Prüfbericht-Nr.: *Test report no.*:	**CN24SI7B 001**	**Auftrags-Nr.:** *Order no.*:	244552879	Seite 1 von 92 *Page 1 of 92*
Kunden-Referenz-Nr.: *Client reference no.*:	2444378	**Auftragsdatum:** *Order date:*	2023-11-01	
Auftraggeber: *Client*:	Zhejiang Anfu New Energy Technology Co., Ltd. First Floor, No.1 Building, No. 237, Weisan Road, Economic Development Zone, Yueqing City, Zhejiang, P.R. China			
Prüfgegenstand: *Test item*:	DC EV Charging station			
Bezeichnung / Typ-Nr.: *Identification / Type no.*:	AF-DC-a-b (a=20, 30, 40, 60, 80, 90, 100, 120, 140, 150, 160, 180, 200, 240; b=A, B)			
Auftrags-Inhalt: *Order content*:	TÜV Bauart approval			
Prüfgrundlage: *Test specification*:	EN IEC 61851-1:2019,IEC 61851-1:2017,EN 61851-23:2014,IEC 61851-23:2014,EN 61851-24:2014, IEC 61851-24:2014			

Wareneingangsdatum: *Date of sample receipt*:	2023-10-22
Prüfmuster-Nr.: *Test sample no:*	Engineering sample
Prüfzeitraum: *Testing period*:	2023-10-22 - 2024-03-12
Ort der Prüfung: *Place of testing*:	See page 5
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shanghai) Co., Ltd.
Prüfergebnis*: *Test result**:	Pass

geprüft von:
tested by: Fred Xu

Fred Xu

Datum:
Date: 2024-05-14

genehmigt von:
authorized by: Rafer Xu

Rafer Xu

Ausstellungsdatum:
Issue date: 2024-05-14

Stellung / Position:	PE	**Stellung** / Position:	Authorizer

Sonstiges / *Other*: Partial tests subcontract to CQC-Guochuang Testing Technology (Jiangsu) Co., Ltd. (CNAS L16098), details refer to page 5.

Zustand des Prüfgegenstandes bei Anlieferung: *Condition of the test item at delivery*: Prüfmuster vollständig und unbeschädigt *Test item complete and undamaged*

* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*P(ass) = passed a.m. test specification(s)*	*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Prüfbericht-Nr.: CN24SI7B 001
Test report no.:

Anmerkungen
Remarks

1	Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfkonditionen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden. *The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.*
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3	Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt. *Test clauses with remark of * are subcontracted to qualified subcontractors and descripted under the respective test clause in the report.* *Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.*
4	Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnisen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezueglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019. *The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the “Zero Guard Band Rule” and “Simple Acceptance” in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.*

Test Report issued under the responsibility of:

TÜVRheinland®

TEST REPORT
IEC 61851-1:2017
Electric vehicle conductive charging system
Part 1: General requirements

Report Number. ..... :	**CN24SI7B 001**
Date of issue ..... :	See cover page
Total number of pages ..... :	See cover page
Name of Testing Laboratory preparing the Report ..... :	TÜV Rheinland (Shanghai) Co., Ltd.
Applicant's name ..... :	Zhejiang Anfu New Energy Technology Co., Ltd.
Address ..... :	First Floor, No.1 Building, No. 237, Weisan Road, Economic Development Zone, Yueqing City, Zhejiang, P.R. China
Test specification:	
Standard ..... :	EN IEC 61851-1:2019, IEC 61851-1:2017
Test procedure ..... :	TÜV Bauart approval
Non-standard test method ..... :	N/A
TRF template used ..... :	IECEE OD-2020-F1:2022, Ed.1.5
Test Report Form No. ..... :	IEC61851_1D
Test Report Form(s) Originator .... :	VDE Prüf- und Zertifizierungsinstitut GmbH
Master TRF ..... :	Dated 2023-06-02

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description..... :	DC EV Charging station
Trade Mark..... :	AMPAL
Manufacturer..... :	Same as applicant
Model/Type reference..... :	AF-DC-a-b (a=20, 30, 40, 60, 80, 90, 100, 120, 140, 150, 160, 180, 200, 240; b=A, B)
Ratings..... :	See model list.

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s): N/A			
☐	**CB Testing Laboratory:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address.....:			
Tested by (name + signature) .....:			
Witnessed by (name, function, signature)..:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Witnessed by (name, function, signature)..:			
Approved by (name, function, signature)...:			
Supervised by (name, function, signature) :			

List of Attachments (including a total number of pages in each attachment):
Attachment 1: EN 61851-24:2014 test report (41 pages)
Attachment 2 Photo documentation (12 pages)
Attachment 3: CDF (7 pages)

Summary of testing:

Tests performed (name of test, test clause and date test performed):

Test clause	Test item	Test date Y/M/D
6.3	Functions provided in Mode 2, 3 and 4	2024-01-05
12.4	IP degrees	2024-01-31~2024-02-01
12.5	Insulation resistance	2024-01-22
12.6	Touch current	2024-01-22
12.7.1	AC withstand voltage	2024-01-22
12.7.2	Impulse dielectric withstand test	2024-01-22
12.8	Temperature rise	2023-12-27~2023-12-29
12.9	Damp heat functional test	2024-01-12~2024-01-22
12.10	Minimum temperature functional test	2024-01-23~2024-01-24
12.11	Mechanical strength	2024-01-11

8.2.2	Loss of supply voltage to permanently connected EV supply equipment	2024-01-04
12.3	Clearances and creepage distances	2024-01-04
16.5	Durability test for marking	2024-01-22

All tests are conducted on model AF-DC-240-B for representative.

Testing location: (CBTL, SPTL, CTF, Subcontractor)

CQC-Guochuang Testing Technology (Jiangsu) Co., Ltd.
No.67-1 Fuyang Road, Tianning District, Changzhou City, Jiangsu Province, P.R. China.

TUV Rheinland (Shanghai) Co., Ltd.
No.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China.

Summary of compliance with National Differences (List of countries addressed):

No EU Group Differences.

☒ **The product fulfils the requirements of EN IEC 61851-1:2019, IEC 61851-1:2017.**

Use of uncertainty of measurement for decisions on conformity (decision rule):

☒ No decision rule is specified by the IEC standard, when comparing the measurement result with the applicable limit according to the specification in that standard. The decisions on conformity are made without applying the measurement uncertainty ("simple acceptance" decision rule, previously known as "accuracy method").

☐ Other: … (to be specified, for example when required by the standard or client, or if national accreditation requirements apply)

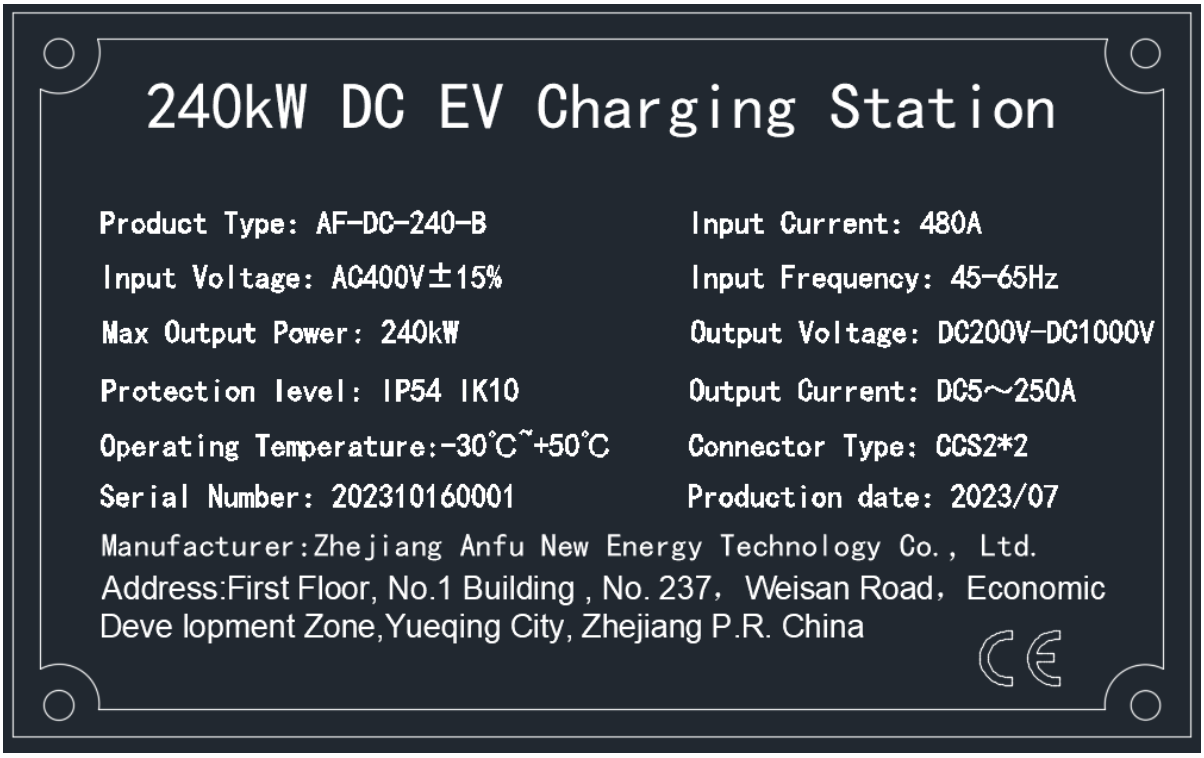
Information on uncertainty of measurement:
The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.
IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

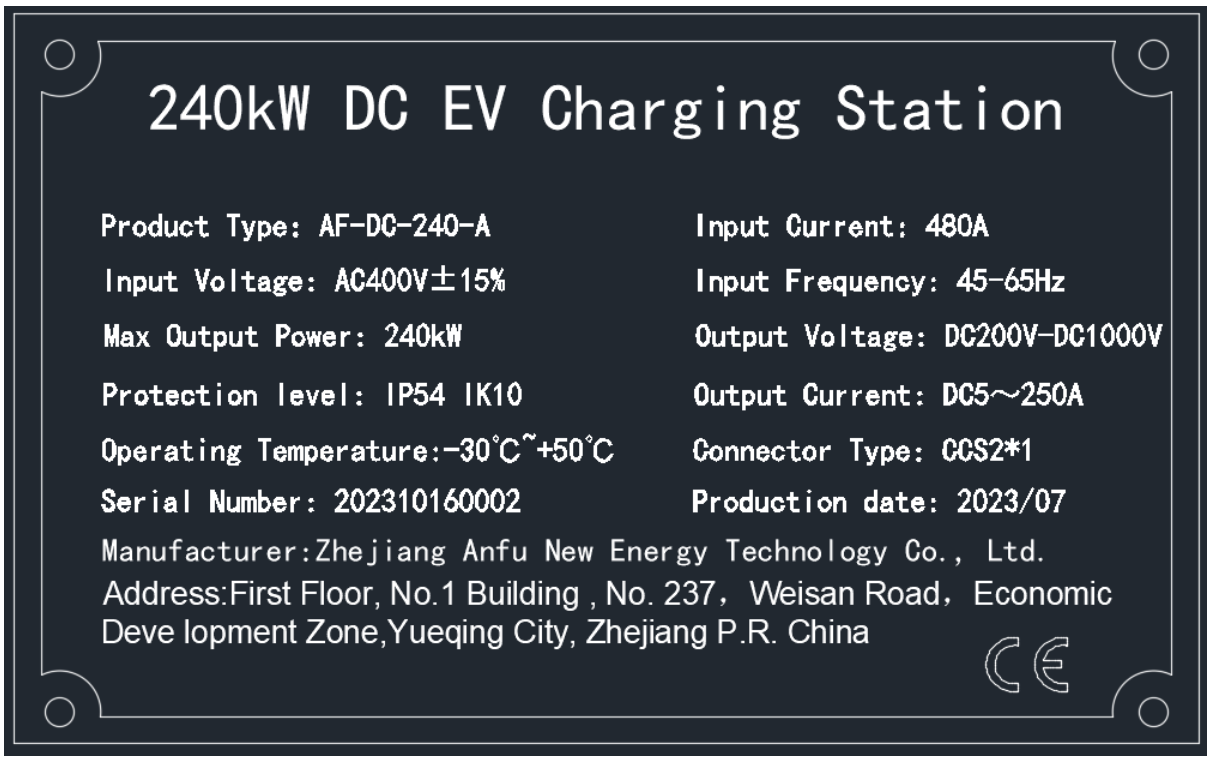
Calculations leading to the reported values are on file with the NCB and testing laboratory that conducted the testing.

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

Models AF-DC-240-A, AF-DC-240-B as representative.



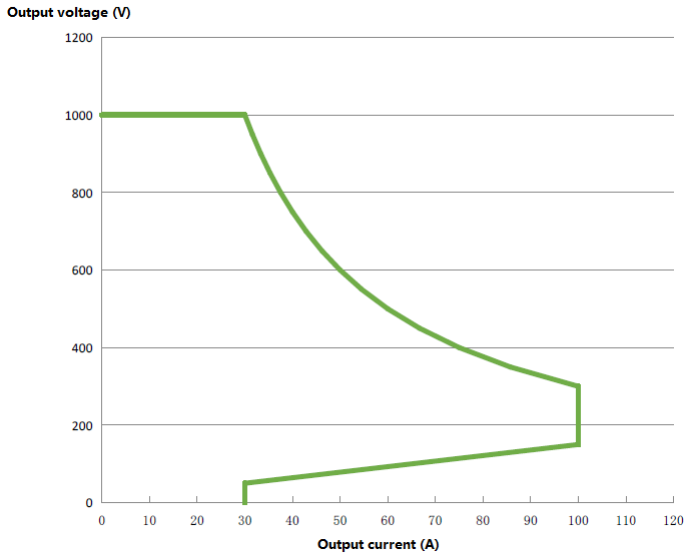


Test item particulars .....:	
Equipment mobility.....:	☐ movable ☐ hand-held ☐ transportable ☒ stationary ☐ for building-in ☐ direct plug-in
Connection to the mains.....:	☐ pluggable equipment ☐ type A ☐ type B ☒ permanent connection ☐ detachable power supply cord ☐ non-detachable power supply cord ☐ not directly connected to the mains
EV charging modes.....:	☐ Mode 1 charging ☐ Mode 2 charging ☐ Mode 3 charging ☒ Mode 4 charging
Type of EV connection .....:	☐ Case A ☐ Case B ☒ Case C
Access location .....:	☒ operator accessible ☐ service access area ☐ restricted access location
Over voltage category (OVC) .....:	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV ☐ other:
Mains supply tolerance (%) or absolute mains supply values .....:	±15%
Tested for IT power systems .....:	☐ Yes ☒ No
IT testing, phase-phase voltage (V) .....:	N/A
Class of equipment .....:	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Considered current rating (A) .....:	See model list
Pollution degree (PD) .....:	☐ PD 1 ☒ PD 2(internal) ☒ PD 3(external)
IP protection class .....:	IP54
Altitude during operation (m) .....:	<2000
Altitude of test laboratory (m) .....:	≤500
Mass of equipment (kg) .....:	See model list
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing .....:	
Date of receipt of test item.....:	See cover page
Date (s) of performance of tests .....:	See cover page

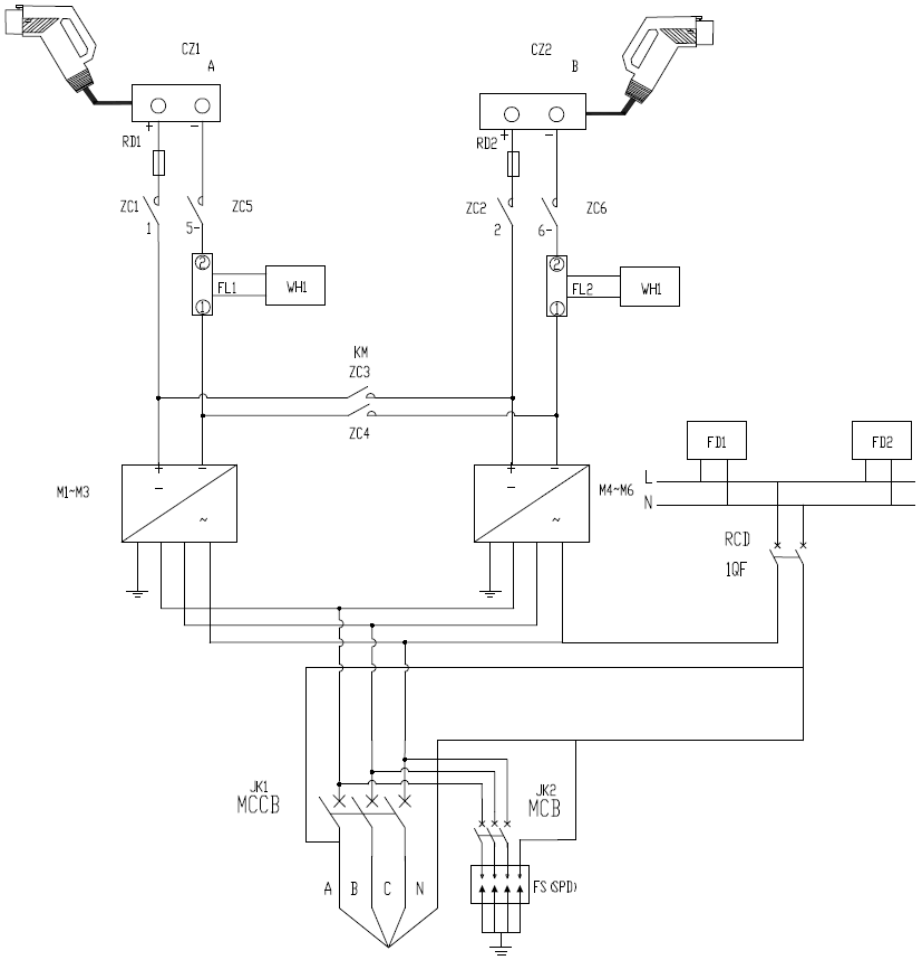
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)..... : Same as applicant	

General product information and other remarks:

This series DC Charger is configurated with maximum 240kW output power which highest output voltage can be up to 1000Vdc. It may contain one or two vehicle connectors. When it is configurated with two connectors, the connectors can output independently of each other at the same time and use different control circuits. When two DC circuits are output at the same time, the total maximum DC output power is the rated output power. The electrical structure and enclosure of the models are basically the same. The only difference is the quantity of power module. The 30kW power module's output power characteristic is showed below.



System diagram:



Model list

Model	Rated input	Rated Output	Mass (kg)	Quantity of module
AF-DC-240-A AF-DC-240-B	AC400V±15%, 480A	DC200~1000V, DC5~250A, 240kW	420	8
AF-DC-200-A AF-DC-200-B	AC400V±15%, 400A	DC200~1000V, DC5~250A, 200kW	420	8
AF-DC-180-A AF-DC-180-B	AC400V±15%, 360A	DC200~1000V, DC5~250A, 180kW	360	6
AF-DC-160-A AF-DC-160-B	AC400V±15%, 320A	DC200~1000V, DC5~250A, 160kW	360	6
AF-DC-150-A AF-DC-150-B	AC400V±15%, 300A	DC200~1000V, DC5~250A, 150kW	360	6
AF-DC-140-A AF-DC-140-B	AC400V±15%, 280A	DC200~1000V, DC5~250A, 140kW	360	6
AF-DC-120-A AF-DC-120-B	AC400V±15%, 240A	DC200~1000V, DC5~250A, 120kW	330	4
AF-DC-100-A AF-DC-100-B	AC400V±15%, 200A	DC200~1000V, DC5~250A, 100kW	330	4
AF-DC-90-A AF-DC-90-B	AC400V±15%, 180A	DC200~1000V, DC5~250A, 90kW	330	4
AF-DC-80-A AF-DC-80-B	AC400V±15%, 160A	DC200~1000V, DC5~200A, 80kW	290	4
AF-DC-60-A AF-DC-60-B	AC400V±15%, 120A	DC200~1000V, DC5~200A, 60kW	290	2

AF-DC-40-A AF-DC-40-B	AC400V±15%, 80A	DC200~1000V, DC5~150A, 40kW	200	2
AF-DC-30-A AF-DC-30-B	AC400V±15%, 60A	DC200~1000V, DC5~133A, 30kW	200	2
AF-DC-20-A AF-DC-20-B	AC400V±15%, 40A	DC200~1000V, DC5~100A, 20kW	200	2

SPECIFICATIONS		
Input parameter		See model list
Output parameter		See model list
Classification of Use		☒ indoor ☒ outdoor
Output connector interface type		CCS2
Power Supply system		☒ TN-S ☒ TN-C ☒ TN-C-S ☒ TT ☐ IT
Number of Phase		☐ Single-phase ☒ Three-phase
EV charging mode		Mode 4
EV Connection type		Case C
IP Code		IP54
Pollution degree		PD 3(Outside), PD 2(Inside)
Overvoltage category		OVC III
Ambient Temperature (operating)		-30°C to +50ºC
Ambient Temperature (Storage)		-40°C to +85ºC
Altitude (m)		<2000
Other specific environmental conditions		N/A
Overall dimensions(mm*mm*mm)		1800mm*800mm*600(H*W*D)
Mass(kg)		See model list
RCD type	External required	☐ Type A mA ☐ Type B mA
	Built-in	☒ Type A 30mA ☐Type B 30mA AC smooth 6 mA DC

IEC 61851-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	**GENERAL REQUIREMENTS**		P
	The EV supply equipment shall be so constructed that an EV can be connected to the EV supply equipment so that in normal conditions of use, the energy transfer operates safely, and its performance is reliable and minimises the risk of danger to the user or surroundings.		P
	Unless otherwise stated all tests indicated in this document are type tests.		P
	Unless otherwise stated, all tests required by this standard may be conducted on separate samples.		P
	Unless otherwise stated, each test is conducted once.		P
	Unless otherwise specified, all tests shall be carried out in a draught-free location and at an ambient temperature of 20°± 5 °C.		P
	The EV supply equipment shall be rated for one or more of standard nominal voltages and frequencies as given in IEC 60038.		P
	Assemblies for EV supply equipment shall comply with IEC TS 61439-7 with the exceptions or additions as indicated in Clause 13.		N/A
	The standard applies to equipment that is designed to be used at an altitude up to 2 000 m.		P
	For equipment designed to be used at altitudes above 2 000 m, it is necessary to take into account the reduction of the dielectric strength and the cooling effect of the air.	≤2000m	N/A
5	**CLASSIFICATION**		**P**
5.1.1	**Characteristics of power supply input**		P
	The EV supply equipment shall be classified according to the supply network system that it is intended to be connected to:		P
	– EV supply equipment connected to AC supply network;		P
	– EV supply equipment connected to DC supply network.		N/A
	The EV supply equipment shall be classified according to the electric connection method:		P
	– Plug and cable connected;		N/A
	– Permanently connected.		P
5.1.2	**Characteristics of power supply output**		P
	The EV supply equipment shall be classified according to the type of current the EV supply equipment delivers:		P

IEC 61851-1			
Clause	Requirement + Test	Result - Remark	Verdict
	– AC EV supply equipment;		N/A
	– DC EV supply equipment;		P
	– AC and/or DC EV supply equipment.		N/A
5.2	**Normal environmental conditions**		—
	The EV supply equipment shall be classified according to the environmental conditions and use:		P
	– indoor use;		P
	– Outdoor use.	IP54	P
5.3	**Special environmental conditions**		—
	The EV supply equipment may be classified according to their suitability for use in special environmental conditions other than those specified in this document, if declared so by the manufacturer.		N/A
5.4	**Access**		—
	The EV supply equipment shall be classified according to the location they are intended for:		P
	– equipment for locations with restricted access;		N/A
	– equipment for locations with non-restricted access.		P
5.5	**Mounting method**		—
	The EV supply equipment shall be classified according to the type of mounting:		P
	a) stationary equipment;		P
	– mounted on walls, poles or equivalent positions:		N/A
	•flush mounted;		N/A
	•surface mounted.		N/A
	– pole/column/pipe-mounted		N/A
	– floor mounted		P
	– ground mounted.		P
	b) non stationary equipment		N/A
	– portable equipment;		N/A
	– mobile equipment.		N/A
5.6	**Protection against electric shock**		—
	The equipment shall be classified according to the protection against electric shock:		P
	– class I equipment;		P
	– class II equipment;		N/A

IEC 61851-1			
Clause	Requirement + Test	Result - Remark	Verdict
	– class III equipment.		N/A
5.7	**Charging modes**		**—**
	The EV supply equipment shall be classified according to 6.2:		P
	Mode 1, Mode 2, Mode 3 or Mode 4	Mode 4	P
6	**CHARGING MODES AND FUNCTIONS**		**P**
6.1	**General**		**—**
	Clause 6 describes the different charging modes and functions for energy transfer to EVs.		P
6.2	**Charging Modes**		**—**
6.2.1	**Mode 1**		N/A
	Mode 1 is a method for the connection of an EV to a standard socket-outlet of an AC supply network, utilizing a cable and plug, both of which are not fitted with any supplementary pilot or auxiliary contacts.		N/A
	The rated values for current and voltage shall not exceed:		N/A
	– 16 A and 250 V AC, single-phase,		N/A
	– 16 A and 480 V AC, three-phase.		N/A
	EV supply equipment intended for Mode 1 charging shall provide a protective earthing conductor from the standard plug to the vehicle connector.		N/A
6.2.2	**Mode 2**		N/A
	Mode 2 is a method for the connection of an EV to a standard socket-outlet of an AC supply network utilizing an AC EV supply equipment with a cable and plug, with a control pilot function and system for personal protection against electric shock placed between the standard plug and the EV.		N/A
	The rated values for current and voltage shall not exceed:		N/A
	– 32 A and 250 V AC single-phase;		N/A
	– 32 A and 480 V AC three-phase.		N/A
	Current limitations are also subject to the standard socket-outlet ratings described in 9.2.		N/A
	EV supply equipment intended for Mode 2 charging shall provide a protective earthing conductor from the standard plug to the vehicle connector.		N/A
	Mode 2 equipment that is destined to be mounted on a wall but is detachable by the user, or to be used in a shock resistant enclosure shall use		N/A

IEC 61851-1			
Clause	Requirement + Test	Result - Remark	Verdict
	protection equipment as required by IEC 62752.		
6.2.3	**Mode 3**		N/A
	Mode 3 is a method for the connection of an EV to an AC EV supply equipment permanently connected to an AC supply network, with a control pilot function that extends from the AC EV supply equipment to the EV.		N/A
	EV supply equipment intended for Mode 3 charging shall provide a protective earthing conductor to the EV socket-outlet and/or to the vehicle connector.		N/A
6.2.4	**Mode 4**		P
	Mode 4 is a method for the connection of an EV to an AC or DC supply network utilizing a DC EV supply equipment, with a control pilot function that extends from the DC EV supply equipment to the EV.		P
	Mode 4 equipment may be either permanently connected or connected by a cable and plug to the supply network.	Permanently connected.	P
	EV supply equipment intended for Mode 4 charging shall provide a protective earthing conductor or protective conductor to the vehicle connector.		P
6.3	**Functions provided in Mode 2, 3 and 4**		—
6.3.1	**Mandatory functions in Modes 2, 3, and 4**		P
6.3.1.1	**General**		P
	The following control pilot functions shall be provided by the EV supply equipment:		P
	•Continuous continuity checking of the protective conductor according to 6.3.1.2;		P
	•Verification that the EV is properly connected to the EV supply equipment according to 6.3.1.3;		P
	•Energization of the power supply to the EV according to 6.3.1.4;		P
	•De-energization of the power supply to the EV according to 6.3.1.5;		P
	•Maximum allowable current according to 6.3.1.6.		P
	If EV supply equipment can supply more than one vehicle simultaneously, it shall ensure that the control pilot function performs the above functions independently at each connecting point.		P
	EV supply equipment designed for Mode 2 or Mode 3, using the control pilot conductor and utilizing accessories according to IEC 62196-2, shall be provided with control pilot function		N/A

IEC 61851-1			
Clause	Requirement + Test	Result - Remark	Verdict
	according to Annex A.		
6.3.1.2	**Continuous continuity checking of the protective conductor**		P
	While charging in Mode 2, the electrical continuity of the protective earthing conductor between the ICCB and the respective EV contact shall be continuously monitored by the ICCB.	Mode 4	N/A
	While charging in Mode 3, the electrical continuity of the protective earthing conductor between the EV charging station and the respective EV contact shall be continuously monitored by the EV supply equipment.		N/A
	While charging in Mode 4, the electrical continuity of the protective conductor between the EV charging station and the respective EV contact shall be continuously monitored by the EV supply equipment.		P
	The EV supply equipment shall disconnect the supply to the EV in case of:		P
	•loss of electrical continuity of the protective conductor (i.e. open control pilot circuit), within 100 ms.		P
	•incapacity to verify the continuity of the protective conductor (e.g. short circuit between pilot wire and protective conductor), within 3 s.		P
6.3.1.3	**Verification that the EV is properly connected to the EV supply equipment**		P
	The EV supply equipment shall be able to determine that the EV is properly connected to the EV supply equipment.		P
6.3.1.4	**Energization of the power supply to the EV**		P
	The EV socket-outlet or the vehicle connector shall not be energized unless the control pilot function between EV supply equipment and EV has been established correctly with signal states allowing energization.		P
	The presence of such states does not imply that energy will be transferred between the EV supply equipment and the EV as this may be subject to other external conditions, e.g. energy management system.	.	P
	If the EV requests ventilation, the EV supply equipment shall only energize the system if such ventilation is provided by the installation or the premises.		N/A
6.3.1.5	**De-energization of the power supply to the EV**		P

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Clause	Requirement + Test	Result - Remark	Verdict
	If the control pilot signal is interrupted the power supply to the EV shall be interrupted according to 6.3.1.2.		P
	If the control pilot signal status no longer allows energization, the power supply to the EV shall be interrupted but the control pilot signalling may remain in operation.		P
6.3.1.6	**Maximum allowable current**		P
	A means shall be provided to inform the EV of the value of the maximum current it is allowed to draw. The value of the maximum current permitted shall be transmitted and shall not exceed any of the following:		P
	•the rated output current of the EV supply equipment,		P
	•the rated current of the cable assembly.		P
	The transmitted value may change, without exceeding the maximum allowed current, to adapt to power limitations, e.g. for load management.		P
	The EV supply equipment may interrupt the energy supply if the current drawn by the EV exceeds the transmitted value.		P
6.3.2	**Optional functions for Modes 2, 3 and 4**		P
6.3.2.1	**General**		P
	The optional functions that are implemented shall be indicated in the manual and shall fulfil the requirements of 6.3.2.		P
6.3.2.2	**Ventilation during supply of energy**		N/A
	EV supply equipment can exchange information with installation regarding the request and presence for ventilation.	.	N/A
6.3.2.3	**Intentional and unintentional disconnection of the vehicle connector and/or the EV plug**		P
	A mechanical or electromechanical means shall be provided to prevent intentional and unintentional disconnection under load of the vehicle connector and/or plug according to IEC 62196-1.	Approved connector used.	P
6.3.2.4	**Mode 4 using the combined charging system**		P
	The combined charging system as described in Annex CC of IEC 61851-23:2014 and ISO 17409 shall be so designed that:		P
	•AC chargeable EVs with a basic vehicle inlet do not require any means to protect the EV against DC voltage at the inlet.		N/A
	•AC EV supply equipment does not require any		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	means to be self-protected against DC voltage coming from the EV.		
	For DC charging, digital communication shall be established between the vehicle and the DC EV charging station that validates the DC energy transfer.		P
	The DC supply to the vehicle shall not be connected until such complete validation from the vehicle is achieved.		P
	A combined interface extends the use of a basic interface for AC and DC charging.		N/A
	DC charging can be achieved by using separate and additional DC power contacts to supply DC energy to the EV or by using power contacts placed at the position of the AC power contacts of a basic interface, if the vehicle connector and the vehicle inlet are both suitable for DC.		N/A
	The basic portion of the combined vehicle inlet can be used with a basic connector for AC charging only or with a combined connector having separate contacts for AC or DC charging.		N/A
	AC and DC power transfer shall not occur through the combined interface at the same time.		N/A
	Analysis and design of the EV supply equipment using a basic interface for DC shall apply a risk analysis according to IEC 61508 (all parts) applying a severity level of at least S2 for the function preventing the risk of unintended DC voltage output.		N/A
7	**COMMUNICATIONS**		P
7.1	**Digital communication between the EV supply equipment and the EV**		—
	Digital communication is optional for Modes 1, 2 and 3	Model 4	N/A
	For Mode 4 the digital communication as described in IEC 61851-24 shall be provided to allow the EV to control the EV supply equipment.		P
7.2	**Digital communication between the EV supply equipment and the management system**		—
	Telecommunication network or telecommunication port of the EV supply equipment, connected to the telecommunication network, if any, shall comply with the requirements for connection to telecommunication networks according to Clause 6 of IEC 60950-1:2005.		N/A
8	**PROTECTION AGAINST ELECTRIC SHOCK**		P

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Clause	Requirement + Test	Result - Remark	Verdict
8.1	**Degrees of protection against access to hazardous-live-parts**		—
	The different parts of the EV supply equipment as mentioned shall fulfil the following requirements:		P
	•IP ratings for enclosures shall be at least IPXXC;	IP54C	P
	•vehicle connector when mated with vehicle inlet: IPXXD;		P
	•plug mated with socket-outlet: IPXXD;		N/A
	•vehicle connector intended for Mode 1 use, not mated: IPXXD;		N/A
	•vehicle connector intended for Mode 2 use, not mated: IPXXB and fulfilling the following:		N/A
	Minimum opening of the contact equal to the clearance according to IEC 60664-1 considering overvoltage category 2 (e.g. the value given in IEC 60664-1 for 230 V/400 V is 2,5 kV rated impulse voltage withstand that implies 1,5 mm separation of contacts) and inhibits the charging and warns the user in case of welded contact.		N/A
	•vehicle connector and EV socket-outlet intended for Mode 3 use, not mated: IPXXB provided it is associated directly upstream with a mechanical switching device (see also 12.3) and fulfilling one of the following:		N/A
	a) minimum opening of the contact equal to the clearance according to IEC 60664-1 considering overvoltage category 3 (e.g. the value given in IEC 60664-1 for 230 V/400 V is 4 kV rated impulse voltage withstand that implies at least 3 mm separation of contacts);		N/A
	b) presence of monitoring of the switching contacts associated with a means to operate another mechanical switching device providing isolating function upstream the above in case of fault of operation of the switching device upstream the accessory;		N/A
	c) presence of shutters on live entry hole of the socket-outlets or connectors for case C.		N/A
8.2	**Stored energy**		—
8.2.1	**Disconnection of plug connected EV supply equipment Disconnection of plug connected EV supply equipment**		N/A
	For plug connected EV supply equipment, where the connection pins are accessible after unplugging, one second after disconnecting the standard plug from the standard socket-outlet, the voltage between any combination of accessible contacts of the standard plug shall be less than or equal to 60 V DC or the stored charge available	Permanently connected	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	shall be less than 50 µC.		
8.2.2	**Loss of supply voltage to permanently connected EV supply equipment**		P
	The voltage between power lines or power lines and protective earthing conductor, when measured at the input supply terminals of the EV supply equipment, shall be less than or equal to 60 V DC or the stored energy shall be less than or equal to 0,2 J within 5 seconds after disconnecting the power supply voltage to the EV supply equipment.	0V,0J	P
8.3	**Fault protection**		—
	Fault protection shall consist of one or more protective measures as permitted according to IEC 60364-4-41:		P
	•automatic disconnection of supply;		P
	•double or reinforced insulation;		P
	•electrical separation if limited to the supply of one item of current-using equipment;		N/A
	•extra low-voltage (SELV and PELV).		P
	Electric separation is fulfilled if there is one electrically separated circuit for each EV.		P
8.4	**Protective conductor**		—
	The protective earthing conductor and the protective conductor shall be of sufficient rating in accordance with requirements of IEC TS 61439-7.		P
	For Modes 1, 2 and 3, a protective earthing conductor shall be provided between the AC supply input earthing terminal of the EV supply equipment and the EV.		N/A
	Mode 4 EV supply equipment shall provide either:		P
	a) a protective earthing conductor from the input earthing terminal of the AC supply network to the EV or		P
	b) a protective conductor from the EV supply equipment to the EV if fault protection is based on electric separation.		N/A
	For Modes 3 and 4 permanently connected EV supply equipment, protective earthing conductors shall not be switched.		P
8.5	**Residual current protective devices**		—
	EV supply equipment can have one or more connecting points to supply energy to EVs.		P
	Where connecting points can be used		P

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Clause	Requirement + Test	Result - Remark	Verdict
	simultaneously and are connected to a common input terminal of the EV supply equipment, they shall have individual protection incorporated in the EV supply equipment.		
	If the EV supply equipment has more than one connecting point that cannot be used simultaneously then such connecting points can have common protection devices.		N/A
	EV supply equipment that includes an RCD and that does not use the protective measure of electrical separation shall comply with the following:		P
	•The connecting point of the EV supply equipment shall be protected by an RCD having a rated residual operating current not exceeding 30 mA;		P
	•RCD(s) protecting connecting points shall be at least type A;		P
	•RCDs shall comply with one of the following standards: IEC 61008-1, IEC 61009-1, IEC 60947-2 and IEC 62423;		P
	•RCDs shall disconnect all live conductors.		P
	Where the EV supply equipment is equipped with a socket-outlet or vehicle connector for AC use in accordance with IEC 62196 (all parts), protective measures against DC fault current shall be taken. The appropriate measures shall be:		N/A
	•RCD type B or		N/A
	•RCD Type A and appropriate equipment that ensures the disconnection of the supply in case of DC fault current above 6 mA.		N/A
8.6	**Safety requirements for signalling circuits between the EV supply equipment and the EV**		—
	Any circuit for signalling, which extends beyond the EV supply equipment enclosure for connection with the EV (e.g. control pilot circuit), shall be extra low voltage (SELV or PELV) according to IEC 60364-4-41.		P
8.7	**Isolating transformers**		—
	Isolating transformers (excluding safety isolating transformers used for signalling) shall comply with the requirements of IEC 61558-1 and IEC 61558-2-4.		P
9	**CONDUCTIVE ELECTRICAL INTERFACE REQUIREMENTS**		P
9.1	**General**		—
	Clause 9 provides a description of the conductive electrical interface requirements.		P
9.2	**Functional description of standard accessories**		—

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Clause	Requirement + Test	Result - Remark	Verdict
	Standard accessories used for EV supply equipment shall be in accordance with IEC 60309-1, IEC 60309-2 or IEC 60884-1 or the national standard.		N/A
	Standard accessories that are intermateable with interfaces described in the IEC 60320 series shall not be used for EV supply equipment.		N/A
	Socket-outlets and plugs designed for household and similar use might not be designed for extended current draw or continuous use at maximum rated currents and might be subject to national regulations and standards for supply of energy to an EV.		N/A
9.3	**Functional description of the basic interface**		—
	General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1. The basic interface is specified in 6.5 of IEC 62196-1:2014.		N/A
	The following contacts are indicated:		N/A
	•up to three phases (L1, L2, L3);		N/A
	•neutral (N);		N/A
	•protective conductor (PE);		N/A
	•control pilot (CP);		N/A
	•proximity contact (PP).		N/A
	It may be used either for single-phase or for three-phase or both.		N/A
	Ratings and requirements for the use of the basic interface shall be in accordance with the requirements specified in IEC 62196-2.		N/A
9.4	**Functional description of the universal interface**		—
	General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1. The universal interface is specified in 6.4 and Table 2 of IEC 62196-1:2014.		N/A
9.5	**Functional description of the DC interface**		—
	General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1. The DC interface, configurations and ratings are specified in 6.6 and Table 4 of IEC 62196-1:2014. Ratings and requirements for the use of DC interface shall be in accordance with the requirements specified in IEC 62196-3.		P
9.6	**Functional description of the combined interface**		—

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Clause	Requirement + Test	Result - Remark	Verdict
	The combined interface is specified in 6.7 and Table 5 of IEC 62196-1:2014. General requirements and ratings shall be in accordance with the requirements specified in IEC 62196-1. Ratings and requirements for the use of the combined interface with alternating current shall be in accordance with the requirements specified in IEC 62196-2. Ratings and requirements for the use of the combined interface with direct current shall be in accordance with the requirements specified in IEC 62196-3.		N/A
9.7	**Wiring of the neutral conductor**		**—**
	Where accessories according to IEC 62196 are used for three phase supply the neutral conductor shall always be wired to the accessories.		N/A
	Where accessories according to IEC 62196 are used for single phase supply, the terminals L (L1) and N (Neutral) shall always be wired.		N/A
10	**REQUIREMENTS FOR ADAPTORS**		N/A
	Vehicle adaptors shall not be used to connect a vehicle connector to a vehicle inlet.		N/A
	Adaptors between the EV socket-outlet and the EV plug shall only be used if specifically designated and approved by the vehicle manufacturer or by the EV supply equipment manufacturer and in accordance with national requirements, if any (see 16.2).		N/A
	Such adaptors shall comply with the requirements of this standard, and the other relevant standards governing either the EV plug or EV socket-outlet portions of the adaptor.		N/A
	The adaptors shall be marked to indicate the specific conditions of use allowed by the manufacturer, e.g. IEC 62196 series.		N/A
	Such adaptors shall not allow transitions from one mode to another.		N/A
11	**CABLE ASSEMBLY REQUIREMENTS**		P
11.1	**General**		**—**
	The cable assembly shall be provided with a cable that is suitable for the application.	Approved cable used.	P
	Cable assemblies shall not allow transitions from one mode to another. This does not concern Mode 2 cable assembles that are constructed according to IEC 62752.		P
11.2	**Electrical rating**		**—**

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Clause	Requirement + Test	Result - Remark	Verdict
	For case C, the voltage and current ratings of the cable assembly shall be compatible with the rating of the EV supply equipment.		P
	For accessories requiring current coding according to Annex B and IEC 62196-2, the maximum value of the current coding as indicated in Clause B.2 shall be in accordance with the current rating of the cable assembly.		P
	Cables used with accessories according to IEC 62196-2 for Mode 3 case B, shall have a minimum withstand I^2t value of 75 000 A^2s.		N/A
11.3	**Dielectric withstand characteristics**		—
	Dielectric withstand characteristics of the cable assembly shall be as indicated for the EV supply equipment in 12.7.		P
	For Class I equipment: between live part and earth with test voltage for Class I equipment;		P
	For Class II equipment: between live part and exposed conductive parts with test voltage for Class II equipment.		N/A
11.4	**Construction requirements**		—
	A cable assembly shall be so constructed that it cannot be used as a cord extension set.		P
	A cable assembly may include one or more cables, which may be in a flexible tube, conduit or wire way.		P
	The cable may be fitted with an earth-connected metal shielding.		P
	The cable insulation shall be wear resistant and maintain flexibility over the full temperature range required by the classification of the EV supply equipment.		P
11.5	**Cable dimensions**		—
	The maximum cable length shall be in accordance with the national codes if any.		P
11.6	**Strain relief**		—
	The strain relief of the cable in the vehicle connector, EV plug or in the standard plug shall be as specified in the relevant product standard (e.g. IEC 62196-1, IEC 60309-1 or IEC 60884-1).		P
	For case C the strain relief at the EV supply equipment shall be in accordance with the requirements in IEC 62196-1.		P
11.7	**Cable management and storage means for cables assemblies**		—

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Clause	Requirement + Test	Result - Remark	Verdict
	For case C EV supply equipment, a storage means shall be provided for the vehicle connector when not in use.		P
	For case C EV supply equipment the lowest point of the vehicle connector when stored shall be located at a height between 0,5 m and 1,5 m above ground level.		P
	For case C EV charging stations with cables of more than 7,5 m, a cable management system shall be provided. The free cable length shall not exceed 7,5 m when not in use.	Cable length is 5m.	N/A
	Prevention of overheating of cables or cable assemblies used in stored or partially stored position shall be ensured.		P
12	**EV SUPPLY EQUIPMENT CONSTRUCTIONAL REQUIREMENTS AND TESTS**		**P**
12.1	**General**		**—**
	The control means and the protection means in Mode 2 EV supply equipment that is intended to be used both as stationary equipment and as portable equipment shall comply with IEC 61851-1 and with IEC 62752.		N/A
	For case C EV supply equipment, the output cable assembly is considered part of the assembly for testing purpose.		P
	Electric devices and components of EV supply equipment shall comply with their relevant standards. The tests of devices and components shall be carried out with the specimen, or any movable part of it, placed in the most unfavourable position that can occur in normal use.		P
	For extreme environment or other special service conditions, see IEC TS 61439-7.		N/A
12.2	**Characteristics of mechanical switching devices**		**—**
12.2.1	**General**		**P**
	Switching devices within EV supply equipment intended to supply the connecting points shall comply with their relevant standards, with at least the characteristics as given in 12.2.		P
12.2.2	**Switch and switch-disconnector**		**N/A**
	Switches and switch-disconnectors shall comply with IEC 60947-3.		N/A
	For AC applications, switches and switch-disconnectors shall have a rated current, at a utilization category of at least AC-22A, not less		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	than the rated current of the circuit that they are intended to operate in.		
	For DC applications, switches and switch-disconnectors shall have a rated current, at a utilization category of at least DC-21A, not less than the rated current of the circuit that they are intended to operate in.		N/A
12.2.3	**Contactor**		P
	Contactors shall comply with IEC 60947-4-1.		P
	For AC applications, contactors shall have a rated current, at a utilization category of at least AC-1, not less than the rated current of the circuit that they are intended to operate in.		P
	For DC applications, contactors shall have a rated current, at a utilization category of at least DC-1, not less than the rated current of the circuit that they are intended to operate in.		P
12.2.4	**Circuit-breaker**		P
	Circuit breakers, if any, shall comply with IEC 60898-1 or IEC 60947-2 or IEC 61009-1.		P
12.2.5	**Relays**		N/A
	Relays used to switch the main current path shall comply with IEC 61810-1 with the following minimum characteristics:		N/A
	•50 000 cycles,		N/A
	•contact category: CC 2.		N/A
12.2.6	**Inrush current**		N/A
	AC EV supply equipment shall withstand the inrush current according to 8.2.2 of ISO 17409:2015.		N/A
	The following values are specified in ISO 17409:		N/A
	•After closing the contactor in the EV supply equipment at the peak value of the supply voltage, the EV supply equipment shall be able to withstand 230 A peak within the duration of 100µs.		N/A
	•During the next second the EV supply equipment shall be able to withstand 30 A (rms).		N/A
	The protection means shall be selected not to trip for inrush current.		N/A
12.2.7	**Residual direct current monitoring device (RDC MD)**		N/A
	This will be covered in the future IEC 62955 (under consideration).		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
12.3	**Clearances and creepage distances**		—
	The clearances and creepage distances in the EV supply equipment, installed as intended by the manufacturer, shall be in accordance with the requirements specified in IEC 60664-1.		P
	Parts of the EV supply equipment directly connected to the public AC supply network shall be designed according to overvoltage category IV.		N/A
	Permanently connected EV supply equipment shall be designed according to a minimum overvoltage category III except for the socket-outlet or the vehicle connector in case C where a minimum overvoltage category II applies.	Overvoltage category III.	P
	EV supply equipment supplied through a cable and plug shall be designed according to a minimum overvoltage category II.		N/A
	Equipment that is intended to be used under the conditions of a higher overvoltage category shall include appropriate overvoltage protective device (see 4.3.3.6 of IEC 60664-1:2007).		N/A
12.4	**IP degrees**		—
12.4.1	**Degrees of protection against solid foreign objects and water for the enclosures**		P
	Enclosures of the EV supply equipment shall have an IP degree, according to IEC 60529 as follows:		P
	•indoor use: at least IP41;		P
	•outdoor use: at least IP44.	IP54	P
	The minimum IP degree for socket-outlets and the vehicle connectors shall be in accordance with their appropriate standards.		P
	IPX4 may be obtained by the combination of the socket-outlet or connector and the lid or cap, EV supply equipment enclosure or EV enclosure.		P
12.4.2	**Degrees of protection against solid foreign objects and water for basic, universal and combined and DC interfaces**		P
	The minimum IP degrees for ingress of objects and liquids shall be:		P
	•Indoor use:		P
	– vehicle connector when mated with vehicle inlet: IP21;		P
	– EV plug mated with EV socket-outlet: IP21;		N/A
	– vehicle connector for case C when not mated: IP21;		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– vehicle connector for case B when not mated: IP24.		N/A
	•Outdoor use:		P
	– vehicle connector when mated with vehicle inlet: IP44;		P
	– EV plug mated with EV socket-outlet: IP44;		N/A
	– vehicle connector when not mated: IP24;		P
	– vehicle connector for case B when not mated: IP24;		N/A
	– socket outlet when not mated: IP24.		N/A
	IPX4 may be obtained by the combination of the socket-outlet or connector and the lid or cap, EV supply equipment enclosure or EV enclosure.		P
12.5	**Insulation resistance**		—
	The insulation resistance measured with a 500 V DC voltage applied between all inputs/outputs connected together (power source included) and the accessible parts shall be:		P
	•for a class I EV supply equipment: R > 1 MΩ;		P
	•for a class II EV supply equipment: R > 7 MΩ.		N/A
	For this test all extra low voltage (ELV) circuits shall be connected to the accessible parts during the test.		P
	The measurement of insulation resistance shall be carried out with the protective impedances disconnected, and after applying the test voltage for the duration of 1 min and immediately after the damp heat continuous test of IEC 60068-2-78, test Ca, at 40 °C ± 2 °C and 93 % relative humidity for four days.		P
	The conditioning test for the insulation test and the touch current can be avoided if the conditioning for test of 12.9 followed by test of 12.5, 12.6 and final test of 12.9, are conducted sequentially in that order.		P
12.6	**Touch current**		—
	The touch current between any AC supply network poles and the accessible metal parts connected with each other, and with a metal foil covering insulated external parts, is measured in accordance with IEC 60990 and shall not exceed the values indicated in Table 1.		P
	The touch current shall be measured within one hour after the damp heat continuous test of IEC 60068-2-78, test Ca, at 40 °C± 2 °C and 93 %		P

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Clause	Requirement + Test	Result - Remark	Verdict
	relative humidity for four days, with the electric vehicle charging station connected to AC supply network in accordance with IEC 60990.		
	The test voltage shall be 1,1 times the maximum rated voltage.		P
	Table 1 – Touch current limits		P
	Between any network poles and the accessible metal parts connected with each other and a metal foil covering insulated external parts:		P
	Class I 3,5 mA	2.2mA	P
	Class II 0,25 mA		N/A
	Between any network poles and the metal inaccessible parts normally non-activated (in the case of double insulation):		N/A
	Class I N/A		N/A
	Class II 3,5 mA		N/A
	Between inaccessible and accessible parts connected with each other and a metal foil covering insulated external parts (additional insulation):		N/A
	Class I N/A		N/A
	Class II 0,5 mA		N/A
	This test shall be made when the EV supply equipment is functioning with a resistive load at rated output power.		P
	Circuitry that is connected through a fixed resistance or referenced to earth (for example, proximity function and control pilot function) are disconnected before this test.		P
	The equipment is fed through an isolating transformer or installed in such a manner that it is isolated from the earth.		P
12.7	**Dielectric withstand voltage**		**—**
12.7.1	**AC withstand voltage**		P
	The dielectric withstand voltage, at power frequency of 50 Hz or 60 Hz, shall be applied for 1 min as follows:		P
	1) For a class I EV supply equipment. (Un + 1 200 V) (r.m.s.) in common mode (all circuits in relation to the exposed conductive parts) and differential mode (between each electrically independent circuit and all other exposed conductive parts or circuits) as specified in 5.3.3.2 of IEC 60664-1:2007.		P
	2) For a class II EV supply equipment. 2 times (Un +1 200 V) (r.m.s). in common mode (all circuits in relation to the exposed conductive parts) and differential mode (between each		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	electrically independent circuit and all other exposed conductive parts or circuits) as specified in 5.3.3.2.3 of IEC 60664-1:2007.		
	3) For both class I and class II AC EV supply equipment where the insulation between the AC supply network and the extra low voltage circuit is double or reinforced insulation, 2 times (Un + 1 200 V) (r.m.s.) shall be applied to the insulation.		P
	Alternatively the test can be carried out using a DC voltage equal to the AC peak values.		P
	For this test, all the electrical equipment shall be connected, except those items of apparatus which, according to the relevant specifications, are designed for a lower test voltage; current consuming apparatus (e.g. windings, measuring instruments, voltage surge suppression devices) in which the application of the test voltage would cause the flow of a current, shall be disconnected.		P
	Such apparatus shall be disconnected at one of their terminals unless they are not designed to withstand the full test voltage, in which case all terminals may be disconnected		P
12.7.2	**Impulse dielectric withstand (1,2 µs/50 µs)**		P
	The dielectric withstand of the power circuits at impulse test shall be tested according to IEC 60664-1.		P
	The impulse voltage shall be applied to live parts and exposed conductive parts.		P
	The test shall be carried out in accordance with the requirements of IEC 61180.		P
	Parts of the EV supply equipment directly connected to the public AC supply network shall be tested according to overvoltage category IV.		N/A
	Permanently connected EV supply equipment shall be tested according to an overvoltage category III except for the socket-outlet or the vehicle connector in case C where an overvoltage category II applies.		P
	EV supply equipment supplied through a cable and plug shall be tested according to an overvoltage category II.		N/A
12.8	**EV supply equipment shall comply with IEC TS 61439-7.** *Temperature rise:*		—
12.9	**Damp heat functional test**		—
	Following the conditioning defined below, the EV supply equipment is deemed to pass the test, if, it		P

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Clause	Requirement + Test	Result - Remark	Verdict
	passes the normal sequences test according to A.4.7 of Annex A. The precision of the timing does not need to be verified.		
	Conditioning:		P
	– For indoor units, 6 cycles of 24 h each to a damp heat cycling test according to IEC 60068-2-30 (Test Db) at (40±3) °C and relative humidity of 95 %;		N/A
	– For outdoor units, two 12 day periods, with each period consisting of 5 cycles of 24 h each to a damp heat cycling test according to IEC 60068-2-30 (Test Db) at (40±3) °C and relative humidity of 95 %.		P
12.10	**Minimum temperature functional test**		—
	The EV supply equipment shall be pre-conditioned in accordance with IEC 60068-2-1, test Ab, at the minimum operating temperature (either -5 °C for indoor, -25 °C outdoor or lower values declared by the manufacturer ± 3 K) for (16 ± 1) h.		P
	The EV supply equipment is deemed to pass the test, if, immediately after the preconditioning, it passes the sequences test according to A.4.7 of Annex A while at the minimum operating temperature. The precision of the timing does not need to be verified.		P
12.11	**Mechanical strength**		—
	For Mode 2 EV supply equipment the minimum degree of protection of the external enclosure against mechanical impact shall be IK08 according to IEC 62262.	Although the product is mode 4, it has been tested by IK10. After the test, it has no damage and passed the IP grade test. It conforms to IP54.	N/A
	After the test, the samples shall show that:		N/A
	– the IP degree according to 12.5 is not impaired;		N/A
	– no part has moved, loosened, detached or deformed to the extent that any safety functions are impaired;		N/A
	– the test did not cause a condition that results in the equipment not complying with the strain relief requirements, if applicable;		N/A
	– the test did not result in a reduction of creepage and clearance between uninsulated live parts of opposite polarity, uninsulated live parts and accessible dead or grounded metal below the minimum acceptable values;		N/A
	– the test did not result in any other evidence of		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	damage that could increase the risk of fire or electric shock.		
13	**OVERLOAD AND SHORT-CIRCUIT PROTECTION**		P
13.1	**General**		—
	Where connecting points can be used simultaneously and are intended to be supplied from the same input line, they shall have individual protection incorporated in the EV supply equipment.		P
	If the EV supply equipment presents more than one connecting point then such connecting points may have common overload protection means and may have common short-circuit protection means, if those protection means provide the required protection for each of the connecting points		N/A
	If the EV supply equipment presents more than one connecting point that cannot be used simultaneously then such connecting points can have common protection means.		N/A
	Such overcurrent protective devices shall comply with IEC 60947-2, IEC 60947-6-2 or IEC 61009-1 or with the relevant parts of IEC 60898 series or IEC 60269 series.		P
13.2	**Overload protection of the cable assembly**		—
	The EV charging stations or Mode 2 EV supply equipment shall provide overload protection for all cases for all intended cable conductor sizes if not provided by the upstream supply network.		P
	The overload protection may be provided by a circuit breaker, fuse or combination thereof.	With fuse.	P
	If overload protection is provided by a means other than a circuit breaker, fuse or combination thereof, such means shall trip within 1 min if the current exceeds 1,3 times the rated current of the cable assembly.		N/A
13.3	**Short-circuit protection of the charging cable**		—
	The EV charging stations or Mode 2 EV supply equipment shall provide short-circuit current protection for the cable assembly if not provided by the supply network.		P
	In case of short-circuit, the value of I2t at the EV socket-outlet of the Mode 3 charging station shall not exceed 75 000 A2s.		N/A
	In case of short-circuit, the value of I2t at the vehicle connector (Case C) of the Mode 3		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	charging station shall not exceed 80 000 A2s.		
	The real value of the prospective short-circuit current is evaluated at the point where the cable assembly is connected.		N/A
14	**AUTOMATIC RECLOSING OF PROTECTIVE DEVICES**		P
	The automatic or remote reclosing of protective devices after tripping in the EV supply equipment shall only be possible in case the following requirement is fulfilled:		N/A
	•the socket-outlet shall not be mated to a plug. This shall be checked by the EV supply equipment.		N/A
	For automatic or remote reclosing automatic reclosing devices (ARDs) with an assessment means may be used.		N/A
	The EV supply equipment may close the contactor during an automatic or remote reset cycle to establish conductivity between the protection device and the socket-outlet.		N/A
	By this procedure the EV supply equipment can check the circuit up to the socket-outlet to be free of fault current.		N/A
	For case C the EV supply equipment shall not provide automatic or remote reclosing of protective devices.		P
15	**EMERGENCY SWITCHING OR DISCONNECT (OPTIONAL)**		P
	Emergency switching or disconnect equipment shall be used either to disconnect the supply network from EV supply equipment or to disconnect the socket-outlet(s) or the cable assembly(ies) from the supply network.	Emergency switch used.	P
	Such equipment shall be installed in accordance with national rules.		P
	Such equipment may be part of the supply network or either the EV charging station or the Mode 2 supply equipment.	Such equipment be part of the EVSE.	P
16	**MARKING AND INSTRUCTIONS**		P
16.1	**Installation manual of EV charging stations**		—
	The installation manual of EV charging stations shall indicate the classification as given in Clause 5.		P
	The EV supply equipment manufacturer shall state the interface characteristics specified in Clause 5 of IEC TS 61439-7:2014 in the manual where applicable.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Wiring instructions shall be provided.		P
	If protective devices are included in the EV charging station, the manual shall indicate the characteristics of those protection devices explicitly describing the type and rating.		P
	If the protective devices are not in the EV charging station, the manual shall indicate all information necessary for the installation of external protection explicitly describing the type and rating of the devices to be used.		N/A
	It is recommended that the installation manual be made available to future customers.		P
	If the EV charging station has more than one connection of the equipment to the AC supply network, and does not have individual protection for each connecting point to the vehicles, then the installation manual shall indicate that each connection of the equipment to the AC supply network requires individual protection.		N/A
	The installation manual shall indicate if the optional function for ventilation is supported by the charging station (6.3.2.2).		N/A
	The installation manual shall indicate ratings or other information that denote special (severe or unusual) environmental conditions of use, see 5.3.		P
16.2	**User manual for EV supply equipment**		**—**
	User information shall be provided by the manufacturer on the EV supply equipment or in a user's manual.		P
	Such information shall state:		P
	•which adaptors or conversion adapters are allowed to be used, or		N/A
	•which adaptors or conversion adapters are not allowed to be used, or		N/A
	•that adaptors or conversion adapters are not allowed to be used, and		P
	•that cord extension sets are not allowed to be used.		P
	The user manual shall include information about national usage restrictions.		P
16.3	**Marking of EV supply equipment**		**—**
	The EV supply equipment manufacturer shall provide each EV supply equipment with one or more labels, marked in a durable manner and located in a place such that they are visible and legible during installation and maintenance:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	a) EV supply equipment manufacturer's name, initials, trade mark or distinctive marking;		P
	b) type designation or identification number or any other means of identification, making it possible to obtain relevant information from the EV supply equipment manufacturer;		P
	c) “Indoor Use Only", or the equivalent, if intended for indoor use only;		N/A
	The EV supply equipment manufacturer shall provide each EV supply equipment with one or more labels, marked in a durable manner and located in a place such that they are visible and legible during installation:		P
	d) means of identifying date of manufacture;	See label.	P
	e) type of current;		P
	f) frequency and number of phases in case of alternating current;		P
	g) rated voltage (input and output if different);		P
	h) rated current (input and output if different) and the ambient temperature used to determine the rated current;		P
	i) degree of protection;	IP54	P
	j) all necessary information relating to the special declared classifications, characteristics and diversity factor(s), severe or unusual environmental conditions of use, see 5.3.		P
16.4	**Marking of charging cable assemblies case B**		—
	Cable assemblies for Mode 1 Case B or Mode 3 Case B shall be marked in a durable manner with the following information:		N/A
	a) manufacturer's name or trade mark;		N/A
	b) type designation or identification number or any other means of identification, making it possible to obtain relevant information from the manufacturer;		N/A
	c) rated voltage;		N/A
	d) rated current;		N/A
	e) number of phases. f) degree of protection		N/A
	Marking for the entire cable assembly shall be provided in a clear manner by a label or equivalent means.		N/A
16.5	**Durability test for marking**		—
	Marking made by moulding, pressing, engraving or similar, including labels with a laminated plastic covering, shall not be submitted to the following		P

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Clause	Requirement + Test	Result - Remark	Verdict
	test.		
	The markings required by this standard shall be legible with corrected vision, durable and visible during use.		P
	After the test, the marking shall be legible to normal or corrected vision without additional magnification. It shall not be easily possible to remove marking plates and they shall show no curling.		P
A	**ANNEX A – CONTROL PILOT FUNCTION TROUGH A CONTROL PILOT CIRCUIT USING A PWM SIGNAL AND A CONTROL PILOT WIRE**		N/A
A.1	**General**		**—**
A.2	**Control pilot circuit**		**—**
A.2.1	**General**		N/A
	Figures A.1 and A.2 illustrate an electric equivalent circuit of the control pilot circuit. The EV supply equipment shall set the duty cycle of the PWM control pilot signal to indicate the maximum current according to Table A.7.		N/A
	The indicated maximum current transmitted shall not exceed the value according to 6.3.1.6.		N/A
	The EV supply equipment may open the switching device that energizes the EV if the EV draws a higher current than the PWM signal (duty cycle) indicates. In this case, the EV supply equipment shall respect the following conditions:		N/A
	•the allowed response time of the EV, according to Table A.6 (e.g. sequence 6).		N/A
	•the current tolerance related to the duty cycle generated by the EV supply equipment (1 percentage point).		N/A
	•the tolerances of the current measurement used in the EV supply equipment itself.		N/A
	The control pilot circuit shall be designed in accordance with Figures A.1 or A.2 with the values defined in Table A.2, Table A.3 and Table A.4.		N/A
	The functionality of the control pilot circuit shall follow the requirements defined in Table A.4, Table A.6, Table A.7 and Table A.8.		N/A
A.2.2	**Typical control pilot circuit** **(see IEC 61851-1:2017)**		N/A
	The EV supply equipment communicates by setting the duty cycle of a PWM signal or a continuous DC voltage signal (Table A.7).		N/A
	The EV supply equipment may change the duty		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	cycle of the PWM signal at any time.		
	The EV responds by applying a resistive load to the positive half-wave to the control pilot circuit.		N/A
	For further information about the PWM signal see also Table A.2, Table A.3 and Table A.4.		N/A
	EVs using typical control pilot circuit (Figure A.1) shall be able to create state B and use it according to the sequences specified in Table A.6.		N/A
	EV using a typical control pilot circuit shall determine the maximum current from EV supply equipment from the duty cycle of the PWM signal (Table A.8).		N/A
A.2.3	**Simplified control pilot circuit (see IEC 61851-1:2017)**		N/A
	An EV using the simplified control pilot circuit shall limit itself to single phase charging and shall not draw a current of more than 10 A.		N/A
	EV supply equipment that supports an EV using the simplified control pilot shall modulate the PWM signal in the same manner as done for EVs using the typical control pilot circuit.		N/A
	EVs using simplified control pilot circuit (Figure A.2) are not able to create state B.		N/A
	An EV using the simplified control pilot circuit can measure the duty cycle.		N/A
	The designer of an EV using the simplified control pilot should be aware that the EV supply equipment can open its switching device, if the EV supply equipment indicates less current (by the duty cycle) than the EV draws (see A 2.1).		N/A
	It is not recommended to use the simplified control pilot circuit for new EV design.		N/A
A.2.4	**Additional components and high frequency signals**		N/A
	Digital communication as described in ISO/IEC 15118 series may be carried out over the control pilot conductor. Additional components can be needed to couple this high-frequency signal onto the control pilot signal.		N/A
	Additional components required for signal coupling shall not deform the control pilot signal beyond the limits defined in Tables A.2 and A.4.		N/A
	The maximum inductance of the control pilot circuit of the EV supply equipment is limited to		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	1 mH (see Table A.3).		
	The maximum inductance of the control pilot circuit of the EV is limited to 1 mH (see Table A.2).		N/A
	The additional signal for digital communication shall have a frequency of at least 148 kHz.		N/A
	The voltage of the high frequency signal (used for digital communication) shall be in accordance with the values given in Table A.1.		N/A
	One further capacitive (max of 2 000 pF) branch (on the vehicle and on the EV supply equipment) can be used for detection of the high frequency signals, provided the resistance/impedance to ground is higher than 10 kΩ. Such capacitive/resistive branch would typically be used for signal inputs and automatic signal voltage control (refer to Table A.1).		N/A
A.3	**Requirements for parameters and system behaviour**		**—**
	The control pilot circuit parameters shall be in accordance with Table A.2 and Table A.3 and are shown in Figures A.1 and A.2.		N/A
	EV pilot circuit values and parameters as indicated on Figures A.1 and A.2 are given in Table A.3.		N/A
	Value ranges shall be maintained over full useful life and under design environmental conditions.		N/A
	1 % tolerance resistors are commonly recommended for this application.		N/A
	Table A.4 indicates the pilot voltage range based on components values in Tables A.2 and A.3. It incorporates an increased voltage margin for Va to allow for measurement tolerances of the EV supply equipment.		N/A
	There is no undefined voltage range, for the PWM signal, between the system states.		N/A
	The state is valid if it is within the above values. The state detection shall be noise resistant, e.g. against EMC and high frequency data signals on the control pilot circuit.		N/A
	For reliable detection of a state, it is recommended to apply averaging of the measurement over several milliseconds or PWM cycles.		N/A
	The EV supply equipment shall verify that the EV is properly connected by verifying the presence of the diode in the control pilot circuit, before energizing the system.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	This shall be done at the transition from x1 to x2 or at least once during state x2, before closing the supply switching device.		N/A
	Presence of the diode is detected if the low side of the PWM-signal is within the voltage range defined in Table A.4.		N/A
	The EV supply equipment shall open or close the supply switching device within the time indicated in Table A.6.		N/A
	Compliance is tested as in Clause A.4.		N/A
	The state changes between A, B, C and D are caused by the EV or by the user.		N/A
	The state changes between state x1 and x2 are created by the EV supply equipment.		N/A
	A change between states x1 and x2 indicates an availability (x2) or unavailability (x1) of power supply to the EV.		N/A
	After changing to state F and while the reason for changing to state F persists, an EV supply equipment with permanently attached cable (case C) shall:		N/A
	– remain in state F, or		N/A
	– remain in state F for at least 300 ms and then change to state x1 (and stays there), in order to detect if an EV is connected.		N/A
	If the failure is not recovered after disconnecting the vehicle connector, the EV supply equipment shall:		N/A
	– remain in or change to state F, or		N/A
	– remain in state x1, if the EV supply equipment provides an indicator (e.g. a display) which shows “not available”.		N/A
	In the absence of a fault condition in the EV supply equipment, the EV supply equipment shall not use the state F in order to signal that the EV supply equipment will not deliver the energy to the EV. Instead, this shall be done by the state x1.		N/A
	A transition from state E or state F to any other state (x1 or x2) is allowed.		N/A
	If the EV is connected to the EV supply equipment which does not use 5 % duty cycle, and authentication (e.g. RFID identification, payment, etc.) is needed, the control pilot signal shall stay at x1 as long as the energy is not allowed to be supplied.		N/A
	In case, no authentication is needed, the system may go to state x2.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	In case EV supply equipment requires authentication to supply power, a change from states CX or DX to state BX shall not lead to loss of authentication.		N/A
	This means that no repeated authentication shall be needed.		N/A
	Table A.6 indicates the principle sequences and transitions from one state to another with the timing requirements where applicable. Some transitions that may take place are not indicated in the table.		N/A
	If the EV supply equipment or the EV changes to a new state within the timing indicated for that sequence, the new sequence is initiated and replaces the previous sequence.		N/A
A.4	**Test procedures**		**N/A**
A.4.1	**General**		**—**
A.4.2	**Constructional requirements of the EV simulator**		N/A
A.4.3	**Test procedure**		**—**
A.4.4	**Test List – Oscillator frequency and generator voltage test**	(see table 4.4)	N/A
A.4.5	**Duty Cycle test**	(see table 4.5)	N/A
A.4.6	**Pulse wave shape test**	(see table 4.6)	N/A
A.4.7	**Sequences test**	(see table 4.7)	N/A
A.4.7.1	**General**		N/A
A.4.7.2	**Sequence test using the typical control pilot circuit**	(see table 4.7.2)	N/A
A.4.7.3	**Sequence test using the simplified control pilot circuit**	(see table 4.7.3)	N/A
A.4.7.4	**Optional testing the EV supply equipment that support grid**	(see table 4.7.4) Not applicable to such function.	N/A
A.4.8	**Test of interruption of the protective conductor**	(see table 4.8)	N/A
A.4.9	**Test of short-circuit values of the voltage**	(see table 4.9)	N/A
A.4.10	**Example of a test simulator of the vehicle (informative)**		N/A
A.4.11	**Optional hysteresis test**		N/A
A.4.11.1	**General**		N/A
A.4.11.2	**Test sequence for hysteresis between states B**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	and C		
A.4.11.3	**Test sequence for hysteresis between states C-E, D-E**		N/A
A.4.11.4	**Test sequence for hysteresis between states C-D**		N/A
A.5	**Implementation hints**		N/A
A.5.1	**Retaining a valid authentication until reaching CP State B**		N/A
A.5.2	**Load control using transitions between state x1 and x2**		N/A
A.5.3	**Information on difficulties encountered with some legacy EVs for wake-up after a long period of inactivity (informative)**		N/A
B	**ANNEX B – PROXIMITY DETECTION AND CABLE CURRENT CODING CIRCUITS FOR THE BASIC INTERFACE**		N/A
B.1	**Circuit diagram for vehicle couplers using an auxiliary switch associated with the proximity detection contact**		N/A
	The vehicle couplers using the proximity contact with an auxiliary switch and without current capability coding of the cable assembly shall use the circuit diagram as indicated in Figure B.1 and Table B.1.		N/A
B.2	**Circuit for simultaneous proximity detection and current coding**		N/A
	Vehicle connectors and plugs using the proximity contact for simultaneous proximity detection and current capability coding of the cable assembly shall have a resistor electrically connected between the proximity contact and the earthing contact (see Figure B.2) with a value as indicated in Table B.2.		N/A
	The resistor shall be coded to the maximum current capability of the cable assembly.		N/A
	The EV supply equipment shall interrupt the current supply if the current capability of the cable is exceeded as detected by the measurement of the Rc, as specified by the values for the recommended interpretation range in Table B.2.		N/A
	The EV supply equipment shall detect the current coding by measurement of the Rc, as defined in Table B.2 and use the result to set the value of the maximum allowed current, if necessary, according to 6.3.1.6.		N/A
	The resistor is also used for proximity detection.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

4.4	TABLE: Oscillator frequency and generator voltage test					N/A
	Minimum Voltage [V]	**Maximum Voltage [V]**	**Measured Value [V]**	**Resistor Value [Ω] (EV Simulator)**	**Oscillator Frequency [Hz] (Req. 1000 Hz +/- 0,5%)**	**Verdict**
State A	11,4	12,6	/	Nominal value	-	N/A
State B1, B2 / positive	8,37	9,59	/	Nominal value	/	N/A
Negative B	-12,6	-11,4	/	Nominal value	/	N/A
State C1, C2 / positive	5,47	6,53	/	Nominal value	/	N/A
Negative C	-12,6	-11,4	/	Nominal value	/	N/A
State D1, D2 / positive	-	-	/	/	/	N/A
Negative D	/	/	/	/	/	N/A
	Internal resistor value (1000 Ω +/-3%) [Ω] Calculated: R1_calc(= 2 740 × (U_StateA – U_StateB) / (U_StateB – 0,7)					
R1	/					N/A
Note:						

4.5	TABLE: Duty cycle test					N/A
Duty cycle	**Measured Value [V]**	**Resistor Value [Ω] (EV Simulator)**	**Pulse width [µs]**	**Duty cycle**	**Indicated current (duty cycle * 0.6)**	**Verdict**
State B / 5% Duty cycle	/	/	/	/	/	N/A
State B / 10% Duty cycle	/	/	/	/	/	N/A
State B / Max declared / Default Duty cycle	/	/	/	/	/	N/A
Note:						

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Clause	Requirement + Test	Result - Remark	Verdict

4.6	TABLE: Pulse wave shape test						N/A
	Measured Voltage[a] [V]	**Maximum rise time [µs]**	**Measured Value [µs]**	**Maximum fall time [µs]**	**Measured Value [µs]**	**Duty Cycle [%]**	**Verdict**
State B1, B2 / positive	/	5	/	13	/	/	N/A
State C1, C2 / positive	/	5	/	13	/	/	N/A
State D1, D2 / positive	/	5	/	13	/	/	N/A
[a] with nominal resistance values							

4.7.2	TABLE: Sequence test using the typical control pilot circuit										N/A
Sequence	**1.1 [s]**	**3.1 [s]**	**4 [s]**	**7 [s]**	**8.1 [s]**	**4 [s]**	**6 [s]**	**7 [s]**	**8.1 [s]**	**2.1 [s]**	**9.3 [s]**	**Verdict**
Test 1 / Max resistance	/	/	/	/	/	/	/	/	/	/	/	N/A
Test 2 / Max resistance + HF voltage	/	/	/	/	/	/	/	/	/	/	/	N/A
Test 3 / Min resistance	/	/	/	/	/	/	/	/	/	/	/	N/A
Test 4 / Min resistance +HF voltage	/	/	/	/	/	/	/	/	/	/	/	N/A
Note:												

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Clause	Requirement + Test	Result - Remark	Verdict

4.7.3	TABLE: Sequence test using the simplified control pilot circuit					N/A
Sequence	**1.2 [s]**	**3.2 [s]**	**5 [s]**	**6 [s]**	**2.2 [s]**	**Verdict**
Test 1 / Max resistance	/	/	/	/	/	N/A
Test 2 / Max resistance + HF voltage	/	/	/	/	/	N/A
Test 3 / Min resistance	/	/	/	/	/	N/A
Test 4 / Min resistance +HF voltage	/	/	/	/	/	N/A
Note:						

4.7.4	TABLE: Optional testing the EV supply equipment that support grid												N/A
Sequence	**1.1 [s]**	**3.1 [s]**	**4 [s]**	**9.1 [s]**	**10.1 [s]**	**8.2 [s]**	**3.1 [s]**	**4 [s]**	**7 [s]**	**8.1 [s]**	**2.1 [s]**	**9.3 [s]**	**Verdict**
Nominal resistance values	/	/	/	/	/	/	/	/	/	/	/	/	

4.8	TABLE: Test of interruption of the protective conductor		N/A
	Measured cut off time [ms]	**Max. cut off time [ms]**	**Verdict**
State C or D → earth wire open	/	/	N/A
Note:			

4.9	TABLE: Test of short circuit values of the voltage	N/A
	Shutdown time [s]	**Verdict**
State C + 120Ω resistance	/	N/A
Note:		

Test Report issued under the responsibility of:

TÜVRheinland®

TEST REPORT
IEC 61851-23
Electric vehicle conductive charging system – Part 23: DC electric vehicle charging station

Report Number.....:	**CN24SI7B 001**
Date of issue .....:	See cover page
Total number of pages.....	See cover page
Name of Testing Laboratory preparing the Report.....:	See cover page
Applicant's name .....:	See cover page
Address.....:	See cover page
Test specification:	
Standard.....:	EN 61851-23:2014, IEC 61851-23:2014
Test procedure.....:	TÜV Bauart approval
Non-standard test method.....:	N/A
Test Report Form No. .....:	IEC61851_23B
Test Report Form(s) Originator....:	TÜV SÜD Product Service Ltd.
Master TRF .....:	2016-11

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Test item description..... :	See page 4
Trade Mark..... :	See page 4
Manufacturer..... :	See page 4
Model/Type reference..... :	See page 4
Ratings..... :	See page 4

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s): N/A			
☐	**CB Testing Laboratory:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
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☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address.....:			
Tested by (name + signature) .....:			
Witnessed by (name, function, signature)..:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Witnessed by (name, function, signature)..:			
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List of Attachments (including a total number of pages in each attachment):
N/A

Summary of testing:

Tests performed (name of test and test clause):

Test clause	Test item	Test date Y/M/D
6.4	Functions provided in d.c. charging	2024-01-05
11.4	Dielectric withstand characteristics	2024-01-22
11.5	Insulation resistance	2024-01-22
11.7	Leakage – touch current	2024-01-22
11.11.2	Mechanical impact	2024-01-11
101.1.2	IP degrees for ingress of objects	2024-01-31~2024-02-01
101.2.1.1	Rated outputs and maximum output power	2024-01-05
101.2.1.2	Output voltage and current tolerance	2024-01-05
101.2.1.3	Control delay of charging current in CCC	2024-01-05
101.2.1.4	Descending rate of charging current	2024-01-05
101.2.1.5	Periodic and random deviation (current ripple)	2024-01-05
101.2.1.6	Periodic and random deviation (voltage ripple in CVC)	2024-01-05
101.2.1.7	Load dump	2024-01-05
101.2.2	Earthing continuity	2023-12-29

9.4	Breaking capacity	2024-01-04
11.6	Clearances and creepage distances	2023-01-04
101.1.4	Stability	2024-01-06
Annex CC	DC EV charging station of system C	2024-01-05

All tests are conducted on model AF-DC-240-B for representative.

Testing location:
CQC-Guochuang Testing Technology (Jiangsu) Co., Ltd.
No.67-1 Fuyang Road, Tianning District, Changzhou City, Jiangsu Province, P.R. China.

TUV Rheinland (Shanghai) Co., Ltd.
No.177, 178, Lane 777 West Guangzhong Road, Jing'an District, Shanghai, China.

Summary of compliance with National Differences (List of countries addressed):

No EU Group Differences.

☒ **The product fulfils the requirements of EN 61851-23:2014, IEC 61851-23:2014.**

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

See page 7.

Test item particulars .....:	
Equipment mobility.....:	[] movable [] hand-held [] transportable [x] stationary [] for building-in [] direct plug-in
Connection to the mains.....:	[] pluggable equipment [] type A [] type B [x] permanent connection [] detachable power supply cord [] non-detachable power supply cord [] not directly connected to the mains
Access location .....:	[x] operator accessible [] service access area [] restricted access location
Over voltage category (OVC) .....:	[] OVC I [] OVC II [x] OVC III [] OVC IV [] other:
Class of equipment .....:	[x] Class I [] Class II [] Class III [] Not classified
Mains supply tolerance (%) or absolute mains supply values .....:	±15%
Considered current rating (A) .....:	See model list
Pollution degree (PD) .....:	[] PD 1 [x] PD 2(internal) [x] PD 3(external)
IP protection class .....:	IP54
Altitude during operation (m) .....:	<2000
Output Connector Interface Type .....:	CCS2
Mass of equipment (kg) .....:	See model list
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing .....:	See cover page
Date of receipt of test item.....:	See cover page
Date (s) of performance of tests .....:	See cover page

General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)..... : Same as applicant	

General product information:

See page 9~11.

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Clause	Requirement + Test	Result - Remark	Verdict
5	**RATING OF THE SUPPLY VOLTAGE**		P
	Equipment operates as intended within a supply voltage tolerance of ±10%		P
	Equipment operates as intended within a frequency tolerance of ±1%		P
6	**GENERAL SYSTEM REQUIREMENTS AND INTERFACE**		P
6.1	**General Description**		—
	Method of charging uses an on-board charger		N/A
	Method of charging uses an off-board charger		P
6.2	**EV Charging Modes**		—
	EV charging mode is Mode 4, utilizing a d.c. EV charging station (e.g. off-board charger) where the control pilot function extends to the d.c. EV charging station.		P
	Pluggable d.c. EV charging stations, which are intended to be connected to the a.c. supply network (mains) using standard plugs and socket outlets, shall be compatible with residual current device with characteristics of type A.	Permanent connection.	N/A
	The pluggable d.c. EV charging station shall be provided with an RCD, and may be equipped with an overcurrent protection device.		N/A
6.3	**Types of EV Connection**		—
6.3.1	General description		P
	The connection of EVs using cables shall be carried out in case of C connection		P
6.3.2	Cord extension sets not provided	No cord extension	P
	Vehicle instructions indicate no cord extensions		P
	Cable assembly provided cannot be used as a cord extension		P
6.3.3	Adaptors shall not be used to connect a vehicle connector to a vehicle inlet.		P
6.4	**Functions provided in each charging mode**		—
	The d.c. EV charging station shall supply a d.c. current or voltage to the vehicle battery in accordance with a VCCF request.		P
6.4.1	Mode 4 charging functions		P
	- verification that the vehicle is properly connected;		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- protective conductor continuity checking (6.4.3.2);		P
	- energization of the system;		P
	- de-energization of the system (6.4.3.4);		P
	- d.c supply for EV (6.4.3.101);		P
	- measuring current and voltage (6.4.3.102);		P
	- retaining / releasing coupler (6.4.3.103);		P
	- locking of the coupler (6.4.3.104);		P
	- compatibility assessment (6.4.3.105)		P
	- insulation test before charging (6.4.3.106)		P
	- protection against overvoltage at the battery (6.4.3.107);		P
	- verification of vehicle connector voltage (6.4.3.108);		P
	- control circuit supply integrity (6.4.3.109);		P
	- short circuit test before charging (6.4.3.110);		P
	- user initiated shutdown (6.4.3.111);		P
	- overload protection for parallel conductors (conditional function) (6.4.3.112);		N/A
	- protection against temporary overvoltage (6.4.3.113).		P
	- emergency shutdown (6.4.3.114)		P
6.4.2	Optional function		P
	- determination of ventilation requirements of the charging area;		N/A
	- detection/adjustment of the real time available load current of the DC charger;		P
	- selection of charging current;		P
	- wake up of d.c. EV charging station by EV (6.4.4.101);		P
	- indicating means to notify users of locked status of vehicle coupler.		P
	Other additional functions may be provided.		P
6.4.3	Details of functions for DC charging		P
6.4.3.1	Verification that the vehicle is properly connected		P
	The EVSE are able to determine that the connector is properly inserted in the vehicle inlet and properly connected to the EVSE.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Vehicle movement by its own propulsion system is impossible as long as the vehicle is physically connected to the EVSE as required in ISO 6469-2.		P
6.4.3.2	Protective conductor continuity checking		P
	For isolated systems, protective conductor continuity between the d.c. EV charging station and the vehicle shall be monitored.		P
	For the rated voltage of d.c. 60 V or higher, the d.c. EV charging station shall perform an emergency shutdown (see 6.4.3.114) within 10 s after a loss of electrical continuity of the protective conductor between d.c. EV charging station and EV (emergency shutdown).		P
	For non-isolated systems, in case of loss of earthing conductor continuity, the non-isolated d.c. EV charging station shall be disconnected from a.c supply network (mains).	Isolated systems	N/A
	Earthing conductor continuity between the d.c. EV charging station and the vehicle shall be monitored. For the rated voltage of d.c. 60 V or higher, the d.c. EV charging station shall perform an emergency shutdown within 5 s after a loss of electrical continuity of the protective conductor between d.c. EV charging station and EV.		N/A
6.4.3.3	Energization of the system		P
	Energization of the system did not performed until the pilot function between EVSE and EV has been established correctly.	EVSE cannot start charging without CP connection	P
	Energization may also be subject to other conditions being fulfilled.		P
6.4.3.4	De-energization of the system		P
	If the pilot function is interrupted, the power supply to the cable assembly is interrupted but the control circuit may remain energized.		P
	In the case of failure in control circuit of d.c. EV charging station, such as short-circuit, earth leakage, CPU failure or excess temperature, the d.c. EV charging station shall terminate the supply of charging current, and disconnect the supply of control circuit.		P
	In addition, the conductor, in which earth fault or overcurrent is detected, shall be disconnected from its supply.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Requirement for disconnection of EV is defined in 7.2.3.1.		---
6.4.3.101	DC supply for EV		P
	The d.c. EV charging station shall supply d.c. voltage and current to the vehicle battery in accordance with VCCF's controlling.		P
	For regulated systems, the d.c. EV charging station shall supply regulated d.c. voltage or current to the vehicle battery in accordance with VCCF's controlling.		P
	Requirements for charging performance of regulated d.c. current / voltage are given in 101.2.1.1, 101.2.1.2 and 101.2.1.3 and 101.2.1.4.		---
	In either case mentioned above, the maximum ratings of the d.c EV charging station shall not be exceeded.		P
	The vehicle can change the requested current and/or requested voltage.		P
6.4.3.102	Measuring current and voltage		P
	The d.c. EV charging station shall measure the output current and output voltage. The accuracy of output measurement is defined for each system in Annexes AA, BB and CC.		P
6.4.3.103	Retaining/releasing coupler		P
	A means shall be provided to retain and release the vehicle coupler. Such means may be mechanical, electrical interlock, or combination of interlock and latch.		P
6.4.3.104	Locking of the coupler		P
	A vehicle connector used for d.c. charging shall be locked on a vehicle inlet if the voltage is higher than 60 V d.c.		P
	The vehicle connector shall not be unlocked (if the locking mechanism is engaged) when hazardous voltage is detected through charging process including after the end of charging. In case of charging system malfunction, a means for safe disconnection may be provided.		P
	The d.c. EV charging station shall have the following functions in case the locking is done by the d.c. EV charging station:		P
	– electrical or mechanical locking function to retain the locked status, and		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– function to detect the disconnection of the electrical circuits for the locking function.		P
6.4.3.105	Compatibility assessment		P
	Compatibility of EV and d.c. EV charging station shall be checked with the information exchanged at the initialization phase as specified in 102.5.1.		P
6.4.3.106	Insulation test before charging		P
	The d.c. EV charging station shall confirm the insulation resistance between its d.c. output circuit and protective conductor to the vehicle chassis, including the charging station enclosure, before the EV contactors are allowed to close.		P
	If the required value is not met, the d.c. EV charging station shall send the signal to the vehicle that the charging is not allowed.		P
	Conformance is determined by measuring the insulation resistance as follows:		P
	Any relays in the d.c. output circuit of the d.c. EV charging station shall be closed during the test.		P
	The required value of insulation resistance R shall be: R ≥100 Ω/V x U U is rated output voltage of the d.c. EV charging station.		P
6.4.3.107	Protection against overvoltage at the battery		P
	The d.c. EV charging station shall perform an emergency shutdown and disconnect its supply to prevent overvoltage at the battery, if output voltage exceeds maximum voltage limit sent by the vehicle. In case of vehicle failure, disconnection from a.c. mains may not be necessary.		P
	Specific requirement for detection and shutdown are defined in Annexes AA, BB and CC.		---
	The vehicle can change the maximum voltage limit during charging process.		P
	Compliance is checked according to the following test.		P
	The d.c. EV charging station is connected to a d.c. voltage source or artificial load.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The voltage of the d.c. voltage source or artificial load should be within the operating range of the charging station.		P
	The d.c. EV charging station is set to charge the d.c. voltage source at a current of more than 10 % of the maximum rated current of d.c. EV charging station.		P
	A maximum voltage limit command lower than the voltage of the voltage source shall be sent to the d.c. EV charging station.		P
	Both the time between when the command is sent and the beginning of charging current reduction, and the rate of reduction shall be measured.		P
	The voltage of the voltage source, the way the command voltage limit is sent and the value of the voltage limit may be chosen freely to comply with this test.		P
6.4.3.108	Verification of vehicle connector voltage		P
	This clause is only applicable for charging stations which are responsible for locking of vehicle connector, such as system A and system B.		P
	The d.c. EV charging station shall not energize the charging cable when the vehicle connector is unlocked. The voltage at which the vehicle connector unlocks shall be lower than 60 V.		P
6.4.3.109	Control circuit supply integrity		P
	If an earth fault, short circuit or overcurrent is detected in output circuit of d.c. EV charging station, the power circuit shall be disconnected from its supply, but the power supply for control circuit shall not be interrupted unless the power circuit interruption is due to a loss of a.c. supply network (mains).		P
6.4.3.110	Short circuit test before charging		P
	With the EV connected to the d.c. EV charging station and before the EV contactor is closed, the d.c. EV charging station shall have a means to check for a short circuit between d.c. output circuit positive and negative for the cable and vehicle coupler.		P
6.4.3.111	User initiated shutdown		P
	The d.c. EV charging station shall have a means to allow the user to shut down the charging process.		P

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Clause	Requirement + Test	Result - Remark	Verdict
6.4.3.112	Overload protection for parallel conductors (conditional function)		N/A
	If more than one conductor or wire and/or vehicle connector contact is used in parallel for d.c. current supply to the vehicle, the d.c. EV charging station shall have a mean to ensure, that none of the conductors or wires will be overloaded.		N/A
6.4.3.113	Protection against temporary overvoltage		P
	For stations serving a maximum output voltage up to 500 V, no voltage higher than 550 V shall occur for more than 5 s at the output between DC+ and PE or between DC- and PE.		N/A
	For stations serving a maximum output voltage above 500 V and up to 1 000 V, no voltage higher than 110 % of d.c. output voltage shall occur for more than 5 s at the output between DC+ and PE or between DC- and PE.		P
	The d.c. EV charging station shall terminate the supply of charging current and disconnect the d.c. power circuit from its supply within 5 s, to remove the source of overvoltage. This shall also apply in case of a first earth fault within the isolated output part of the d.c. EV charging station.		P
	For Un, as the minimum DC charger output voltage, the d.c. EV charging station shall limit the voltage between DC+/- and PE at: - (2Un + 1 000) x 1,41 V or; - (Un + 1 200) x 1,41 V.		P
6.4.3.114	Emergency shutdown		P
	When the d.c. EV charging station detects an abnormality in the station and/or the vehicle, the safety shall be ensured by the emergency shutdown. Stop charging by:		P
	a) controlled expedited interruption of charging current or voltage to the vehicle, where d.c. current descends with a controlled slope, and appropriate signalling to the vehicle, or		P
	b) uncontrolled abrupt termination of charging under specific fault conditions, where there is no control of current, and the vehicle may not be informed in time.		P
	Under specific conditions, the following disconnection, for example, is required according to the risk assessment of the abnormality in the station or the vehicle:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– disconnection of the supply to the conductor in which an earth leakage is detected;		P
	– disconnection of the conductor in which an overcurrent is detected;		P
	– disconnection of the d.c. power circuit from the supply if an insulation failure is detected.		P
	General procedure of shutdown in the charging control process is given in 102.5.3.		—
6.4.4	Details of Optional Functions		P
6.4.4.1	Determination of ventilation requirements during charging		N/A
	If additional ventilation is required during charging, charging is only allowed if such ventilation is provided.		N/A
6.4.4.2	Detection/adjustment of the real time available load current of the supply equipment		P
	Means is provided to ensure that the charging rate did not exceed the real time available load current of the EVSE and its power supply.		P
6.4.4.4	Selection of charging rate		P
	A manual or automatic means is provided to ensure that the charging rate does not exceed the rated capacity of the a.c. supply network (mains), vehicle or battery capabilities.		P
6.4.4.101	Wake up of d.c. EV charging station by EV		P
	The charging station may support a standby mode to minimize power consumption. In this case, the station shall be able to be woken up by the EV.		P
6.4.5	Details of Pilot Function		P
	Control pilot function is mandatory. The control pilot function shall be capable of performing at least the mandatory functions described in 6.4.3.1, 6.4.3.2, 6.4.3.3 and 6.4.3.4, and may also be capable of contributing to optional functions described in 6.4.4.		P
6.5	**Serial data communication**		—
	Serial data communication exchange shall be provided		P
	Serial communication shielded or earthed twisted pair.....		P
6.101	**Classification**		—
6.101.1	Category		---

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Clause	Requirement + Test	Result - Remark	Verdict
6.101.1.1	According to system structure:		---
	- isolated d.c. EV charging station, according to the type of insulation between input and output:	☒ basic insulation ☐ reinforced insulation ☐ double insulation	P
	- non-isolated d.c. EV charging station.		N/A
6.101.1.2	According to system control		---
	- regulated d.c. EV charging station	☐ controlled current charging ☐ controlled voltage charging ☒ combination of controlled current and voltage charging	P
	- non-regulated d.c. EV charging station.		N/A
6.101.1.3	According to power receiving	☒ d.c. EV charging station connected to a.c. mains ☐ d.c. EV charging station connected to d.c. mains	---
6.101.1.4	According to environmental conditions	☒ outdoor use ☒ indoor use	---
6.101.1.5	According to the system used	☐ system A (see Annex AA), ☐ system B (see Annex BB), ☒ system C (see Annex CC)	---
6.101.2	Rating		P
	According to d.c. output voltage I.....	☐ up to and including 60 V, ☒ over 60 V up to and including 1500 V.	---

7	**PROTECTION AGAINST ELECTRIC SHOCK**		**P**
7.1	**General Requirements**		**—**
	Hazardous live parts are not accessible		P
	Exposed conductive parts not live under normal conditions		P
	Exposed conductive parts not live under single fault conditions		P
7.2	**Protection against direct contact**		**—**
7.2.1	One or more provisions prevent contact .....:		P
7.2.2	Accessibility of live parts		P
	Hazardous live parts are not accessible before or after removal of parts not requiring a tool for removal		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Accessibility with finger probe does not allow contact with hazardous live parts		P
7.2.3	Stored energy – discharge of capacitors		P
7.2.3.1	Disconnection of EV		P
	Voltage after 1 second shall be less than 60V..... :		P
	Stored energy available shall be less than 20J..... :		P
	Warning label provided		P
7.2.3.2	Disconnection of d.c. EV charging station		P
	Voltage after 1 second shall be less than 60V..... :		P
	Stored energy available shall be less than 20J..... :		P
	Warning label provided		P
7.3	**Fault Protection**		—
	One or more provisions prevent indirect contact.... :		P
7.4	**Supplementary Measures**		—
	Only applicable to mobile d.c. EV charging station		N/A
	An RCD (I∆n ≤ 30 mA) shall be provided as a part of the EV conductive supply equipment for earthed systems. The RCD shall have a performance at least equal to Type A and be in conformity with standard IEC 60364-4-4.		N/A
	Where power supply circuits that are galvanically separated from mains and are galvanically isolated from earth, electrical isolation between the isolated circuits and earth, and between the isolated circuits and exposed conductive parts of vehicle and EVSE shall be monitored. When a fault condition related to the electrical isolation is detected, the power supply circuits shall be automatically de-energized or disconnected by the EVSE.		N/A
7.5	**Protective measures for d.c. EV charging stations**		—
	The types of d.c. EV charging stations covered by these requirements, including all accessible conductive parts on the equipment shall have the following protective measures.		P
	– protective measures by automatic disconnection of supply by connecting all exposed conductive- parts to a protective conductor during battery charging, unless protective measure by reinforced or double insulation or protective measure by electrical separation is used for the d.c. EV charging stations.		P

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Clause	Requirement + Test	Result - Remark	Verdict
7.5.101	Requirements of the isolated d.c. EV charging station		P
	Requirements for the isolated d.c. EV charging station for protection against electric shock are defined for each system in AA.3.1, BB.2 or CC.4.1.		---
	In addition, if the d.c. EV charging station has multiple d.c. outputs designed for simultaneous operation, each output circuit shall be isolated from each other by basic insulation or reinforced insulation.		P
7.5.102	Requirements of the non-isolated d.c. EV charging station		N/A
	under consideration.		N/A
7.5.103	Protective conductor dimension cross-sectional area		P
	Protective conductor shall be of sufficient cross-sectional area to satisfy the requirements of IEC 60364-5-54.		P
7.6	**Additional requirements**		**—**
	The d.c. EV charging station shall be compatible with RCD Type A in the installation, i.e. a.c. supply network (mains).		P
	Class II chargers may have a lead- through protective conductor for earthing the EV chassis.		N/A

8	**CONNECTION BETWEEN THE POWER SUPPLY AND THE EV**		**P**
8.1	**General**		**—**
	Type of interface being used	CCS2	P
8.2	**Contact Sequencing**		**—**
	For all d.c. interfaces, the contact sequence during the connection process shall be: – Protective Earth (if any) – d.c. power contacts – Isolation monitor contacts – Proximity detection or connection switch contact – Control pilot contact During disconnection the order shall be reversed.		P
8.3	**Functional description of a standard interface**		---

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Clause	Requirement + Test	Result - Remark	Verdict
	Not applicable.		---
8.4	**Functional description of a basic interface**		---
	Not applicable.		---
8.5	**Functional description of a universal interface**		—
	Universal interface intermateable with either high power ac or high power dc connector		N/A
	Means provided to ensure dc power connector cannot be mated with ac inlet and vice versa		N/A
	Electrical ratings comply with level 1		N/A

9	**SPECIFIC REQUIREMENTS FOR VEHICLE COUPLER**		**P**
9.1	**General requirements**		—
	The construction and performance requirements of vehicle coupler are specified in IEC 62196-1.	Approved connector used.	P
	The requirements for the d.c. interfaces are specified in IEC 62196-3.		P
9.2	**Operating temperature**		—
	Operating temperature.....		P
9.3	**Service life of vehicle coupler**		—
	Service life of vehicle coupler.....		P
9.4	**Breaking Capacity**		—
	For d.c. charging, the vehicle couplers are rated "not for current interruption." A disconnection shall not take place under load.		P
	In the case of disconnection under d.c. load due to a fault, no hazardous condition shall occur.		P
	Avoidance of breaking under load can be achieved by a specific means on the vehicle connector or a system with interlock.		P
	In addition to locking mechanism defined in 6.4.3.104, in case of unintended disconnection of the vehicle coupler, the output current of the d.c. EV charging station shall be turned off within a defined time to contain a possible arc within the vehicle coupler housing. This turn-off time shall comply with the value specified in Annexes AA, BB and CC, using a speed of separation of the vehicle connector of (0,8 ± 0,1) m/s according to IEC 60309-1.		P
	Disconnection of vehicle coupler can be detected when one of the following occurs:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– loss of digital communication; – interruption of interlock circuit(s), e.g. control pilot, proximity circuit, to mitigate electrical arcing and shock hazards.		P
	The system specific requirement for breaking capacity and system redundancy are defined in Annexes AA, BB and CC.		P
9.5	**IP Degrees**		—
	Complies with 11.3		P
9.6	**Insertion and Extraction Forces**		—
	Complies with IEC 62196-1		P
9.7	**Latching of the retaining device**		—
	Latching or retaining if required may be a function of the complete system or the connector.		P

10	**CHARGING CABLE ASSEMBLY REQUIREMENTS**		**P**
10.1	**Electrical Rating**		—
	The rated voltage and current of each conductor shall correspond to the rated voltage and current of the d.c. output of the d.c. EV charging station.		P
10.2	**Electrical characteristics**		—
	Voltage and current ratings of the cable are compatible with the ratings of the EVSE		P
	Cable insulation is wear resistant and maintains flexibility over the full ambient range		P
10.3	**Dielectric Withstand Characteristics**		—
	Complies with 11.4		P
10.4	**Mechanical Characteristics**		—
	Meets or exceeds the characteristics specified in IEC 60245-6		P
	Cable is fire resistant		P
	Cable withstands chemical exposure		P
	Cable is rated for UV exposure		P
10.5	**Functional characteristics**		—
	The maximum cord length may be specified by national codes		P

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Clause	Requirement + Test	Result - Remark	Verdict
11	**EVSE REQUIREMENTS**		**P**
11.1	**General Test Requirements**		**—**
	Tests performed in an ambient of 20°C ± 5°C unless otherwise specified		P
11.2	**Classification**		**—**
	EVSE is considered indoor use only		N/A
	EVSE is considered indoor/outdoor use		P
11.3	**IP Degrees for basic and universal interfaces**		**—**
11.3.1	IP Degrees for ingress of objects		N/A
	Indoor Use (IP).....		—
	Vehicle inlet mated with connector is IP 21		N/A
	Connector for Case “C” when not connected is IP 21		N/A
	Outdoor Use (IP).....		—
	Vehicle inlet mated with connector is IP 44		N/A
	All Cable Assemblies.....		—
	Inlet in “road” position is IP 55 with or without assistance from vehicle design……..:		N/A
	Connector when not mated is IP 24		N/A
11.3.2	Protection against electric shock		N/A
	Vehicle inlet mated with connector is IP XXD		N/A
	Connector for Mode 1 not connected is IP XXD		N/A
	Connector for Mode 2 and Mode 3 not connected is IP XXB		N/A
11.4	**Dielectric Withstand Characteristics**		**—**
11.4.1	Dielectric Withstand Voltage	See appended Table 11.4.1	P
	No breakdown indicated		P
11.4.2	Impulse dielectric withstand	See appended Table 11.4.2	P
	No breakdown indicated		P
11.4.101	Suppression of overvoltage category		P
	The isolated d.c. EV charging station shall reduce overvoltage to the EV to the rated impulse voltage of 2 500 V.		P
	Primary circuit of d.c. charging station in outdoor is overvoltage category (OVC) III according to Part 1.	OVC III	P
11.5	**Insulation Resistance**		**—**

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Clause	Requirement + Test	Result - Remark	Verdict
	Insulation resistance measurement is greater than 1 MΩ	See appended Table 11.5	P
11.6	**Clearance and Creepage Distances**		**—**
	Clearance and Creepage Distances meet the minimum values	See appended Table 11.6	P
11.7	**Leakage – Touch Current**		**—**
11.7.101-11.7.105	Leakage current	See appended Table 11.7	P
11.7.106	Protection measures for the touch current exceeding 3.5 mA		N/A
	For Class I d.c. EV charging station, if the test touch current exceeds 3.5 mA r.m.s, any of the following requirements shall be met:		N/A
	a) The protective conductor shall have a cross-sectional area of at least 10mm² Cu or 16 mm² Al, through its total run.		N/A
	b) Where the protective conductor has a cross-sectional area of less than 10 mm² Cu or 16 mm² Al, a second protective conductor of at least the same cross-sectional area shall be provided up to a point where the protective conductor has a cross-sectional area not less than 10 mm² Cu or 16 mm² Al.		N/A
	c) Automatic disconnection of the supply in case of loss of continuity of the protective conductor.		N/A
	A caution symbol ⚠ shall be placed on the outside of the d.c. EV charging station, visible to the user.		N/A
	The minimum size of the protective earthing conductor shall comply with the local safety regulations, and shall be indicated in the installation manual.		N/A
11.8	**Environmental Tests**		**—**
11.8.1	General		P
	Equipment meets the original requirements after each test		P
11.8.2	Ambient air temperature		P
	Manufacturer's rated ambient temperature range (°C)……..:		P
	Equipment operates as intended within full range of ambient temperatures		P
11.8.3	Ambient Humidity		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Test in accordance with IEC 60068-2-78, test Ca, at 40°C ± 2°C and 93% relative humidity for four days……..:		P
	Test in accordance with IEC 60068-2-30, test Db, at 40°C ± 2°C for 6 cycles ……..:		N/A
11.8.4	Ambient Air Pressure		P
	Designed for operation between 860 hPa and 1060 hPa		P
11.9	**Permissible Surface Temperature**		—
	Temperature limits on surfaces are not exceeded	See appended Table 11.9	P
11.10	**Environmental Conditions**		—
	The EVSE is designed to resist the effect of normal automotive solvents and fluids, vibration and shock, material flammability standards and other conditions appropriate to the application.		P
11.11	**Mechanical Environmental Tests**		—
11.11.2	Mechanical Impact	IK10 for all parts.	P
	No damage to the enclosure, and no access to internal live parts after impact	IP test after Impact test.	P
11.12	**Electromagnetic Compatibility tests**		—
	The EMC requirements for d.c. EV charging stations are defined in IEC 61851-21-2.		P
11.13	**Latching of the retaining device**		—
	Latching device used to prevent disconnection under load		P
11.14	**Service**		—
	Parts are designed such that they can be removed, serviced and replaced when necessary		P
11.15	**Marking and Instructions**		—
11.15.1	Connection Instructions		P
	Instructions for proper connection of the vehicle to the EVSE shall appear in the vehicle manual		P
	Instructions for proper connection of the vehicle to the EVSE shall appear in the owner's manual		P
	Instructions for proper connection of the vehicle to the EVSE shall appear on the EVSE product		P
11.15.2	All marking comply with the legibility requirements after the rub tests		P

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Clause	Requirement + Test	Result - Remark	Verdict
11.15.3	Marking of Electric Vehicle Charging Station		P
	The EVSE product is marked with all relevant information		P
	Name of manufacturer		P
	Model number		P
	Serial number.....		P
	Date of manufacturer		P
	Rated voltage (V)		P
	Rated frequency (Hz).....		P
	Rated current (A).....		P
	Number of phases		P
	IP Degrees.....		P
	“Indoor use Only” if the product is intended for indoor use only		N/A
	Class II stations marked with Class II symbol		N/A
11.16	**Telecommunication Network**		**—**
	Telecommunication networks comply with IEC 60950-1		N/A
11.101	**Metering**		**—**
	If electric metering is provided, it shall comply with IEC 62052-11 and IEC 62053-21.		P

101	**SPECIFIC REQUIREMENTS FOR D.C. EV CHARGING STATION**		**P**
101.1	**General Requirements**		**—**
101.1.1	Emergency switching		P
	An emergency disconnection device may be installed to isolate the a.c. supply network (mains) from the d.c. electric vehicle charging station in case of risk of electric shock, fire or explosion.		P
	The disconnection device may be provided with a means to prevent accidental operation.		P
101.1.2	IP degrees for ingress of objects		P
	The minimum IP degrees shall be as specified: - indoor: IP21 - outdoor: IP44	IP54	P
101.1.3	Storage means of the cable assembly and vehicle connector		P

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Clause	Requirement + Test	Result - Remark	Verdict
	For d.c. EV charging stations, a storage means shall be provided for the cable assembly and vehicle connector when not in use.		P
	The storage means provided for the vehicle connector shall be located at a height between 0.4m and 1.5m above ground level.		P
101.1.4	Stability		P
	The d.c. electric vehicle charging station shall be installed as intended by the manufacturer's installation instructions.		P
	A force of 500 N shall be applied for 5 min in the horizontal direction to the top of the d.c. electric vehicle charging station in each of the four directions or in the worst possible horizontal direction.		P
	There shall be neither deterioration of the d.c. electric vehicle charging station nor deformation at its summit greater than: – 50 mm during the load application; – 10 mm after the load application.		P
101.1.5	Protection against uncontrolled reverse power flow from vehicle		P
	The d.c. EV charging station shall be equipped with a protective device against the uncontrolled reverse power flow from vehicle.		P
101.2	**Specific requirements for isolated systems**		—
101.2.1	DC output		P
101.2.1.1	Rated outputs and maximum output power		P
	The d.c. EV charging station may limit its maximum current under the given condition independent of the rated and demanded power.		P
	The d.c. EV charging station shall be able to deliver d.c. power in the voltage range [Vmin, Vmax] and the regulated current range [Imin, Imax] within the limit of its maximum rated power [Pmax] at the ambient temperature –5 °C to 40 °C below 1 000 m above sea level.		P
	The d.c. EV charging station shall not exceed its maximum rated power, even if the maximum power requested by the EV is beyond the rated maximum power of DC charger. Outside this operating range the DC charger is allowed to de-rate the power or the current.		P
101.2.1.2	Output voltage and current tolerance		P

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Clause	Requirement + Test	Result - Remark	Verdict
101.2.1.2.1	Output current regulation in CCC		P
	The tolerance between the output current of the d.c. EV charging station compared to the required value sent by the electric vehicle shall be ± 2,5 A for the requirement below 50 A, and ± 5 % of the required value for 50 A or more.	See appended Table 101.2.1.2.1	P
101.2.1.2.2	Output voltage regulation in CVC		P
	The tolerance between the output voltages of the d.c. EV charging station compared to the required value sent by the electric vehicle in steady state operation shall not be greater than 2 % for the maximum rated voltage of the d.c. EV charging station.	See appended Table 101.2.1.2.2	P
101.2.1.3	Control delay of charging current in CCC		P
	The d.c. EV charging station shall control the output current within 1 s after the request from vehicle, with a current control accuracy specified in 101.2.1.2.1, and with a changing rate dI_{min} of 20 A/s or more.	See appended Table 101.2.1.3	P
	If target current I_N deviated from base current I_0 lower than or equal to 20A, control delay should be <1s		P
	If target current I_N deviated from base current I_0 higher than 20A, control delay T_d should be $T_d \leq \frac{\lvert I_N - I_0 \rvert}{dI_{min}}$		P
101.2.1.4	Descending rate of charging current		P
	The d.c. EV charging station shall be able to reduce current with the descending rate of 100 A/s or more in normal operation.	Normal operation: 2541.7A/s	P
	For emergency shutdown and for fulfilling general requirements in 9.4, even much higher descending rates are necessary. For detailed values refer to Annexes AA, BB and CC.	Emergency stop: 3915.8A/s Disconnect CP: 1662.6A/s	P
101.2.1.5	Periodic and random deviation (current ripple)		P
	Current ripple of d.c. EV charging station during current regulation shall not exceed the limit.	See appended Table 101.2.1.5	P
101.2.1.6	Periodic and random deviation (voltage ripple in CVC)		P
	For CVC, the maximum voltage deviation during pre-charge state and during charging of the vehicle/traction battery shall not exceed ±5 % of the requested voltage.	See appended Table 101.2.1.6	P
	The maximum voltage ripple in normal operation shall not exceed ±5 V.		P

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Clause	Requirement + Test	Result - Remark	Verdict
101.2.1.7	Load dump		P
	In any case of load dump, voltage overshoot shall not exceed the limit specified for each system in Annexes AA, BB or CC.		P
	Maximum slew rate of output voltage in case of load dump shall not exceed 250 V/ms.	<250 V/ms	P
101.2.2	Effective earth continuity between the enclosure and the external protective circuit	0.061 Ω	P
	Exposed conductive part of d.c. EV charging station shall be connected to the terminal for the external protective conductor.		P
	The test shall be conducted in accordance with 10.5.2 in IEC 61439-1:2011 unless otherwise specified by national regulations.		P
102	**COMMUNICATION BETWEEN EV AND D.C. EV CHARGING STATION**		**P**
102.1	**General**		—
	This clause provides the general requirements for the control communication function and the system between EV and d.c. EV charging station. The specific requirements of digital communication of charging control between off-board d.c. charging system and electric road vehicle are defined in IEC 61851-24.		P
102.2	**System configuration**		—
	The communication between the d.c. EV charging station and the vehicle can be established via basic communication and high level communications.		P
	Key steps in the charging control process, such as start of charging and normal/emergency shutdown, shall be managed through the basic communication with signal exchange via the control pilot lines in d.c. EV charging system.		P
	In addition to the basic communication, the d.c. EV charging station shall be equipped with digital communication means in order to exchange the control parameters for d.c. charging between the d.c. EV charging station and the vehicle through the high level communication.		P
	Digital communication means used:		P
102.3	**Basic communication**		—
102.3.1	Interface		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Typical interfaces of control pilot function on d.c. EV charging systems are specified in Annexes AA, BB and CC. Each system shall carry out control pilot function through the control pilot conductors and terminals specified in IEC 62196-3.		P
102.3.2	Charging state		P
	The charging states show physical status of d.c. EV charging system. The d.c. EV charging station and the vehicle can exchange their charging state through the signal communication and the digital communication.		**P**
102.4	**Digital communication**		—
	Digital communication is specified in IEC 61851-24.		**P**
102.5	**Charging control process and state**		**—**
102.5.1	General		P
	Charging control process of general-purpose d.c. EV charging stations shall consist of the following three stages: - process before the start of charging (initialization); - process during charging (energy transfer); - process of shutdown (shutdown).		P
	The d.c. EV charging station and the vehicle shall synchronize control process with each other. The following signals and information shall be used for the synchronization: - signals through the pilot wire circuit; - parameters through the digital communication circuit; - measurement values such as voltage and current level of the d.c. charging circuit.		P
	The d.c. EV charging station and the vehicle shall preserve specified time constraints and control timings for ensuring smooth charging control and operation.		P
	Charging control process as system action level is shown in Table 103. General sequence diagrams are specified in Annex AA, Annex BB, and Annex CC. Digital communication parameters, formats, and other communication requirements are specified in IEC 61851-24.		P
102.5.2	Description of the process before the start of charging (initialization)		P

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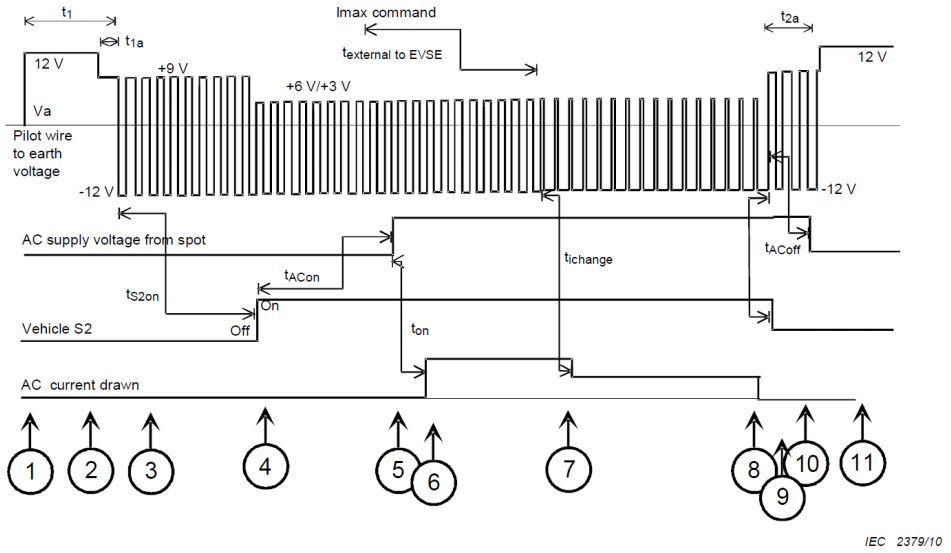
Clause	Requirement + Test	Result - Remark	Verdict
	In this process, the vehicle and the d.c. EV charging station exchange their operational limitations and relevant parameters for charging control.		P
102.5.3	Description of the process during charging (energy transfer)		P
	In this process, the vehicle continues to send a setting value of charging current or voltage to the d.c. EV charging station throughout the charging process.		P
	Either of the following two algorithms shall be taken: a) CCC b) CVC		P
102.5.4	Description of process of shutdown		P
	Normal shutdown shall occur when the vehicle battery capacity reaches a certain limit, or when the charging process is stopped by the user with a normal stop means.		P
	Emergency shutdown shall occur under a fault condition.		P

A	**ANNEX A (NORMATIVE), PILOT FUNCTION THROUGH A CONTROL PILOT CIRCUIT USING PWM MODULATION AND A CONTROL PILOT WIRE**		**P**
A.1	**General**		---
A.2	**Control pilot circuit**		---
	 Figure A.3 – Typical charging cycle under normal operating conditions		---
	Table A.4 – description of connecting sequences as shown on Figure A.3		---

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Clause	Requirement + Test	Result - Remark	Verdict

	--	State	Conditions	---
	1	A	Vehicle unconnected – the full generator voltage is measured by the EVSE at Va (see Figure A.1). The generator signal Vg is a +12 V DC voltage	P
	2	B	The cable assembly is connected to the vehicle and to the EVSE. This condition is detected by the 9 V signal measured at Va. The voltage from the signal generator (Vg) may be either a steady state +12 V DC or a ±12 V, 1 kHz signal in conformity with Table A.1 if the EVSE is immediately available f or the supply of energy.	P
	3	B	The EVSE is now able to supply energy and indicated the available current to the vehicle by the duty cycle in conformity with Table A.5. The presence of the diode D (see Figure A.1) is detected by the – 12 V and gives added guarantee that the 9 V signal is a reliable indication of a vehicle connected.	P
	4	B → C,D	S2 is closed by vehicle as a function of requirements to indicate that the vehicle can receive energy. There are no timing requirements for the closing of On.	P
	5	C,D	EVSE closes circuit. The timing of switch closure may be subject other requirements (payment, data exchange). If state D is detected, the switch will close only if ventilation requirements are met.	P
	6	C,D	Current drawn from the vehicle. The timing and current profile are determined by the vehicle. Current may not exceed that indicated by the duty cycle (Table A.5).	P
	7	C,D	External demand for power reduction. Such a demand may originate from the grid or by manual setting on EVSE. The Vehicle adjusts the current demand to that indicated by the duty cycle.	P
	8	C,D	End of charge, decided by the vehicle.	P
	9	C,D →B	Vehicle asks for disconnect. This may be the result of the proximity contact being opened	P
	10	B	EVSE detects state B (created by opening of S2 on vehicle) and opens the contactor.	P
	11	A	Complete removal of cable assembly from vehicle or EVSE is detected by the 12V signal.	P
	NOTE The EVSE should allow removal of the plug if the end of the charging session is ended by entering state A.			---

Annex AA	**DC EV CHARGING STATION OF SYSTEM A**		N/A
AA.3	**Specific safety requirements**		---
AA.3.1	Fault protection in the secondary circuit		N/A
AA.3.1.1	General		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	For fault protection in the secondary circuit, system A station shall have the following measures: a) reinforced isolating transformer; b) earth leakage current measurement using a grounding resistor between the d.c. power lines DC+/DC- and earth (enclosure and chassis); c) automatic disconnection of supply to d.c. power circuit at the first d.c. earth fault; d) charging cable consisting of line conductors that are individually insulated.		N/A
	When PE forms part of a charging cable, the cross-sectional area of PE shall be determined by the formula in 543.1.2 of IEC 60364-5-54:2011.		N/A
AA.3.1.2	Automatic disconnection and earth fault monitoring		N/A
	System A station shall measure the earth leakage current between the secondary circuit and its enclosure, or between the secondary circuit and the vehicle chassis.		N/A
	When an earth fault is detected during charging, the station shall reduce the d.c. output current to 5A or less.		N/A
	Then, the switch d1 shall be open in order to prevent the vehicle to close EV contactor. The line-to-line voltage of d.c. output Vdc shall be reduced to less than 60 V The automatic disconnection process shall be accomplished within 5 s from the detection of earth fault.		N/A
	A method to detect a d.c. fault current is required for the first earth fault.		N/A
AA.3.2	Voltage measurement of d.c. power line for vehicle connector unlock		N/A
	The vehicle connector shall not be unlocked when hazardous voltage is detected. To unlock the vehicle connector, the voltage of d.c. power line shall be measured and be confirmed to be within safe levels, i.e. 10 V or less.		N/A
AA.3.3	Prevention of the hazard due to vehicle battery short-circuit		N/A
	Overcurrent protection device, such as current-limiting fuse u, shall be provided in the output circuit of system A station in order to prevent the hazard due to short-circuit current of vehicle battery caused by the reverse connection of charging cable by mistake.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The overcurrent protection device shall have a current rating of 250 A or less, and be a quick-break type.		N/A
AA.3.4	Lock and latch monitoring for vehicle connector		N/A
	The vehicle connector shall have a means of mechanical latching, electrical locking, and lock and latch monitoring.		N/A
	In case of failure of mechanical latching or electrical locking of the vehicle connector, the station shall not energize the d.c. power lines connected to the vehicle connector.		N/A
	If the failure is detected during charging, the station shall reduce the d.c. output current to 5 A or less within 2 s. Then, the switch d1 shall open.		N/A
	The vehicle connector shall have a means to provide system A station with information on anomaly detection in monitoring of latch and electrical locking.		N/A
AA.3.5	Protection of EV contactor		N/A
	In order to prevent the welding of EV contactor, switches d1 and d2 shall not open at current exceeding 5 A.		N/A
AA.3.6	Emergency shutdown at control pilot disconnection		N/A
	If a control pilot is disconnected during charging, system A station shall decrease output current to 5 A or less within 30 ms.		N/A
AA.3.7	Turn on inrush current for vehicle circuit		N/A
	Inrush current on d.c. power line of system A station shall not exceed 20 A at vehicle connector.		N/A
AA.3.8	Protection against overvoltage at the battery		N/A
	System A station shall reduce the d.c. output current to 5 A or less of rated current within 3 s to prevent overvoltage at the battery, if output voltage exceeds maximum voltage limit sent by the vehicle.		N/A
AA.3.9	Load dump		N/A
	In any case of load dump, voltage overshoot of d.c. output of the station shall not exceed 600 V.		N/A
AA.4	**Charging process and communication between the d.c. EV charging station and the vehicle for charging control**		---
	Communication between the station and the vehicle is carried out through the control pilots CP, CP2 and CP3, proximity circuit CS, the digital communication circuits COM1 and COM2.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
AA.4.2	Charging control process		N/A
AA.4.2.1	State transition diagram and sequence diagram		N/A
	The charging process of system A shall conform to the state transition diagram as shown in Figure AA.5. Figure AA.6 gives the charging control sequence under normal conditions		N/A
AA.4.2.2	Start of charging		N/A
	When the charging process is initiated by system A station, d1 shall be closed. The switch d2 shall be open until the end of insulation test in AA.4.2.3.		N/A
AA.4.2.3	Insulation test before charging		N/A
	The insulation test shall not start until the vehicle provides system A station with a permission signal through CP3, and permission parameters by digital communication as shown in Annex A of IEC 61851-24:— Before the insulation test, system A station shall inform the vehicle through digital communication that the vehicle connector is locked.		N/A
	The insulation test shall be performed in accordance with 6.4.3.106 and as per the following procedure. a) Before the test, the station shall measure Vdc of d.c. power line and confirm that the EV contactors open. The voltage of d.c. power line, measured at Vdc, shall be 10 V or less. If the measured voltage exceeds 10 V, the charging process shall be shut down (see Figure AA.5). b) The voltage U that is applied to the d.c. power line shall be the maximum output voltage of the station. c) After the test, it shall be confirmed that the voltage at Vdc is 20 V or less. Then, the station shall inform the vehicle of the termination of test with closing d2 switch.		N/A
	During the insulation test, the earth fault shall be monitored in accordance with AA.3.1.2.		N/A
AA.4.2.4	Energy transfer		N/A
	System A shall continuously monitor the charging current value requested by the vehicle. The charging current shall be changed responding to the vehicle requested value, in accordance with CCC requirements in 101.2.1.2.1 and 101.2.1.3. The characteristics of charging current control shall meet Table AA.5 and Figure AA.8.		N/A
AA.4.2.5	Shutdown		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	In order to terminate the charging safely, system A station shall comply with the following procedure.		N/A
	a) The station shall notify the vehicle of start of shutdown process by digital communication.		N/A
	b) The station shall reduce the output current to 5 A or less.		N/A
	c) In normal conditions, switches d1 and d2 shall not be open until the welding detection of EV contactor by vehicle is finished.		N/A
	d) After d1 and d2 open, and before the vehicle connector unlocks, it shall be confirmed that the voltage at Vdc is 10 V or less.		N/A
AA.4.3	Measuring current and voltage		N/A
	The accuracy of output measurement of system A shall be within the following values: – current: ± (1,5% of actual current + 1) A; – voltage: ±5 V.		N/A
AA.5	**Response to vehicle command on charge current**		---
	System A station shall supply d.c. current to the vehicle using CCC with the vehicle as the master and DC charger as the slave. Recommended specification for the charge current request from the vehicle and the response performance of system A station are given in Table AA.5 and Figure AA.7 for the vehicle, and in Table AA.6 and Figure AA.8 for system A station.		N/A

Annex BB	**DC EV CHARGING STATION OF SYSTEM B**		**N/A**
BB.3	**The operation and control procedure of charging process**		---
BB.3.1	Measurement accuracy of current and voltage		N/A
	The accuracy of output measurement of system B shall be within the following values:		---
	- voltage measurement: ± 0,5%		N/A
	- current measurement: a) ±2 % of the actual current if the actual current is above (>) 50 A; b) ±1 A if the actual current is less than or equal to (≤) 50 A.		N/A
BB.3.2	Proximity function		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	When the vehicle connector is inserted into the vehicle inlet, the proximity function will be active. Namely once the voltage of detecting point 2 changes from 12 V to 6 V, the vehicle confirms the presence of the vehicle connector.		N/A
BB.3.3	Confirmation of connection state of vehicle interface (state 3).		N/A
	When the operator initiates the charging configuration for the d.c. EV charging station, the DC charger control unit can determine whether the vehicle connector is properly connected to the vehicle inlet by the voltage measurement of detecting point 1.		N/A
	When the operator completes the human-machine interaction setup and the d.c. EV charging station is properly connected, the DC charger control unit retains electrical interlock.		N/A
	The releasing of electrical interlock cannot be achieved unless the following three conditions are fully met: – charging terminates (there is no charging current output); – K1 – K6 are all disconnected; – unlock command is received from operator.		N/A
BB.3.4	DC charger self-detection is finished (state 4)		N/A
	After the vehicle interface is properly connected, if the DC charger self-detection (including insulation monitoring) is finished, close K3 and K4 to initiate low voltage auxiliary supply circuit.		N/A
	After the energy is transferred to the low voltage supply power circuit by DC charger, the EV vehicle control unit determines whether the vehicle interface is properly connected by the voltage measurement of detecting point 2.		N/A
	If the voltage of detecting point 2 is 6 V, then the vehicle control unit begins to send “vehicle control unit (or battery management system) identification broadcast message” periodically.		N/A
	The signal can be considered as one of the trigger conditions of non-driving state.		N/A
BB.3.5	Charger ready (state 5)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	After handshaking and configuration for the vehicle control unit and the DC charger control unit is finished by communication, the vehicle control unit closes K5 and K6 to energize charging supply output circuit; and the DC charger control unit closes K1 and K2 to energize the d.c. power supply circuit.		N/A
BB.3.6	Charging stage (state 5)		N/A
	During the whole charging process, the vehicle control unit controls the charging process by sending the battery charge level requirements to the DC charger control unit. The DC charger control unit adjusts the charging voltage and current to ensure normal operation of charging procedure according to the battery charge level requirements. In addition, the vehicle control unit and the DC charger control unit send charging status to each other.		N/A
BB.3.7	Terminate charging in normal condition		N/A
	The vehicle control unit determines when to stop charging according to the charged status of the battery system or whether there is a message of “Terminate Charger Request/Response” from the d.c. EV charging station.		N/A
	When one of the above charging termination conditions is met, the vehicle control unit starts to send “Vehicle control unit (or battery management system) Terminate Charger Request/Response” periodically, and makes the charger stop charging before K1, K2, K5 and K6 are opened.		N/A
	After communication is closed, K3 and K4 shall be opened, then release the electrical interlock. Finally the vehicle coupler could be disconnected and the whole charging process is finished.		N/A
BB.3.8	Safety protection under failure mode		N/A
BB.3.8.1	Safety protection under general failures		N/A
	During the charging process, when there are general failures, the DC charger control unit automatically stops charging (shutdown charging current output), then contactors K1, K2, K5, K6, K3 and K4 are opened by the DC charger control unit and the vehicle control unit before the operators release the electrical interlock through the DC charger setup, pull out the vehicle connector or carry out the error checks.		N/A
BB.3.8.2	Protection against overvoltage at the battery		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The system B station shall reduce the d.c. output current to less than 5 A within 2 s, to prevent overvoltage at the battery, if the output voltage exceeds the maximum voltage limit of the battery system for 1 s.		N/A
BB.3.8.3	Requirements for load dump		N/A
	In any case of load dump, the voltage overshoot shall not exceed 110 % of the maximum voltage limit requested by the vehicle.		N/A
BB.4	**Sequence diagram of charging process**		---
	The sequence diagram of charging process should comply with Figure BB.2.		N/A

Annex CC	**DC EV CHARGING STATION OF SYSTEM C (COMBINED CHARGING SYSTEM)**		**P**
CC.2	**Communication**		---
CC.2.1	The general definitions and functions of the Proximity (PP) and Pilot (CP) – signals / contacts are according to IEC 61851-1 (including detailed resistor definitions in Clause B.5) and SAE J1772™ with specific resistor values for configurations DD and FF given in Table CC.2. A CP duty cycle of 5% shall be used according Annex A of IEC 61851-1:2010.		P
CC.2.2	Charge control communications between the d.c. supply and the EV are specified in IEC 61851-24		P
	The physical layer for charge control communications shall comply with ISO/IEC 15118-3. Equivalent requirements for the physical layer of communications are in SAE J2931/4.		P
	Communication is achieved by PLC on CP and PE/ground contacts. Contact assignments of the different connectors are in IEC 62196-3.		P
	Charge control communications shall comply with DIN SPEC 70121. Charge control communications shall also comply with ISO/IEC 15118-2. Equivalent requirements for charge control communications are in SAE J2836/2™, SAE J2847/2 and SAE J2931/1.		P
CC.3	**Process of energy supply**		---
	The process of supplying energy to the EV by the d.c. supply is initiated and controlled by the messages sent over PLC and shall follow the sequences shown in Figures CC.1 to CC.4.		P
CC.3.2	Normal start up		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Sequence diagram for normal start up shall follow Figure CC.1 and Table CC.3.		P
CC.3.3	Normal shutdown		P
	Sequence diagram for normal shutdown shall follow Figure CC.2 and Table CC.4.		P
CC.3.4	DC supply initiated emergency shutdown		P
	An emergency shutdown of the output current to less than 5 A within 1s with a current descending rate of 200 A/s or more shall be applied by the d.c. supply.		P
	DC supply shall indicate supply initiated emergency shutdown by turning off CP oscillator.		P
CC.3.5	EV initiated emergency shutdown		P
	EV triggers emergency shutdown by opening S2 and changing CP state from C/D to B.		P
	DC supply shall acknowledge emergency shutdown request from the EV by performing emergency shutdown according to CC.3.3.		P
CC.4	**Safety measures**		---
CC.4.1	IT (isolated terra) system requirements		P
	The secondary circuit (output side) of the d.c. supply shall be designed as an IT system and protection measures in accordance with 411 of IEC 60364-4-41:2005 shall be applied.		P
	In case of using an insulation monitoring device (IMD), it shall comply with IEC 61557-8 or equivalent. The d.c. supply shall perform insulation monitoring between DC+ and PE and DC and PE during the supply process and communicate the current state (Invalid, Valid, Warning, Fault) of the system periodically to the EV.		P
	Prior to each supply cycle the following tests shall be performed. During these tests the d.c. output voltage shall not exceed 500 V at vehicle connector.		P
	a) A self-test of the insulation monitoring function of the d.c. supply shall be done by applying a defined fault resistor between d.c. output rail and equipotential bonding (e.g. PE). At least one of the following three possibilities for time management of self-test shall be applied:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	1) directly prior to supply cycle with vehicle connector plugged into vehicle inlet; 2) at regular intervals with maximum period of 1 h; 3) after self-test has successfully been performed the station may stay in Valid state for a maximum time of 1 h and during supply session under normal conditions.		P
	b) An insulation check of the system according to 6.4.3.106, e.g. by IMD shall be performed:		P
	1) vehicle connector not plugged into vehicle inlet: system comprises station, cable and vehicle connector, or		P
	2) vehicle connector plugged into vehicle inlet: system comprises station, charging cable, vehicle connector, vehicle inlet and vehicle cables.		P
	The insulation states of the system are defined as follows: invalid state, valid state, warning state, fault state, no IMD state.		P
CC.4.2	Temperature monitoring		P
	Temperature monitoring of the vehicle connector is required and shall be done by the d.c. supply to avoid overheating of vehicle connector.		P
	The station shall shutdown when the lower of the following 2 limits is exceeded: – the vehicle connector contact temperature limit is exceeded; or – the vehicle connector cable temperature rating is exceeded.		P
CC.4.3	Combined coupler lock function		P
	For all types of d.c. connectors according to Table CC.1, the vehicle inlet shall provide a locking function to mitigate unintentional disconnecting of the vehicle connector from the vehicle inlet during energy supply.		P
CC.4.4	CP lost shutdown (for all connectors of configuration CC)		P
	Fast emergency shutdown of the output current to less than 5 A within 30 ms shall be applied by the d.c. supply.		P
	Shutdown is initiated by direct change of pilot from state C to state A due to interruption of the CP line. If an interruption of the pilot occurs the station shall latch the fault, which will prevent the station from going into ready mode until the station is serviced.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	De-energization of the system shall be done within 100 ms according to Table A.7 in Part 1.		P
CC.4.5	PP lost shutdown (additionally with using connector configurations CC and EE)		N/A
	Fast emergency shutdown of the output current by the d.c. supply within 30 ms shall be applied. Shutdown is initiated by the EVSE and vehicle detecting the Proximity Circuit transitioning from no Proximity Circuit fault detected, S3 closed, to any other state.		N/A
CC.4.6	Voltage check at initialization		P
	At beginning of supply session, with CP state A or B, the d.c. supply shall check if voltage on the cable is less than 60 V and shall terminate supply session if 60 V is exceeded.		P
CC.4.7	DC EV charging station maximum output Y capacitance		P
	The maximum total parallel Y capacitance shall not exceed 1 µF. This implies Y capacitance ≤500 nF across each d.c. rail and ground for a d.c. EV charging station with Y capacitance equally distributed between each d.c. rail and ground.		P
CC.5	**Additional functions**		---
CC.5.1	Pre-charging		P
	Pre-charging for voltage matching shall be done by d.c. EV charging station according to the requirements given in 101.2.1.6.		P
CC.5.2	Wake up of d.c. supply by EV		P
	The d.c. supply may support a standby mode to minimize power consumption as described as optional function in 6.4.4.101.		P
	In this case it is mandatory for the d.c. supply to wake up and resume energy supply according to the following method.		P
	If the vehicle attached to the d.c. supply has not changed the control pilot from state B2 to C2 or D2 for more than 2 min, the station may go to sleep.		P
	The control pilot signal B1 shall be supplied continuously by the d.c. supply to enable a wake up of the station triggered by the EV changing into state C1 or D1.		P
CC.5.3	Provision for manual unlocking of vehicle connector		P

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Clause	Requirement + Test	Result - Remark	Verdict
	A means may be provided by the EV to manually unlock the vehicle connector even in case the voltage at the output stays higher than 60 V after the termination of the energy supply.		P
CC.5.4	Configuration CC connector latch position switch (S3) activation		N/A
	Latch position switch (S3) of the configuration CC connector shall not be able to be actuated when the vehicle connector is locked to the vehicle inlet.		N/A
CC.5.5	Configuration CC connector latch and latch position switch (S3) verification		N/A
	A supply cycle shall only be allowed once the d.c. EV charging station checks for the existence of the configuration CC connector latch and the function of the latch position switch (S3) prior to connecting the vehicle connector to the vehicle inlet.		N/A
CC.6	**Specific requirements**		---
CC.6.1	Turn on inrush current (d.c. side)		P
	Any inrush current on d.c. side in both directions when closing of EV disconnection device and station contactors, if any, shall not exceed 2 A. DC supply shall be responsible for limiting the inrush current, e.g. by applying a pre-charging circuit as shown in Figure CC.3.		P
CC.6.2	Protection against overvoltage of battery		P
	The d.c. supply shall trigger a d.c. supply initiated emergency shutdown according to CC.3.4 in order to prevent overvoltage at the battery, if output voltage exceeds maximum voltage limit sent by the vehicle for 400 ms.		P
CC.6.3	Requirements for load dump		P
	In any case of load dump, voltage overshoot shall not exceed 110 % of the maximum voltage limit requested by the vehicle.		P
	Maximum slew rate of output voltage in case of load dump shall not exceed 250 V/ms.		P
CC.6.4	DC output current regulation		P
	When in current regulation mode, the DC charger shall provide direct current to the vehicle.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The maximum allowable error between the actual average d.c. current value and the vehicle commanded current value is: – ±150 mA when the commanded current value is less than or equal to 5 A; – ±1.5 A when the commanded current value is greater than 5 A but less than or equal to 50A; – ±3 % of the DC charger's maximum current output when the commanded current value is greater than 50 A.	See table 101.2.1.2.1	P
CC.6.5	Measuring current and voltage		P
	The accuracy of output measurement of system C shall be within the following values: – voltage: ±10 V	See table 101.2.1.2.2	P
	The measured current reported shall be within ±1,5% of reading, but not better than ± 0,5 A.		P

IEC 61851-23			
Clause	Requirement + Test	Result - Remark	Verdict

11.4.1	TABLE: Dielectric Strength		P
Test voltage applied between:		**Test potential applied (V)**	**Breakdown / flashover (Yes/No)**
Input to the exposed conductive parts		DC 2121	No
Output to the exposed conductive parts		DC 2121	No
Main AC circuits to SELV circuit		DC 4242	No
Main DC circuits to SELV circuit		DC 4242	No
Supplementary information:			

11.4.2	TABLE: impulse tests (1.2/50μs)		P
Test voltage applied between:		**Test voltage applied (V)**	**Breakdown / flashover (Yes/No)**
Input to the exposed conductive parts		4000	No
Output to the exposed conductive parts		4000	No
Main AC circuits to SELV circuit		6000	No
Main DC circuits to SELV circuit		6000	No
Supplementary information:			

11.5	TABLE: insulation resistance measurements		P
Insulation resistance R between:		**R (MΩ)**	**Required R (MΩ)**
DC output to Enclosure		>50000	>1
AC input to Enclosure		>50000	>1
AC input to DC output		>50000	>1
Supplementary information:			

IEC 61851-23			
Clause	Requirement + Test	Result - Remark	Verdict

11.6	TABLE: Clearance and Creepage Distance Measurements					P
Clearance cl and creepage distance dcr at/of:	**Up (V)**	**U r.m.s. (V)**	**Required cl (mm)**	**cl (mm)**	**Required dcr (mm)**	**dcr (mm)**
L1 to L2 at MCCB (FI)	565	400	3.0	17.70	4.0	68.02
L1-PE at MCCB (BI)	325	230	3.0	29.35	3.0	46.35
L1 to L2 at contactor (FI)	565	400	3.0	16.04	4.0	22.34
L1 to PE at contactor (BI)	325	230	3.0	15.58	3.0	17.25
Input L1 to L2 at SPD (FI)	565	400	3.0	23.94	4.0	23.94
L-N at RCD (FI)	325	230	3.0	21.36	3.0	21.36
output DC+ to DC- (FI)	1000	1000	5.5	58.81	10.0	71.18
output DC+ to PE (BI)	1000	1000	5.5	35.95	10.0	35.95
Supplementary information: BI=basic insulation, FI=functional insulaiton						

11.7	TABLE: Touch current and protective conductor current				P
	Test circuit				—
	Supply voltage (Volt) .....:		440V		—
	Frequency (Hz) .....:		60Hz		—
—	—	—	Touch Current (mA r.m.s.)		
Terminal A (Switch “s”) of Measuring Instrument Connected to:	Switch “e” Position	Component Disconnected	Polarity P1/Primary Switch Condition		
—	—	—	Normal/ EUT On	Normal/ EUT Off	Reverse/ EUT On	Reverse/ EUT Off
Metal enclosure	Close	—	2.2	0.2	-	-
Miss phase (Metal enclosure)	Open	—	-	0.7	-	-
Supplementary information:						

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Clause	Requirement + Test	Result - Remark	Verdict

11.9	**TABLE: Heating Test**		**P**
	Test voltage (V) ..... :	Output 1000	—
	Test current (A) ..... :	Output 240	—
	Ambient (°C)..... :	50	—

Thermocouple Locations	**Max. temperature measured, (°C)**	**Max. temperature limit, (°C)**
DC- contactor (QC4)	76	85
DC- contactor (QC3)	81.1	85
DC- contactor for two vehicle connectors	77	85
DC+ contactor for two vehicle connectors	78	85
Meter	60.9	85
Circuit breaker (2QF)	65.1	80
SPD (FS)	67.1	80
Circuit breaker (1QF)	66.2	80
DC- Shunt (FL2)	82.7	120
DC- Shunt terminal (FL2)	71.4	120
Switching power supply (FD1)	71.7	80
DC+ contactor terminal	125.9	120
DC+ fuse terminal	106.8	120
Terminal block (CZ1)	68.9	90
AC circuit breaker (1JK)	60	80
Input L1 terminal	63.4	120
Input L2 terminal	63.8	120
Input L3 terminal	66.4	120
Input N terminal	56.8	120
AC contactor (1JC)	72.7	80
Input terminal of power module	83.4	120
Output terminal of power module	73.3	120
Emergency stop button	52.3	75
Enclosure	56.9	80
Charging cable	69	75
Vehicle connector	58.5	75
Handle part of vehicle connector	57.4	75
Screen	51.9	90

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Clause	Requirement + Test	Result - Remark	Verdict

Doorknob	50.8	65
Ambient temperature 1	50.0	--
Ambient temperature 2	49.8	--
Supplementary information:		

11.9	**TABLE: Heating Test**		**P**
	Test voltage (V) ..... :	Output 960	—
	Test current (A) ..... :	Output 250	—
	Ambient (°C)..... :	50	—

Thermocouple Locations	**Max. temperature measured, (°C)**	**Max. temperature limit, (°C)**
DC- contactor (QC4)	78.6	85
DC- contactor (QC3)	82.7	85
DC- contactor for two vehicle connectors	75.4	85
DC+ contactor for two vehicle connectors	77.1	85
Meter	60.2	85
Circuit breaker (2QF)	64.1	80
SPD (FS)	65.7	80
Circuit breaker (1QF)	64.8	80
DC- Shunt (FL2)	86.6	120
DC- Shunt terminal (FL2)	74.6	120
Switching power supply (FD1)	72	80
DC+ contactor terminal	133.9	120
DC+ fuse terminal	113.7	120
Terminal block (CZ1)	67.8	90
AC circuit breaker (1JK)	58.7	80
Input L1 terminal	63.1	120
Input L2 terminal	63.6	120
Input L3 terminal	65	120
Input N terminal	55.7	120
AC contactor (1JC)	71.9	80
Input terminal of power module	81.9	120
Output terminal of power module	72.3	120
Emergency stop button	53.2	75

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Clause	Requirement + Test	Result - Remark	Verdict

Enclosure	57.7	80
Charging cable	69	75
Vehicle connector	59	75
Handle part of vehicle connector	56.8	75
Screen	53.7	90
Doorknob	51.3	65
Ambient temperature 1	50.0	--
Ambient temperature 2	49.8	--
Supplementary information:		

101.2.1.2.1	**TABLE: output current regulation in CCC**			**P**
Required output current (A)	Current measured (A)	Deviation (A)	Limit (A)	Remark
1000V/240A	238.38	-1.62	±12.0	--
1000V/120A	120.05	0.05	±6.0	--
1000V/24A	24.05	0.05	±2.5	--
600V/250A	247.84	-2.16	±12.5	--
600V/125A	124.69	-0.31	±6.25	--
600V/25A	24.44	-0.56	±2.5	--
200V/250A	248.51	-1.49	±12.5	--
200V/125A	125.06	0.06	±6.25	--
200V/25A	24.99	-0.01	±2.5	--
960V/250A	245.83	-4.17	±12.5	--
960V/125A	125.11	0.11	±6.25	--
960V/25A	25.08	0.08	±2.5	--
Supplementary information:				

IEC 61851-23			
Clause	Requirement + Test	Result - Remark	Verdict

101.2.1.2.2	TABLE: output voltage regulation in CVC			P
Required output voltage (V)	Voltage measured (V)	Deviation (V)	Limit (V)	Remark
1000V/240A	1000.50	0.50	±20	--
1000V/120A	1002.10	2.10	±20	--
1000V/24A	1002.30	2.30	±20	--
600V/250A	598.68	-1.32	±12	--
600V/125A	599.33	-0.67	±12	--
600V/25A	599.71	-0.29	±12	--
200V/250A	199.77	-0.23	±4	--
200V/125A	200.23	0.23	±4	--
200V/25A	200.48	0.48	±4	--
960V/250A	960.30	0.30	±19.2	--
960V/125A	961.00	1.00	±19.2	--
960V/25A	961.40	1.40	±19.2	--
Supplementary information:				

101.2.1.3	TABLE: Control delay of charging current in CCC			P
Current range of change	Reaction time of EV charging station (s)	Delay time (s)	Limit (s)	Remark
5A to 20A	0.021	0.19	1	--
5A to 250A	0.03	2.00	12.25	--
Supplementary information:				

101.2.1.5	TABLE: Periodic and random deviation (current ripple)				P
Output voltage (V)	Output current (A)	Current ripple (A)	Frequency (Hz)	Limit (A)	Remark
1000	240	0.04	10	1.5	--
1000	240	1.84	5,000	6	--
1000	240	2.78	150,000	9	--
600	250	0.02	10	1.5	--
600	250	1.58	5,000	6	--
600	250	2.34	150,000	9	--
200	250	0.06	10	1.5	--
200	250	1.76	5,000	6	--
200	250	2.68	150,000	9	--
960	250	0.08	10	1.5	--
960	250	1.98	5,000	6	--
960	250	2.62	150,000	9	--
Supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

101.2.1.6	**TABLE: Periodic and random deviation (voltage ripple in CVC)**			**P**
Required output voltage (V)	Output voltage (V)	Voltage deviation (%)	Limit (%)	Remark
200V/240A	199.81	-0.095	±5	--
200V/120A	200.14	0.07	±5	--
200V/24A	200.46	0.23	±5	--
600V/250A	598.66	-0.22	±5	--
600V/125A	598.98	-0.17	±5	--
600V/25A	599.70	-0.05	±5	--
1000V/240A	1000.50	0.05	±5	--
1000V/120A	1002.20	0.22	±5	--
1000V/24A	1002.20	0.22	±5	--
Supplementary information:				

--End of report--

Test Report issued under the responsibility of:

TÜVRheinland®

TEST REPORT
IEC 61851-24
Electric vehicle conductive charging system – Digital communication between a d.c. EV charging station and an electric vehicle for control of d.c. charging

Report Number. ..... :	**CN24SI7B 001 attachment 1**
Date of issue ..... :	**See cover page**
Total number of pages ..... :	**See cover page**
Name of Testing Laboratory preparing the Report ..... :	See cover page
Applicant's name ..... :	See cover page
Address ..... :	See cover page
Test specification:	
Standard ..... :	EN 61851-24:2014/COR1:2015 for use in conjunction with EN 61851-23:2014/COR1:2016
Test procedure ..... :	CE LVD
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC61851_24A
Test Report Form(s) Originator .... :	
Master TRF ..... :	

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description ..... :	See report CN24SI7B 001
Trade Mark ..... :	See report CN24SI7B 001
Manufacturer ..... :	See report CN24SI7B 001
Model/Type reference ..... :	See report CN24SI7B 001
Ratings ..... :	See report CN24SI7B 001

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s): N/A			
☐	**CB Testing Laboratory:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address.....:			
Tested by (name + signature).....:			
Witnessed by (name, function, signature) .:			
Approved by (name, function, signature)...:			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address.....:			
Tested by (name, function, signature).....:			
Witnessed by (name, function, signature) .:			
Approved by (name, function, signature)...:			
Supervised by (name, function, signature) :			

List of Attachments (including a total number of pages in each attachment): N/A	
Summary of testing:	
Tests performed (name of test and test clause): All system C applicable tests are according to EN IEC 61851-24:2014	**Testing location:** See cover page.
Summary of compliance with National Differences (List of countries addressed): N/A ☒ **The product fulfils the requirements of EN IEC 61851-24:2014 (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)**	

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBs that own these marks.

See report CN24SI7B 001.

Test item particulars.....:	
Equipment mobility .....:	[] movable [] hand-held [] transportable [×] stationary [] for building-in [] direct plug-in
Connection to the mains .....:	[] pluggable equipment [] type A [] type B [×] permanent connection [] detachable power supply cord [] non-detachable power supply cord [] not directly connected to the mains
Access location .....:	[×] operator accessible [] service access area [] restricted access location
Over voltage category (OVC) .....:	[] OVC I [] OVC II [×] OVC III [] OVC IV [] other:
Class of equipment .....:	[×] Class I [] Class II [] Class III [] Not classified
Mains supply tolerance (%) or absolute mains supply values .....:	10%
Considered current rating (A) .....:	Refer to model list
Pollution degree (PD) .....:	[] PD 1 [] PD 2 [×] PD 3
IP protection class .....:	IP54
Altitude during operation (m) .....:	≤2000
Output Connector Interface Type.....:	See model list
Mass of equipment (kg) .....:	See model list
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object does meet the requirement.....:	P (Pass)
- test object does not meet the requirement.....:	F (Fail)
Testing.....:	
Date of receipt of test item .....:	See cover page
Date (s) of performance of tests.....:	See cover page

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

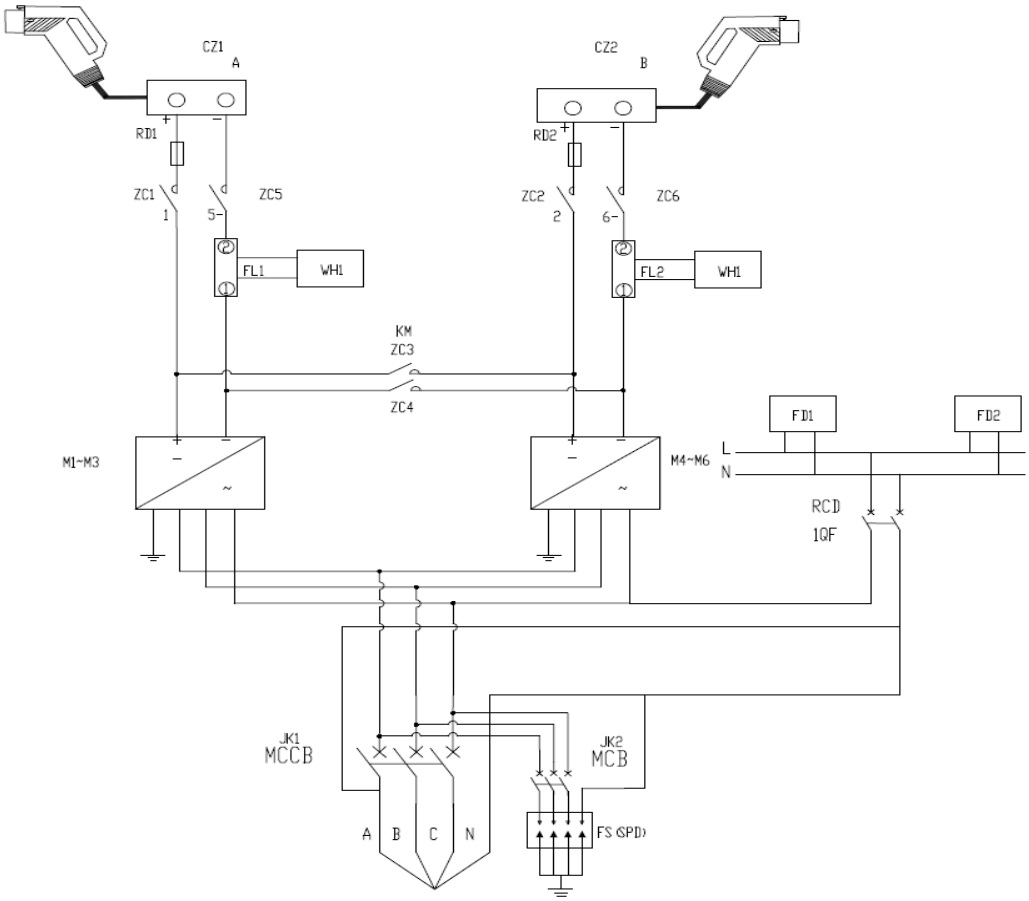
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	☐ **Yes** ☒ **Not applicable**

When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies) ..... : See report CN24SI7B 001.

General product information:

System diagram
For CCS2+CCS2 two connectors



output

Note: 1) This reports only tests system C using PLC communication.
Note: 2) the PLC module is GQSECC that is RNL PLC module, PLC hardware version is V8819 and PLC module software version is GQFW_20220811,the firmware is MAC-QCA7000-1.21.2025-00-20151013-CS in the E^2PROM of PLC module.
Note: 3) PLC chip is QCA7000 and MCU is PIC32MZ1024EFH100.
Note: 4) MCU of EVES controller board, hardware version is JC-6512 V11 and software version is JC-6512-jcccs-gy-20240306-1948, main chip is HC32F4A0RITB-LQFP144
Note: 5) IEC 61851-24 protocol test on the Model **"**AF-DC-240-B" as representative type.

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Clause	Requirement + Test	Result - Remark	Verdict
4	**SYSTEM CONFIGURATION**		P
	The system configuration is in accordance with 102.2 of IEC 61851-23.	See report CN24SI7B 001	P
5	**DIGITAL COMMUNICATION ARCHITECTURE**		p
	Two digital communication architectures are used:		p
	– one, based on CAN using a dedicated data communication circuit; CAN protocol is given in ISO 11898-1; refer to Annex A and Annex B for specific implementation details; and		N/A
	– the other, based on Homeplug Green PHY™[1] over the control pilot line; refer to Annex C for specific implementation details.		P
6	**CHARGING CONTROL PROCESS**		P
	The charging control process is in accordance with 102.5 of IEC 61851-23.	See report CN24SI7B 001 System C	P
7	**OVERVIEW OF CHARGING CONTROL**		P
	The digital communication of d.c. charging control covered by this standard is as shown in Figure 1.		P
8	**EXCHANGED INFORMATION FOR D.C. CHARGING CONTROL**		P
	Information which is exchanged between a d.c. EV charging station and a vehicle during the charging process according to IEC 61851-23.	(See appended Table 1)	P
	The information in Table 1 is common to all systems described in Annexes A, B and C.		P
	Each information listed in Table 1 is defined as a parameter in each annex.		P
	Each system may need additional parameters, and these parameters are defined in each annex.		P
ANNEX A	**DIGITAL COMMUNICATION FOR CONTROL OF D.C. EV CHARGING SYSTEM A**		N/A
A.1	**General**		N/A
	The specification of digital communication for control of the d.c EV charging station of system A (in this annex, referred to as "system A station" or "station") as specified in Annex AA of IEC 61851-23. More detailed information on system A is defined in JIS/TSD0007.		N/A
A.2	**Digital communication actions during charging control process**		N/A
	The communication actions and parameters according to the charging control process as defined in Table 103 of IEC 61851-23 are shown in Table A.1.	(see appended Table A.1)	N/A
A.3	**Digital communication of d.c. charging control**		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The parameters for digital communication of d.c. charging control are exchanged according to the sequence diagram as shown in Figure A.1.		N/A
A.4	**Parameter definition**		N/A
	The definition of parameters during d.c. charging control process are shown in Table A.2.	(see appended Table A.2)	N/A
A.5	**Physical/data link layer**		N/A
A.5.1	Specifications		N/A
	The physical/data link layer specifications are shown in Table A.3.	(see appended Table A.3)	N/A
A.5.2	Communication circuit		N/A
	The CAN communication circuit is established to exchange parameters, i.e. voltage, current, status flags, and fault flags, which are necessary for the charging control.		N/A
	– Terminating resistor 1:1 communication is assumed.		N/A
	The vehicle and the d.c. EV charging station are equipped with terminating resistors.		N/A
	– Noise filter The vehicle and the d.c. EV charging station are equipped with noise filters to reduce the conducted noise of the common mode and differential mode.		N/A
	– Twisted-pair line Twisted pair line are utilized as the communication line that links the d.c. EV charging station with the vehicle so as to reduce differential mode noise.		N/A
	– CAN transceiver CAN transceiver is equipped to send and receive CAN communication data.		N/A
	The CAN-bus circuit is established independently for d.c. charging, as shown in Figure A.2.		N/A
A.5.3	Transmission		N/A
	Data frames are transmitted in ascending order of ID number specified in Table A.2.		N/A
	The data frames are continuously transmitted at 100 ms (± 10 %) interval through the charging process.		N/A
	Interval duration (ms)……..:		--
A.5.4	Reception		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	When the vehicle or the d.c. EV charging station receives data frames from the other party, the received frames are echoed.		N/A
	Furthermore, the received error frames are destroyed.		N/A
A.5.5	CAN communication		N/A
	Figure A.3 shows the basic specifications related to the dedicated CAN communication between the vehicle and the d.c. EV charging station.		N/A
ANNEX B	**DIGITAL COMMUNICATION FOR CONTROL OF D.C. EV CHARGING SYSTEM B**		N/A
B.1	**General**		N/A
	The specification of d.c. charging control digital communication for the d.c EV charging station of system B (in this annex, referred to as "System B station" or "charger") as specified in Annex BB of IEC 61851-23.		N/A
B.2	**Digital communication of d.c. charging control**		N/A
	The parameters for digital communication of d.c. charging control are exchanged according to the sequence diagram as shown in Figure B.1.		N/A
B.3	**Digital communication actions during charging control process**		N/A
	The communication actions and parameters during d.c. charging control process are shown in Table B.1.	(see appended Table B.1)	N/A
B.4	**Parameter definition**		N/A
	The definition of parameters during d.c. charging control process are shown in Tables B.2, B.3, B.4, B.5 and B.6.	(see appended Tables B.2 , B.3, B.4, B.5,and B.6)	N/A
B.5	**Physical/data link layer**		N/A
	The physical/data link layer specifications are shown in Table B.7.	(see appended Table B.7)	N/A
	The physical/data link layer refers to SAE J1939-11 and SAE J1939-21.		N/A
	The application layer refers to GB/T 27930.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX C	**DIGITAL COMMUNICATION FOR CONTROL OF D.C. CHARGING SYSTEM C (COMBINED SYSTEM)**		**P**
C.1	**General**		P
	The digital communication for the d.c EV charging station of system C as specified in Annex CC of IEC 61851-23 is defined in the following standards: DIN SPEC 70121, ISO/IEC 15118-1, ISO/IEC 15118-2 and ISO/IEC 15118-3.	System C based on DIN SPEC 70121,	P
	The following SAE specifications can also be used as information: SAE J2836/2™, SAE J2847/2, SAE J2931/1 and SAE J2931/4.		N/A
	Systems implementing these specifications incorporate the following features:		P
	• security concept including encryption, signing, key management, etc.		P
	• robust PLC-based communications,		P
	• automatic address assigning and association,		P
	• IPv6-based communications,		P
	• compressed XML messages,		P
	• client-server approach,		P
	• safety concept including cable check, welding detection, etc.		P
	• extension concept for added-value services.		P
C.2	**Required exchange parameters**		
	The parameters to be exchanged for d.c. charging control are shown in Table C.1, corresponding to Table 1.	(See appended Table C.1)	P
	Additional parameters can be found in DIN SPEC 70121 and ISO/IEC 15118-2.		P

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Clause	Requirement + Test	Result - Remark	Verdict

8	TABLE 1: Exchanged information for d.c. charging control				
No.	**Information**	**Description**	**Relevant requirement in IEC 61851-23 (unless specified as IEC 61851-1)**	**Other remarks**	**Verdict**
a-1	Current request for the controlled current charging (CCC) system	Exchange of current value requested by EV	6.4.3.101, DC supply	See report CN24SI7B 001 attachment 1	P
a-2	Voltage request for the controlled voltage charging (CVC) system	Exchange of voltage value requested by EV	6.4.3.101, DC supply	See report CN24SI7B 001 attachment 1	P
a-3	Maximum rated voltage of d.c. EV charging station	Exchange of maximum rated voltage value of d.c. EV charging station	6.4.3.101, DC supply	See report CN24SI7B 001 attachment 1	P
			6.4.3.105, Compatibility assessment	See report CN24SI7B 001 attachment 1	P
			6.4.3.107, Protection against overvoltage at the battery	See report CN24SI7B 001 attachment 1	P
a-4	Maximum rated current of d.c. EV charging station	Exchange of maximum rated current value of d.c. EV charging station	6.4.3.101, DC supply for EV	See report CN24SI7B 001 attachment 1	P

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Clause	Requirement + Test		Result - Remark		Verdict
			6.4.3.105, Compatibility assessment	See report CN24SI7B 001 attachment 1	P
b-1	Communication protocol	Exchange of software version of a charging system	6.4.3.105, Compatibility assessment	See report CN24SI7B 001 attachment 1	P
b-2	Maximum voltage limit of EV	Exchange of maximum voltage limit value of vehicle.	6.4.3.105, Compatibility assessment	See report CN24SI7B 001 attachment 1	P
b-3	EV minimum current limit, only for the controlled voltage charging (CVC) system	not defined yet	6.4.3.105, Compatibility assessment	See report CN24SI7B 001 attachment 1	P
c	Insulation test result	Exchange of the result of insulation test before charging	6.4.3.106, Insulation test before charging	See report CN24SI7B 001 attachment 1	P
		- If insulation test fails, a signal is sent that charging is not allowed.	6.4.3.106, Insulation test before charging	See report CN24SI7B 001 attachment 1	P
d	Short circuit test before charging	Exchange of information on short circuit test before charging	6.4.3.110, Short circuit test before charging	See report CN24SI7B 001 attachment 1	P
e	Charging stopped by user	Exchange of information on charge stop command by the user of d.c. EV charging station	6.4.3.111, User initiated shutdown	See report CN24SI7B 001 attachment 1	P

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Clause	Requirement + Test	Result - Remark	Verdict

f	EVSE real time available load current (optional)	Exchange of EVSE real time available load current for demand management. Required for system providing that function.	6.4.4.2 (of IEC 61851-1), Detection/adjustment of the real time available load current of EVSE	See report CN24SI7B 001 attachment 1	P
g	Loss of digital communication	Detection of loss of digital communication	9.4, Breaking capacity	See report CN24SI7B 001 attachment 1	P
		- If a receiver does not get information expected to receive within time out period, it is considered as loss of digital communication.	9.4, Breaking capacity	See report CN24SI7B 001 attachment 1	P
h-1	Zero current confirmed	Notification of zero current confirmed	102.5, Charging control process and state	See report CN24SI7B 001 attachment 1	P
		- Station informs EV that low current condition has been met (to allow connector unlocking)	102.5, Charging control process and state	See report CN24SI7B 001 attachment 1	P

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Clause	Requirement + Test	Result - Remark	Verdict

h-2	Welding detection	Exchange of information on the whole process of welding detection	102.5, Charging control process and state	See report CN24SI7B 001 attachment 1	P
Supplementary information:					

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX A.2	**TABLE A.1 – Communication actions and parameters during d.c. charging control process between system A station and vehicle**						**N/A**
Charging control stage	**State**	**High level action at system level [a]**	**Digital communication action**	**Parameter**			
				From d.c. EV charging station	**From vehicle**	**Other remarks**	**Verdict**
Initialization / Handshaking	DC-A	Vehicle unconnected	None	N/A	N/A		
	DC-B1	Connector plugged in	None	N/A	N/A		
	DC-B1	Wake up of DCCCF and VCCF	None	None	(default CAN)		
		Communication data initialization	Preparation for digital communication	(default CAN)	(default CAN)		
	DC-B1 → DC-B2	Communication established, parameters exchanged, and compatibility checked	Exchange of charging control parameters	- Control protocol number - Available output voltage - Available output current - Battery incompatibility	- Control protocol number - Rated capacity of battery - Maximum battery voltage - Maximum charging time - Target battery voltage - Vehicle charging enabled		

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Clause	Requirement + Test				Result - Remark		Verdict
	Charge preparation	DC-B2 → DC-B3	Connector locked	Notification of connector locked status	- Vehicle connector lock	None		
		DC-B3	Insulation test for d.c. power line	None	Charging system malfunction	None		
		DC-B3	Pre-charge (depending on the system architecture)	N/A	N/A	N/A		
Energy transfer		DC-C or DC-D	Vehicle side contactors closed	Notification of vehicle main contactor closed status	None	None		
		DC-C or DC-D	Charging by current demand (for CCC)	Notification of request value of charging current (or voltage)	- Station status - Output voltage - Output current - Remaining charging time - Station malfunction - Charging system malfunction	- Charging current request - Charging system fault - Vehicle shift lever position		
		DC-C or DC-D	Charging by voltage demand (for CVC)	N/A	N/A	N/A		
		DC-C,(D) → DC-B'1	Current suppression	Request of energy transfer shut-off	- Station status - Charging stop control - Output voltage - Output current	Vehicle charging enabled		
Shutd own		DC-B'1	Zero current confirmed	Notification of energy transfer shut-off	- Station status - Charging system malfunction	-		

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Clause	Requirement + Test				Result - Remark		Verdict
	DC-B'1 → DC-B'2	Welding detection (by vehicle)	-	None	None		
	DC-B'2	Vehicle side contactors open	None	None	None		
	DC-B'2	DC power line voltage verification	Notification of present voltage	Output voltage	None		
	DC-B'3	Connector unlocked	Notification of connector unlocked status	Vehicle connector lock	None		
	DC-B'4	End of charge at communication level	Terminate the digital communication	None	None		
	DC-A	Connector unplugged		N/A	N/A		
[a] The order of actions does not refer to the procedure of charging control process.							
Supplementary information:							

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX A.4	**TABLE A.2 – Exchanged parameter during d.c. charging control process between system A station and vehicle**										**N/A**
Item in Table 1	**Parameter**	**Content**	**CAN ID ID.byte (bit)**	**Source**	**Destination**	**Data update rate**	**Unit**	**Status flag**	**Resolution (range)**	**Other remarks**	**Verdict**
b-2	Maximum battery voltage	The maximum voltage value at the vehicle inlet terminals, at which the station stops charging to protect the vehicle battery	H'100.4 H'100.5	EV	System A station	100 ms	V	-	1 V/bit		
	Rated capacity of battery	Rated capacity of battery	H'101.5 H'101.6	EV	System A station	100 ms	kWh	-	0,1 kWh /bit		
	Constant of charging rate indication	Fixed value for charging rate indication, which is the maximum charging rate (100 %) of vehicle battery	H'100.6	EV	System A station	100 ms	%	-	1 %/bit, 100 % (fixed)		
	Maximum charging time (set by 10 s)	Maximum charging time permitted by EV, set by 10 s	H'101.1	EV	System A station	100 ms	s	-	10 s/bit (0 to 2 540 s)		

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Clause	Requirement + Test							Result - Remark			Verdict
	Maximum charging time (set by minute)	Maximum charging time permitted by EV, set by minute	H'101.2	EV	System A station	100 ms	min	-	1 min/bit (0 to 255 min)		
	Estimated charging time	Estimated remaining time before the end of charging calculated by EV	H'101.3	EV	System A station	100 ms	min	-	1 min/bit (0 to 254 min)		
b-1	Control protocol number	Software version of control protocol to which EV corresponds	H'102.0	EV	System A station	100 ms	-	-	1 /bit (0 to 255)		
	Target battery voltage	Targeted charging voltage at the vehicle inlet terminals	H'102.1 H'102.2	EV	System A station	100 ms	V	-	1 V/bit (0 to 600 V)		
a-1	Charging-current-request	Current value requested by EV during charging	H'102.3	EV	System A station	100 ms	A	-	1 A/bit (0 to 255 A)		
	Charging rate	Charging rate of vehicle battery	H'102.6	EV	System A station	100 ms	%	-	1 %/bit (0 % to 100 %)		

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Clause	Requirement + Test							Result - Remark			Verdict
g	Vehicle charging enabled	Status flag indicating charge permission status of EV	H'102.5(0)	EV	System A station	-	-	**0:** disabled **1:** enabled	-		
	Vehicle shift lever position	Status flag indicating the shift lever position	H'102.5(1)	EV	System A station	-	-	**0:** "Parking" position **1:** other position	-		
	Charging system fault	Status flag indicating a malfunction caused by EV or the station, and detected by EV	H'102.5(2)	EV	System A station	-	-	**0:** normal **1:** fault	-		

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Clause	Requirement + Test							Result - Remark			Verdict
	Vehicle status	Status flag indicating the EV contactor status	H'102.5(3)	EV	System A station	-	-	**0:** EV contactor closed or during welding detection, **1:** EV contactor open or welding detection finished	-		
	Normal stop request before charging	Status flag indicating the request of EV to stop charging control	H'102.5(4)	EV	System A station	-	-	**0:** no request **1:** request to stop	-		
	Battery overvoltage	Status flag indicating whether or not the vehicle battery voltage exceeds the maximum limit specified by EV	H'102.4(0)	EV	System A station	-	-	**0:** normal, **1:** fault	-		

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Clause	Requirement + Test	Result - Remark	Verdict

	Battery undervoltage	Status flag indicating whether or not the vehicle battery voltage is less than the lower limit specified by EV	H'102.4(1)	EV	System A station	-	-	**0:** normal **1:** fault	-		
	Battery current deviation error	Status flag indicating whether or not the output current deviates from EV requested current	H'102.4(2)	EV	System A station	-	-	**0:** normal **1:** fault	-		
	High battery temperature	Status flag indicating whether or not the temperature of vehicle battery exceeds the maximum limit	H'102.4(3)	EV	System A station	-	-	**0:** normal **1:** fault	-		
	Battery voltage deviation error	Status flag indicating whether or not the vehicle battery voltage deviates from the output voltage measured by the station	H'102.4(4)	EV	System A station	-	-	**0:** normal, **1:** fault	-		

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Clause	Requirement + Test							Result - Remark			Verdict
h-2	EV contactor welding detection support identifier	Identifier indicating whether or not the station deals with EV contactor welding detection	H'108.0	System A station	EV	100 ms	-	**0:** not supporting vehicle welding detection, **1 or more:** supporting vehicle welding detection	-		
a-3	Available output voltage	Maximum output voltage value at the vehicle connector terminals	H'108.1 H'108.2	System A station	EV	100 ms	V	-	1 V/bit (0 to 600 V)		
a-4	Available output current	Maximum output current value of the station	H'108.3	System A station	EV	100 ms	A	-	1 A/bit (0 to 255 A)		
b-2	Threshold voltage	Threshold voltage to stop the charging process in order to protect vehicle battery	H'108.4 H'108.5	System A station	EV	100 ms	V	-	1 V/bit (0 to 600 V)		
b-1	Control protocol number	Software version number of control protocol or charging sequences that the station deals with	H'109.0	System A station	EV	100 ms	-	-	1 / bit (0 to 255)		

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Clause	Requirement + Test	Result - Remark	Verdict

	Output voltage	Supply voltage value of the output circuit in the station	H'109.1 H'109.2	System A station	EV	100 ms	V	-	1 V/bit (0 to 600 V)		
	Output current	Supply current value of the output circuit in the station	H'109.3	System A station	EV	100 ms	A	-	1 A/bit (0 to 255 A)		
	Remaining charging time (counted by 10 s)	Remaining time before the end of charging (counted by 10 s)	H'109.6	System A station	EV	100 ms	s	-	10 s/bit (0 to 2540 s)		
	Remaining charging time (counted by min)	Remaining time before the end of charging (counted by min)	H'109.7	System A station	EV	100 ms	min	-	1 min/bit (0 to 255 min)		
c h-1	Station status	Status flag indicating the energy transfer from the station	H'109.5(0)	System A station	EV	100 ms	-	**0:** standby **1:** charging	-		
	Station malfunction	Status flag indicating whether or not there is a malfunction caused by the station	H'109.5(1)	System A station	EV	100 ms	-	**0:** normal, **1:** fault	-		

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Clause	Requirement + Test	Result - Remark	Verdict

	Vehicle connector lock	Status flag indicating the electromagnetic lock status of vehicle connector	H'109.5(2)	System A station	EV	100 ms	-	**0:** unlocked **1:** locked	-		
	Battery in-compatibility	Status flag indicating the compatibility of vehicle battery with the output voltage of station	H'109.5(3)	System A station	EV	100 ms	-	**0:** compatible **1:** in compatible	-		
d	Charging system malfunction	Status flag indicating whether or not there is a problem with EV, such as improper connection	H'109.5(4)	System A station	EV	100 ms	-	**0:** normal **1:** mal function	-		
e	Charger stop control	Status flag indicating whether or not the station proceeds with shutdown process	H'109.5(5)	System A station	EV	100 ms	-	**0:** operating, **1:** shutdown or stop charging	-		

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX 5.1	**TABLE A.3 – The physical/data link layer specifications for system A**			**N/A**
			Other remarks	**Verdict**
Communication system	Communication protocol	ISO 11898-1 and ISO 11898-2 The extension bit (12 - 29 bit) is not used.		
	Transmission rate (kbps)	500		
	Cycle	100 ms ± 10 %		
Supplementary information:				

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX B.3	**TABLE B.1 – Communication actions and parameters during d.c. charging control process between system B station and vehicle**						**N/A**
Charging control stage (process)	**Digital communication action**	**Information**	**Source**	**Destination**	**Parameter cycle**	**Other remarks**	**Verdict**
Handshaking	Confirm the necessary parameters of battery and charger.	Charger recognition parameter	Charger	Vehicle	250 ms		
		Vehicle recognition parameter	Vehicle	Charger	250 ms		
Charging parameter configuration	Exchange of charging control parameters.	Battery charge parameter	Vehicle	Charger	500 ms		
		Charger time synchronization	Charger	Vehicle	500 ms		
		Charger max/min output parameter	Charger	Vehicle	250 ms		
		Vehicle charge ready	Vehicle	Charger	250 ms		
		Charger output ready	Charger	Vehicle	250 ms		
Charging stage	Send charging status to each other, according to the battery charge level requirements sent by Vehicle; the charger adjusts the charging process.	Battery charge requirement	Vehicle	Charger	50 ms		
		Charger charge status	Charger	Vehicle	50 ms		
		Battery charge status 1	Vehicle	Charger	250 ms		
		Battery charge status 2	Vehicle	Charger	250 ms		
		Battery cell voltage	Vehicle	Charger	1 s		
		Battery temperature	Vehicle	Charger	1 s		
		Vehicle stopping command	Vehicle	Charger	10 ms		
		Charger stopping command	Charger	Vehicle	10 ms		

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Clause	Requirement + Test			Result - Remark			Verdict
Charging ending stage	Energy transfer shut-off.	Vehicle statistic data	Vehicle	Charger	250 ms		
		Charger statistic data	Charger	Vehicle	250 ms		
Communication error	Restart communication program or stop charging process.	Vehicle receiving error	Vehicle	Charger	250 ms		
		Charger receiving error	Charger	Vehicle	250 ms		
Supplementary information:							

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX B.4	**TABLE B.2 – Parameters in charge handshake stage for system B**							**N/A**
Information	**Parameter**	**M[a] /O[b]**	**Unit**	**Resolution**	**Status flag**	**Item in Table 1**	**Other remarks**	**Verdict**
Charger recognition parameter	Recognition result	M	-	-	0x00: unre-cognized 0xAA: re-cognized	-		
	Charger number	M	-	-	-	-		
	Charger/charge station location code	O	-	-	-	-		
Vehicle recognition parameter	Vehicle communication protocol version	M	-	-	-	b-1		
	Battery type code	M	-	-	-	-		
	Battery system rated capacity	M	Ah	0,1 Ah/bit	-	-		
	Battery system rated voltage	M	V	0,1 V/bit	-	-		
	Battery manufacturer code, ASCII	O	-	-	-	-		
[a] M = Mandatory [b] O = Optional NOTE The communication protocol version includes 3 bytes. The current version is V1.0, which is expressed: Byte 3, Byte 2 – 0001H; Byte1 – 00H.								
Supplementary information:								

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX B.4	TABLE B.3 – Parameters in charge parameter configuration stage for system B							N/A
Information	**Parameter**	**M[a] /O[b]**	**Unit**	**Resolution**	**Status flag**	**Item in Table 1**	**Other remarks**	**Verdict**
Battery charge parameter	Maximum permissible charge voltage of battery cell	M	V	0,01 V/bit	-	-		
	Maximum permissible charge current	M	A	0,1 A/bit	-	-		
	Maximum permissible charge energy	M	kWh	0,1 kWh/bit	-	-		
	Maximum permissible charge voltage of battery system	M	V	0,1 V/bit	-	b-2		
	Maximum permissible temperature	M	°C	1 °C/bit	-	-		
	The initial SOC	M	%	0,1 %/bit	-	-		
	Total voltage of battery system	M	V	0,1 V/bit	-	-		
Charger time synchronization	Year/month/date/hour/minute/ second	O	-	-	-	-		
Charger max/min output parameter	Maximum output voltage	M	V	0,1 V/bit	-	a-3		
	Minimum output voltage	M	V	0,1 V/bit	-	-		
	Maximum output current	M	A	0,1 A/bit	-	a-4		
Vehicle charge ready	If the vehicle is ready to be charged	M	-	-	0x00: unready 0xAA: ready	-		

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Clause	Requirement + Test				Result - Remark			Verdict
Charger output ready	If the charger is ready to charge	M	-	-	0x00: unready 0xAA: ready	-		
[a] M = Mandatory [b] O = Optional								
Supplementary information:								

IEC 61851-24			
Clause	Requirement + Test	Result - Remark	Verdict

ANNEX B.4	**TABLE B.4 – Parameters in charging stage for system B**							**N/A**
Information	**Parameter**	**M[a] /O[b]**	**Unit**	**Resolution**	**Status flag**	**Item in Table 1**	**Other remarks**	**Verdict**
Battery charge requirement	Voltage requirement	M	V	0,1 V/bit	-	a-2		
	Current requirement	M	A	0,1 A/bit	-	a-1		
	Charge mode	M	-	-	-	-		
Charger charge state	Output voltage	M	V	0,1 V/bit	-	-		
	Output current	M	A	0,1 A/bit	-	h-1		
	Accumulated charge time	M	min	1 min/bit	-	-		
Battery charge state 1	Measured charge voltage	M	V	0,1 V/bit	-	-		
	Measured charge current	M	A	0,1 A/bit	-	-		
	Maximum cell voltage and corresponding battery pack number[c]	M	V	0,01 V/bit	-	-		
	SOC	M	%	1 %/bit	-	-		
	Estimated remainder time	M	min	1 min/bit	-	-		
Battery charge state 2	Cell number of maximum cell voltage	M	-	-	-	-		
	Maximum battery temperature	M	°C	1 °C/bit	-	-		
	Test point number of maximum temperature	M		-	-	-		
	Minimum battery temperature	M	°C	1 °C/bit	-	-		
	Test point number of minimum temperature	M	-	-	-	-		

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Clause	Requirement + Test				Result - Remark			Verdict
	Cell voltage over-high	M	-	-	**0:** normal **1:** over-high	-		
	Cell voltage over-low	M	-	-	**0**: normal **1**: over-low	-		
	Battery charge overcurrent	M	-	-	**0:** normal **1:** over-current	-		
	Battery temperature overhigh	M	-	-	**0:** normal **1**: over-high	-		
	Battery insulation state	M	-	-	**0**: normal **1:** abnormal	-		
	Connection state of battery output connector	M	-	-	**0**: normal **1:** abnormal	-		
	Charge permission	M	-	-	**0:** forbidden **1:** permission	c, d		

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Clause	Requirement + Test					Result - Remark		Verdict
Battery cell voltage	Voltage of each battery cell	O	V	0,01 V/bit	-	-		
Battery temperature	Temperature of each test point	O	°C	1 °C/bit	-	-		
Vehicle stopping command	Vehiclestopping reason	M	-	-	-	-		
	Vehiclestopping failure reason	M	-	-	-	h-2		
	Vehicle stopping error reason	M	-	-	-	-		
Charger stopping command	Charger stopping reason	M	-	-	-	e		
	Charger stopping failure reason	M	-	-	-	-		
	Charger stopping error reason	M	-	-	-	-		
[a] M = Mandatory [b] O = Optional [c] Maximum cell voltage and corresponding battery pack number includes 2 bytes. 1 – 12 bit: the maximum cell voltage in the battery system, 0,01 V/bit; 13 – 16 bit: the battery pack number in which the maximum cell voltage has occurred, 1/bit.								
Supplementary information:								

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX B.4	**TABLE B.5 – Parameters in charge ending stage for system B**							**N/A**
Information	**Parameter**	**M[a] /O[b]**	**Unit**	**Resolution**	**Status flag**	**Item in Table 1**	**Other remarks**	**Verdict**
Vehicle statistic data	The final SOC	M	%	1 % /bit	-	-		
	Minimum cell voltage	M	V	0,01 V/bit	-	-		
	Maximum cell voltage	M	V	0,01 V/bit	-	-		
	Minimum battery temperature	M	°C	1 °C/bit	-	-		
	Maximum battery temperature	M	°C	1 °C/bit	-	-		
Charger statistic data	Accumulated charge time	M	min	1 min/bit	-	-		
	Accumulated output energy	M	kWh	0,1 kWh/bit	-	-		
[a] M = Mandatory [b] O = Optional								
Supplementary information:								

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX B.4	**TABLE B.6 – Error parameters for system B**							**N/A**
Information	**Parameter**	**M[a] /O[b]**	**Unit**	**Resolution**	**Status flag**	**Item in Table 1**	**Other remarks**	**Verdict**
Vehicle receiving error	Receiving timeout of information from charger	M	-	-	-	g		
Charger receiving error	Receiving timeout of information from vehicle	M	-	-	-	g		
[a] M = Mandatory [b] O = Optional								
Supplementary information:								

ANNEX B.5	**TABLE B.7 – Physical/data link layer specifications for system B**			**N/A**
			Other remarks	**Verdict**
Communication system	Communication protocol	CAN 2,0 B, ISO 11898-1		
	Transmission rate (kbps)	250		
	Cycle	10/50/250/500/1 000 ms ± 10 %		
Supplementary information:				

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Clause	Requirement + Test	Result - Remark	Verdict

ANNEX C.2	**TABLE C.1 – Required exchanged parameters for d.c. charging control for system C**			**P**
Item in Table 1	**Information**	**Parameter name (ISO/IEC 15118-2)**	**Other remarks**	**Verdict**
a-1	Current request for the controlled current charging (CCC) system	CurrentDemandReq/EVTargetCurrent	The EVCC simulator sends the CurrentDemandReq to EVSE, include the massages like EVTargetCurrent, EVMaximumVoltageLimit, EVMaximumCurrentLimit and EVTargetVoltage. EVTargetCurrent is set to 10A.	**P**
a-2	Voltage request for the controlled voltage charging (CVC) system	CurrentDemandReq/EVTargetVoltage	The EVCC simulator sets the EVTargetVoltage value to 390V.	**P**
a-3	Maximum rated voltage of d.c. EV charging station	CurrentDemandRes/EVSEMaximumVoltageLimit	After receiving the CurrentDemandReq from the EVCC the SECC sends the CurrentDemandRes informing the EV about the EVSE status and the present EVSE output voltage and current. EVSEMaximumVoltageLimit value is 1000VDC.	**P**
a-4	Maximum rated current of d.c. EV charging station	CurrentDemandRes/EVSEMaximumCurrentLimit	EVSEMaximumCurrentLimit value is 200A.	**P**
b-1	Communication protocol	supportedAppProtocol{Req,Res}	Supported DIN:70121:2012	**P**
b-2	Maximum voltage limit of EV	CurrentDemandReq/EVMaximumVoltageLimit	The EVCC simulator sets the EVMaximumVoltageLimit value to 400V.	**P**

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Clause	Requirement + Test		Result - Remark	Verdict
b-3	EV minimum current limit, only for the controlled voltage charging (CVC) system	ChargeParameterDiscoveryRes / DC_EVSEChargeParameter / EVSEMinimumCurrentLimit	The EVCC simulator sets the EVSEMinimumCurrentLimit value to 0A.	**P**
c	Insulation test result	{PowerDeliveryRes, CableCheckRes, PreChargeRes, CurrentDemandRes, WeldingDetectionRes} / DC_EVSEStatus / EVSEIsolationStatus	EV requests cable and insulation check by <CableCheckReq> after connector lock has been confirmed. DC supply starts checking HV system insulation and continuously reports insulation state by <CableCheckRes>. DC supply determines that insulation resistance of system is above 100 kΩ. After having successfully finished the insulation check, DC supply indicates status ”Valid” with subsequent message <CableCheckRes>. DC supply status changes to “Ready” with Cable Check Response <CableCheckRes>. Start of pre-charge phase with EV sending Pre-Charge Request <PreChargeReq>, which contains eVTargetVoltage is 320v and eVTargetCurrent is 1A.	**P**
d	Short circuit test before charging	CableCheck{Req,Res}	EV requests cable and insulation check by <CableCheckReq> after connector lock has been confirmed. DC supply starts checking HV system insulation and continuously reports insulation state by <CableCheckRes>.	**P**

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Clause	Requirement + Test	Result - Remark		Verdict
e	Charging stopped by user	{ChargeParameterDiscoveryRes,PowerDeliveryR es, CableCheckRes, PreChargeRes, CurrentDemandRes, WeldingDetectionRes} / DC_EVSEStatus / EVSEStatusCode / EVSE_Shutdown {ChargeParameterDiscoveryRes, PowerDeliveryRes, CableCheckRes, PreChargeRes, CurrentDemandRes, WeldingDetectionRes} / DC_EVSEStatus / EVSENotification / StopCharging	Normal shutdown shall occur when the vehicle battery capacity reaches a certain limit, or when the charging process is stopped by the user with a normal stop means.	**P**
f	EVSE real time available load current (optional)	CurrentDemandRes/EVSEMaximumCurrentLimit	EVSEMaximumCurrentLimi 200A	**P**
g	Loss of digital communication	Message timers Control pilot state	Disconnecting of vehicle connector changes CP state from B to A	**P**

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Clause	Requirement + Test		Result - Remark	Verdict
h-1	Zero current confirmed	PowerDeliveryRes/ResponseCode CurrentDemandRes/EVSEPresentCurrent	EVCC set the parameter EVSEStatusCode equal to “EVSE_Shutdown“ in a PowerDeliveryRes message sent in response to a PowerDeliveryReq message with ReadyToChargeState equal to “TRUE”, the EVCC has successfully processed a received PowerDeliveryRes message with ResponseCode equal to “OK” as a response to a previous PowerDeliveryReq message with ReadyToChargeState equal to “TRUE”, the EVCC shall send a CurrentDemandReq message equal to “0 A” and shall then wait for a CurrentDemandRes message.	**P**
h-2	Welding detection	WeldingDetection{Req, Res}	EV can optionally perform its welded contactor check and indicate this to the DC supply with message <WeldingDetectionReq>. The vehicle sends multiple <WeldingDetectionReq> requests in order to read the DC supply output voltage measured by the DC supply in the response message <WeldingDetectionRes>. DIN 70121 protocol include this test case.	**P**
Supplementary information:				

List of test equipment used:

A completed list of used test equipment shall be provided in the Test Reports when a Manufacturer Testing Laboratory according to CTF stage 1 or CTF stage 2 procedure has been used.
Note: This page may be removed when CTF stage 1 or CTF stage 2 are not used. See also clause 4.8 in OD 2020 for more details.

Clause	Measurement / testing	Testing / measuring equipment / material used, (Equipment ID)	Range used	Last Calibration date	Calibration due date
ANNEX C	Rugged Testing Hardware Adapter for SUT EVSE Verisco	GC-SH-014590	ISO15118&DIN 70121/70122 Protocol test	--	--
	Blank				