DC VCU

Compliance shall be tested by measurement on installed equipment in IEC TS 61851-3-1:2023.

CC.3 Current and voltage regulation, DC/DC VCU for removable battery systems

Figure CC.3 shows the diagram for current and voltage regulation of a DC/DC VCU for removable battery systems.



Key	Object ^a [hex]	Document	Description	Category
U_{max}	6000	IEC TS 61851-3-5	Supported virtual devices	Mandatory
$U_{A,nom}$	6008	IEC TS 61851-3-5	Device nominal voltage (see IEC PAS 62840-3)	Mandatory
$U_{A,dyn}$	6020	IEC TS 61851-3-5	Device request dynamic voltage limitation	Mandatory
$I_{A,+dyn}$	6022	IEC TS 61851-3-5	Device request dynamic current input limitation	Mandatory
$I_{A,-dyn}$	6023	IEC TS 61851-3-5	Device request dynamic current output limitation	Mandatory
$I_{A,+cont}$	6024	IEC TS 61851-3-5	Device maximum continuous input current	Mandatory
	604A	IEC TS 61851-3-5	Device set maximum continuous input current	Mandatory
$I_{A,-cont}$	6025	IEC TS 61851-3-5	Device maximum continuous output current	Mandatory
	604B	IEC TS 61851-3-5	Device set maximum continuous output current	Mandatory
$U_{A,max}$	6026	IEC TS 61851-3-5	Device maximum voltage	Mandatory
	6046	IEC TS 61851-3-5	Device set maximum voltage	Mandatory
$U_{A,min}$	6027	IEC TS 61851-3-5	Device minimum voltage	Mandatory
	6047	IEC TS 61851-3-5	Device set minimum voltage	Mandatory
$I_{A,+peak}$	603A	IEC TS 61851-3-5	Device peak input current	Mandatory
	604C	IEC TS 61851-3-5	Device set maximum peak input current	Mandatory
$I_{A,-peak}$	603C	IEC TS 61851-3-5	Device peak output current	Mandatory
	604E	IEC TS 61851-3-5	Device set maximum peak output current	Mandatory
$U_{A,avail}$	6072	IEC TS 61851-3-5	Device available output voltage	Mandatory
$I_{A,avail}$	6073	IEC TS 61851-3-5	Device available output current	Mandatory
$I_{B,avail}$	6074	IEC TS 61851-3-5	Device available input current	Optional
$U_{B,min}$			Under consideration	
$U_{B,max}$			Under consideration	
$I_{B,max}$			Under consideration	
$P_{B,max}$			Under consideration	
$P_{A,-max}$			Under consideration	
R	--		Inner resistance, see IEC PAS 62840-3	

NOTE Further objects for removable battery systems are under consideration.

^a As defined in the IEC 61851-3 series.

Figure CC.3 – Current and voltage regulation, DC/DC VCU for removable battery systems

Compliance shall be tested by measurement on installed equipment in IEC TS 61851-3-1:2023.