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检测
TESTING
CNAS L2291

TEST REPORT

Product Name : Uninterruptible Power Systems

Model Number : See page 3 for details

Prepared for : Netcon Enterprise Pvt Ltd
Address : 430A, Kathirvedu, Puzhal, Chennai- 600066, India

Prepared by : EMTEK (SHENZHEN) CO., LTD.
Address : Bldg 69, Majialong Industry Zone, Nanshan District,
Shenzhen, Guangdong, China

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Report Number : ENS2407290306P00601R



TEST REPORT IEC 62040-1 Uninterruptible power systems (UPS) – Part 1: General and safety requirements for UPS	
Report Number.	ENS2407290306P00601R
Date of issue	Aug. 07, 2024
Total number of pages	133 pages
Name of Testing Laboratory preparing the Report	EMTEK (Shenzhen) Co., Ltd.
Applicant's name	Netcon Enterprise Pvt Ltd
Address	430A, Kathirvedu, Puzhal, Chennai- 600066, India
Test specification:	
Standard	IEC 62040-1:2017, IEC 62040-1:2017/AMD1:2021
Test procedure	Test Report
Non-standard test method	N/A
TRF template used	IECEE OD-2020-F1:2021, Ed.1.4
Test Report Form No.	IEC62040_1F
Test Report Form(s) Originator	TÜV Rheinland Japan Ltd.
Master TRF	Dated 2021-08-27
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General disclaimer:	
The test results presented in this report relate only to the object tested. This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.	

Test item description.....:	Uninterruptible Power Systems	
Trade Mark.....:		
Manufacturer	Netcon Enterprise Pvt Ltd 430A, Kathirvedu, Puzhal, Chennai- 600066, India	
Model/Type reference.....:	NTCS33150-TY, NTCS33160-TY, NTCS33180-TY, NTCS33200-TY	
Ratings.....:	See copy of marking plate for details.	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ Testing Laboratory:	EMTEK (Shenzhen) Co., Ltd.	
Testing location/ address	Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China	
Tested by (name, function, signature).....:	Alan Zhang Engineer	
Approved by (name, function, signature) ..:	William Guo * Manager	
☐ Testing procedure: CTF Stage 1:		
Testing location/ address		
Tested by (name, function, signature)		
Approved by (name, function, signature) ..:		
☐ Testing procedure: CTF Stage 2:		
Testing location/ address		
Tested by (name + signature)		
Witnessed by (name, function, signature) .:		
Approved by (name, function, signature) ..:		
☐ Testing procedure: CTF Stage 3:		
☐ Testing procedure: CTF Stage 4:		
Testing location/ address		
Tested by (name, function, signature)		
Witnessed by (name, function, signature) .:		
Approved by (name, function, signature) ..:		
Supervised by (name, function, signature) :		

List of Attachments (including a total number of pages in each attachment):

- Photo document (20 pages)

Summary of testing:

From the result of our tests on the submitted samples, we conclude they comply with the requirements of the standards EN IEC 62040-1:2019+A11:2021.

Tests performed (name of test and test clause):

The submitted samples were found to comply with the requirements of:

- EN IEC 62040-1:2019+A11:2021

Note:

Vibration test in clause 5.2.6.4 was conducted at Subcontractor's laboratory.

Testing location:

EMTEK (Shenzhen) Co., Ltd.

Bldg 69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, China

Subcontractor's laboratory:

EMTEK (Dongguan) Co Ltd

-1&2F., Building 2, Zone A, Zhongda Marine Biotechnology Research and Development Base, No. 9, Xincheng Avenue, Songshanhu High-technology Industrial Development Zone, Dongguan, Guangdong, China (523808)

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

N/A

☒ The product fulfils the requirements of EN IEC 62040-1:2019+ A11:2021.

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

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

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

Information on uncertainty of measurement:

The uncertainties of measurement are calculated by the laboratory based on application of criteria given by OD-5014 for test equipment and application of test methods, decision sheets and operational procedures of IECEE.

IEC Guide 115 provides guidance on the application of measurement uncertainty principles and applying the decision rule when reporting test results within IECEE scheme, noting that the reporting of the measurement uncertainty for measurements is not necessary unless required by the test standard or customer.

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

Copy of marking plate:

The artwork below may be only a draft.

    S/N : Model : NTCS33150-TY System Capacity: 150kVA/150kW AC Input : 380/400/415Vac; 3Φ+N+PE; 282/268/258A; 50/60Hz Bypass Input : 380/400/415Vac; 3Φ+N+PE; 230/219/211A; 50/60Hz Output : 380/400/415Vac; 3Φ+N+PE; 228/217/209A; 50/60Hz Battery Input : 360~600Vdc Icc : 10kA Protective Class I 	    S/N : Model : NTCS33160-TY System Capacity: 160kVA/160kW AC Input : 380/400/415Vac; 3Φ+N+PE; 301/286/276A; 50/60Hz Bypass Input : 380/400/415Vac; 3Φ+N+PE; 246/233/225A; 50/60Hz Output : 380/400/415Vac; 3Φ+N+PE; 243/231/223A; 50/60Hz Battery Input : 360~600Vdc Icc : 10kA Protective Class I 
    S/N : Model : NTCS33180-TY System Capacity: 180kVA/180kW AC Input : 380/400/415Vac; 3Φ+N+PE; 339/322/310A; 50/60Hz Bypass Input : 380/400/415Vac; 3Φ+N+PE; 276/262/253A; 50/60Hz Output : 380/400/415Vac; 3Φ+N+PE; 273/260/250A; 50/60Hz Battery Input : 360~600Vdc Icc : 10kA Protective Class I 	    S/N : Model : NTCS33200-TY System Capacity: 200kVA/200kW AC Input : 380/400/415Vac; 3Φ+N+PE; 376/358/345A; 50/60Hz Bypass Input : 380/400/415Vac; 3Φ+N+PE; 307/292/281A; 50/60Hz Output : 380/400/415Vac; 3Φ+N+PE; 304/289/278A; 50/60Hz Battery Input : 360~600Vdc Icc : 10kA Protective Class I 

Manufacturer: Netcon Enterprise Pvt Ltd
Address: 430A, Kathirvedu, Puzhal, Chennai-600066, India

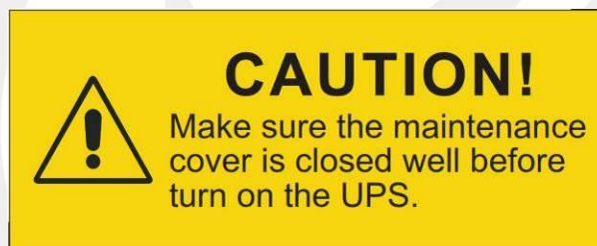
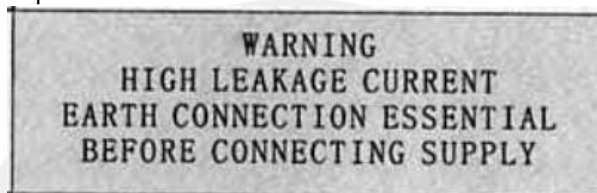
Importer: xxxxxxxx
Address: xxxxxxxx

Copy of caution mark:

Caution:

- For operation read user manual including safety warnings first!
- This unit may be opened by authorized technicians only!
- Lead acid battery in the inside of the enclosure!
- The battery may present a risk of electric shock and energy hazards.
- Risk of explosion if battery replaced by an incorrect type. For battery information, see user's manual.
- For disposal instructions of the battery, see user's manual.
- Do not dispose of batteries in a fire. The batteries may explode.
- Do not open or mutilate batteries. Released electrolyte is

- harmful to the skin and eyes. It may be toxic.
- A battery can present a risk of electric shock and burns by high short-circuit current.
- Disconnect the charging source prior to connecting or disconnecting battery terminals
- Do not wear any metal objects including watches and rings
- Do not lay tools or metal parts on top of batteries
- Use tools with insulated handles
- Wear rubber gloves and boots
- Determine if battery is either intentionally or inadvertently grounded. Contact with any part of a grounded battery can result in electric shock and burns by high short-circuit current. The risk of such hazards can be reduced if grounds are removed during installation and maintenance by a skilled person.
- The bus capacitor discharge time is 5 min, after the removal of power from the UPS



Remark:

- The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
- The CE marking and WEEE symbol should be at least 5.0 mm and 7.0 mm respectively in height.

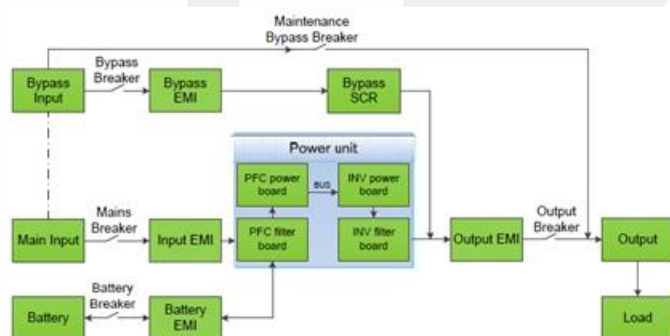
Test item particulars..... :	
Classification of installation and use	☐ Ordinary Person ☒ Instructed Person ☒ Skilled Person
Supply Connection	☐ pluggable equipment ☐ type A ☐ type B ☒ permanent connection ☐ detachable power supply cord ☐ non-detachable power supply cord
Environmental category	☒ indoor ☐ unconditional ☐ conditional ☐ outdoor
Equipment mobility	☐ movable ☒ stationary ☐ for building-in ☐ fixed
Access location.....	☒ ordinary person accessible ☐ restricted access location
Over voltage category	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%)	380/400/415Vac +10%, -10% (declared by client)
Tested for power systems.....	TN
IT testing, phase-phase voltage (V).....	☐ Yes ☒ No
Class of equipment	☒ Class I ☐ Class II ☐ Class III
Considered current rating of protective device as part of the building installation (A).....	400A
Pollution degree (PD)	☐ PD1 ☒ PD2 ☐ PD3
IP protection class	IP20
Elevation during operation (m)	Up to 2000m
Elevation of test laboratory (m).....	Below 2000m
Mass of equipment (kg)	Approx. 165 kg
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..... : N/A	
Date (s) of performance of tests..... : N/A	
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. Throughout this report a ☐ comma / ☒ point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:	

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided:	☐ Yes ☒ Not applicable																				
When differences exist; they shall be identified in the General product information section.																					
General product information and other remarks: This report is amended from previous report ENS2209080124S00201R, issued by EMTEK (SHENZHEN) CO., LTD on November 09, 2022, due to below amendments: - Updated the Applicant, Manufacturer, Factory name to Netcon Enterprise Pvt Ltd - Updated the Applicant, Manufacturer, Factory address to No: 430A, Kathirvedu, Puzhal, Chennai - 600066, India - Updated the model to NTCS33150-TY, NTCS33160-TY, NTCS33180-TY, NTCS33200-TY - Updated Trade Mark - Updated the product Overview of picture. The original model and new model have the similar constructions, circuit diagram and PCB layout except model name No any tests need be considered. 1. The equipment is an Uninterruptible Power Systems for general use with Uninterruptible power systems equipment. 2. The UPS is designed as primary, therefore, clearances, creepage distances and distances through insulation from input, output, battery, control circuits to the RS232, RS485, USB, LBS and parallel port are dimensioned for reinforced insulation and suitable distance through insulation. The test samples are pre-production without any serial number. 3. Suitable backfeed protect device according to operating instruction should be provided before installation. 4. External battery cabinet is optional and not provided with the UPS. External battery cabinet used during testing. 5. Model difference description: All models have the same constructions, circuit diagram and PCB layout. Only model name, appearance and the parameter of some parts are different. Unless otherwise stated, all tests were performed on model NTCS33200-TY which means the typical model. (See below table A for details)																					
<table border="1"> <thead> <tr> <th colspan="4" data-bbox="161 1518 1433 1559">Table A: Model Rating</th></tr> <tr> <th data-bbox="161 1559 485 1608">Model</th><th data-bbox="485 1559 828 1608">Input rating</th><th data-bbox="828 1559 1219 1608">Output rating</th><th data-bbox="1219 1559 1433 1608">Battery</th></tr> </thead> <tbody> <tr> <td colspan="4" data-bbox="161 1608 485 1653">PF=1.0</td></tr> <tr> <td data-bbox="161 1653 485 1935">NTCS33150-TY</td><td data-bbox="485 1653 828 1935">380/400/415Vac; 3Φ+N+PE, 282/268/258A.; 50/60Hz; Icc: 10kA Bypass Input: 380/400/415Vac; 3Φ+N+PE; 230/219/211A; 50/60Hz</td><td data-bbox="828 1653 1219 1935">380/400/415Vac; 3Φ+N+PE; 228/217/209A; 50/60Hz; 150kVA/150kW</td><td data-bbox="1219 1653 1433 1935">360-600Vdc</td></tr> <tr> <td data-bbox="161 1935 485 2042">NTCS33160-TY</td><td data-bbox="485 1935 828 2042">380/400/415Vac; 3Φ+N+PE, 301/286/276A; 50/60Hz; Icc: 10kA</td><td data-bbox="828 1935 1219 2042">380/400/415Vac; 3Φ+N+PE; 243/231/223A; 50/60Hz; 160kVA/160kW</td><td data-bbox="1219 1935 1433 2042">360-600Vdc</td></tr> </tbody> </table>		Table A: Model Rating				Model	Input rating	Output rating	Battery	PF=1.0				NTCS33150-TY	380/400/415Vac; 3Φ+N+PE, 282/268/258A.; 50/60Hz; Icc: 10kA Bypass Input: 380/400/415Vac; 3Φ+N+PE; 230/219/211A; 50/60Hz	380/400/415Vac; 3Φ+N+PE; 228/217/209A; 50/60Hz; 150kVA/150kW	360-600Vdc	NTCS33160-TY	380/400/415Vac; 3Φ+N+PE, 301/286/276A; 50/60Hz; Icc: 10kA	380/400/415Vac; 3Φ+N+PE; 243/231/223A; 50/60Hz; 160kVA/160kW	360-600Vdc
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NTCS33160-TY	380/400/415Vac; 3Φ+N+PE, 301/286/276A; 50/60Hz; Icc: 10kA	380/400/415Vac; 3Φ+N+PE; 243/231/223A; 50/60Hz; 160kVA/160kW	360-600Vdc																		

	Bypass Input: 380/400/415Vac; 3Φ+N+PE; 246/233/225A; 50/60Hz		
NTCS33180-TY	380/400/415Vac; 3Φ+N+PE, 339/322/310A; 50/60Hz; Icc: 10kA Bypass Input: 380/400/415Vac; 3Φ+N+PE; 276/262/253A; 50/60Hz	380/400/415Vac; 3Φ+N+PE; 273/260/250A, 50/60Hz; 180kVA/180kW	360-600Vdc
NTCS33200-TY	380/400/415Vac; 3Φ+N+PE, 376/358/345A; 50/60Hz; Icc: 10kA Bypass Input: 380/400/415Vac; 3Φ+N+PE; 307/292/281A; 50/60Hz	380/400/415Vac; 3Φ+N+PE; 304/289/278A, 50/60Hz; 200kVA/200kW	360-600Vdc

6. The product has been tested according to standard EN IEC 62040-1:2019+A11:2021

- Maximum ambient temperature: 40°C
- The equipment is designed for altitudes not exceeding 2000m.
- See below block diagram for details:



IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	Protection against hazards		P
4.1/RD	General	See the following details	P
4.2 4.2/RD	Fault and abnormal conditions	See Table 4.2/RD to 4.3/RD	P
5.2.4.6/RD	Breakdown of components test (type test)	See Table 4.2/RD to 4.3/RD	P
5.2.4.6.1 /RD	Load conditions	Tested with the UPS 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	The short circuit shall be applied with cable of a cross-section appropriate for the current that normally flows through the component, but not less than 2,5 mm ² . 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
5.2.4.6.3 /RD	Test sequence	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
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	See the following details	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.	Permanently connected 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.	For permanently connected equipment, 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	See the following details	P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	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.	Maximum allowable prospective short circuit current: up to 10kA.	P
	If external protective devices are specified or provided the characteristics of those shall be specified by the manufacturer.	No such external protective devices are specified or provided	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.	The peak & r.m.s value of output short-circuit current is provided in user manual. See Table 4.2/RD to 4.3/RD.	P
4.3.2.4/RD	Combined input and output ports	DC port	P
	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.	External batteries terminals are considered both input and output ports.	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.	The interrupting capability of breakers specified in the user manual is greater than the short circuit current of the mains supply up to 10kA.	P
	Compliance shall be checked by inspection and by the tests of 5.2.4.4/RD and 5.2.4.5/RD.	Checked by the tests of 5.2.4.4 and 5.2.4.5	P
4.3.4/RD	Protection by several devices	See the following details	N/A

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	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.	Only one pole of a supply to a given load	N/A
4.3.101	AC input current	See table 4.3.101, 5.2.3.102 for details	P
4.3.102	Transformer protection	See Table 4.2/RD to 4.3/RD	P
4.3.103	AC input short-circuit current	$I_{cc} \leq 10\text{kA}$ for the UPS manufacturer specified.	P
4.3.104	Protection of the energy storage device	The external energy storage device shall be installed by the users. The statement is mentioned in the user manual.	N/A
4.3.105	Unsynchronized load transfer	Employed a manual switch that connects the bypass source of supply to the UPS output. Determined by conducting the test in 5.2.3.105	P
4.4	Protection against electric shock	See the following details	P
4.4.1/RD	General	See above	P
4.4.2/RD	Decisive voltage class		P
4.4.2.1/RD	General		P
4.4.2.2/RD	Determination of decisive voltage class	DVC A circuit is considered in the equipment.	P
4.4.2.2.1/RD	General	See above	P
	For protection against the ventricular fibrillation body reaction, DVC can be selected from Table 2.	DVC A circuit is considered in the equipment.	P
4.4.2.2.2 4.4.2.2.2/RD	Selection tables for contact area and skin humidity condition	a) body contact area: "Hand" (Table 3) b) skin humidity condition: "Dry" (Table 4)	P
4.4.2.2.3/RD	Limits of the working voltage for the DVC	30 V RMS, 42.4V peak or 60 V DC	P
4.4.2.3/RD	Requirements for protection against electric shock	Basic insulation between DVC C circuits to PE, DVC C circuit to DVC A circuit.	P
4.4.3/RD	Provision for basic protection	See the following details	P
4.4.3.1/RD	General	See the following details	P
4.4.3.2/RD	Protection by means of basic insulation of live parts	See the following details	P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	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.	Live part is completely restricted inside the equipment.	P
	Basic insulation may be provided by solid insulation or air clearance.	Basic insulation is provided by air clearance and solid insulation.	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.	Considered.	P
4.4.3.3	Openings	Top/bottom/left/right: no openings; Front: numerous Ø5.0 rectangle openings, no hazards live parts located in 5° projection, covered with internal foam board; Rear: numerous Ø5.0 hexagon openings, no hazards live parts located in 5° projection.	P
4.4.3.4/RD	Protection by means of limitation of touch current and charge	Tested on detective resistance for basic insulation.	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	See the following details	P
	The voltage between simultaneously accessible parts shall not be greater than DVC As as determined in 4.4.2.2/RD.	Internal circuits include examples of A.2, A.3 and A.4	P
4.4.4/RD	Provision for fault protection	See the following details	P
4.4.4.1/RD	General	See below	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.	See sub-clauses for details	P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
4.4.4.2/RD	Protective equipotential bonding	See the following details	P
4.4.4.2.1 /RD	General	See above	P
	Protective equipotential bonding shall be provided between accessible conductive parts of the equipment and the means of connection for the PE 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.	Accessible metal chassis connected to PE conductor	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.	All means considered.	P
4.4.4.2.2 /RD	Rating of protective equipotential bonding	a) considered and comply	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	See above	P
4.4.4.3/RD	PE conductor	See the following details	P
4.4.4.3.1 /RD	General	See below	P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	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.	Protective Class I considered	P
	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.	Permanently connected equipment, no disconnect device used on PE conductor, relevant instruction stated in manual.	P
	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.		N/A
	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.	No such connection	N/A
4.4.4.3.2 /RD	Means of connection for the PE conductor	See below	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.	Checked by inspection	P
4.4.4.3.3 /RD	Touch current in case of failure of PE conductor	The touch current can be shown to be less than the limits specified in 4.4.3.4	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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 mm² Cu or 16 mm² 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 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	Compliance is checked by inspection and by test of 5.2.3.7/RD.		N/A
4.4.4.4/RD	Automatic disconnection of supply	No such components.	N/A
	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.		N/A
4.4.4.5/RD	Supplementary insulation	Supplementary insulation considered in T1 on ECU board	P
4.4.4.6/RD	Simple separation between circuits	See the following details	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.	Y cap. between live parts to PE and detective resistance for basic insulation meets the requirements of the highest voltage present and withstands the electric stresses.	P
4.4.4.7/RD	Electrically protection		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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	See the following details	P
4.4.5.1/RD	General	See the following details	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.	Refer to 4.4.5.2/RD, 4.4.5.3/RD, 4.4.5.4/RD	P
4.4.5.2/RD	Reinforced insulation	Complied	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)	Complied	P
4.4.5.3/RD	Protective separation between circuits		P
	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.	Primary circuits and secondary circuits are considered reinforced insulation in 4.4.5.2/RD	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)	See the following details	P
4.4.5.4/RD	Protection by means of protective impedance	See table 4.2/RD to 4.3/RD for details.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
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 equipment	N/A

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Clause	Requirement + Test	Result - Remark	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 equipment	N/A
4.4.6.4.1 /RD	General		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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
4.4.6.4.2 /RD	Connection to PELV and SELV circuits	No port is intended for connection of an external PELV or SELV circuit with a higher voltage than DVC As	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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 ($< 1 \text{ mm}^2$), 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.		N/A
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.	See sub-clauses 4.4.7.1.2 to 4.4.7.1.7 for details.	P

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Clause	Requirement + Test	Result - Remark	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).	Pollution degree 2 considered	P
	The PECS manufacturer shall state in the documentation the pollution degree for which the PECS has been designed.	State in the user manual.	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)	OVC II	P

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Clause	Requirement + Test	Result - Remark	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.	See above	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.		P
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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, TT	P
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.	2500V considered	P
4.4.7.1.6 /RD	Determination of the system voltage	See the following details	P
4.4.7.1.6.1 /RD	For mains supply	Max. 240Vac between a phase and earth considered for all models.	P
4.4.7.1.6.2 /RD	For non-mains supply	External batteries connected to the d.c. 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.		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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	X2 and Y1 or Y2 capacitors complied with IEC 60384-14	P
	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		P
4.4.7.2/RD	Insulation to the surroundings	See the following details	P
4.4.7.2.1 /RD	General	See above	P
4.4.7.2.2 4.4.7.2.2 /RD	Circuits connected to mains supply	See above	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.	See above	P
4.4.7.2.3 /RD	Circuits connected to non-mains supply		N/A
	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.		N/A
	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.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
4.4.7.3/RD	Functional insulation		P
	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

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Clause	Requirement + Test	Result - Remark	Verdict
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.	See Table 4.4.7.4/RD	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.		P
4.4.7.4.2 /RD	Electric field homogeneity		N/A
	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.		N/A
4.4.7.4.3 /RD	Clearance to conductive enclosure		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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	Material group IIIb is assumed to be used.	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".		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.		P
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
	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 consideration	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.	See 4.2/RD	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	No such consideration	N/A
4.4.7.8/RD	Solid insulation	See below for details.	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
	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.	Complied	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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	Approved AC terminal block used	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.	See Table 4.4.7.8.2/RD	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.		N/A
	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.		N/A
4.4.7.8.3/RD	Thin sheet or tape material		P
4.4.7.8.3.1/RD	General	See Table 4.4.7.8.3.2/RD	P
	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		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		N/A
	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.		N/A
	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.		N/A
	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.		N/A
4.4.7.8.3.3 /RD	Material thickness less than 0,2 mm		P
	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.	Transformer, min. two layer tapes for basic insulation.	P
	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	See table 4.4.7.10 /RD, 5.2.3/RD for details.	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
4.4.7.8.4 /RD	Printed wiring boards (PWBs)		P
4.4.7.8.4.1 /RD	General		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	Multi-layer PWBs used, 4.4.7.8.1/RD, 4.4.7.10.1/RD and 4.4.7.10.2/RD considered.	P
4.4.7.8.4.2 /RD	Use of coating materials	No coated printed boards.	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

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Clause	Requirement + Test	Result - Remark	Verdict
4.4.7.8.5 /RD	Wound components		P
	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.		P
4.4.7.8.6 /RD	Potting materials	No potting materials used.	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)		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/RD	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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
	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.	No solid insulation used on 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.	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.		N/A
4.4.7.11 /RD	Insulation requirements above 30kHz		N/A
4.4.8/RD	Compatibility with residual current-operated protective devices (RCD)		P
	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.		P
	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	Result - Remark	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.	For permanently connected UPS limit value 15s considered.	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.	IP20 considered.	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		P
4.5.2 4.5.2/RD	Service access areas	No such area	N/A
	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.		N/A
	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.		N/A
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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
	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.	No internal batteries provided.	N/A
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

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	With having the following components: a) Components in primary circuits c) Insulated wiring Semiconductor devices, transistors, diodes, integrated circuits d) Resistors, capacitors, inductors The fire enclosure is required.	P
4.6.3.2/RD	Flammability of enclosure materials		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
	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 used.	N/A
	Metals, ceramic materials, and glass which is heat-resistant tempered, wired or laminated, are considered to comply without test.	Metal enclosure used.	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.	No such materials for components that fill an opening in a fire 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.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		N/A
	Compliance shall be checked by visual inspection and, where necessary, by test.....		P
4.6.3.3/RD	Openings in fire enclosure		P
4.6.3.3.1/RD	General		P
4.6.3.3.2 4.6.3.3.2/RD	Openings in the top and side of fire enclosures		P
	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.	No 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.	P
	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.		P
4.6.3.3.3/RD	Openings in the bottom of a fire enclosure	No bottom openings	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	No such doors or covers	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		N/A
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
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	See below	P
	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.	See table 4.6.5/RD for details.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	See table 4.6.5/RD for details.	P
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	No such 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
	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.		N/A
4.7.2.3.2/RD	Corrosion resistance		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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.		N/A
4.7.2.3.3 /RD	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.		N/A
4.7.2.3.5 /RD	Leakage of 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		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		N/A
	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		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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	No such area	N/A
4.8	Equipment with multiple sources of supply	Maybe external batteries provided	P
4.8.101	General		P
4.8.102	Backfeed protection	Backfeed protection provided externally to the UPS.	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.	Relevant information specified in user manual.	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).	Relevant information specified in user manual.	P
4.10	Protection against sonic pressure hazards		N/A
4.11	Wiring and connections	Relevant information specified in user manual.	P
4.11.1/RD	General		P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	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.		P
4.11.2/RD	Routing		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 clamping 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	Result - Remark	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.		P
4.11.6/RD	Interconnection between parts of the PECS		P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	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		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	Approved power connection terminals used by UL.	P
4.11.8.1/RD	Construction requirements		P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	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	See below sub-clause.	P
	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.	The terminals 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.		N/A
	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.		N/A
	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.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
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		N/A
	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.		N/A
4.12.3/RD	Cast metal		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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 cm² or having any dimension larger than 150 mm; • not less than 1,2 mm thick for an area of 155 cm² 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 cm² or having any dimension more than 150 mm; • at least 1,5 mm thick for an area of 155 cm² 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	Mechanical test considered.	P
4.12.5/RD	Stability test for enclosure		P
	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.		P
4.101	UPS isolation and disconnect device		P
4.101.1	Emergency switching (disconnect) device		P
4.101.2	Normal disconnect devices		P

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Clause	Requirement + Test	Result - Remark	Verdict
4.102	Stored energy source	Maybe external batteries provided	N/A
4.102.1	General		N/A
4.102.2	Accessibility and maintainability		N/A
4.102.3	Distance between battery cells		N/A
4.102.4	Case insulation		N/A
4.102.5	Electrolyte spillage		N/A
4.102.6	Ventilation and hydrogen concentration		N/A
4.102.7	Charging voltages		N/A
4.102.8	Battery circuit protection		N/A
4.102.8.1	Overcurrent and earth fault protection		N/A
4.102.8.2	Location of protective device		N/A
4.102.8.3	Rating of protective devices		N/A
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	Neutral to earth Neutral to earth through high impedance	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)		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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
5.2.2.1/RD	Clearance and creepage distance test (type test)		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)	IP20	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.	IP20	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

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Clause	Requirement + Test	Result - Remark	Verdict
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	250 N applied to outer enclosure.	P
5.2.2.4.3 /RD	Impact test (type test)	No hazard as result from steel ball fall test.	P
5.2.2.4.4	Drop test	Not required for this equipment.	N/A
5.2.2.4.5 /RD	Stress relief test	Tested at temperature of 70 °C. No distortion of enclosure observed and no hazards.	P
5.2.2.5/RD	Stability test	The UPS do not overturn when: - tilted to an angle of 10° - a force equal to 250N - use a constant downward force of 800N. Warning information provided on the marking and instruction to guide the end user aware of this hazard during the future usage.	P
5.2.2.6	Wall, ceiling or rack mounted equipment test	No such function	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 rack mounted equipment all mounted equipment.	N/A
5.2.2.7/RD	Handle and manual controls securement test		N/A
5.2.2.101	Cord guard test	No cord guard provided	N/A
5.2.3/RD	Electrical tests	See table 4.4.7.10 /RD, 5.2.3/RD.	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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)	2500V between primary live parts to PE See Table 4.4.7.10/RD 5.2.3/RD	P
5.2.3.3/RD	Alternative to impulse voltage test (type test and sample test)		N/A
	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.		N/A
	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.		N/A
	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.		N/A
5.2.3.4/RD	Ac or d.c. voltage test (type test and routine test)	See Table 4.4.7.10/RD 5.2.3/RD	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
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

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Clause	Requirement + Test	Result - Remark	Verdict
	a) Test (1) between accessible conductive part 8 connected 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.		N/A
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 for type test; 1s for routine test.	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
5.2.3.5/RD	Partial discharge test (type test, sample test)	The recurring peak working voltage across the insulation is less than 750V and the voltage stress on the insulation is less than 1kV/mm.	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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)	Tested on detective resistance for basic insulation.	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)	See Table 4.4.4.3.3 /RD	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.		P
	• 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.		P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	• 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.		P
	• For a PSCS with a particular earthing system, this system shall operate as intended during the test.		P
	• 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)	See table 4.4.9/RD.	P
	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.	Caution label including the discharge time is provided on the whole UPS enclosure.	P
5.2.3.9	Limited power source test (type test)	See table 4.6.5/RD	P
5.2.3.10 5.2.3.10 /RD	Temperature rise test (type test)	See table 4.6.4/RD.	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 $\pm 1^{\circ}\text{C}$ between any of the three successive readings, with respect to the ambient temperature.		P

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
	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
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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		P
5.2.3.11.2.1/RD	Test conditions	Test current: 800A; Test duration: 10 minutes; Voltage drop measured: Input PE to earthed side enclosure: 5.6V;	P

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Clause	Requirement + Test	Result - Remark	Verdict
	Where required by 4.4.4.2/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.		P
5.2.3.11.2.2/RD	Test current, duration and acceptance criteria	10 mins	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.	Less than 460A	N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	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)	See above	P
	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.	10kA considered.	P
	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.	Complied according to analysis the path have enough capability to withstand short circuit.	P
5.2.3.11.4 /RD	Protective equipotential bonding continuity test (routine test)	Overcurrent protective device rating less than 460A.	N/A
5.2.3.101	Backfeed protection test (type test)		N/A
5.2.3.101.1	General		N/A
5.2.3.101.2	Test for pluggable UPS		N/A
5.2.3.101.3	Test for permanently connected UPS		N/A
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	See table 4.3.101, 5.2.3.102	P
5.2.3.103	Short-time withstand current test (type test)	Icc≤10kA, not exceeding 10kA	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	Icc≤10kA, not exceeding 10kA	P
5.2.3.104	Transformer protection test	See Table 4.2/RD to 4.3/RD	P
5.2.3.105	Unsynchronized load transfer test	See Table 4.2/RD to 4.3/RD	P
5.2.3.105.1	General		P

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Clause	Requirement + Test	Result - Remark	Verdict
5.2.3.105.2	Phase displacement		P
5.2.4/RD	Abnormal operation and simulated fault tests	See table 4.2/RD and 4.3/RD	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
	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.	No fire propagated beyond the equipment. No molten metal was emitted. Electric strength tests from primary to SELV and primary to PE were passed.	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)	No more than 460 A for overcurrent protective device rating.	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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)	See table 4.2/RD to 4.3/RD	P
5.2.4.4.1 /RD	Load condition		P
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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)	See table 4.2/RD to 4.3/RD	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 mm ² . 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
5.2.4.6.3 /RD	Test sequence		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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)	See Table 4.2/RD to 4.3/RD	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)	See table 4.2/RD to 4.3/RD	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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
	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.	Approved power connection terminals used by UL.	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)		N/A
5.2.5.6/RD	Flaming oil test (type test)		N/A
5.2.5.7/RD	Cemented joints test (type test)		N/A

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Clause	Requirement + Test	Result - Remark	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)	See the following details	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.	No hazard as result from Dry heat test, Damp heat test, Vibration test.	P
5.2.6.2/RD	Acceptance criteria		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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
	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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	The label was subjected to the permanence of marking test. The label was rubbed with cloth soaked with water for 15 s and then again for 15 s with the cloth soaked with petroleum spirit. After this test there was no damage to the label. The marking on the label did not fade. There was neither curling nor lifting of the label edge.	P
6.1.102	Removable parts	No required markings placed on removable parts.	P
6.2	Information for selection	See rating label	P
6.3	Information for installation and commissioning	Detailed information regarding external interfaces and connection of supply and loads provided in the user's manual	P
6.3.1/RD	General		P
6.3.2/RD	Mechanical considerations		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The following drawings shall be prepared by the manufacturer: - Dimensional drawing, including mass information - Mounting drawing		P
6.3.3/RD	Environment		P
	In accordance with 4.9/RD the following environmental conditions shall be specified, for operation, transportation and storage:	Relevant and sufficient information provided in manual.	P
	Climatic (temperature, humidity, altitude, pollution, ultra-violet light, etc.)	See above	P
	Mechanical (vibration, shock, drop, topple, etc.)	See above	P
	Electrical (overvoltage category)	See above	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	See the following details	N/A
	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.	Enclosure temperature did exceed the limit of 4.6.4.2/RD	N/A
	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	Relevant and sufficient information provided in manual.	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

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Clause	Requirement + Test	Result - Remark	Verdict
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	Relevant and sufficient information provided in manual.	P
	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	See the following details	P
6.3.7.1/RD	Accessible parts and circuits		N/A
	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.		N/A
	The manuals shall also indicate the precautions to be taken to ensure that the safety of DVC As connections maintained during installation.		N/A
	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.		N/A
	The manual of a PSCS shall state the maximum voltage allowed to be connected to each port.		N/A
	The manuals shall provide instructions for the use of PELF circuits within a zone of equipotential bonding.		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
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)	TN, TT	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	Class I	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
	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)	Only PE of "Normal AC supply" with symbol 60417-1-IEC-5019, others with symbol 60417-1-IEC-5017.	P
	With the letters PE		P
	The colour coding green or green-yellow	Green-yellow	P
6.3.7.3.3/RD	Protective class II equipment	Class I 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		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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.	Leakage current of the equipment does not exceed 3.5 mA. However due to the connected load has influence on the overall earth leakage current a corresponding statement was provided in the user's manual.	P
6.3.7.5/RD	Compatibility with RCD marking		P
	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.)		P
6.3.7.6/RD	Cable and connection		N/A
	Any particular cable and connection requirements shall be identified in the installation and maintenance manuals.		N/A
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	Relevant and sufficient information provided in manual.	P
	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	Relevant and sufficient information provided in manual.	P

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Clause	Requirement + Test	Result - Remark	Verdict
6.4	Information for use	Relevant and sufficient information provided in manual or warning labels.	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	Result - Remark	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

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Clause	Requirement + Test	Result - Remark	Verdict
	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 stating that it does not disconnect all power to the PSCS.		N/A
	Where a control circuit disconnecter 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 disconnecter stating that it does not disconnect all power to the PSCS.		N/A
6.4.3.3/RD	Visual and audible signals		N/A
	Visual signals such as flashing lights, and audible 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.		N/A
6.4.3.4/RD	Hot surfaces		N/A
	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.	No parts exceeding the touch temperature limits	N/A
6.4.3.5/RD	Control and device marking		P

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Clause	Requirement + Test	Result - Remark	Verdict
	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	Relevant and sufficient information provided in manual or warning labels.	P
6.4.3.102	Protection in building installation	Protection against electric shock does not rely on residual current devices.	P
6.4.3.102.1	General		P
6.4.3.102.2	Rated conditional short-circuit current (Icc)	10kA	P
6.4.3.102.3	Prospective short-circuit current (Icp)	Less than 10kA	P
6.4.3.102.4	Requirement for building installation		P
6.4.3.103	Batteries installed within the UPS enclosure	External batteries provided.	N/A
6.5	Information for maintenance	Relevant and sufficient information provided in manual or warning labels.	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

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Clause	Requirement + Test	Result - Remark	Verdict
	• 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.	Capacitors inside require 5 minutes to discharge to a safe level after all power is removed. See warning label in final installation system.	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		N/A
	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.		N/A
6.5.101	Battery information for maintenance	External batteries is provided.	N/A
6.5.101.1	Labelling on battery		N/A
6.5.101.2	Information in instruction manual(s)		N/A
6.5.101.2.1	General		N/A
6.5.101.2.2	Instructions for battery replacement	No operator replaceable batteries.	N/A

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

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Clause	Requirement + Test	Result - Remark	Verdict
A.3/RD	Protection by means of protective impedance		P
A.4/RD	Protection by using limited voltages		P
A.5/RD	Evaluation of working voltage and selection of DVC for touch voltage, PELV and SELV circuits		N/A
A.5.1/RD	General		N/A
A.5.2/RD	Selection of DVC for touch voltage sets to protect against ventricular fibrillation		N/A
A.5.3/RD	Selection of DVC for touch voltage sets to protect against muscular reaction		N/A
A.5.4/RD	Selection of DVC for touch voltage sets to protect against startle reaction		N/A
A.5.5/RD	Determination of voltage limits for touch voltage under fault condition depending on protective equipotential bonding impedance		N/A
A.5.6/RD	Touch time- d.c. voltage zones of ventricular fibrillation		N/A
A.5.7/RD	Touch time- d.c. voltage zones of muscular reaction (inability to let go reaction)		N/A
A.5.8/RD	Touch time- d.c. voltage zones of saltwater-wet skin condition		N/A
A.5.9/RD	Touch time- a.c. voltage zones of ventricular fibrillation		N/A
A.5.10/RD	Touch time- a.c. voltage zones of muscular reaction (inability to let go reaction)		N/A
A.5.11/RD	Touch time- a.c. voltage zones for startle reaction		N/A
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		N/A
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		P
D.2/RD	Relationship of measurement to pollution degree		P
D.3/RD	Examples		P

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Clause	Requirement + Test	Result - Remark	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		P
BB.1	General		P
BB.2	Reference resistive load		P
BB.3	Reference inductive-resistive loads		P
BB.4	Reference capacitive-resistive loads		P
BB.5	Reference non-linear load		P
BB.5.1	General		P
BB.5.2	Test method		P

Annex CC	Ventilation of lead-acid battery compartments		P
CC.1	General		P
CC.2	Normal conditions		P
CC.3	Blocked conditions		P
CC.4	Overcharge conditions		P

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

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Clause	Requirement + Test	Result - Remark	Verdict

4.2/RD to 4.3/RD		TABLE: fault condition tests						P
		ambient temperature (°C)				See below		—
No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result	
1	Output	O-L	457Va.c.	1hour 15 mins	Input breaker	--	110% load. Warning signal alarm sounds (Inverter Overload). UPS transfer to bypass mode after 60 mins. No damage. No hazards.	
2	Output	O-L	457Va.c.	15 mins	Input breaker	--	125% load. Warning signal alarm sounds (Inverter Overload). UPS transfer to bypass mode after 10 mins. No damage. No hazards.	
3	Output	O-L	457Va.c.	10 mins	Input breaker	--	150% load. Warning signal alarm sounds (Inverter Overload). UPS transfer to bypass mode after 1 min. No damage. No hazards.	
4	Output (L1-L2)	S-C	457Va.c.	305 ms	Input breaker	--	UPS phase L1-N output voltage decrease to 0V and phase L2-N output voltage decrease to 0V immediately. UPS output shut down after 305ms. Warning signal alarm sounds (Load power off). Recoverable after fault removed. No damage. No hazards.	
5	Output(L1-N)	S-C	457Va.c.	306ms	Input breaker	--	UPS phase L1-N output voltage decrease to 0V and phase L2-N output voltage decrease to 0V immediately. UPS output shut down after 306ms. Warning signal alarm sounds (Load power off). Recoverable after fault removed. No damage. No hazards.	

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Clause	Requirement + Test					Result - Remark	Verdict
6	Output(L1-L2)	S-C	Battery mode	320ms	Input breaker	--	UPS phase L1-N output voltage decrease to 0V and phase L2-N output voltage decrease to 0V immediately. UPS output shut down after 320ms. Warning signal alarm sounds (Load power off). Recoverable after fault removed. No damage. No hazards.
7	Output(L1-N)	S-C	Battery mode	312ms	Input breaker	--	UPS phase L1-N output voltage decrease to 0V and phase L2-N output voltage decrease to 0V immediately. UPS output shut down after 312ms. Warning signal alarm sounds (Load power off). Recoverable after fault removed. No damage. No hazards.
8	Fan of module	Locked a fan	457Va.c.	1 hour 25 mins	Input breaker	--	Warning signal alarm sounds immediately (Fan Fault). After 1 hour 12 mins. Recoverable after fault removed. No damage. Max. Temperatures measured: Control board T1 coil: 36.5°C; Control board T1 core: 35.7°C; Ambient: 25.0°C, No hazards.
9	Fan of UPM	Locked all fans	457Va.c.	2 hours 15 mins	Input breaker	--	Warning signal alarm sounds immediately (Fan Fault). After 2 hour 10 mins. Recoverable after fault removed. No damage. Max. Temperatures measured: Control board T1 coil: 38.1°C; Control board T1 core: 37.6°C; Ambient: 25.0°C, No hazards.

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Clause	Requirement + Test					Result - Remark	Verdict
10	Ventilation opening	All blocked (all openings on the front door and rear panel)	457Va.c.	1 hour 35 mins	Input breaker	--	Warning signal alarm sounds immediately (INV Over Temperature), after 1 hour 30 mins minutes. UPS transfer to bypass mode. Recoverable after fault removed. No damage. Max. Temperatures measured: Control board T1 coil: 46.6°C; Control board T1 core: 45.3°C; Ambient: 25.0°C, No hazards.
I/O board							
11	PIN 6-8 of T1	S-C	457Va.c.	30 mins	Input breaker	--	Worked normally. No damage. No hazards.
12	Pin9-10 of T1	S-C	457Va.c.	30 mins	Input breaker	--	Worked normally. No damage. No hazards.
13	R112(BUS+ voltage detection)	S-C	457Va.c.	10 mins	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately (DC bus abnormal, Rectifier Fault). Recoverable after fault removed. No damage. No hazards.
14	R118(BUS- voltage detection)	S-C	457Va.c.	10 mins	Input breaker	--	UPM output shut down. UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately (DC bus abnormal, Rectifier Fault). Recoverable after fault removed. No damage. No hazards.
15	Opto-coupler pin1-pin2	S-C	457Va.c.	10 mins	Input breaker	--	Worked normally. No damage. No hazards.
16	Opto-coupler pin3-pin4	S-C	457Va.c.	10 mins	Input breaker	--	Worked normally. No damage. No hazards.
17	Opto-coupler pin1	O-C	457Va.c.	10 mins	Input breaker	--	Worked normally. No damage. No hazards.
18	Opto-coupler pin3	O-C	457Va.c.	10min	Input breaker	--	Worked normally. No damage. No hazards.
PFC POWER board							

IEC 62040-1							
Clause	Requirement + Test				Result - Remark		Verdict
19	Rectifier IGBT Q3 (d-g)	S-C	457Va.c.	1s	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately (Rectifier Fault). Input fuse F1-F6 opened. Q3, Q6, D4, R9, R3, R6 damaged No hazards.
20	Rectifier IGBT Q3 (d-s)	S-C	457Va.c.	1s	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately Rectifier Fault). Input fuse F1-F6 opened. Battery fuse F7, F16 opened. Q3, Q6, D3, D10, D9, damaged No hazards.
21	Rectifier IGBT Q3 (g-s)	S-C	457Va.c.	1s	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately Rectifier Fault). Input fuse F1-F6 opened. Q3, Q6, Q9, Q12, D4, D10, D9, D4, R3 damaged. No hazards.
22	Battery converter IGBT Q14 (d-g)	S-C	457Va.c.	5min	Input breaker	--	Worked normally. Warning signal alarm sounds immediately (BAT Charger Fault). No damage. No hazards.
23	Battery converter IGBT Q14 (d-s)	S-C	457Va.c.	5min	Input breaker	--	Worked normally. No damage. No hazards.
24	Battery converter IGBT Q14 (g-s)	S-C	457Va.c.	5min	Input breaker	--	Worked normally. Warning signal alarm sounds immediately (BAT Charger Fault). No damage. No hazards.
INV POWER board							

IEC 62040-1							
Clause	Requirement + Test				Result - Remark		Verdict
25	Inverter IGBT Q18 (d-s)	S-C	457Va.c.	1s	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately (Inverter Fault, INV IGBT SHORT). Input fuse F1-F6 opened. Output fuse F8-F13 opened. Q2, Q5, Q8, Q11, D1, D6, D8, D11, Q21, Q13, Q16 damaged. No hazards.
26	Inverter IGBT Q34 (d-g)	S-C	457Va.c.	1s	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately (Inverter Fault, INV IGBT SHORT). Input fuse F1-F6 opened. Output fuse F8-F13 opened. Q23, D22, Q28, Q31, Q34, R95, R89, R02 damaged. No hazards.
27	Inverter IGBT Q34 (d-s)	S-C	457Va.c.	1s	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately (Inverter Fault, INV IGBT SHORT). Input fuse F1-F6 opened. Output fuse F8-F13 opened. D19, Q28, D22, Q23, Q34, Q31, D28, Q27, Q25, D18, D21 damaged. No hazards.
28	Inverter IGBT Q34 (g-s)	S-C	457Va.c.	1s	Input breaker	--	UPS transfer to bypass mode immediately. Warning signal alarm sounds immediately (Inverter Fault, INV IGBT SHORT). Input fuse F1-F6 opened. Output fuse F8-F13 opened. Q23, Q28, Q31, Q34, D22, D24, D28, D19, Q25, Q27, Q30, Q33, D21, D25, R95, R89, R02 damaged. No hazards.
Supplementary information: S-C: short circuit, O-C: open circuit, O-L: over load							

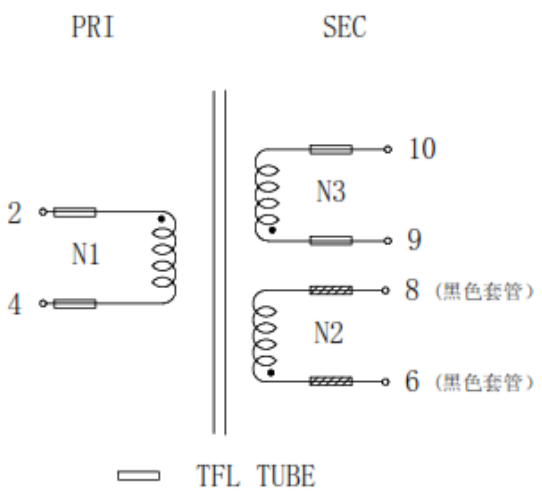
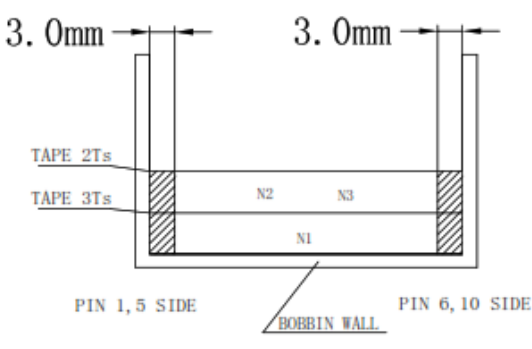
IEC 62040-1						
Clause	Requirement + Test				Result - Remark	Verdict
4.3.101, 5.2.3.102	TABLE: Electrical Data (in normal conditions)					P
fuse #	I rated (A)	U (V)	P (W)	I (A)	I fuse (A)	condition/status
--	--	342/50Hz	63.5k/64.0k/ 63.5k	321.3/324.2/32 0.4	--	Normal operation, no battery battery charging
	--	342/60Hz	63.4k/64.2k/ 63.6k	321.0/342.9/32 1.2	--	
	376	380/50Hz	63.0k/63.6k/ 63.3k	287.4/289.9/28 7.7	--	
	376	380/60Hz	63.4k/63.6k/ 63.4k	289.0/290.2/28 8.0	--	
	358	400/50Hz	62.9k/63.4k/ 63.2k	273.2/275.6/27 3.5	--	
	358	400/60Hz	63.1k/63.6k/ 63.3k	274.0/276.0/27 3.8	--	
	345	415/50Hz	62.7k/63.3k/ 63.0k	260.7/263.1/26 1.3	--	
	345	415/60Hz	62.9k/63.7k/ 63.1k	261.2/263.7/26 1.8	--	
	--	457/50Hz	62.7k/63.4k/ 62.9k	237.3/239.7/23 7.8	--	
	--	457/60Hz	62.7k/63.4k/ 63.2k	237.8/240.0/23 8.2	--	
Supplementary information: Test model: NTCS33200-TY						

4.4.4.3.3 /RD	TABLE: Touch current measurement			P
Measured between:		Measured (mA)	Limit (mA)	Comments/conditions
Metal enclosure and earthing (three phase balance)		3.3 / 3.3	3.5	Switch 'e' opened
Metal enclosure and earthing (R-phase imbalance)		3.3 / 3.3	3.5	Switch 'e' opened
Metal enclosure and earthing (S-phase imbalance)		3.3 / 3.3	3.5	Switch 'e' opened
Metal enclosure and earthing (T-phase imbalance)		3.3 / 3.3	3.5	Switch 'e' opened
RS232 port and earthing		0.18 / 0.18	0.25	Switch 'e' closed
RS485 port and earthing		0.18 / 0.18	0.25	Switch 'e' closed

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Clause	Requirement + Test	Result - Remark	Verdict
USB port and earthing	0.18 / 0.18	0.25	Switch 'e' closed
LBS port and earthing	0.18 / 0.18	0.25	Switch 'e' closed
Parallel port	0.18 / 0.18	0.25	Switch 'e' closed
LCD display with foil to earthing	0.024 / 0.024	0.25	Switch 'e' closed
Supplementary information:			

4.4.7/RD		TABLE: Transformers						P
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.	
Transformer T1 on ECU board	Pri. to secondary: Reinforced insulation	420	250	3000VAC	3.0	6.0	--	
Transformer T1 on ECU board	Pri. to core: basic/ supplementary insulation	420	250	1500VAC	1.5	3.0	--	
Transformer T1 on ECU board	Sec. to core: basic/ supplementary insulation	420	250	1500VAC	1.5	3.0	--	
Loc.	Tested insulation			Test voltage/ V	Measured clearance / mm	Measured creepage dist./ mm	Measured distance thr. insul. / mm; number of layers	
Transformer T1 on ECU board	Pri. to secondary: Reinforced insulation			3000VAC	6.0	6.2	3 layers of insulating tape and one layer of epoxy	
Transformer T1 on ECU board	Pri. to core: basic/ supplementary insulation			1500VAC	3.0	3.1	3 layers of insulating tape and one layer of epoxy	
Transformer T1 on ECU board	Sec. to core: basic/ supplementary insulation			1500VAC	3.0	3.1	3 layers of insulating tape and one layer of epoxy	
Supplementary information:								

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Clause	Requirement + Test	Result - Remark	Verdict

4.4.7/RD	TABLE: Transformers	P
Transformer: Transformer T1 on ECU board Construction / winding diagram: SCHEMATIC:  WINDING CONSTRUCTION: 		

4.4.7.2/RD	TABLE: Working Voltage Measurement			--
Location		RMS voltage (V)	Peak voltage (V)	Comments
BUS Capacitor BUS + to PE		292.2	334.7	--
BUS Capacitor BUS - to PE		288.4	326.4	--
T1 pin2-pin6		99	278	--
T1 pin2-pin8		100	278	Max. Vpeak
T1 pin2-pin9		71	220	--
T1 pin2-pin10		69	206	--
T1 pin4-pin6		99	254	--
T1 pin4-pin8		92	114	--
T1 pin4-pin9		106	128	--
T1 pin4-pin10		117	150	Max. Vrms
U1 pin1-pin3		65	115	--
U1 pin1-pin4		106	168	--
U1 pin2-pin3		107	176	--
U1 pin2-pin4		106	174	--
Supplementary information:				

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Clause	Requirement + Test			Result - Remark		Verdict
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:	Up (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Whole unit						
Line1 to Line2 before Fuse (FI)	587	418	3.0	4.5	4.2	4.5
Line2 to Line3 before Fuse (FI)	587	418	3.0	4.5	4.2	4.5
Line1 to N before Fuse (FI)	420	250	3.0	4.5	3.0	4.5
Primary trace to earthed (BI)	420	250	3.0	7.0	3.0	7.0
Metal enclosure to bare pin of battery terminal	420	250	3.0	12.2	3.0	15.8
Heatsink on Main board to earthed enclosure after 250N force	420	250	3.0	8.2	3.0	8.6
Primary trace to PE	420	250	3.0	4.0	3.0	4.0
Primary pin to earthed metal plate	420	250	3.0	7.2	3.0	7.9
Input EMI Board						
Primary traces to earthed traces nder inlet	420	250	3.0	3.1	3.0	3.1
Primary traces to earthed traces nder Y2-cap	420	250	3.0	3.1	3.0	3.1
Primary pin to earthed metal plate	420	250	3.0	5.7	3.0	5.7
Control board						
Primary trace to secondary trace under Optocoupler	420	250	5.5	6.8	5.5	6.8
Primary trace to secondary trace under the isolation chip	420	250	5.5	6.8	5.5	6.8
Primary pin to earthed metal plate	420	250	3.0	8.6	3.0	9.1
Supplementary information: FI=Functional insulation, BI=Basic insulation, RI=Reinforced insulation. Unless otherwise specified, the worst conditions of Cl. & Cr. In above mentioned locations have been considered and listed.						

4.4.7.8.2 /RD	TABLE: Ball Pressure Test of Thermoplastics	P
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Clause	Requirement + Test	Result - Remark	Verdict
Allowed impression diameter (mm)		2	—
Object/ Part No./ Material	Manufacturer/ trademark	Test temperature (°C)	Impression diameter (mm)
AC connector	See table List of critical components	125	1.1
AC terminal block	See table List of critical components	125	0.9
Supplementary information:			

4.4.7.8.2 /RD	TABLE: Resistance to heat and fire - Glow wire tests							N/A
Object/ Part No./ Material	Manufacturer / trademark	Glow wire test (GWT); (°C)						Verdict
		550	650		750		850	
			te	ti	te	ti		
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--
Object/ Part No./ Material	Manufacturer / trademark	Glow-wire flammability index (GWFI), °C				GW ignition temp. (GWIT), °C		Verdict
		550	650	750	850	675	775	
		--	--	--	--	--	--	
--	--	--	--	--	--	--	--	--
The test specimen passed the glow wire test (GWT) with no ignition [(te – ti) ≤ 2s] (Yes/No) :								--
If no, then surrounding parts passed the needle-flame test of annex E (Yes/No)..... :								--
The test specimen passed the test by virtue of most of the flaming material being withdrawn with the glow-wire (Yes/No)?..... :								--
Ignition of the specified layer placed underneath the test specimen (Yes/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)
Plastic front panel		250	AC 3000	0.4	>0.4*
Epoxy Resins		250	AC 3000	0.4	>0.4*

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Clause	Requirement + Test	Result - Remark	Verdict

Supplementary information:

*See table List of critical components.

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)	
Primary to accessible LCD display	DC 4240	4000	--	No	
Primary to USB port	DC 4240	4000	--	No	
Primary to LBS port	DC 4240	4000	--	No	
Primary to RS232 port	DC 4240	4000	--	No	
Primary to RS485 port	DC 4240	4000	--	No	
Primary to parallel port	DC 4240	4000	--	No	
Input/output to earth	DC 2120	2500	--	No	
Battery +/- to earth	DC 2120	2500	--	No	
Primary to secondary in safety isolation transformer T1	DC 4240	4000	--	No	
Primary to core of T1	DC 2120	2500	--	No	
Secondary to core of T1	DC 2120	2500	--	No	
Any one Insulation tape	DC 4240	4000	--	No	
Supplementary information:					

4.4.9/RD	TABLE: Capacitor discharge				P
Condition	τ calculated (s)	τ measured (s)	$t_{u \rightarrow 0V}$ (s)	Comments	
Input L1-N	--	2.43	7.8	Tested at online mode with batteries	
Input L2-N	--	2.22	7.22		
Input L3-N	--	3.18	9.92		
Input L1-PE	--	3.21	10.34		
Input L2-PE	--	2.32	9.18		
Input L3-PE	--	3.15	9.99		
Input N-PE	--	0	0		

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Clause	Requirement + Test			Result - Remark	Verdict
Input L1-N	--	2.28	9.68	Tested at bypass mode without batteries	
Input L2-N	--	3.12	10.76		
Input L3-N	--	3.14	11.02		
Input L1-PE	--	2.26	9.13		
Input L2-PE	--	2.26	8.84		
Input L3-PE	--	3.08	9.92		
Input N-PE	--	0	0		
Supplementary information: Test with model NTCS33200-TY					

4.6.3/RD	TABLE: Resistance to fire					P
Part	Manufacturer of material	Type of material	Thickness (mm)	Flammability class	Evidence	
Material of front panel	See table List of critical components	See table List of critical components	See table List of critical components	5VA	UL	
Epoxy Resins	See table List of critical components	See table List of critical components	See table List of critical components	5VA	UL	
Supplementary information:						

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	
--	--	--	--	--	--	
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	TABLE: Heating Test		P
	Test voltage (V)..... :	See below	—
	Ambient (°C):	See below	—
Thermocouple Locations		Max. temperature measured, (°C)	Max. temper ature limit,

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Clause	Requirement + Test		Result - Remark		Verdict
					(°C)
Test condition:	a	b	—	—	—
C93 body(YDC3300 MO4)	46.9	46.3	—	—	125
D5 body(YDC3300 MO4)	48.0	47.4	—	—	150
L15 coil(YDC3300 MO4)	48.3	48.1	—	—	130
L5 coil(YDC3300 MO4)	49.8	49.4	—	—	130
Q27 body(YDC3300 MO4)	53.8	52.5	—	—	175
C30 body(YDC3300 MO6)	54.6	53.2	—	—	125
C157 body(YDC3300 MO6)	51.7	50.4	—	—	105
L7 coil(YDC3300 MO6)	58.1	55.1	—	—	130
PCB near D88(YDC3300 MO6)	52.4	51.6	—	—	130
T7 core(YDC3300 MO6)	57.1	56.7	—	—	110
T7 coil(YDC3300 MO6)	60.3	59.7	—	—	110
T6 coil(YDC3300 MO6)	45.0	44.5	—	—	130
PCB near HS4(YDC3300 MO6)	46.6	46.4	—	—	130
T5 coil(YDC3300 MO6)	51.1	50.3	—	—	130
C84 body(YDC3300 MO6)	51.1	50.4	—	—	125
L6 coil(YDC3300 MO6)	51.2	50.9	—	—	130
PCB near Q12(YDC3300 MO6)	52.3	50.5	—	—	130
K2 body(YDC3300 MO6)	52.6	51.7	—	—	85
R143(YDC3300 MO6)	46.2	45.0	—	—	--
L8 coil(YDC3300 MO6)	53.7	53.7	—	—	130
C268 body(YDC3300 MO6)	54.0	53.3	—	—	125
C26 body(YDC3300 MO5)	54.9	55.9	—	—	125
L2 coil(YDC3300 MO5)	56.3	57.5	—	—	130
RLY4 body(YDC3300 MO5)	55.0	56.1	—	—	85
CT2 body(YDC3300 MO5)	54.9	56.8	—	—	130
C52 body(YDC3300 MO5)	56.6	58.5	—	—	125
C8 body(YDC3300 MO3)	52.4	51.7	—	—	105
L4 coil(YDC3300 MO3)	68.4	73.6	—	—	130
C6 body(YDC3300 MO3)	46.5	46.7	—	—	105
L6 coil(YDC3300 MO3)	44.5	44.8	—	—	130
D16 body(YDC3300 MO3)	53.4	55.2	—	—	150
Fan	50.6	50.5	—	—	--

IEC 62040-1					
Clause	Requirement + Test		Result - Remark		Verdict
T2 core(HPM3350 uo5)	50.8	51.4	—	—	110
T2 coil(HPM3350 uo5)	50.8	51.8	—	—	110
U45 body(HPM3350 uo5)	52.2	52.9	—	—	115
T1 core(YDC3300 uo7)	52.9	53.3	—	—	110
T1 coil(YDC3300 uo7)	53.3	54.4	—	—	110
U45 body(YDC3300 uo7)	52.1	52.1	—	—	115
C1 body(filter board)	44.1	44.3	—	—	105
Input wire board plug	44.2	44.5	—	—	75
C8 body(filter board)	44.1	44.2	—	—	105
C15 body(YDC3300 004)	45.8	47.0	—	—	125
C8 body(YDC3300 004)	45.9	46.4	—	—	105
MOV2 body(YDC3300 004)	45.4	45.3	—	—	85
T2 core(Rev.001)	45.0	44.9	—	—	110
T2 coil (Rev.001)	45.1	44.9	—	—	110
PCB near Q7(Rev.001)	45.0	45.2	—	—	130
Ambient	40.0	40.0	—	—	--
Supplementary information:					
a. Recharge mode, I/P: 342V/50Hz, O/P: with Rating load until battery is full and temperature stable.					
b. Recharge mode, I/P: 457V/50Hz, O/P: with Rating load until battery is full and temperature stable.					

4.6.4/RD	TABLE: Heating test, resistance method					N/A
	Test voltage (V).....:					—
	Ambient, t₁ (°C)					—
	Ambient, t₂ (°C)					—
Temperature rise of winding	R₁ (Ω)	R₂ (Ω)	ΔT (K)	Max. dT (K)	Insulation class	
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Supplementary information:						

4.6.5/RD	TABLE: Limited power sources	P
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IEC 62040-1						
Clause	Requirement + Test			Result - Remark		Verdict
Components	Test condition (Single fault)	Uoc (V)	Isc (A)		VA	
			Meas.	Limit	Meas.	Limit
RS232 port	Output S-C	0*	0*	8	0*	100
RS485 port	Output S-C	0*	0*	8	0*	100
USB port	Output S-C	0*	0*	8	0*	100
Supplementary information: 1. S-C= short circuits 2. * indicate the unit shut down immediately.						

4.8.102, 5.2.3.101	TABLE: Backfeed protection				N/A
Condition		Voltage measured (V)			Comments
		L-N	L-PE	N-PE	
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--		--	--	--	--
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--		--	--	--	--
--		--	--	--	--
--		--	--	--	--
Supplementary information:					

4.12.1/RD, 5.2.2.4.3 /RD	TABLE: Impact Resistance			P
Impacts per surface		Surface tested	Impact energy (Nm)	Comments
Front		Front	6.4	No damage, no hazard
Top		Top	6.4	No damage, no hazard
Side		Side	6.4	No damage, no hazard
Rear		Rear	6.4	No damage, no hazard
Supplementary information:				

Annex CC	TABLE: Ventilation of lead-acid battery compartments	P
The required dimension for the ventilation openings will be calculated with the following formula:		
$A \geq Q/360 [m^2]$		

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict
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 : 40 (6 cells per battery, 40 battery in series) (for all models)			
C : 100Ah for all models			
$A \geq (0.054 * n * 0.2 \text{ A/100 Ah} * C)/360$			
$A=0.01 \geq 7.2 \times 10^{-3}$ for all models			
Verdict			
The size of ventilation openings in battery cabinet exceeds the required airflow by far (as well as the UPS).			
Supplementary information:			

IEC 62040-1			
Clause	Requirement + Test	Result - Remark	Verdict

TABLE: List of critical components					P
Object/part no.	Manufacturer/trademark	Type/model	Technical data	Standard	Mark(s) of conformity ¹⁾
Whole unit					
Enclosure	Various	Hot Galvanized Steel	Thickness min. 0.8mm	IEC 62040-1	Tested with appliance
Plastic front panels	LG Chem Huizhou Petrochemical Co Ltd	ABS+PC FR-310C	UL94-V0, thickness 2.5mm, 60°C	UL796	UL E476284
Breaker for 150k&160 k models	Nader	NDM3-250C/3321 3P	250A/400V	IEC 60947-2	TUV 50234712
(Alternative)	CHINT	NXM-250S/3300 3P	250A/400V	IEC 60947-3	CE
(Alternative)	Schneider	EZD250E 3P	250A/400V	IEC 60947-3	CE
Breaker for 180k &200k models	Nader	NDM3-400C/3300 3P	400A/400V	IEC 60947-2	TUV B 0835740204
(Alternative)	CHINT	NXM-400S/3300 3P	400A/400V	IEC 60947-3	CE
(Alternative)	Schneider	EZD400E 3P	400A/400V	IEC 60947-3	CE
Fan for 50k~ 67k power models	Asian Vital components Co.,Ltd	DBTB1225B2 GP072	12Vdc/3.2A, 201.69CFM, 6000RPM	IEC/EN 60950-1	TUV B 18 01 25730 821
Alternative	YCC FAN INTERNATIONAL (HK) LIMITED	YDS1225B12 F	12Vdc/3. 6A, 192.3CFM, 6000RPM	IEC/EN 60950-1	TUV R 50486168
Bypass SCR for 150k-160k models	SEMIKRON	SKKT162/16E	160A, 1600V	UL 1577	UL E63532
(Alternative)	SEMIKRON	SKKT172/16E	175A, 1600V	UL 1577	UL E63532
(Alternative)	INFINEON	TT175N16	175A, 1600V	UL 1577	UL E83335

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	ZHEJIANG GUCHI ELECTRONICS CO LTD	MTC200G-16	200A, 1600V	UL 1577	UL E304417
Bypass SCR for 180k-200k models	INFINEON	TT330N16AOF	305A, 1600V	UL 1577	UL E83335
(Alternative)	SEMIKRON	SKKT330/16E	305A, 1600V	UL 1577	UL E63532
(Alternative)	ZHEJIANG GUCHI ELECTRONICS CO LTD	MTC330-16	330A, 1600V	UL 1577	UL E304417
Internal input wire and output wire	Dongguan Yonghao Electrical Industry Co., Ltd.	UL1015	6AWG, 600V 105°C, VW-1	UL 758	UL E240426
Heat shrinkable sleeve	Sanlian	S-901-DWT-600V	V-1, 125°C thickness 0.5±0.1mm	UL 94	UL E209436
Insulating column	INDUSTRIAL DIELECTRICS INC	46-12	Minimum thickness: 3.0mm, V-0, 130°C, HWI: 0	UL 94 UL 746A	UL E53587
Insulation board	CHENGDU KANGLONGXIN PLASTICS CO LTD	FRPC-1880B	V-0, 130°C, Thickness min. 0.25mm	UL 94, UL 746	UL E315185
(Alternative)	SHENZHEN TEESUN TECHNOLOGY CO LTD	TS-FR1370	V-0, 130°C, Thickness min. 0.25mm	UL 94, UL 746	UL E329660
Parallel board					
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
Bypass signal terminal 2 (J42)	CELANESE PRODUCTION GERMANY GMBH & CO KG	A63V0	600V, 2A, V-0 125°C	UL 94 UL 746	UL E86034
Power terminal of Monitor module (J40, J43)	MITSUI CHEMICALS INC	PA6T E430N(#) (r3)	Minimum thickness: 0.7mm, V-0, 110°C	UL 94 UL 746	UL E52579

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
ECU board					
Plastic terminal material (J5)	POLYPLASTICS CO LTD	LCP E130i	Minimum thickness: 0.9mm V-0, 240°C, HWI:2	UL 94 UL 746A	UL E106764
Transformer (T1)	Click	Vertical ED25(PQ20-234)	CLASS B	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	Vertical ED25(PQ20-234)	CLASS B	IEC/EN 62040-1	Test in the appliance
(Alternative)	JEPULS technology (shenzhen) Co., LTD	Vertical ED25(PQ20-234)	CLASS B	IEC/EN 62040-1	Test in the appliance
Optocoupler (U45, U13, U50, U49, U14, U9, U62, U61, U53, U52, U33, U27, U59)	COSMO	K1010	Ext. cr.: 6.5mm, 115°C	IEC/EN 60747-5-5 UL1577	VDE 101347 UL E169586
(Alternative)	LITEON	LTV-816S	Ext. cr.: 6.5mm, 125°C	UL 1577	UL E113898
Capacitor (C4, C5, C59)	CAPXON	KM102M035I200ECA	1000UF±20% 35V, 105°C	IEC/EN 62040-1	Test in the appliance
Isolated IC (U8, U10, U24, U42, U47)	Silicon Laboratories	SI8600(a)(b)	Reinforced insulation with 5000Vrms, External Cr. 7.6mm	IEC/EN 60950-1 UL 1577	VDE 40030763 UL E257455
(Alternative)	NOVOSENSE	NSI8100W	Reinforced insulation with 5000Vrms	IEC/EN 60950-1 UL 1577	VDE 40050121 UL E500602
Isolated CAN Transceiver (U22, U25)	TI	ISO1050DWR	Reinforced insulation with 5000Vrms	IEC/EN 60950-1	TUV U8V 1109 77311 008
(Alternative)	NOVOSENSE	NSI1050-DSWR	Reinforced insulation with 5000Vrms	IEC/EN 60950-1 UL 1577	VDE 40050121 UL E500602

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
Monitoring board					
Transformer (T1)	Click	EFD25 (BCK2501)	CLASSB	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	DMR40(PQ20-20)	CLASS B	IEC/EN 62040-1	Test in the appliance
(Alternative)	JEPULS technology (shenzhen) Co., LTD	DMR40(PQ20-20)	CLASS B	IEC/EN 62040-1	Test in the appliance
Plastic terminal material (J5)	SHINKONG SYNTHETIC FIBERS CORP	E202G30	V-0, 130°C, Min. thickness: 0.75mm, HWI: 3	UL 94 UL 746	UL E107536
Optocoupler (U15, U16)	COSMO	K1010	Ext. cr.: 6.5mm, 115°C	IEC/EN 60747-5-5 UL1577	UL E169586 VDE 101347
(Alternative)	LITEON	LTV-816S	Ext. cr.: 6.5mm, 125°C	UL 1577	UL E113898
Isolated CAN Transceiver (U22)	TI	ISO1050DWR	Reinforced insulation with 5000Vrms	IEC/EN 61010-1	TUV U8V 1109 77311 008
(Alternative)	NOVOSENSE	NSI1050-DSWR	Reinforced insulation with 5000Vrms	IEC/EN 60950-1 UL 1577	VDE 40050121 UL E500602
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
Bypass SCR board					
Driving plate fuse (F1,F2,F3)	Advanced SurgeTech Materials.	HV520.4	4A/600Vac/500Vdc	UL 248 CSA-C22.2 No. 248	UL E355868
(Alternative)	XC Electronics (ShenZhen) Corp.,Ltd.	5CH 4A/600V	4A/600Vac/500Vdc	UL 248 CSA-C22.2 No. 248	UL E249609
Driving Transformer (T1,T2,T3)	Click	Vertical EFD25 (BCK2501-1682)	CLASS B	IEC 62040-1	Test in the appliance

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	JINGQUANHUA	Vertical EFD25 (BCK2501-1682)	CLASS B	IEC 62040-1	Test in the appliance
(Alternative)	JEPULS technology (shenzhen) Co., LTD	Vertical EFD25 (BCK2501-1682)	CLASS B	IEC 62040-1	Test in the appliance
Inductance (L6,L7,L10)	MITSUI CHEMICALS INC	UHTWSL3	CLASS B	IEC 62040-1	Test in the appliance
Diode (D4,D15, D16,D17, D18,D19, D21,D23, D25,D26, D27,D28, D29,D30, D31,D32, D42,D54, D55,D56, D58,D59, D60,D61, D65,D77, D78,D94, D79,D80, D81,D82, D92)	Yangjie Electronic Technology Co., Ltd.	SMB	3A, 1000V	IEC/EN 62040-1	Test in the appliance
(Alternative)	LITEON	SMB	3A, 1000V	IEC/EN 62040-1	Test in the appliance
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
AC EMI board					
X2 capacitor (C12, C18, C22)	Xiamen Faratronic	MKP62	0.33uF, 305Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40000358 UL E186600
(Alternative)	SONGTIAN	MPX	0.1uF, 305Vac, 125°C	IEC/EN 60384-14 UL 60384-14	UL E208107 VDE 40034679
X2 capacitor (C1,C7,C15)	Xiamen Faratronic	C43 MKP63	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	ENEC-SEMKO SE/0366-2C UL E186600

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	TDK	MKP	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40018909 UL E97863
Y2 capacitor (C2, C8, C16, C25, C32)	Xiamen Faratronic	C43 MKP63	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	ENEC-SEMKO SE/0366-2C UL E186600
(Alternative)	TDK	MKP	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40018909 UL E97863
Y2 capacitor (C3, C9, C17, C27, C29)	SONGTIAN	CE Series	1nF, 250Vac, 125°C	IEC/EN 60384-14 UL 60384-14	UL E208107 VDE 40025748
(Alternative)	JYA-NAY	JY	250Vac, 1nF 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40001827 UL E201384
Y2 capacitor (C6, C11, C21, C30, C31)	SONGTIAN	CE Series	1nF, 250Vac, 125°C	IEC/EN 60384-14 UL 60384-14	UL E208107 VDE 40025748
(Alternative)	JYA-NAY	JY	250Vac, 1nF 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40001827 UL E201384
Discharge resistance (R1, R2, R3, R4, R5, R6)	Interchangeable	Interchangeable	100kΩ±5% 3W	IEC 62040-1	Test in the appliance
Insulating paper	SABIC JAPAN LLC	FR700	V-0, 135°C, thickness: 0.25mm	UL 94	UL E207780
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
Mains EMI board					
X2 capacitor (C12, C18, C22)	Xiamen Faratronic	MKP62	305Vac, 125°C, 0.033uF	IEC/EN 60384-14 UL 60384-14	VDE 40000358 UL E186660
(Alternative)	SONGTIAN	MPX	0.1uF, 305Vac, 125°C	IEC/EN 60384-14 UL 60384-14	UL E208107 VDE 40034679

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
X2 capacitor (C1, C7, C15)	Xiamen Faratronic	C43 MKP63	300Vac, 0.22uF 125°C	IEC/EN 60384-14 UL 60384-14	ENEC-SEMKO SE/0366-2C UL E18660
(Alternative)	TDK	MKP	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40018909 UL E97863
Discharge resistance (R1, R3, R5)	Interchangeable	Interchangeable	200kΩ±5%, 2W	IEC 62040-1	Test in the appliance
Y2 capacitor (C2, C8, C16, C25, C32)	Xiamen Faratronic	C43, MKP63	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	ENEC-SEMKO SE/0366-2B UL E186600
(Alternative)	TDK	MKP	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40018909 UL E97863
Y2 capacitor (C3, C9, C17, C27, C29)	SONGTIAN	MPX	275Vac, 3.3nF 100°C	IEC/EN 60384-14 UL 60384-14	UL E208107 VDE 40034679
DC EMI Board					
X2 capacitor (C1, C7)	SONGTIAN	MPX	2.2uF, 305Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40034679 UL E208107
(Alternative)	TDK	MKP	0.22uF, 300Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40010694 UL E97863
Discharge resistance (R1, R2, R3, R4)	Interchangeable	Interchangeable	200kΩ±5%, 2W	IEC 62040-1	Test in the appliance
Y2 capacitor (C2, C8, C13)	Xiamen Faratronic	C43, MKP63	0.22uF 300Vac, 125°C	IEC/EN 60384-14 UL60384-14	ENEC-SEMKO SE/0366-2B UL E186600
Y2 capacitor (C4, C5, C10, C11, C15, C16)	SONGTIAN	MPX	2.2uF, 305Vac, 125°C	IEC/EN 60384-14 UL 60384-14	VDE 40034679 UL E208107

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
Y2 capacitor (C3, C6, C9, C12, C14, C17)	JYA-NAY	JY	250Vac, 4.7nF 100°C	IEC/EN 60384-14 UL 60384-14	VDE 40001827 UL E201384
(Alternative)	SONGTIAN	CE Series	250Vac, 4.7nF 100°C	IEC/EN 60384-14	VDE 40025748 UL E208107
Insulating paper	SABIC JAPAN L L C	FR700	V-0, 135°C, thickness: 0.25mm	UL 94	UL E207780
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
Power block board					
Epoxy plate	SUZHOU TAIYAO INSULATIVE MATERIALS CO LTD	FR-4	130°C, thickness 0.5mm V-0	--	UL E476190
Insulating paper	CHENGDU KANGLONGXIN PLASTICS CO LTD	FRPC-1880B	V-0, 130°C, Thickness min. 0.25mm	UL 94, UL 746	UL E315185
(Alternative)	SHENZHEN TEESUN TECHNOLOGY CO LTD	TS-FR1370	V-0, 130°C, Thickness min. 0.25mm	UL 94, UL 746	UL E329660
Plastic terminal materials	SHINKONG SYNTHETIC FIBERS CORP	E202G30	V-0, 130°C, Minimum thickness: 0.75mm, HWI: 3	UL 94 UL 746A	UL E107536
INV Power Board					

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
Busbar capacitance (C1,C2,C3,C4,C5,C6,C7,C8,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48,C49,C50,C51,C52,C53,C54) for 50k&54k power models	Jianghai	CD294	680uF, 450V, 105°C	IEC 62040-1	Test in the appliance
(Alternative)	HUNAN AIHUA GROUP CO., LTD	ELH2EM182R55KT	680uF, 450V, 105°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	CAPXON	HP821M450P550A00AH	820uF, 450V, 105°C	IEC 62040-1	Test in the appliance
(Alternative)	Aishi	ELH2WM821R50KTP	820uF, 450V, 105°C	IEC 62040-1	Test in the appliance
Busbar capacitance (C1,C2,C3,C4,C5,C6,C7,C8,C37,C38,C39,C40,C41,C42,C43,C44,C45,C46,C47,C48,C49,C50,C51,C52,C53,C54) for 60k&67k power model	CAPXON	HP821M450P550A00AH	820uF, 450V, 105°C	IEC 62040-1	Test in the appliance
(Alternative)	Aishi	ELH2WM821R50KTP	820uF, 450V, 105°C	IEC 62040-1	Test in the appliance

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
Inverter inductor (L4, L5, L6) for 50k&54k power models	Click	NPF184026×3 P	130°C	IEC 62040-1	Test in the appliance
(Alternative)	SHENZHEN JINGQUANHUA ELECTRONICS CO.,LTD	NPF184026×3 P	130°C	IEC 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	NPF184026×3 P	130°C	IEC 62040-1	Test in the appliance
Inverter inductor (L1, L2, L3, L4, L5, L6) for 60k&67k power model	Click	NPF184026×2 P	130°C	IEC 62040-1	Test in the appliance
(Alternative)	SHENZHEN JINGQUANHUA ELECTRONICS CO.,LTD	NPF184026×2 P	130°C	IEC 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	NPF184026×2 P	130°C	IEC 62040-1	Test in the appliance
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
INV Filter Board					
Output relay (RLY1, RLY2, RLY3, RLY4, RLY5, RLY6) for 50K&54K power models	SONGCHUAN	832HA-1A-F-C	40A/277Vac 4PIN, CLASS F	IEC/EN 60255-23 IEC/EN 61810-1 ANSI/UL508	UL E88991 VDE 006615
(Alternative)	Hongfa	HF165FD-G/12-HY1STF	40A/277Vac, 4PIN, CLASS F	IEC/EN 60255-23 IEC/EN 61810-1	VDE 40043143

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	Song Chuan Precision Co., Ltd.	AZ2150	12Vdc 40A/250Vac	UL 60947-4-1, UL 60947-1, IEC/EN 61810-1	UL E88991 VDE 006615
(Alternative)	Song Chuan Precision Co., Ltd.C.	AZ21501	12Vdc 50A/240Vac	UL 60947-4-1, UL 60947-1, IEC/EN 61810-1	UL E88991 VDE 006615
Output relay (RLY1, RLY2, RLY3, RLY4, RLY5, RLY6) for 60K&67K power model	Song Chuan Precision Co., Ltd.	AZ21501	12Vdc 50A/240Vac	UL 60947-4-1, UL 60947-1, IEC/EN 61810-1	UL E88991 VDE 006615
Output filter capacitor (C4, C8, C12, C51, C52, C53)	Hongfarad	HAPK225J350 RHXH	30uF, 300Vac, 155°C	IEC/EN 62040-1	TUV R 40044173
(Alternative)	Xiamen Faratronic	C6AQ13062M 3A 352	30uF, 300Vac, 155°C	EN61071:2007 EN61881-1:2011 UL 810	TUV R 50266136 UL E256238
(Alternative)	TDK	B3202	30uF, 300Vac, 90°C	UL 810 IEC/EN 61071:2007 IEC/EN	VDE 40018909
Output Fuse	Bussmann	100FE	100A, 690Vac	UL 248-1 UL 248-14	UL E91958
(Alternative)	MERSEN FRANCE SB S A S	URS	100A,700Vac,500 Vdc	UL 248 CSA-C22.2 No. 248	UL E76491
(Alternative)	Sinofuse Electric Co Ltd	RS308-HB-4G100A	100A/690Vac	UL 248 CSA-C22.2 No. 248	UL E353337-20160504
(Alternative)	Bussmann	80FE	80A, 690Vac	UL 248-1 UL 248-14	UL E91958
(Alternative)	Sinofuse Electric Co Ltd	RS308-HB-4G80A	80A/690Vac	UL 248 CSA-C22.2 No. 248	UL E353337-20160504

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
Output filter inductance (L1, L2, L3)	Click	KSF1030P-060×1P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	KSF1030P-060×1P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	KSF1030P-060×1P	130°C	IEC/EN 62040-1	Test in the appliance
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
PFC Power Board					
BOOST inductor (L19, L20, L21, L22, L23, L24) for 50K&54K power models	Click	NPF184026×2 P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	NPF184026×2 P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	NPF184026×2 P	130°C	IEC/EN 62040-1	Test in the appliance
BOOST inductor (L19, L20, L21, L22, L23, L24) for 60K&67K power model	Click	NPF184026×3 P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	NPF184026×3 P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	NPF184026×3 P	130°C	IEC/EN 62040-1	Test in the appliance
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
PFC Filter Board					

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
Input Fuse (F1, F2, F3)	Bussmann	100FE	100A/690Vac	UL 248	UL E91958
(Alternative)	MERSEN FRANCE SB S A S	URS	100A,700Vac,500 Vdc	UL 248 CSA-C22.2 No. 248	UL E76491
(Alternative)	Sinofuse Electric Co Ltd	RS308-HB-4G100A	100A/690Vac, 500Vdc	UL 248 CSA-C22.2 No. 248	UL E353337-20160504
Battery fuse (F4, F5) for 50k&54k power models	XI'AN SINFUSE ELECTRIC CO LTD	RS309-MD-150A	150A/500V	UL 248	UL E353337
(Alternative)	COOPER BUSSMANN LLC	FWH-150C	150A/500Vdc	UL 248 CSA-C22.2 No. 248	UL E91958
Battery fuse (F4, F5) for 60k&67k power model	XI'AN SINFUSE ELECTRIC CO LTD	RS309-MD-200A	200A/500V	UL 248	UL E353337
(Alternative)	COOPER BUSSMANN LLC	FWH-200C	200A/500Vdc	UL 248 CSA-C22.2 No. 248	UL E91958
Slow start relay (K1, K2)	PANASONIC CORPORATION	ALQ112	Coil: 12Vdc, 10A/125Vac, CLASS B	IEC/EN 60255-23 IEC/EN 61810-1 IEC/EN 61810-5 ANSI/UL508	UL E43028 VDE 40032836
(Alternative)	Hongfa	HF33F/012-ZS3	Coil: 12Vdc, 10A/125Vac, CLASS F	IEC/EN 60255-23 IEC/EN 61810-1 IEC/EN 61810-5	VDE 125661

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
Filter capacitor (C11, C12, C14, C16, C18, C26, C27, C29, C30, C31, C32, C34, C35, C36, C37, C38, C50, C157, C158, C253, C254, C255)	Xiamen Faratronic	C6AR8225MB 10382	2.2uF±20% 380Vac, 85°C	UL 810	UL E256238 TUV R 50266136
(Alternative)	TDK	B32754S8225 K507	2.2uF±5% 350Vac 85°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	Hongfarad	HAPK225J350	2.2uF±5% 350Vac 85°C	IEC/EN 62040-1	TUV R 40044173
(Alternative)	Hongfarad	HAPK225J380	2.2uF±5% 380Vac 85°C	IEC/EN 62040-1	TUV R 40044173
Input filter inductance 1 (L3, L4, L7)	Click	KSF1030P-060×1P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	KSF1030P-060×1P	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	KSF1030P-060×1P	130°C	IEC/EN 62040-1	Test in the appliance
Input filter inductance 2 (L2, L5, L8)	Click	R21×40×1P(L C21-022)	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	R21×40×1P(L C21-022)	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	R21×40×1P(L C21-022)	130°C	IEC/EN 62040-1	Test in the appliance
Auxiliary power transformer (T6)	Click	Vertical EP13 (EP13-315)	CLASSB	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	Vertical EP13 (EP13-315)	CLASSB	IEC/EN 62040-1	Test in the appliance

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	JEPULS technology (shenzhen) Co., LTD	Vertical EP13 (EP13-315)	CLASSB	IEC/EN 62040-1	Test in the appliance
Auxiliary power driven transformer (T7)	Click	Vertical ER40	CLASSB	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	Vertical ER40	CLASSB	IEC/EN 62040-1	Test in the appliance
(Alternative)	JEPULS technology (shenzhen) Co., LTD	Vertical ER40	CLASSB	IEC/EN 62040-1	Test in the appliance
Charging fuse (F6, F7)	littelfuse	0505025X52L EP	25A/500Vac	UL 248 CSA-C22.2 No. 248	UL E10480
(Alternative)	ASTML	HV660.25P-L	25A/500Vac	UL 248 CSA-C22.2 No. 248	UL E355868
(Alternative)	XC Electronics (ShenZhen) Corp., Ltd.	6CH Series 25A 660V	25A/660Vac/dc	UL 248 CSA-C22.2 No. 248	UL E249609
Auxiliary power fuse	Advanced SurgeTech Materials.	HV520.4	4A/600Vac/500Vdc	UL 248 CSA-C22.2 No. 248	UL E355868
(Alternative)	XC Electronics (ShenZhen) Corp., Ltd.	5CH 4A/600V	4A/600Vac/500Vdc	UL 248 CSA-C22.2 No. 248	UL E249609
Charging inductance (L6, L9)	Click	NPF184060	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	JINGQUANHUA	NPF184060	130°C	IEC/EN 62040-1	Test in the appliance
(Alternative)	Shenzhen Forward Electronics Co., Ltd	NPF184060	130°C	IEC/EN 62040-1	Test in the appliance
Y2 capacitor (C4, C7, C21, C23)	SONGTIAN	CE Series	1nF, 250Vac, 125°C	IEC/EN 60384-14 UL 60384-14	UL E208107 VDE 40025748

IEC 62040-1					
Clause	Requirement + Test			Result - Remark	Verdict
(Alternative)	JYA-NAY CO LTD	JY	250Vac, 125°C 0.001uF	UL 60384-14 CAN/CSA-E60384-14	UL E201384 VDE 40001827
Y2 capacitor (C4, C7, C21, C23)	SONGTIAN	G07E8E102M A5B0S0N0	250Vac, 125°C 0.001uF	UL 60384-14 CAN/CSA-E60384-14	UL E208107 VDE 40025748
(Alternative)	JYA-NAY CO LTD	JY	250Vac, 125°C 0.001uF	UL 60384-14 CAN/CSA-E60384-14	UL E201384 VDE 40001827
Y2 capacitor (C266, C264, C265, C267, C268, C269)	JYA-NAY CO LTD	JY	4.7nF, 250Vac, 125°C	IEC/EN 60384-14 UL 60384-14	UL E201384 VDE 40001827
(Alternative)	JYA-NAY CO LTD	JY	AC250V, 125°C, 0.047uF	UL 60384-14 CAN/CSA-E60384-14	UL E201384 VDE 40001827
PCB	Interchangeable	Interchangeable	V-0, 130°C	UL 94 UL796	UL
Supplementary information: ¹⁾ Provided evidence ensures the agreed level of compliance. See OD-CB2039.					



External view



External view



External view



External view



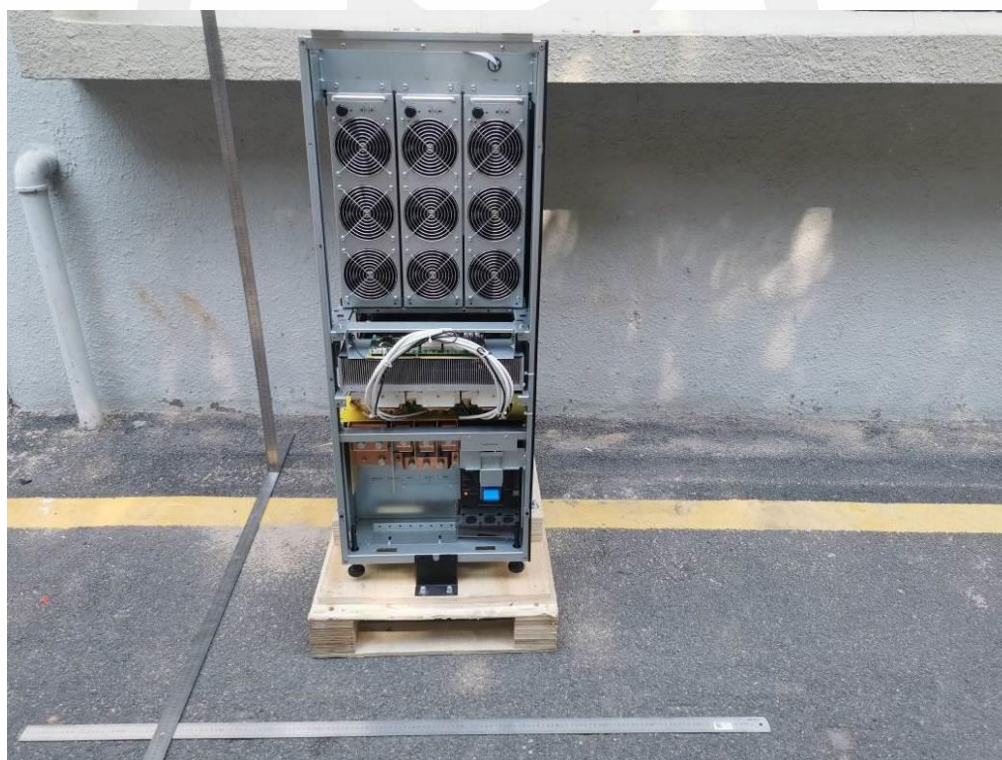
External view



External view



Internal view



Internal view



Internal view



Internal view



External view of module



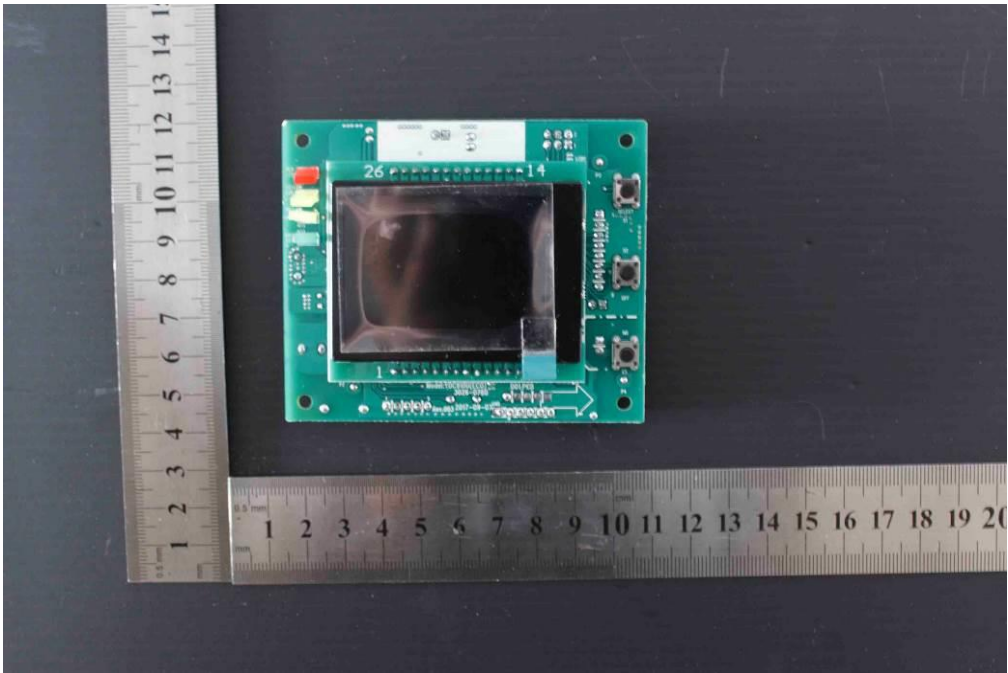
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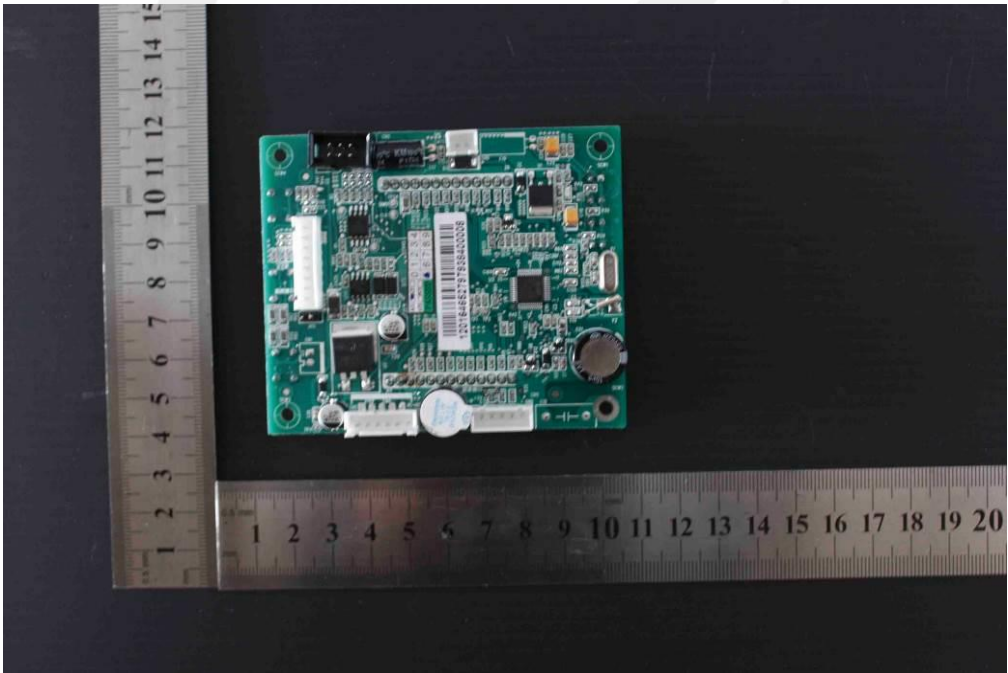
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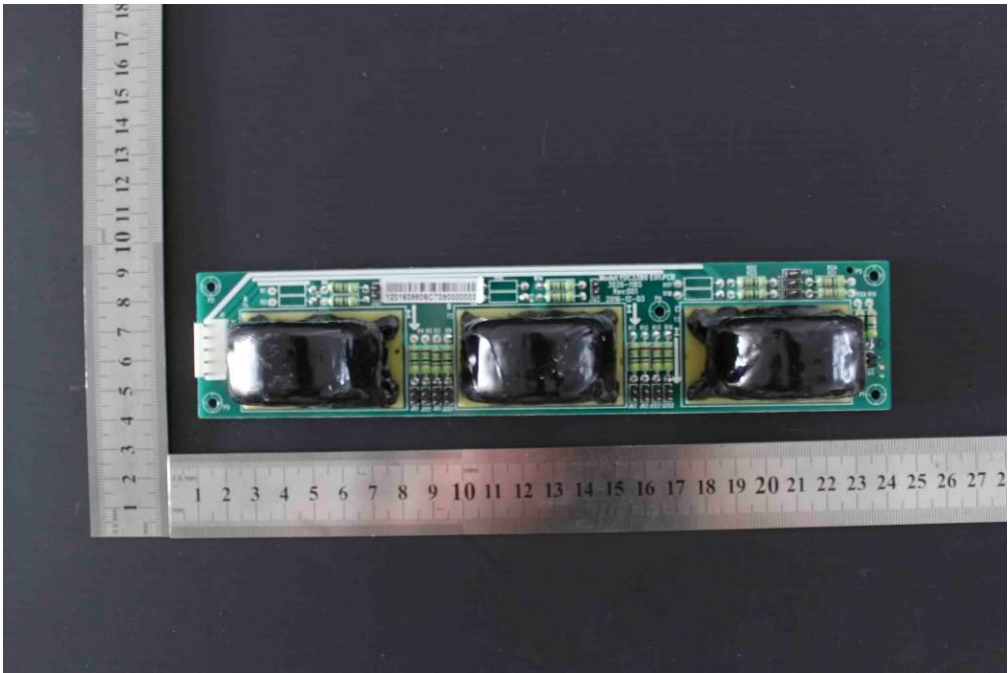
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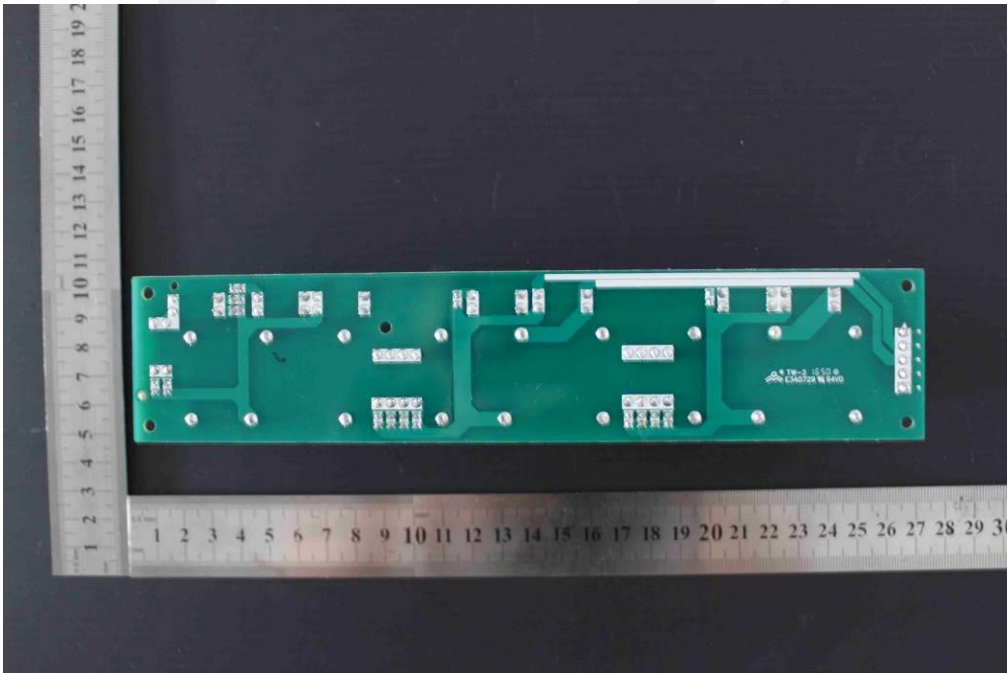
PCB view



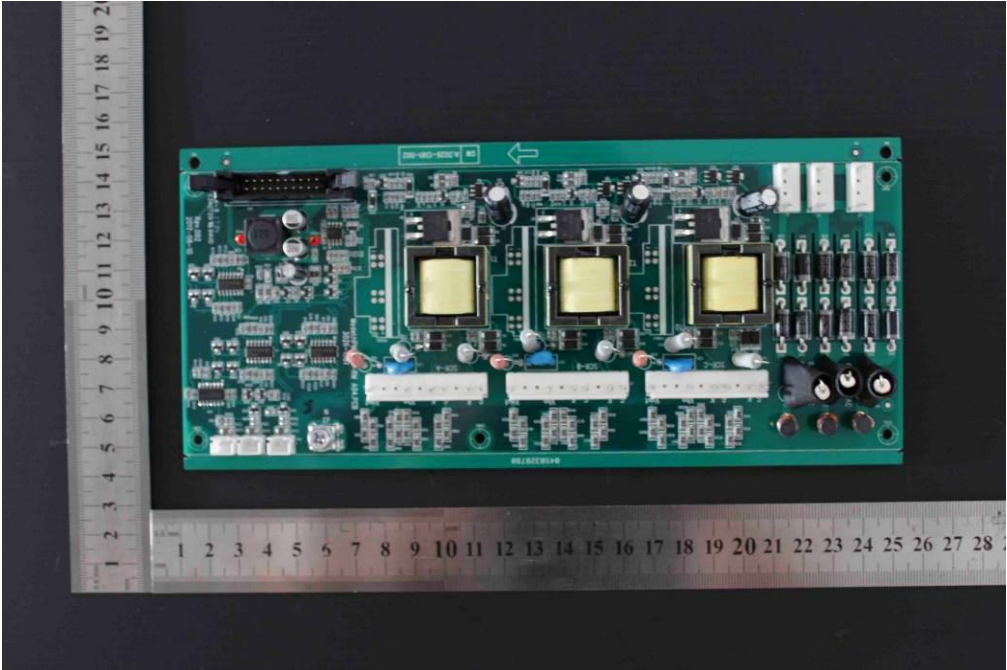
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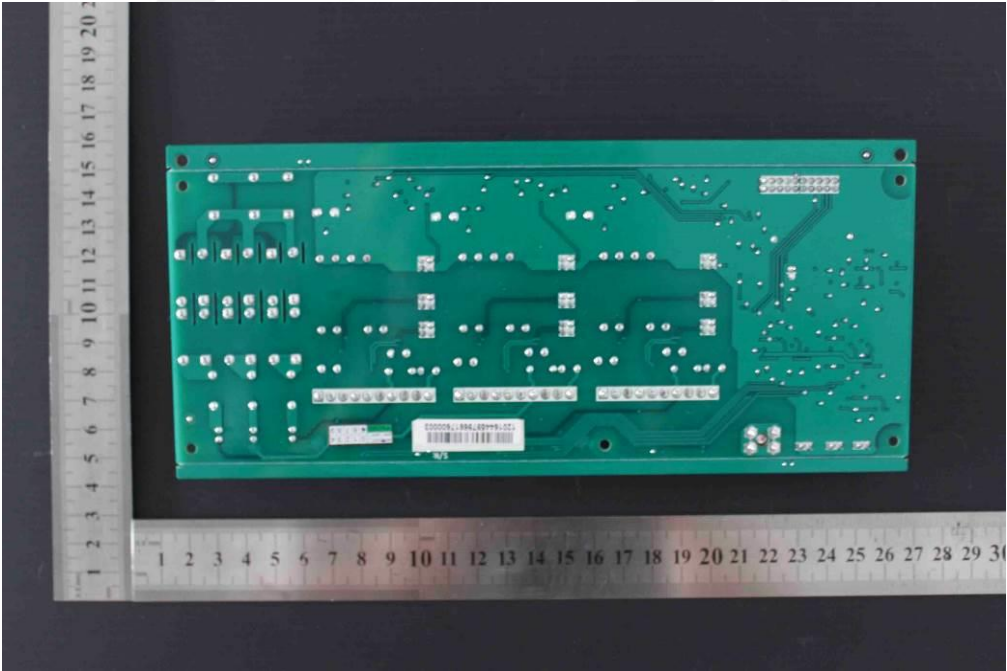
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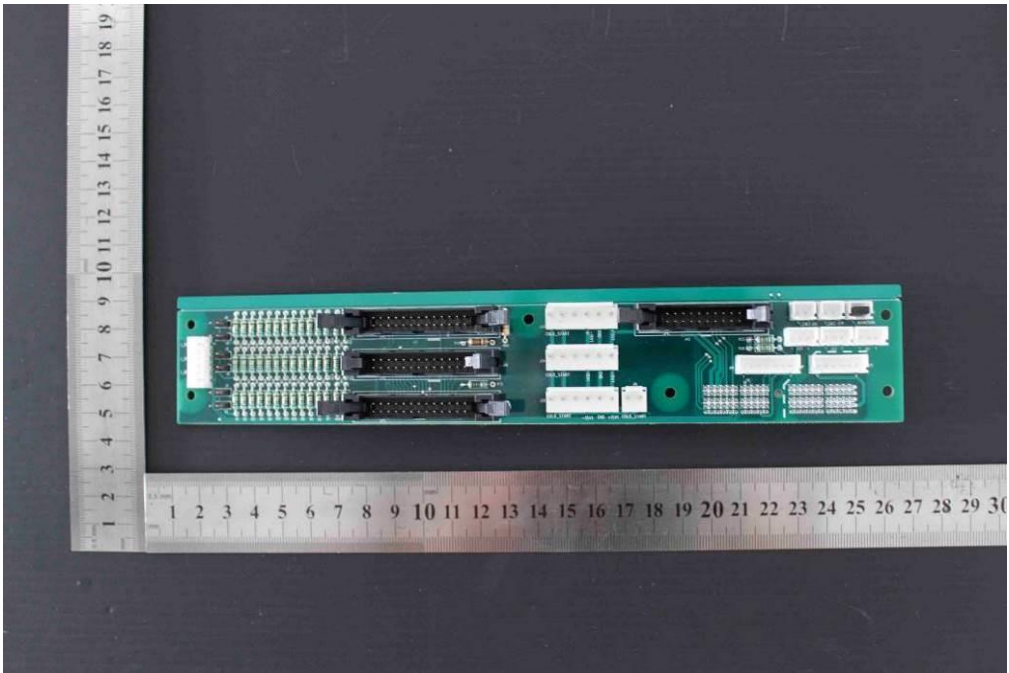
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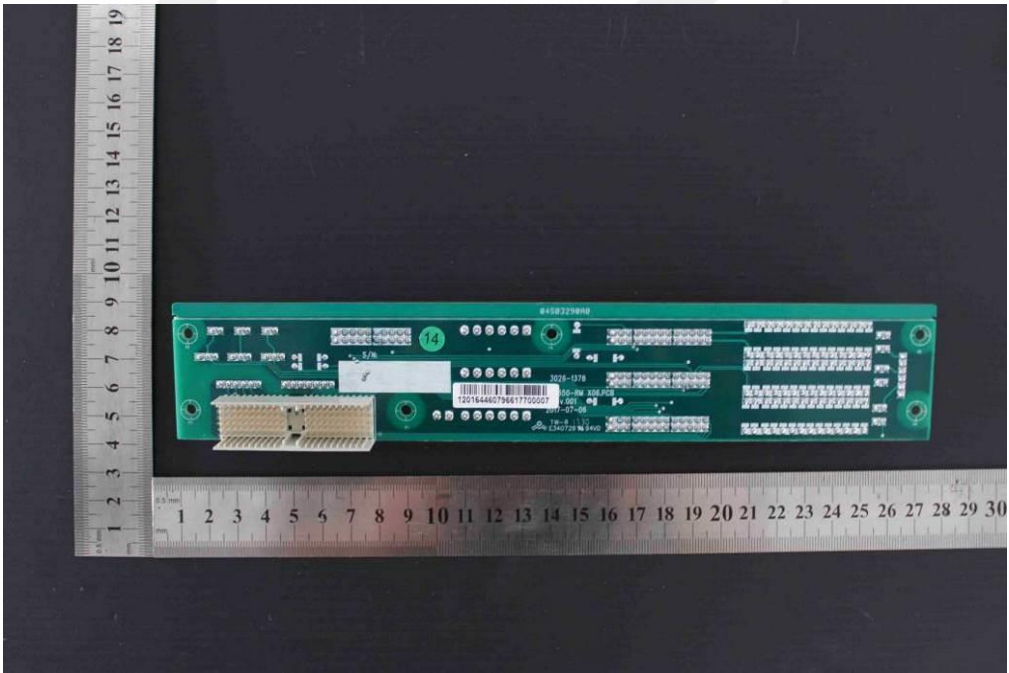
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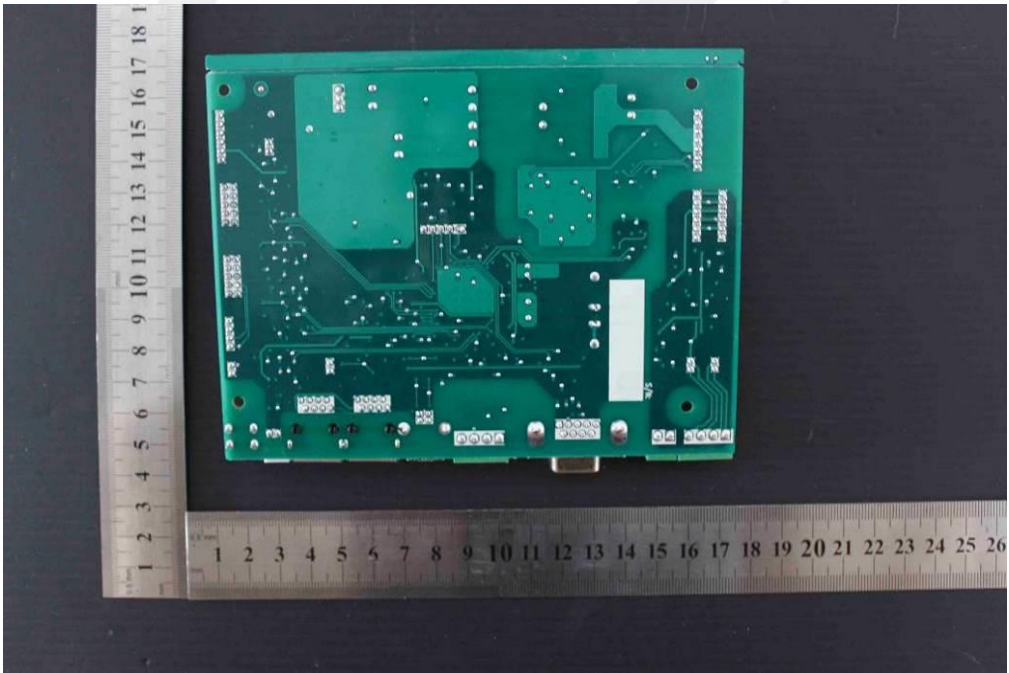
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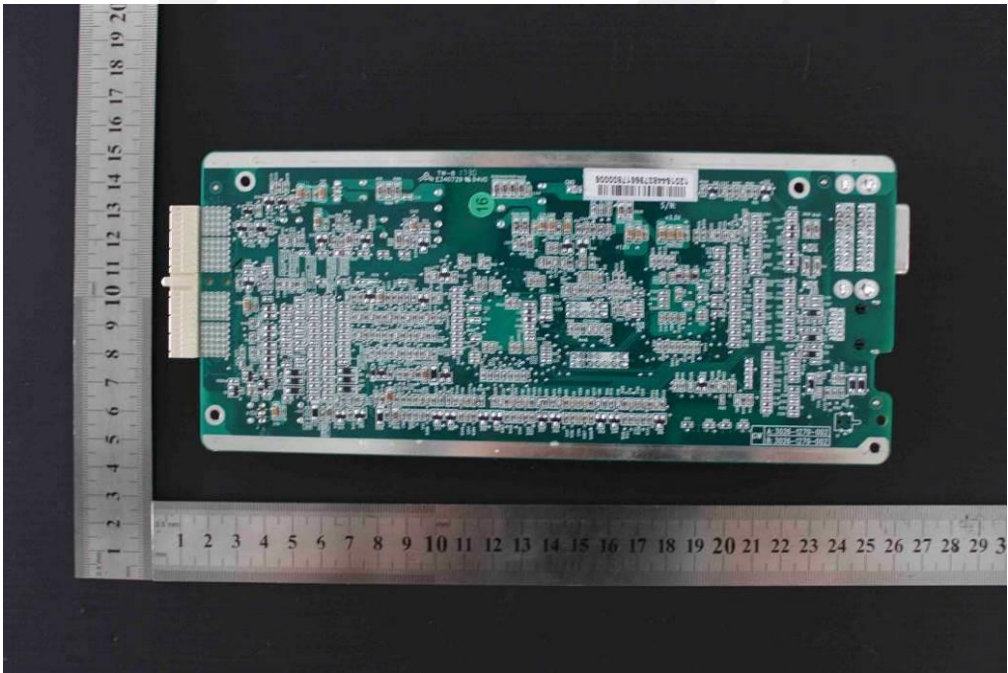
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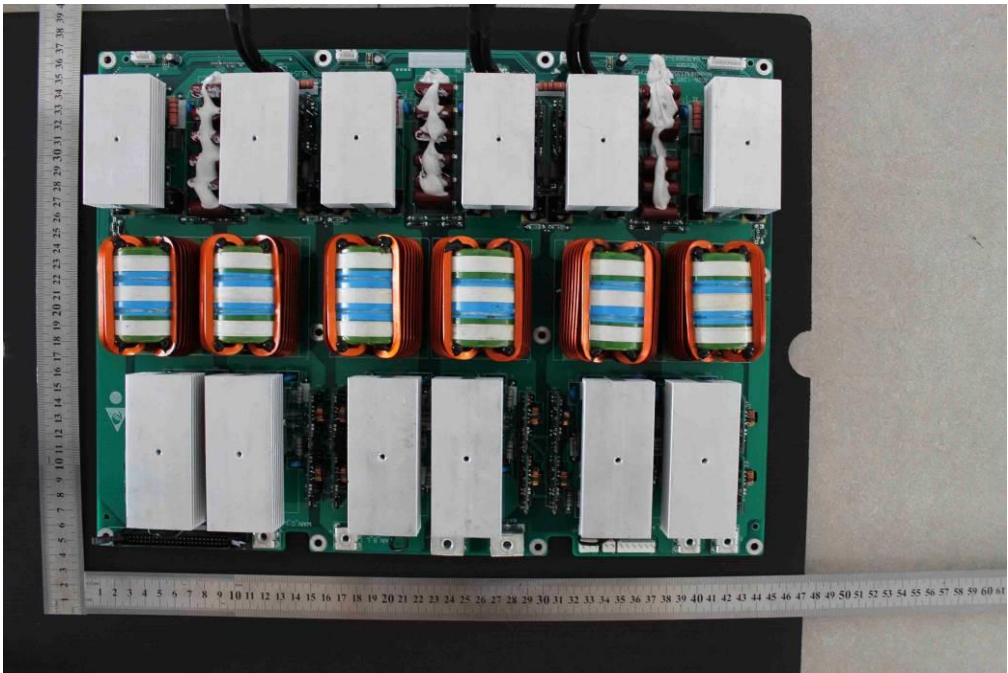
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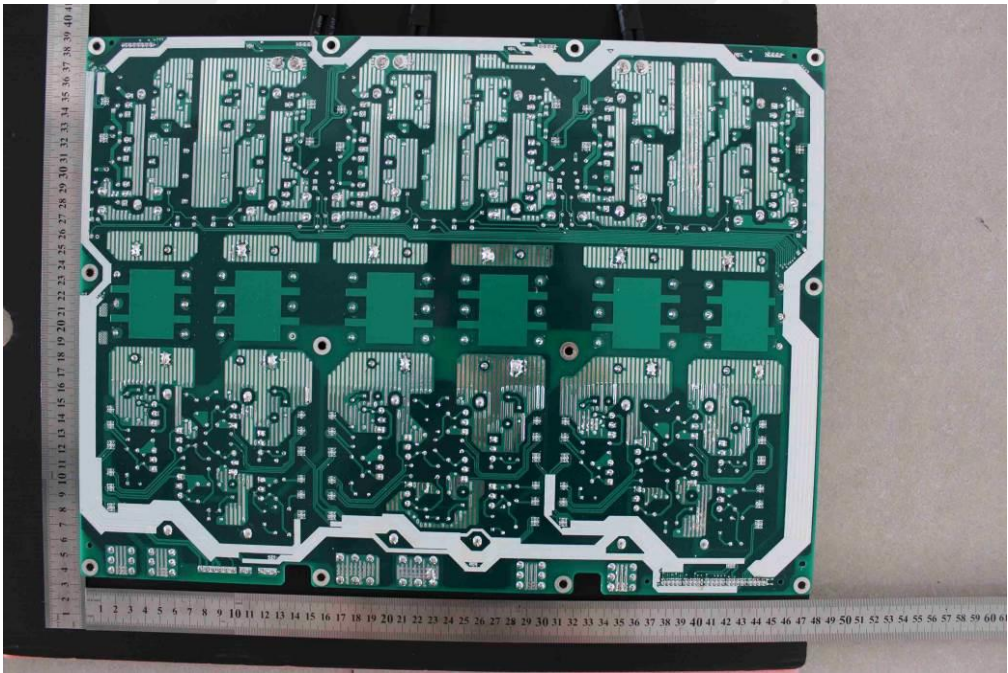
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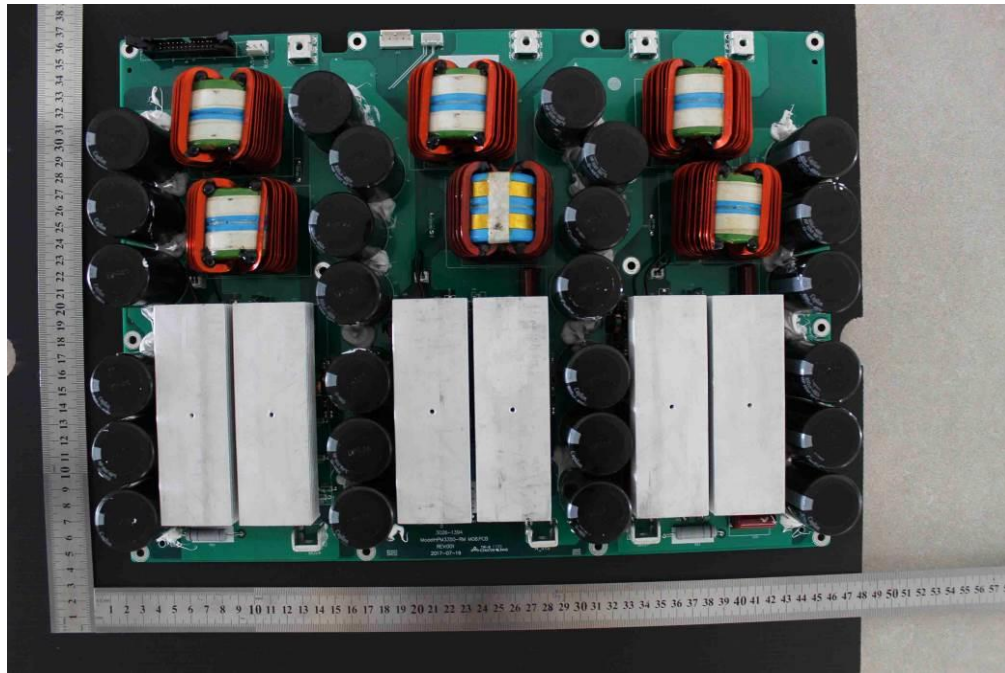
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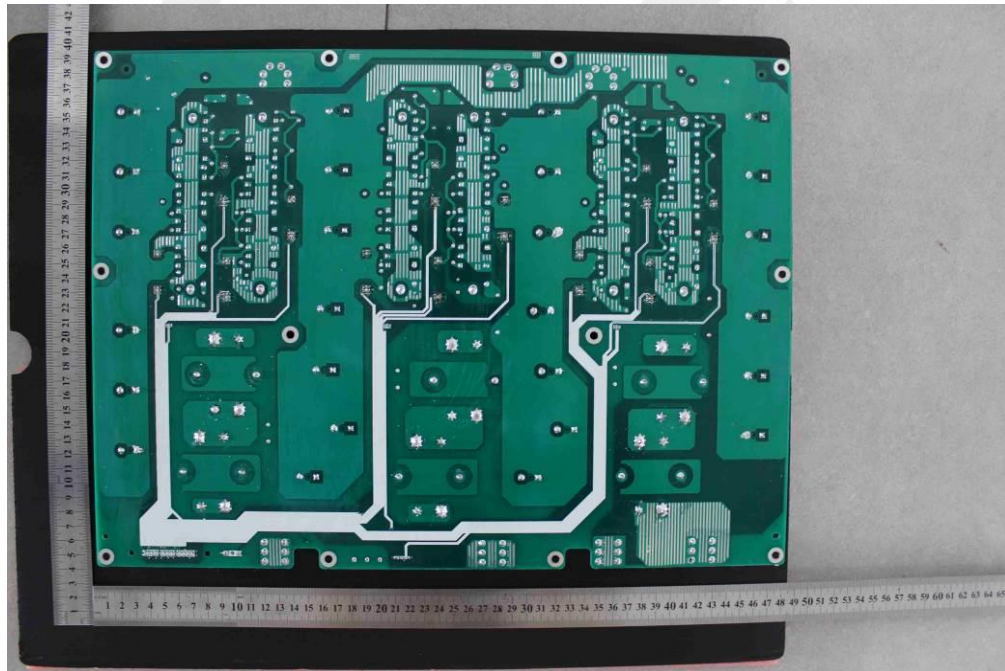
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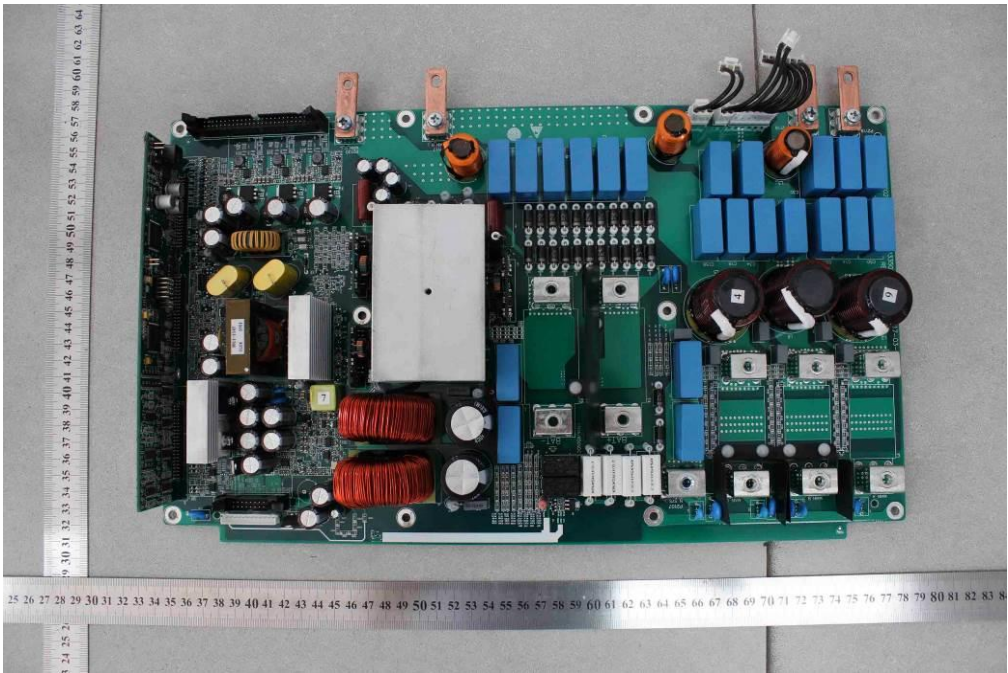
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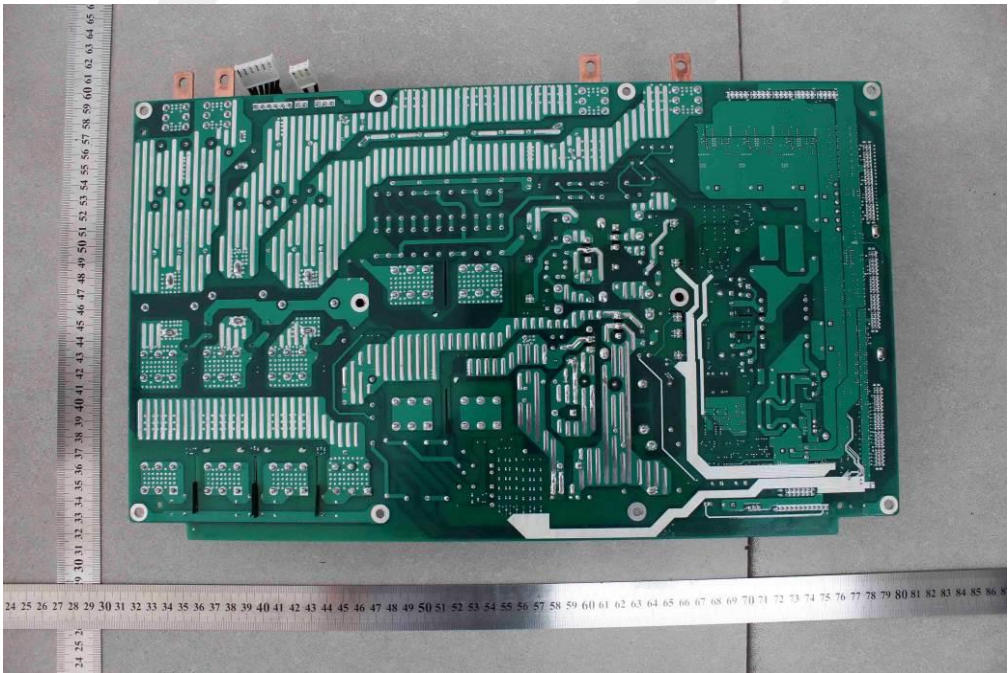
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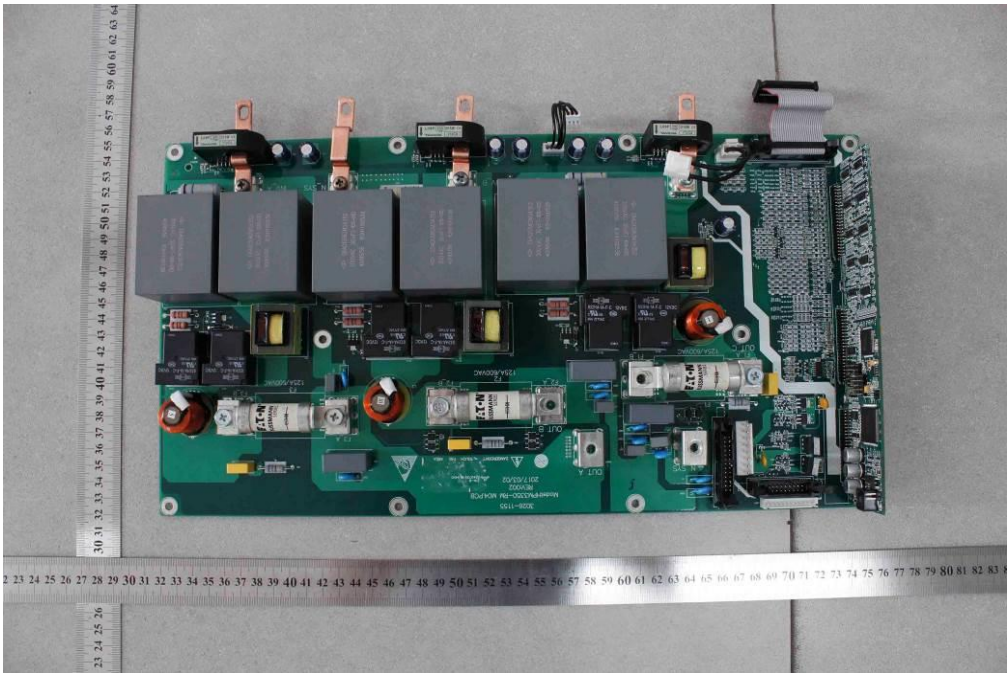
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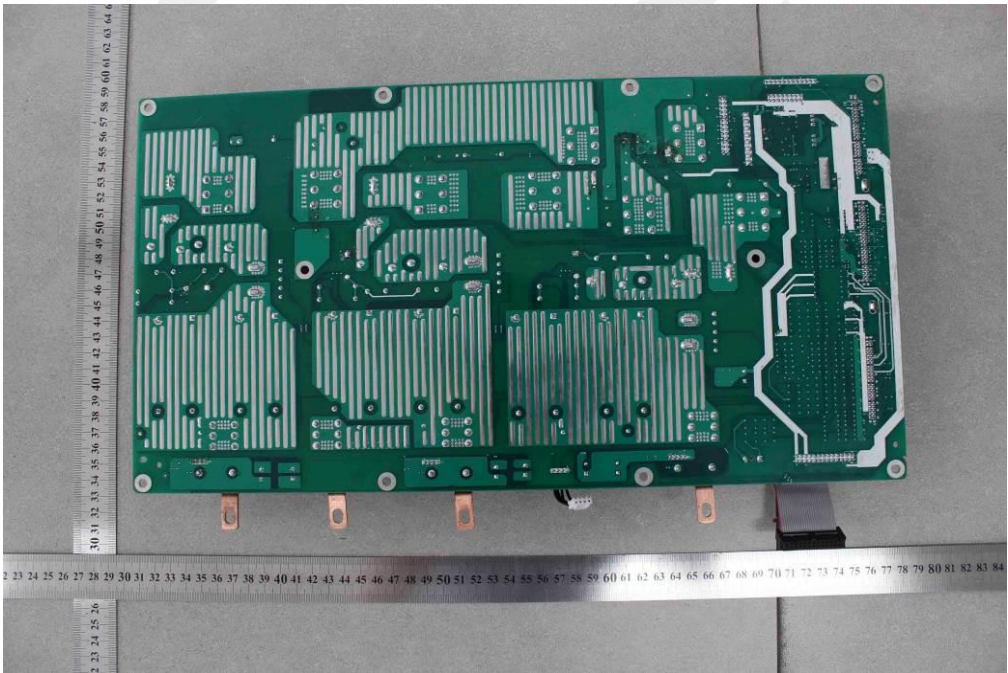
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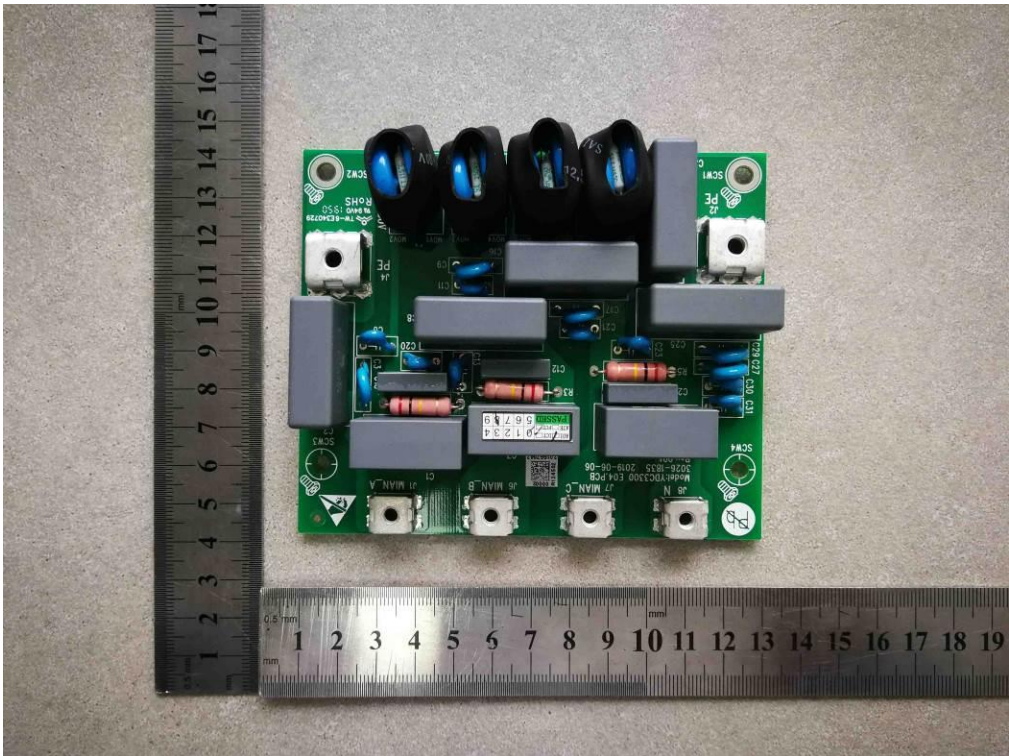
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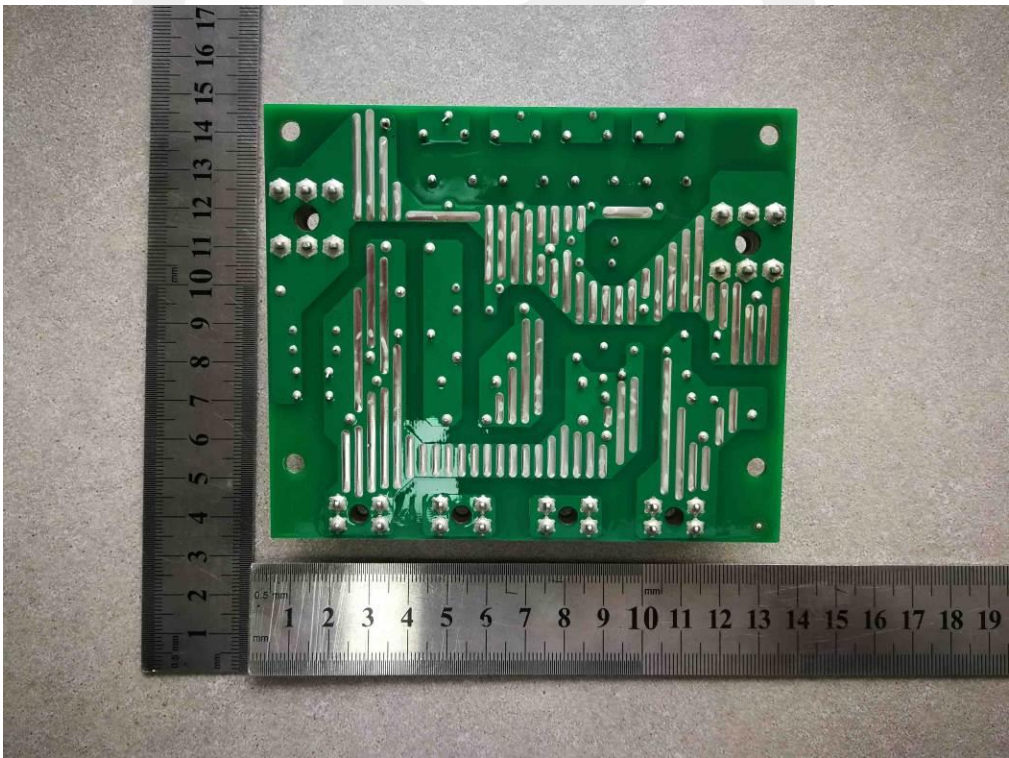
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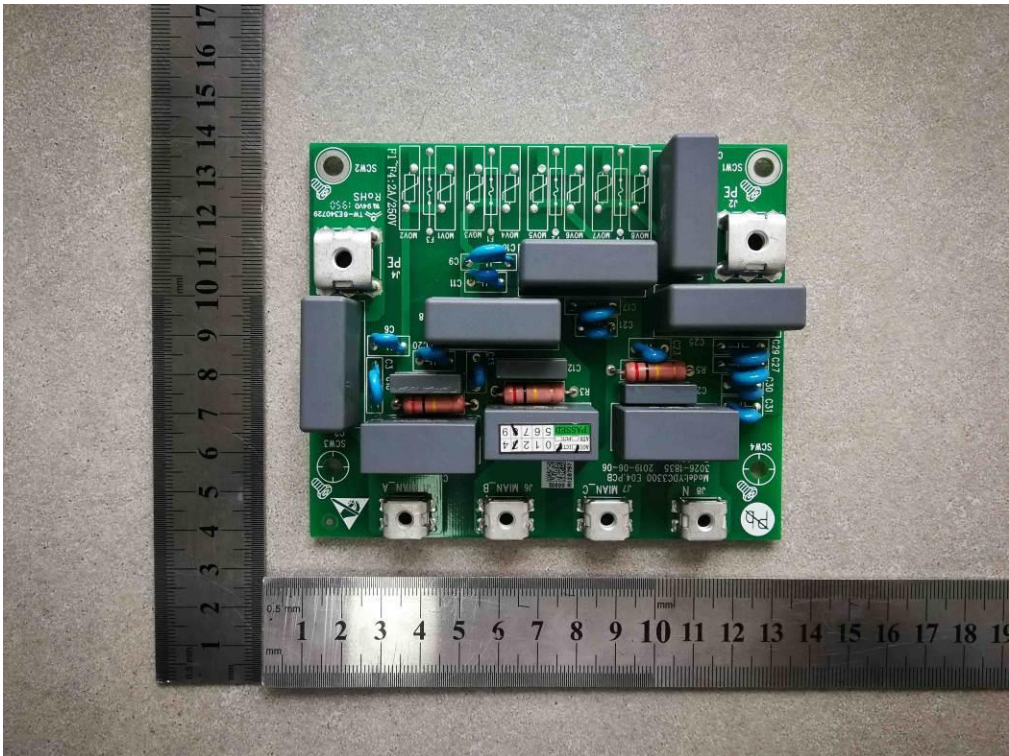
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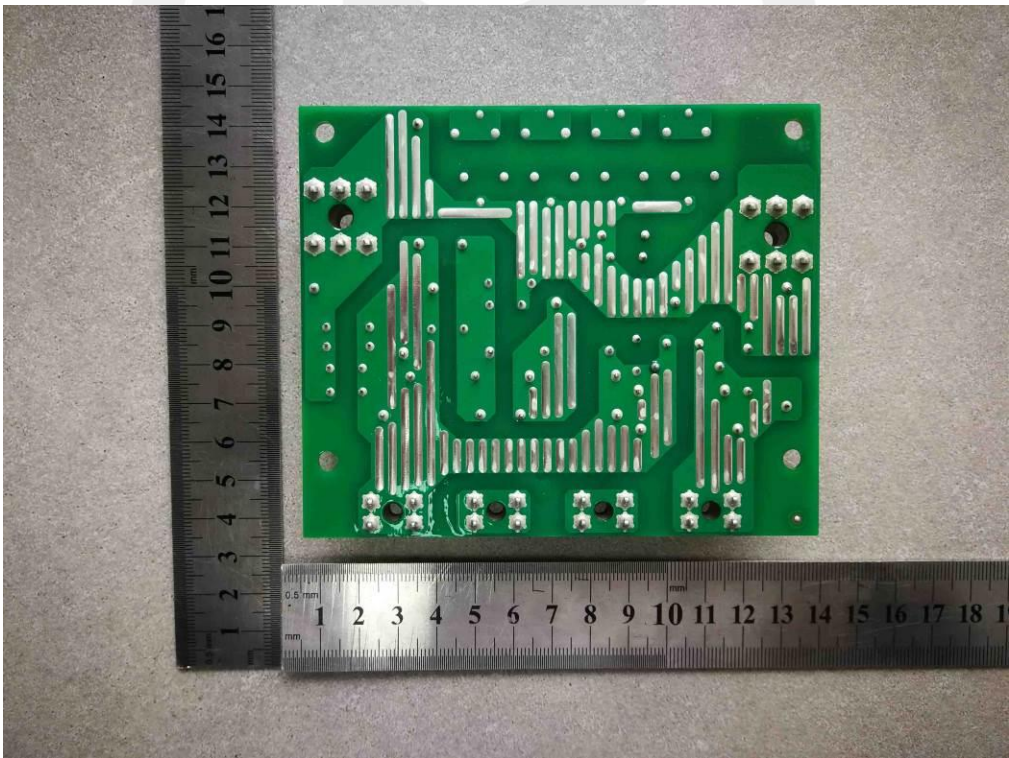
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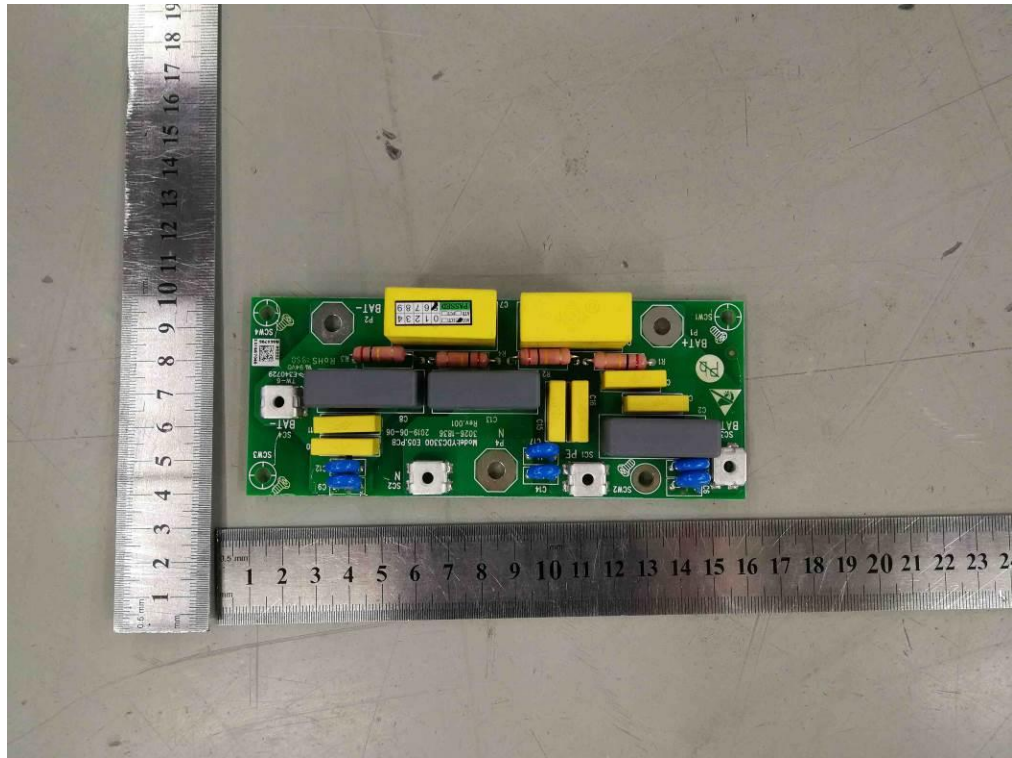
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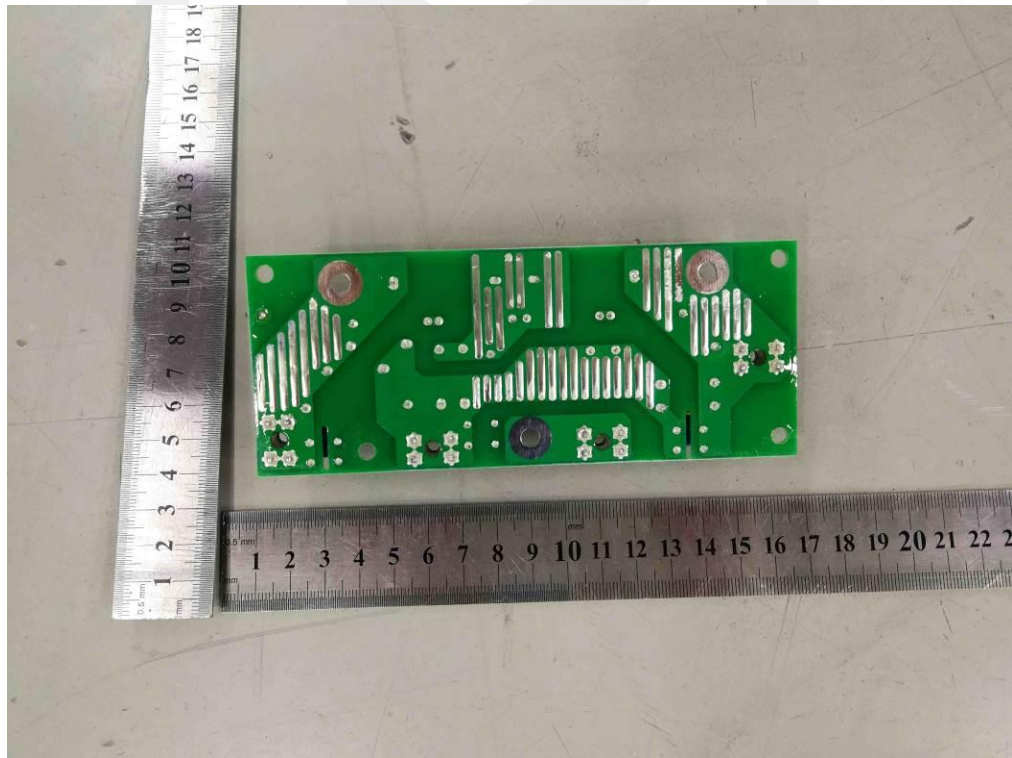
PCB view



PCB view



PCB view



PCB view

*** End of Report ***

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