TEST REPORT

IEC 62040-1

Uninterruptible power systems (UPS) -
Part 1: Safety requirements

Report reference number ..... :	CNDQ-ESH-P24121066
Date of issue..... ……...:	2025-02-28
Total number of pages ..... ……...:	120 pages
Testing laboratory name..... :	**BUREAU VERITAS ADT (SHANGHAI) CORPORATION**
Address ..... :	Building 4, No. 518, Xinzhuan Road, Caohejing Songjiang High-Tech Park, Shanghai, P.R.China (201612)
Accreditation..... :	ACCREDITED Test Lab Cert 2343.01
Applicant's name ..... :	BSL NEW ENERGY TECHNOLOGY CO., LTD
Address ..... :	8F, Building D-2-3,1F, Building D-2-3, 8F, Building D-2-2, No. 6, Xingyuan North Road, Starting AreaChina-Korea Huizhou Industrial Park, Zhongkai District, Huizhou City, Guangdong, P.R. China
Test specification	
Standard..... :	IEC 62040-1:2017+A1:2021; EN 62040-1:2019+A11:2021
Test procedure..... :	**Certificate of compliance**
Test report form number. ..... :	IEC62040-1_0
Master TRF..... :	**BUREAU VERITAS ADT (SHANGHAI) CORPORATION**
Test item description..... :	**ESS-GRID Integrated Li-ion Battery Energy Storage System**
Trademark ..... :	BSLBATT®
Model / Type..... :	ESS-GRID C241, ESS-GRID C225, ESS-GRID C208, ESS-GRID C192, ESS-GRID C176, ESS-GRID C160
Ratings ..... :	See below table

Ratings ..... :	See below table		
Model / Type **..... :**	ESS-GRID C241	ESS-GRID C225	ESS-GRID C208
PV Port (x3):			
PV Max. Input Voltage... :	620Vd.c.	577Vd.c.	532Vd.c.
PV MPPT Voltage Range :	250-600Vdc	250-557Vdc	250-512Vdc
PV Max. Input Current..... :	160A*3	160A*3	160A*3
Isc PV ..... :	180A*3	180A*3	180A*3
Maximum PV Input Power ..... :	50kW*3	50kW*3	50kW*3
AC Grid Port:			
AC Input ..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
AC Output (On-Grid) ..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
Power Factor Range ..... :	-0.8(lagging) to 0.8(leading)		
AC Load Port:			
AC Output (Off-Grid) ..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
AC Output (By-pass) ..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
Battery system:			
Battery Type ..... :	Li-ion Battery	Li-ion Battery	Li-ion Battery
Nominal Voltage ..... :	768Vd.c.	716.8Vd.c.	665.6Vd.c.
Voltage Range ..... :	672-852Vd.c.	627.2-795.2Vd.c.	582.4-738.4Vd.c.
Nominal Capacity ..... :	314Ah	314Ah	314Ah
Nominal Energy ..... :	241kWh	225kWh	208kWh
Rated Charge Current .... :	157A	157A	157A
Rated Discharge Current :	157A	157A	157A
Max Charge Current ..... :	250A	250A	250A
Rated Discharge Current :	250A	250A	250A
Max Discharge Current ... :	0°C ~ 55°C	0°C ~ 55°C	0°C ~ 55°C
Charging Temperature .... :	-20°C ~ 55°C	-20°C ~ 55°C	-20°C ~ 55°C

Model / Type..... :	ESS-GRID C192	ESS-GRID C176	ESS-GRID C160
PV Port (x3):			
PV Max. Input Voltage... :	488Vd.c.	443Vd.c.	398Vd.c.
PV MPPT Voltage Range :	250-468Vdc	250-423Vdc	250-378Vdc
PV Max. Input Current..... :	160A*3	160A*3	160A*3
Isc PV..... :	180A*3	180A*3	180A*3
Maximum PV Input Power ..... :	50kW*3	50kW*3	50kW*3
AC Grid Port:			
AC Input ..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
AC Output (On-Grid)..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
Power Factor Range..... :	-0.8(lagging) to 0.8(leading)		
AC Load Port:			
AC Output (Off-Grid)..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
AC Output (By-pass) ..... :	3/N/PE, 400Vac, 50Hz, 173A, 125kW Max.		
Battery system:			
Battery Type ..... :	Li-ion Battery	Li-ion Battery	Li-ion Battery
Nominal Voltage ..... :	614.4Vd.c.	563.2Vd.c.	512Vd.c.
Voltage Range ..... :	537.6-681.6Vd.c.	492.8-624.8Vd.c.	448-568Vd.c.
Nominal Capacity ..... :	314Ah	314Ah	314Ah
Nominal Energy ..... :	192kWh	176kWh	160kWh
Rated Charge Current .... :	157A	157A	157A
Rated Discharge Current :	157A	157A	157A
Max Charge Current ..... :	250A	250A	250A
Rated Discharge Current :	250A	250A	250A
Max Discharge Current... :	0°C ~ 55°C	0°C ~ 55°C	0°C ~ 55°C
Charging Temperature.... :	-20°C ~ 55°C	-20°C ~ 55°C	-20°C ~ 55°C

Testing Location ..... :	**BUREAU VERITAS ADT (SHANGHAI) CORPORATION**
Address ..... :	Building 4, No. 518, Xinzhuan Road, Caohejing Songjiang High-Tech Park, Shanghai, P.R.China (201612)
Tested by (name and signature) ..... :	Jiaxin Tan Test Engineer
Approved by (name and signature) ..... :	Robin Wu Project Manager
Manufacturer's name ..... :	BSL NEW ENERGY TECHNOLOGY CO., LTD
Factory address ..... :	8F, Building D-2-3,1F, Building D-2-3, 8F, Building D-2-2, No. 6, Xingyuan North Road, Starting AreaChina-Korea Huizhou Industrial Park, Zhongkai District, Huizhou City, Guangdong, P.R. China
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Document History

Date	Internal reference	Modification / Change / Status	Revision
2025-02-28	Jiaxin Tan	Initial report was written	0

Supplementary information:

Test item particulars	
Classification of installation and use ..... :	☐ Ordinary Person ☒ Instructed Person ☒ Skilled Person
Supply connection ..... :	☐ pluggable equipment ☐ type A ☐ type B ☒ permanent/lockable connection ☐ detachable power supply cord ☐ non-detachable power supply cord
Environmental category ..... :	☐ outdoor ☒ indoor ☐ unconditional ☒ conditional
Equipment mobility ..... :	☐ movable ☒ stationary ☐ for building-in ☒ fixed
Access location ..... :	☒ Ordinary person ccessible ☐ Restricted access location
Over voltage category Mains..... :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV / DC ..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%)..... :	±10 %
Tested for power systems ..... :	N/A
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III
Pollution degree ..... :	☐ PD 1 ☒ PD 2 ☐ PD 3 (Reduction of table 5 is considered)
Protection against ingress of water ..... :	IP55
Elevation during operation (m) ..... :	Max. 2000m
Elevation of test laboratory (m)..... :	<2000m
Mass of equipment (kg) ..... :	Approximately 3090kg
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 ..... :	2024-11-13
Date (s) of performance of tests ..... :	2024-11-13 to 2024-12-20

General remarks

The test results presented in this report relate only to the object tested.
This report shall not be reproduced in part or in full without the written approval of the issuing testing laboratory.
"(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.

This report consists of the following documents and/or enclosures

1. Test Report
2. Pictures of the unit – Annex No. 1

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.

ESS-GRID Integrated Li-ion Battery Energy Storage System

SL3ATT

Product Data	
Model	ESS-GRID C241
Battery Information	1FpP74/176/209/[1P240S]/M/-20+50/95
Dimension	1850*1430*2300mm
Weight	3090Kg
Altitude	<2000m
Charge Operation Temperature	0℃-55℃
Discharge Operation Temperature	-20℃-55℃
Protective Class	I
Overvoltage Category	III
Protection Rating	IP55
AC Grid Parameter	
AC Input: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. Power Factor Range: -0.8(lagging) to 0.8(leading).	
AC Load Parameter	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Bypass Parameter	
AC Bypass: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. During device maintenance, the bypass switch can connect the mains to the load to prevent the load from being outage for a long time due to maintenance.	
PV MPPT Parameter	
PV Operating Voltage	250V-600Vdc
Maximum PV Voltage	620Vdc
PV Power	50kW*3
PV Operating Current	160A*3
Isc PV	180A*3
Battery Parameter	
Nominal Voltage	768Vdc
Voltage Range	672-852Vdc
Nominal Capacity	314Ah
Nominal Energy	241kWh
Rated Charge Current	157A
Rated Discharge Current	157A
Max Charge Current	250A
Max Discharge Current	250A

DISPOSAL OF BATTERIES SHOULD FOLLOW LOCAL REGULATIONS

Charge the battery at constant current 157A until voltage reaches 852V then charge at constant voltage 852V till charge current is 15.7A

5min RoHS COMPLIANT

MFD: YYMMDD

MADE IN CHINA

BSL NEW ENERGY TECHNOLOGY CO., LTD

www.bsl-battery.com

ESS-GRID Integrated Li-ion Battery Energy Storage System

SL3ATT

Product Data	
Model	ESS-GRID C225
Battery Information	1FpP74/176/209/[1P224S]/M/-20+50/95
Dimension	1850*1430*2300mm
Weight	2977Kg
Altitude	<2000m
Charge Operation Temperature	0℃-55℃
Discharge Operation Temperature	-20℃-55℃
Protective Class	I
Overvoltage Category	III
Protection Rating	IP55
AC Grid Parameter	
AC Input: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. Power Factor Range: -0.8(lagging) to 0.8(leading).	
AC Load Parameter	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Bypass Parameter	
AC Bypass: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. During device maintenance, the bypass switch can connect the mains to the load to prevent the load from being outage for a long time due to maintenance.	
PV MPPT Parameter	
PV Operating Voltage	250V-557Vdc
Maximum PV Voltage	577Vdc
PV Power	50kW*3
PV Operating Current	160A*3
Isc PV	180A*3
Battery Parameter	
Nominal Voltage	716.8Vdc
Voltage Range	627.2-795.2Vdc
Nominal Capacity	314Ah
Nominal Energy	225kWh
Rated Charge Current	157A
Rated Discharge Current	157A
Max Charge Current	250A
Max Discharge Current	250A

DISPOSAL OF BATTERIES SHOULD FOLLOW LOCAL REGULATIONS

Charge the battery at constant current 157A until voltage reaches 795.2V then charge at constant voltage 795.2V till charge current is 15.7A

5min RoHS COMPLIANT

MFD: YYMMDD

MADE IN CHINA

BSL NEW ENERGY TECHNOLOGY CO., LTD

www.bsl-battery.com

ESS-GRID Integrated Li-ion Battery Energy Storage System

BSLBATT

Product Data	
Model	ESS-GRID C208
Battery Information	1FpP74/176/209/[1P208S]/M/-20+50/95
Dimension	1850*1430*2300mm
Weight	2864Kg
Altitude	<2000m
Charge Operation Temperature	0℃-55℃
Discharge Operation Temperature	-20℃-55℃
Protective Class	I
Overvoltage Category	III
Protection Rating	IP55
AC Grid Parameter	
AC Input: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. Power Factor Range: -0.8(lagging) to 0.8(leading).	
AC Load Parameter	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Bypass Parameter	
AC Bypass: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. During device maintenance, the bypass switch can connect the mains to the load to prevent the load from being outage for a long time due to maintenance.	
PV MPPT Parameter	
PV Operating Voltage	250V-512Vdc
Maximum PV Voltage	532Vdc
PV Power	50kW*3
PV Operating Current	160A*3
Isc PV	180A*3
Battery Parameter	
Nominal Voltage	665.6Vdc
Voltage Range	582.4-738.4Vdc
Nominal Capacity	314Ah
Nominal Energy	208kWh
Rated Charge Current	157A
Rated Discharge Current	157A
Max Charge Current	250A
Max Discharge Current	250A

DISPOSAL OF BATTERIES SHOULD FOLLOW LOCAL REGULATIONS

Charge the battery at constant current 157A until voltage reaches 738.4V then charge at constant voltage 738.4V till charge current is 15.7A

5min RoHS COMPLIANT

MFD: YYMMDD

MADE IN CHINA

BSL NEW ENERGY TECHNOLOGY CO., LTD
www.bsl-battery.com

ESS-GRID Integrated Li-ion Battery Energy Storage System

BSLBATT

Product Data	
Model	ESS-GRID C192
Battery Information	1FpP74/176/209/[1P192S]/M/-20+50/95
Dimension	1850*1430*2300mm
Weight	2751Kg
Altitude	<2000m
Charge Operation Temperature	0℃-55℃
Discharge Operation Temperature	-20℃-55℃
Protective Class	I
Overvoltage Category	III
Protection Rating	IP55
AC Grid Parameter	
AC Input: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. Power Factor Range: -0.8(lagging) to 0.8(leading).	
AC Load Parameter	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Bypass Parameter	
AC Bypass: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. During device maintenance, the bypass switch can connect the mains to the load to prevent the load from being outage for a long time due to maintenance.	
PV MPPT Parameter	
PV Operating Voltage	250V-468Vdc
Maximum PV Voltage	488Vdc
PV Power	50kW*3
PV Operating Current	160A*3
Isc PV	180A*3
Battery Parameter	
Nominal Voltage	614.4Vdc
Voltage Range	537.6-681.6Vdc
Nominal Capacity	314Ah
Nominal Energy	192kWh
Rated Charge Current	157A
Rated Discharge Current	157A
Max Charge Current	250A
Max Discharge Current	250A

DISPOSAL OF BATTERIES SHOULD FOLLOW LOCAL REGULATIONS

Charge the battery at constant current 157A until voltage reaches 681.6V then charge at constant voltage 681.6V till charge current is 15.7A

5min RoHS COMPLIANT

MFD: YYMMDD

MADE IN CHINA

BSL NEW ENERGY TECHNOLOGY CO., LTD
www.bsl-battery.com

ESS-GRID Integrated Li-ion Battery
Energy Storage System

Product Data	
Model	ESS-GRID C176
Battery Information	1FpP74/176/209/[1P176S]/M/-20+50/95
Dimension	1850*1430*2300mm
Weight	2638Kg
Altitude	<2000m
Charge Operation Temperature	0℃-55℃
Discharge Operation Temperature	-20℃-55℃
Protective Class	I
Overvoltage Category	III
Protection Rating	IP55
AC Grid Parameter	
AC Input: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. Power Factor Range: -0.8(lagging) to 0.8(leading).	
AC Load Parameter	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Bypass Parameter	
AC Bypass: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. During device maintenance, the bypass switch can connect the mains to the load to prevent the load from being outage for a long time due to maintenance.	
PV MPPT Parameter	
PV Operating Voltage	250V-423Vdc
Maximum PV Voltage	443Vdc
PV Power	50kW*3
PV Operating Current	160A*3
Isc PV	180A*3
Battery Parameter	
Nominal Voltage	563.2Vdc
Voltage Range	492.8-624.8Vdc
Nominal Capacity	314Ah
Nominal Energy	176kWh
Rated Charge Current	157A
Rated Discharge Current	157A
Max Charge Current	250A
Max Discharge Current	250A

DISPOSAL OF BATTERIES SHOULD FOLLOW LOCAL REGULATIONS
Charge the battery at constant current 157A until voltage reaches 624.8V then charge at constant voltage 624.8V till charge current is 15.7A

5min RoHS COMPLIANT

MFD: YYMMDD
MADE IN CHINA

BSL NEW ENERGY TECHNOLOGY CO., LTD
www.bsl-battery.com

ESS-GRID Integrated Li-ion Battery
Energy Storage System

Product Data	
Model	ESS-GRID C160
Battery Information	1FpP74/176/209/[1P160S]/M/-20+50/95
Dimension	1850*1430*2300mm
Weight	2525Kg
Altitude	<2000m
Charge Operation Temperature	0℃-55℃
Discharge Operation Temperature	-20℃-55℃
Protective Class	I
Overvoltage Category	III
Protection Rating	IP55
AC Grid Parameter	
AC Input: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. Power Factor Range: -0.8(lagging) to 0.8(leading).	
AC Load Parameter	
AC Output: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max.	
AC Bypass Parameter	
AC Bypass: 3/N/PE, 400Vac, 50Hz, 173A, 125KW Max. During device maintenance, the bypass switch can connect the mains to the load to prevent the load from being outage for a long time due to maintenance.	
PV MPPT Parameter	
PV Operating Voltage	250V-378Vdc
Maximum PV Voltage	398Vdc
PV Power	50kW*3
PV Operating Current	160A*3
Isc PV	180A*3
Battery Parameter	
Nominal Voltage	512Vdc
Voltage Range	448-568Vdc
Nominal Capacity	314Ah
Nominal Energy	160kWh
Rated Charge Current	157A
Rated Discharge Current	157A
Max Charge Current	250A
Max Discharge Current	250A

DISPOSAL OF BATTERIES SHOULD FOLLOW LOCAL REGULATIONS
Charge the battery at constant current 157A until voltage reaches 568V then charge at constant voltage 568V till charge current is 15.7A

5min RoHS COMPLIANT

MFD: YYMMDD
MADE IN CHINA

BSL NEW ENERGY TECHNOLOGY CO., LTD
www.bsl-battery.com

The MFD date: YYMMDD, code rule shows below:

1) The “YY” digits represent the year, means final 2 numbers of year, eg “24” is 2024 year;

2) The “MM” digits represent the month, eg “05” is May;

3) The “DD” digits represent the day, eg “15” is 15th day.

Remark:

1. The above markings are the minimum requirements by the safety standard. For the final production samples, additional markings which do not give rise to misunderstanding may be added.

2. The height of WEEE mark at least 7mm, height of other marks at least 5mm, height of letters and numerals at least 2mm.

3. Manufacturer information (name/registered trademark/registered trade name and postal address) and importer information for manufacturer outside of the EU (name/registered trademark/registered trade name and postal address) should be pasted on product when sell the product to the EU market.

General product information:

1. The product covered by this report is ESS-GRID Integrated Li-ion Battery Energy Storage System (commercial energy storage system). which includes 3 PV converter, power conversion system, Static transfer systems, three-phase isolating transformer, fire protection system, air conditioning system, and battery system (maximum 15 battery modules and high-voltage box).
2. The PV converter (model Monet-50DC), power conversion system (model Monet-125AC), Static transfer systems (model Monet-150STS) and three-phase isolating transformer (model BYL-3125KA) had been evaluated according to relative product standards, detail see critical component list.
3. The battery system complied with IEC 62619:2022.
4. The battery system contains electrochemical batteries, battery control units, battery management units, power and signal terminals, and mechanical parts.
5. The single battery module is equipped with 16 cells in 16S1P, cell model no. is CB75. Only one complete control box is in battery system.

Model differences:

All series models ESS-GRID C241, ESS-GRID C225, ESS-GRID C208, ESS-GRID C192, ESS-GRID C176, ESS-GRID C160 are identical to each other expect for model name and the number of battery modules. All models are used the same control box and stacked by the same battery module, only the number of battery modules is different (note: series stacking). The tested model ESS-GRID C241 is representatives of all models.

The product was tested on:

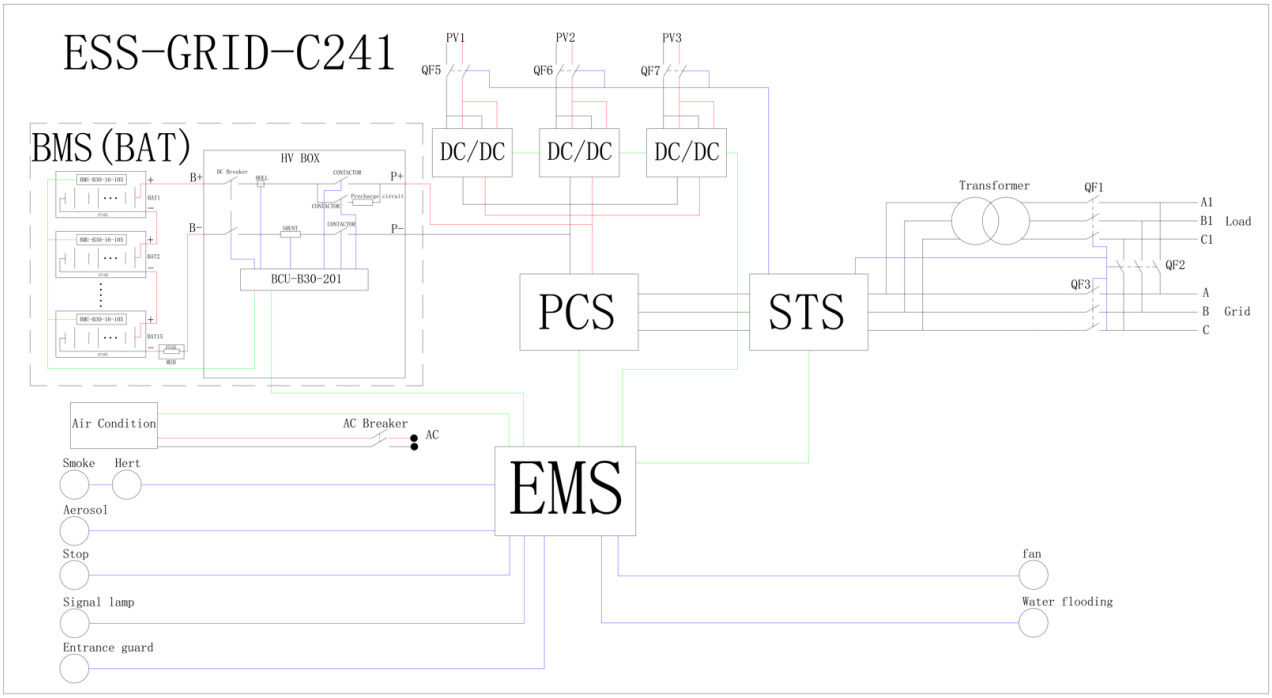
The Software version: V1.0

The Hardware version: V1.2

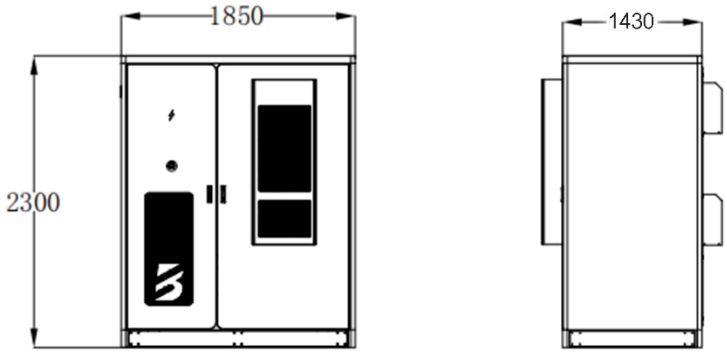
Summary of testing:

1. All tests were performed on ESS-GRID C241
2. Basic insulation between the DVC-C circuit and PE.
3. Reinforced insulation between the DVC-C circuit and communication port.
4. The EUT provides special lockable terminal for the input and output.
5. The EUT is rated class I and shall be properly bonded to the main protective earthing terminal in the final installation.
6. The EUT has been evaluated for use in a Pollution Degree II environment and a maximum altitude of 2000m. The unit is specified for indoor (conditioned) use.
7. The enclosure fulfils the requirements of an electrical, mechanical and fire enclosure.
8. The EUT was evaluated for a maximum ambient of 55°C.

Block diagram for EUT:



Dimension of EUT (mm):



IEC 62040-1			
Clause	**Requirement + Test**		**Verdict**
4	**Protection against hazards**		**P**
4.1/RD	General		P
4.2 4.2/RD	Fault and abnormal conditions	See Table 4.2/RD to 4.3/RD	P
4.3	Short-circuit and overload protection	See Table 4.2/RD to 4.3/RD	P
4.3.1/RD	General		P
4.3.2/RD	Specification of input short-circuit withstand strength and output short circuit current ability		P
4.3.2.1/RD	General		P
	The interrupting capability of the overcurrent protective device shall be equal or greater than the prospective short circuit current of the mains supply.		P
	For pluggable equipment type A, either the PECS shall be designed so that the building installation provides short circuit backup protection, or additional short circuit backup protection shall be provided as part of the equipment.	Not pluggable A equipment.	N/A
	For permanently connected equipment or pluggable equipment type B, it is permitted for short circuit backup protection to be in the building installation.		P
4.3.2.2/RD	Input ports short-circuit withstand strength		N/A
	For co-ordination and selection of internal or external protective devices, the PECS manufacturer shall specify: - a maximum allowable prospective short circuit current for each input port of the PECS; and -a minimum required prospective short circuit current in order to ensure proper operation of the protective device.		N/A
	If external protective devices are specified or provided the characteristics of those shall be specified by the manufacturer.		N/A
4.3.2.3/RD	Output short circuit current ability		P
	The output short circuit current ratings apply to a.c. and d.c. power output ports and to other ports for which overcurrent protection is necessary. For all output ports, short circuit evaluation to determine the minimum and maximum output short circuit current shall be performed according to 5.2.4.4/RD and the output short circuit current available from the PECS shall be specified as in 5.2.4.4/RD and 6.2. Internal electronic output short circuit protection is considered acceptable as an output short circuit protection device of the PECS, when compliance is shown by test in 5.2.4.4/RD.	Internal electronic short-circuit protection. And approved circuit-breaker was used.	P
4.3.2.4/RD	Combined input and output ports		P

IEC 62040-1			
Clause	**Requirement + Test**		**Verdict**
	For ports which are both input and output ports the applicable requirements of both 4.3.2.1/RD and 4.3.2.3/RD apply.	Considered.	P
4.3.3/RD	Short-circuit coordination (backup protection)		P
	Protective devices provided or specified shall have adequate breaking capability to interrupt the maximum prospective short circuit current specified for the port to which they are connected. If internal protection of the PECS is not rated for the prospective short circuit current, the installation instructions shall specify an upstream protective device, rated for this prospective short circuit current of that port, which shall be used to provide backup protection. Analysis shall ensure the protection coordination between the external and internal protective device.	Internal electronic short-circuit protection. And approved circuit-breaker was used.	P
	Compliance shall be checked by inspection and by the tests of 5.2.4.4/RD and 5.2.4.5/RD.		P
4.3.4/RD	Protection by several devices		N/A
	Where protective devices that require manual replacement or resetting are used in more than one pole of a supply to a given load, those devices shall be located together. It is permitted to combine two or more protective devices in one component. Compliance shall be checked by inspection.	No such devices.	N/A
4.3.101	AC input current		P
4.3.102	Transformer protection		P
4.3.103	AC input short-circuit current		P
4.3.104	Protection of the energy storage device		P
4.3.105	Unsynchronized load transfer	Considered	P
4.4	Protection against electric shock		P
4.4.1/RD	General		P
4.4.2/RD	Decisive voltage class		P
4.4.2.1/RD	General	Considered	P
4.4.2.2/RD	Determination of decisive voltage class		P
4.4.2.2.1 /RD	General		P
	For protection against the ventricular fibrillation body reaction, DVC can be selected from Table 2.		P
4.4.2.2.2 /RD	Selection tables for contact area and skin humidity condition		P
4.4.2.2.3 /RD	Limits of the working voltage for the DVC		P
4.4.2.3/RD	Requirements for protection against electric shock		P
4.4.3/RD	Provision for basic protection		P
4.4.3.1/RD	General	Considered	P

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Clause	**Requirement + Test**		**Verdict**
4.4.3.2/RD	Protection by means of basic insulation of live parts	Basic insulation is provided between enclosure and internal hazardous live parts.	P
	Live parts shall be completely surrounded with insulation if their working voltage is greater than DVC As or if they do not have protective separation from adjacent circuits of DVC C.		P
	Basic insulation may be provided by solid insulation or air clearance.		P
	The insulation shall be rated according to the impulse voltage, temporary overvoltage or working voltage (see 4.4.7.2.1/RD), whichever gives the most severe requirement. It shall not be possible to remove the insulation without the use of a tool or key.	According to the impulse voltage	P
4.4.3.3	Openings		P
4.4.3.4/RD	Protection by means of limitation of touch current and charge		P
	The limitation of touch current and discharge energy shall not exceed: - a value of 3,5 mA a.c. or 10 mA d.c. for the limitation of touch current; and - a value of 50 µC for the limitation of discharge energy.		P
4.4.3.5/RD	Protection by means of limited voltage		P
	The voltage between simultaneously accessible parts shall not be greater than DVC As as determined in 4.4.2.2/RD.		P
4.4.4/RD	Provision for fault protection		P
4.4.4.1/RD	General		P
	Fault protection shall be provided by one or more of the following measures: • Protective equipotential bonding in 4.4.4.2/RD in combinations with the PE conductor in 4.4.4.3/RD; • Automatic disconnection of supply in 4.4.4.4/RD; • Supplementary insulation in 4.4.4.5/RD; • Simple separation between circuits in 4.4.4.6/RD; • Electrically protective screening in 4.4.4.7/RD. Fault protection shall be independent and additional to those for basic protection.		P
4.4.4.2/RD	Protective equipotential bonding		P
4.4.4.2.1 /RD	General	Class I equipment, metal enclosure is earthed	P

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Clause	**Requirement + Test**		**Verdict**
	Protective equipotential bonding shall be provided between accessible conductive parts of the equipment and the means of connection for the PC conductor, except: a) accessible conductive parts that are protected by one of the measures in 4.4.6.4/RD; or b) when accessible conductive parts are separated from live parts using double or reinforced insulation.		P
	Electrical contact to the means of connection of the PE conductor shall be achieved by one or more of the following means: • through direct metallic contact; • through other accessible conductive parts or other metallic components which are not removed when the PECS is used as intended; • through a dedicated protective equipotential bonding conductor.	Direct metallic contact	P
4.4.4.2.2 /RD	Rating of protective equipotential bonding		P
	Protective equipotential bonding shall either be: a) sized in accordance with the requirements for the PE conductor in 4.4.4.3/RD and the means of connection for the PE conductor in 4.4.4.3.2/RD to ensure no voltage drop exceeding the values from 4.4.2.2.3/RD during a fault; or b) sized • to withstand the highest stresses that can occur to the PECS item(s) concerned when they are subjected to a fault connecting to accessible conductive parts; and • to remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part; and • to ensure no voltage drop exceeding the values from 4.4.2.2.3/RD during normal operation and during a fault. Compliance shall be checked with the type tests in 5.2.3.11/RD		P
4.4.4.3/RD	PE conductor		P
4.4.4.3.1 /RD	General		P
	A PE conductor shall be connected at all times when power is supplied to the PECS, unless the PECS complies with the requirements of protective class II (see 4.4.6.3/RD) or protective class III. Unless local wiring regulations state otherwise, the PE conductor cross-sectional area shall be determined from Table 7 or by calculation according to 543.1 of IEC 60364-5-54:2011.	PE conductor permanently connected	P

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Clause	**Requirement + Test**		**Verdict**
	If the PE conductor is routed through a plug and socket, or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		N/A
	The cross-sectional area of every PE conductor that does not form part of the supply cable or cable enclosure shall, in any case, be not less than: • 2,5 mm^2 if mechanical protection is provided; or • 4 mm^2 if mechanical protection is not provided.		P
	Provisions within cord-connected equipment shall be made so that the PE conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted. For special system topologies, the PECS designer shall verify the PE conductor cross-section required.	Permanently connected equipment	N/A
4.4.4.3.2 /RD	Means of connection for the PE conductor		P
	PECS shall have a means of connection for the PE conductor, located near the terminals for the respective live conductors. The means of connection shall be corrosion-resistant and shall be suitable for the connection of conductors according to Table 7 and of cables in accordance with the wiring rules applicable at the installation. The means of connection for the PE conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. Connection and bonding points shall be designed so that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion. Compliance shall be checked by inspection.	Considered	P
4.4.4.3.3 /RD	Touch current in case of failure of PE conductor		P
	For all other PECS, one or more of the following measures shall be applied, unless the touch current can be shown to be less than the limits specified in 4.4.3.4: a) Use of a fixed connection and • a cross-section of the PE conductor of at least 10 mm^2 Cu or 16 mm^2 Al; or • automatic disconnection of the supply in case of discontinuity of the PE conductor; or • provision of an additional terminal for a second PE conductor of the same cross-sectional area as the original PE conductor; or b) Use of a pluggable type B connection with a minimum PE conductor cross-section of 2,5 mm^2 as part of a multi-conductor power cable. Adequate strain relief shall be provided.	Use of a fixed connection	P

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Clause	**Requirement + Test**		**Verdict**
	Compliance is checked by inspection and by test of 5.2.3.7/RD.		P
4.4.4.4/RD	Automatic disconnection of supply		P
	For automatic disconnection of supply: • a protective equipotential bonding system shall be provided; and • a protective device operated by the fault current shall disconnect one or more of the line conductors supplying the equipment, system or installation, in case of a failure of basic insulation. The protective device shall interrupt the fault current within a time as specified in Figure 1, Figure 2 or Figure 3 in 4.4.2.2.3/RD.		P
4.4.4.5/RD	Supplementary insulation		P
4.4.4.6/RD	Simple separation between circuits		P
	If any component is connected between the separated circuits, that component shall withstand the electric stresses specified for the insulation which it bridges. If any component is connected between a circuit and a circuit connected to earth, its impedance shall limit the current flow through the component to the steady-state touch current values indicated in 4.4.3.4/RD.		P
4.4.4.7/RD	Electrically protection		N/A
	Electrically protective screening interposed between hazardous live parts of a PECS, shall consist of a conductive screen connected to the protective equipotential bonding of the PECS whereby the screen is separated from live parts by at least simple separation. The protective screen and the connection to the protective equipotential bonding system of the PECS and that interconnection shall comply with the requirements of 4.4.4.2/RD.		N/A
4.4.5/RD	Enhanced protection		P
4.4.5.1/RD	General		P
	Enhanced protection shall provide both basic and fault protection and can be achieved by means of: • Reinforced insulation in 4.4.5.2/RD; • Protective separation between circuits in 4.4.5.3/RD; • Protection by means of in 4.4.5.4/RD.		P
4.4.5.2/RD	Reinforced insulation		P
	Reinforced insulation shall be so designed as to be able to withstand electric, thermal, mechanical and environmental stresses with the same reliability of protection as provided by double insulation. (basic insulation and supplementary insulation, see 4.4.3.2/RD and 4.4.4.5/RD)	Between the DVC-A circuit and DVC-C circuit	P
4.4.5.3/RD	Protective separation between circuits		P

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Clause	**Requirement + Test**		**Verdict**
	Protective separation between a circuit and other circuits shall be achieved by one of the following means: • double insulation (basic insulation and supplementary insulation in 4.4.3.2/RD and 4.4.4.5/RD); • reinforced insulation in 4.4.5.2/RD; • electrically protective screening in 4.4.4.7/RD; • a combination of these provisions.		P
	If conductors of the separated circuit are contained together with conductors of other circuits in a multi-conductor cable or in another grouping of conductors, they shall be insulated, individually or collectively, for the highest voltage present, so that double insulation is achieved. If any component is connected between the separated circuits, that component shall comply with the requirements for protective impedance devices (see 4.4.5.4/RD)		P
4.4.5.4/RD	Protection by means of protective impedance		P
	Protective impedance shall be arranged so that under both normal and single fault conditions the current and discharge energy available shall be limited according to 4.4.3.4/RD.		P
	The protective impedances shall be designed and tested to withstand the impulse voltages and temporary overvoltages for the circuits to which they are connected. See 5.2.3.2/RD and 5.2.3.4/RD for tests.		P
	Compliance with the requirement for the limitation of touch current is checked by test of 5.2.3.6/RD.		P
	Compliance with the requirement for the discharge energy shall be checked by performing calculations and/or measurements to determine the voltage and capacitance. NOTE A protective impedance designed according to this subclause is not considered to be a galvanic connection.		N/A
4.4.6/RD	Protective measures		P
4.4.6.1/RD	General		P
4.4.6.2/RD	Protective measures for protective class I equipment		P
	Protective class I equipment shall meet the requirements for: • basic protection in 4.4.3/RD; and • fault protection in 4.4.4.2/RD and 4.4.4.3/RD with respect to equipotential bonding and PE conductor.		P
4.4.6.3/RD	Protective measures for protective class II equipment	Class I	N/A

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Clause	**Requirement + Test**		**Verdict**
	Protective class II equipment shall meet the requirements for enhanced protection according to 4.4.5/RD and the enclosure shall meet the requirement for basic protection in 4.4.3/RD with respect to accessibility to hazardous live parts. Protective class II equipment shall not have means of connection for the PE conductor. This does not apply if a PE conductor is passed through the equipment to equipment series-connected beyond it. In the latter case the PE conductor and its means for connection shall be separated from: • accessible surface of the equipment; and • circuits which employ protective separation with at least simple separation according to the requirement in 4.4.4.6/RD. The simple separation shall be designed according to the rated voltage of the series-connected equipment. Equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for the damping of overvoltages. In this case, the functional earthing conductor shall be separated from: • accessible surface of the equipment; and • circuits which employ protective separation according to 4.4.5.3/RD with at least protective separation according to the requirement in 4.4.5.3/RD. Equipment of protective class II shall be marked according to 6.3.7.3.3/RD. Compliance is checked by inspection.		N/A
4.4.6.4/RD	Protective measures for protective class III equipment or circuits	Class I	N/A
4.4.6.4.1 /RD	General		N/A
	Protective measures shall be achieved by protective separation by one of the following means: • basic insulation and supplementary insulation (double insulation) according to 4.4.3.2/RD and 4.4.4.5/RD; • reinforced insulation according to 4.4.5.2/RD; • electrically protective screening and simple separation according to 4.4.4.7/RD; or • a combination of these provisions; used in combination with one of the following means: • protective impedance according to 4.4.5.4/RD comprising limitation of discharge energy and of current; or • limitation of voltage according to 4.4.3.5/RD.		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PECS.		N/A

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Clause	**Requirement + Test**		**Verdict**
4.4.6.4.2 /RD	Connection to PELV and SELV circuits	The communication ports are SELV.	P
	If a port is intended for connection of an external PELV or SELV circuit with a higher voltage than DVC As: • measures to limit the voltage to that of DVC As shall be taken (see Annex A); or • basic protection shall be provided. For connectors containing pins with very small contact area (< 1 mm²), the next higher voltage level for DVC As, of Table 5, is permitted. Example: if DVC A1 is DVC As, then DVC A2 is permitted at pins of signal connectors. The connection of external PELV or SELV circuits to an internal circuit is permitted with the following consideration: • without measures: only if the DVC of the PELV and SELV voltage are lower than or equal to the DVC selected from Table 5 for the internal circuit under consideration; and • with measures: if the DVC of the PELV and SELV voltage are higher than the DVC selected from Table 5 for the internal circuit under consideration. The possibility of an addition of the voltages of the circuits under consideration to a higher level under fault conditions shall be considered. For marking, see 6.3.7.1/RD. Consideration needs to be given to factors such as whether the circuits involved are earthed or not, what the voltages involved are, whether or not direct contact with live parts is possible, single faults in either equipment or the interconnections, etc.	The DVC of the SELV voltage is lower than or equal to the DVC selected from Table 5 for the internal circuit under consideration.	P
4.4.7/RD	Insulation		P
4.4.7.1/RD	General		P
4.4.7.1.1 4.4.7.1.1 /RD	Influencing factors		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Insulation shall be selected after consideration of the following influences: - pollution degree; - overvoltage category; - supply system earthing; - impulse withstand voltage, temporary overvoltage and working voltage; - location of insulation; - type of insulation.		P

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Clause	**Requirement + Test**		**Verdict**
	Verification of insulation shall be made according to 5.2.2.1/RD, 5.2.3.2/RD, 5.2.3.4/RD and 5.2.3.5/RD. The working voltage can also be measured in accordance with Annex A.		P
4.4.7.1.2 4.4.7.1.2 /RD	Pollution degree	PD2	P
	Insulation, especially when provided by clearances and creepage distances, is affected by pollution which occurs during the expected lifetime of the PECS. The micro-environmental conditions for insulation shall be applied according to Table 8.		P
	The pollution degree shall be determined according to the environmental condition for which the product is specified. See Table 18 for selection of pollution degree according to environmental classification of the installation.		P
	The insulation may be determined according to pollution degree 2 if one of the following applies: a) instructions are provided with the PECS indicating that it shall be installed in a pollution degree 2 environment; or b) the specific installation application of the PECS is known to be a pollution degree 2 environment; or c) the PECS enclosure or coatings applied within the PECS according to 4.4.7.8.4.2/RD or 4.4.7.8.6/RD provide adequate protection against what is expected in pollution degree 3 and 4 (conductive pollution and condensation).	IP55 enclosure	P
	The PECS manufacturer shall state in the documentation the pollution degree for which the PECS has been designed.		P
	If operation in a pollution degree 4 environment is required, protection against conductive pollution shall be provided by means of a suitable enclosure.		N/A
	Unless otherwise specified by the UPS manufacturer, the UPS shall be suitable for installation in environments in which the pollution degree is 2 (PD2), see IEC 62477-1: 2012, Table 8.		P
4.4.7.1.3 4.4.7.1.3 /RD	Overvoltage category (OVC)		P

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Clause	**Requirement + Test**		**Verdict**
	Four categories are considered. • Equipment of overvoltage category IV (OVC IV) is for use at the origin of the installation. • Equipment of overvoltage category III (OVC III) is equipment in fixed installations and for cases where the reliability and the availability of the equipment are subject to special requirements. • Equipment of overvoltage category II (OVC II) is energy-consuming equipment to be supplied from the fixed installation. • Equipment of overvoltage category I (OVC I) is equipment for connection to circuits in which measures are taken to limit transient overvoltages to an appropriately low level.	OVC III	P
	The measures for reduction of the impulse voltage shall ensure that the temporary overvoltages that could occur are sufficiently limited so that their peak value does not exceed the relevant rated impulse voltage of Table 9 and shall meet the requirement of 4.4.7.2.2/RD, 4.4.7.2.3/RD and 4.4.7.3/RD as applicable.		N/A
	As a minimum, the UPS shall be suitable for installation in environments presenting overvoltage categories listed in Table 102. For UPS units designed to be part of a parallel configuration, the current to be considered in Table 102 is that provided by the parallel configuration.		N/A
	If measures are provided to reduce impulses of overvoltage category III to values of category II, or values of category II to values of category I, appropriate insulation may be designed to the reduced values, provided that following a single failure, e.g. of the reduction measure, at least the basic insulation requirements for the original overvoltage category shall be fulfilled.		N/A
4.4.7.1.4 /RD	Supply system earthing		P
	The following three basic types of system earthing are described in IEC 60364-1. • TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN system, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductors. • TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system. • IT system: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the system earthing.	TN system	P

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Clause	**Requirement + Test**		**Verdict**
4.4.7.1.5 /RD	Determination of impulse withstand voltage and temporary overvoltage		P
	Table 9 uses the system voltage (see 4.4.7.1.6/RD) and overvoltage category of the circuit under consideration to determine the impulse withstand voltage. The system voltage is also used to determine the temporary overvoltage. A PECS having more than one input or output shall be evaluated according to the input or output which gives the most severe requirements.		P
4.4.7.1.6 /RD	Determination of the system voltage		P
4.4.7.1.6.1 /RD	For mains supply		P
4.4.7.1.6.2 /RD	For non-mains supply		P
	For PSCS supplied by non-mains a.c. or d.c., the system voltage is the r.m.s. value of the supply voltage between phases.		P
4.4.7.1.7 4.4.7.1.7 /RD	Components bridging insulation		P
	Components bridging insulation shall comply with the requirements of the level of insulation (e.g. basic, reinforced, double) they are bridging.	Considered.	P
	A capacitor connected between two line conductors in a primary circuit, or between one line conductor and the neutral conductor or between the primary circuit and protective earth shall comply with one of the subclasses of IEC 60384-14 or with the requirement of 4.4.7.1.7 of IEC 62477-1: 2012 and shall be used in accordance with its rating for voltage and current		N/A
	For equipment to be connected to IT power distribution systems components connected between line and earth shall be rated for the line-to-line voltage. However, capacitors rated for the applicable line-to-neutral voltage are permitted in such applications if they comply with subclass Y1, Y2 or Y4 of IEC 60384-14		N/A
4.4.7.2/RD	Insulation to the surroundings		P
4.4.7.2.1 /RD	General		P
4.4.7.2.2 4.4.7.2.2 /RD	Circuits connected to mains supply		P
	Insulation between the surroundings and circuits which are connected directly to the mains supply shall be designed according to the impulse withstand voltage, temporary overvoltage, or working voltage, whichever gives the most severe requirement.		P
4.4.7.2.3 /RD	Circuits connected to non-mains supply		P

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Clause	**Requirement + Test**		**Verdict**
	Insulation between the surroundings and circuits supplied from a non-mains supply shall be designed according to: • the impulse withstand voltage determined from Table 9 using the system voltage; • the working voltage; • the temporary overvoltage if known to exist due to the nature of the supply; whichever gives the more severe requirement.		P
	Temporary overvoltage on a non-mains supply shall be determined as follows: • Without detailed knowledge of the temporary overvoltage, it shall be according to Table 9. • If the temporary overvoltage is known this value shall be used.	According to Table 9.	P
	By the determination of temporary overvoltages on non-mains supply, following situations should be considered: • loss of the neutral in a non-mains low-voltage system; • accidental earthing of a non-mains low voltage IT system; and • short circuit in the non-mains low voltage installation.		N/A
4.4.7.2.4 /RD	Insulation between circuits		P
	Insulation between two circuits shall be designed according to the circuit having the more severe requirement. For the design of simple and protective separation between circuits the insulation shall be designed according to: • the circuit having the more severe requirement; or • the working voltage between the circuits; whichever gives the most severe requirement.	Basic insulation between the DVC-C circuit and PE. Reinforced insulation between the DVC-C circuit and communication ports.	P
4.4.7.3/RD	Functional insulation		P

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Clause	**Requirement + Test**		**Verdict**
	If the failure of functional insulation does not produce a hazard (electrical, thermal, fire), no specific requirements apply for the dimensioning of functional insulation. In other cases the following requirements apply. Testing is not required, except where the circuit analysis required by 4.2/RD shows that failure of the insulation could result in a hazard. For parts or circuits that are significantly affected by external transients, functional insulation shall be designed according to the impulse withstand voltage of overvoltage category II, except that overvoltage category III shall be used when the PECS is connected at the origin of the installation. Where measures are provided that reduce transient overvoltages within the circuit from category III to values of category II, or values of category II to values of category I, functional insulation may be designed for the reduced values. Where the circuit characteristics can be shown by testing (see 5.2.3.2/RD) to reduce impulse voltages, functional insulation may be designed for the highest impulse voltage occurring in the circuit during the tests. For parts or circuits that are not significantly affected by external transients, functional insulation shall be designed according to the working voltage across the insulation.		P
4.4.7.4/RD	Clearance distance		P
4.4.7.4.1 /RD	Determination	See Table 4.4.7.4/RD	P
	Clearances for functional, basic and supplementary insulation shall be dimensioned according to Table 10 (see Annex D for examples of the evaluation of clearance distances). Interpolation is permitted, when clearance is determined from temporary overvoltage or working voltage. Clearances for reinforced insulation shall be dimensioned to withstand an impulse voltage one step higher than the impulse withstand voltage, or 1,6 times the peak temporary overvoltage or peak working voltage, required for basic insulation. Clearance distances for use in altitudes between 2 000 m and 20 000 m shall be calculated using a correction factor according to Table A.2 of IEC 60664-1:2007, which is reproduced as Table E.1. A correction factor selected from Table F.2 is also used for determination of clearance distances for approximately homogenous fields when frequencies are greater than 30 kHz, as given in Annex F.		P
	Compliance shall be checked by visual inspection (see 5.2.2.1/RD) or by performing the impulse voltage test of 5.2.3.2/RD and the a.c. or d.c. voltage test of 5.2.3.4/RD.	(See appended table 4.4.7.4/RD to 4.4.7.5/RD)	P

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Clause	**Requirement + Test**		**Verdict**
4.4.7.4.2 /RD	Electric field homogeneity		P
	The dimensions in Table 10 correspond to the requirements of an inhomogeneous electric field distribution across the clearance, which are the conditions normally experienced in practice. If a homogeneous electric field distribution is known to exist, the clearance distance for basic or supplementary insulation may be reduced to not less than that required by Table F.2 (Case B) of IEC 60664-1:2007. In this case, however, the impulse voltage test of 5.2.3.2/RD shall be performed across the considered clearance. If the withstand against steady state voltages, recurring peak or temporary overvoltages according to Table 10 is decisive for the dimensioning of clearance and if these clearances are smaller than the values of Table 10 then an a.c. or d.c. voltage test according to 5.2.3.4/RD is required. Clearance distances for reinforced insulation shall not be reduced for homogeneous fields.	inhomogeneous electric field	P
4.4.7.4.3 /RD	Clearance to conductive enclosure		P
	The clearance between any non-insulated live part and the walls of a metal enclosure shall be in accordance with 4.4.7.4.1/RD during and following the deflection tests of 5.2.2.4.2/RD.		P
	Compliance is checked by inspection and by test of 5.2.2.4.2/RD.		P
	If the design clearance distance is at least 12,7 mm and the clearance distance required by 4.4.7.4.1/RD does not exceed 8 mm, the deflection tests may be omitted.		P
4.4.7.5/RD	Creepage distances		P
4.4.7.5.1 /RD	Insulating material groups		P
	Creepage distance requirements for PWBs exposed to pollution degree 3 environmental conditions shall be determined based on Table 11 pollution degree 3 under “Other insulators”.	degree 2	N/A
	For inorganic insulating materials, for example glass or ceramic, which do not track, the creepage distance may equal the associated clearance distance, as determined from Table 10.	No such inorganic insulating materials	N/A
4.4.7.5.2 /RD	Determination	See Table 4.4.7.5/RD	P
	Creepage distances for functional, basic and supplementary insulation shall be dimensioned according to Table 11. Interpolation is permitted. Creepage distances for reinforced insulation shall be twice the distances required for basic insulation.		P

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Clause	**Requirement + Test**		**Verdict**
	When the creepage distance requirement determined from Table 11 is less than the clearance distance required by 4.4.7.4.1/RD or the clearance distance determined by impulse testing (see 5.2.3.2/RD), then the creepage distance shall be increased to the clearance distance.		P
	Compliance of creepage distances shall be checked by measurement or inspection (see 5.2.2.1/RD) (see Annex D for examples of the evaluation of creepage distances).		P
4.4.7.6/RD	Coating	No such part	N/A
	A coating may be used to provide insulation, to protect a surface against pollution, and to allow a reduction in creepage and clearance distances (see 4.4.7.8.4.2/RD and 4.4.7.8.6/RD)		N/A
4.4.7.7 4.4.7.7/RD	PWB spacings for functional insulation		P
	Spacings for functional insulation shall comply with the requirement of 4.4.7.4/RD and 4.4.7.5/RD.		P
	Decreased spacing for components mounted on PWB or decreased spacing on PWB are permitted when all the following are satisfied: • the PWB has flammability rating of V-0 (see IEC 60695-11-10); • the PWB base material has a minimum CTI of 100; • the equipment complies with the PWB short circuit test (see 5.2.4.7/RD). Decreased spacings for components assembled on PWB are permitted when used in: • pollution degree 1 or 2 environment; and • not more than overvoltage category I. In this case the manufacture specification may be used. Compliance is checked by inspection and by test of 5.2.4.7/RD if applicable.		N/A
4.4.7.8/RD	Solid insulation		P
4.4.7.8.1 /RD	General		P
	Materials selected for solid insulation shall be able to withstand the stresses occurring. These include mechanical, electrical, thermal, climatic and chemical stresses which are to be expected in normal use. Insulation materials shall also be resistant to ageing during the expected lifetime of the PECS. Tests shall be performed on components and sub-assemblies using solid insulation, in order to ensure that the insulation performance has not been compromised by the design or manufacturing process.		P
4.4.7.8.2 /RD	Material requirements		P

IEC 62040-1			
Clause	**Requirement + Test**		**Verdict**
	The insulating material shall have a CTI of 100 or greater. The insulating material shall be suitable for the maximum temperature it attains as determined by the temperature rise test of 5.2.3.10/RD. Consideration shall be given as to whether or not the insulating material additionally provides mechanical strength and whether or not the part can be subject to impact during use.		P
	The insulating material in contact with live parts higher than DVC As shall comply with: • the glow-wire test described in 5.2.5.3/RD at a test temperature of 850 °C; or • the glow-wire test described in 5.2.5.3/RD, at a lower test temperature, but not less than 550 °C, depending on the classification of the use of the PECS, according to Table A.1 of IEC 60695-2-11:2011; or • the alternative hot wire ignition test of 5.2.5.4/RD		P
	Thermoplastic insulating materials used in contact with live parts higher than DVC As or used as part of the enclosure shall comply with the ball pressure test as abnormal heat test according to IEC 60695-10-2.		P
	Where an insulating material is used in a PECS that incorporates switching contacts, and is within 12,7 mm of the contacts, it shall comply with the high current arcing ignition test of 5.2.5.2/RD.		N/A
	In case the manufacturer of the insulating material provides data to demonstrate compliance with the above requirements no further testing is required. No further evaluation is required when generic materials are used according to Table 12.		P
	Compliance is checked by inspection and by test of 5.2.3.10/RD and 5.2.5.3/RD or 5.2.5.2/RD.		P
4.4.7.8.3 /RD	Thin sheet or tape material		P
4.4.7.8.3.1 /RD	General		P

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Clause	**Requirement + Test**		**Verdict**
	4.4.7.8.3/RD applies to the use of thin sheet or tape materials in assemblies such as wound components and bus-bars. Insulation consisting of thin (less than 0,75 mm) sheet or tape materials is permitted, provided that it is protected from damage and is not subject to mechanical stress under normal use. Where more than one layer of insulation is used, there is no requirement for all layers to be of the same material. NOTE 1 One layer of insulation tape wound with more than 50 % overlap is considered to constitute two layers. NOTE 2 Basic, supplementary and double insulation can be applied as a pre-assembled system of thin materials.		P
4.4.7.8.3.2 /RD	Material thickness equal to or more than 0,2 mm		P
	Basic or supplementary insulation shall consist of at least one layer of material, which will meet the requirements of 4.4.7.8.1/RD and 4.4.7.10.1/RD.		P
	Double insulation shall consist of at least two layers of material, each of which will meet the requirements of 4.4.7.8.1/RD, 4.4.7.10.1/RD, and the partial discharge requirements of 4.4.7.10.2/RD, and both layers together will meet the impulse and a.c. or d.c. voltage requirements of 4.4.7.10.2/RD.		P
	Reinforced insulation shall consist of a single layer of material, which will meet the requirements of 4.4.7.8.1/RD and 4.4.7.10.2/RD.		P
	NOTE The requirements of this subclause indicate that double insulation can be at least 0,4 mm thick, while reinforced insulation is permitted to be 0,2 mm thick.		P
4.4.7.8.3.3 /RD	Material thickness less than 0,2 mm		N/A
	Basic or supplementary insulation shall consist of at least two layers of material, which will meet the requirements of 4.4.7.8.1/RD and 4.4.7.10.1/RD.		N/A
	Double insulation shall consist of at least three layers of material. Each layer shall meet the requirements of 4.4.7.8.1/RD and 4.4.7.10.1/RD, and any two layers together shall meet the requirements of 4.4.7.10.2/RD.		N/A
	Reinforced insulation consisting of a single layer of material is not permitted.		N/A
4.4.7.8.3.4 /RD	Compliance		P
	Compliance shall be checked by the tests described in 5.2.3.1/RD to 5.2.3.5/RD. When a component or sub-assembly makes use of thin sheet insulating materials, it is permitted to perform the tests on the component rather than on the material.		P

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Clause	**Requirement + Test**		**Verdict**
4.4.7.8.4 /RD	Printed wiring boards (PWBs)		P
4.4.7.8.4.1 /RD	General		P
	Insulation between conductor layers in double-sided single-layer PWBs, multi-layer PWBs and metal core PWBs, shall meet the requirements of 4.4.7.8.1/RD. Basic, supplementary, double and reinforced insulation shall meet the appropriate requirements of 4.4.7.10.1/RD or 4.4.7.10.2/RD. Functional insulation in PWBs shall meet the requirements of 4.4.7.7/RD. For the inner layers of multi-layer PWBs, the insulation between adjacent tracks on the same layer shall be treated as either: • a creepage distance for pollution degree 1 and a clearance as in air (see Example D.14); or • solid insulation, in which case it shall meet the requirements of 4.4.7.8.1/RD and 4.4.7.10/RD.		P
4.4.7.8.4.2 /RD	Use of coating materials		N/A
	A coating material used to provide functional, basic, supplementary and reinforced insulation shall meet the requirement as specified below.		N/A
	Type 1 protection (as defined in IEC 60664-3) improves the microenvironment of the parts under protection. The clearance and creepage distance of Table 10 and Table 11 for pollution degree 1 apply under the protection. Between two conductive parts, it is a requirement that one or both conductive parts, together with all the spacing between them, are covered by the protection.		N/A
	Type 2 protection is considered to be similar to solid insulation. Under the protection, the requirements for solid insulation specified in 4.4.7.8/RD are applicable, including the coating material itself, and spacings shall not be less than those specified in Table 1 of IEC 60664-3:2003. The requirements for clearance and creepage in Table 10 and Table 11 do not apply. Between two conductive parts, it is a requirement that both conductive parts, together with the spacing between them, are covered by the protection so that no air gap exists between the protective material, the conductive parts and the printed boards.		N/A
	The coating material used to provide Type 1 and Type 2 protection shall be designed to withstand the stresses anticipated to occur during the expected lifetime of the PECS. A type test on representative PWBs shall be conducted according to Clause 5 of IEC 60664-3:2003. For the cold test (5.7.1 of IEC 60664-3:2003), a temperature of -25 °C shall be used, and for the rapid change of temperature test (5.7.3 of IEC 60664-3:2003): -25 °C to +125 °C. No routine test is required.		N/A
4.4.7.8.5 /RD	Wound components		P

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Clause	**Requirement + Test**		**Verdict**
	Varnish or enamel insulation of wires shall not be used for basic, supplementary, double or reinforced insulation. Wound components shall meet the requirements of 4.4.7.8.1/RD and 4.4.7.10/RD. The component itself shall pass the requirements given in 4.4.7.8.1/RD and 4.4.7.10.2/RD. If the component has reinforced or double insulation, the a.c. or d.c. voltage test of 5.2.3.4/RD shall be performed as a routine test.	Certified three-phase isolating transformer is used	P
4.4.7.8.6 /RD	Potting materials	No such part	N/A
	A potting material may be used to provide solid insulation or to act as a coating to protect against pollution.		N/A
	If used as solid insulation, it shall comply with the requirements of 4.4.7.8.1/RD and 4.4.7.10/RD.		N/A
	If used to protect against pollution, the requirements for Type 1 protection in 4.4.7.8.4.2/RD apply.		N/A
4.4.7.9/RD	Connection of parts of solid insulation (cemented joints)	No such part	N/A
	The creepage and clearance path in the presence of a cemented joint between two insulating parts, are determined as follows. • Type 1 or type 2 protection as described in 4.4.7.8.4.2/RD apply. • A cemented joint that is not evaluated as providing protection of type 1 or type 2, is neither considered solid insulation nor to reduce pollution degree. The clearance and creepage distances of Table 10 and Table 11 apply for the pollution degree of the environment around the joint. See 5.2.5.7/RD for test.		N/A
4.4.7.10 /RD	Requirements for electrical withstand capability		P
4.4.7.10.1 /RD	Basic or supplementary insulation	See Table 4.4.7.10/RD	P
	Test with impulse withstand voltage according to 5.2.3.1/RD		P
	Test with a.c. or d.c. voltage according to 5.2.3.4/RD		P
4.4.7.10.2 /RD	Double or reinforced insulation	See Table 4.4.7.10	P
	Double or reinforced insulation shall be tested as follows: • Test with impulse withstand voltage according to 5.2.3.2/RD; and • Test with a.c. or d.c. voltage according to 5.2.3.4/RD.		P

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Clause	**Requirement + Test**		**Verdict**
	For solid insulation, the partial discharge test according to 5.2.3.5/RD shall be performed in addition to the above tests, if the recurring peak working voltage across the insulation is greater than 750 V and the voltage stress on the insulation is greater than 1 kV/mm. The partial discharge test shall be performed as a type test on all components, sub-assemblies and PWB. In addition, a sample test shall be performed if the insulation consists of a single layer of material.		N/A
	Double insulation shall be designed so that failure of the basic insulation or of the supplementary insulation will not result in reduction of the insulation capability of the remaining part of the insulation.		P
4.4.7.11 /RD	Insulation requirements above 30kHz	Certified PCS (power conversion system) is used	P
4.4.8/RD	Compatibility with residual current-operated protective devices (RCD)		N/A
	To ensure the intended work of an RCD provided by the installation PECS shall satisfy one of the following conditions. a) A Pluggable Type A single-phase PECS, shall be designed so that, under normal and fault conditions any resulting d.c. component of the current in the PE conductor does not exceed the d.c. current withstand requirements in IEC 60755 for RCD of type A. b) For PECS that are Pluggable Type B or intended for permanent connection, d.c. current in the PE conductor is not limited if the information and marking requirements of 6.3.7.4/RD are complied with.		N/A
	Compliance with RCD provided by the installation shall be checked by simulation or calculation of current in the PE conductor under normal and single fault conditions according to the guideline provided in Annex H/RD.		N/A
4.4.9 4.4.9/RD	Capacitor discharge		P

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Clause	**Requirement + Test**		**Verdict**
	For protection against shock hazard, capacitors within a PECS shall be discharged to a voltage less than DVC As, or to a residual charge less than 50 µC, after the removal of power from the PECS: • for pluggable UPS type A, the discharge time shall not exceed 1 s or the hazardous live parts shall be protected against direct contact by at least IPXXB (see 4.4.3.3); • for pluggable UPS type B, the discharge time shall not exceed 5 s or the hazardous live parts shall be protected against direct contact by at least IPXXB (see 4.4.3.3); • for permanently connected UPS, the discharge time shall not exceed 15 s. For pluggable PECS type A and B and permanently connected PECS, which do not meet the above requirements, access shall only be possible by means of a tool or key and the information and marking requirements of 6.5.2/RD apply. Compliance is checked by test of 5.2.3.8/RD.	Only be possible by means of a tool or key and the information and marking requirements of 6.5.2/RD meet	P
4.5	Protection against electrical energy hazards		P
4.5.1/RD	Operator access areas		P
4.5.1.1/RD	General		P
	Equipment shall be so designed that there is no risk of electrical energy hazard in operator access areas from accessible circuits by fulfilling requirement of 4.2/RD. A risk of injury due to an electrical energy hazard exists if it is likely that two or more bare parts (one of which may be earthed) between which a hazardous energy level exists, will be bridged by a metallic object. The likelihood of bridging the parts under consideration is determined by means of the test finger of Figure 1 of IEC 60529:1989, in a straight position. If it is possible to bridge the parts with this test finger, a hazardous energy level shall not exist. Barriers, guards, and similar means preventing unintentional contact may be provided as an alternative to limiting the energy.		P
	Compliance is checked by inspection or test of 5.2.2.2/RD.		P
4.5.1.2/RD	Determination of hazardous electrical energy level		P
	A hazardous electrical energy level is considered to exist if: • the voltage is 2 V or more; and • power available exceeds 240 VA after 60 s; or • the energy exceeds 20 J. Compliance shall be checked with the test in 5.2.3.9/RD or by calculation.	Considered.	P

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Clause	**Requirement + Test**		**Verdict**
4.5.2 4.5.2/RD	Service access areas		P
	Capacitors within a PECS shall be discharged to an energy level less than 20 J, as in 4.5.1.2, within 5 s after the removal of power from the PECS. If this requirement is not achievable for functional or other reasons, the information and marking requirements of 6.5.2/RD apply.	Only be possible by means of a tool or key and the information and marking requirements of 6.5.2/RD meet	P
	This requirement does not apply to terminals covered by 4.4.9. In a service access area, the following requirements apply. Bare parts at hazardous voltage shall be located or guarded so that unintentional contact with such parts is unlikely during service operations involving other parts of the equipment. Bare parts at hazardous voltage shall be located or guarded so that accidental shorting to parts at non-hazardous potentials (for example, by tools or test probes used by a service person) is unlikely.		P
	If the capacitor discharge time cannot be accurately calculated, the discharge time shall be measured.		N/A
4.6	Protection against fire and thermal hazards		P
4.6.1/RD	Circuits representing a fire hazard		P
	The following types of circuits are considered a fire hazard: - circuits directly connected to the mains - circuits that are not directly connected to the mains but exceed the limits for limited power sources in 4.6.5/RD - components having unenclosed arcing parts		P
4.6.2/RD	Components representing a fire hazard		P
4.6.2.1/RD	General		P
	Compliance with 4.6.2/RD and 4.6.3/RD shall be confirmed by inspection of component and material data sheets and, where necessary, by test.		P
4.6.2.2 4.6.2.2/RD	Components within a circuit representing a fire hazard		P
	Inside fire enclosures, materials for components and other parts and all materials in contact with such parts shall comply with flammability class V-2 as classified in IEC 60695-11-10 or flammability class HF-2 as classified in ISO 9772 or better.		P

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Clause	**Requirement + Test**		**Verdict**
	The above requirement does not apply to any of the following: • electrical components which do not present a fire hazard under abnormal operating conditions when tested according to 5.2.4.6/RD; • materials and components within an enclosure of 0,06 m3 or less, consisting totally of metal and having no ventilation openings, or within a sealed unit containing an inert gas; • electronic components, such as integrated circuit packages, opto-coupler packages, capacitors and other small parts that are mounted on material of flammability class V-1 or better; • wiring, cables and connectors insulated with PVC, TFE, PTFE, FEP, neoprene or polyimide; • the following parts, provided that they are separated from electrical parts (other than insulated wires and cables) which under fault conditions are likely to produce a temperature that could cause ignition, by at least 13 mm of air or by a solid barrier of material of flammability class V-1 or better: – other small parts which would contribute negligible fuel to a fire, including, labels, mounting feet, key caps, knobs and the like; – tubing for air or any fluid systems, containers for powders or liquids and foamed plastic parts, provided that they are of flammability class HB.		P
	Batteries shall have a flammability class HB or better.		P
4.6.2.3/RD	Components within a circuit not representing a fire hazard		P
	For components within a circuit not representing a fire hazard 4.6.2/RD does not apply.		P
4.6.3/RD	Fire enclosure		P
4.6.3.1 4.6.3.1/RD	General		P
	Fire enclosures are used to reduce the risk of fire to the environment, independent of the location where they are installed. A fire enclosure shall be provided for all UPS unless: • circuits inside of an enclosure are within the limits of limited power sources in 4.6.5 of this document; or • there is an agreement between the user and the manufacturer; or • the UPS is intended to be used only in areas without combustible materials and is marked according to 6.3.5/RD.		P
4.6.3.2/RD	Flammability of enclosure materials	Metal enclosure used.	P
	Materials used for fire enclosures of PECS shall meet the flammability test requirements of 5.2.5.5/RD, except for those portions of the enclosure that enclose only circuits not representing a fire hazard.		N/A

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Clause	**Requirement + Test**		**Verdict**
	Materials are considered to comply without test if, in the minimum thickness used, the material is of flammability class 5VA or better, according to IEC 60695-11-20.	Metal enclosure	N/A
	Metals, ceramic materials, and glass which is heat-resistant tempered, wired or laminated, are considered to comply without test.		P
	Materials for components that fill an opening in a fire enclosure shall: • be of at least V-1 class material and no larger than 100 mm in any dimension; or • be of at least V-2 class material and either – not larger than 25 mm in any dimension; or – not larger than 100 mm in any dimension and located at least 100mm from any part that is a source of fire hazard; or • be of at least V-2 class material and there is a barrier or device(s) that forms a barrier made of a V-0 class material between the part and a source of fire hazard; or • comply with a relevant IEC component standard that includes flammability requirements for components that are intended to form part of, or fill openings in, a fire enclosure.	Metal enclosure	N/A
	Polymeric materials that serve as the outer enclosure and have surface area greater than 1 m^2 or a single dimension larger than 2 m, shall have a maximum flame spread index of 100 as determined by ASTM E162 or ANSI/ASTM E84.	Metal enclosure	N/A
	The manufacturer may provide data from the fire enclosure material supplier to demonstrate compliance with the above requirements. In this case, no further testing is required.	Metal enclosure	N/A
	Compliance shall be checked by visual inspection and, where necessary, by test.	(See appended table)	P
4.6.3.3/RD	Openings in fire enclosure	No openings in fire enclosure	N/A
4.6.3.3.1 /RD	General		N/A
4.6.3.3.2 4.6.3.3.2 /RD	Openings in the top and side if fire enclosures		N/A
	Openings in the top surfaces of fire enclosures shall be designed to prevent an external object falling vertically or at up to 5° from vertically from entering the enclosure in an area that could lead to a fire hazard. This requirement applies to all sides of moveable equipment with no defined top and bottom, unless top and bottom surfaces can be suitably demonstrated in the installation instructions. The test requirements are found in 5.2.2.2 of this document.		N/A

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Clause	**Requirement + Test**		**Verdict**
	Openings in the top surfaces of fire enclosures not located vertically above or within 5° from vertical of a circuit representing a fire hazard as defined in 4.6.1/RD are not subject to the test of 5.2.2.2/RD and can be of any construction if the construction prevents access to parts greater than DVC As with the IP2X probe as detailed in 4.4.3.3/RD. Where a portion of the side of a fire enclosure falls within the area traced out by the 5° angle in Figure 6, the limitations in 4.6.3.3.3/RD regarding openings in bottoms of fire enclosures also apply to this portion of the side. Compliance shall be checked by visual inspection.		N/A
4.6.3.3.3 /RD	Openings in the bottom of a fire enclosure	No openings in the bottom of enclosure.	N/A
	Compliance is checked by inspection or with the hot flaming oil test in 5.2.5.6/RD, in case the fire enclosure is designed differently than as described in this subclause.		N/A
4.6.3.3.4 /RD	Doors or covers in fire enclosures		P
	If part of a fire enclosure consists of a door or a cover leading to an operator access area, it shall comply with one of the following requirements: • the door or cover shall be provided with a safety interlock; or • a door or cover, intended to be routinely opened by the user, shall comply with both of the following conditions: – it shall not be removable from other parts of the fire enclosure by the user; and – it shall be provided with a means to keep it closed during normal operation. A door or cover intended only for occasional use by an installer, such as for the installation of accessories, is permitted to be removable provided that the equipment instructions include directions for correct removal and reinstallation of the door or cover. Compliance is checked by inspection.		P
4.6.4/RD	Temperature		P
4.6.4.1 4.6.4.1/RD	Internal parts	See table 4.6.4/RD	P
	Equipment and its component parts shall not attain temperatures in excess of those in Table 14 when tested in normal mode in accordance with the ratings of the equipment. Magnetic components shall not attain temperatures in excess of those in Table 103 when tested in stored energy mode in accordance with the ratings of the equipment. Compliance is checked by test of 5.2.3.10/RD.		P

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Clause	**Requirement + Test**		**Verdict**
4.6.4.2/RD	Accessible parts		P
	When surface temperatures of the PECS, close to mounting surfaces, exceed the limit of Table 15, a warning according to 6.3.5/RD shall be provided.		P
4.6.5 4.6.5/RD	Limited power sources	The output is not complying with limited power sources (LPS).	N/A
	Where a limited power source is required, the source shall comply with Table 16 or Table 17 as applicable. Compliance to both the maximum allowed current and maximum apparent power available from the power source is required.		N/A
	A limited power source shall comply with one of the following requirements: a) the output is inherently limited in compliance with Table 16; or b) a linear or non-linear impedance limits the output in compliance with Table 16. If a positive temperature coefficient device (PTC) is used, it shall pass the tests specified in IEC 60730-1, Clauses 15, 17, J.15 and J.17; or c) a regulating network limits the output in compliance with Table 16, both with and without a single fault in the regulating network; or d) an overcurrent protective device is used and the output is limited in compliance with Table 17.		N/A
	Compliance to determine the maximum available power is checked by test of 5.2.3.9/RD.		N/A
4.7	Protection against mechanical hazards		P
4.7.1/RD	General		P
	Failure of any component within the PECS shall not release sufficient energy to lead to a hazard, for example, expulsion of material into an area occupied by personnel.		P
4.7.2/RD	Specific requirements for liquid cooled PECS	Not liquid cooled PECS	N/A
4.7.2.1/RD	General		N/A
4.7.2.2/RD	Coolant		N/A
	Coolant temperature in operation shall not exceed the limit specified in Table 14.		N/A
	Compliance is checked by inspection and test of 5.2.3.10/RD.		N/A
4.7.2.3/RD	Design requirements		N/A
4.7.2.3.1 /RD	General		N/A

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Clause	**Requirement + Test**		**Verdict**
	The liquid containment system components shall be compatible with the liquid to be used. Equipment using liquids shall be so constructed that it is unlikely that either a dangerous concentration of these materials or a hazard in the meaning of this standard will be created by condensation, vaporization, leakage, spillage or corrosion during normal operation, storage, filling or emptying. Compliance is checked by inspection. The flexible hoses should be made of material free of conductive contaminants such as carbon.	No liquid containment system components.	N/A
4.7.2.3.2 /RD	Corrosion resistance		N/A
	All cooling system components shall be suitable for use with the specified coolant. They shall be corrosion resistant and shall not corrode as a result of prolonged exposure to the coolant and/or air. Compliance is checked by inspection.	No coolant	N/A
4.7.2.3.3 /RD	Tubing, joints and seals	No tubing, joints and seals.	N/A
	Cooling system tubing, joints and seals shall be designed to prevent leakage during excursions of pressure over the life of the equipment. The entire cooling system including tubing shall satisfy the requirements of the hydrostatic pressure test of 5.2.7/RD.		N/A
4.7.2.3.4 /RD	Provision for condensation		N/A
	Where internal condensation occurs during normal operation or maintenance, measures shall be taken to prevent degradation of insulation. In those areas where such condensation is expected, clearance and creepage distances of Table 10 and Table 11 shall be evaluated at least for a pollution degree 3 environment (see Table 8), and provision shall be made to prevent accumulation of water (for example by providing a drain). Compliance is checked by inspection.	No coolant	N/A
4.7.2.3.5 /RD	Leakage of coolant	No coolant	N/A
	During a leakage measures has to ensure that coolant will not result in wetting of live parts or electrical insulation.		N/A
4.7.2.3.6 /RD	Loss of coolant	No coolant	N/A
	Loss of coolant form the cooling system shall not result in thermal hazards, explosion, or shock hazard. The requirements of the Loss of coolant test of 5.4.3.9.4/RD shall be satisfied.		N/A
4.7.2.3.7 /RD	Conductivity of coolant	No coolant	N/A

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Clause	**Requirement + Test**		**Verdict**
	When the coolant is intentionally in contact with live parts (for example non-earthed heatsinks), the conductivity of the coolant shall be continuously monitored and controlled, in order to avoid hazardous current flow through the coolant.		N/A
4.7.2.3.8 /RD	Insulation requirements for coolant hoses	No coolant hoses	N/A
	When the coolant is intentionally in contact with live parts (for example non-earthed heatsinks), the coolant hoses form a part of the insulation system. Depending on the location of the hoses, the requirements of 4.4.7/RD for functional or simple or protective separation shall be applied where relevant.		N/A
4.7.101	Protection in service access area		P
4.8	Equipment with multiple sources of supply		P
4.8.101	General		P
4.8.102	Backfeed protection		P
4.9 4.9/RD	Protection against environmental stresses		P
	The manufacturer has to specify the following conditions for operation, storage and transportation according to IEC 60721: - Coolant temperature (min/max); - Ambient temperature (min/max); - Humidity (min/max) - Pollution degree; - Vibration; - U.V. resistance; - Over voltage category (OVC); - Altitude for thermal consideration, if rated for operation above 1000 m; - Altitude for insulation coordination considerations, if rated for operation above 2000 m.	Pollution degree: PD2; OVC: III Altitude: max. 2000 m See more information in the Specification.	P
	The manufacturer shall state the environmental service condition for the PECS according to Table 18. The UPS, as a minimum, shall comply with the following indoor conditions: climatic, pollution degree, and humidity condition of the skin as part of the environmental service condition 3K2 of Table 18 of IEC 62477-1:2012. The manufacturer may elect to comply with environmental service conditions more onerous than 3K2 subject to the UPS being marked accordingly (see 6.2).	Provided in the Use Manual	P
4.10	Protection against sonic pressure hazards	No acoustic noise hazards	N/A
4.11	Wiring and connections		P
4.11.1/RD	General		P

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Clause	**Requirement + Test**		**Verdict**
	The wiring and connections between parts of the equipment and within each part shall be protected from mechanical damage during installation. The insulation, conductors and routing of all wires of the equipment shall be suitable for the electrical, mechanical, thermal and environmental conditions of use. Conductors which are able to contact each other shall be provided with insulation rated for the DVC requirements of the relevant circuits. The compliance with 4.11.2/RD to 4.11.8/RD shall be checked by inspection (see 5.2.1/RD) of the overall construction and datasheets if applicable.	Complied.	P
4.11.2/RD	Routing	Complied.	P
	A hole through which insulated wires pass in a sheet metal wall within the enclosure of the equipment shall be provided with a smooth, well-rounded bushing or grommet or shall have smooth, well-rounded surfaces upon which the wires bear to reduce the risk of abrasion of the insulation.		P
	Wires shall be routed away from sharp edges, screw threads, burrs, fins, moving parts, drawers, and similar parts, which abrade the wire insulation. The minimum bend radius specified by the wire manufacturer shall not be violated.		P
	Clamps and guides, either metallic or non-metallic, used for routing stationary internal wiring shall be provided with smooth, well-rounded edges. The camping action and bearing surface shall be such that abrasion or deformation of the insulation does not occur. If a metal clamp is used for conductors having thermoplastic insulation less than 0,8 mm thick, non-conduction mechanical protection shall be provided.		P
4.11.3/RD	Colour coding		P
	Insulated conductors, other than those which are integral of ribbon cable or multi-cord signal cable, identified by the colour green with or without one or more yellow stripes shall only be used for protective bonding.		P
4.11.4/RD	Splices and connections		P

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Clause	**Requirement + Test**		**Verdict**
	All splices and connections shall be mechanically secured and shall provide electrical continuity. Electrical connections shall be soldered, welded, crimped, or otherwise securely connected. A soldered joint, other than a component on a PWB, shall additionally be mechanically secured. NOTE Stranded wire should not be consolidated with solder where secured in a terminal that relies on pressure for contact or equivalent When stranded internal wiring is connected to a wire-binding screw, the construction shall be such that loose strands of wire do not contact: • other uninsulated live parts not always of the same potential as the wire; • de-energized metal parts. When screw terminal connections are used, the resulting connections may require routine maintenance (tightening). Appropriate reference shall be made in the maintenance manual (see 6.5.1/RD).		P
4.11.5/RD	Accessible connections		P
	In addition to measures given in 4.4.6.4/RD it shall be ensured that neither insertion error nor polarity reversal of connectors can lead to a voltage on an accessible connection higher than the maximum of DVC As. This applies for example to plug-in sub-assemblies or other plug-in devices which can be plugged in without the use of a tool or key or which are accessible without the use of a tool or key. This does not apply to equipment intended to be installed in restricted access areas. If relevant, non-interchangeability and protection against polarity reversal of connectors, plugs and socket outlets shall be confirmed by inspection and trial insertion.	No voltage higher than DVC As occur	P
4.11.6/RD	Interconnection between parts of the PECS		P

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Clause	**Requirement + Test**		**Verdict**
	In addition to complying with the requirements given in 4.11.1/RD to 4.11.5/RD, the means provided for the interconnection between parts of the PECS shall comply with the following requirements or those of 4.11.7/RD. Cable assemblies and flexible cords provided for interconnection between sections of equipment or between units of a system shall be suitable for the service or use involved. Cables shall be protected from physical damage as they leave the enclosure and shall be provided with mechanical strain relief. Misalignment of male and female connectors, insertion of a multipin male connector in a female connector other than the one intended to receive it, and other manipulations of parts which are accessible to the operator shall not result in mechanical damage or a risk of thermal hazards, electric shock, or injury to persons. When external interconnecting cables terminate in a plug which mates with a receptacle on the external surface of an enclosure, no risk of electric shock shall exist at accessible contacts of either the plug or receptacle when disconnected. NOTE An interlock circuit in the cable to de-energize the accessible contacts whenever an end of the cable is disconnected meets the intent of these requirements.		P
4.11.7/RD	Supply connections	A statement is given in the installation instructions.	P
	The connection points provided shall be of appropriate construction to preclude the possibility of loose strands reducing the spacing between conductors when careful attention is paid to installation.		P
4.11.8/RD	Terminals		P
4.11.8.1 /RD	Construction requirements		P
	All parts of terminals which maintain contact and carry current shall be of metal having adequate mechanical strength. Terminal connections shall be such that the conductors can be connected by means of screws, springs or other equivalent means so as to ensure that the necessary contact pressure is maintained. Terminals shall be so constructed that the conductors can be clamped between suitable surfaces without any significant damage either to conductors or terminals. Terminals shall not allow the conductors to be displaced or be displaced themselves in a manner detrimental to the operation of equipment and the insulation shall not be reduced below the rated values. The requirements of this subclause are met by using terminals complying with IEC 60947-7-1 or IEC 60947-7-2, as appropriate.		P
4.11.8.2 4.11.8.2 /RD	Connecting capacity		P

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Clause	**Requirement + Test**		**Verdict**
	Terminals shall be provided which accommodate the conductors specified in the installation and maintenance manuals (see 6.3.6.4/RD) and cables in accordance with the wiring rules applicable at the installation. The terminals shall meet the temperature rise test of 5.2.3.10/RD.		P
	Information regarding the permitted wire sizes shall be given in the installation manual.	Information regarding the permitted wire sizes is given in the installation manual.	P
	The UPS manufacturer shall indicate whether the terminals are suitable for connection of copper or aluminium conductors, or both. The terminals shall be such that the external conductors may be connected by a means (screws, connectors, etc.) which ensures that the necessary contact pressure corresponding to the current rating, the short-circuit strength of the apparatus and the circuit are maintained.		P
	In the absence of a special agreement between the UPS manufacturer and the purchaser, terminals shall be capable of accommodating copper conductors from the smallest to the largest cross-sectional areas corresponding to the appropriate rated current (see Annex AA). Compliance is checked by inspection, by measurement and by fitting at least the smallest and largest cross-sectional areas of the appropriate range in Annex AA.		P
4.11.8.3 /RD	Connection		P
	Terminals for connection to external conductors shall be readily accessible during installation. Sets of terminals for connection to the same input or output shall be grouped together and shall be located in proximity to each other and to the main protective earthing terminal, if any. If the installation instructions provide detail on the proper earthing of the system, the protective earthing terminal need not be placed in proximity to the terminals. Clamping screws and nuts shall not serve to fix any other component although they may hold the terminals in place or prevent them from turning.		P
4.11.8.4 /RD	Wire bending space for wires 10 mm^2 and greater		P
	The distance between a terminal for connection to the main supply, or between major parts of the PECS (for example a transformer), and an obstruction toward which the wire is directed upon leaving the terminal shall be at least that specified in Table 19.		P
4.11.101	Non-detachable cords		N/A
4.11.101.1	Cord guard		N/A
4.11.101.2	Cord anchorages and strain relief		N/A
4.12/RD	Enclosures		P
4.12.1/RD	General		P
4.12.2/RD	Handle and manual controls		P

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Clause	**Requirement + Test**		**Verdict**
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this could result in a hazard. Sealing compounds and the like, other than self-hardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this could result in a hazard.		P
4.12.3/RD	Cast metal	Sheet metal	N/A
	Die-cast metal, except at threaded holes for conduit, where a minimum of 6,4 mm thickness is required, shall be: • not less than 2,0 mm thick for an area larger than 155 cm^2 or having any dimension larger than 150 mm; • not less than 1,2 mm thick for an area of 155 cm^2 or less and having no dimension larger than 150 mm. The area under evaluation may be bounded by reinforcing ribs subdividing a larger area. Malleable iron or permanent-mould cast aluminium, brass, bronze, or zinc, except at threaded holes for conduit, where a minimum of 6,4 mm thickness is required, shall be: • at least 2,4 mm thick for an area greater than 155 cm^2 or having any dimension more than 150 mm; • at least 1,5 mm thick for an area of 155 cm^2 or less having no dimension more than 150 mm. A sand-cast metal enclosure shall be a minimum of 3,0 mm thick except at locations for threaded holes for conduit, where a minimum of 6,4 mm is required.		N/A
4.12.4/RD	Sheet metal		P
4.12.5/RD	Stability test for enclosure		N/A
	Under conditions of normal use, units and equipment shall not become physically unstable to the degree that they could become a hazard to an operator or to a service person. If units are designed to be fixed together on site and not used individually, the stability of each individual unit is exempt from the requirements of 4.12.5/RD. The requirements of 4.12.5/RD are not applicable if the installation instructions for a unit specify that the equipment is to be secured to the building structure before operation. Under conditions of operator use, a stabilizing means, if needed, shall be automatic in operation when drawers, doors, etc., are opened. During operations performed by a service person, the stabilizing means, if needed, shall either be automatic in operation, or a marking shall be provided to instruct the service person to deploy the stabilizing means. Compliance is checked by test of 5.2.2.5/RD.		N/A

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Clause	**Requirement + Test**		**Verdict**
4.101	UPS isolation and disconnect device	Circuit breaker is regarded as disconnected device.	P
4.101.1	Emergency switching (disconnect) device		P
4.101.2	Normal disconnect devices		P
4.102	Stored energy source		P
4.102.1	General		P
4.102.2	Accessibility and maintainability		P
4.102.3	Distance between battery cells		P
4.102.4	Case insulation		P
4.102.5	Electrolyte spillage	Lithium-ion battery	N/A
4.102.6	Ventilation and hydrogen concentration	Lithium-ion battery	N/A
4.102.7	Charging voltages		P
4.102.8	Battery circuit protection		P
4.102.8.1	Overcurrent and earth fault protection		P
4.102.8.2	Location of protective device		P
4.102.8.3	Rating of protective devices		P
4.103	UPS connection to telecommunication lines		N/A

5	**Test requirements**		P
5.1/RD	General		P
5.1.1/RD	Test objectives and classification		P
5.1.2/RD	Selection of test samples		P
5.1.3/RD	Sequence of tests		P
5.1.4/RD	Earthing conditions		P
5.1.5/RD	General conditions for tests		P
5.1.5.1/RD	Application of tests		P
	Unless otherwise stated, upon conclusion of the tests, the equipment need not be operational.		P
5.1.5.2/RD	Test samples		P
5.1.5.3 5.1.5.3/RD	Operating parameters for tests		P
5.1.6/RD	Compliance		P
5.1.7	Test overview		P
5.1.101	UPS test overview		P
5.2	Test specification		P
5.2.1/RD	Visual inspections (type test, sample test and routine test)	Type test applied	P
	Before type testing, a check shall be made that the PECS delivered for the test is as expected with respect to supply voltage, input and output ranges, etc.		P
5.2.2/RD	Mechanical tests		P

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Clause	**Requirement + Test**		**Verdict**
5.2.2.1/RD	Clearance and creepage distance test (type test)	See table 4.4.7.4/RD and 4.4.7.5/RD for details.	P
	It shall be verified by measurement or visual inspection that the clearance and creepage distances comply with 4.4.7.4/RD and 4.4.7.5/RD.		P
	Where this verification is impossible to perform, an impulse voltage test (see 5.2.3.2/RD) shall be performed between the considered circuits.		P
5.2.2.2	Non-accessibility test (type test)		P
5.2.2.3/RD	Ingress protection test (IP rating) (type test)	IP55	P
	The claimed IP rating of the enclosure shall be verified. This test shall be performed as a type test of the enclosure of a PSCS as specified in IEC 60529 for the enclosure classification.	See IP55 test report	P
5.2.2.4/RD	Enclosure integrity test (type test)		P
5.2.2.4.1 /RD	General		P
	The integrity tests apply to PSCS, and also where PSCS are intended for operation without a further enclosure in restricted access areas. After completion of the integrity test, the PSCS shall pass the tests of 5.2.3.2/RD and 5.2.3.4/RD and shall be inspected to confirm that:		P
	- no degradation of any safety-relevant component of the PSCS has occurred.		P
	- live parts have not become accessible (see 4.4.3.3/RD).		P
	- enclosures show no cracks or openings which could cause a hazard.		P
	- clearances are not less than their minimum permitted values and other insulation is undamaged.		P
	- barriers have not been damaged or loosened.		P
	- no moving parts which could cause a hazard are exposed.		P
	The integrity tests shall be performed at the worst case point on representative accessible face(s) of the enclosure.		P
	The PSCS is not required to be operational after testing and the enclosure may be deformed to such an extent that its original IP rating is not maintained.		P
5.2.2.4.2 /RD	Deflection test (type test)		P
5.2.2.4.2.1 /RD	General		P
5.2.2.4.2.2 /RD	Stead force test, 30N		N/A
5.2.2.4.2.3 /RD	Stead force test, 250N		P

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Clause	**Requirement + Test**		**Verdict**
5.2.2.4.3 /RD	Impact test (type test)	Metal enclosure	N/A
5.2.2.4.4	Drop test	≥18kg	N/A
5.2.2.4.5 /RD	Stress relief test	Metal enclosure	N/A
5.2.2.5/RD	Stability test		N/A
5.2.2.6	Wall, ceiling or rack mounted equipment test		N/A
5.2.2.6.101	Wall and ceiling mounted equipment test		N/A
5.2.2.6.102	Rack mounted equipment test	Not this type	N/A
5.2.2.7/RD	Handle and manual controls securement test	No such part	N/A
5.2.2.101	Cord guard test	No such part	N/A
5.2.3/RD	Electrical tests		P
5.2.3.1/RD	General		P
	The electrical tests described in 5.2.3.2/RD to 5.2.3.5/RD are applicable to basic, supplementary and reinforced insulation. Before performing these tests, preconditioning according to 5.2.6.3.1/RD and 5.2.6.3.2/RD is required.		P
	When performing electrical and preconditioning tests, the preferred procedure is to test the entire equipment; however it is acceptable to test the components or sub-assemblies providing the basic and reinforced insulation. When components or sub-assemblies are tested, test conditions shall simulate the least favourable conditions occurring inside the equipment at the place of installation.		P
5.2.3.2/RD	Impulse voltage test (type test and sample test)	See Table 4.4.7.10/RD	P
5.2.3.3/RD	Alternative to impulse voltage test (type test and sample test)		P
	An a.c. or d.c. voltage test according to 5.2.3.4/RD may be used as an alternative method to the impulse voltage test of 5.2.3.2/RD.		P
	For an a.c. voltage test the peak value of the a.c. test voltage shall be equal to the impulse test of Table 25 and applied for three cycles of the a.c. test voltage.		P
	For a d.c. voltage test the average value of the d.c. test voltage shall be equal to the impulse test voltage of Table 25 and applied three times for 10 ms in each polarity.		N/A
	See IEC60664-1 clause 6.1.2.2.2/RD for further information.		P
5.2.3.4/RD	Ac or d.c. voltage test (type test and routine test)		P
5.2.3.4.1 /RD	Purpose of test		P
	The test is used to verify that the clearances and solid insulation of components and of assembled PSCS has adequate dielectric strength to resist temporary overvoltage conditions.		P

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Clause	**Requirement + Test**		**Verdict**
5.2.3.4.2 /RD	Value and type of test voltage		P
	The values of the test voltage for circuits connected to mains supply are determined from column 2 or 3 of Table 26. The voltage test shall be performed with a sinusoidal voltage at 50 Hz or 60 Hz. If the circuit contains capacitors the test may be performed with a d.c. voltage of a value equal to the peak value of the specified a.c. voltage.		P
5.2.3.4.3 /RD	Performing the voltage test		P
	a) Test (1) between accessible conductive part 8connected to earth) and each circuit sequentially (except DVC As circuits). Test voltage according to Table 26, or Table 27, column 2, corresponding to voltage of considered circuit under test. Test (2) between accessible surface (nonconductive or conductive but not connected to earth9 and each circuit sequentially (except DVC As circuits). Test voltage according to Table 26 or Table 27, column 3 (for type test) or column 2 (for routine test), corresponding to voltage of considered circuit under test.		P
	b) Test between each considered circuit sequentially and the other adjacent circuits connected together. Test voltage according to Table 26 or Table 27, column 2, corresponding to voltage of considered circuit under test.		P
	c) Test between DVC As circuit and each adjacent circuit sequentially. Test voltage according to Table 26 or Table 27, column 3 (for type test) or column 2 (for routine test), corresponding to the circuit with the higher voltage. Either the adjacent circuit or the DVC As circuit may be earthed for this test. It is necessary to test functional insulation between PELV and SELV circuits, but it is not necessary to test functional insulation between adjacent PELV or adjacent SELV circuits.		P
5.2.3.4.4 /RD	Duration of the a.c. or d.c. voltage test		P
	The duration of the test shall be at least 60 s for the type test and 1 s for the routine test. The test voltage may be applied with increasing and/or decreasing ramp voltage but the full voltage shall be maintained for 60 s and 1 s respectively for type and routine tests.	60s	P
5.2.3.4.5 /RD	Verification of the a.c. or d.c. voltage test		P
	The test is successfully passed if no electrical breakdown occurs during the test.		P

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Clause	**Requirement + Test**		**Verdict**
5.2.3.5/RD	Partial discharge test (type test, sample test)		N/A
	The partial discharge test shall confirm that the solid insulation (see 4.4.7.8/RD) used in components and subassemblies for protective separation of electrical circuits remains partial-discharge-free within the specified voltage range (see Table 28).		N/A
	This test shall be performed as a type test and a sample test. It may be omitted for insulating materials which are not degraded by partial discharge, for example ceramics. The partial discharge inception and extinction voltage are influenced by climatic factors (e.g. temperature and moisture), equipment self-heating, and manufacturing tolerance. These influencing variables can be significant under certain conditions and shall therefore be taken into account during type testing.		N/A
5.2.3.6/RD	Protective impedance test (type test and routine test)		P
	A type test shall be performed to verify that the current through a protective impedance under normal operating or single-fault conditions does not exceed the values given in 4.4.3.4/RD. The test shall be performed using the circuit of IEC 60990:1999, Figure 4. NOTE IEC 60990 states that the use of a single network for the measurement of a.c. combined with d.c. has not been investigated, but no suggestion is made for measurement in such cases. The value of the protective impedance shall be verified as a routine test.		P
5.2.3.7/RD	Touch current measurement test (type test)		P
	The touch current shall be measured to determine if the measures of protection need not be taken (see 4.4.4.3.3/RD). The PECS shall be set up in an insulated state without any connection to the earth and shall be operated at rated voltage. Under these conditions, the touch current shall be measured between the means of connection for the PE conductor and the PE conductor itself with the test circuit of Figure 4 of IEC 60990:1999.		P
	• For a PSCS to be connected to an earthed neutral system, the neutral of the mains of the test site shall be directly connected to the protective earthing conductor.		N/A
	• For a PSCS to be connected to an earthed neutral system, the neutral shall be connected through a resistance of 1 kΩ to the protective earthing conductor which shall be connected to each input phase in turn. The highest value will be taken as the definitive result.		N/A
	• For a PSCS to be connected to a corner earthed system, the protective earthing conductor shall be connected to each input phase in turn. The highest value will be taken as the definitive result.		N/A
	• For a PSCS with a particular earthing system, this system shall operate as intended during the test.		P

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Clause	**Requirement + Test**		**Verdict**
	• If a PSCS is intended to be connected to more than one system network, each of these different system networks (or the worst-case, if that can be determined) shall be used to make the touch current measurement.		P
5.2.3.8/RD	Capacitor discharge test (type test)	Only be possible by means of a tool or key and the information and marking requirements of 6.5.2/RD meet	N/A
	The capacitor discharge time as required by 4.4.3.4/RD may be verified by a type test and/or by calculation taking into account the relevant tolerances.		N/A
5.2.3.9	Limited power source test (type test)		N/A
5.2.3.10 5.2.3.10 /RD	Temperature rise test (type test)	See table 4.6.4	P
	If possible the PECS must operate in the worst conditions of the rated power and the output current.		P
	Equipment, in which the heating or cooling quantity depends on the temperature, the temperature measurement must be carried out under the most unfavourable conditions of ambient temperature within the range specified by the manufacturer.		P
	The PECS shall be tested with at least 1,2 m of wire attached to each field wiring terminal. The wire shall be of the smallest size intended to be connected to the PECS as specified by the manufacturer for installation. When there is only provision for the connection of bus-bars to the PECS, they shall be of the minimum size intended to be connected to the PECS as specified by the manufacturer, and they shall be at least 1,2 m in length.		P
	The test shall be maintained until thermal stabilization has been reached. That is, when three successive readings, taken at intervals of 10 % of the previously elapsed duration of the test and not less than 10 min. intervals, indicate no change in temperature, defined as ± 1 °C between any of the three successive readings, with respect to the ambient temperature.		P
	The temperature of an electrical insulation (other than that of windings) is measured on the surface of the insulation at a point close to the heat source, if a failure of this insulation could cause a hazard. If temperatures of windings are measured by the thermocouple method, the thermocouple shall be located on the surface of the winding assuming the hottest part due to surrounding heat emitting components. See also notes in Table 14.		P
	The maximum temperature attained shall be corrected to the rated ambient temperature of the PSCS by adding the difference between the ambient temperature during the test and the maximum rated ambient temperature.		P
	No corrected temperature of the material or component shall exceed the temperature in Table 14 in IEC 62477-1: 2012 or Table 103 as applicable.		P

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Clause	**Requirement + Test**		**Verdict**
	During the test, thermal cut-out, overload detection functions and devices shall not operate.		P
5.2.3.11 /RD	Protective equipotential bonding tests (type tests and routine test)		P
5.2.3.11.1 /RD	General		P
	Each conductive accessible part under consideration shall be tested separately, to determine if the protective equipotential bonding path for that part is adequate to withstand the test current that the bonding path may be subjected to under fault conditions. The circuit under consideration shall be selected from amongst those circuits adjacent to the accessible part under consideration and separated from it by only basic or functional insulation. All of these selected circuits have to be analysed regarding prospective short circuit current and the associated protective element(s): - If the circuit under consideration exceeds the 5 s disconnection time requirement of IEC 60364-4-41, the protective equipotential bonding impedance test of 5.2.3.11.2/RD and the protective equipotential bonding short circuit test of 5.2.3.11.3/RD have to be performed. - If the circuit under consideration meets the 5 s disconnection time requirement of IEC 60364-4-41, the protective equipotential bonding short circuit test of 5.2.3.11.3/RD has to be performed. - If the circuit under consideration meets the disconnection time requirement of IEC 60364-4-41:2005, Table 41.1, as applicable, depending on the earthing system of the installation, no type test is required.		P
	For pluggable equipment type A only the protective equipotential bonding impedance test of 5.2.3.11.2/RD have to be performed.		N/A
5.2.3.11.2 /RD	Protective equipotential bonding impedance test	Measure<0,1Ω	P
5.2.3.11.2.1/ RD	Test conditions		P

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Clause	**Requirement + Test**		**Verdict**
	Where required by 4.4.4.2.2/RD and 5.2.3.11.2.1/RD, the impedance of protective equipotential bonding means shall be checked by passing a test current through the bond for a period of time. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows: • for pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack); • for pluggable equipment type B and permanently connected equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment; • the rating of the provided overcurrent device for a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment.	Permanently connected equipment	P
5.2.3.11.2.2/ RD	Test current, duration and acceptance criteria		P
	a) For PECS with an overcurrent protective device rating of 16 A or less, this test may be omitted, if an impedance not exceeding 0,1 Ω can be demonstrated.		N/A
	b) As an alternative to Table 29, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective equipotential bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic. The tests are conducted for a duration corresponding to the 200 % current value on the time-current characteristic.		P
	c) For PECS with an overcurrent protective device rating of more than 460 A, calculations or simulations according to IEC 60949 shall be used to show the ability of the prospective short circuit current to fulfil the requirements. The protective equipotential bonding continuity routine test of 5.2.3.11.4/RD shall be performed to show that the impedance of the protective equipotential bonding means during and at the end of the test shall not exceed the expected value.		N/A
	Acceptance criteria: The test current is 200 % of the overcurrent protective device rating and the duration of the test is as shown in Table 29. The voltage drop in the protective equipotential bonding means, during and at the end of the test, shall not exceed DVC As, as determined from Table 2 and Table 5 with respect to the accessible surface of the enclosure.		P
	After the tests, visual inspection shall show no damage to the protective equipotential bonding means.		P
5.2.3.11.3 /RD	Protective equipotential bonding short circuit withstand test (type test)		N/A

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Clause	**Requirement + Test**		**Verdict**
	As required by 5.2.3.11.2.1/RD, the short circuit test in 5.2.4.3/RD shall be performed to ensure that protective bonding has the ability to withstand the prospective short circuit current that it may be subjected to under fault conditions.		N/A
	The testing shall include an individual test of the protective bonding path for each conductive accessible part unless analysis shows that the short circuit withstand capability of the path is adequate, or that the results of one combination are representative of the anticipated results of another combination.	The short circuit withstand capability of the path is adequate	N/A
5.2.3.11.4 /RD	Protective equipotential bonding continuity test (routine test)		N/A
5.2.3.101	Backfeed protection test (type test)		P
5.2.3.101.1	General		P
5.2.3.101.2	Test for pluggable UPS		N/A
5.2.3.101.3	Test for permanently connected UPS		P
5.2.3.101.4	Method to simulate the load-induced change of reference potential for pluggable UPS		N/A
5.2.3.101.5	Solid-state backfeed protection		N/A
5.2.3.102	Input current test		P
5.2.3.103	Short-time withstand current test (type test)		P
5.2.3.103.1	General procedure		N/A
5.2.3.103.2	Input port rated conditional short-circuit current		N/A
5.2.3.103.3	Input port short-time withstand current rating		N/A
5.2.3.103.4	Exemption from testing		P
5.2.3.104	Transformer protection test		N/A
5.2.3.105	Unsynchronized load transfer test		P
5.2.3.105.1	General		P
5.2.3.105.2	Phase displacement		P
5.2.4/RD	Abnormal operation and simulated fault tests		P
5.2.4.1 5.2.4.1/RD	General	See table 4.2/RD and 4.3/RD	P
5.2.4.2/RD	Pass criteria		P

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Clause	**Requirement + Test**		**Verdict**
	As a result of the abnormal operation tests, the PSCS shall comply with the following: - there shall be no emission of flame, burning particles or molten metal; - the surgical cotton indicator shall not have ignited; - the earth connection and protective bonding of the PSCS shall not have opened; - doors and cover shall remain in place; - during and after the test, accessible DVC As, SELV and PELV circuits and accessible conductive parts shall not exhibit voltages greater than the time dependent voltages of Figure 1, Figure 2 or Figure 3, as appropriate and shall be separated from live parts at voltages greater than DVC As with at least basic insulation. Compliance shall be checked by the a.c./d.c. insulation test of 5.2.3.4/RD for basic insulation; - during and after the test, live parts at voltages greater than DVC As shall not become accessible.		P
	The PSCS is not required to be operational after testing and it is possible that the enclosure can become deformed. Overcurrent protection integral to the PECS, or required to be used with the PECS, is allowed to open.		P
5.2.4.3/RD	Protective equipotential bonding short circuit withstand test (type test)		N/A
5.2.4.3.1 /RD	General		N/A
	When required by 5.2.3.11.2.1/RD, a protective bonding path shall be subjected to the following short-circuit withstand test.		N/A
5.2.4.3.2 /RD	Test conditions		N/A
	The equipment under test shall be supplied with power and the output port shall be operating as intended in 5.2.4.1/RD prior to closing the switching means that applied will be more severe.		N/A
	The protective bonding short circuit test shall be performed with the PSCS working with light load, unless analysis shows that higher short circuit currents are available under higher loading conditions.		N/A
	A new sample may be used for each short-circuit test.		N/A
5.2.4.3.3 /RD	Protective equipotential bonding short circuit test method		N/A
5.2.4.3.4 /RD	Pass criteria		N/A
5.2.4.4/RD	Output short-circuit test (type test)		P
5.2.4.4.1 /RD	Load condition		P

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Clause	**Requirement + Test**		**Verdict**
	The short circuit test shall be performed with the PSCS at full load or light load whichever creates the more severe condition.		P
5.2.4.4.2 /RD	Short-circuit test method		P
	In addition to determining compliance with the criteria of 5.2.4.2/RD, this test is used to determine the output short circuit current rating of the port under consideration, in accordance with 4.3.2.3/RD. An oscilloscope or other suitable instrument shall be used to measure the peak current during the test, and to measure or calculate the r.m.s. value of the current.		P
	The value(s) to be recorded and to be provided with the PECS instructions, in accordance with 6.2, are the peak current, and the highest of the r.m.s. current values measured or calculated over a time period as follows: a) for a.c. signals, three cycles of the nominal a.c. frequency for the port under consideration, in which case the value is to be stated as the 3-cycle r.m.s. value; b) for all signals, the duration of the short circuit from the time the short circuit is applied, until the time the short circuit current is interrupted by a protective device or other mechanism, in which case the value stated is to include the r.m.s. value and the time period in seconds; c) for short circuit tests that result in a continuous non-zero value, the steady-state r.m.s. value, in which case the value is to be stated as a continuous r.m.s value. For PECS with internal short circuit protection according to 4.3.2.3/RD, which protects the output port within some few µs, the requirements in a), b) and c) are not applicable.		P
5.2.4.5/RD	Output overload test (type test)		P
5.2.4.6/RD	Breakdown of components test (type test)		P
5.2.4.6.1 /RD	Load conditions	See table 4.2/RD and 4.3/RD	P
	The breakdown of a component, identified as a result of the circuit analysis of 4.2/RD, shall be tested with the PSCS at full load or light load whichever creates the more severe condition.		P
5.2.4.6.2 /RD	Application of short circuit or open-circuit		P
	The short circuit shall be applied with cable of a cross-section appropriate for the current that normally flows through the component, but no less than 2.5 mm². The length of the loop shall be as short as practical to perform the test. Short circuits and open circuits are applied using an appropriate switching device.		P
	Each identified component shall be subjected to only one breakdown of components test unless both open- and short-circuit failure modes are likely in that component.		P

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Clause	**Requirement + Test**		**Verdict**
5.2.4.6.3 /RD	Test sequence		P
	For the Breakdown of components test, identified components shall be short-circuited or open-circuited, whichever creates the worst hazard, one at a time.		P
5.2.4.7/RD	PWB short circuit test (type test)		N/A
	On PWBs, functional insulation provided by spacings which are less than those specified in Table 10 and Table 11 (see 4.4.7.7/RD) shall be type tested as described below.		N/A
	The decreased spacings shall be short-circuited one at a time, on representative samples, and the short-circuit shall be maintained until no further damage occurs.		N/A
5.2.4.8/RD	Loss of phase test (type test)		P
	A multi-phase PSCS shall be operated with each line (including neutral, if used) disconnected in turn at the input. The test shall be performed by disconnecting one line with the power conversion equipment operating at its maximum normal load and shall be repeated by initially energizing the device with on lead disconnected.		P
	The test shall continue until terminated by a protective mechanism, a component failure occurs, or the temperature stabilizes.		P
	This particular requirement may be simulated for PSCS with rated input current greater than 500 A.		N/A
5.2.4.9/RD	Cooling failure tests (type tests)		P
5.2.4.9.1 /RD	General and pass criteria		P
	For PSCS having a combination of cooling mechanisms, all relevant tests shall be performed. It is not necessary to perform the tests simultaneously. The test shall continue, - until the temperature stabilizes, in which case the temperature limits of 4.6.4.2/RD apply; or - until terminated by a protective mechanism or a component failure occurs, in which case the temperature limits of 4.6.4.2/RD may be exceeded by not more than 5°C. If this is not possible a warning statement shall be provided in the user documentation.		P
	NOTE The temperature increase of 5 °C with regard to the steady state limits reflect the spread of the burn threshold given in IEC Guide 117.		P
5.2.4.9.2 /RD	Inoperative blower motor test		P
	A PSCS having forced ventilation shall be operated at rated load with fan or blower motor or motors made inoperative, singly or in combination from a single fault, by physically preventing their rotation.		P
5.2.4.9.3 /RD	Clogged filter test		P

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Clause	**Requirement + Test**		**Verdict**
	Enclosed PSCS having filtered ventilation openings shall be operated with the openings blocked to represent clogged filters. The test shall be performed initially with the ventilation openings blocked 50 %. The test shall be repeated under full blocked condition.		P
5.2.4.9.4 /RD	Loss of coolant test		N/A
	A liquid cooled PSCS shall be operated at rated load. Loss of coolant shall be simulated by draining the coolant, blocking the flow or disabling the system coolant pump.		N/A
	If the PSCS is shut down due to the operation of a thermal device located inside the coolant, then the test shall be repeated with the coolant drained out of the system.		N/A
	NOTE: It is presumed that the thermal device will be inoperative if not surrounded by coolant liquid.		N/A
5.2.5/RD	Material tests		P
5.2.5.1/RD	General		P
	When requested by 4.4.7.8.2/RD, the manufacturer shall test the flammability properties of the materials used for insulating purposes, as defined in 5.2.5.2/RD, 5.2.5.3/RD and 5.2.5.4/RD. When requested by 4.6.3.2/RD the manufacturer shall test the flammability properties of the materials used for fire enclosure, as defined in 5.2.5.5/RD		P
5.2.5.2/RD	High current arcing ignition test (type test)		N/A
5.2.5.3/RD	Glow-wire test (type test)		P
	The glow-wire test shall be made under the conditions specified in 4.4.7.8.2/RD according to IEC 60695-2-10 and IEC 60695-2-13.		P
5.2.5.4/RD	Hot wire ignition test (type test – alternative to glow-wire test)		N/A
5.2.5.5/RD	Flammability test (type test)	Metal enclosure	N/A
5.2.5.6/RD	Flaming oil test (type test)	No opening in the bottom	N/A
5.2.5.7/RD	Cemented joints test (type test)		N/A

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Clause	**Requirement + Test**		**Verdict**
	When required by 4.4.7.9/RD representative samples of cemented joints providing protection of type 1 or type 2 as defined in IEC 60664-3:2003 shall be tested as a type test as follows. The samples shall be subjected to the conditioning procedure specified in 5.7 of IEC 60664-3:2003, using the following parameters: for the cold test (5.7.1/RD), a temperature of -25 °C shall be used, and for the rapid change of temperature test (5.7.3/RD): –25 °C to +125 °C. After the conditioning the samples shall pass the following tests in the prescribed order: a) The mechanical strength of the joint shall be evaluated by loading the joint using the forces anticipated to be present under normal conditions. There shall be no separation of the parts. b) The insulation resistance between the conductive parts separated by the joint shall be measured according to 5.8.3 of IEC 60664-3:2003. c) Cemented joints shall be treated as to be thin sheet material and shall be tested according 4.4.7.8.3/RD d) The sectioning of the joint shall not show any cracks, voids or separation.		N/A
5.2.6 5.2.6/RD	Environmental tests (type tests)		P
5.2.6.1/RD	General		P
	Compliance is shown by conducting test of 5.2.6.3/RD, 5.2.6.4/RD, 5.2.6.5/RD and 5.2.6.6/RD according to Table 30 as applicable for the environmental conditions specified by the manufacture.		P
5.2.6.2/RD	Acceptance criteria		P
	The following acceptance criteria shall be satisfied: - no degradation of any safety-relevant component of the PSCS; - no potentially hazardous behaviour of the PSCS during the test; - no sign of component overheating; - no live part shall become accessible; - no cracks in the enclosure and no damaged or loose insulators; - pass routine a.c. or d.c. voltage test 5.2.3.4/RD; - pass protective bonding test 5.2.3.11.2/RD; - no potentially hazardous behaviour when the PSCS is operated following the test.		P
5.2.6.3/RD	Climatic tests		P
5.2.6.3.1 /RD	Dry heat test (steady state)		P

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Clause	**Requirement + Test**		**Verdict**
	To prove the ability of components and equipment to be operated, transported or stored at high temperatures the dry heat (steady state) test shall be performed according to the conditions specified in Table 31.		P
5.2.6.3.2 /RD	Damp heat test (steady state)		P
	To prove the resistance to humidity, the PSCS shall be subjected to a Damp heat test (steady state) according to Table 32.		P
5.2.6.4	Vibration test (type test)		P
5.2.6.5	Salt mist test (type test)		N/A
5.2.6.6	Dust and sand test (type test)		N/A
5.2.7/RD	Hydrostatic pressure test (type test and routine test)		N/A
	For type tests, the pressure inside the cooling system of a liquid cooled PSCS (see 4.7.2.3.3/RD) shall be increased at a gradual rate until a pressure relief mechanism (if provided) operates, or until a pressure of twice the operating value or 1,5 times the maximum pressure rating of the system is achieved, whichever is the greater. NOTE: for the purpose of this test the coolant pump may be disabled. For routine tests, the pressure shall be increased to the maximum pressure rating of the system. The pressure shall be maintained for at least one minute. There shall be no thermal, shock, or other hazard resulting from the test. There shall be no significant leakage of coolant or loss of pressure during the test, other than from a pressure relief mechanism during a type test. After the hydrostatic pressure type test the PSCS shall pass the a.c. or d.c. voltage test 5.2.3.4/RD.		N/A

6	**Information and marking requirements**		P
6.1	General		P
6.1.101	Durability		P
6.1.102	Removable parts		N/A
6.2	Information for selection		P
6.3	Information for installation and commissioning		P
6.3.1/RD	General		P
6.3.2/RD	Mechanical considerations		P
	The following drawings shall be prepared by the manufacturer: - Dimensional drawing, including mass information - Mounting drawing		P
6.3.3/RD	Environment		P

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Clause	**Requirement + Test**		**Verdict**
	In accordance with 4.9/RD the following environmental conditions shall be specified, for operation, transportation and storage:		P
	Climatic (temperature, humidity, altitude, pollution, ultra-violet light, etc.)		P
	Mechanical (vibration, shock, drop, topple, etc.)		P
	Electrical (overvoltage category)		P
6.3.4/RD	Handling and mounting		P
	In order to prevent injury or damage, the installation documents shall include warnings of any hazards which can be experienced during installation. Where necessary, instructions shall be provided for: - packing and unpacking; - moving; - lifting; - strength and rigidity of mounting surface; - fastening; - provision of adequate access for operation, adjustment and maintenance.		P
6.3.5/RD	Enclosure temperature		P
	When surface temperatures of the PECS, close to mounting surfaces, exceed the limit of 4.6.4.2/RD, the installation manual shall contain a warning to consider the combustibility of the mounting surface.		P
	Where required by 4.6.3.1/RD, the following marking shall appear on the PECS and in the installation instructions: “suitable for mounting on concrete or other non-combustible surfaces only”.		N/A
6.3.6/RD	Connections		P
6.3.6.1/RD	General		P
	Information shall be provided to enable the installer to make safe electrical connection to the PSCS. This shall include information for protection against hazards (for example, electric shock or availability of energy) that may be encountered during installation, operation or maintenance.		P
6.3.6.2/RD	Interconnection and wiring diagrams		P
	The installation and maintenance manuals shall include details of all necessary connections, together with a suggested interconnection diagram.		P
6.3.6.3/RD	Conductor (cable)selection		P
	The Installation manual shall define the voltage and current levels for all connections to the PSCS, together with cable insulation requirements. These shall be worst-case values, taking into account overcurrent and overload conditions and the possible effects of non-sinusoidal currents.		P
6.3.6.4/RD	Terminal capacity and identification		P

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Clause	**Requirement + Test**		**Verdict**
	The installation and maintenance manuals shall indicate the range of acceptable conductor sizes and types (solid or stranded) for all terminals, and also the maximum number of conductors which can simultaneously be connected.		P
	For field wiring terminals, the manuals shall specify the requirements for tightening torque values and also the insulation temperature rating requirements for the conductor or cable.		P
	The identification of all field wiring terminals shall be marked on the PSCS, either directly or by label attached close to the terminals.		P
	The installation and maintenance manuals shall identify all external terminals relating to circuits protected by one of the methods of 4.4.6.4/RD.		P
6.3.7/RD	Protection requirements		P
6.3.7.1/RD	Accessible parts and circuits		P
	The installation, users and maintenance manuals shall identify any accessible parts at voltages greater than DVC As, and shall describe the insulation and separation provisions required for protection.		P
	The manuals shall also indicate the precautions to be taken to ensure that the safety of DVC As connections maintained during installation.		P
	Where a hazard is present after the removal of a cover, a warning label shall be placed on the equipment. The label shall be visible before the cover is removed.		P
	The manual of a PSCS shall state the maximum voltage allowed to be connected to each port.		P
	The manuals shall provide instructions for the use of PELF circuits within a zone of equipotential bonding.		N/A
6.3.7.2/RD	Type of electrical supply system		P
	The installation manual or the PECS shall specify requirements for safe earthing including the permitted earthing system of the installation (see 4.4.7.1.4/RD)		P
	The unacceptable earthing systems shall be indicated as: - not permitted; or - with modification of values and/or safety levels which shall be quantified through type test.		P
6.3.7.3/RD	Protective class		P
6.3.7.3.1 /RD	General		P
	The installation manual of the PECS shall declare the protective class specified for the PECS and the product shall be marked according to the requirement of 6.3.7.3.2/RD, 6.3.7.3.3/RD, and 6.3.7.3.4/RD		P
6.3.7.3.2 /RD	Protective class I equipment		P

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Clause	**Requirement + Test**		**Verdict**
	Terminals for connection of the PE conductor shall be clearly and indelibly marked with one or more of the following:		P
	The symbol IEC 60417-5019 (2011-01)		P
	With the letters PE		P
	The colour coding green or green-yellow		P
6.3.7.3.3 /RD	Protective class II equipment		N/A
	Equipment of protective class II shall be marked with symbol IEC 60417-5172 (2011-01) (see Annex C). Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 4.4.6.3/RD) it shall be marked with symbol IEC 60417-5018 (2011-01) (see Annex C).		N/A
6.3.7.3.4 /RD	Protective class III equipment		N/A
	No marking is required on the product.		N/A
6.3.7.4/RD	Touch current marking		N/A
	Where the touch current in the PE conductor exceeds the limits given in 4.4.4.3.3/RD, this shall be stated in the installation and maintenance manuals. In addition, a warning symbol ISO 7010- W001 (2011-06) (see Annex C) shall be placed on the product, and a notice shall be provided in the installation manual to instruct the user that the minimum size of the PE conductor shall comply with the local safety regulations for high PE conductor current equipment.		N/A
6.3.7.5/RD	Compatibility with RCD marking与RCD	No RCD	N/A
	The installation and maintenance manuals shall indicate compatibility with RCDs (see 4.4.8/RD). When 4.4.8/RD b) applies, a caution notice and the symbol ISO 7010-W001 (2011-06) (see Annex C) shall be provided in the user manual, and the symbol shall be placed on the product. The caution notice shall be the following or equivalent: “This product can cause a d.c. current in the PE conductor. Where a residual current-operated protective device (RCD) is used for protection against electrical shock, only an RCD of Type B is allowed on the supply side of this product.” (See 6.4.3/RD for general requirements for labels, signs and signals.)		N/A
6.3.7.6/RD	Cable and connection		P
	Any particular cable and connection requirements shall be identified in the installation and maintenance manuals.		P
6.3.7.7/RD	External protection devices		N/A
	Where external devices are necessary to protect against hazards, the installation manual shall specify the required characteristics (see also 5.2.4/RD and 4.3.2.1/RD)		N/A
6.3.8/RD	Commissioning		P

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Clause	**Requirement + Test**		**Verdict**
	If commissioning tests are necessary to ensure the electrical and thermal safety of a PSCS, information to support these tests shall be provided for each part of the PSCS. This information can depend on the specific installation, and close cooperation between manufacturer, installer, and user can be required. Commissioning information shall include references to hazards that might be encountered during commissioning, for example those mentioned in 6.4/RD and 6.5/RD.		P
6.3.101	Guidance on UPS installation		P
6.4	Information for use		P
6.4.1/RD	General		P
	The user's manual shall include all information regarding the safe operation of the PSCS. In particular, it shall identify any hazardous materials and risks of electrical shock, overheating, misuse of the PSCS.		P
	The manual should also indicate any hazards which can result from reasonably foreseeable misuse of the PSCS.		P
6.4.2/RD	Adjustment		P
	The user's manual shall give details of all safety-relevant adjustments intended for the user. The identification or function of each control or indicating device and fuse shall be marked adjacent to the item. Where it is not possible to do this on the product, the information shall be provided pictorially in the manual.		P
	Maintenance adjustments may also be described in this manual, but shall be made clear that they should only be made by qualified personnel.		P
	Clear warnings shall be provided where excessive adjustment could lead to a hazardous state of the PSCS.		P
	Any special equipment necessary for making adjustments shall be specified and described.		P
6.4.3 6.4.3/RD	Labels, signs and signals		P
6.4.3.1/RD	General		P
	Labelling shall be in accordance with good ergonomic principles so that notices, controls, indications, test facilities, fuses, etc., are sensibly placed and logically grouped to facilitate correct and unambiguous identification. All safety related equipment labels shall be located so as to be visible after installation or readily visible by opening a door or removing a cover. Where a symbol is used, the information provided with the PSCS shall contain an explanation of the symbol and its meaning.		P

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Clause	**Requirement + Test**		**Verdict**
	Labels shall: • wherever possible, use international symbols as given by ISO 3864-1, ISO 7000 or IEC 60417; • if no international symbol is available, be worded in an appropriate language or in a language associated with a particular technical field; • be concise and unambiguous; • be conspicuous, legible and durable; • state the hazards involved and give ways in which risks can be reduced.		P
	When instructing the person(s) concerned as to • what to avoid: the wording should include “no”, “do not”, or “prohibited”; • what to do: the wording should include “shall”, or “must”; • the nature of the hazard: the wording should include “caution”, “warning”, or “danger”, as appropriate; • the nature of safe conditions: the wording should include the noun appropriate to the safety device.		P
	Safety signs shall comply with ISO 3864-1.		P
	The signal words indicated hereinafter shall be used and the following hierarchy respected: • DANGER to call attention to a high risk, for example: “High voltage”. • WARNING to call attention to a medium risk, for example: “This surface can be hot.” • CAUTION to call attention to a low risk, for example: “Some of the tests specified in this standard involve the use of processes imposing risks on persons concerned.” Danger, warning and caution markings on the PECS shall be prefixed with the word “DANGER”, “WARNING”, or “CAUTION” as appropriate in letters not less than 3,2 mm high. The remaining letters of such markings shall be not less than 1,6 mm high.		P
6.4.3.2/RD	Isolators		N/A
	Where an isolating device is not intended to interrupt load current, a warning shall state: DO NOT OPEN UNDER LOAD.		N/A
	The following requirements apply to any supply isolating device which does not disconnect all sources of power to the PSCS.		N/A
	If the isolating device is mounted in an equipment enclosure with the operating handle externally operable, a warning label shall be provided adjacent to the operating handle starting that it does not disconnect all power to the PSCS.		N/A

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Clause	**Requirement + Test**		**Verdict**
	Where a control circuit disconnector can be confused with power circuit disconnectors due to size or location, a warning label shall be provided adjacent to the operating handle of the control disconnector stating that it does not disconnect all power to the PSCS.		N/A
6.4.3.3/RD	Visual and audible signals		P
	Visual signals such as flashing lights, and addible signals such as sirens, may be used to warn of an impending hazardous event such as the driven equipment start-up and shall be identified. It is essential that these signals: - are unambiguous; - can be clearly perceived and differentiated from all other signals used; - can be clearly recognized by the user; - are emitted before the occurrence of the hazardous event. It is recommended that higher frequency flashing lights be used for information. Note: IEC 60073 provides guidance on recommended flashing rates and on/off ratios.		P
6.4.3.4/RD	Hot surfaces		P
	Where required by 4.6.4.2/RD the warning symbol W017 of ISO 7010 shall be marked on or adjacent to parts exceeding the touch temperature limits of Table 15.		P
6.4.3.5/RD	Control and device marking		P
	The Identification of each control or indicating device and fuse shall be marked adjacent to the item. Replaceable fuses shall be marked with their rating and time characteristics. Where it is not possible to do this on the product, the information shall be provided pictorially in the manual. Appropriate identification shall be marked on or adjacent to each movable connector. Test points shall be individually marked with the circuit diagram reference. The polarity of any polarized devices shall be marked adjacent to the device. The diagram reference and if possible the function shall be marked adjacent to each pre-set control in a position where it is clearly visible while the adjustment is being made.		P
6.4.3.101	Distribution-related backfeed		N/A
6.4.3.102	Protection in building installation		N/A
6.4.3.102.1	General		N/A
6.4.3.102.2	Rated conditional short-circuit current (Icc)		N/A
6.4.3.102.3	Prospective short-circuit current (Icp)		N/A

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Clause	**Requirement + Test**		**Verdict**
6.4.3.102.4	Requirement for building installation		N/A
6.4.3.103	Batteries installed within the UPS enclosure		P
6.5	Information for maintenance		P
6.5.1/RD	General		P
	The PECS shall be marked with the date code, or serial number from which the date of manufacture can be determined.		P
	Safety information shall be provided in the installation and maintenance manuals including appropriate, the following:		P
	• Preventive maintenance procedures and schedules		P
	• Safety precautions during maintenance		P
	• Location of live parts that can be accessible during maintenance (for example, when covers are removed)		P
	• Adjustment procedures		P
	• Subassembly and component repair and replacement procedures		P
	• Any other relevant information		P
6.5.2/RD	Capacitor discharge		P
	When the requirements 4.4.9/RD are not met, the warning symbol W012 of ISO 7010 and an indication of the discharge time (for example, 45 s, 5 min) shall be placed in a clearly visible position on the enclosure, the capacitor protective barrier, or at a point close to the capacitor(s) concerned (depending on the construction). The symbol shall be explained and the time required for the capacitors to discharge after the removal or the power from the PSCS shall be stated in the installation and maintenance manuals.		P
6.5.3/RD	Auto restart/bypass connection		P
	If a PSCS can be configured to provide automatic restart or bypass connection, the installation, user and maintenance manuals shall contain appropriate warning statements.		P
	A PSCS which is set to provide automatic restart or bypass connection, after the removal of power, shall be clearly identified at the installation.		P
6.5.4/RD	Other hazards		P
	The manufacturer shall identify any components and materials of a PSCS which require special procedures to prevent hazards.		P
6.5.5/RD	Equipment with multiple sources of supply		P
	In accordance with 4.8/RD, where there is more than one source of supply energizing the PSCS, information shall be provided to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.		P
6.5.101	Battery information for maintenance		P
6.5.101.1	Labelling on battery		P

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Clause	**Requirement + Test**		**Verdict**
6.5.101.2	Information in instruction manual(s)		P
6.5.101.2.1	General		P
6.5.101.2.2	Instructions for battery replacement		P

Annex A	**Addition information for protection against electric shock**		P
A.1/RD	General		P
A.2/RD	Protection by means of DVC As		P
A.3/RD	Protection by means of protective impedance		P
A.4/RD	Protection by using limited voltages		N/A
A.5/RD	Evaluation of working voltage and selection of DVC for touch voltage, PELV and SELV circuits		P
A.5.1/RD	General		P
A.5.2/RD	Selection of DVC for touch voltage sets to protect against ventricular fibrillation		P
A.5.3/RD	Selection of DVC for touch voltage sets to protect against muscular reaction		P
A.5.4/RD	Selection of DVC for touch voltage sets to protect against startle reaction		P
A.5.5/RD	Determination of voltage limits for touch voltage under fault condition depending on protective equipotential bonding impedance		P
A.5.6/RD	Touch time- d.c. voltage zones of ventricular fibrillation		P
A.5.7/RD	Touch time- d.c. voltage zones of muscular reaction (inability to let go reaction)		P
A.5.8/RD	Touch time- d.c. voltage zones of saltwater-wet skin condition		P
A.5.9/RD	Touch time- a.c. voltage zones of ventricular fibrillation		P
A.5.10/RD	Touch time- a.c. voltage zones of muscular reaction (inability to let go reaction)		P
A.5.11/RD	Touch time- a.c. voltage zones for startle reaction		P
A.6/RD	Evaluation of the working voltage of circuits		P
A.6.1/RD	General		P
A.6.2/RD	AC working voltage		P
A.6.3/RD	DC working voltage		P
A.6.4/RD	Pulsating working voltage		N/A
A.7/RD	Examples of the use of elements of protective measures		P
A.101	Comparison of limits of working voltage		P

Annex D	**Evaluation of clearance and creepage distances**		P
D.1/RD	Measurement	Considered.	P
D.2/RD	Relationship of measurement to pollution degree		P
D.3/RD	Examples		P

IEC 62040-1			
Clause	**Requirement + Test**		**Verdict**
Annex F	**Clearance and creepage distance determination for frequencies greater than 30kHz**		N/A
F.1/RD	General influence of the frequency on the withstand characteristics		N/A
F.2/RD	Clearance		N/A
F.2.1/RD	General		N/A
F.2.2/RD	Clearance for inhomogeneous fields		N/A
F.2.3/RD	Clearance for approximately homogenous fields		N/A
F.3/RD	Creepage distance		N/A
F.4/RD	Solid insulation		N/A
F4.1/RD	General		N/A
F4.2/RD	Approximately uniform field distribution without air gaps or voids		N/A
F4.3/RD	Other cases		N/A
Annex BB	**Reference loads**		N/A
BB.1	General		N/A
BB.2	Reference resistive load		N/A
BB.3	Reference inductive-resistive loads		N/A
BB.4	Reference capacitive-resistive loads		N/A
BB.5	Reference non-linear load		N/A
BB.5.1	General		N/A
BB.5.2	Test method		N/A
Annex CC	**Ventilation of lead-acid battery compartments**		N/A
CC.1	General		N/A
CC.2	Normal conditions		N/A
CC.3	Blocked conditions		N/A
CC.4	Overcharge conditions		N/A
Annex GG	**Requirements for the mounting means of rack-mounted equipment**		N/A
GG.1	General		N/A
GG.2	Mechanical strength test, variable force		N/A
GG.3	Mechanical strength test, 250N force, including end stops		N/A
GG.4	Compliance		N/A

Test Result

4.2/RD to 4.3/RD 5.2.4.6/RD	TABLE: fault condition tests		P
	ambient temperature (°C) .....:	25	—

No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1	PV input port (Charge condition)	Reverse polarity	PV: 600Vdc, Battery: full-discharged battery	10 mins	--	--	The unit communication report error message, stop charging, no damage, no hazard.
2	Output port (Discharge condition)	s-c	Supplied by fully charged battery, AC output: 3/N/PE 400Vac	10 mins	--	--	The unit communication report error message, Unit shutdown immediately, no damage, no hazard.
3	Output port (Discharge condition)	o-l	Supplied by fully charged battery, AC output: 3/N/PE 400Vac	3h8mins	--	--	The maximum load to 130.5kW. The unit working normal, no damage, no hazard. Maximum temperature: Isolating transformer wire 1#: 101.9°C, Isolating transformer wire 2#: 104.4°C, Battery Cell: 78.0°C Ambient: 55.0 °C
4	Integrated Air Conditioner (Discharge condition)	Forced to stop running	Supplied by fully charged battery, AC output: 3/N/PE 400Vac	2h45mins	--	--	The unit working normal, no damage, no hazard. Maximum temperature: Isolating transformer wire 1#: 98.8°C, Isolating transformer wire 2#: 99.7°C, Battery Cell: 81.2°C Ambient: 55.0 °C
5	AC Fan motor (Discharge condition)	Fan locked	Supplied by fully charged battery, AC output: 3/N/PE 400Vac	3h16mins	--	--	The unit working normal, no damage, no hazard. Maximum temperature: Isolating transformer wire 1#: 108.5°C, Isolating transformer wire 2#: 107.1°C, AC Fan motor: 120.9°C Ambient: 55.0 °C
6	Fan ventilation openings (Discharge condition)	ventilation openings blocked	Supplied by fully charged battery, AC output: 3/N/PE 400Vac	4h18min	--	--	The unit working normal, no damage, no hazard. Maximum temperature: Isolating transformer wire 1#: 104.9°C, Isolating transformer wire 2#: 106.3°C, AC Fan motor: 93.0°C Ambient: 55.0 °C

7	AC input	Loss of phase	3/N/PE 400Vac	10 mins	--	--	The unit communication report error message, Unit shutdown immediately, no damage, no hazard.
Component fault tests on high voltage control box							
8	Contactor (K2)	s-c	600Vdc or 3/N/PE 400Vac	10min	--	--	Charge condition: The unit communication report error message, “Contact adhesion of contactor”, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10min	--	--	Discharge condition: The unit communication report error message, “Contact adhesion of contactor”, the battery system stops discharging, no damage, no hazard.
9	DC-DC Converter output (24V)	s-c	600Vdc or 3/N/PE 400Vac	10min	--	--	Charge condition: The unit communication report error message, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10min	--	--	Discharge condition: The unit communication report error message, stop discharging, no damage, no hazard.
10	NTC1	s-c	600Vdc or 3/N/PE 400Vac	10min	--	--	Charge condition: The unit communication report error message, “temperature sampling fault”, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10min	--	--	Discharge condition: The unit communication report error message, “temperature sampling fault”, stop discharging, no damage, no hazard.
BCU Board:							
11	R137	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “Abnormal current sampling”, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “Abnormal current sampling”, the battery system stops discharging, no damage, no hazard.
12	C129	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “Power IC supply failure”, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “Power IC supply failure”, stop discharging, no damage, no hazard.

13	CP7	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, "Abnormal current sampling", the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, "Abnormal current sampling", the battery system stops discharging, no damage, no hazard.
14	RP12	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, "Power IC supply failure", stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, "Power IC supply failure", stop discharging, no damage, no hazard.
15	LP8 Pin 1-2	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, "BCU stops working", the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, "BCU stops working", the battery system stops discharging, no damage, no hazard.
16	MCU U6 Pin 32	o-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, main circuit contactor cut-off, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, main circuit contactor cut-off, the battery system stops discharging, no damage, no hazard.
17	MCU U6 Pin 100-101	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, positive contactor cut-off, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, positive contactor cut-off, stop discharging, no damage, no hazard.
18	MCU U6 Pin 131-132	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, "Abnormal voltage sampling", the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, "Abnormal voltage sampling", the battery system stops discharging, no damage, no hazard.

19	MCU U6 Pin 32-GND	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “MCU communication malfunction”, main circuit contactor cut-off, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “MCU communication malfunction”, main circuit contactor cut-off, stop discharging, no damage, no hazard.
20	UH2 pin 1-2	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “insulation detection abnormal”, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “insulation detection abnormal”, the battery system stops discharging, no damage, no hazard.
21	UH2 pin 1-2	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “insulation detection abnormal”, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “insulation detection abnormal”, the battery system stops discharging, no damage, no hazard.
22	TR5 Pin 1-2	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “sampling power failure”, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “sampling power failure”, the battery system stops discharging, no damage, no hazard.
23	TR5 Pin 2-3	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “sampling power failure”, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “sampling power failure”, the battery system stops discharging, no damage, no hazard.
24	R84	o-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “temperature sampling fault”, the battery system stops charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “temperature sampling fault”, the battery system stops discharging, no damage, no hazard.

25	CN11	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “BCU communication malfunction”, main circuit contactor cut-off, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “BCU communication malfunction”, main circuit contactor cut-off, stop discharging, no damage, no hazard.
26	C116	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: Power IC damage, main circuit contactor cut-off, stop charging, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: Power IC damage, main circuit contactor cut-off, stop discharging, no hazard.
27	R159	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “MCU communication malfunction”, main circuit contactor cut-off, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: The unit communication report error message, “MCU communication malfunction”, main circuit contactor cut-off, stop discharging, no damage, no hazard.
BMU board:							
28	CH8	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: Abnormal collection of cell voltage, main circuit contactor cut-off, and the communication report error, stop charging, no danger, no damage.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: Abnormal collection of cell voltage, main circuit contactor cut-off, and the communication report error, stop discharging, no danger, no damage.
29	RV35	o-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: Abnormal collection of cell voltage, main circuit contactor cut-off, and the communication report error, stop charging, no danger, no damage.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: Abnormal collection of cell voltage, main circuit contactor cut-off, and the communication report error, stop discharging, no danger, no damage.
30	CV40	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: Abnormal collection of cell temperature, main circuit contactor cut-off, and the communication report error, stop charging, no danger, no damage.

			Supplied by fully charged battery	10 mins	--	--	Discharge condition: Abnormal collection of cell temperature, main circuit contactor cut-off, and the communication report error, stop discharging, no danger, no damage.
31	RV60	o-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: Abnormal collection of cell temperature, main circuit contactor cut-off, and the communication report error, stop charging, no danger, no damage.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: Abnormal collection of cell temperature, main circuit contactor cut-off, and the communication report error, stop discharging, no danger, no damage.
32	DV1	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: Communication failure BCM module and BMU module, main circuit contactor cut-off, and the communication report error, stop discharging, no danger, no damage.
			Supplied by fully charged battery	10 mins	--	--	Discharge condition: Communication failure BCM module and BMU module, main circuit contactor cut-off, and the communication report error, stop discharging, no danger, no damage.
33	QV1 Pin b-e	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “BCU communication malfunction”, main circuit contactor cut-off, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	
34	QV1 Pin b-c	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “BCU communication malfunction”, main circuit contactor cut-off, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	
35	QV1 Pin c-e	s-c	600Vdc or 3/N/PE 400Vac	10 mins	--	--	Charge condition: The unit communication report error message, “BCU communication malfunction”, main circuit contactor cut-off, stop charging, no damage, no hazard.
			Supplied by fully charged battery	10 mins	--	--	

supplementary information

Note(s): The unit passed electric strength test after single fault test above.

s-c: Short circuit,

o-c: Open circuit

During the test: Fire do not propagate beyond the PCE;

Equipment do not 60mit molten metal;

Enclosures do not deform to cause non-compliance with the standard;

4.3.101, 5.2.3.102	TABLE: Electrical Data (in normal conditions)	P

PV Input charge condition (PV - Battery)

Input (PV)			Output (Battery)		
Input voltage [V d.c.]	Input current [A d.c.]	Input power [kW d.c.]	Output voltage [V d.c.]	Output current [A d.c.]	Output power [kW d.c.]
PV1: 250,436 PV2: 251,241 PV3: 250,847	PV1: 157,533 PV2: 156,735 PV3: 156,172	PV1: 39,452 PV2: 39,378 PV3: 39,175	792,52	142,80	113,17
PV1: 301,766 PV2: 302,057 PV3: 302,659	PV1: 157,798 PV2: 157,916 PV3: 157,681	PV1: 47,618 PV2: 47,699 PV3: 47,724	793,85	171,93	136,49
PV1: 314,558 PV2: 314,901 PV3: 314,468	PV1: 157,936 PV2: 157,707 PV3: 157,752	PV1: 49,680 PV2: 49,662 PV3: 49,608	795,53	180,58	145,10
PV1: 450,122 PV2: 450,347 PV3: 450,246	PV1: 110,670 PV2: 110,577 PV3: 110,355	PV1: 49,824 PV2: 49,798 PV3: 49,687	795,16	183,33	145,75
PV1: 600,410 PV2: 600,304 PV3: 600,402	PV1: 82,534 PV2: 82,601 PV3: 82,598	PV1: 49,554 PV2: 49,586 PV3: 49,592	795,65	183,06	145,65

AC Input charge condition (Grid - Battery)

Input (AC)				Output (Battery)		
Input voltage [V a.c.]	Input current [A a.c.]	Input power [kW a.c.]	Input frequency (Hz)	Output voltage [V d.c.]	Output current [A d.c.]	Output power [kW d.c.]
Ua: 206,93 Ub: 207,04 Uc: 207,10	Ia: 201,69 Ib: 201,59 Ic: 201,63	Pa: 41,668 Pb: 41,663 Pc: 41,675	49,999	795,20	153,61	122,15
Ua: 229,68 Ub: 229,32 Uc: 229,80	Ia: 181,68 Ib: 182,03 Ic: 181,75	Pa: 41,661 Pb: 41,667 Pc: 41,682	50,001	801,40	152,27	122,03
Ua: 252,95 Ub: 252,98 Uc: 252,96	Ia: 164,98 Ib: 165,01 Ic: 165,08	Pa: 41,661 Pb: 41,667 Pc: 41,682	50,001	799,15	152,80	122,10

AC Output discharge condition (Battery-Off Grid)

Input (Battery)			Output (Off-Grid)			
Input voltage [V d.c.]	Input current [A d.c.]	Input power [W d.c.]	Output voltage [V a.c.]	Output current [A a.c.]	Output power [kW a.c.]	Output frequency (Hz)
787,40	163,45	128,70	Ua: 229,40 Ub: 228,79 Uc: 228,56	Ia: 181,98 Ib: 182,48 Ic: 182,69	Pa: 41,668 Pb: 41,675 Pc: 41,680	50,001

AC Output discharge condition (Battery-On Grid)

Input (Battery)			Output (On-Grid)			
Input voltage [V d.c.]	Input current [A d.c.]	Input power [W d.c.]	Output voltage [V a.c.]	Output current [A a.c.]	Output power [kW a.c.]	Output frequency (Hz)

782,40	163,92	128,25	Ua: 229,44 Ub: 228,82 Uc: 228,63	Ia: 181,97 Ib: 182,43 Ic: 182,64	Pa: 41,672 Pb: 41,665 Pc: 41,678	50,001
Supplementary information: Tested on model ESS-GRID C241						

4.4.4.3.3 /RD	TABLE: Touch current measurement	P

Measured between:	Measured (mA)	Limit (mA)	Comments/conditions
Communication terminal to earth	0.158 mA d.c.	3,5	Switch ‘e’ opened
Metal enclosure to earth	0.265 mA d.c.	3,5	Switch ‘e’ opened
Supplementary information:			

4.4.7/RD	TABLE: Transformers	N/A

Loc.	Tested insulation	Working voltage peak / V	Working voltage rms / V	Required electric strength	Required clearance / mm	Required creepage distance / mm	Required distance thr. insul.
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--

Loc.	Tested insulation			Test voltage/ V	Measured clearance / mm	Measured creepage dist./ mm	Measured distance thr. insul. / mm; number of layers
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
Supplementary information: The unit haven’t that part.							

4.4.7.2/RD	TABLE: Working Voltage Measurement	P

Location	RMS voltage (V)	Peak voltage (V)	Comments
High voltage control box input DC+ to DC-	852.0Vdc	--	--
AC input/output	400Vac	--	--
CANH to PE	2.5 Vdc	--	--
CANL to PE	2.5 Vdc	--	--
CANH to CANL	5.0 Vdc	--	--
Supplementary information:			

4.4.7.4/RD to 4.4.7.5/RD	TABLE: Clearance and Creepage Distance Measurements	P

clearance cl and creepage distance dcr at/of:	Impuls withstand voltage (V)	Mains circuit temporary overvoltage (V peak)	U r.m.s. (V)	U peak (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)

Whole unit:								
PV input port to metal enclosure (BI)	6000	--	400Vac/ 852Vdc	--	5,5	15,6	8,6	15,6
AC input port to metal enclosure (BI)	6000	--	400Vac/ 852Vdc	--	5,5	15,6	8,6	15,6
AC output port to metal enclosure (BI)	6000	--	400Vac/ 852Vdc	--	5,5	15,6	8,6	15,6
Other live parts to metal enclosure (BI)	6000	--	400Vac/ 852Vdc	--	5,5	>20	8,6	>20
High voltage control box:								
High voltage control box live part to metal enclosure (BI)	6000	--	852Vdc	--	5,5	11,0	8,6	11,0
Battery circuit to metal enclosure (BI)	6000	--	852Vdc	--	5,5	10,2	8,6	10,2
High voltage control box live parts to the communication port (RI)	6000	--	852Vdc	--	8,0	>20	17,1	>20
BCU board：								
Live parts trace (befor protective impedance) to the communication port on PCB (RI)	6000	--	852Vdc	--	8,0	12,0	8,6	12,0
PCB trace Between two pins of TR5 (RI)	6000	--	852Vdc	--	8,0	32,5	8,6	32,5
BMU board：								
Live parts trace to the communication port on PCB (RI)	6000	--	852Vdc	--	8,0	10,8	8,6	10,8
PCB trace Between two pins of TJ1 (RI)	6000	--	852Vdc	--	8,0	32,5	8,6	32,5

Supplementary information:

1) FI=functional insulation, BI=basic insulation, SI=supplementary insulation, RI=reinforced insulation.

2) When determine the clearance:
   a) For DC input circuits: Overvoltage Category II applied (impulse withstand voltage 6000V, temporary overvoltage 3110Vpeak considered.).
   b) For AC circuits (connected to AC mains): Overvoltage Category III applied (impulse withstand voltage 6000V, temporary overvoltage 2550Vpeak considered.)
   c) Due to the max. altitude is 2000m, limit of clearance by the correction factor 1.00 considered.

3) For the inner layer of the PCB, pollution degree II was considered.

4) Requirement about creepage distances for the distance to the metal enclosure come from columns 7 and 8 of Table 11.

5) Requirement about creepage distances for other parts come from column 3 of table 11.

6) PCB with min. CTI 175 used.

4,4,7,8,2 /RD	**TABLE: Ball Pressure Test of Thermoplastics**		**P**
Allowed impression diameter (mm) .....:		2mm	—
Object/ Part No,/ Material	Manufacturer/ trademark	Test temperature (°C)	Impression diameter (mm)
Connector of P+/P-	See table Critical components information	125	0.85
Terminal Blocks	See table Critical components information	125	0.88

Supporting live part	See table Critical components information	125	0.90
BCU board terminal	See table Critical components information	125	0.86
Connector of B+/B-	See table Critical components information	125	0.96
BMU board terminal	See table Critical components information	125	0.90
Supplementary information:			

4,4,7,8,2 /RD	TABLE: Resistance to heat and fire - Glow wire tests	P

Object/ Part No,/ Material	Manufacturer/ trademark	Glow wire test (GWT); (°C)						Verdict
		550	650		750		850	
			te	ti	te	ti		
Plastic barriers before wiring terminal	See table Critical components information	P	--	--	--	--	--	Pass
Terminal Blocks	See table Critical components information	--	--	--	0	0	P	Pass
Connector of P+/P-	See table Critical components information	--	--	--	0	0	P	Pass
Supporting live part	See table Critical components information	--	--	--	0	0	P	Pass
BCU board terminal	See table Critical components information	--	--	--	0	0	P	Pass
Connector of B+/B-	See table Critical components information	--	--	--	0	0	P	Pass
MSD Connector	See table Critical components information	--	--	--	0	0	P	Pass
BMU board terminal	See table Critical components information	--	--	--	0	0	P	Pass
BMU plastic enclosure	See table Critical components information	--	--	--	0	0	P	Pass
Insulation sheet	See table Critical components information	--	--	--	0	0	P	Pass
	Manufacturer/ trademark	**Glow-wire flammability index (GWFI), °C**			**GW ignition temp, (GWIT), °C**			**Verdict**

Object/ Part No,/ Material		550	650	750	850	675	775	
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
The test specimen passed the glow wire test (GWT) with no ignition [(t_e – t_i) ≤ 2s] (Yes/No):								Yes
If no, then surrounding parts passed the needle-flame test of annex E (Yes/No).....:								N/A
The test specimen passed the test by virtue of most of the flaming material being withdrawn with the glow-wire (Yes/No)? .....:								Yes
Ignition of the specified layer placed underneath the test specimen (Yes/No) .....:								No
Supplementary information: 550 °C GWT not relevant (or applicable) to parts of material classified at least HB40 or if relevant HBF The GWIT pre-selection option, the 850 °C GWFI pre-selection option, and the 850 °C GWT are not relevant (or applicable) for attended appliances.								

4,4,7,8,3,2 /RD to 4,4,7,9/RD	TABLE: Distance Through Insulation Measurements			P
Distance through insulation di at/of:	**U r,m,s, (V)**	**Test voltage (V)**	**Required di (mm)**	**di (mm)**
Epoxy board used in battery module	852,0	3600	0,4	0,52mm
Supplementary information:				

4,4,7,10 /RD, 5,2,3/RD	TABLE: electric strength measurements, impulse voltage test and partial discharge test			P
test voltage applied between:	**test voltage (V)**	**impulse withstand voltage (V)**	**partial discharge extinction voltage (V)**	**Breakdown / flashover (Yes/No)**
PV input to metal enclosure (BI)	2200Vac	6000	--	No breakdown
PV input to communication output port (RI)	4400Vac	8000	--	No breakdown
AC input to metal enclosure (BI)	2200Vac	6000	--	No breakdown
AC input to communication output port (RI)	4400Vac	8000	--	No breakdown
AC output to metal enclosure (BI)	2200Vac	6000	--	No breakdown
AC output to communication output port (RI)	4400Vac	8000	--	No breakdown
High voltage control box:				
DC input connector to earthed enclosure (BI)	2200Vac	6000	--	No breakdown
DC input connector to communication port (RI)	4400Vac	8000	--	No breakdown
BCU board:				
DC input to communication output port (RI)	4400Vac	8000	--	No breakdown

BMU board:				
DC input to communication output port (RI)	4400Vac	8000	--	No breakdown
Supplementary information: BI: Basic insulation, SI: Supplementary insulation, RI: Reinforced insulation				

4,4,9/RD	**TABLE: Capacitor discharge**			**N/A**
Condition	**τ calculated (s)**	**τ measured (s)**	**t u→ 0V (s)**	**Comments**
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Supplementary information:				

4,6,3/RD	**TABLE: Resistance to fire**				**N/A**
Part	**Manufacturer of material**	**Type of material**	**Thickness (mm)**	**Flammability class**	**Evidence**
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4,6,3,3,3 /RD	**TABLE: Needle- flame test (NFT)**				**N/A**
Object/ Part No,/ Material	Manufacturer/ trademark	Duration of application of test flame (ta); (s)	Ignition of specified layer Yes/No	Duration of burning (tb) (s)	Verdict
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Supplementary information: **NFT not relevant (or applicable) for Parts of material classified as V-0 or V-1** **NFT not relevant (or applicable) for Base material of PCBs classified as V-0 or if relevant VTM-0**					

4,6,4/RD 5.2.3.10/RD	**TABLE: Heating Test**				**P**
	Test voltage (V)..... :	3/N/PE 360Vac	3/N/PE 440Vac	full-charged battery	—
	Test current(A)..... :	201,60/201,65/ 201,68	165,02/165.00/ 165,05	163,92	—
	tamb1 (°C) ..... :	See below	See below	See below	—
	tamb2 (°C) ..... :	See below	See below	See below	—
maximum temperature T of part/at:		T (°C)			Tmax (°C)
		Test 1	Test 2	Test 3	
System components					
Enclosure of PV module		77.0	71.5	72.9	Ref.
Enclosure of STS module		77.4	71.9	73.8	Ref.
Enclosure of PCS module		73.9	67.8	71.5	Ref.
AC load circuit breaker		61.4	58.6	67.9	80

Relay KM1	65.1	61.8	65.3	70
Transformer of AC-DC converter	67.5	64.0	68.7	110
AC mains circuit breaker	78.3	72.6	62.5	80
Switch of air-conditioner	63.3	59.9	61.5	70
Enclosure of SPD	61.5	59.1	59.2	85
Internal wire near SPD	62.3	59.3	64.1	200
PV circuit breaker	61.9	58.9	58.8	80
Supporting live part	62.3	58.8	59.3	130
lsolating transformer wire 1#	68.0	64.4	100.0	160 Class H
lsolating transformer wire 2#	67.9	64.2	99.7	160 Class H
Rear contactor KA5	75.1	69.5	73.2	85
Internal wire use for PV connection	76.0	69.7	73.5	200
Internal wire use for PCS connection	79.8	73.4	81.6	200
Rear AC fan	76.2	71.7	78.9	110
Fuse holder	75.8	70.1	72.2	90
Screen	75.1	69.4	73.5	85
High voltage control box:				
P+/P- connector	76.5	76.2	71.2	125
Internal wire	100.7	100.8	101.2	200
Supporting live part	88.5	88.0	83.0	130
DC circuit breaker	83.1	82.7	78.9	85
Contactor of positive pole	93.6	93.0	86.8	105
Precharge relay	72.7	72.8	66.9	105
Fuse holder	66.6	65.8	63.5	90
Transformer of DC-DC converter	69.6	69.2	66.3	110
Enclosure of DC-DC converter	66.9	66.6	61.8	Ref.
PCB terminal J6	66.2	65.5	61.1	130
Inductor L4	73.6	72.7	68.7	130
PCB near U6	73.9	73.2	69.0	130
BMS transformer TR2	68.4	70.1	62.8	125
Optocoupler UH2	68.8	70.0	62.8	110
Varistor RVPW1	67.4	66.5	61.8	105
Optocoupler UH3	68.7	69.2	62.6	110
Eclosure of HV BOX	66.5	65.9	64.4	70
Battery module 1:				
B+/B- connector	92.7	94.8	85.2	125
Battery Cell 1	79.8	81.6	72.6	Ref.
Battery Cell 2	76.8	76.8	71.2	Ref.
Internal wire (signal wire)	70.5	69.9	64.1	200
PCB terminal JP1	68.3	68.6	62.3	105
BMS transformer TJ4	67.1	67.2	64.2	125
PCB near UM1	69.5	69.6	64.3	130

PCB near U1	69.4	69.0	63.7	130
Plastic eclosure of BMU	70.0	67.0	62.9	90
DC FAN	72.9	75.0	67.1	105
Battery module 2:				
B+/B- connector	93.3	94.8	86.2	125
Battery Cell 1	81.2	81.7	73.3	Ref.
Battery Cell 2	76.9	77.6	70.7	Ref.
Internal wire (signal wire)	71.6	70.8	64.5	200
PCB terminal JP1	68.6	69.6	63.5	105
BMS transformer TJ4	68.0	67.9	62.9	125
PCB near UM1	70.5	70.8	63.4	130
PCB near U1	68.5	68.5	63.7	130
Plastic eclosure of BMU	67.4	66.7	63.5	90
DC FAN	73.7	74.9	67.7	105
Battery module connection wire	85.2	85.0	77.9	200
Accessible surfaces				
Rear air outlet	72.3	70.6	74.2	100*
Control panel Air Conditioner	63.1	61.2	60.9	70
Metal eclosure outside of EUT	67.1	66.3	65.6	70
Ambient	55.0	55.0	55.0	--

Supplementary information:
*Marked with the hot surface marking symbol of Annex C.
Note 1: The apparatus was submitted and evaluated for maximum manufacturer's recommended ambient (Tma). Therefore, the maximum temperatures measured are recalculated as follows: T + (Tma – Tamb), where T is the maximum temperature measured during test and Tamb is the ambient temperature during the test.
Note 2: The temperatures were measured under the worst-case normal mode defined in table 4.2.2.6 & 4.7.
Note 3: With a specified maximum ambient temperature and test temperature is 55°C.
Note 7: Test conditions
(Test 1): Charging state (empty battery): Tested on model ESS-GRID C241, AC input: 3/N/PE 360Vac Charging.
(Test 2): Charging state (empty battery): Tested on model ESS-GRID C241, AC input: 3/N/PE 440Vac Charging.
(Test 3): Discharge state (full-charged battery): Tested on model ESS-GRID C241, Run the EUT at full load condition until steady condition established; load: 3/N/PE 400Vac; 125kW.

4,6,4/RD 5.2.3.10/RD	**TABLE: Heating Test**			**P**
	Test voltage (V)..... :	314,602/ 314,724/ 314,588	600,328/ 600,316/ 600,415	—
	Test current(A)..... :	157,896/157,769 157,788	82,560/82,590/ 82,588	—
	tamb1 (°C) ..... :	See below	See below	—
	tamb2 (°C) ..... :	See below	See below	—
maximum temperature T of part/at:		T (°C)		Tmax (°C)
		Test 4	Test 5	
System components				
Enclosure of PV module		79.3	76.2	Ref.

Enclosure of STS module	75.9	76.6	Ref.
Enclosure of PCS module	74.7	72.2	Ref.
AC load circuit breaker	62.1	60.5	80
Relay KM1	66.2	63.9	70
Transformer of AC-DC converter	68.3	65.9	110
AC mains circuit breaker	62.7	61.0	80
Switch of air-conditioner	62.8	62.1	70
Enclosure of SPD	63.2	60.6	85
Internal wire near SPD	63.3	61.7	200
PV circuit breaker	75.0	76.9	80
Supporting live part	62.8	63.5	130
lsolating transformer wire 1#	67.1	64.7	160 Class H
lsolating transformer wire 2#	67.1	64.3	160 Class H
Rear contactor KA5	74.5	73.8	85
Internal wire use for PV connection	79.0	78.7	200
Internal wire use for PCS connection	76.5	75.7	200
Rear AC fan	77.4	74.8	110
Fuse holder	75.4	75.3	90
Screen	74.6	73.7	85
High voltage control box:			
P+/P- connector	77.8	74.4	125
Internal wire	107.5	103.3	200
Supporting live part	89.6	87.1	130
DC circuit breaker	84.1	81.5	85
Contactor of positive pole	93.8	91.5	105
Precharge relay	73.0	70.9	105
Fuse holder	67.2	65.6	90
Transformer of DC-DC converter	70.1	68.0	110
Enclosure of DC-DC converter	67.3	65.2	Ref.
PCB terminal J6	66.3	64.6	130
Inductor L4	73.1	71.1	130
PCB near U6	73.6	73.2	130
BMS transformer TR2	67.4	67.3	125
Optocoupler UH2	68.0	67.6	110
Varistor RVPW1	66.0	66.2	105
Optocoupler UH3	67.5	67.1	110
Eclosure of HV BOX	64.9	66.3	70
Battery module 1:			
B+/B- connector	94.4	90.8	125
Battery Cell 1	81.2	78.1	Ref.
Battery Cell 2	75.8	78.6	Ref.
Internal wire (signal wire)	68.8	69.8	200

PCB terminal JP1	67.0	67.6	105
BMS transformer TJ4	65.6	66.4	125
PCB near UM1	68.2	68.3	130
PCB near U1	67.3	68.0	130
Plastic eclosure of BMU	65.5	68.6	90
DC FAN	73.8	73.3	105
Battery module 2:			
B+/B- connector	93.9	91.8	125
Battery Cell 1	80.6	79.2	Ref.
Battery Cell 2	76.2	75.2	Ref.
Internal wire (signal wire)	69.8	70.3	200
PCB terminal JP1	67.5	66.8	105
BMS transformer TJ4	66.0	66.5	125
PCB near UM1	68.9	69.1	130
PCB near U1	67.8	67.2	130
Plastic eclosure of BMU	66.4	66.4	90
DC FAN	73.5	72.3	105
Battery module connection wire	85.2	83.6	200
Accessible surfaces			
Rear air outlet	71.0	75.6	100*
Control panel Air Conditioner	62.4	61.5	70
Metal eclosure outside of EUT	67.2	65.4	70
Ambient	55.0	55.0	--

Supplementary information:

*Marked with the hot surface marking of symbol of Annex C.

Note 1: The apparatus was submitted and evaluated for maximum manufacturer's recommended ambient (Tma). Therefore, the maximum temperatures measured are recalculated as follows: T + (Tma – Tamb), where T is the maximum temperature measured during test and Tamb is the ambient temperature during the test.

Note 2: The temperatures were measured under the worst-case normal mode defined in table 4.2.2.6 & 4.7.

Note 3: With a specified maximum ambient temperature and test temperature is 55°C.

Note 7: Test conditions
(Test 4): Charging state (empty battery): Tested on model ESS-GRID C241, PV1/PV2/PV3 input: 314Vdc Charging.
(Test 5): Charging state (empty battery): Tested on model ESS-GRID C241, PV1/PV2/PV3 input: 600Vdc Charging.

4,6,4/RD	**TABLE: Heating test, resistance method**		**N/A**
	Test voltage (V).....:		**—**
	Ambient, t_1 (°C).....:		**—**
	Ambient, t_2 (°C).....:		**—**

Temperature rise of winding	**R_1 (Ω)**	**R_2 (Ω)**	**ΔT (K)**	**Max, dT (K)**	**Insulation class**
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Supplementary information:

4,6,5/RD	TABLE: Limited power sources						N/A
Components	Test condition (Single fault)	Uoc (V)	Isc (A)		VA		
			Meas,	Limit	Meas,	Limit	
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--	--	--	--	--	--	--	
Supplementary information:							

4,12,1/RD, 5,2,2,4,3 /RD	TABLE: Impact Resistance			N/A
Impacts per surface	Surface tested	Impact energy (Nm)	Comments	
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--	--	--	--	
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Supplementary information:				

Annex CC	TABLE: Ventilation of lead-acid battery compartments	N/A
The required dimension for the ventilation openings will be calculated with the following formula:		
$A \geq Q/360$ [m²]		
with $Q = 0{,}054 * n * I * C$		
where: Q : airflow in m^3/h n : number of battery cells I : constant factor (0,2A/100Ah for valve regulated lead acid batteries) C : is the battery nominal capacity in Ah at the 10h discharge rate		
With the specific data for the UPS the following dimension for the ventilation openings is required:		
n : ? C : ?		
$A \geq (0{,}054 * n * 0{,}2\ A/100\ Ah * C)/360$		
$A \geq ?\ m^2$		
Verdict		
The size of ventilation openings in battery cabinet exceeds the required airflow by far (as well as the UPS),		
Supplementary information:		

	TABLE: List of critical components				P
Object / part No.	**Manufacturer/ trademark**	**Type / model**	**Technical data**	**Standard**	**Mark(s) of conformity[1]**
System components					
Metal enclosure	Various	Various	SGCC, Min. thickness: 2.0mm	IEC/EN 62109-1 IEC/EN 62109-2	Tested with Appliance
PV Converter	Shenzhen Elecod Electric Co., Ltd.	Monet-50DC	**For HV side** Rated input/output power: 50 kW, Maximum input/output power: 55 kW, DC max. voltage: 1000 V d.c., DC rated voltage: 250-950 V d.c., Maximum current on the high voltage side: 110 A d.c., Isc PV (high voltage side): 120 A d.c. Maximum number of Input/output: 1, **For LV side** Rated input/output power: 50 kW, Maximum input/output power: 55 kW, DC max. voltage: 900 V d.c. DC rated voltage: 200-900 V d.c., Maximum current on the low voltage side: 80*2 A d.c., Isc PV (low voltage side): 90*2 A d.c., Maximum number of Input/output: 2	IEC/EN 62109-1 IEC/EN 62109-2	TÜV SÜD Cert. No.: B 120765 0004 REV. 00
Controller (Static transfer systems)	Shenzhen Elecod Electric Co., Ltd.	Monet-150STS	Rated Input/output: 400Vac/3W+PE, 50/60Hz, 165kW max.	EN 62310-1	TÜV RH (Cert. No.: AN 50641535)

Power Conversion System	Shenzhen Elecod Electric Co., Ltd.	Monet-125AC	DC Voltage Range: 580-1000Vdc, max Max. DC Current: 200A Rated AC Input/output Volt: 230/400(for 3W+N+PE) Rated Input/Output Freq.: 50/60 Hz Rated AC Input/Output Power: 125kW Max. Input/Output Current: 198A	IEC/EN 62477-1 IEC/EN 62109-1 IEC/EN 62109-2	TÜV RH (Cert. No.: R 50649765 0001)
Circuit Breaker for AC fan, air-conditioning, SPD	Shanghai Liangxin Electrical Co., Ltd.	NDB1-63	1P): 230/400V, 6A 1P+N): 230/400V, 32A. 3P) 230/400V, 32/63A. 70°C	EN 60898-1, EN 60898-2	TÜV RH (Cert. No.: AN 50606682)
DC SPD (Surge Protective Device)	Anhui Jinli Electric Tech.Co., Ltd	JLSP-GD1000/40	1200, 20kA, 85°C	EN 61643-31 IEC 61643-31	TÜV RH (Cert. No.: R 50639381)
AC SPD (Surge Protective Device)	Anhui Jinli Electric Tech.Co., Ltd	JLSP-GA750	750, 20kA, 85°C	EN 61643-11 IEC 61643-11	TÜV RH Cert. No.: R 50634520
Internal wire (Connect to SPD)	Jiangxi Zhongzhen New Energy Co Ltd	3644	1000Vac, 200°C, min.6AWG, VW-1	UL 758	UL E529025
(Alternative)	Various	Various	1000Vac, 200°C, min.6AWG, VW-1	UL 758	UL approve
Circuit breaker for AC mains and AC Load	Shanghai Liangxin Electrical Co., Ltd.	NDM3-250C	Ue: AC380/400/415V, 50/60Hz, Ui: 1000 Vac, Uimp: 8 kV In: 250A, 80°C	EN 60947-2	TÜV RH Cert. No.: R 50234712
PV Circuit breaker	Shanghai Liangxin Electrical Co., Ltd.	NDM3Z-250VM	Ue: DC1100, Ui: 1500 Vac, Uimp: 8 kV In: 250A, 80°C	EN 60947-2	TÜV RH Cert. No.: R 50451893
Internal wire (Connect to P+/P- Connector)	Jiangxi Zhongzhen New Energy Co Ltd	3644	1000Vac, 200°C, min.3/0AWG, VW-1	UL 758	UL E529025
(Alternative)	Various	Various	1000Vac, 200°C, min.3/0AWG, VW-1	UL 758	UL approve
Green and yellow wire	Jiangxi Zhongzhen New Energy Co Ltd	10269	1000Vac, 105°C, min.1AWG, VW-1	UL 758	UL E529025
(Alternative)	Various	Various	1000Vac, 105°C, min.1AWG, VW-1	UL 758	UL approve

Plastic barriers before wiring terminal	CHANG CHUN CHEMICAL (ZHANGZHOU) CO LTD	4115-(Z)K(G2)(G3)	PBT, V-0, 120°C, Min. thickness: 3.0mm	UL 94 UL 746C	UL E304813
Power supply (AC-DC Converter)	Mornsun Guangzhou Science & Technology Co., Ltd.	LM100-20B24	Input: 100-240V~, 50/60Hz, 3.0A, Class I Output: 24Vdc, 4.5A	EN IEC 62368-1	TÜV SÜD Cert. No.: B 105228 0007 Rev. 01
Micro relay KM1	Zhejiang Chint Electrics Co., Ltd.	NJX12/1Z	12A, 250VAC, 30VDC, 10T5, 70°C	EN 61810-1	CVC (CE Cert. No.: LVD23-9350)
Electromechanical elementary relay	ABB-Stotz-Kontakt GmbH	CR-M024DC3L	10A, 250VAC, 24VDC, 10T5, 70°C	IEC 61810-1	VDE 40040327
Terminal Blocks	SHANGHAI UPUN ELECTRIC GROUP CO LTD	UKJ-2.5X	600V, 20A, 30-12AWG	UL 60947-1	UL E251499
Supporting live part of AC input terminal	Guangdong Wolf Polymer Material Technology Co., Ltd.	WF88	V-0, 130°C, Min. thickness: 3.0mm	UL 746C	UL E488513
Built-in Fan motor	ebm-papst Ventilator (Xi'an) Co., Ltd.	M2E068-BF	230V, 50/60Hz, 0.23/0.29A, 2350/2500r/min	EN 60335-1	VDE 40055071
Motor lead wire	Jiangxi Zhongzhen New Energy Co Ltd	1015	600Vac, 105°C, min.12AWG, VW-1	UL 758	UL E529025
(Alternative)	Various	Various	600Vac, 105°C, min.12AWG, VW-1	UL 758	UL approve
Three-phase Isolating Transformer	Suzhou Baoyinglong Motor Manufacturing Co., Ltd	BYL-3125A	Class H, Pri. input: 3/N~ 400V; 50/60Hz, 180A, 125kVA. Sec. input: 3/N~ 400V; 50/60Hz, 180A, 125kVA.	EN 61558-1 EN 61558-2-4	TÜV RH Cert. No.: AN 50580447
Current Transformers	Acrel Co., Ltd.	AKH-0.66/100III	Transformation Ratio:2000A/1A, frequency:50/60Hz, Rated voltage:0.66KV	EN 61010-1	Certificate No.: AT78251SC205023
Fuse Link for PV System	ADLER Elektrotechnik Leipzig GmbH	A831100710	410×215×160mm, 1100V, 1A	IEC/EN 60269-1 IEC/EN 60269-6	TÜV RH Cert. No.: R 50481720
Fuse Holder	ADLER Elektrotechnik Leipzig GmbH	BH100-01	1100Vd.c., 32A, 90°C	EN 60947-3	TÜV RH Cert. No.: R 50393963
Magnetic Contactor	Shanghai Liangxin Electrical Co., Ltd.	NDC1-2510	Ue: AC230/415/690V, 50/60Hz, In: 25A Ui: 1000V, Ith: 40A, 85°C	EN 60947-4-1 EN 60947-5-1	TÜV RH Cert. No.: AN 50205405

Integrated Air Conditioner	Suzhou Blackshields Environment Co., Ltd.	AC3000P	220-240V~ 50Hz, 11.5A, R134a 900g	IEC/EN 60335-2-40 IEC/EN 60335-1	TÜV RH Certificate No.: AM 50613465
Circuit breaker of air conditioner	Shanghai Liangxin Electrical Co., Ltd.	NDB1-63 D16	AC 230/240VAC, 16A, OC type	EN 60898-1 EN 60898-2	TÜV Mark: R 50417707
MSD Connector	Henan Joint Technology Co., Ltd.	JES-350A-T-0 JES-350A-Z-0	1500VDC, 350A, 125°C	UL 4128	TÜV RH Certificate No.: TU 50630573
(Alternative)	Amphenol PCD (Shenzhen) Co., Ltd	MSDXLM400, MSDXLF000R	900VDC, 300A, 125°C	IEC/EN 61984	TÜV RH Certificate No.: R 50591538
Heat Detector	Tianjin VSAIL Intelligent Fire Technology Co., Ltd	VC-6633	Supply voltage: 9V to 28Vdc, Alarm Current: 10mA≤I≤50mA	EN54-5	BRE Global Ireland Certificate No: 2831-CPR-F0057
Smoke Detector	Tianjin VSAIL Intelligent Fire Technology Co., Ltd	VC-6623	Supply voltage: 9V to 33Vdc	EN 54-7	BRE Global Ireland Certificate No: 2831-CPR-F0056
Aerosol fire extinguishing system	Shenzhen Fuji Technology Co., LTD	QRR0.3GS-FJ	Condensed aerosol fire extinguishing system with stainless steel casing and 300g of aerosol forming compound. Electrical actuation with an operating temperature range of -50°C to +90°C	EN 15276-1:2019 EN 15276-2:2019	ICR Certificate No.: ICR/VC/HM240665, Test report No.: 240609001CPR
Emergency stop device	LANBOO Intelligent Technology Co., Ltd.	LB22A Series	400V/16A, 230V/22A, 120V/25A, 80°C	IEC 60947-5-1	TÜV-Mark R 50518971
High voltage control box					
Metal enclosure	Various	Various	SPCC, Min. thickness: 1.5mm	IEC/EN 62477-1	Tested with Appliance
Connector of P+/P-	Changzhou Futronics Electronic Technology Co., Ltd.	FPBOX33F8-CA-T8, FPBOX33F8-HA-T8	1500VDC, 300A, 125°C	EN 60947-7-1:2009	TÜV RH Certificate No.: R 50574716
Connector of B+/B-	Shenzhen Connection Electronic Co., Ltd.	ES09-RH8S-03-15-RD, ES09-RH8S-03-15-BK	1500VDC, 350A, -40°C ~125°C	EN 61984: 2009	TÜV SÜD Cert. No.: Z2 108338 0006 Rev.00
Internal wire (DC input)	Jiangxi Zhongzhen New Energy Co Ltd	3644	1000Vac, 200°C, min.3/0AWG, VW-1	UL 758	UL E529025
(Alternative)	Various	Various	1000Vac, 200°C, min.3/0AWG, VW-1	UL 758	UL approve

Internal wire (Signal wire)	DONGGUAN LIUQUAN WIRE CO LTD	1332	200°C, 300 Vac, min.22AWG, VW-1	UL758	UL E327087
(Alternative)	Various	Various	200°C, 300 Vac, min.22AWG, VW-1	UL758	UL approve
Fuse	CFriend Electric (Kunshan) Co., Ltd.	DBE8315JE	1000V, 315A	EN 60269-1 EN 60269-4	CQC (CE cert. No.: CE210317007517)
Supporting live part	Guangdong Wolf Polymer Material Technology Co., Ltd.	WF88	V-0, 130°C, Min. thickness: 3.0mm	UL 746C	UL E488513
(Alternative)	Various	Various	V-0, 130°C, Min. thickness: 3.0mm	UL 746C	UL approve
DC circuit breaker	ProJoy Electric Co., Ltd.	PEMC-320	1500Vdc, 320A, Ics: 25kA, Icu: 40 kA, 85°C	IEC 60947-3 IEC 60947-1	TÜV SÜD Cert. No.: B 123375 0003 REV. 00
DC Contactor of Positive and negative poles	Dongke Xinneng (Wuxi) Electronics Co., Ltd	EVD300G1DA4	1000VDC, 300A, Coil: 12-36VDC, 105°C	EN IEC 60947-1 EN IEC 60947-4-1	TÜV SÜD Cert. No.: B 120874 0003 REV. 00
Precharge Contactor	Dongke Xinneng (Wuxi) Electronics Co., Ltd	EVD30E24DA1	1000VDC, 30A, Coil: 24VDC, 105°C	EN IEC 60947-1 EN IEC 60947-4-1	TÜV SÜD Cert. No.: B 120874 0004 REV. 00
Fuse Link	Zhejiang Chint Electrics Co., Ltd.	NRZ28-20	1000VDC, 20A Breaking capacity: 35kA	EN 60269-1 EN 60269-6	TÜV RH R 50267781
DC-DC Converter	Mornsun (HuaiHua) Science&Technology Co., Ltd	PV150-29B24	Input: 250-1500VDC, 1.0A Output: 24VDC 6.25A	IEC 62109-1	Intertek (CB cert. No.: SE-106536)
BCU board					
PCB	SHANGHAI GLOBAL ELECTRONIC MATERIAL LTD	GF432-1	V-0, 130°C, Min. thickness: 1.8mm	UL 796	UL E224772
(Alternative)	Various	Various	V-0, 130°C, Min. thickness: 1.8mm	UL 796	UL approve
PCB terminal material (J1, J2)	Guangdong Wolf Polymer Material Technology Co., Ltd.	WF88	V-0, 130°C, Min. thickness: 1.8mm	UL 746C	UL E488513
(Alternative)	Various	Various	V-0, 130°C, Min. thickness: 1.8mm	UL 796	UL approve
PCB terminal (J3, J4, J5, J6)	CHANGJIANG CONNECTORS CO LTD	C4201	V-0, 600V, 9A, 105°C	UL 1977	UL E326732
Optocoupler (UH1, UH2, UH3)	Xiamen Hualian Semiconductor Technology Co. LTD	HSSR-61A0D-2	Isolation voltage: 5000Vrms, Temperature range: -55°C to 110°C	EN IEC 60747-5-5	VDE 40004708

BMS transformer (TR5)	SHENZHEN SINODRIVE ELECTRIC TECHNOLOGIES CO., LTD	N12103S	Operating Voltage: 1500V, Temperature range: -40°C to +125°C	UL 62368-1	UL E523028
Resistance (Protective impedance)	Yageo Corporation	RV0805 series	150kΩ	IEC 62368-1	UL (CB cert. No.: DK-64853-UL)
MCU (U6)	STMICROELECTRONICS SRL	STM32F407ZGT6	Supply voltage: 1.8V to 3.6V Operating temperature range: -40°C to 85°C	IEC/EN 62477-1	Tested with Appliance
IC (U9)	Joulwatt Technology Co., Ltd.	JW5121	Supply voltage: 4.5V to 60V Operating temperature range: -40°C to 125°C	IEC/EN 62477-1	Tested with Appliance
AFE (U2)	NXP Semiconductors	MC33772	Supply voltage: 6.0V to 30.0V Operating temperature range: -40°C to 125°C	IEC/EN 62477-1	Tested with Appliance
Battery compartment					
Metal enclosure	Various	Various	SPCC, Min. thickness: 1.5mm	IEC/EN 62477-1	Tested with Appliance
Internal wire (Battery module connection wire)	Jiangxi Zhongzhen New Energy Co Ltd	3644	1000Vac, 200°C, min.3/0AWG, VW-1	UL 758	UL E529025
(Alternative)	Various	Various	1000Vac, 200°C, min.3/0AWG, VW-1	UL 758	UL approve
Connector of B+/B-	Shenzhen Connection Electronic Co., Ltd.	ES09-RH8S-03-15-RD, ES09-RH8S-03-15-BK	1000VDC, 250A, -40°C ~125°C	EN 61984: 2009	TÜV SÜD Cert. No.: B 108338 0005
Internal wire	DONGGUAN LIUQUAN WIRE CO LTD	1332	200°C, 300 Vac, min.22AWG, VW-1	UL758	UL E327087
(Alternative)	Various	Various	200°C, 300 Vac, min.22AWG, VW-1	UL758	UL approve
NTC	SHENZHENBEIDUOLIHOLDING CO., LTD	MF52B-120F39504	Resistance 10KΩ at 25°C	EN 60539-1	TÜV RH R 50582281
(Alternative)	Interchangeable	Interchangeable	Resistance 10KΩ at 25°C	EN 60539-1	TÜV or VDE approve

Battery cells	REPT BATTERO Energy Co., Ltd.	CB75	Lithium-ion Cell, 3.2V, 314Ah	IEC 62619: 2022	TÜV RH (CB Cert. No.: JPTUV-154531)
Insulating sleeve	SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO LTD	RSFR	600V, 125°C, VW-1	UL 224	UL E203950
(Alternative)	Various	Various	600V, 125°C, VW-1	UL 224	UL approve
Insulation sheet (Battery cover)	SHENZHEN TEESUN TECHNOLOGY CO LTD	TS-FR370DL	V-0,80°C Min. thickness 0.4 mm	UL94, UL746C	UL E329660
(Alternative)	Various	Various	V-0, 80°C, Min. thickness: 0.4mm	UL94, UL746C	UL approved
Epoxy board	ANHUI YISOLA COMPOSITE MATERIAL CO LTD	FR-4	V-0, 90°C, Min. thickness: 2.0mm	UL94, UL746C	UL E510612
(Alternative)	Various	Various	V-0, Min. 90°C, Min. thickness: 2.0mm	UL94, UL746C	UL approved
DC Fan	DONGGUAN FENGQUAN ELECTRIC CO., LTD	DA08025B24H	24V, 0.35A, 5000±10%RPM	IEC/EN 62477-1	Tested with Appliance
BMU board					
PCB terminal (J1)	LOTES CO LTD	AAUS01AP4-036K02	V-0, 600V, 3A, 105°C	UL 1977	UL E187055
PCB terminal (J2)	LOTES CO LTD	AAUS01AP4-032K02	V-0, 600V, 3A, 105°C	UL 1977	UL E187055
PCB	SHANGHAI GLOBAL ELECTRONIC MATERIAL LTD	GF432-1	V-0, 130°C, Min. thickness: 1.8mm	UL 796	UL E224772
(Alternative)	Various	Various	V-0, 130°C, Min. thickness: 1.8mm	UL 796	UL approve
BMS transformer (TJ1)	SHENZHEN SINODRIVE ELECTRIC TECHNOLOGIES CO., LTD	N12103S	Operating Voltage: 1500V, Temperature range: -40°C to +125°C	UL 62368-1	UL E523028
AFE (U3)	Analog Devices, Inc.	ADBMS1818ASWZ-RL	Total supply voltage V+ to V-: 112,5 V, Temperature range: -40°C to 125°C	IEC/EN 62477-1	Tested with Appliance
BMU plastic enclosure	FORMOSA CHEMICALS & FIBRE CORP PLASTICS DIV	AC310(+)	90°C, V-0, Min. thickness 1.5mm	UL 94, UL 746	UL E162823

Supplementary information:
[1)] Provided evidence ensures the agreed level of compliance.

Annex No, 1
Pictures of the unit

Figure 1. External view for all model

Figure 2. External view for all model

Figure 3. External view for all model

Figure 4. External view for all model

Figure 5. Internal view after door opened for model ESS-GRID C241

Figure 6. Internal view for model ESS-GRID C241

Figure 7. Air Conditioner view

Figure 8. Internal view for model ESS-GRID C241

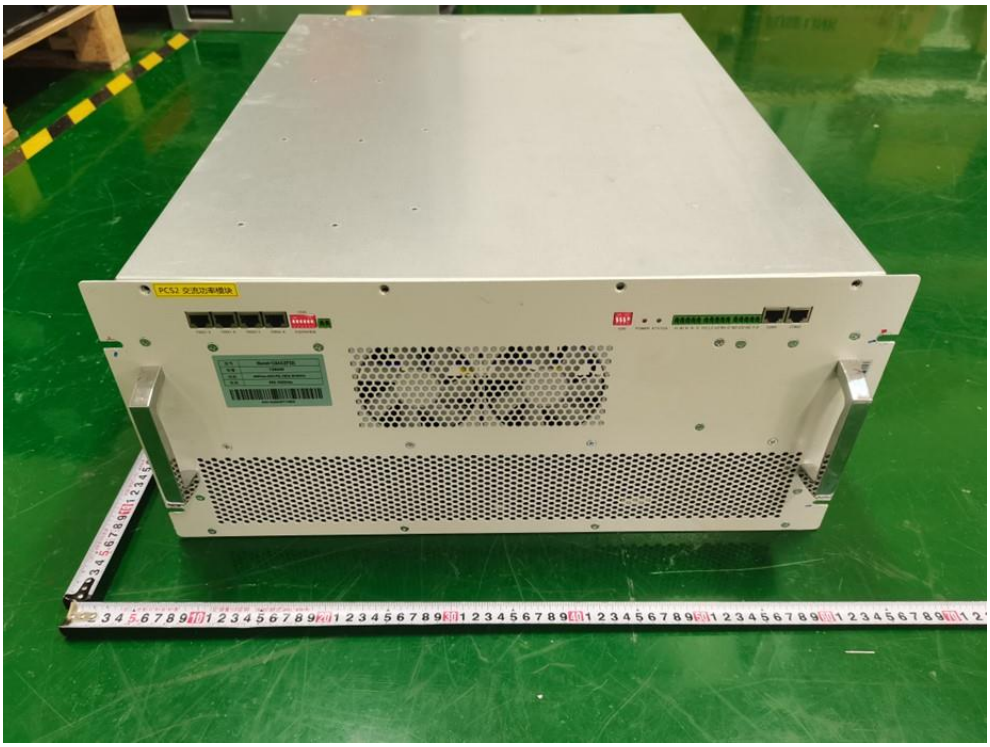

Figure 9. PCS (Power conversion system) view

Figure 10. PCS (Power conversion system) view

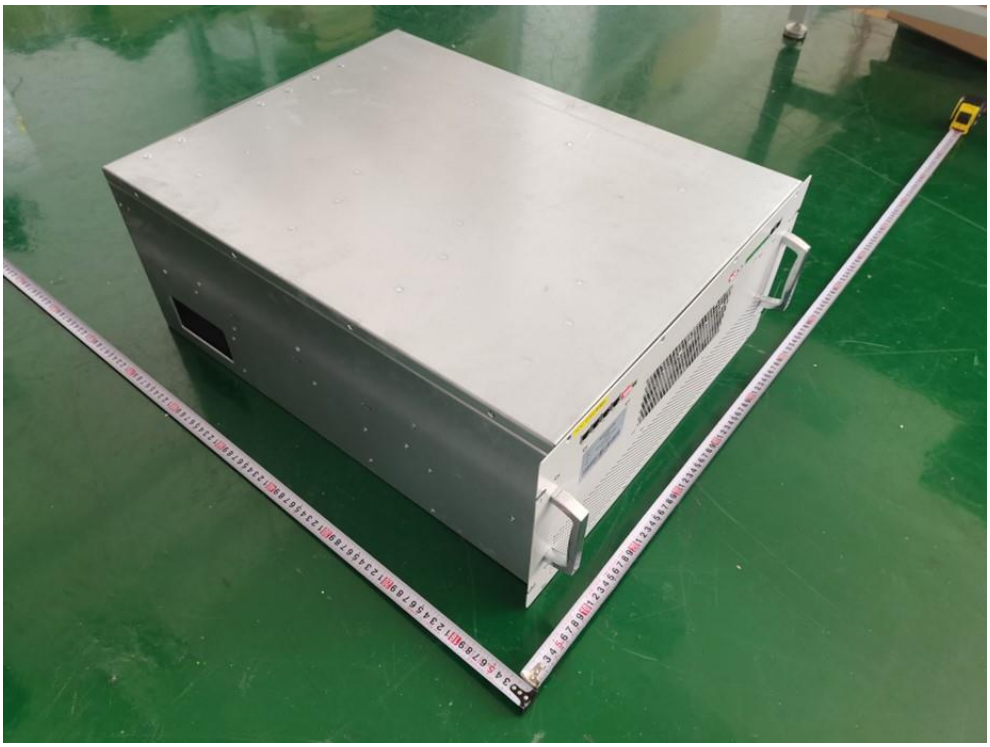

Figure 11. PCS (Power conversion system) view

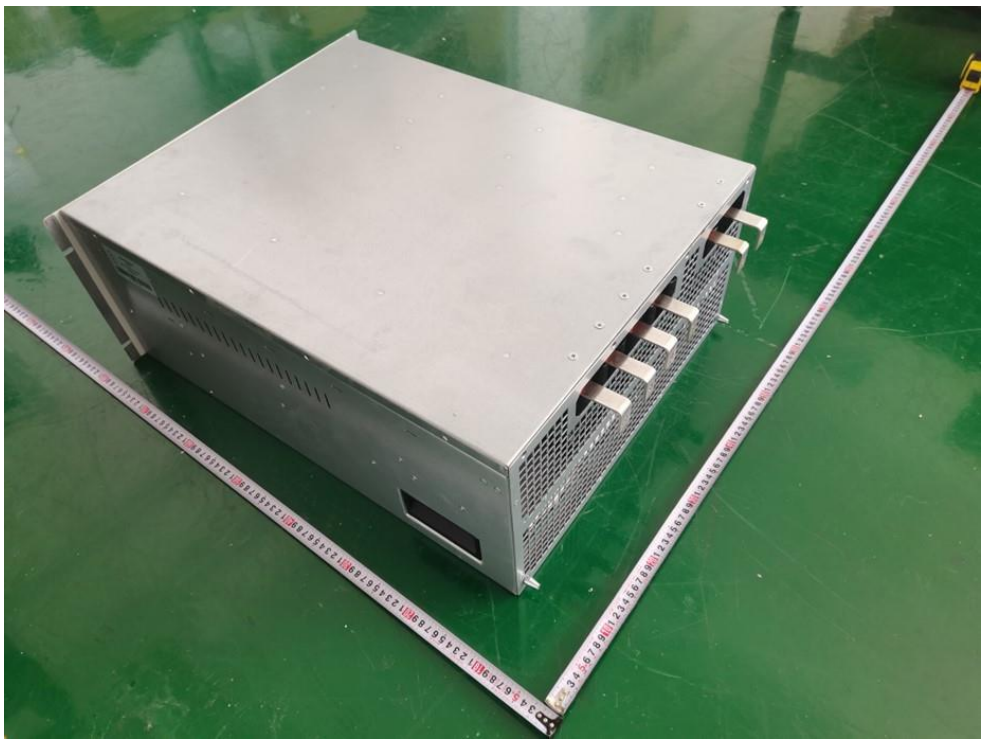

Figure 12. PCS (Power conversion system) view

Figure 13. PV Converter view

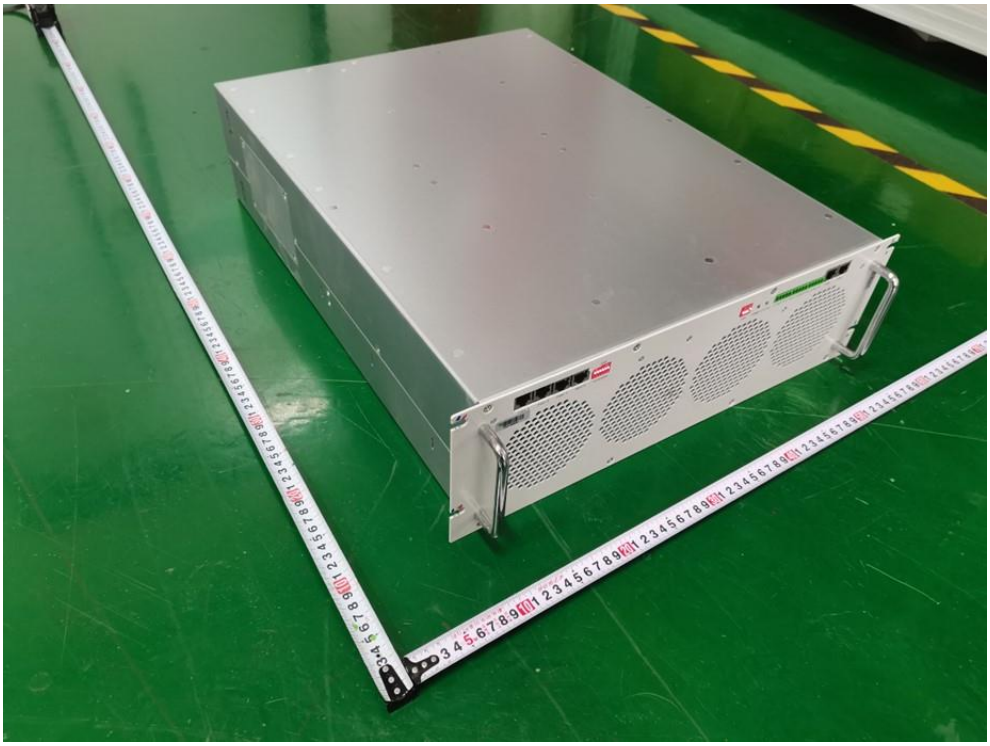

Figure 14. PV Converter view

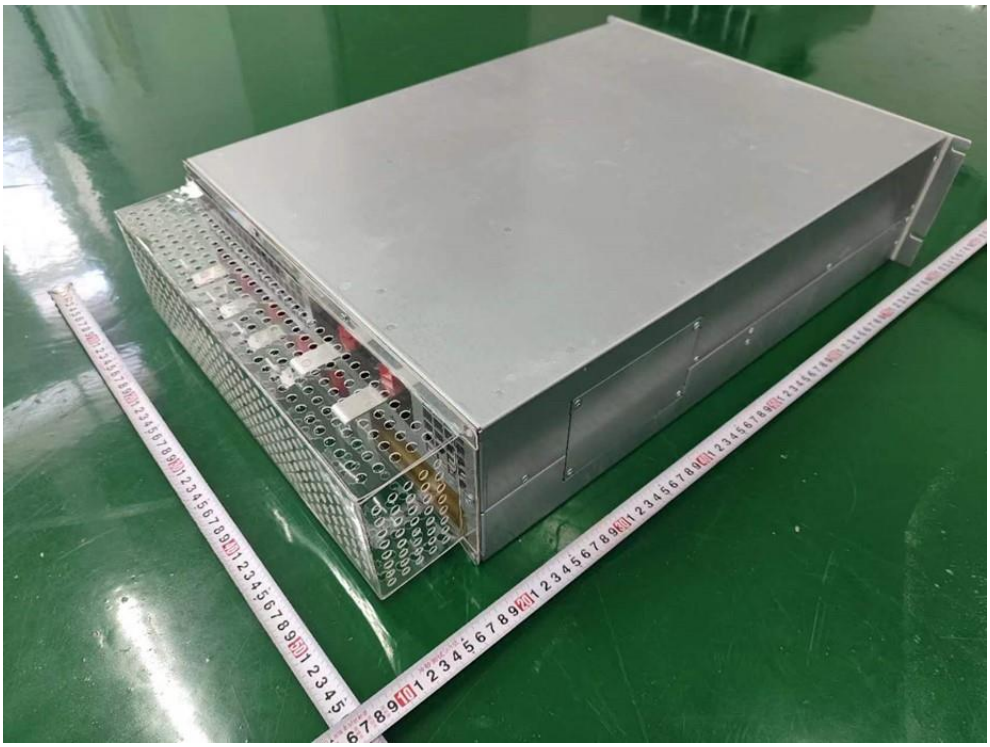

Figure 15. PV Converter view

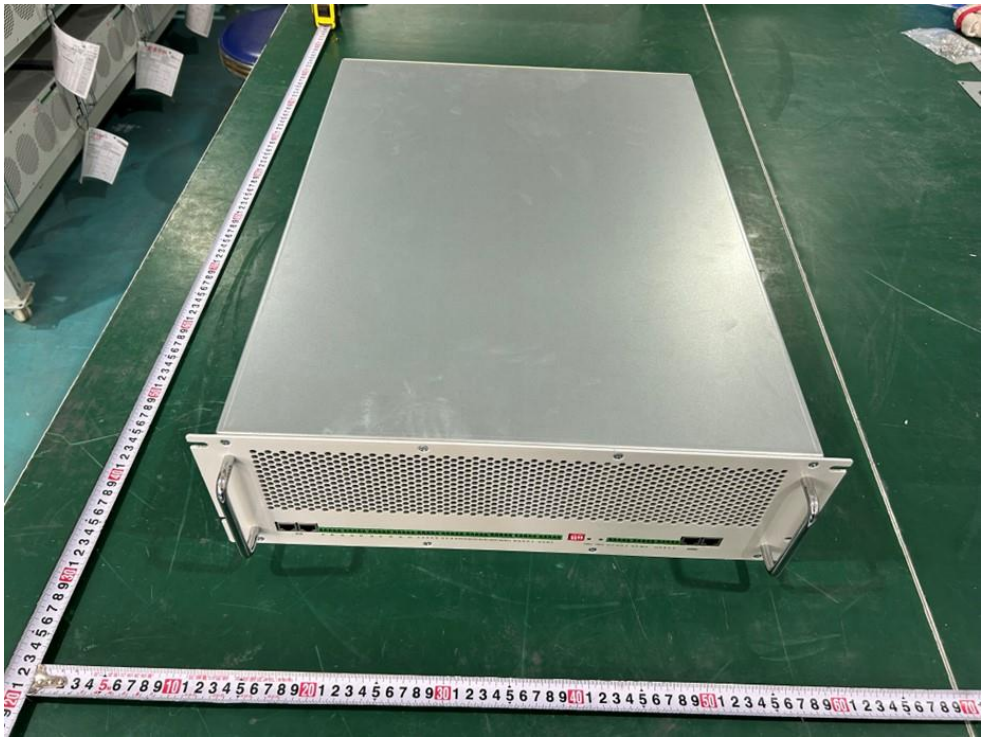

Figure 16. Controller (Static transfer systems) view

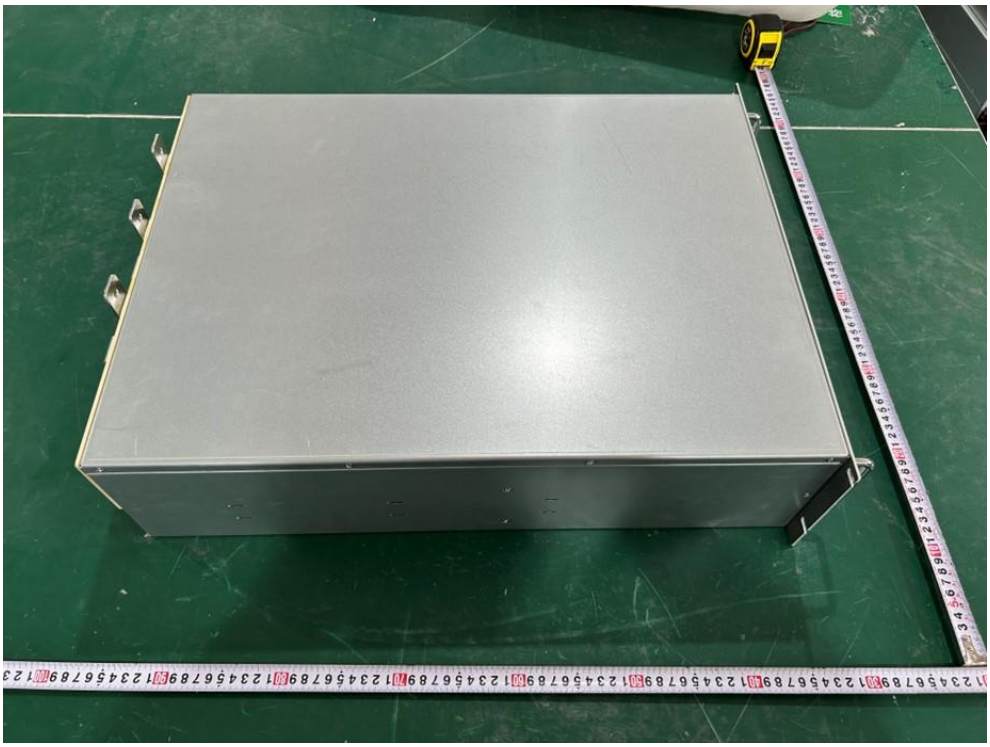

Figure 17. Controller (Static transfer systems) view

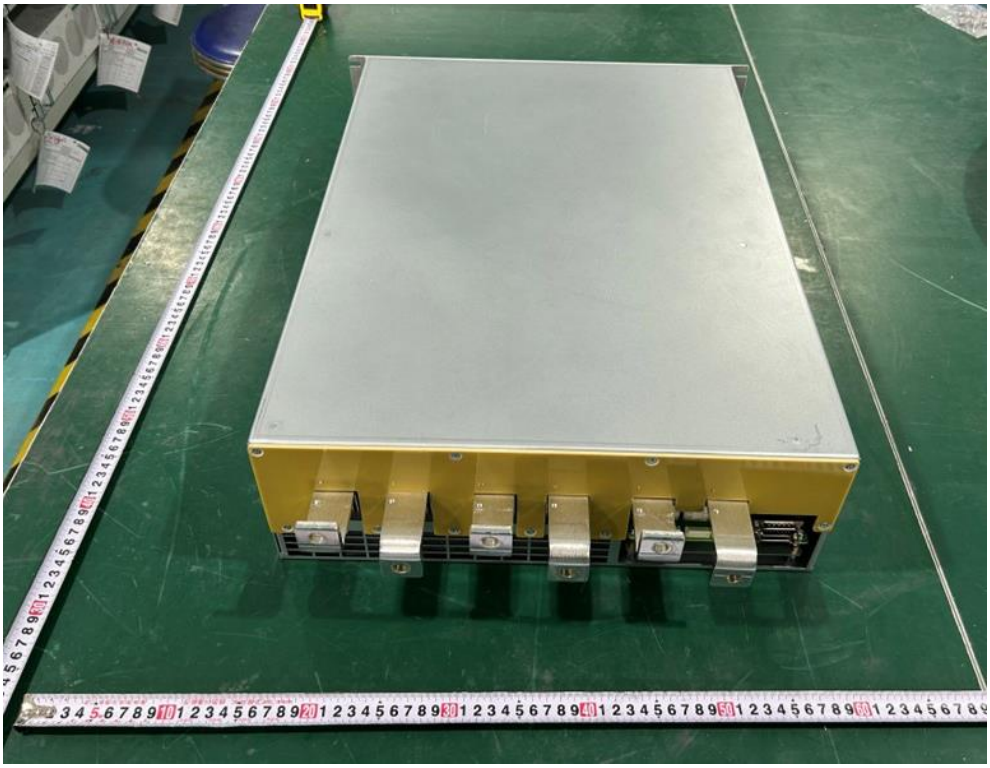

Figure 18. Controller (Static transfer systems) view

Figure 19. Internal view

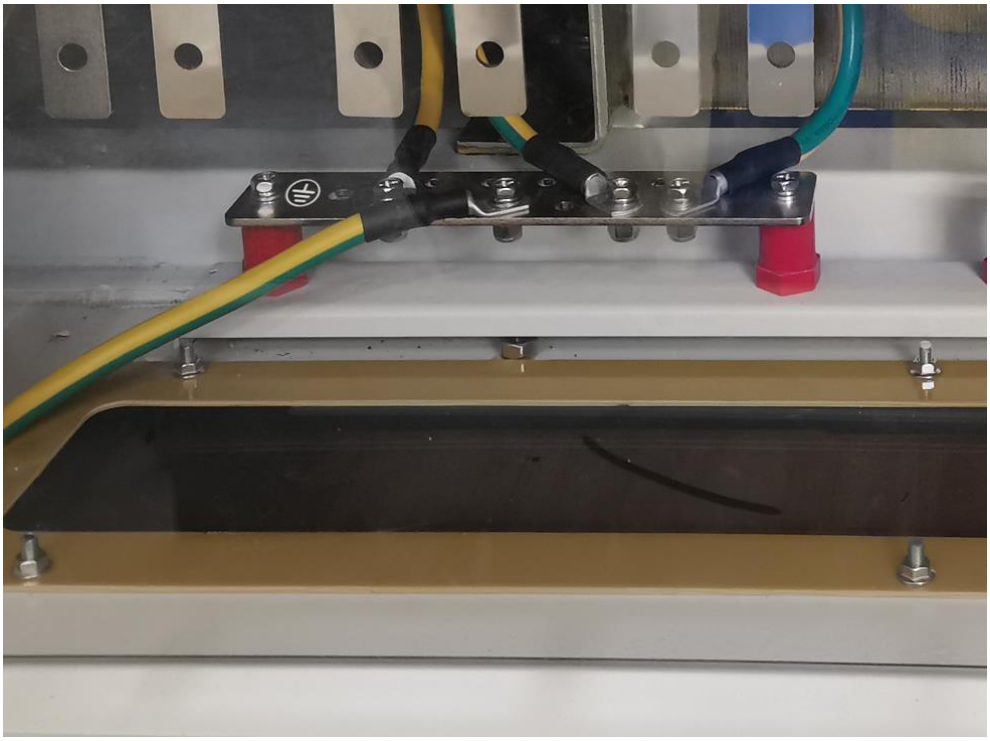

Figure 20. Earthed terminal view

Figure 21. Internal view

Figure 22. Internal view (with fan guard removed)

Figure 23. Fan motor view

Figure 24. Internal view for all model

Figure 25. Three-phase isolating transformer view

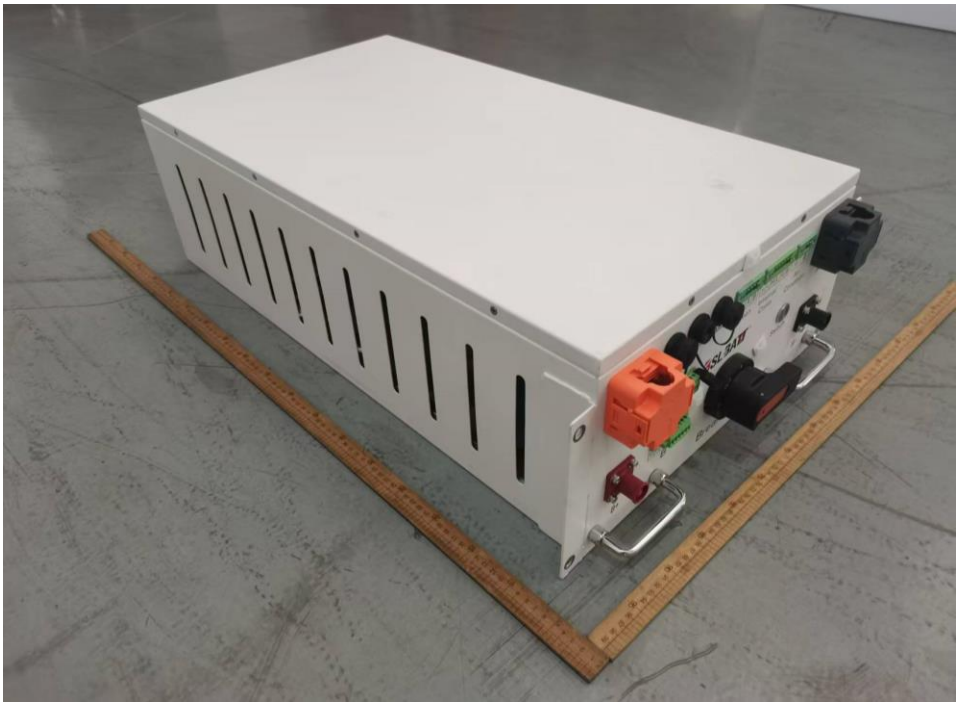

Figure 26. External view for High voltage control box

Figure 27. External view for High voltage control box

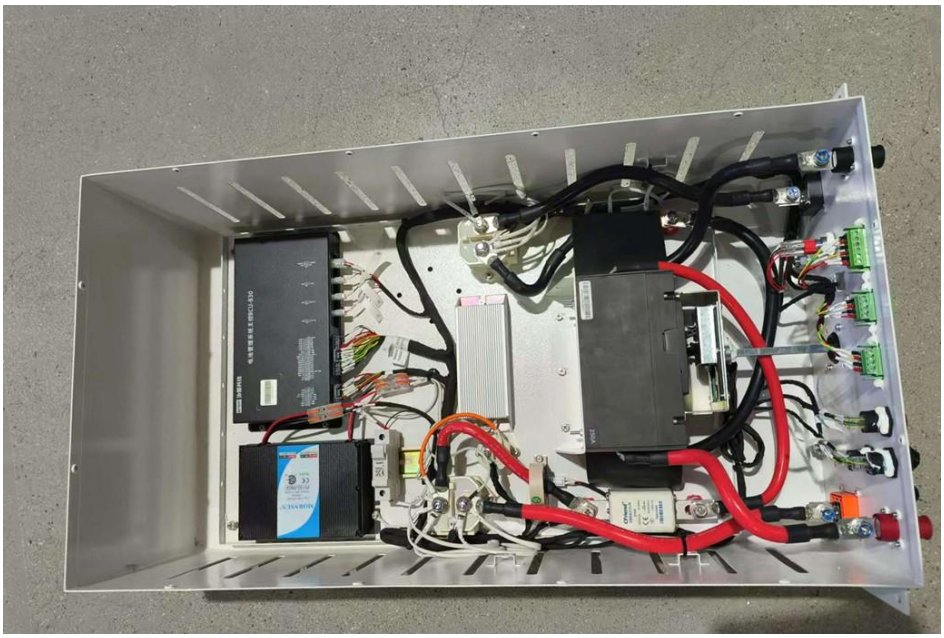

Figure 28. Internal view for High voltage control box

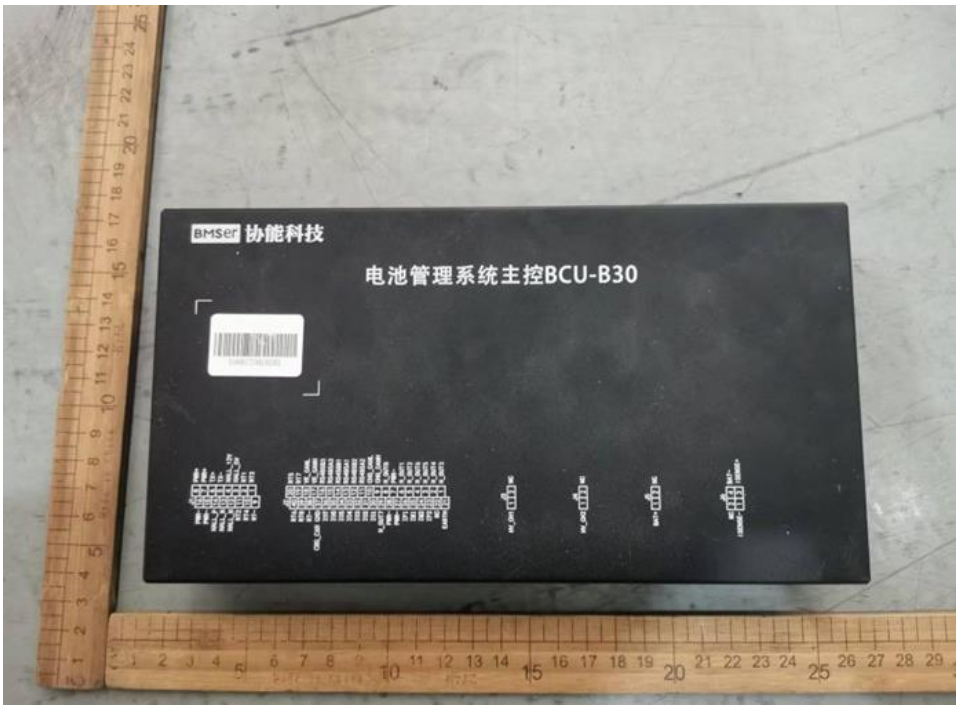

Figure 29. BCU module view

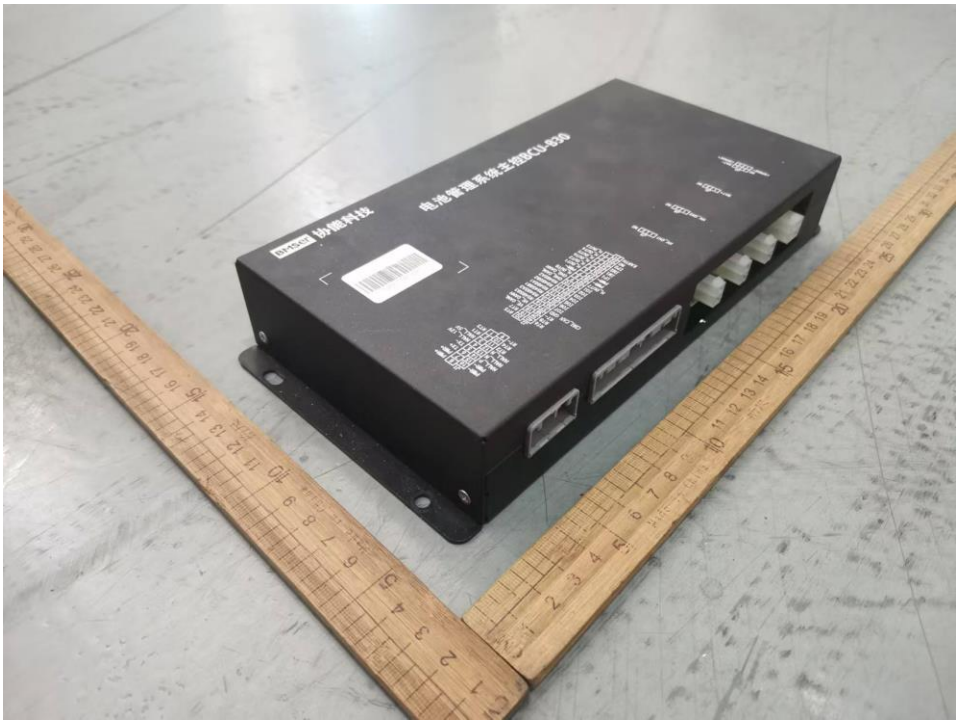

Figure 30. BCU module view

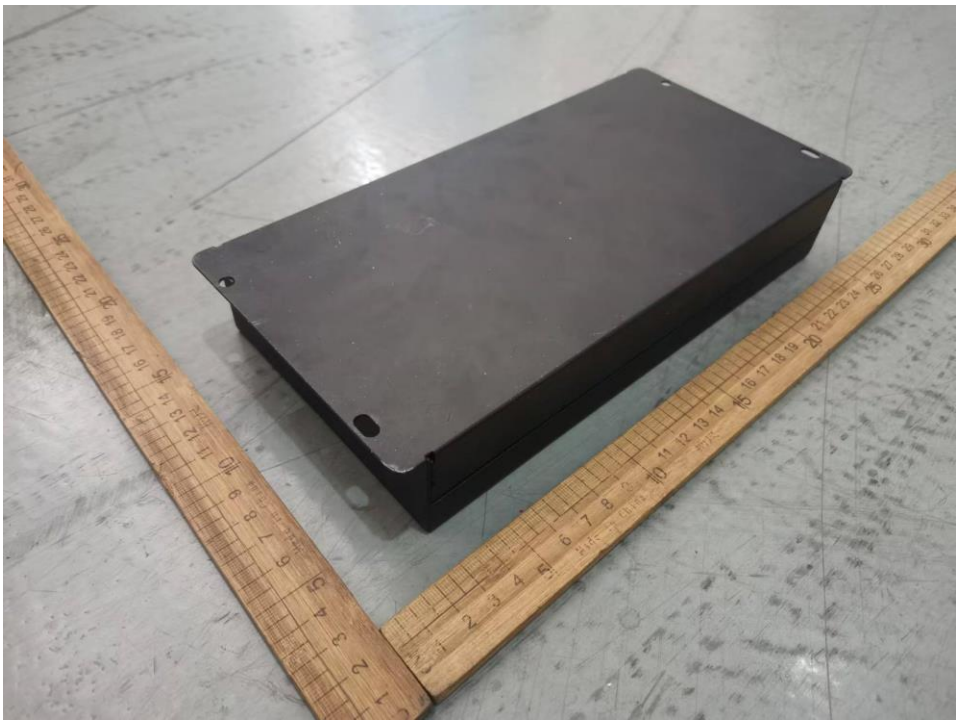

Figure 31. BCU module view

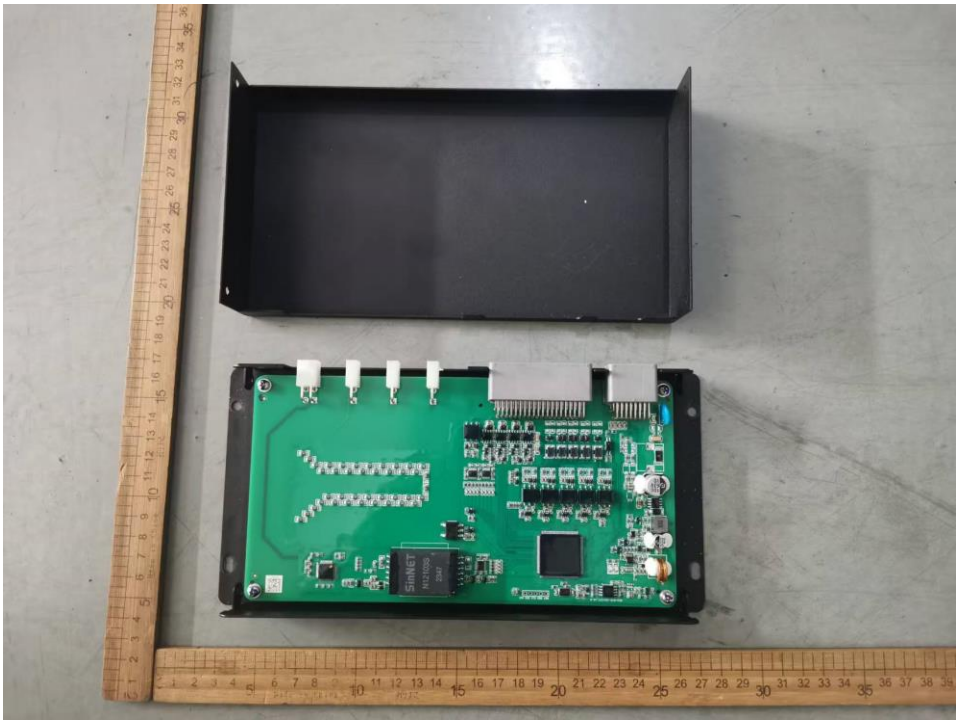

Figure 32. Internal view for BCU module

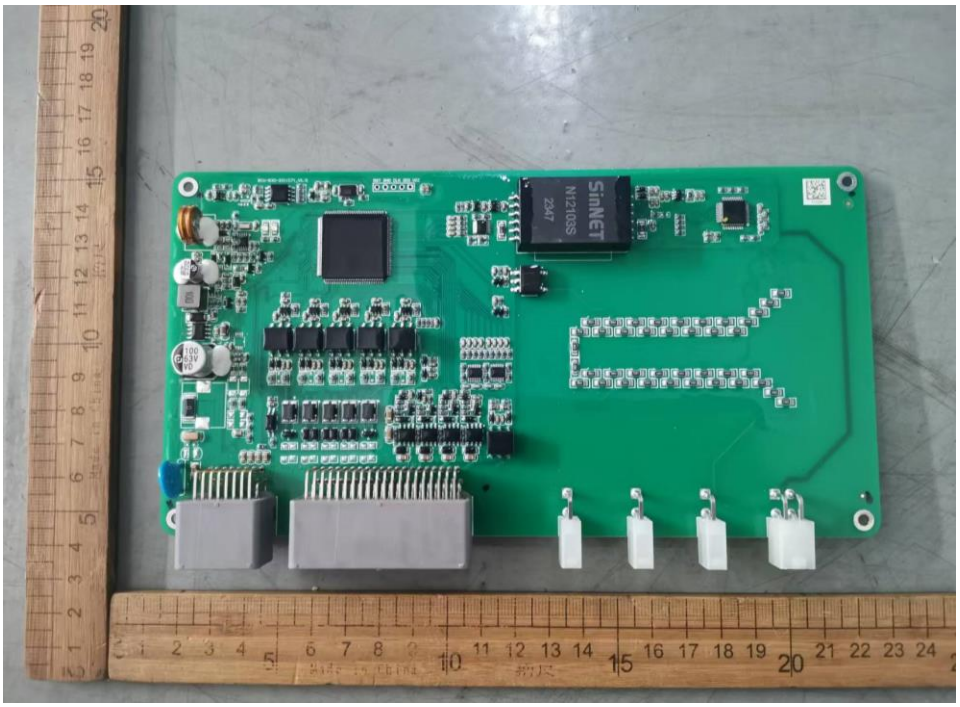

Figure 33. PCB view for BCU board

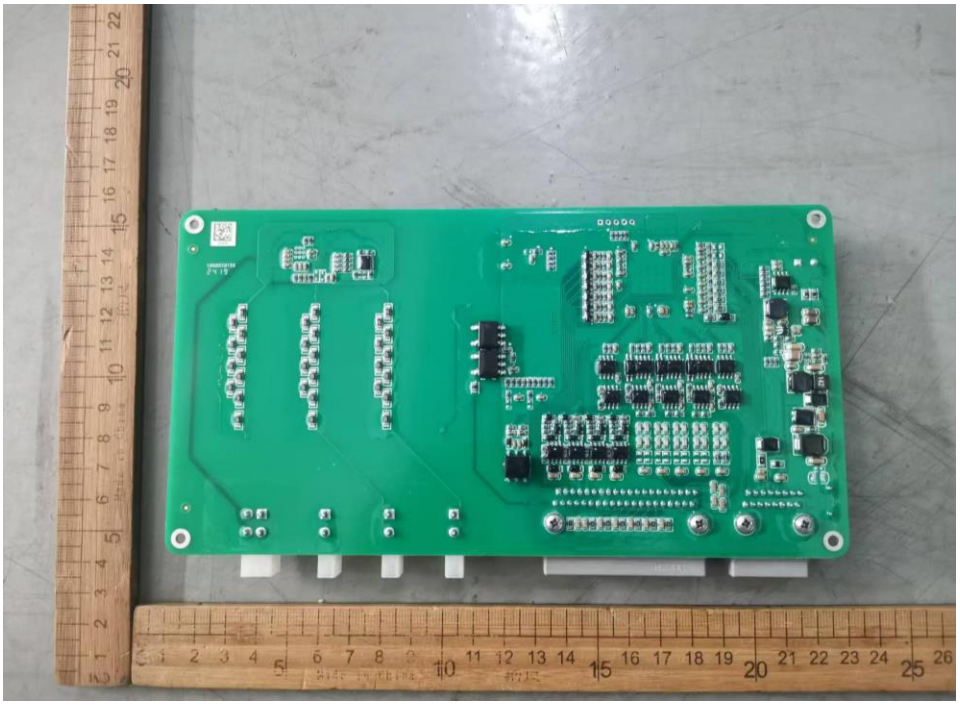

Figure 34. PCB view for BCU board

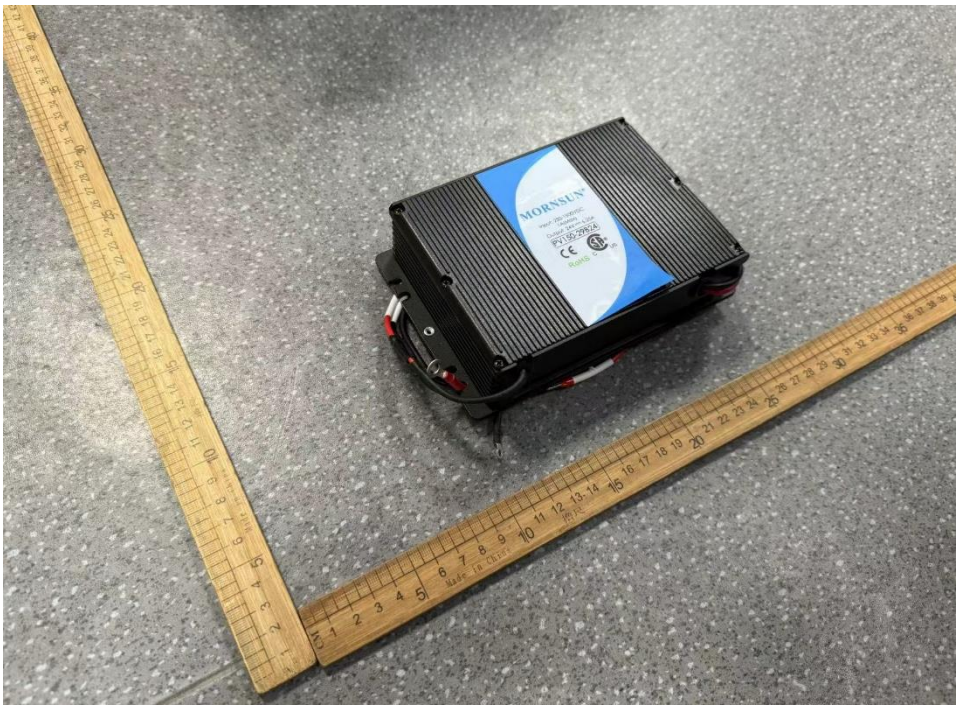

Figure 35. DC-DC Converter view

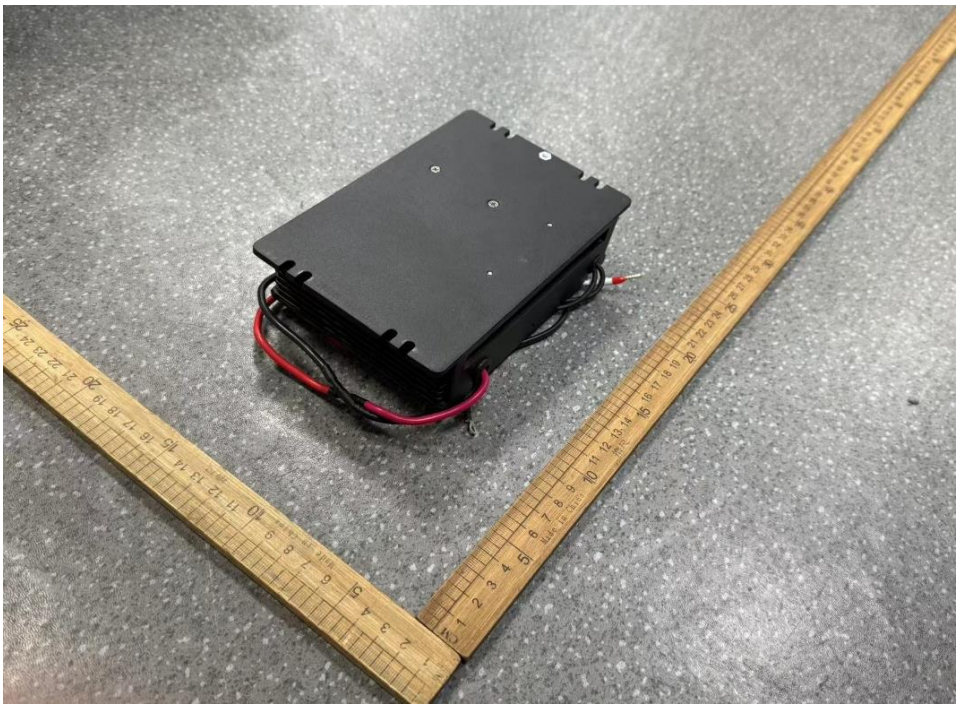

Figure 36. DC-DC Converter view

Figure 37. Battery module view

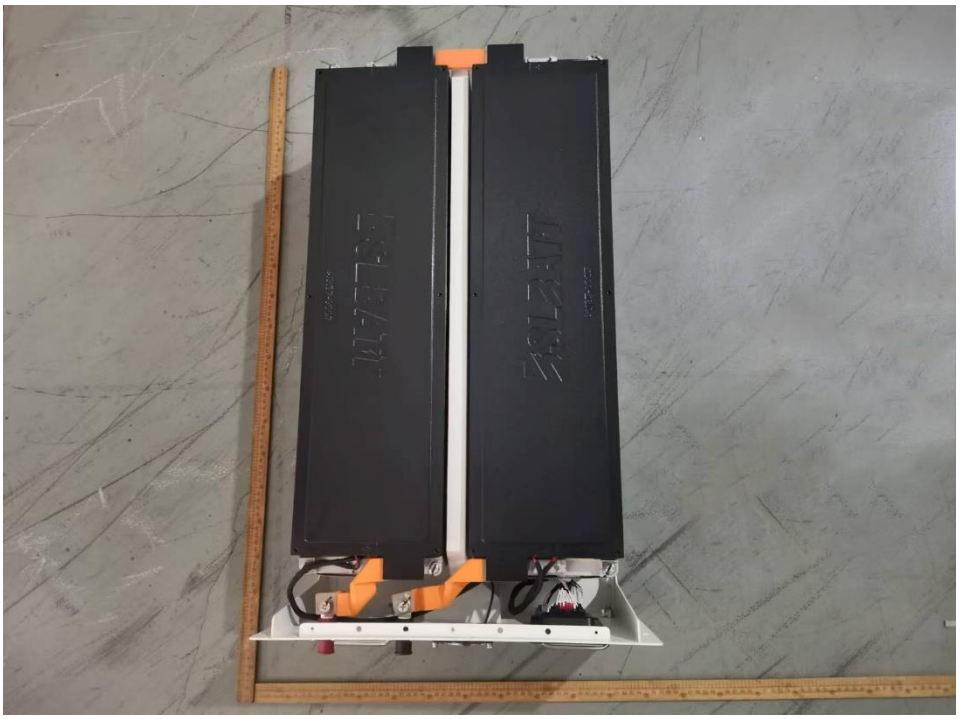

Figure 38. Battery module view

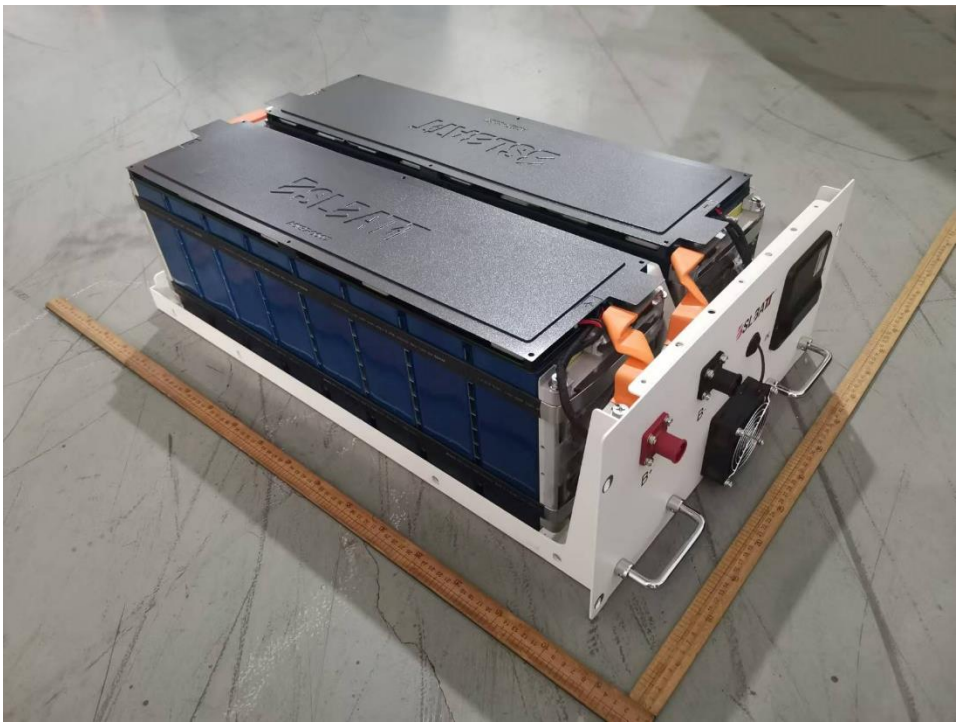

Figure 39. Battery module view

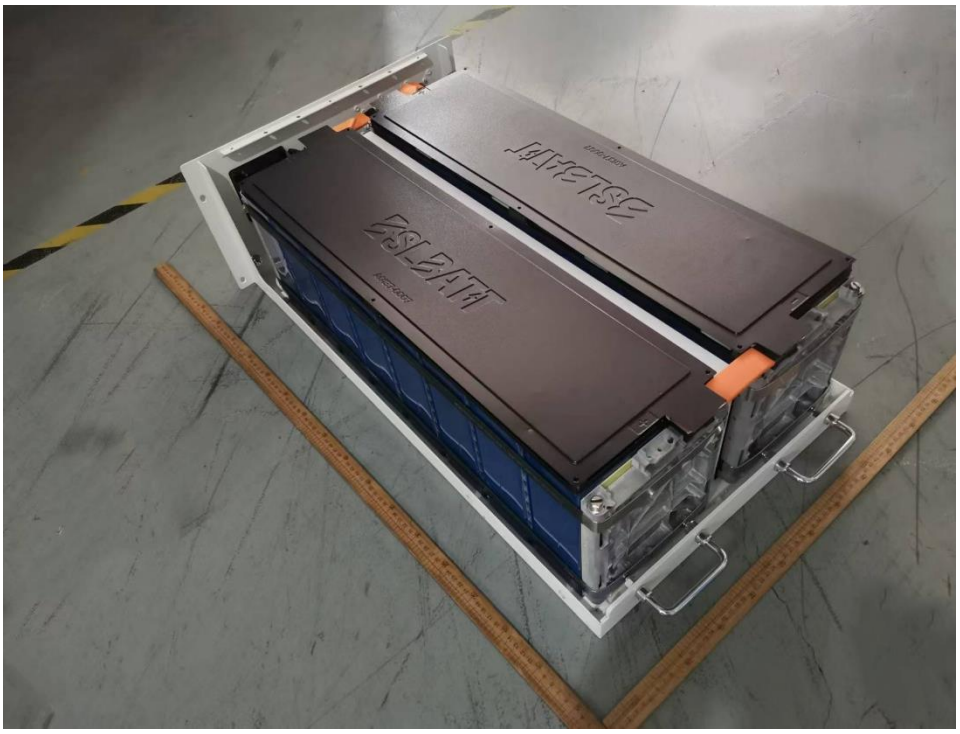

Figure 40. Battery module view

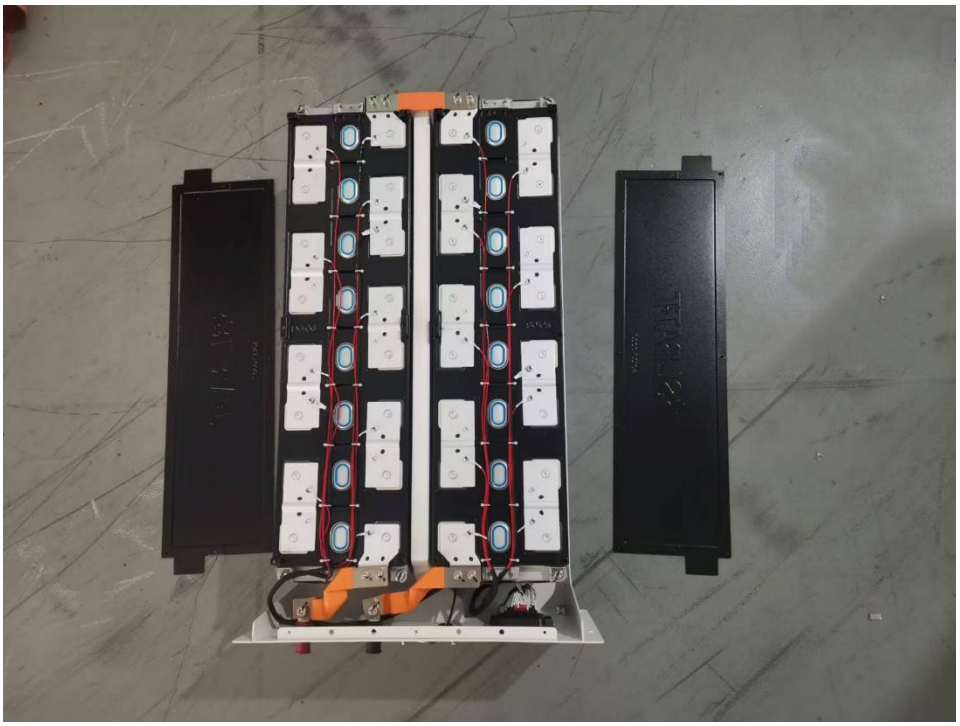

Figure 41. Battery module view

Figure 42. BMU module view

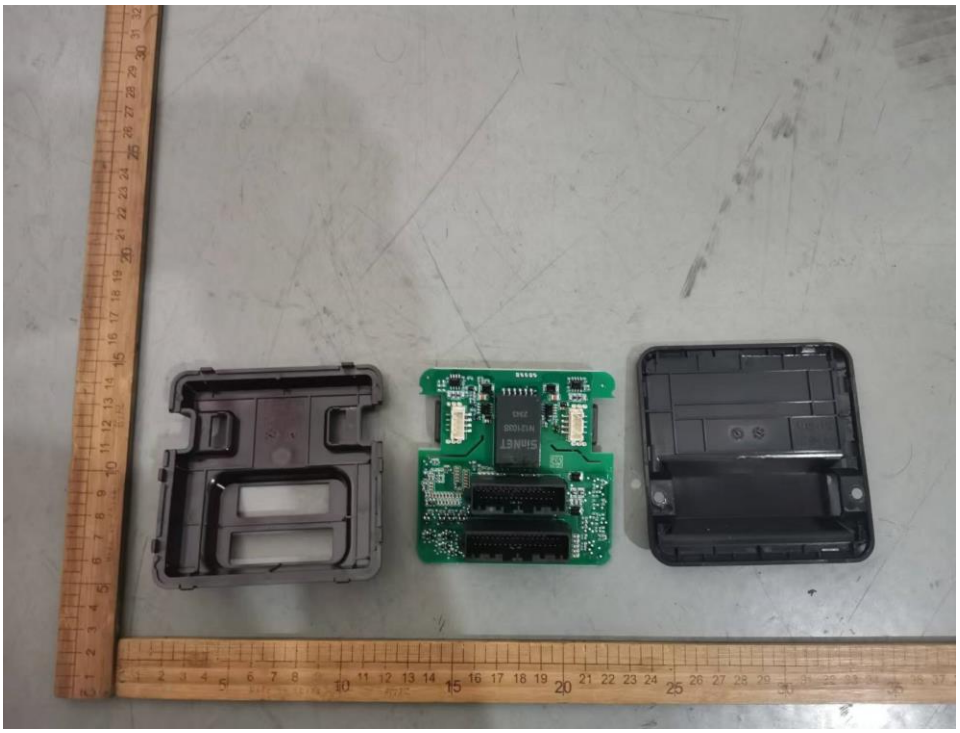

Figure 43. BMU module view

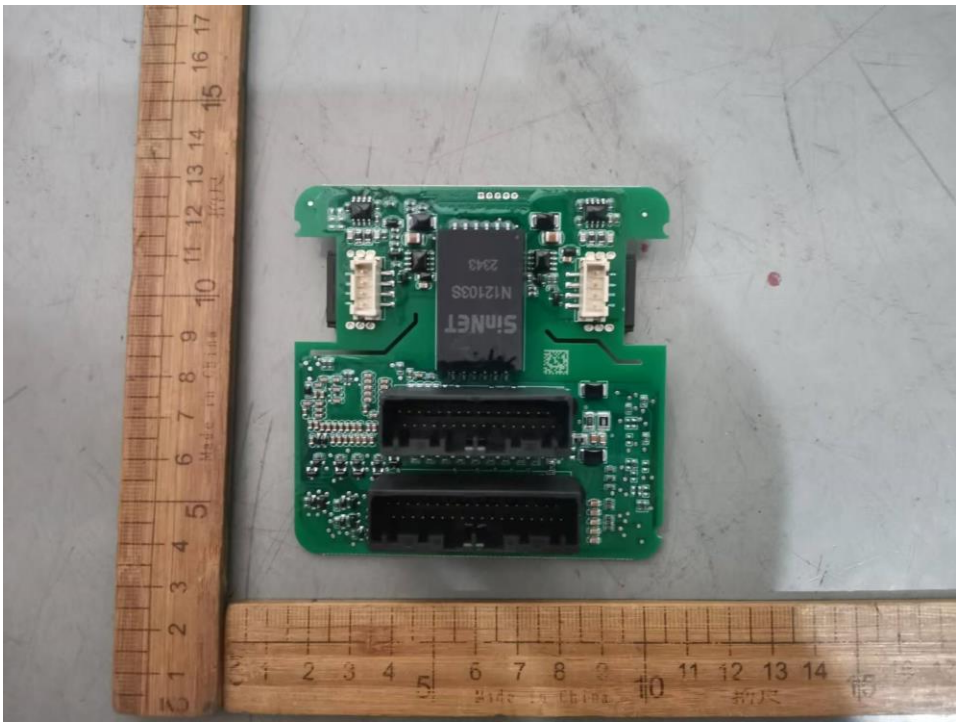

Figure 44. PCB view for BCU board

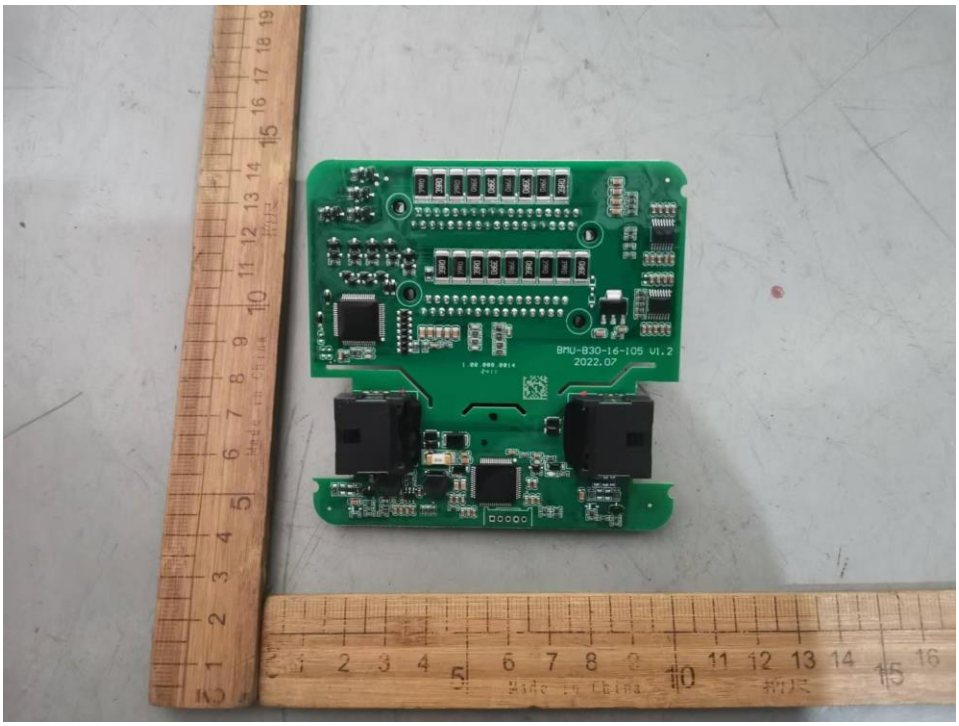

Figure 45. PCB view for BCU board

Figure 46. Internal view after door opened for model ESS-GRID C225

Figure 47. Internal view after door opened for model ESS-GRID C208

Figure 48. Internal view after door opened for model ESS-GRID C192

Figure 49. Internal view after door opened for model ESS-GRID C176

Figure 50. Internal view after door opened for model ESS-GRID C160