Test Report issued under the responsibility of:

TEST REPORT
IEC 62109-1
Safety of Power Converter for use in Photovoltaic Power Systems
Part 1: General requirements

Report Number. ..... :	**GZES230601017901**
Date of issue..... :	**2023-06-04**
Total number of pages ..... :	**68**
Name of Testing Laboratory preparing the Report..... :	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch
Address..... :	198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China
Applicant's name..... :	Huizhou Foryou Optoelectronics Technology Co., Ltd
Address..... :	Building 6, B Area, No.1 North Shangxia Road, Dongjiang High-Tech Industry Park, Huizhou, Guangdong, China
Test specification:	
Standard ..... :	IEC 62109-1:2010 (First Edition) EN 62109-1:2010 (First Edition)
Test procedure ..... :	SGS-CSTC
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC62109_1B
Test Report Form(s) Originator.... :	SGS-CSTC
Master TRF..... :	Dated 2016-04

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Test item description ..... :	Hybrid Inverter
Trade Mark ..... :	ADAYO
Manufacturer ..... :	Huizhou Foryou Optoelectronics Technology Co., Ltd
Address ..... :	Building 6, B Area, No.1 North Shangxia Road, Dongjiang High-Tech Industry Park, Huizhou, Guangdong, China
Model/Type reference ..... :	**ED3600, ED4600, ED5000**
Ratings ..... :	**Refer to the rating on page 8 of the report** **Serial Number:** DN22222222 **Master Software version:** GA01.001-001-001 **Safety Firmware version:** DD1.0

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
☒ **Testing Laboratory:**	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch	
Location/ address .....:	198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China	
Tested by (name, function, signature) .....:	Doris Tao (Project Engineer)	Doris Tao
Approved by (name, function, signature) ....:	Roger Hu (Technical Reviewer)	Roger Hu

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

50 Hz / 60 Hz		
Attachment #	Description	Pages
Attachment I	Pictures of the EUT and Electrical Schemes	11 pages
Attachment II	Testing Information	2 pages

Summary of testing:

Tests performed (name of test and test clause):

The equipment has been tested according to the standard:
IEC/EN 62109-1:2010. Testing has been carried out at 50 / 60 Hz

All applicable tests according to the above specified standard have been carried out.

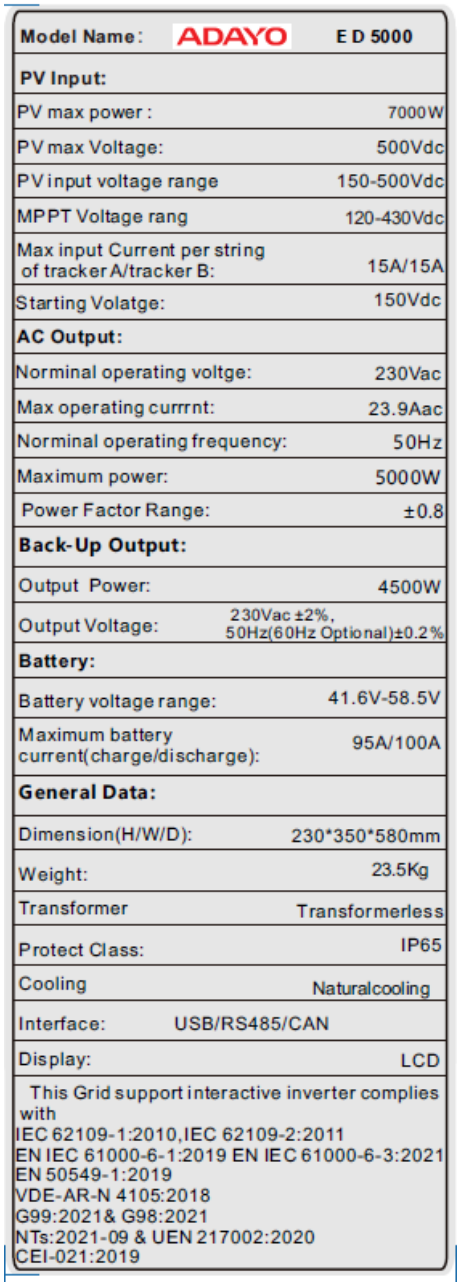
Remarks: All test results are from the original report GZES220801676403, issued by SGS-CTS Standards Technical Services Co., Ltd Guangzhou Branch.

Testing location:
Suzhou Liheng Testing Technology Co., Ltd.
No.2,1177 South Yunlian Road ,Wujiang Economic And Techological Development Zone suzhou City.

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

No National Differences are addressed to this test report

Copy of marking plate:



Model Name: ADAYO	ED 5000
PV Input:	
PV max power :	7000W
PV max Voltage:	500Vdc
PV input voltage range	150-500Vdc
MPPT Voltage rang	120-430Vdc
Max input Current per string of tracker A/tracker B:	15A/15A
Starting Volatge:	150Vdc
AC Output:	
Norminal operating voltge:	230Vac
Max operating currrnt:	23.9Aac
Norminal operating frequency:	50Hz
Maximum power:	5000W
Power Factor Range:	±0.8
Back-Up Output:	
Output Power:	4500W
Output Voltage:	230Vac ±2%, 50Hz(60Hz Optional)±0.2%
Battery:	
Battery voltage range:	41.6V-58.5V
Maximum battery current(charge/discharge):	95A/100A
General Data:	
Dimension(H/W/D):	230*350*580mm
Weight:	23.5Kg
Transformer	Transformerless
Protect Class:	IP65
Cooling	Naturalcooling
Interface:	USB/RS485/CAN
Display:	LCD

This Grid support interactive inverter complies with
IEC 62109-1:2010,IEC 62109-2:2011
EN IEC 61000-6-1:2019 EN IEC 61000-6-3:2021
EN 50549-1:2019
VDE-AR-N 4105:2018
G99:2021& G98:2021
NTs:2021-09 & UEN 217002:2020
CEI-021:2019

Note:

1. 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.
2. Label is attached on the side surface of enclosure and visible after installation
3. Labels of other models are as the same with **ED5000**'s except the parameters of rating.
4. As declared by the applicant, the importer (and manufacturer, if it is different)'s name, registered trade name or registered trademark and the postal address will be marked on the products before being place on the market. The contact details shall be in a language easily understood by end-users and market surveillance authorities.

Test item particulars .....:	Hybrid Inverter used in PV system
Equipment mobility.....:	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains.....:	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Environmental category.....:	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains .....:	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV .....:	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%).....:	-90 / +110 %
Tested for power systems .....:	TN systems
IT testing, phase-phase voltage (V) .....:	N/A
Class of equipment.....:	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) .....:	25 kg for all model
Pollution degree.....:	Outside PD3; Inside PD2
IP protection class .....:	IP65
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 was not evaluated for the requirement..... :	N/E
- test object does not meet the requirement..... :	F (Fail)
Testing ..... :	
Date of receipt of test item..... :	2022-09-28
Date (s) of performance of tests ..... :	2022-10-08 to 2022-10-31

General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies)..... :	**SHENZHEN IYPOWER CO., LTD.** Bulangze Park, Technology Road, Yinhu Industrial District, Qingxi, Dongguan, China.

General product information:

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through connectors.

The Solar inverter converts DC voltage into AC voltage.
The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit can operate in case of single fault.

Equipment Under Testing:

- **ED5000**

Variant models:

- **ED3600**
- **ED4600**

The variant models have been included in this test report without tests because the following features don´t change regarding to the tested model:

- Same connection system and hardware topology.
- Same control algorithm.
- Output power within 1/√10 and 2 times of the rated output power of the EUT or Modular inverters.
- Same Firmware Version.

Information within this section has been provided by the client.

The models of LS3600NPI, LS4600NPI and LS5000NPI are identical on topological schematic circuit diagram and control solution codes except for input/output rating.

The results obtained apply only to the particular sample tested that is the subject of the present test report. The most unfavorable result values of the verifications and tests performed are contained herein.

Following table shows the full ratings of all the models referenced in this report, marked in **bold letters** the ones subjected to testing:

Model	**ED3600**	**ED4600**	**ED5000**
PV Input			
Max. input voltage	500 Vdc		
Start-up operating voltage	150 Vdc		
Rated input voltage	360 Vdc		
MPPT operating voltage range	150-500 Vdc		
Full power MPPT voltage range	150-430 Vdc		
Max. input current	15 A/15 A	15 A/15 A	15 A/15 A
Max. short current	19.8 A/19.8 A	19.8 A/19.8 A	19.8 A/19.8 A
Battery Input			
operating voltage range	41.6V-58.5 Vdc		
input current	15 A/15 A	15 A/15 A	15 A/15 A
Maximum battery charge current	80 A	95 A	95 A
Maximum battery discharge current)	85 A	100 A	100 A
AC Output			
Nominal grid voltage	L/N/PE, 230 V		
Nominal grid frequency	50 Hz		
Rated AC power	3600 W	4600 W	5000 W
Max. AC power	3960 VA	5060 VA	5500 VA
Rated AC current	15.6 A	20.0 A	21.7 A
Max. AC current	17.2 A	22.0 A	23.9 A
Output power factor	1 default (adjustable+/-0.8)		
General Data			
Operating temperature range	-30 ºC ~ +60 ºC		
Protection degree	IP65		
Protective class	Class I		
Cooling method	Natural Cooling		
Topology	Transformerless		

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Clause	Requirement – Test	Result – Remark	Verdict
4	**GENERAL TESTING REQUIREMENTS**		P
4.1	General		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests		P
4.2.2	Reference test conditions		P
4.2.2.1	Environmental conditions	Ambient environmental condition compliance.	P
4.2.2.2	State of equipment	Test carried on a complete EUT.	P
4.2.2.3	Position of equipment	The equipment was installed in accordance with the manufacturer's instructions.	P
4.2.2.4	Accessories	Accessories and operator-interchangeable parts available from, or recommended by the manufacturer according to the installation manual required.	P
4.2.2.5	Covers and removable parts	No covers or parts, which can be removed without using a TOOL.	N/A
4.2.2.6	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:	(see appended table 4.2.2.6)	P
4.2.2.7	Supply ports other than the mains		P
4.2.2.7.1	Photovoltaic supply sources a) Open circuit voltage: b) Short-circuit current:	(see appended table 4.2.2.7)	P
4.2.2.7.2	Battery inputs	(see appended table 4.2.2.7)	P
4.2.2.8	Conditions of loading for output ports	The least favorable loading conditions was considered. Until steady condition was established.	P
4.2.2.9	Earthing terminals	Connection to the earth	P
4.2.2.10	Controls	Any position was set.	P
4.2.2.11	Available short circuit current	Considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict
4.3	Thermal testing	(see appended table 4.3)	P
4.3.1	General		P
4.3.2	Maximum temperatures		P
4.3.2.1	General		P
4.3.2.2	Touch temperatures		P
4.3.2.3	Temperature limits for mounting surfaces		P
4.4	Testing in single fault condition	(see appended table 4.4)	P
4.4.1	General		P
4.4.2	Test conditions and duration for testing under fault conditions		P
4.4.2.1	General		P
4.4.2.2	Duration of tests		P
4.4.3	Pass/fail criteria for testing under fault conditions		P
4.4.3.1	Protection against shock hazard		P
4.4.3.2	Protection against the spread of fire		P
4.4.3.3	Protection against other hazards		P
4.4.3.4	Protection against parts expulsion hazards		P
4.4.4	Single fault conditions to be applied	See below.	P
4.4.4.1	Component fault tests	(see appended table 4.4)	P
4.4.4.2	Equipment or parts for short-term or intermittent operation	Continuous operation equipment.	N/A
4.4.4.3	Motors	Not used.	N/A
4.4.4.4	Transformer short circuit tests	(see appended table 4.4)	P
4.4.4.5	Output short circuit	(see appended table 4.4)	P
4.4.4.6	Backfeed current test for equipment with more than one source of supply	Considered	P
4.4.4.7	Output overload	(see appended table 4.4)	P
4.4.4.8	Cooling system failure	(see appended table 4.4)	P
4.4.4.9	Heating devices	No heating devices used.	N/A
4.4.4.10	Safety interlock systems	No safety interlock device used.	N/A
4.4.4.11	Reverse d.c. connections	(see appended table 4.4)	P
4.4.4.12	Voltage selector mismatch	No voltage selector used.	N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity	DC mains supply.	N/A
4.4.4.14	Printed wiring board short-circuit test	(see appended table 4.4)	P

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Clause	Requirement – Test	Result – Remark	Verdict
4.5	Humidity preconditioning	(see appended table 7.5)	P
4.5.1	General		P
4.5.2	Conditions	Humidity: 93%RH Temperature: 40°C Duration: 48hrs	P
4.6	Backfeed voltage protection	Hazardous voltage and energy was not present on the terminals, with the DC mains supply source de-energized or disconnected. In addition the symbol 13 of Table C.1 was marked for servicing functions	P
4.6.1	Backfeed tests under normal conditions	Relay or Contactor is available at AC output side to prevent back-feed current from AC to DC side.	P
4.6.2	Backfeed tests under single-fault conditions	Relay or contactor is available at AC output side and with auto disconnected device at DC input side to prevent backfeed current from AC to DC side, even if under single-fault conditions.	P
4.6.3	Compliance with backfeed tests	See above.	N/A
4.7	Electrical ratings tests	(see appended table 4.2.2.6)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P
5	**MARKING AND DOCUMENTATION**		P
5.1	Marking		P
5.1.1	General		P
	Equipment shall bear markings as specified in 5.1 and 5.2	The marking label is on the outer surface of the enclosure.	P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.	All used graphic symbols are in accordance with Annex C.	P
	Graphic symbols shall be explained in the documentation provided with the PCE.	The explanations are provided in the user manual.	P
5.1.2	Durability of markings	The labels were subjected to the permanence of marking	P
	Markings required by this clause to be located on the PCE shall remain clear and legible under	After this test there was no damage to the labels. The	P

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Clause	Requirement – Test	Result – Remark	Verdict
	conditions of NORMAL USE and resist the effects of cleaning agents specified by the manufacturer	marking on the labels did not fade. There was no curling or lifting of the label's edges.	
5.1.3	Identification		P
	The equipment shall, as a minimum, be permanently marked with:	See below.	P
	a) the name or trade mark of the manufacturer or supplier	See copy of marking plate.	P
	b) model number, name or other means to identify the equipment	See above.	P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.	See above.	P
5.1.4	Equipment ratings		P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	See below	P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	See model list.	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	See above.	P
	– the ingress protection (IP) rating as in 6.3 below	See clause 6.3	P
5.1.5	Fuse identification		P
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.	Marking on PCB near fuses.	P
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated	See above.	P
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.	See above.	P
5.1.6	Terminals, Connections, and Controls		P
	If necessary for safety, an indication shall be given	Relevant symbol, indicator or	P

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Clause	Requirement – Test	Result – Remark	Verdict
	of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.	information are available.	
	Push-buttons and actuators of emergency stop devices, and indicator lamps used only to indicate a warning of danger or the need for urgent action shall be coloured red.	No such device.	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other non-permanent material.		N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:		P
	– the sign “+“ for positive and “-„ for negative; or	The “+” and “-“ marking provided adjacent to the PV input connectors.	P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation	No pictorial representation illustration used.	N/A
5.1.6.1	Protective Conductor Terminals		P
	The means of connection for the protective earthing conductor shall be marked with:		P
	– symbol 7 of Annex C; or	Symbol 7 of Table C.1 marked adjacent to the PE terminal.	P
	– the letters “PE“; or	See above.	N/A
	– the colour coding green-yellow.		P
5.1.7	Switches and circuit-breakers		P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.	The letter “ON” and “OFF” is clearly marked.	P
5.1.8	Class II Equipment	Class I Equipment.	N/A
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol	See above.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	12 of Table Annex C.		
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C	See above.	N/A
5.1.9	Terminal boxes for External Connections		N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:	Not used.	N/A
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A
5.2	Warning markings		P
5.2.1	Visibility and legibility requirements for warning markings		P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2,75 mm high		P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the background		P
	– Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in colour from the background, shall have a depth or raised height of at least 0,5 mm.	No such symbols.	N/A
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C		P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heat sinks and similar parts		P
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking may be on or adjacent to the heat sink	Marked with symbol 13 of Table C.1.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heat sink exists.		
5.2.2.2	Hot Surfaces		P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.	Marked with symbol 14 of Table C.1.	P
5.2.2.3	Coolant		N/A
	A unit containing coolant that exceeds 70 °C shall be legibly marked externally where readily visible after installation with symbol 15 of Annex C. The documentation shall provide a warning regarding the risk of burns from hot coolant, and either:	Not used.	N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or		N/A
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		N/A
5.2.2.4	Stored energy		P
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.	Marked with Symbol 21 of Table C.1 and the time to discharge capacitors to safe voltage and energy levels accompany the symbol.	P
5.2.2.5	Motor guarding		N/A
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).		N/A
5.2.3	Sonic hazard markings and instructions	No such hazard.	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can ensure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	measures which may be used.		
5.2.4	Equipment with multiple sources of supply		P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.	Marked with symbol 13 of Annex C and explain in user manual.	P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.	See above.	P
5.2.5	Excessive touch current		P
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.	Marked with symbol 15 of Table C.1 and relevant information is provided in user's manual.	P
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:	All related informations provided in the user's maunal.	P
	a) explanations of equipment makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1		P
	– WET LOCATIONS classification fort he intended external environment as per 6.1		P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2		P
	– INGRESS PROTECTION rating as per 6.3		P
	– Ambient temperature and relative humidity ratings		P
	– MAXIMUM altitude rating		P
	– OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation		P

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Clause	Requirement – Test	Result – Remark	Verdict
	complies with the required overvoltage categories;		
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE		P
5.3.1.1	Language		P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.	Instruction related to safety is in English.	P
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	The printed form is available and is delivered with the PCE.	P
	For equipment which requires the use of a computer for both installation and operation, documentation may be provided in electronic format without accompanying printed format.	See above.	N/A
5.3.2	Information related to installation		P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:	All below related informations provided in the user's maunal.	P
	a) assembly, location, and mounting requirements:		P
	b) ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including instructions that the installation position shall not prevent access to the disconnection means;		P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and externals controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P
	e) ventilation requirements;		P
	f) requirements for special services, for example cooling liquid;		N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;	No hazardous sound level.	P

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	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;	No battery used in the PCE.	P
	i) tightening torque to be applied to wiring terminals;		P
	j) values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceed the max. rated current of the circuit, as per 4.4.4.6;	No backfeed current available.	P
	k) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed; and		P
	l) compatibility with RCD and RCM;	RCMU built in PCE.	P
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:		P
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		P
	"This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product."		P
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	PCE is not intended to charge battery.	P
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		P
5.3.3	Information related to operation		P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:	All related information provided in the user's maunal.	P
	– Instructions for adjustment of controls including the effects of adjustment;		P
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and		P
	– Instructions, that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.		P
5.3.4	Information related to maintenance		P
	Maintenance instructions shall include the following:	All related information provided in the service maunal.	P
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		P
	– Part numbers and instructions for obtaining any required operator replaceable parts;		P
	– Instructions for safe cleaning (if recommended)		P
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.		P
5.3.4.1	Battery maintenance		N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:	The PCE is Grid Interactive inverter without battery energy storage function.	N/A
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	eyes. It may be toxic.		
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		P
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below		P
	– Suitability for WET LOCATIONS or not		P
	– POLLUTION DEGREE rating in 6.2 below		P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below		P
	– Ultraviolet (UV) exposure rating, as in 6.4 below		P
	– Ambient temperature and relative humidity ratings, as in 6.5 below		P
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor	For outdoor use.	P
6.1.2	Indoor, unconditioned	See above.	N/A
6.1.3	Indoor, conditioned	See above.	N/A
6.2	Pollution degree	PD 2 (inside), PD 3 (outside)	P
6.3	Ingress Protection	IP65.	P
6.4	UV exposure	The shelter is considered	P

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Clause	Requirement – Test	Result – Remark	Verdict
		necessary for outdoor use. Anti-UV approved AC and DC connectors provided.	
6.5	Temperature and humidity	Specified by manufacturer.	P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		P
7.1	General	The proper construction of PCE is available for protection against shock and energy hazards during installation, operation and maintenance under normal and single fault conditions.	P
7.2	Fault conditions	See subclause 4.4.	P
7.3	Protection against electric shock		P
7.3.1	General	Each circuit under evaluation is compliance.	P
7.3.2	Decisive voltage classification		P
7.3.2.1	Use of decisive voltage class (DVC)	See below	P
7.3.2.2	Limits of DVC (according table 6)	See subclause 7.3.2.1.	P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions		P
7.3.2.4	Requirements for protection (according table 7)	For circuits evaluation information of PCE, refer to brief description of general product information on previous pages.	P
7.3.2.5	Connection to PELV and SELV circuits	DVC-A is classified for display and communication circuits.	P
7.3.2.6	Working voltage and DVC	See subclause 7.3.2.4.	P
7.3.2.6.1	General	See above.	P
7.3.2.6.2	AC working voltage (see Figure 2)		P
7.3.2.6.3	DC working voltage (see Figure 3)		P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		P
7.3.3	protective separation	For protective separation evaluation information of PCE, refer to brief description of general product information on previous pages.	P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or		P
	▪ protective screening, i.e. by a conductive		P

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	screen connected to earth by protective bonding in the PCE, or connected to the protective earth conductor itself, whereby the screen is separated from live parts by at least basic insulation, or		
	▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or		N/A
	▪ limitation of voltage according to 7.3.5.4.		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact	Protection against electic shock by means of earthed metal enclosure. Any access to touch live parts is impossible.	P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).	See subclause 7.3.2.4.	P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.		N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.		N/A
7.3.4.2	Protection by means of enclosures and barriers	Protection against electic shock by means of earthed metal enclosure.	P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.		P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6		N/A
7.3.4.2.2	Access probe criteria	Considered.	P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Considered.	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	No DVC-B in the PCE	N/A
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	Considered.	P
7.3.4.2.3	Access probe tests		P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and	Live parts are enclosed by the earthed metal enclosure and no openings.	P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuseholders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavourable position.	It is not possible to touch the hazardous live parts by the test finger and test pin.	P
	The test finger and the test pin are applied as above, without appreciable force, in every possible position, except that floor-standing equipment having a mass exceeding 40 kg is not tilted.		P
	Equipment intended for building-in or rack mounting, or for incorporation in larger equipment, is tested with access to the equipment limited according to the method of mounting detailed in the installation instructions.	Not intended for built-in or rack mounting.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to 30 N.	No openings.	N/A
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±5 ° only.	No openings.	N/A
7.3.4.2.4	Service access areas	It is not allowed to remove the cover during installation and maintenance when PCE is energized.	P
7.3.4.3	Protection by means of insulation of live parts	See subclause 7.3.2, 7.3.3 and 7.3.4.1.	P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		P
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		P
7.3.5	Protection in case of direct contact		P
7.3.5.1	General	See below.	P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:		P
	– is of decisive voltage class A and complies with 7.3.5.2, or	Only DCV-A classified circuit can be touched directly, see also 7.3.5.2.	P
	– is provided with protective impedance according to 7.3.5.3, or		N/A
	– is limited in voltage according to 7.3.5.4		N/A
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with		P

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Clause	Requirement – Test	Result – Remark	Verdict
	protective separation. 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 (key) or which are accessible without the use of a tool.		
	Conformity is checked by visual inspection and trial insertion.		P
7.3.5.2	Protection using decisive voltage class A	Comm. port is considerd as DVC-A which can be accessible and separated from DVC-C by double or reinforced insulaiton.	P
7.3.5.3	Protection by means of protective impedance	This method not considered.	N/A
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		N/A
7.3.5.3.1	Limitation of current through protective impedance		N/A
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		N/A
7.3.5.3.2	Limitation of discharging energy through protective impedance		N/A
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		
7.3.5.4	Protection by means of limited voltages	This method not considered.	N/A
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		N/A
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		N/A
	This type of protection shall not be used in case of		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	protective class II or unearthed circuits, because it relies on protective earth being connected.		
7.3.6	Protection against indirect contact		P
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)	The PCE is defined as protective class I.	P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	The earthing metal enclosure is complied with Protective class I.	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	The circuit of communication is complied with Protective class II for accessible communication ports.	P
	That part of PCE which meets the requirements of decisive voltage class A and in which no hazardous voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		N/A
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.		P
7.3.6.2	Insulation between live parts and accessible conductive parts	See subclaus 7.3.2.3, 7.3.7.4 and 7.3.7.5.	P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5	The clearances specified in 7.3.7.4 and creepage specified in 7.3.7.5 are complied.	P
7.3.6.3	Protective class I – Protective bonding and earthing		P
7.3.6.3.1	General		P
	Equipment of protective class I shall be provided with protective earthing, and with protective bonding to ensure electrical contact between accessible conductive parts and the means of connection for the external protective earthing conductor, except bonding is not required for:	Suitable protective bonding provided.	P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or	DVC-A classified circuit is considered.	P
	b) accessible conductive parts are separated from	Display and communication	P

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Clause	Requirement – Test	Result – Remark	Verdict
	live parts of DVC-B or -C using double or reinforced insulation.	circuits are separated from live parts used double or reinforced insulation.	
7.3.6.3.2	Requirements for protective bonding	The cross-section of the protective bonding conductor is the same as that for the external protective earthing conductor.	P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:		P
	a) through direct metallic contact;	The connection of external protective earthing conductor is direct metal contact via a terminal with screw.	P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		P
	c) through a dedicated protective bonding conductor;	Protective earthing terminal used.	P
	d) through other metallic components of the PCE		N/A
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.		P
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.		N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.		P
7.3.6.3.3	Rating of protective bonding	See below.	P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall 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.	Suitable protective bonding used.	P
	Protective bonding shall meet following	See below.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	requirements:		
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.	Sub clause 7.3.6.3.5 is considered.	N/A
	As alternative to a) and b) the protective bonding may designed according to the requirements for the external protective earthing conductor in 7.3.6.3.5, in which case no testing is required.	The cross-section of the protective bonding conductor is the same as that for the external protective earthing conductor.	P
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		N/A
	a) 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);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		N/A
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		N/A
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.		N/A
	On equipment where the protective earth connection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cab le is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		
7.3.6.3.3.1	Test current, duration, and acceptance criteria	The alternative of sub clause 7.3.6.3.5 was considered.	N/A
	The test current, duration of the test and acceptance criteria are as follows:	(see appended table 7.3.6.3.3)	N/A
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.		N/A
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		N/A
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		N/A
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective 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.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)		N/A
	If the continuity of the protective bonding is	The alternative of sub clause	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:	7.3.6.3.5 was considered.	
	▪ the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:		N/A
	▪ the test duration may be reduced to no less than 2 s		N/A
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		N/A
7.3.6.3.5	External protective earthing conductor		P
	A protective earthing conductor shall be connected at all times when power is supplied to PCE of protective class I. Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.	The external protective earthing conductor crosssectional is designed as half of phase conductors with same material. Related statement specified in manual.	P
	If the external protective earthing 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.		P
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		P
	▪ 2,5 mm² if mechanical protection is provided;		N/A
	▪ 4 mm² if mechanical protection is not provided.	Related statement specified in user manual.	P
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.		N/A
7.3.6.3.6	Means of connection for the external protective		P

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Clause	Requirement – Test	Result – Remark	Verdict
	earthing conductor		
7.3.6.3.6.1	General		P
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed 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.	The external protective earthing terminal block consist of other live conducts as AC connector for connecting PCE to the mains. Corrosion-resistant is considered for connection and bonding points. Separated earthing terminal be provided for protective earthing conductor was specified in user manual.	P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or	With the symbol 7 of Table C.1.	P
	• the colour coding green-yellow	The color coding of Green – yellow recommended.	P
	Marking shall not be done on easily changeable parts such as screws.		P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		P
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5 mA a.c. or mA d.c.	(see appended table 7.3.6.3.7)	N/A
	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3,5 mA a.c. or 10 mA d.c.	See appended table 7.5.4. In addition, the caution symbol 15 of Table C.1 provided on PCE and in manual.	P
	a) Permanently connected wiring, and:		P
	• a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm²		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Al; or		
	• automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or		P
	• provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or		P
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	PCE is designed for protective class I.	N/A
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		N/A
	• equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low voltage,		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	protective impedance and limited discharging energy, according to 7.3.5. This basic insulation shall correspond to the rated voltage of the series-connected equipment;		
	• metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	• equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	• equipment employing protective class II shall be marked according to 5.1.8.		N/A
7.3.7	Insulation Including Clearance and Creepage Distance		P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	• pollution degree	(see appended table 7.3.7.1.1)	P
	• overvoltage category	(see appended table 7.3.7.1.2)	P
	• supply earthing system	(see appended table 7.3.7.1.3)	P
	• insulation voltage	(see appended table 7.3.7.1.4)	P
	• location of insulation		P
	• type of insulation		P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.		P
7.3.7.1.3	Supply earthing systems	For TN system.	P
	Three basic types of earthing system are described in IEC 60364-1. They are:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	• 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 systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor.		P
	• 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;		N/A
	• 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 earthing system.		N/A
7.3.7.1.4	Insulation voltages	PV supply circuits: 4000V (VMAX PV: 500Vd.c.) AC mains circuits: 4000V (Rated: 230Va.c.) Other circuits: 4000V (Rated: 230Va.c.)	P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstands voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General	Considered.	P
7.3.7.2.2	Circuits connected directly to the mains	Clearances and solid insulation required according to the impulse voltage, temporary overvoltage, or working voltage, whichever gives the most severe requirement.	P
7.3.7.2.3	Circuits other than mains circuits	Clearances and solid insulation required according to the impulse voltage and recurring peak voltage.	P
7.3.7.2.4	Insulation between circuits	Clearances and solid insulation according to the higher impulse voltages. Creepages according ot the higher r.m.s. working voltage.	P
7.3.7.3	Functional insulating		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.4	Clearance distances	(see appended table 7.3.7)	P
7.3.7.4.1	Determination	The max. insulation / implulse voltage: 4000V.	P
7.3.7.4.2	Electric field homogeneity	Not considered.	N/A
7.3.7.4.3	Clearance to conductive enclosures	Refer to subclause 7.3.7.4.1 and 13.7.	P
7.3.7.5	Creepage distances	(see appended table 7.3.7)	P
7.3.7.5.1	General		P
7.3.7.5.2	Voltage		P
7.3.7.5.3	Materials	Insulating material group IIIb 175 > CTI ≥ 100 assumed.	P
7.3.7.6	Coating	Not used.	N/A
7.3.7.7	PWB spacings for functional insulating	Comply with 7.3.7.4 and 7.3.7.5.	N/A
7.3.7.8	Solid insulating	(see appended table 7.3.7)	P
7.3.7.8.1	General		P
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation		P
7.3.7.8.2.1	Basic, supplemental, reinforced, and double insulation	Passed the impulse withstand voltage and a.c. or d.c. voltage tests. See appended table 7.5.1, 7.5.2 & 7.5.3. Note: No double or reinforced solid insulation used. No voltage stress on the insulation is greater than 1 kV/mm.	P
7.3.7.8.2.2	Functional insulation	Not used.	N/A
7.3.7.8.3	Thin sheet or tape material	See below.	P
7.3.7.8.3.1	General		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm	Bobbin used in power transformer.	P
7.3.7.8.3.3	Material thickness less than 0,2 mm	Multi-layers mylar sheets provided between primary and secondry in main transformer.	P
7.3.7.8.3.4	Compliance	See subclause 7.3.7.8.3.2.	P
7.3.7.8.4	Printed wiring boards		P
7.3.7.8.4.1	General	Insulation between conductor	P

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Clause	Requirement – Test	Result – Remark	Verdict
		layers in double-sided singlelayer PWBs meet the requirements of 7.3.7.8.1. Basic, supplementary, double and reinforced insulation meet the appropriate requirements of 7.3.7.8.2.1 or 7.3.7.8.2.2. Functional insulation in PWBs meet the requirements of 7.3.7.8.2.3.	
7.3.7.8.4.2	Use of coating materials	No coating material used.	N/A
7.3.7.8.5	Wound components	No such wound components.	N/A
7.3.7.8.6	Potting materials	No potting materials used.	N/A
7.3.7.9	Insulation requirements above 30 kHz	Considered.	P
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility	Built-in RCM unit within the PCE.	N/A
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.	Under normal and single-fault conditions, the resulting d.c. component of the current in the protective earthing conductor does not exceed the d.c. current withstand requirements in IEC 60755 and IEC 62020 for RCD and RCM of type B.	N/A
7.3.9	Capacitor discharge	(see appended table 7.3.9)	P
7.3.9.1	Operator access area		N/A
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.		N/A
7.3.9.2	Service access areas		P
	Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from charge stored on capacitors after disconnection of the PCE.	The warning symbol 21 of Table C.1 and an indication of the discharge time is placed in a clearly visible position on the protective barrier to avoid unconsciousness contact.	P
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level	There is no risk of energy hazard in operator access areas, protection of electrical shock by means of earthed metal enclosure.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5\ CU^2$		P
7.4.2	Operator Access Areas		P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.	All hazardous energy parts were enclosed within the earthed metal enclosure.	P
7.4.3	Services Access Areas		P
7.5	Electrical tests related to shock hazard	(see appended table 7.5)	P
7.5.1	Impulse voltage test (type test)	See appended table 7.5.1. During the test no puncture, flashover, or sparkover occurs.	P
7.5.2	Voltage test (dielectric strength test)	See below.	P
7.5.2.1	Purpose of test		P
7.5.2.2	Value and type of test voltage	(see appended table 7.5.2)	P
7.5.2.3	Humidity pre-conditioning	PCE is inteneded for WET LOCATIONS use.	P
7.5.2.4	Performing the voltage test	Refer to appended table 7.5.2.	P
7.5.2.5	Duration of the a.c. or d.c. voltage test	The full voltage is maintained for 60s.	P
7.5.2.6	Verification of the a.c. or d.c. voltage test	No electrical breakdown occurs during the test.	P
7.5.3	Partial discharge test	No double or reinforced solid insulation used. No voltage stress on the insulation is greater than 1 kV/mm.	N/A
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	(see appended table 7.3.6.3.7)	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.	See above.	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.5.5	Equipment with multiple sources of supply		N/A
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.	Edges, projections, corners, openings, guards, handles and the like, that are accessible to the OPERATOR are smooth and rounded.	P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		N/A
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.		N/A
8.2.1	Protection of service persons		P
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.	Barrier and the marking of symbol 15 of Table C.1 is provided for service persons.	P
8.3	Stability		N/A
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	The PCE is wall mounted equipment.	N/A
8.4	Provisions for lifting and carrying		P
	If carrying handles or grips are fitted to, or supplied with, the equipment, they shall be capable of withstanding a force of four times the weight of the equipment.		P
	Equipment or parts having a mass of 18 kg or more shall be provided with a means for lifting and carrying or directions shall be given in the manufacturer's documentation.		P
8.5	Wall mounting		P
	Mounting brackets on equipment intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the equipment.	Mounting brackets and wall construction for installation condition are specified in	P

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Clause	Requirement – Test	Result – Remark	Verdict
		installation manual. Mounting brackets withstand a force of four times the weight of the equipment.	
8.6	Expelled parts		N/A
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.	No such parts.	N/A
9	**PROTECTION AGAINST FIRE HAZARDS**		P
9.1	Resistance to fire		P
	This subclause specifies requirements intended to reduce the risk of ignition and the spread of flame, both within the equipment and to the outside, by the appropriate use of materials and components and by suitable construction.	Suitable and appropriate materials, components and construction are used to reduce the risk of ignition and the spread of flame.	P
9.1.1	Reducing the risk of ignition and spread of flame		P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.		P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.	A FIRE ENCLOSURE is required for equipment or parts of equipment.	P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;		P
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED		P

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Clause	Requirement – Test	Result – Remark	Verdict
	POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and		P
	– insulated wiring, except as permitted in 9.1.2.2.		P
9.1.2.2	Parts not requiring a fire enclosure	See above.	N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.	Metal enclosure provided.	P
9.1.3.2	Materials for fire enclosures		P
	If an enclosure material is not classified as specified below, a test may be performed on the final enclosure or part of the enclosure, in which case the material shall additionally be subjected to periodic SAMPLE testing.	Metal enclosure provided.	P
9.1.3.3	Materials for components and other parts outside fire enclosures		P
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.	Flammability CLASS HB or better used.	P
9.1.3.4	Materials for components and other parts inside fire enclosures	Flammability CLASS HB or better used.	P
9.1.3.5	Materials for air filter assemblies	No such materials.	N/A
9.1.4	Openings in fire enclosures		P
9.1.4.1	General	No openings in fire enclosures.	P
	For equipment that is intended to be used or installed in more than one orientation as specified in the product documentation, the following requirements apply in each orientation.		P
	These requirements are in addition to those in the following sections:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– 7.3.4, Protection against direct contact;		P
	– 7.4, Protection against energy hazards;		P
	– 13.5, Openings in enclosures		P
9.1.4.2	Side openings treated as bottom openings	See above.	N/A
9.1.4.3	Openings in the bottom of a fire enclosure	See above.	N/A
	The bottom of a FIRE ENCLOSURE or individual barriers, shall provide protection against emission of flaming or molten material under all internal parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.		N/A
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA		N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures		P
9.1.4.6	Additional requirements for openings in transportable equipment	PCE not for transportable equipment.	N/A
9.2	LIMITED POWER SOURCES	Not applied.	N/A
9.2.1	General		N/A
9.2.2	Limited power source tests	(see appended table 9.2)	N/A
9.3	Short-circuit and overcurrent protection		P
9.3.1	General		P
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.	No overcurrent hazards was presented by short circuits and overloads tests. Refer to sub-clause 4.4.4.	P
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		P

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Clause	Requirement – Test	Result – Remark	Verdict
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.	Upstream protective device for backup protection is specified in the installation manual.	P
10	**PROTECTION AGAINST SONIC PRESSURE HAZARDS**		P
10.1	General		P
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.		P
10.2	Sonic pressure and Sound level		P
10.2.1	Hazardous Noise Levels	Sound pressure level is lower than 80dB.	P
11	**PROTECTION AGAINST LIQUID HAZARDS**		N/A
11.1	Liquid Containment, Pressure and Leakage	No liquid contained in this system, and energy staorage battery used.	N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A
11.3	Oil and grease		N/A
12	**CHEMICAL HAZARDS**		N/A
12.1	General	No chemical Hazards.	N/A
13	**PHYSICAL REQUIREMENTS**		P
13.1	Handles and manual controls	It shall not be possible to fix them in wrong position if this	P

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Clause	Requirement – Test	Result – Remark	Verdict
		might result in a hazard.	
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might 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 might result in hazard.		P
13.1.1	Adjustable controls	No such controls.	N/A
13.2	Securing of parts	Screws, nuts, washers, springs or similar parts are secured so as to withstand mechanical stresses occurring	P
13.3	Provisions for external connections		P
13.3.1	General	Appropriate provisons for external connections applied.	P
13.3.2	Connection to an a.c. Mains supply		P
13.3.2.1	General	Terminals provided for permanent connection to the PV supply.	P
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:		P
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or		P
	– a non-detachable power supply cord for connection to the supply by means of a plug		N/A
	– an appliance inlet for connection of a detachable power supply cord; or		N/A
	– a mains plug that is part of direct plug-in equipment as in 13.3.8		N/A
13.3.2.2	Permanently connected equipment	A set of terminals as specified in 13.3.3 for external connection of supply cords.	P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord	Not provided, but technical requirements provided in user manual.	N/A
13.3.2.5	Cord anchorages and strain relief	No power supply cords provided.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		N/A
	– the connecting points of the cord conductors are relieved from strain; and		N/A
	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage	No power supply cords provided, however plastic inlet bushings provided ready for use.	N/A
13.3.3	Wiring terminals for connection of external conductors		P
13.3.3.1	Wiring terminals	Terminals for power supply cords connection by means of screws.	P
13.3.3.2	Screw terminals	Screws and nuts which clamp external supply conductors have a thread conforming to ISO 261 or ISO 262.	P
13.3.3.3	Wiring terminal sizes	The terminals meet the temperature rise test of 4.3 when connected using wire sizes as specified in the documentation or in Table 24.	P
13.3.3.4	Wiring terminal design	Lug terminals applied, and the cable lug clamped by nut.	P
13.3.3.5	Grouping of wiring terminals	Terminals located in proximity to each other.	P
13.3.3.6	Stranded wire	Lug terminals applied.	P
13.3.4	Supply wiring space	Lug terminals applied, and the cable lug is clamped by nut without the risk of damage to the conductors or their insulation.	P
13.3.5	Wire bending space for wires 10 mm² and greater	Considered.	P
13.3.6	Disconnection from supply sources	Disconnect devices provided.	P
13.3.7	Connectors, plugs and sockets	The misconnection is unlikely for PV or DC connectors.	P
13.3.8	Direct plug-in equipment	Not direct plug-in use.	N/A
13.4	Internal wiring and connections		P
13.4.1	General	The insulation, conductors and routing of all wires of the equipment is suitable for the	P

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Clause	Requirement – Test	Result – Remark	Verdict
		electrical, mechanical, thermal and environmental conditions of use.	
13.4.2	Routing	Wires are routed away from sharp edges, screw threads, burrs, fins, moving parts, drawers, and similar parts, which could abrade the wire insulation.	P
13.4.3	Colour coding	The green/yellow color coding wire only used for protective earthing conductor.	P
13.4.4	Splices and connections	All splices and connections are mechanically adequate secure and provided electrical continuity. The likelihood of loose is impossible.	P
13.4.5	Interconnections between parts of the PCE	The communication cable only used for servicing, no any physical damage or mechanical damage likely.	P
13.5	Openings in enclosures	Not opening in metal enclosure.	N/A
13.5.1	Top and side openings		N/A
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		N/A
13.6	Polymeric Materials		P
13.6.1	General	See below.	P
13.6.1.1	Thermal index or capability	Appropriate electrical, mechanical, thermal and flammability degree polymeric materials provided.	P
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards	Metal enclosure used.	N/A
13.6.2.1	Stress relief test	See above.	N/A
13.6.3	Polymers serving as solid insulation	See below.	P
13.6.3.1	Resistance to arcing		P
13.6.4	UV resistance	Metal enclosure provided.	N/A
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
13.7	Mechanical resistance to deflection, impact, or drop		P
13.7.1	General	See below.	P
13.7.2	250-N deflection test for metal enclosures	A steady force of 250 N applied for 5 s, after test no hazards occurred.	P
13.7.3	7-J impact test for polymeric enclosures	Impact test applied on the display screen cover.	P
13.7.4	Drop test	Not for hand - held, direct plug - in, or transportable equipment.	N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General		P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal		N/A
14	**COMPONENTS**		P
14.1	General	(see appended table 14)	P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		
14.2	Motor Over temperature Protection		N/A
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperature HAZARD, or a fire HAZARD, shall be protected by an over temperature or thermal protection device meeting the requirements of 14.3.		N/A
14.3	Over temperature protection devices	Approved overtemperature protective devices used and for which appropriate rating was selected for use and do not operate in normal use. For overtemperature protection test or evaluation see appended table 4.4.4.	P
14.4	Fuse holders	Fuse holders with fuses are not intended to be replaceable by an OPERATOR.	N/A
14.5	MAINS voltage selecting devices	No such devices.	N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.	PCB materials with a flammability classification of V-1 or better used.	P
	This requirement does not apply to thin-film flexible printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		P
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.		P
14.7	Circuits or components used as transient overvoltage limiting devices		N/A
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.	No such components.	N/A
14.8	Batteries		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.		N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A non-metallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions	Single fault safe compliance. Failures evaluation and risk analysis were performed by means of fault simulation or single fault conditions. (refer to subclause of 4.4.4).	P

4.2.2.6/4.7	TABLE: electrical data in normal condition					P
Type	U (V) DC	I (A) DC	P (W) DC	U (V) grid	I (A) AC	P (W) AC
Test by model: ED5000						
Inverter Grid connection)	423.62	12.43	5114.4	230.99	21.64	4991.6
	268.74	19.79	5167.8	231.00	21.64	4991.4
	158.05	33.35	5121.4	230.98	21.63	4990.1
Inverter (Stand-alone)	423.01	12.58	5171.3	230.99	21.63	4990.5
	262.61	20.42	5271.3	230.98	21.62	4988.8
	157.90	33.40	5125.1	231.00	21.63	4989.8
Inverter (Battery input)	56.68	91.49	5170.3	230.99	21.63	4990.3
Charger	57.86	85.43	4928.6	230.92	22.21	5118.2
Test by model: ED4600						
Inverter Grid connection)	430.79	11.28	4752.3	230.97	19.73	4550.4
	261.42	18.62	4786.3	230.95	19.73	4550.0
	150.11	31.03	4645.6	230.94	19.74	4551.2
Inverter (Stand-alone)	433.77	11.27	4750.4	230.97	19.73	4551.3
	262.47	18.52	4777.3	230.97	19.73	4551.3
	151.60	30.69	4638.8	230.97	19.74	4552.0
Inverter (Battery input)	56.59	83.99	4739.5	230.96	19.74	4551.7
Charger	54.19	84.28	4556.6	230.94	20.58	4743.8
Test by model: ED3600						
Inverter Grid connection)	430.74	8.79	3704.9	230.86	15.37	3539.7
	261.64	14.40	3702.2	230.95	15.36	3537.8
	150.12	25.30	3786.9	230.87	15.36	3538.6
Inverter (Stand-alone)	433.63	8.79	3705.5	230.87	15.33	3532.8
	262.28	14.37	3703.1	230.85	15.34	3534.0
	148.75	25.49	3780.3	230.87	15.34	3534.2
Inverter (Battery input)	56.22	66.63	3735.4	230.87	15.36	3538.1
Charger	56.59	63.68	3593.6	230.87	16.06	3703.1
Supplementary information:						

4.3	TABLE: Heating Test				P
	test voltage (V) ..... :	See below			—
	t1 (°C) ..... :	See below			—
	t2 (°C) ..... :	See below			—

Thermocouple Locations	Max. temperature measured (°C)				Limit, (°C)
Conditions:	Inverter model (Grid connection)				--
Supplied Voltage [Vd.c.]	120	120	430	430	--
Ambient [°C]	45	60	45	60	--
DC inductance coil	57.1	89.3	57.5	72.3	110
DC capacitor C90	55.6	79.5	55.9	70.8	105
DC capacitor C122	54.8	76.1	55.1	69.8	105
TX5 Transformer coil	53.8	77.6	54.0	70.2	110
P14 Inductive coil	58.1	77.3	58.6	73.3	110
P10 Inductive coil	54.9	76.5	55.2	70.0	110
DC capacitor C82	59.3	80.3	59.7	74.7	105
Relay 1	66.8	83.2	67.1	81.6	85
PCB near IGBT	64.6	83.6	65.2	80.5	105
Bus capacitance C7	57.3	75.8	57.8	72.2	105
Fan	55.3	74.1	55.6	70.2	-
Fan bracket	55.4	73.3	55.7	70.4	-
X6 transformer coil	66.0	82.1	66.5	80.0	110
PCB near IGBT HS1	63.6	80.0	64.1	78.1	105
AC side current transformer	64.5	81.3	65.1	79.5	110
AC capacitance measurement	59.8	76.3	60.4	74.7	105
Inductive magnetic ring at AC side	70.0	84.9	71.2	86.0	-
Inductive coil at AC side	72.8	87.8	74.1	89.0	110
AC side relay 2	66.2	82.4	66.7	81.2	85
Inductive magnetic ring 2	63.8	79.3	64.6	79.3	-
Inductive coil 2	66.0	81.5	67.2	82.0	110
Varistor	55.1	72.2	55.4	70.0	-
AC side capacitance C306	53.8	70.9	54.1	68.6	105
AC side transformer coil	59.4	77.1	59.8	74.3	110
GFCI	58.7	76.3	59.2	73.6	-

Relay 2	55.9	73.3	56.3	70.9	85
Relay 4	55.7	73.4	56.1	70.6	85
Off grid side capacitance	54.7	72.2	55.0	69.6	85
Current transformer at off grid side	54.6	72.4	54.9	69.3	110
Off grid side transformer coil	56.7	74.7	57.1	71.7	110
Off grid side transformer KFT2229 coil	55.9	73.9	56.3	70.8	110
PCB near Off grid side IGBT	53.9	71.9	54.1	68.7	105
C15 capacitance	54.6	72.8	54.9	69.4	105
C20 capacitance	54.2	73.0	54.5	69.1	105
PCB near battery side IGBT	54.3	73.2	54.6	69.2	105
Battery side transformer	55.4	73.4	55.7	70.0	110
PCB near U1	67.7	84.5	67.9	82.1	105
PCB near STK BS1	52.9	70.5	53.2	67.5	105
AC relay 3	57.3	75.1	57.6	72.0	85
AC relay 4	59.4	77.1	59.6	74.1	85
Grid side terminal	51.2	67.8	51.3	65.9	95
Off grid terminal	49.8	66.6	49.8	64.5	95
DC switch	50.3	68.0	50.4	64.8	95
DC positive plug	45.7	61.1	45.6	60.3	95
DC negative plug	45.9	62.9	45.7	60.5	95
Enclosure	49.2	65.6	49.2	63.9	70
Button	47.6	62.9	47.4	62.2	95
Heat sink	50.8	69.4	51.1	65.8	70
Switch	45.5	60.7	45.4	60.1	95

Thermocouple Locations	Max. temperature measured (°C)				Limit, (°C)
Conditions:	Inverter model (stand-alone)				--
Supplied Voltage [Vd.c.]	120	120	430	430	--
Ambient [°C]	45	60	45	60	--
DC inductance coil	57.1	89.5	56.9	72.6	110
DC capacitor C90	55.6	79.7	55.3	71.0	105
DC capacitor C122	54.8	76.3	54.6	70.0	105
TX5 Transformer coil	53.8	77.7	53.6	70.5	110
P14 Inductive coil	58.1	77.4	58.0	73.5	110
P10 Inductive coil	54.9	76.6	54.7	70.1	110

DC capacitor C82	59.3	80.5	59.1	74.9	105
Relay 1	66.8	83.4	66.7	81.8	85
PCB near IGBT	64.6	83.8	64.4	80.6	105
Bus capacitance C7	57.4	75.9	57.2	72.4	105
Fan	55.3	74.3	55.1	70.3	-
Fan bracket	55.4	73.4	55.3	70.5	-
X6 transformer coil	66.1	82.3	65.9	80.2	110
PCB near IGBT HS1	63.6	80.2	63.5	78.3	105
AC side current transformer	64.5	81.5	64.4	79.6	110
AC capacitance measurement	59.8	76.5	59.6	74.9	105
Inductive magnetic ring at AC side	69.9	85.1	69.8	86.2	-
Inductive coil at AC side	72.8	88.0	72.6	89.2	110
AC side relay 2	66.2	82.5	66.1	81.4	85
Inductive magnetic ring 2	63.8	79.6	63.6	79.4	-
Inductive coil 2	66.0	81.7	65.9	82.2	110
Varistor	55.1	72.3	54.9	70.2	-
AC side capacitance C306	53.8	71.0	53.7	68.8	105
AC side transformer coil	59.4	77.3	59.3	74.6	110
GFCI	58.7	76.5	58.5	73.8	-
Relay 2	55.9	73.4	55.8	71.1	85
Relay 4	55.8	73.6	55.6	70.7	85
Off grid side capacitance	54.7	72.3	54.6	69.7	85
Current transformer at off grid side	54.6	72.5	54.5	69.5	110
Off grid side transformer coil	56.7	74.9	56.6	71.9	110
Off grid side transformer KFT2229 coil	56.0	74.0	55.8	71.0	110
PCB near Off grid side IGBT	53.9	72.0	53.7	68.9	105
C15 capacitance	54.6	73.0	54.5	69.6	105
C20 capacitance	54.2	73.2	54.1	69.2	105
PCB near battery side IGBT	54.3	73.3	54.2	69.4	105
Battery side transformer	55.4	73.5	55.2	70.1	110
PCB near U1	67.7	84.7	67.5	82.2	105
PCB near STK BS1	53.0	70.7	52.8	67.6	105
AC relay 3	57.4	75.3	57.2	72.2	85
AC relay 4	59.4	77.3	59.2	74.3	85
Grid side terminal	51.2	67.9	51.0	66.1	95
Off grid terminal	49.8	66.7	49.6	64.7	95

DC switch	50.3	68.2	50.2	65.0	95
DC positive plug	45.7	61.3	45.6	60.4	95
DC negative plug	45.9	63.0	45.7	60.6	95
Enclosure	49.2	65.7	49.2	64.1	70
Button	47.6	63.0	47.4	62.4	95
Heat sink	50.9	69.6	50.7	66.1	70
Switch	45.5	60.8	45.4	60.2	95

Thermocouple Locations	Max. temperature measured (°C)		Limit, (°C)
Conditions:	Charge		--
Supplied Voltage [Vd.c.]	430	430	--
Ambient [°C]	45	60	--
DC inductance coil	57.0	60.4	110
DC capacitor C90	55.6	89.5	105
DC capacitor C122	54.8	79.7	105
TX5 Transformer coil	53.7	76.3	110
P14 Inductive coil	58.1	77.8	110
P10 Inductive coil	54.9	77.4	110
DC capacitor C82	59.2	76.6	105
Relay 1	66.8	80.5	85
PCB near IGBT	64.5	83.4	105
Bus capacitance C7	57.3	83.8	105
Fan	55.2	76.0	-
Fan bracket	55.4	74.3	-
X6 transformer coil	66.0	73.5	110
PCB near IGBT HS1	63.6	82.3	105
AC side current transformer	64.5	80.2	110
AC capacitance measurement	59.7	81.5	105
Inductive magnetic ring at AC side	70.0	76.5	-
Inductive coil at AC side	72.7	85.2	110
AC side relay 2	66.2	88.1	85
Inductive magnetic ring 2	63.7	82.6	-
Inductive coil 2	66.0	79.6	110
Varistor	55.0	81.7	-
AC side capacitance C306	53.8	72.3	105
AC side transformer coil	59.4	71.0	110

GFCI	58.6	77.4	-
Relay 2	55.9	76.5	85
Relay 4	55.7	73.5	85
Off grid side capacitance	54.7	73.6	85
Current transformer at off grid side	54.5	72.4	110
Off grid side transformer coil	56.7	72.6	110
Off grid side transformer KFT2229 coil	55.9	75.0	110
PCB near Off grid side IGBT	53.8	74.1	105
C15 capacitance	54.6	72.1	105
C20 capacitance	54.2	73.1	105
PCB near battery side IGBT	54.3	73.2	105
Battery side transformer	55.3	73.3	110
PCB near U1	67.7	73.5	105
PCB near STK BS1	52.9	84.6	105
AC relay 3	57.3	70.7	85
AC relay 4	59.3	75.3	85
Grid side terminal	51.1	77.3	95
Off grid terminal	49.7	67.9	95
DC switch	50.2	66.8	95
DC positive plug	45.6	68.2	95
DC negative plug	45.8	61.2	95
Enclosure	49.2	63.1	70
Button	47.5	65.8	95
Heat sink	50.8	63.0	70
Switch	45.5	69.6	95
Supplementary information:			

	TABLE: Heating test, resistance method		--
	Test voltage (V) ..... :	--	—
	Ambient, t_1 (°C) ..... :	--	—
	Ambient, t_2 (°C) ..... :	--	—

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

4.4	TABLE: fault condition tests						P
	ambient temperature (°C) .....:		25°C				—
No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1	AC output	Overload	Refer to above table	Steady condition	-	-	Inverter protection, exit inverter status. No components damage. No hazard.
2	DC+ to DC-	Reverse	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	Inverter can not start up. No output power feed into grid. DC input fuse damaged. No hazard.
3	Output L to N	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	Inverter stop operation immediately after short-circuit. No output power feed into grid. No components damage, no hazard.
4	DC+ to DC -	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	Inverter stop operation immediately after short-circuit. No backfeed current observed to PV side. No output power feed into grid. No components damage, no hazard.
5	DC source disconnected	Disconnected without additional fault	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	Inverter stop operation immediately due to DC under voltage. No backfeed voltage observed onto PV side. No output power feed into grid. No components damage, no hazard.
6	DC source disconnected	IGBT shorted	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	Inverter stop operation immediately due to DC under voltage. No backfeed voltage observed onto PV side. No output power feed into grid. No components damage, no hazard.
7	Main soutage	Disconnected	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	Inverter shut down for immediately due to islanding detection.No backfeed voltage observed onto Mains side.No output no power feed into grid. No components damage, no hazard.
8	Mains outage	IGBT shorted	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	Inverter damaged and shut down immediately.No backfeed voltage observed onto Mains side. No output power feed into grid, no hazard.
9	Y1 capacitor, C296	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	The inverter operates normally. No components damage, no hazard.

10	Bus-capacitor, C1	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter stop operation immediately after short-circuit. No output power feed into grid. IGBT damaged, no hazard.
11	TX2, pin 6– pin7	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down. IGBT & TX2 damaged no hazard.
12	TX6, pin 2 – pin 3	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down. Auxiliary power off. TX2 damage, no hazard.
13	TX8, pin 9– pin 10	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	The auxiliary power supply and mains power supply circuit are damaged, and the TX8 is damaged.No hazard.
14	TX1, pin 9 – pin 8	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down. No components damage, no hazard.
15	Boost IGBT Q44, C-E	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down. Q44 and its drive circuit are damaged, no hazard.
16	Boost IGBT Q44, G-E	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	The inverter exits the inverter and enters the waiting state. No components damage, no hazard.
17	Boost Diode D110	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down. Q44 & D110 damage, no hazard.
18	Boost IGBT Q46, C-E	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down. Q46 and its drive circuit are damaged, no hazard.
19	Boost IGBT Q46, G-E	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	The inverter exits the inverter and enters the waiting state. No components damage, no hazard.
20	Boost Diode D112	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down. Q46 & D112 damage, no hazard.

21	INV IGBT Q45, C-E	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down immediately. All IGBTs damage , no hazard.
22	INV IGBT Q47, C-E	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down immediately. All IGBTs damage , no hazard.
23	INV IGBT Q43. C-E	Short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down immediately. All IGBTs damage , no hazard.
24	Relay 2	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
25	Relay 4	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
26	Relay 6	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
27	Relay 9	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
28	Relay 10	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
29	Relay 11	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
30	Relay driver R303	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
31	Relay driver R302	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.

32	Relay driver Q38	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
33	Relay driver Q37	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
34	PV array insulation resistance monitoring, R14	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
35	PV array insulation resistance monitoring, R14	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
36	PV array insulation resistance monitoring, R23	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
37	PV array insulation resistance monitoring, R30	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter works normally. No other components damage, no hazard.
38	PV array insulation resistance monitoring, R39	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
39	PV array insulation resistance monitoring, R42	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
40	PV array insulation resistance monitoring, R50	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
41	PV array insulation resistance monitoring, R40	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start. No components damage, no hazard.
42	RCMU detect, Q11	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start to work. No components damage, no hazard.

43	RCMU detect, R95	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start to work. No components damage, no hazard.
44	RCMU detect, R52	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start to work. No components damage, no hazard.
45	RCMU detect, R117	Open before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start to work. No components damage, no hazard.
46	RCMU detect, C43	Short before start-up	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter could not start to work. No components damage, no hazard.
47	Main CPU, 21	Short +3.3V power supply pin to GND	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down immediately. No components damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
48	Main CPU, 21	Short +1.2V power supply pin to GND	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down immediately. No components damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
49	Main CPU, 21	Oscillator short	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down immediately. IGBT damage, no hazard.
50	Communication between DSPs, R162	Open	PV: 500Vdc Battery side: 58Vdc AC output: 230Vac	10min	-	-	PV inverter shut down immediately. No components damage, no hazard.
51	Slave CPU, U22	Short +3.3V power supply pin to GND	MAINS:400 PV: 800	10min	-	-	PV inverter shut down immediately.No components damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.

Supplementary information:
Note 1: All single fault tests were carried out by a 30A non-time delay fuse connected between the protective earthing terminal and the protective earthing conductor in the test setup which had not opened during the tests. All single fault tests were conducted with the AC output protected by external circuit breaker provided in all live connections to the AC supply.
Note 2: Pass the dielectric strength test of basic insulation test voltage for accessible DVC-A, reinforced or double Insulation and basic insulation in protective class I equipment.

Note 3: The equipment was placed on white tissue-paper covering a softwood surface and covering the equipment with cheesecloth during the fault testing, no emission of molten metal, burning insulation, or flaming or glowing particles from the fire enclosure, and there was no charring, glowing, or flaming of the cheesecloth.

Note 4: No other hazard(e.g. chemical, expulsion) observed after each test, SC=Short circuit, OC=Open circuit, OV=Over voltage, OL=Over load.

7.3.6.3.3	**TABLE: protective equipotential bonding ;**	P

Measured between:	Test current (A)	Voltage drop (V)	Resistance (mΩ)	result
AC connector earthing pin to furthest point of earthed metal enclosure	40	0.32	8	Pass
supplementary information				

7.3.6.3.7	**TABLE: touch current measurement**	P

Measured between:	Measured (mA)	Limit (mA)	Comments/conditions
At metal enclosure	AC 2.7	AC 3.5 / DC 10	PE disconnected
Supplementary information: Max. MPPT Voltage supply input, 1.1Un AC mains connection.			

7.3.7	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)
INV board to metal chassis: BI		4000	500Vdc 230Vac	3.0	7	3.0	7
DSP board to metal chassis: BI		4000	500Vdc 230Vac	3.0	15	3.0	15
PV supply circuits + to -: FI		4000	500Vdc 230Vac	3.0	>5	3.0	>5
AC grid circuits L to N: FI		4000	500Vdc 230Vac	3.0	>10	3.0	>10
AC grid circuits to metal chassis: BI		4000	500Vdc 230Vac	3.0	>10	3.0	>10
AC backup circuits L to N: FI		4000	500Vdc 230Vac	3.0	>10	3.0	>10
PV supply circuits to PE: BI		4000	500Vdc 230Vac	3.0	>10	3.0	>10
DC supply circuits + to -: FI		4000	500Vdc 230Vac	3.0	>10	3.0	>10
PV supply circuits to SELV circuits: RI		4000	500Vdc 230Vac	5.5	>10	5.5	>10
AC mains circuits to SELV circuits: RI		4000	500Vdc 230Vac	5.5	>10	5.5	>10
AC grid circuits to PE: BI		4000	500Vdc 230Vac	3.0	>10	3.0	>10
AC grid circuits L to N: FI		4000	500Vdc 230Vac	3.0	3.7	3.0	3.7
Circuits Definition:							
Communication Circuits: DVC-A			PV Circuits: DVC-C				
Battery circuits: DVC-A			AC mains / Grid Circuits: DVC-C				
Supplementary information: PV supply circuits = O.V.C II, AC mains circuits = O.V.C. III, DC Power Supply Voltage = O.V.C II. PD = PD2 (inside) (IP65), MG = IIIa/b, Altitude = 2000m							

7.3.7	TABLE: distance through insulation measurement			
distance through insulation di at/of:	U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)
Bobbin in transformer (BI)	DC 500V or AC 230V	2120	0.2	1.0
Optical coupler [1)] (RI)	DC 500V or AC 230V	4240	0.4	0.6
Note(s): [1)] Certificated components.				

7.5	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)	result
Input to metal chassis (BI)	1500	6000	--	Pass
Output to metal chassis (BI)	1500	6000	--	Pass
Input to Comm. part (DI)	3000	8000	--	Pass
Output to Comm. part (DI)	3000	8000	--	Pass

9.2	TABLE: Limited power sources	N/A

Circuit output tested:

Note: Measured Uoc (V) with all load circuits disconnected:

Components	Sample No.	Uoc (V)	I_{sc} (A)		VA	
			Meas.	Limit	Meas.	Limit

supplementary information:

Sc=Short circuit, Oc=Open circuit

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
Metal enclosure	--	--	Min.2mm thickness	--	--
PV Input connectors	Vaconn	VP-D4B-PHSF4	1100V/30A	IEC62852	TUV R50396796
AC connectors	CNNT	ERTB10-03-10.16	3P/57A	UL486	UL E304128
Battery connection terminal block	CNNT	BRTB200	2P/150A/600V	UL486	UL E304128
DC switch	ASwitch	EDS5HM/13-3	1500V 32A	EN60947-3:2009+A1+A2	TUV R50496000
Internal wiring (PV-in)	ShenZhen JiRui	12AWG	1000V,105°C	UL758	UL E317702
Internal wiring (AC) and Earthing wiring	ShenZhen JiRui	12AWG	1000V,105°C 12AWG	UL758	UL E317702
All PCB	ShenZhen JinXin	FR-4	150°C V-0	UL796	UL E109769
DC fan	ShenZhen Xinqifeng	602525	12V/0.15A/5400	EN55022:2010 EN61000-4-11:2004	BKC-160712232
Silica gel	ShenZhen AnPin	QMFZ2	105°C	UL746	UL E257078
Y capacitor (C98, C99, C53, C54, C307, C310)	Sichuang ZhongXing	MK63472KF240 B000G	Y2, 300Vac, 4700pF, 110°C,	UL 60384-14	UL E217215
Y capacitor (C311, C296)	Sichuang ZhongXing	MK63333KF26X B000G	Y2, 300Vac, 33000pF, 110°C	UL 60384-14	UL E217215
Inductor (CT2, CT1)	ShenZhen YuYuan	D13.02.0002-0	2.9mH, CLASS B	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
-WIRE	DONG GUAN YIDA INDUSTRIAL CO LTD	1PEW	180°C	UL1581	UL E344055
-BOARD	KINGBOARD LAMINATES LTD	FR4	130°C	UL796	UL E123995
-Insulation tape	JINGJIANG YAHUA PRESSURE SENSITIVE	CT-280	130°C	UL510	UL E165111

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
	GLUE CO LTD				
Current sensors	LEM	LAH 25-NP	25A, 600V	UL2808	UL E189713
X Capacitor (C205)	Sichuang ZhongXing	MK61475KP2B 0B000G	X1, 4.7uF, 275Vac,	IEC/EN 60384-14	SU03046-13003A
X Capacitor (C306)	Sichuang ZhongXing	MK61335KP2B 0B000G	X2, 3.3uF, 305Vac,	IEC/EN 60384-14	SU03046-13003A
Inductor (L2)	ShenZhen YuYuan	D13.02.0008-0	1.1mH,CLASS B	62109-1 IEC/EN 62109-2	Tested within apparatus
-WIRE	DONG GUAN YIDA INDUSTRIAL CO LTD	1PEW	180°C	UL1581	UL E344055
-BOARD	KINGBOARD LAMINATES LTD	FR4	130°C	UL796	UL E123995
-Insulation tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280	130°C	UL510	UL E165111
X capacitor (C82, C65)	Sichuang ZhongXing	CB24224J2J9S B000U	X2, 305Vac, 0.22uF, 110°C	UL 60384-14	SU03046-13003A
Relay(RY3, RY4，RY6, RY9, RY10, RY11)	Zettler	AZSR131	35A, 305VAC	IEC 61810-1	TUV No 088793 005
Transformer (TX8)	ShenZhen YuYuan	EI28	CLASS B	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	150°C	UL94	UL E59481
-WIRE	DONG GUAN YIDA INDUSTRIAL CO LTD	2PEW 180℃	180°C	UL1581	UL E344055
-BOARD	KINGBOARD LAMINATES LTD	FR4	130°C	UL796	UL E123995
-Insulation tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280	130°C	UL510	UL E165111

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
Optical coupler (U13, U15, U16, U18, U19, U20, U21, U22, U23, U24, U26, U27，U1, U2, U4, U7, U8, U9, U11, U12)	Toshiba	TLP352	External creepage≥5.5mm; Pollution degree: 2; 100ºC	IEC/EN 60747-5-5	VDE 40011913
Transformer (mian)	ShenZhen YuYuan	EE55	CLASS B	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
-WIRE	DONG GUAN YIDA INDUSTRIAL CO LTD	2PEW 180℃	180°C	UL1581	UL E344055
-BOARD	KINGBOARD LAMINATES LTD	FR4	130°C	UL796	UL E123995
-Insulation tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280	130℃	UL510	UL E165111
Optical coupler (U29)	EVERLIGHT	EL817S1(B)(TU)-G	External creepage≥5.5mm; Pollution degree: 2;	IEC 61810-1	VDE 132249
MOSFET (Q49, Q50, Q51, Q53, Q55, Q57, Q59, Q60)	NCEPOWER	NCEP023N10T	100V/280A	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
MOSFET (Q41, Q47，Q52, Q54, Q56, Q58, Q44, Q46)	OrientalSemiconductor	OST75N65HSXF	75A, 650V	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
MOSFET (Q42, Q43, Q45, Q48)	OrientalSemiconductor	OST60N65HSX	75A, 650V	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
Diodes (D109, D110, D111, D112)	Yang Jie	MUR6060P -B1-OOOOHF	60A, 600V	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
RCMU (GFCI1) detector	ShenZhen YuYuan	MP2303-4AS	73:10/	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
-WIRE	GUANGZHOU CITY ZHI	LSTIW	155°C	UL1581	UL E344055

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
	CHANG ELECTRONIC TECHNOLOGY CO LTD				
-BOARD	KINGBOARD LAMINATES LTD	FR4	130°C	UL796	UL E123995
Insulation tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280	130℃	UL510	UL E165111
DSP chipset (21)	TI	TMS320F28069 PZ/100PIN	90M 100Pin -40°C~105°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
CPU (U22)	GigaDevice	GD32F305RET 6	120M 64Pin -40°C~85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
CPU (U45)	China Key System & Integrated Circuit Co., Ltd	CKS32F103CB T6	72M 48Pin -40°C~105°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested within apparatus
[1]) an asterisk indicates a mark which assures the agreed level of surveillance					

List of test equipment used:

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

No,	Equipment	Internal No,	Type/characteristics	Manufacturer	Last Calibration	Due Data
1	Oscilloscope	LBEQ0013	DP0 4054	Tektronix	2021-11-26	2022-11-25
2	Voltage probe	LBEQ0018-A	Zp1500D	Guangzhou ZHIYUAN Electronics Co., Ltd.	2021-11-26	2022-11-25
3	Current probe	LBEQ0016	CT60	Shenzhen ZhiYong Electronics Co., Ltd.	2021-11-26	2022-11-25
4	Current probe	LBEQ0016-A	CT60	Shenzhen ZhiYong Electronics Co., Ltd.	2021-11-26	2022-11-25
5	Current probe	LBEQ0016-B	CT60	Shenzhen ZhiYong Electronics Co., Ltd.	2021-11-26	2022-11-25
6	Current probe	LBEQ0016-C	CT60	Shenzhen ZhiYong Electronics Co., Ltd.	2021-11-26	2022-11-25
7	AC power supply	LBEQ0002	WLPA-33075KVA	WAGO DINYI	2021-11-26	2022-11-25
8	Programmabl e DC source	LBEQ0006	WPVD-60K	WAGO DINYI	2021-11-26	2022-11-25
9	Pull and push	BZ-DGD-L080	2P-1000	/	2022-08-25	2023/08/24
10	Digital Caliper	LBEQ0023	0-150mm/0.01mm	DELI	2021-11-26	2022-11-25
11	Tape measure	LBEQ0038	5M	SATA	2022-01-11	2023-01-10
12	safetyComprehe nsive Tester	LBEQ0030	LPⅤ-5040	Suzhou Luyi Measurement and Control Technology Co., Ltd.	2021-11-26	2022-11-25
13	Heating Recoder	LBEQ0027	34970A	Agilent	2021-11-26	2022-11-25
14	Noise meter	BZ-DGD-L029	TES-1357	/	2022-06-29	2023-06-28
15	Spring Hammer	BZ-DGE-L036	HCWG 70	/	2022-08-09	2023-08-08
16	Thermostat	LBEQ0026	OK-TH-3.3m3c	ouke	2021-11-26	2022-11-25
17	Electronic Scale	BZ-DGB-L257	YH-T1	/	2022-09-07	2023-09-06
18	Sand and dust chamber	BZ-KKX-L010	SC-500	/	2022-09-09	2023-09-08
19	Diving test device	BZ-KKX-L008	JL-122	/	2022-09-09	2023-09-08

----------End of report----------

Attachment I

(Pictures of the EUT and Electrical Schemes)

1.1 PICTURES

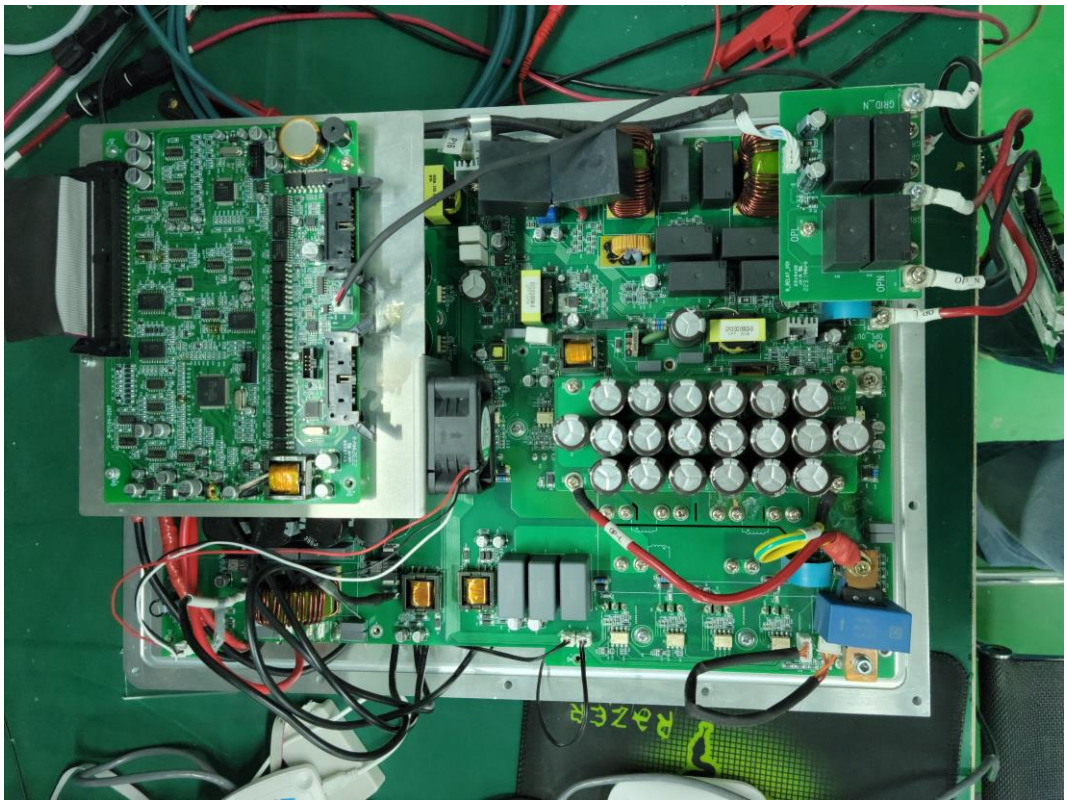
Front view

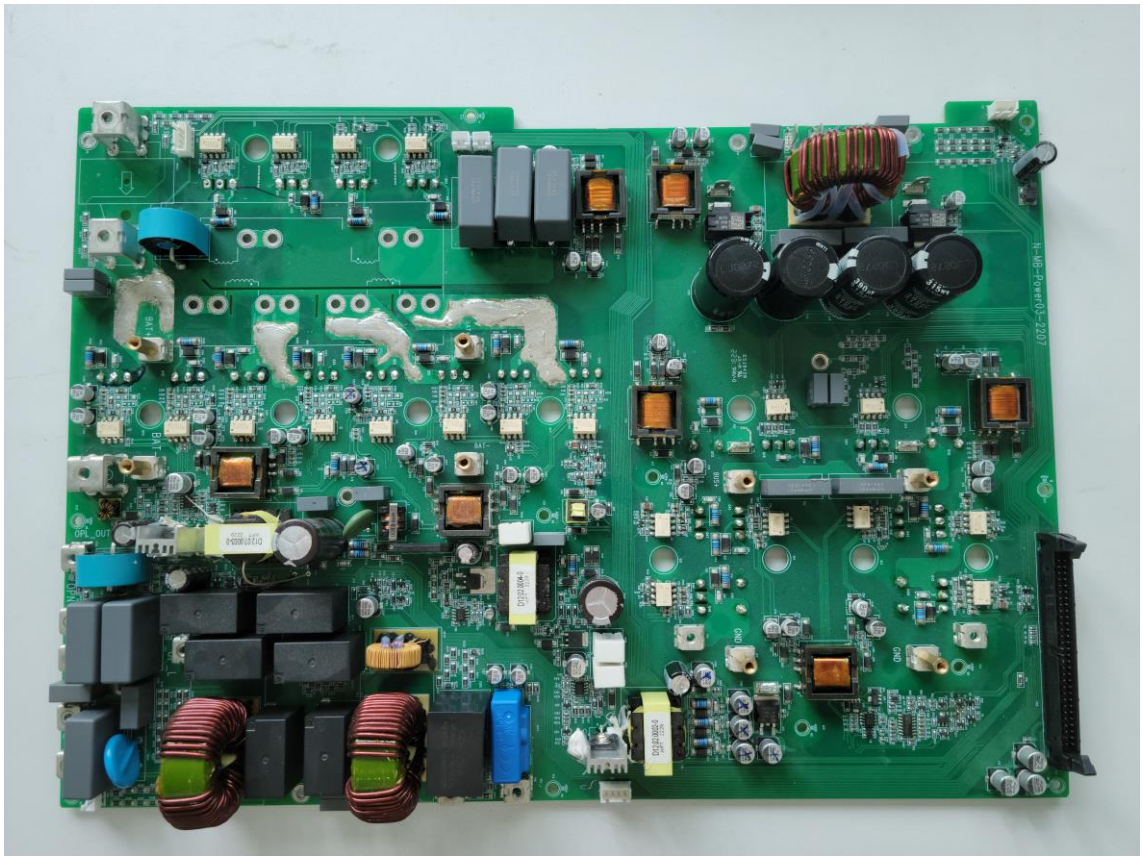
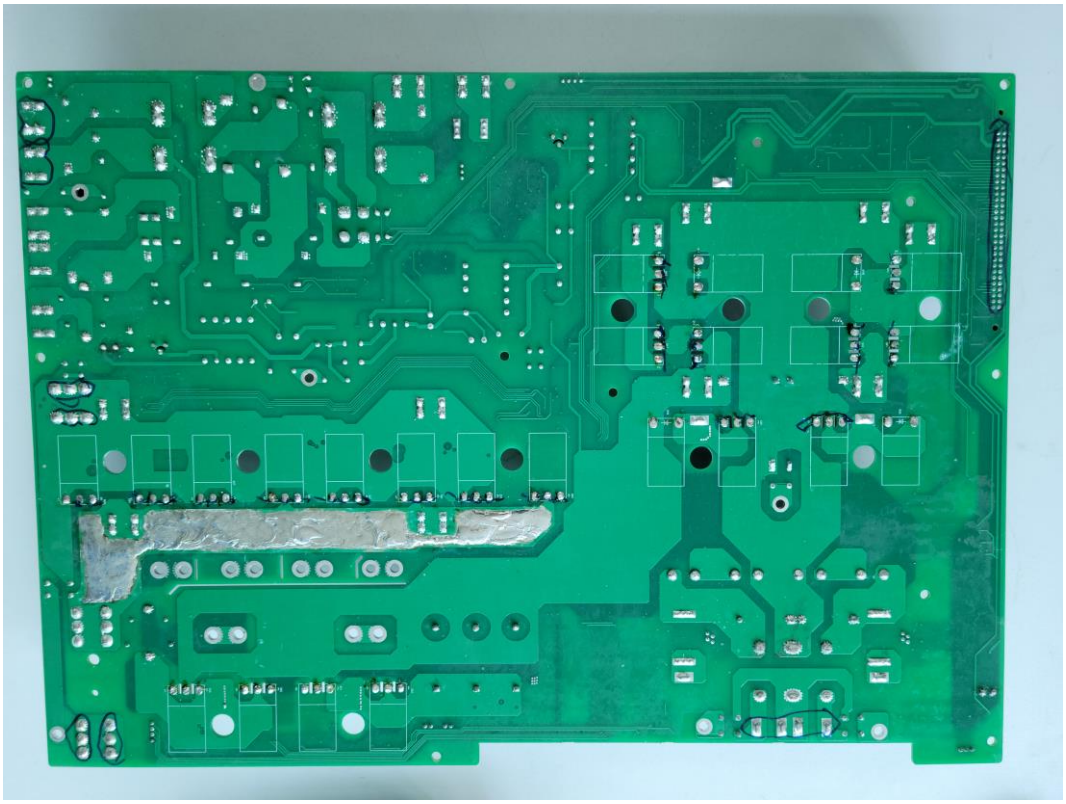
Back Side


Connection interface

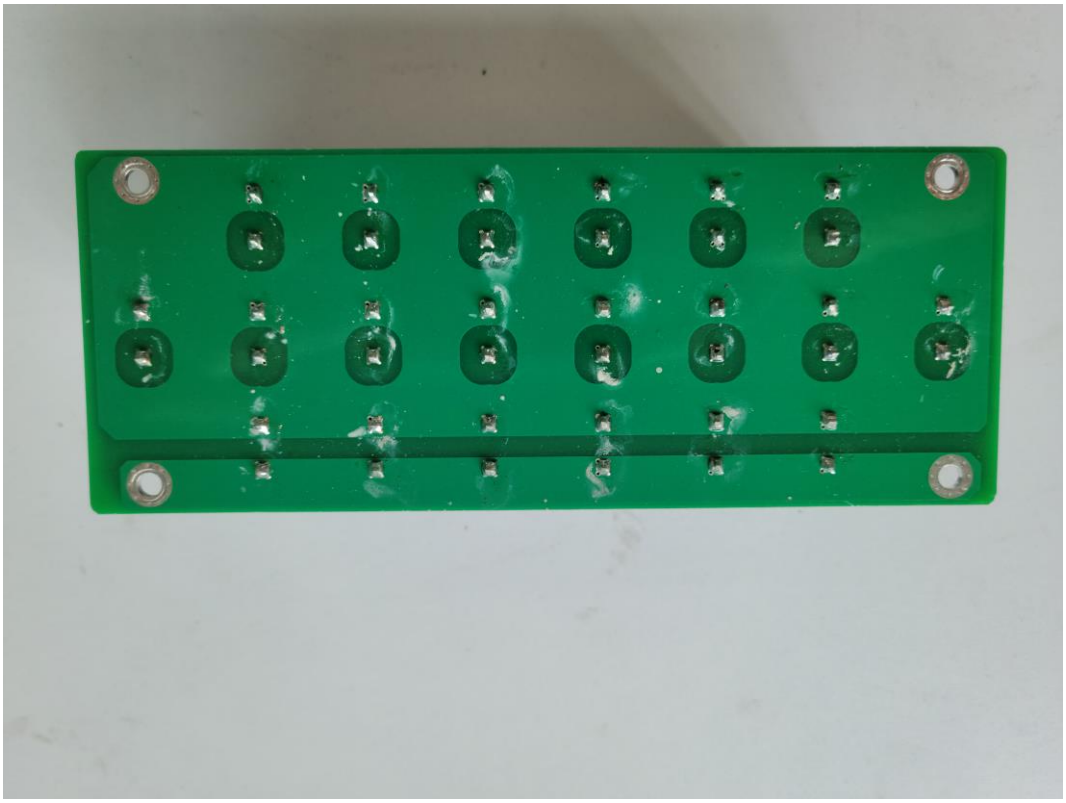
Top Side


External grounding

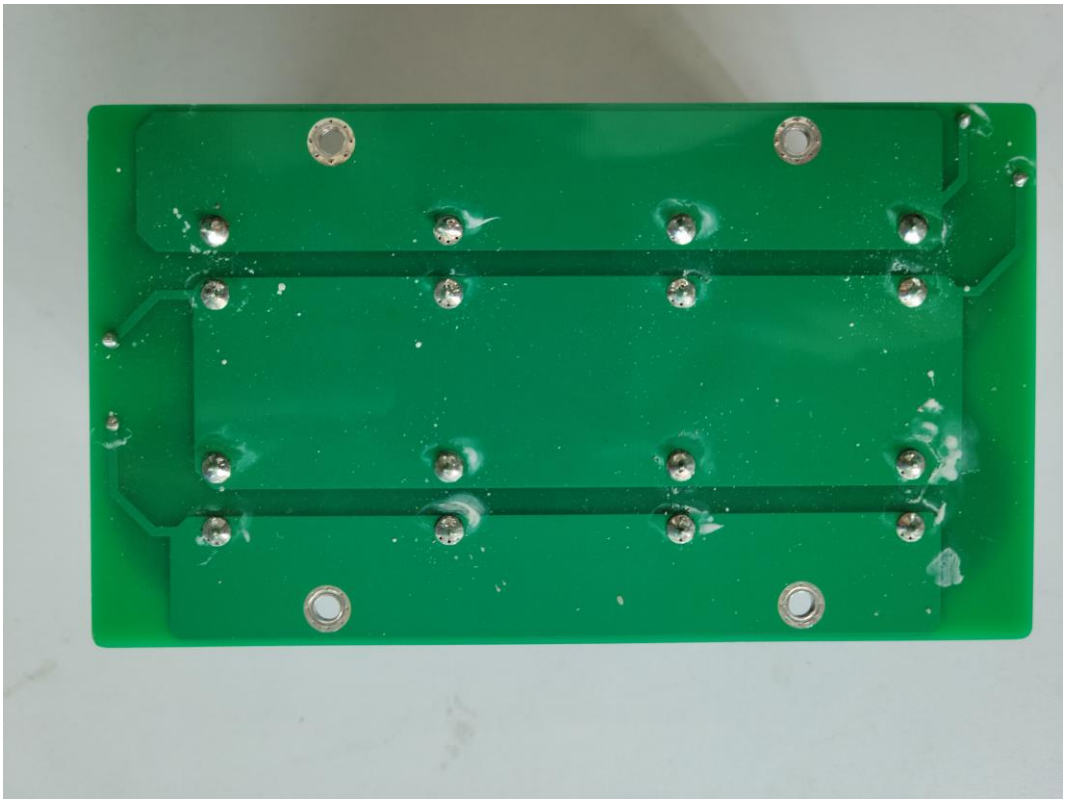
General Internal view of inverter


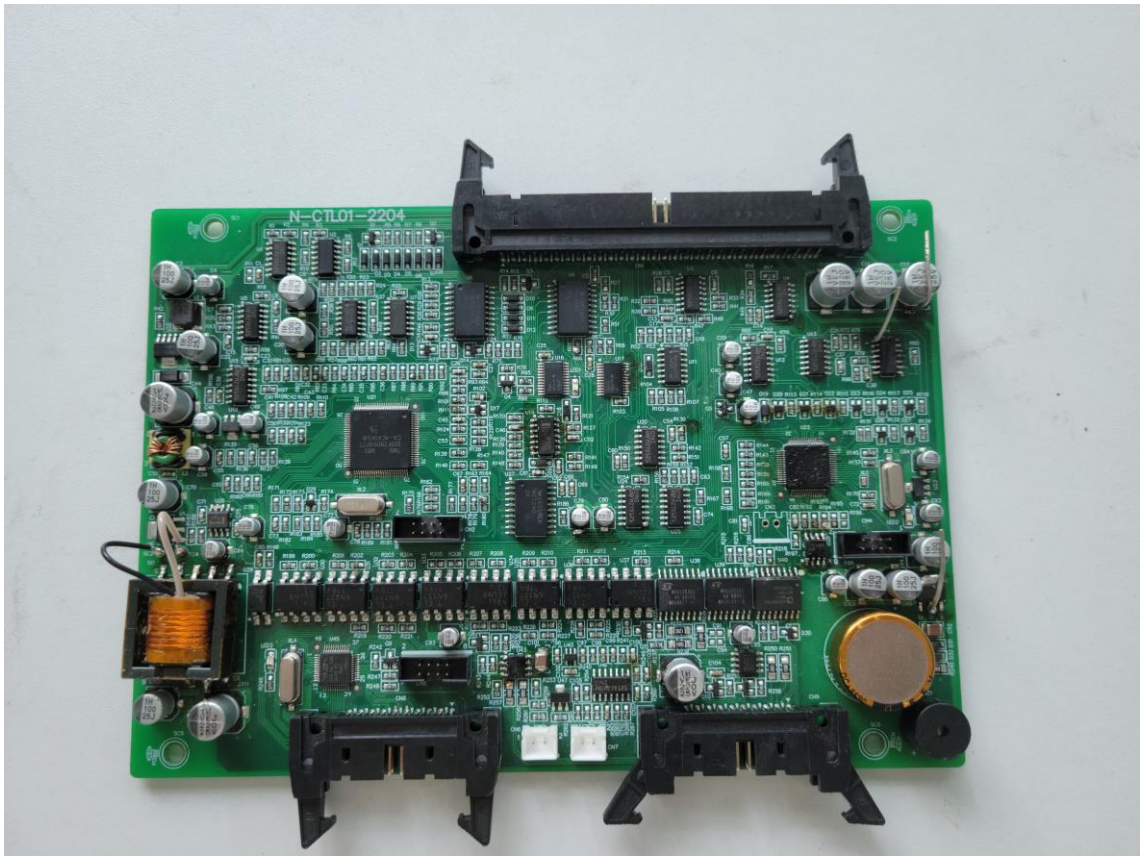
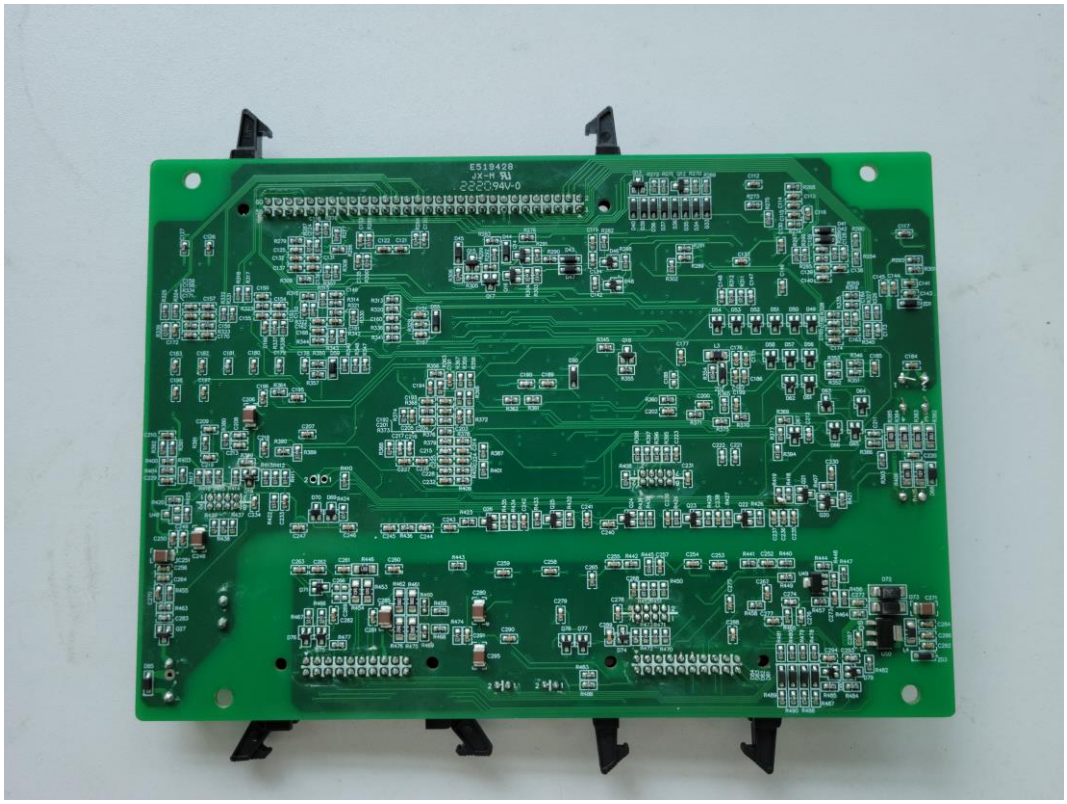
Front of main power board

Back of main power board


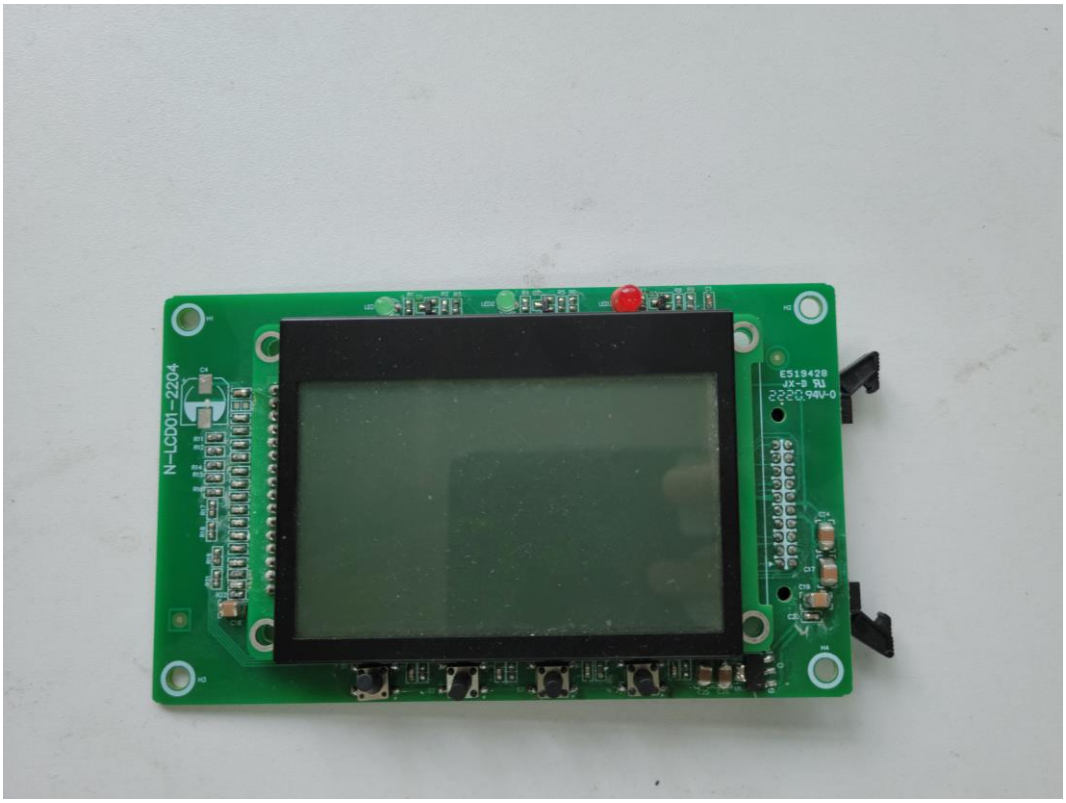
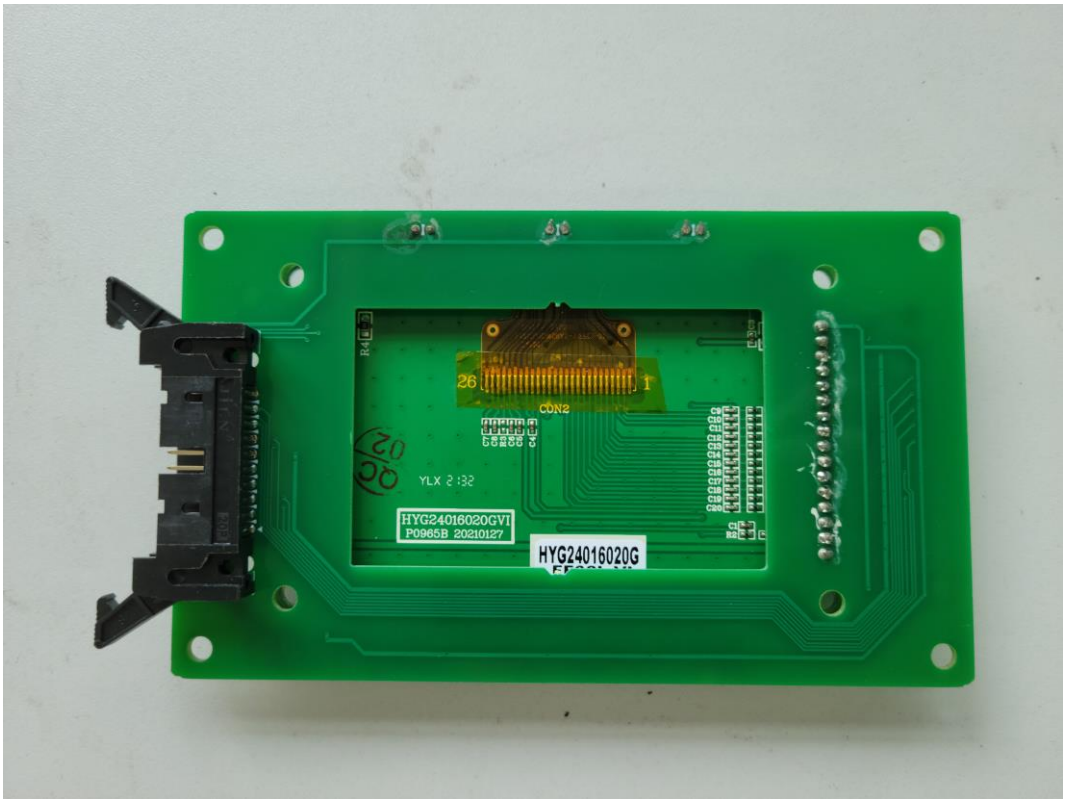
Front of Bus capacitance board

Back of Bus capacitance board


Front of capacitance board

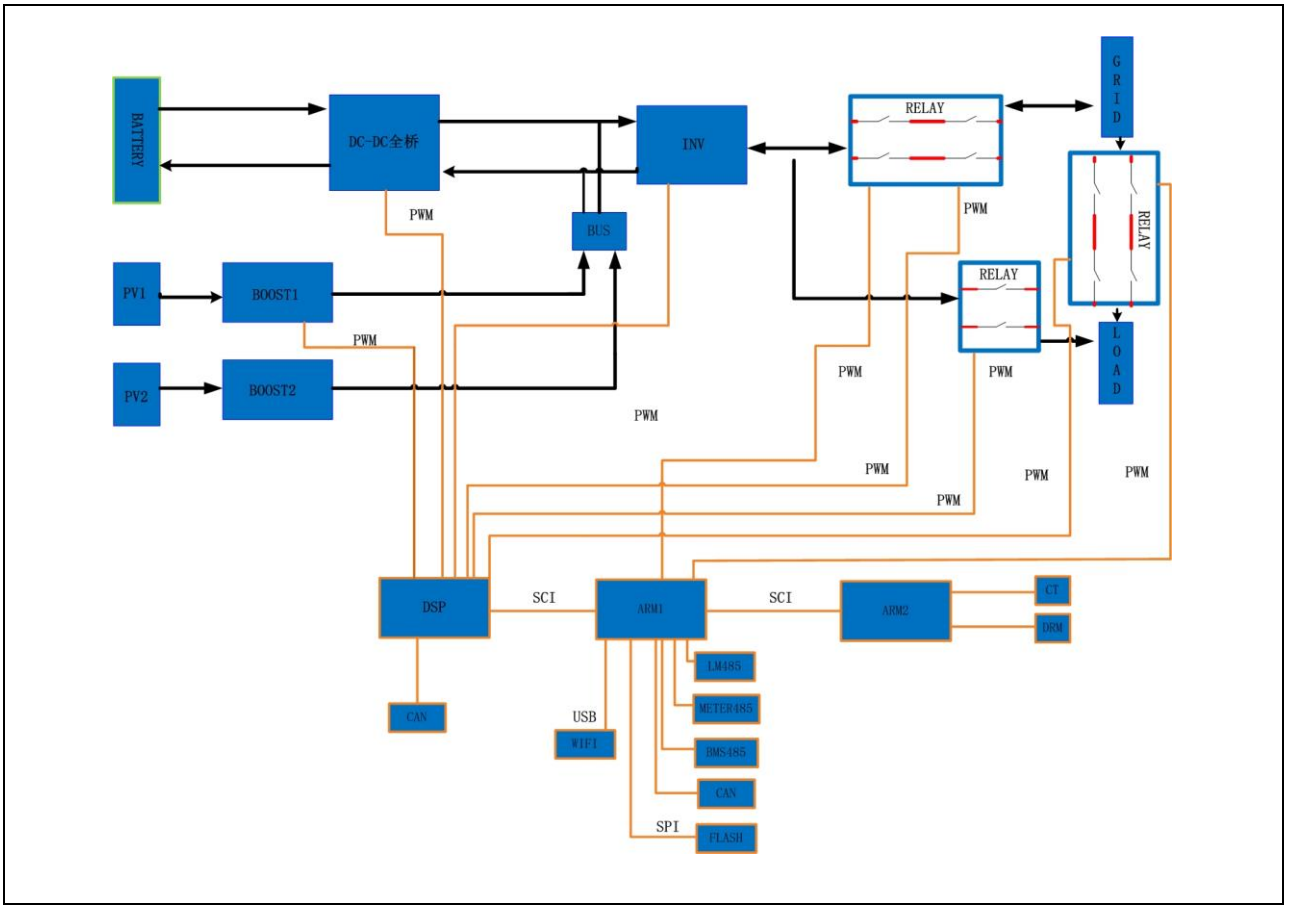
Back of capacitance board


Front of control board

Back of control board


Front of display board

Back of control board


Serial Number

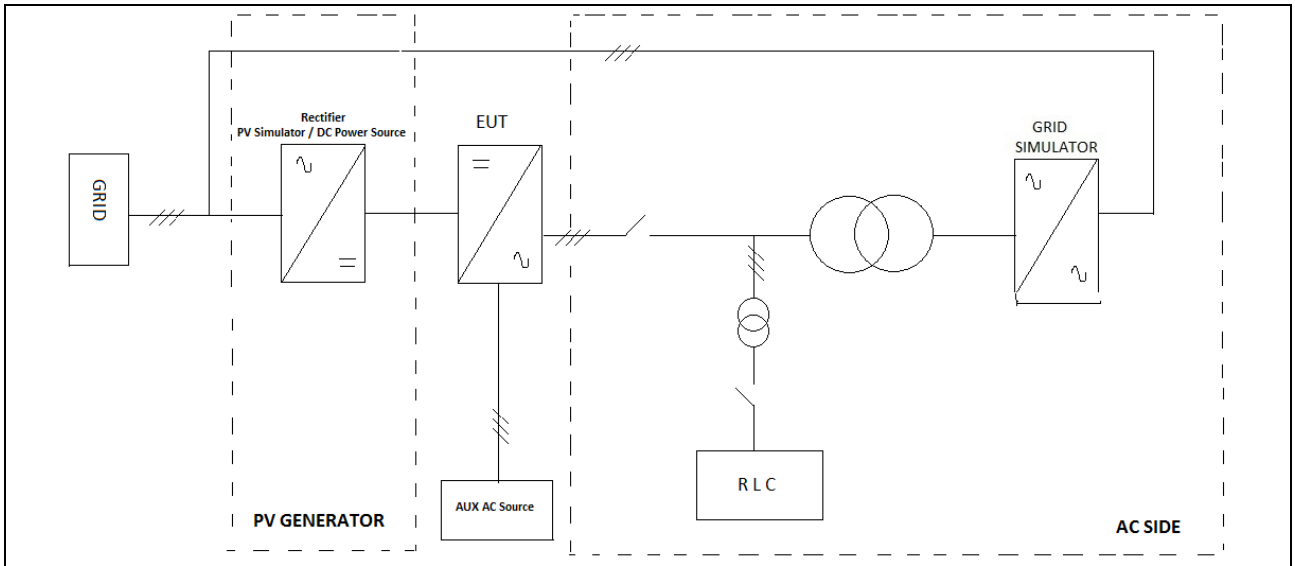

1.2 ELECTRICAL SCHEMES



Attachment II

(Testing information)

2.1 TESTING CIRCUIT



Different equipment has been used to take measures as it shows in testing equipment list.

Current and voltage clamps have been connected to the inverter output for all the tests.

All the tests described in the following pages have used this specified test setup.

2.2 MEASUREMENT UNCERTAINTY

Magnitude	Uncertainty
Voltage measurement uncertainty	±1.5 %
Current measurement uncertainty	±2.0 %
Frequency measurement uncertainty	±0.2 %
Time measurement uncertainty	±0.2 %
Power measurement uncertainty	±2.5 %
Phase Angle	±1º
Temperature	±3º C
Note1: Measurements uncertainties showed in this table are maximum allowable uncertainties. The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the solicitant.	