Prüfbericht-Nr.: *Test Report No.*:	CN229UFF 001	**Auftrags-Nr.:** *Order No.*:	244373159	Seite 1 von 63 *Page 1 of 63*
Kunden-Referenz-Nr.: *Client Reference No.*:	2097619	**Auftragsdatum:** *Order date*:	2021.11.09	
Auftraggeber: *Client*:	**NingBo Deye Inverter Technology Co., Ltd.** No.26 South YongJiang Road, Daqi, Beilun NingBo, 315800 Zhejiang P.R. China			
Prüfgegenstand: *Test item*:	Grid-connected PV inverter			
Bezeichnung / Typ-Nr.: *Identification / Type No.*:	SUN-18K-G05, SUN-20K-G05, SUN-25K-G05			
Auftrags-Inhalt: *Order content*:	TÜV Bauart approval			
Prüfgrundlage: *Test specification*:	EN 62109-1: 2010 IEC 62109-1: 2010, EN 62109-2: 2011, IEC 62109-2: 2011			
Wareneingangsdatum: *Date of receipt*:	2021.11.10			
Prüfmuster-Nr.: *Test sample No.*:	A003225895-004~006			
Prüfzeitraum: *Testing period*:	2021.11.10 – 2022.03.01			
Ort der Prüfung: *Place of testing*:	TÜV Rheinland (Shanghai) Co.,Ltd.			
Prüflaboratorium: *Testing laboratory*:	TÜV Rheinland (Shanghai) Co.,Ltd.			
Prüfergebnis*: *Test result**:	Pass			

erstellt von: *created by:*		**genehmigt von:** authorized by:	
Datum: 2022.04.30 Date:	Sean Ke Rafer Xu	**Datum**: 2022.04.30 Date:	John Dai
Stellung / Position	Sean Ke / Trainees Rafer Xu / PE	**Stellung** / Position	Reviewer

Sonstiges / *Other*:
This report does not evidence compliance of the provided sample with the relevant standards but only with the referred tests. This test report documents the findings of examination conducted on the delivered product mentioned above only. This report does not entitle the applicant to carry any safety mark on this or similar products. Further for sales or other application purposes of the tested product, any reference to TÜV Rheinland or a test through TÜV Rheinland is only permissible with prior written consent of TÜV Rheinland.

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

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

V05

Test Report issued under the responsibility of:

TÜVRheinland®

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TEST REPORT
IEC 62109-1
Safety of power converters for use in photovoltaic power systems – Part1: General requirements

Report Reference No. ..... :	CN229UFF 001.
Tested by (name + signature) ..... :	See cover page
Witnessed by (name + signature).... :	N/A
Supervised by (name + signature)... :	N/A
Approved by (name + signature) ..... :	See cover page
Date of issue..... :	See cover page
Testing Laboratory..... :	**TÜV Rheinland (Shanghai) Co., Ltd.**
Address ..... :	B1-13F, No. 177, Lane 777, West Guangzhong Road, Jingan District, Shanghai 200072, P. R. China
Testing location/ procedure..... :	CBTL☐ TMP☐ WMT☐ SMT☐ RMT☐ CCATL☒
Testing location/ address ..... :	See cover page.
Applicant's name ..... :	**NingBo Deye Inverter Technology Co., Ltd.**
Address..... :	No.26 South YongJiang Road, Daqi, Beilun NingBo, 315800 Zhejiang P.R. China
Test specification:	
Standard..... :	IEC 62109-1: 2010, EN 62109-1: 2010
Test procedure ..... :	TUV Bauart approval
Non-standard test method……...:	N/A
Test Report Form No. ..... :	MS-0024886-appendix 1 V.0
Test Report Form(s) Originator ..... :	VDE Testing and Certification Institute
Master TRF ..... :	Dated 2011-03

Test item description..... :	Grid-connected PV Inverter
Trade Mark..... :	Deye
Manufacturer ..... :	Same as the applicant
Model/Type reference..... :	SUN-18K-G05, SUN-20K-G05, SUN-25K-G05
Ratings..... :	See marking label and model list

Testing procedure and testing location:	
☐ **CB Testing Laboratory:**	
Testing location/ address ..... :	
☐ **Associated CB Test Laboratory:**	
Testing location/ address ..... :	
Tested by (name + signature)..... :	See cover page
Approved by (+ signature) ..... :	See cover page
☐ Testing procedure: TMP	
Tested by (name + signature)..... :	
Approved by (+ signature) ..... :	
Testing location/ address ..... :	
☐ Testing procedure: WMT	
Tested by (name + signature)..... :	
Witnessed by (+ signature)..... :	
Approved by (+ signature) ..... :	
Testing location/ address ..... :	
☐ Testing procedure: SMT	
Tested by (name + signature)..... :	
Approved by (+ signature) ..... :	
Supervised by (+ signature)..... :	
Testing location/ address ..... :	
☐ Testing procedure: RMT	
Tested by (name + signature)..... :	
Approved by (+ signature) ..... :	
Supervised by (+ signature)..... :	
Testing location/ address ..... :	

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

- ATTACHMENT 1 – Test report of IEC 62109-2: 2011 (15 pages)
- ATTACHMENT 2 – Photos (8 pages)
- ATTACHMENT 3 – CDF (5 pages)

Summary of testing

Tests performed (name of test and test clause):	**Testing location:**
4.3 Temperature measurement 4.4 Testing in single fault condition 4.5.2 Humidity preconditioning 4.7 Electric rating test 5.1.2 Durability of marking test 6.3 Ingress protection (IP test) 7.4 Determination of hazardous energy level 7.5.1 Impulse voltage test 7.5.2 Voltage test (electric strength) 7.3.4 Protection against direct contact 7.3.7.4 and 7.3.7.5 Clearance and creepage distance 7.5.4 Touch current measurement 7.3.2.6 Working voltage and DVC 8.5 Wall mounting 13.7.2 Mechanical resistance test 13.7.3 Impact test	The laboratory described on cover page.

Summary of compliance with National Differences

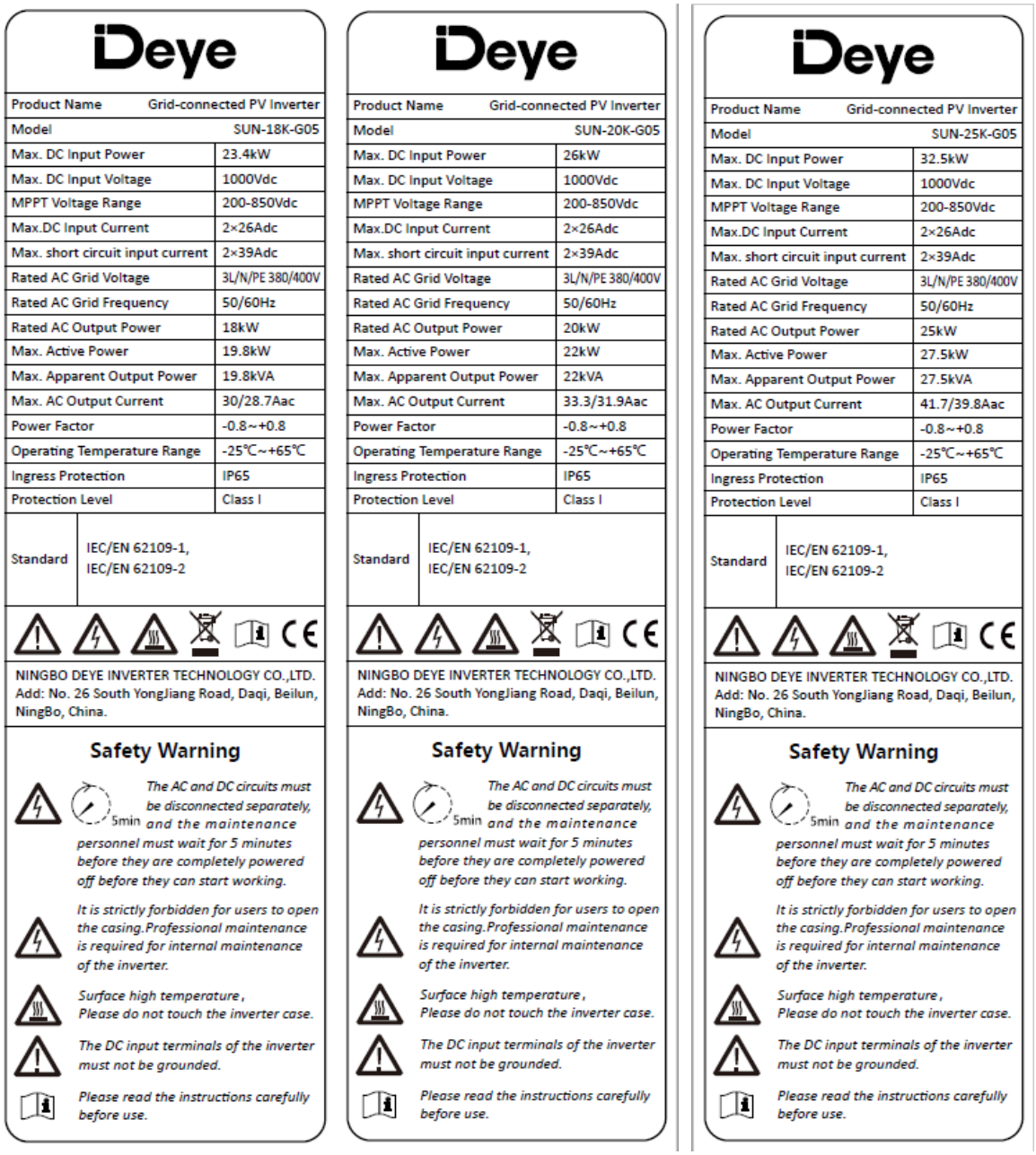
List of countries addressed: None.

☒ The product fulfils the requirements of

IEC/EN 62109-1: 2010 and IEC/EN 62109-2: 2011,

Copy of marking plate:

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



Deye

Product Name	Grid-connected PV Inverter
Model	SUN-18K-G05
Max. DC Input Power	23.4kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	2×26Adc
Max. short circuit input current	2×39Adc
Rated AC Grid Voltage	3L/N/PE 380/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	18kW
Max. Active Power	19.8kW
Max. Apparent Output Power	19.8kVA
Max. AC Output Current	30/28.7Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

NINGBO DEYE INVERTER TECHNOLOGY CO.,LTD.
Add: No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China.

Safety Warning

The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature, Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

Deye

Product Name	Grid-connected PV Inverter
Model	SUN-20K-G05
Max. DC Input Power	26kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	2×26Adc
Max. short circuit input current	2×39Adc
Rated AC Grid Voltage	3L/N/PE 380/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	20kW
Max. Active Power	22kW
Max. Apparent Output Power	22kVA
Max. AC Output Current	33.3/31.9Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

NINGBO DEYE INVERTER TECHNOLOGY CO.,LTD.
Add: No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China.

Safety Warning

The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature, Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

Deye

Product Name	Grid-connected PV Inverter
Model	SUN-25K-G05
Max. DC Input Power	32.5kW
Max. DC Input Voltage	1000Vdc
MPPT Voltage Range	200-850Vdc
Max.DC Input Current	2×26Adc
Max. short circuit input current	2×39Adc
Rated AC Grid Voltage	3L/N/PE 380/400V
Rated AC Grid Frequency	50/60Hz
Rated AC Output Power	25kW
Max. Active Power	27.5kW
Max. Apparent Output Power	27.5kVA
Max. AC Output Current	41.7/39.8Aac
Power Factor	-0.8~+0.8
Operating Temperature Range	-25℃~+65℃
Ingress Protection	IP65
Protection Level	Class I
Standard	IEC/EN 62109-1, IEC/EN 62109-2

NINGBO DEYE INVERTER TECHNOLOGY CO.,LTD.
Add: No. 26 South YongJiang Road, Daqi, Beilun, NingBo, China.

Safety Warning

The AC and DC circuits must be disconnected separately, and the maintenance personnel must wait for 5 minutes before they are completely powered off before they can start working.

It is strictly forbidden for users to open the casing.Professional maintenance is required for internal maintenance of the inverter.

Surface high temperature, Please do not touch the inverter case.

The DC input terminals of the inverter must not be grounded.

Please read the instructions carefully before use.

Test item particular ..... :	
Equipment mobility..... :	☐ movable ☐ hand-held ☐ transportable ☒ fixed ☐ stationary ☐ for building-in
Connection to the mains..... :	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category ..... :	☒ outdoor ☐ indoor conditional ☐ indoor unconditional
Operating condition..... :	☒ continuous ☐ short-time ☐ intermittent
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 (%) ..... :	According to the specified supply range, see model list on the following pages for details.
Tested for IT power systems ..... :	☐ Yes ☒ No
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg)..... :	See model list on the following pages.
Pollution degree ..... :	☐ PD1 ☒ PD2 (Inside) ☒ PD3 (Outside)
IP protection class ..... :	IP65
Possible test case verdicts:	
- test case does not apply to the test object.....:	N/A
- test object was not evaluated for the requirement.....:	N/E
- test object does meet the requirement.....:	Pass (P)
- test object does not meet the requirement .....:	Fail (F)
Testing:	
Date of receipt of test items.....:	See cover page
Date(s) of performance of tests .....:	See cover page

General remarks:

"(see Attachment #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

The tests results presented in this report relate only to the object tested.

This report shall not be reproduced except in full without the written approval of the testing laboratory.

List of test equipment must be kept on file and available for review.

Additional test data and/or information provided in the attachments to this report.

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

Determination of the test results includes consideration of measurement uncertainty from the test equipment and methods.

Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided:

☐ Yes

☒ Not applicable

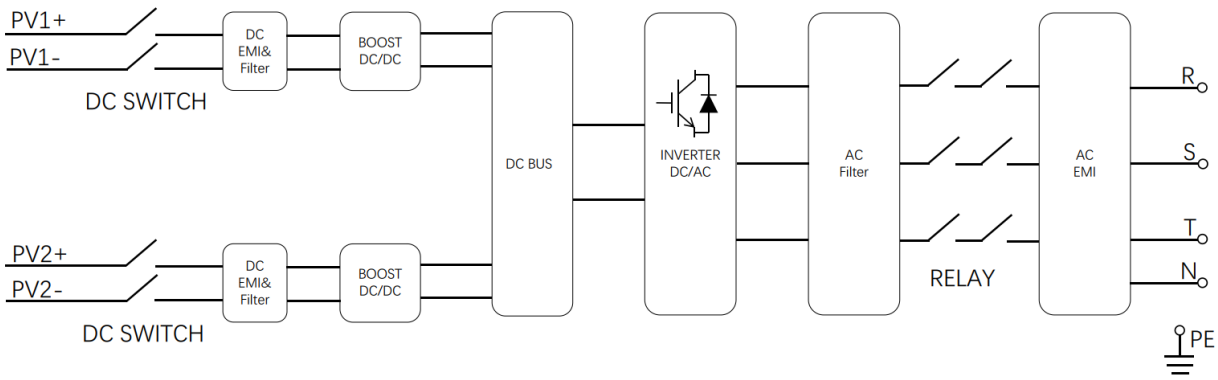
When differences exist; they shall be identified in the General product information section.

Name and address of factory (ies): **Same as application.**

General product information:

Breif description:

The PCEs under test SUN-18K-G05, SUN-20K-G05 and SUN-25K-G05 are three-phase grid connected inverter for solar power generation. The Grid-connected PV Inverter utilize the advanced power conversion technology IGBT to convert the DC power normally from the photovoltaic array to stable three-phase AC power and then feed the power to the utility grid.



Circuit Diagram

Model Difference:
The models SUN-18K-G05, SUN-20K-G05 and SUN-25K-G05 are identical in hardware and software, except for MPPT numbers, electrical ratings and model name

Eletrical ratings see below model list.

Unless otherwise specified, all tests were conducted on basic model of SUN-25K-G05 to represent the other models.

Throughout the test report following abbreviations may be used:

•	cl	clearance	•	s-c	short-circuit
•	dcr	creepage distance	•	o-c	open-circuit
•	dti	distance through insulation	•	o-l	overload
•	BI	basic insulation	•	SI	supplementary insulation
•	DI	double insulation	•	RI	reinforced insulation

Model list:

Model		SUN-18K-G05	SUN-20K-G05	SUN-25K-G05
DC INPUT SIDE	V_{MAX} Input [Vd.c.]	1000	1000	1000
	Isc PV[Ad.c.]	39+39	39+39	39+39
	Input Voltage Range [Vd.c.]	200-850	200-850	200-850
	Maximum DC Input Current [Ad.c.]	26+26	26+26	26+26
	MPPT Full Power Voltage Range[Vd.c.]	500-850	500-850	550-850
	Start PV Voltage [Vdc]	250	250	250
	Backfeed Current [A]	0	0	0
	Overvoltage Category (OVC)	II	II	II
AC OUTPUT SIDE	Rated Output Voltage Ur [Va.c.]	3L/N/PE,380/400	3L/N/PE,380/400	3L/N/PE,380/400
	Rated Output Frequency F_{NETZ} [Hz]	50/60	50/60	50/60
	Rated Output Power P_E [kW]	18	20	25
	Maximum Output Power [kW]	19.8	22	27.5
	Max.Output Apparent Power[kVA]	19.8	22	27.5
	Rated. Output Current Ir [Aa.c.]	27.3/26.1	30.3/29	37.9/36.2
	Max. Output Current Imax [Aa.c.]	30/28.7	33.3/31.9	41.7/39.8
	Power Factor cosφ [λ]	-0.8 to 0.8	-0.8 to 0.8	-0.8 to 0.8
	Overvoltage Category (OVC)	III	III	III
SYSTEM	Protective Class	I	I	I
	Enclosure Protection (IP)	IP65	IP65	IP65
	Operating Temperature Range [ºC]	-25 to + 65 , ＞45ºCLoad reduction	-25 to + 65 , ＞45ºCLoad reduction	-25 to + 65 , ＞45ºCLoad reduction
	Pollution degree (PD)	PD 3	PD 3	PD 3
	Altitude [m]	4000	4000	4000
	Weight [kg]	20	20	20
	Dimension [WxHxD (mm)]	362*527*220	362*527*220	362*527*220
	Type of inverter	non isolated	non isolated	non isolated
	Firmware version	5120	5120	5120

IEC/EN 62109-1: 2010			
Clause	Requirement – Test	Result - Remark	Verdict
4	GENERAL REQUIREMENTS		P
4.1	General General Testing is required by this standard to demonstrate that the EUT is fully in accordance with the applicable requirements of this standard.		P
4.2	General conditions for testing	See below.	P
4.2.1	Sequence of tests	The same sample used for all tests.	P
4.2.2	Reference test conditions		P
4.2.2.1	Environmental conditions a) temp. of 15 °C to 40 °C b) humidity of 5% to 75 % c) air pressure of 75 kPa to 106 kPa. d) no frost, dew, percolating water, rain, solar radiation, etc.	Ambient environmental conditions compliance.	P
4.2.2.2	State of equipment	Tests were carried out 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		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	See below.	P
	a) Voltage:	A wider range is given in the specifications for the EUT. See the model list.	P
	b) Frequency:	DC Input side: N/A AC Output side: 50Hz.	P
	c) Polarity:	Permanently connected equipment.	N/A
	d) Earthing:	Equipment was supplied from either an earthed supply system under tests.	P
	e) Over-current Protection:	Input over current protection that will be present in the installation was provided during testing.	P
4.2.2.7	Supply ports other than the mains	See below.	P
4.2.2.7.1	Photovoltaic supply sources	DC power supply soure was used with suffcient capability.	P
4.2.2.7.2	Battery inputs	Not used.	N/A

IEC/EN 62109-1: 2010			
Clause	Requirement – Test	Result - Remark	Verdict
4.2.2.8	Conditions of loading for output ports	The least favorable loading conditions was considered.	P
	- for continuous operation.	Until steady condition was established.	P
	- for intermittent operation.		N/A
	- for short-time operation.		N/A
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
4.3	Thermal Testing	See below.	P
4.3.1	General		P
4.3.2	Maximum temperatures Materials and components shall be selected so that under the most serve rated operating conditions, the temperatures do not exceed the temperature limits.	See appended table 4.3.	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
	- automatic reset devices or circuits		N/A
	- manual reset devices or circuits		N/A
	- non-resettable devices or circuits	One cycle and until temperatures stabilize.	P
4.4.3	Compliance after application of 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	See below.	P

IEC/EN 62109-1: 2010			
Clause	Requirement – Test	Result - Remark	Verdict
4.4.4.1	Component fault tests The following faults are simulated: a) Short circuit or open circuit of relevant components. b) Short circuit or open circuit of any components or insulation where failure could adversely affect supplementary insulation or reinforced insulation. c) In addition, where required by Method 2 of 9.1.1, components that could result in a fire hazard are to be overloaded unless they comply with the requirements of 9.1.3.	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	Fan for heatsink.	P
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		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		P
4.4.4.14	PWB short-circuit test	See appended table 4.4.	P
4.5	Humidity preconditioning	See below.	P
4.5.1	General		P
4.5.2	Conditions	Humidity:100%RH Temperature: 65°C Duration: 48h	P
4.6	Voltage Backfeed 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

IEC/EN 62109-1: 2010			
Clause	Requirement – Test	Result - Remark	Verdict
4.6.1	Backfeed tests under normal conditions	Relay is available at AC output side to prevent backfeed current from AC to DC side.	P
4.6.2	Backfeed tests under single-fault conditions	Relay is available at AC output side and certified connectors 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.	P
	- 15 s for sources that are connected by fixed wiring		P
	- 1 s for sources that are cord-connected or use connectors that can be opened without the use of a tool		N/A
4.7	Electrical Ratings Tests	See appended table 4.7.	P
4.7.1	Input Ratings		P
4.7.2	Output Ratings		P

5	Marking and documentation		P
5.1	Marking		P
5.1.1	General		P
5.1.2	Durability of markings	The labels were subjected to the permanence of marking test. The labels were rubbed with the cloth soaked with petroleum spirit for 30 s. After this test there was no damage to the labels. The marking on the labels did not fade. There was no curling or lifting of the label's edges.	P
5.1.3	Identification	See below.	P
	a) the name or trade mark of the manufacturer or supplier	Trade mark is provided on the front enclosure.	P
	b) a model number, name or other means to identify the equipment	The model name is provided on the label.	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.	The serial number is provided on the equipment body.	P
5.1.4	Equipment ratings	See below	P

IEC/EN 62109-1: 2010			
Clause	Requirement – Test	Result - Remark	Verdict
	- 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	See model list.	P
	- Protective class (I, II, or III)	See model list.	P
	- Overvoltage Category	See model list.	P
	- the environmental information required in section 6	See model list and section 6.	P
5.1.5	Fuse identification	No such devices	N/A
5.1.6	Terminals, Connections, and Controls	Relevant symbol, indicator or information are available.	P
5.1.6.1	Protective Conductor Terminals	Symbol 7 of Table C.1 is used.	P
5.1.7	Switches and circuit-breakers	The letter “ON” and “OFF” is clearly marked.	P
5.1.8	Class II Equipment	Class I Equipment.	N/A
5.1.9	Terminal boxes for External Connections	The temperature observed on the terminals were not exceed the limited values specified.	N/A
5.2	Warning markings	See below.	P
5.2.1	Visibility and legibility requirements for warning markings	Warning markings are be visible and legible.	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
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heatsinks and similar parts	All accessible metal parts were grounded.	N/A
5.2.2.2	Hot Surfaces	Marked with symbol 14 of Table C.1.	P
5.2.2.3	Coolant	Not used.	N/A
	a) a statement that coolant system servicing is to be done only by SERVICE PERSONNEL		N/A

IEC/EN 62109-1: 2010			
Clause	Requirement – Test	Result - Remark	Verdict
	b) instructions for safe venting, draining or otherwise working on the cooling system		N/A
5.2.2.4	Stored energy	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	No such devices which can conducted injury to service personal.	N/A
5.2.3	Sonic hazard markings and instructions	No such hazard.	N/A
	a) be marked to warn the OPERATOR of the sonic pressure hazard		N/A
	b) be provided with installation instructions that specify how the installer can ensure that the sound pressure level from equipment		N/A
5.2.4	Equipment with multiple sources of supply		P
5.2.5	Excessive touch current	No touch current exceed 3.5mAac. or 10mAdc. Under any operation conditions	N/A
5.3	Documentation	See below.	P
5.3.1	General	All related informations provided in the user's maunal.	P
	a) explanations of equipment markings, 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		P
	- ENVIRONMENTAL CATEGORY as per 6.1		P
	- WET LOCATIONS classification 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
	- OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2		P
	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	Instructions related to safety is in English.	P

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Clause	Requirement – Test	Result - Remark	Verdict
5.3.1.2	Format	The printed form is available and is delivered with the PCE.	P
5.3.2	Information related to installation	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 external controls, colour coding of leads, or overcurrent protection needed		P
	d) ventilation requirements		P
	e) requirements for special services, for example cooling liquid		N/A
	f) instructions and information relating to sound pressure level if required by 10.2.1	No sound pressure hazard.	N/A
	g) 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, prevent the accumulation of hazardous gases	No battery used in the PCE.	N/A
	h) tightening torque to be applied to wiring terminals		P
	i) 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	N/A
	j) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed		P
	k) compatibility with RCD and RCM		P
	l) instructions for protective earthing, including the information required by 7.3.6.3.6 applicable		P
5.3.3	Information related to operation	All below related informations provided in the user's maunal.	P
	- instructions for adjustment of controls including the effects of adjustment		P

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Clause	Requirement – Test	Result - Remark	Verdict
	- instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials		P
	- 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		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	All below related informations 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	No any operator replaceable part.	N/A
	- 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
	- where required by 7.3.9.2, information regarding the location(s) and safe discharge times for capacitor(s).		P
5.3.4.1	Battery maintenance	The PCE is Grid-connected 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

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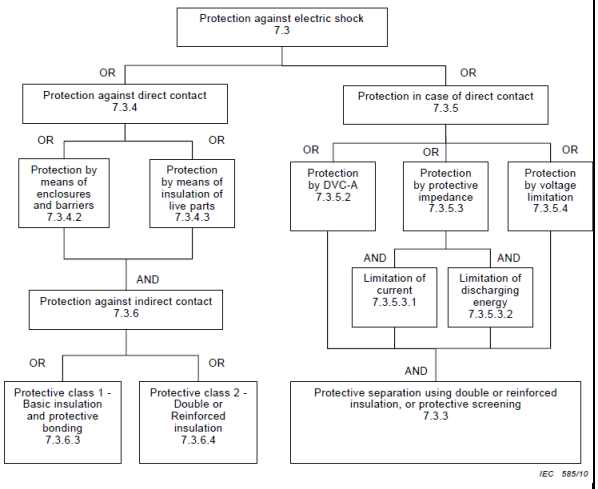
Clause	Requirement – Test	Result - Remark	Verdict
	- CAUTION: Do not open or mutilate batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic		N/A
	- CAUTION: A battery can present a risk of electrical shock and high short-circuit current.		N/A
	The following precautions should be observed when working on batteries: 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	See below.	P
6.1	Environmental categories and minimum environmental conditions	See below.	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 3 (outside) PD 2 (inside).	P
6.3	Ingress Protection	IP65.	P
6.4	UV exposure	Anti-UV approved AC/DC connectors are provided.	P
6.5	Temperature and humidity	Specified by manufacturer as: Humidity: 100%RH max. Temperature: 65°C max.	P

7	Protection against electric shock and energy hazards		P

<table>
<tr><th colspan="4">IEC/EN 62109-1: 2010</th></tr>
<tr><th>Clause</th><th>Requirement – Test</th><th>Result - Remark</th><th>Verdict</th></tr>
<tr><td>7.1</td><td>General</td><td>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.</td><td>P</td></tr>
<tr><td>7.2</td><td>Fault conditions</td><td>Refer to subclause and table 4.4.4.</td><td>P</td></tr>
<tr><td>7.3</td><td>Protection against electric shock</td><td></td><td>P</td></tr>
<tr><td>7.3.1</td><td>General
 
</td><td>Each circuit under evaluation is compliant with Figure 7-1.</td><td>P</td></tr>
<tr><td>7.3.2</td><td>Decisive voltage classification</td><td></td><td>P</td></tr>
<tr><td>7.3.2.1</td><td>Use of decisive voltage class (DVC)</td><td>See below</td><td>P</td></tr>
<tr><td>7.3.2.2</td><td>Limits of DVC
Table 6 – Summary of the limits of the decisive voltage classes
<table>
<tr><th rowspan="2">Decisive voltage Classification (DVC)</th><th colspan="3">Limits of working voltage V</th></tr>
<tr><th>a.c. voltage r.m.s. U_{ACL}</th><th>a.c. voltage peak U_{ACPL}</th><th>d.c. voltage mean U_{DCL}</th></tr>
<tr><td>A*</td><td>≤25
(16)</td><td>≤35,4
(22,6)</td><td>≤60
(35)</td></tr>
<tr><td>B</td><td>50
(33)</td><td>71
(46,7)</td><td>120
(70)</td></tr>
<tr><td>C</td><td>>50
(>33)</td><td>>71
(>46,7)</td><td>>120
(>70)</td></tr>
<tr><td colspan="4">The table values in parentheses are to be used for PCE or portions of PCEs rated for installation in wet locations as addressed in 6.1 for environmental categories and minimum environmental conditions.
*DVC-A circuits are allowed under fault conditions to have voltages up to the DVC-B limits, for maximum 0,2 s.</td></tr>
</table></td><td>See subclause 7.3.2.1.</td><td>P</td></tr>
<tr><td>7.3.2.3</td><td>Requirements for protection</td><td>See subclause 7.3.2.1.</td><td>P</td></tr>
<tr><td>7.3.2.4</td><td>Circuit evaluation</td><td>For circuits evaluation information of PCE, refer to brief description of general product information on previous pages.</td><td>P</td></tr>
</table>

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Clause	Requirement – Test	Result - Remark	Verdict
7.3.2.5	Connection to PELV and SELV 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 7-2)		P
7.3.2.6.3	DC working voltage (see Figure 7-3)		P
7.3.2.6.4	Pulsating working voltage (see Figure 7-4)		P
7.3.3	Protective separation Protective separation shall be achieved by: ·double or reinforced insulation, or ·protective screening, i.e. by a conductive 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 7.3.5.3.1 and of discharged energy per 7.3.5.3.2, or ·limitation of voltage according to 7.3.5.4.	The double or reinforced insulation was provided between 1) DC input circuits and display and communication circuits; 2) AC input circuits and display, communication circuits. All accessible metal parts were earthed and separated from live parts by basic insulation.	P
7.3.4	Protection against direct contact	Protection against electic shock by means of earthed metal enclosure without openings. Any access to touch live parts is impossible.	P
7.3.4.1	General	See above.	P
7.3.4.2	Protection by means of enclosures and barriers	Protection against electic shock by means of earthed metal enclosure.	P
7.3.4.2.1	General	See above.	P
7.3.4.2.2	Access probe criteria	Considered.	P
7.3.4.2.3	Access probe tests	See below.	P
	a) Inspection		P
	b) Tests with the test finger (Figure E-1) and test pin (Figure E-2) of 0E		P
	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 a straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N	No openings.	N/A

<table>
<tr><th colspan="4">IEC/EN 62109-1: 2010</th></tr>
<tr><th>Clause</th><th>Requirement – Test</th><th>Result - Remark</th><th>Verdict</th></tr>
<tr><td></td><td>d) In addition to a) - c) above, top surfaces of enclosures shall be tested with the IP3X probe of IEC 60529</td><td>No openings.</td><td>N/A</td></tr>
<tr><td>7.3.4.2.4</td><td>Service access areas</td><td>There is no such kinds of adjustments needed to be opened the enclosure during installation or maintenance.</td><td>N/A</td></tr>
<tr><td>7.3.4.3</td><td>Protection by means of insulation of live parts
Table 8 – Insulation between accessible unearthed parts and DVC-A or -B circuits adjacent to DVC-B or -C circuits
<table>
<tr><th>Considered circuit (closer to accessible parts)</th><th>Adjacent circuit</th><th>Insulation between the considered circuit and the adjacent circuit</th><th>Insulation between the considered circuit and unearthed accessible parts</th></tr>
<tr><td rowspan="2">DVC-A</td><td rowspan="2">DVC-B or DVC-C</td><td>Basic[a]</td><td>Supplemental[a]</td></tr>
<tr><td>Reinforced[a]</td><td>Functional</td></tr>
<tr><td rowspan="2">DVC-B</td><td rowspan="2">DVC-C</td><td>Basic[a]</td><td>Supplemental[a]</td></tr>
<tr><td>Reinforced[a]</td><td>Reinforced</td></tr>
<tr><td colspan="4">[a] Based on the voltage of the circuit having the higher DVC.</td></tr>
</table></td><td>See subclause 7.3.2, 7.3.3 and 7.3.4.1.</td><td>P</td></tr>
<tr><td>7.3.5</td><td>Protection in case of direct contact</td><td></td><td>P</td></tr>
<tr><td>7.3.5.1</td><td>General</td><td>See below.</td><td>P</td></tr>
<tr><td>7.3.5.2</td><td>Protection using decisive voltage class A</td><td>Communication port is considerd as DVC-A which can be accessible and separated from DVC-C by double or reinforced insulaiton.</td><td>P</td></tr>
<tr><td>7.3.5.3</td><td>Protection by means of protective impedance</td><td>This method not considered.</td><td>N/A</td></tr>
<tr><td>7.3.5.3.1</td><td>Limitation of current through protective impedance
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.
Compliance is checked by inspection, by analysis of the relevant circuit diagrams, and by testing, using the circuit of IEC 60990, Figure 4.</td><td></td><td>N/A</td></tr>
<tr><td></td><td>The protective impedances shall be designed and tested to withstand the impulse voltages, temporary overvoltage and working voltage of the circuits to which they are connected. Compliance is checked by the testing of 7.5.1 and 7.5.2.</td><td></td><td>N/A</td></tr>
<tr><td></td><td>Touch current at accessible parts limited to 3,5 mA a.c., 10 mA d.c. from parts to earth and between simultaneously accessible parts</td><td></td><td>N/A</td></tr>
<tr><td>7.3.5.3.2</td><td>Limitation of discharging energy through protective impedance</td><td></td><td>N/A</td></tr>
</table>

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Clause	Requirement – Test	Result - Remark	Verdict
7.3.5.4	Protection by means of limited voltages	This method not considered.	N/A
7.3.6	Protection against indirect contact		P
7.3.6.1	General	The PCE is defined as protective class I.	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
7.3.6.3	Protective class I - Protective bonding		P
7.3.6.3.1	General	Suitable protective bonding provided.	P
7.3.6.3.2	Requirements for protective bonding	Considered	P
7.3.6.3.3	Rating of protective bonding Protective bonding shall meet following 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.	See 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.		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 alternative of 7.3.6.3.5 is considered.	P
7.3.6.3.3.1	Test current, duration, and acceptance criteria 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 120 s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω	See above.	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

<table>
<tr><th colspan="4">IEC/EN 62109-1: 2010</th></tr>
<tr><th>Clause</th><th>Requirement – Test</th><th>Result - Remark</th><th>Verdict</th></tr>
<tr><td></td><td>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.
Table 10 – Test duration for protective bonding test
<table>
<tr><th>Overcurrent protective devide rating
A</th><th>Duration of the test
min</th></tr>
<tr><td>>16 to 30</td><td>2</td></tr>
<tr><td>31 to 60</td><td>4</td></tr>
<tr><td>61 to 100</td><td>6</td></tr>
<tr><td>101 to 200</td><td>8</td></tr>
<tr><td>> 200</td><td>10</td></tr>
</table></td><td></td><td>N/A</td></tr>
<tr><td>7.3.6.3.4</td><td>Protective bonding impedance (routine test)
The test shall be as in 7.3.6.3.3, except for the following:
·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;
· the test duration may be reduced to no less than 2 s.
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
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).</td><td>Considered.</td><td>P</td></tr>
<tr><td>7.3.6.3.5</td><td>External protective earthing conductor
Table 11 – External protective earthing conductor cross-section
<table>
<tr><th>Cross-sectional area of phase conductors of the PCE, S
mm²</th><th>Minimum cross-sectional area of the corresponding external protective earthing conductor, S_p
mm²</th></tr>
<tr><td>S ≤ 16</td><td>S</td></tr>
<tr><td>16 < S ≤ 35</td><td>16</td></tr>
<tr><td>35 < S</td><td>S/2</td></tr>
<tr><td colspan="2">NOTE The values in this table are valid only if the external protective earthing conductor is made of the same metal as the phase conductors. If this is not so, the cross-sectional area of the external protective earthing conductor is to be determined in a manner which produces a conductance equivalent to that which results from the application of this table.</td></tr>
</table></td><td>10 mm²</td><td>P</td></tr>
<tr><td>7.3.6.3.6</td><td>Means of connection for the external protective earthing conductor</td><td></td><td>P</td></tr>
<tr><td>7.3.6.3.6.1</td><td>General</td><td></td><td>P</td></tr>
<tr><td></td><td>The means of connection for protective conductor corrosion-resistant</td><td>Corrosion-resistant is considered for connection and bonding points.</td><td>P</td></tr>
</table>

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Clause	Requirement – Test	Result - Remark	Verdict
	The means of connection for the protective earthing conductor shall be permanently marked with: – symbol 7 of Annex C; or – the colour coding green-yellow. Marking shall not be done on easily changeable parts such as screws.	With the symbol 7 of Table C.1. And Green-yellow wire is used.	P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P
	For plug-connected single phase PCE	Three phase PCE.	N/A
	For all other PCE	See appended table 7.5.5. In addition, the caution symbol 15 of Table C.1 provided on PCE and in manual.	P
	Connect two or more PCEs in parallel	Not for parallelly connection use.	N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Class I equipment.	N/A
7.3.7	Insulation Including Clearance and Creepage Distances	See below.	P
7.3.7.1	General		P
7.3.7.1.1	Pollution degree	PD 3 (outside), PD 2 (inside)	P
7.3.7.1.2	Overvoltage category and Impulse withstand voltage rating ..... :		P
	- MAINS circuits	O.V.C III	P
	- PV circuits insulated	O.V.C II	P
	- PV circuits not insulated	No such circuits.	N/A
	- Other circuits	O.V.C II	P
7.3.7.1.3	Supply earthing systems TN system/TT system/IT system	For TN system only.	P
7.3.7.1.4	Insulation voltages	PV supply circuits: 6000V ($V_{MAX\ PV}$: 1000V) AC mains circuits: 4000V (Rated: 3L/N/PE,380/400)	P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General	Considered.	P

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Clause	Requirement – Test	Result - Remark	Verdict
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 insulation		P
7.3.7.4	Clearance distances	See appended table 7.3.7.4.	P
7.3.7.4.1	Determination	Altitude: up to 4000m. The max. insulation / implulse voltage: 6000V.	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 7.3.7.5.	P
7.3.7.5.1	General		P
7.3.7.5.2	Voltage	The max. vlotage: 400Vrms / 1000Vd.c	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 insulation	Comply with 7.3.7.4 and 7.3.7.5.	N/A
7.3.7.8	Solid insulation		P
7.3.7.8.1	General		P
7.3.7.8.2	Requirements for electrical withstand capability		P

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Clause	Requirement – Test	Result - Remark	Verdict
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
	Basic or supplementary insulation shall consist of at least one layer of material, and shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic or supplementary insulation.	See appended table 7.5.1, 7.5.2 & 7.5.3.	P
	Double insulation shall consist of at least two layers of material. Each layer shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic insulation, and the partial discharge requirements of 7.3.7.8.2.1. The two or more layers together shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for double insulation.	Not used.	N/A
	Reinforced insulation shall consist of a single layer of material, which will meet the impulse, a.c. or d.c. voltage, and partial discharge test requirements 7.3.7.8.2.1 for reinforced insulation.	Not used.	N/A
7.3.7.8.3.3	Material thickness less than 0.2 mm		P
	Basic or supplementary insulation shall consist of at least one layer of material, and shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic or supplementary insulation.	See appended table 7.5.1, 7.5.2 & 7.5.3.	P
	Double insulation shall consist of at least three layers of material. Each layer shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic insulation any two layers together shall meet the impulse, a.c. or d.c. voltage, and partial discharge test requirements of 7.3.7.8.2.1 for double insulation.	Not used.	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
	Reinforced insulation consisting of a single layer of material less than 0,2 mm thick is not permitted.	Not used.	N/A
7.3.7.8.3.4	Compliance	See subclause 7.3.7.8.3.2.	P
7.3.7.8.4	Printed wiring boards (PWBs)		P
7.3.7.8.4.1	General	Insulation between conductor layers in double-sided single-layer 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.	P
7.3.7.8.4.2	Use of coating materials	No coating material used.	N/A
	Type 1 protection		N/A
	Type 2 protection		N/A
	Cold test (-25°C) and rapid change of temperature test (-25°C to +125°C)		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		P
7.3.8	Residual Current -operated protective (RCD) or monitoring (RCM) device compatibility The residual current in the AC input and/or output circuit is measured using a meter or power analyzer or other instrument that can detect only the d.c. component of the residual current. The resulting d.c. residual current component is compared to the limits in IEC 60755 or IEC 62020 as appropriate.		N/A
7.3.9	Capacitor discharge	See appended table 7.3.9.	P
7.3.9.1	Operator access area	The operator is instructed to the installation shall be performed by qualified technician. The pins of connector cannot be touched by test finger due to the design protection.	P
	Time-constant (s); measured voltage (V) ..... :		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
7.3.9.2	Service access areas	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
	Time-constant (s); measured voltage (V) ..... :		N/A
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
7.4.2	Operator Access Areas	See above.	P
7.4.3	Service Access Areas	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
7.5	Electrical tests related to shock hazard		P
7.5.1	Impulse voltage test (*type test*) The impulse voltage test is performed with a voltage having a 1,2/50 µs waveform (see Figure 6 of IEC 60060-1) and is intended to simulate overvoltages induced by lightning or due to switching of equipment. See Table 15 for conditions of the impulse voltage test.	During the test no puncture, flashover, or sparkover occurs. See appended table 7.5.1.	P
7.5.2	Voltage Test (dielectric strength test) (type test and routine test)	See below.	P
7.5.2.1	Purpose of test		P
7.5.2.2	Value and type of test voltage The values of the test voltage are determined from column 2 or 3 of Table 17 or Table 18 depending upon whether the circuit under test is mains connected or not mains connected.	See appended table 7.5.2.	P
7.5.2.3	Humidity pre-conditioning		P

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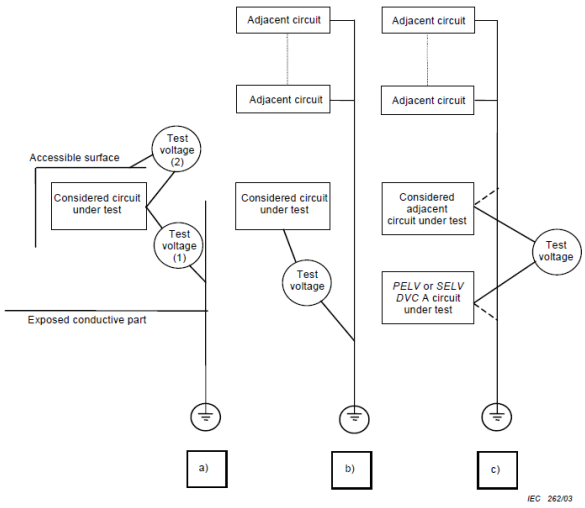
Clause	Requirement – Test	Result - Remark	Verdict
7.5.2.4	Performing the voltage test The test shall be applied as follows, according to Figure 13:  Figure 13 – Voltage test procedures	Refer to appended table 7.5.2.	P
7.5.2.5	Duration of the a.c. or d.c. voltage test The duration of the test shall be at least 60 s for the type test and 1 s for the routine test. The test voltage may be applied with increasing and/or decreasing ramp voltage, and the ramp times are not specified, but regardless of the ramp time, the dwell time at full voltage shall be 60 s and 1 s respectively for type and routine tests.	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 (type test or sample 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)	See appended table 7.5.4.	P
7.5.5	Equipment with multiple sources of supply		N/A

8	Protection against mechanical HAZARDS		P
8.1	General	Edges, projections, corners, openings, guards, handles and the like, that are accessible to the OPERATOR are smooth and rounded.	P
8.2	Moving parts	Enclosed coolant fan be used.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	Openings: Straight unjointed version of the test finger, 30N.	No openings	N/A
8.2.1	Protection of service persons Compliance is checked by inspection, and where necessary, by ensuring that the IP1X probe of IEC 60529 cannot contact the hazardous moving part with the guard in place.	Enclosed fan be used that it unlikely accessible during servicing operations.	P
8.3	Stability	The PCE is intended to be mounted on a wall.	N/A
	a) Equipment other than HAND - HELD EQUIPMENT; angle of 10°		N/A
	b) Equipment which has both a height of 1 m or more and a mass of 25 kg or more, and all floor-standing equipment; 250 N, or 20 % of the weight of the equipment		N/A
	c) Floor-standing equipment; 800 N		N/A
8.4	Provisions for lifting and carrying 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. Compliance is checked by inspection and by the following test. A single handle or grip is subjected to a force corresponding to four times the weight of the equipment. The force is applied uniformly over a 70 mm width at the centre of the handle or grip, without clamping. The force is steadily increased so that the test value is attained after 10 s and maintained for a period of 1 min.		P
8.5	Wall mounting	Mounting brackets withstand a force of four times the weight of the equipment.	P
8.6	Expelled parts	No such parts.	N/A

9	Protection Against Fire Hazards		P
9.1	Resistance to fire	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
	Method 1 – Selection and application of components , wiring and materials that reduce the possibility of ignition and spread of flame and, where necessary, by the use of a FIRE ENCLOSURE .	See subclause of 9.1.2 and 9.1.3. In addition, the simulated faults of 4.4.4.1 a) and b) are applied.	P

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Clause	Requirement – Test	Result - Remark	Verdict
	Method 2 – Application of all of the simulated fault tests in 4.4.4.1 a), b), and c).	Not applied.	N/A
9.1.2	Conditions for a fire enclosure 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	FIRE ENCLOSURE requiered: – Components in PRIMARY CIRCUITS. – Components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2. – Components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2. – Components having unenclosed arcing parts. – 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
9.1.3.2	Materials for fire enclosures	Metal enclosure provided.	P
9.1.3.3	Materials for components and other parts outside fire enclosures	All components and parts are enclosed within fire enclosure.	N/A
9.1.3.4	Materials for components and other parts inside fire enclosures	All electronic components are soldered and mounted on V-0 PCB	P
9.1.3.5	Materials for air filter assemblies	No such materials.	N/A
9.1.4	Openings in fire enclosures		N/A
9.1.4.1	General		N/A
9.1.4.2	Side openings treated as bottom openings		N/A
9.1.4.3	Openings in the bottom of a fire enclosure		N/A

<table>
<tr><th colspan="4">IEC/EN 62109-1: 2010</th></tr>
<tr><th>Clause</th><th>Requirement – Test</th><th>Result - Remark</th><th>Verdict</th></tr>
<tr><td>9.1.4.4</td><td>Equipment for use in a CLOSED ELECTRICAL OPERATING AREA</td><td></td><td>N/A</td></tr>
<tr><td>9.1.4.5</td><td>Doors or covers in fire enclosures</td><td>No such parts.</td><td>N/A</td></tr>
<tr><td>9.1.4.6</td><td>Additional requirements for openings in transportable equipment</td><td>PCE not for transportable equipment.</td><td>N/A</td></tr>
<tr><td>9.2</td><td>LIMITED POWER SOURCES</td><td>Not applied.</td><td>N/A</td></tr>
<tr><td>9.2.1</td><td>General</td><td></td><td>N/A</td></tr>
<tr><td>9.2.2</td><td>Limited power source tests
Table 22 – Limits for inherently limited power sources
<table>
<tr><th colspan="2">Output voltage[1] U_{oc}</th><th>Output current[2] I_{sc}</th><th>Apparent power[3] S</th></tr>
<tr><th>V a.c.</th><th>V d.c.</th><th>A</th><th>VA</th></tr>
<tr><td>≤20</td><td>≤20</td><td>≤8,0</td><td>≤5 · U_{oc}</td></tr>
<tr><td>20 < U_{oc} ≤ 30</td><td>20 < U_{oc} ≤ 30</td><td>≤8,0</td><td>≤100</td></tr>
<tr><td>-</td><td>30 < U_{oc} ≤ 60</td><td>≤150/U_{oc}</td><td>≤100</td></tr>
</table>
Table 23 – Limits for power sources not inherently limited
<table>
<tr><th colspan="2">Output voltage[1] U_{oc}</th><th>Output current[2] I_{sc}</th><th>Apparent power[3] S</th><th>Current rating of overcurrent protective device[4]</th></tr>
<tr><th>Vac</th><th>Vdc</th><th>A</th><th>VA</th><th>A</th></tr>
<tr><td>≤20</td><td>≤20</td><td rowspan="3">≤1 000/U_o</td><td rowspan="3">≤250</td><td>≤5</td></tr>
<tr><td>20 < U_{oc} ≤ 30</td><td>20 < U_{oc} ≤ 30</td><td>≤100/U_{oc}</td></tr>
<tr><td>-</td><td>30 < U_{oc} ≤ 60</td><td>≤100/U_{oc}</td></tr>
</table></td><td></td><td>N/A</td></tr>
<tr><td>9.3</td><td>Short-circuit and overcurrent protection</td><td>See below.</td><td>P</td></tr>
<tr><td>9.3.1</td><td>General
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.</td><td>No overcurrent hazards was presented by short circuits and overloads tests. (refer to sub-clause 4.4.4)</td><td>P</td></tr>
<tr><td>9.3.2</td><td>Number and location of overcurrent protective devices</td><td>All poles circuit breaker was provided DC termianls.</td><td>P</td></tr>
<tr><td>9.3.3</td><td>Short-circuit co-ordination (backup protection)</td><td>Upstream protective device for backup protection was specified in installation instrucion.</td><td>P</td></tr>
</table>

10	Protection Against Sonic Pressure Hazards		P
10.1	General	The equipment is not likely to cause such HAZARDS.	P
10.2	Sonic Pressure and Sound level		P
10.2.1	Hazardous Noise Levels	Measured sound level is less then 80dB during the PCE operated with any unfavorable conditions.	P

11	Protection Against Liquid Hazards	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
11.1	Liquid Containment , Pressure and Leakage	No liquid contained in this system, and energy staorage battery used.	N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
	a) the rated maximum supply pressure specified for an external source		N/A
	b) the pressure setting of an overpressure safety device provided as part of the assembly		N/A
	c) the maximum pressure that can be developed by an air compressor that is part of the assembly, unless the pressure is limited by an overpressure safety device		N/A
11.2.2	Leakage from parts (two times the maximum pressure in NORMAL USE)		N/A
11.2.3	Overpressure safety device		N/A
	a) be connected as close as possible to the liquid-containing parts of the system that it is intended to protect		N/A
	b) be installed so as to provide easy access for inspection, maintenance and repair		N/A
	c) only be adjustable via the use of a TOOL		N/A
	d) have its discharge opening so located and directed that the released material is not directed towards any person		N/A
	e) have its discharge opening so located and directed that operation of the device will not deposit liquid on parts that may cause a hazard		N/A
	f) have adequate discharge capacity to ensure that, in the event of a failure of the supply pressure control, the pressure does not exceed the rated maximum working pressure of the system		N/A
	g) have no shut-off valve between it and the parts that it is intended to protect		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

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Clause	Requirement – Test	Result - Remark	Verdict
13.1	Handles and manual controls	It can not be possible to fix them in wrong position.	P
	Axial pull is unlikely – 15 N for the operating means of electrical components		N/A
	Axial pull is unlikely – 20 N in other cases		N/A
	Axial pull is likely – 30 N for the operating means of electrical components		P
	Axial pull is likely – 50 N in other cases		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
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	Permanently connected	N/A
13.3.2.4	Power supply cords	Not provided, but technical requirements provided in manual.	N/A
13.3.2.5	Cord anchorages and strain relief	No power supply cords provided.	N/A
13.3.2.6	Protection against mechanical damage	No sharp points or cutting edge at the bushing.	N/A
13.3.3	Wiring terminals for connection of external conductors	See below.	N/A
13.3.3.1	Wiring terminals	No such parts.	N/A
13.3.3.2	Screw terminals	No such parts.	N/A
13.3.3.3	Wiring terminal sizes	No such parts.	N/A
13.3.3.4	Wiring terminal design	No such parts.	N/A
13.3.3.5	Grouping of wiring terminals	No such parts.	N/A
13.3.3.6	Stranded wire	No such parts.	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
13.3.4	Supply wiring space	The space of power supply cords connection met this requirement.	P
13.3.5	Wire bending space for wires 10 mm^2 and greater	Considered.	P
13.3.6	Disconnection from supply sources	The breaker should be provide in the PV and AC branch circuits with specified capacity on mounted.	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	No for direct plug-in use.	N/A
13.4	Internal wiring and connections	See below.	P
13.4.1	General	The insulation, conductors and routing of all wires of the equipment is suitable for the electrical, mechanical, thermal and environmental conditions of use.	P
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	One or more yellow stripes is not used other than for protective bonding.	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	No such interconnections.	N/A
13.5	Openings in enclosures These requirements are in addition to those in the following sections: – 7.3.4, Protection against direct contact; – 7.4, Protection against energy hazards; – 9.1.4, Openings in fire enclosures.	Not opening in metal enclosure.	N/A
13.5.1	Top and side openings	No openings.	N/A
13.6	Polymeric Materials		P
13.6.1	General	See below.	P

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Clause	Requirement – Test	Result - Remark	Verdict
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	The polymeric material only used for LCD display.	P
13.6.2.1	Stress relief test	70°C	P
13.6.3	Polymers serving as solid insulation	7.3.7.8 considered for insulation sheet and passed.	P
13.6.3.1	Resistance to arcing		N/A
13.6.4	UV resistance	Approved AC/DC connector is provided. Anti-UV approved insulation plastic is provided and covers the control panel.	P
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	No polymeric enclosures.	N/A
13.7.4	Drop test	Not for HAND - HELD , DIRECT PLUG - IN , or TRANSPORTABLE equipment.	N/A
13.8	Thickness requirements for metal enclosures		N/A
13.8.1	General	The metal enclosure complied with 13.7	N/A
13.8.2	Cast metal		N/A
13.8.3	Sheet metal		N/A

14	Components		P
14.1	General	Components that are certified to IEC and /or national standards are used correctly within their ratings. Components not covered by IEC standards are tested under the conditions present in the equipment. See appended table 14.1.	P

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Clause	Requirement – Test	Result - Remark	Verdict
14.2	Motor Overtemperature Protection	DC motor used in cooling fan. For overtemperature protection test or evaluation see appended table 4.4.4.	P
14.3	Overtemperature protection devices	No such devices	N/A
14.4	Fuse holders	No such devices	N/A
14.5	MAINS voltage selecting devices	No such devices.	N/A
14.6	Printed circuit boards	The PCB is UL certified with flammability classification of V-0 minimum.	P
14.7	Circuits or components used as transient overvoltage limiting devices	.	P
14.8	Batteries	Not batteries used.	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
14.8.3	Electrolyte spillage		N/A
14.8.4	Battery Connections		N/A
14.8.5	Battery Maintenance instructions		N/A
14.8.6	Battery accessibility and maintainability		N/A

15	Software and firmware performing safety functions	See below.	P
	Firmware or software used in or with PCE, that performs one or more safety functions the failure of which could result in a risk of fire, electric shock or other hazard as specified by this standard, shall be evaluated in accordance with Annex B.	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

A	Annex A, Measurement of clearance and creepage distances (normative)	P

B	Annex B, Programmable Equipment (normative)		N/A
B.1	Software or Firmware That Perform Safety Critical Functions	Refer to subclause 15.	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
B.1.1	All software or firmware that performs a critical safety function/s, such as protection from excessive temperature, over current or improper synchronization of AC source, where failure of which can result in a risk of fire, electric shock or other hazard as specified by this document, shall be evaluated by one of the following means. a) All software or firmware limit or control shall be disabled before the test to evaluate the hardware circuitry during the abnormal test condition of the safety function, and the hardware sensor component that is monitored by the firmware or software is modified or disabled to prevent the software or firmware from reading or responding to the abnormal condition. b) Protection Controls employing software or firmware to perform their function(s), shall be so constructed that they comply with IEC 60730-1 Annex H to address the risks identified in B2.1. Each combination of microprocessor model, manufacturer and firmware/software version used in the production of a PCE shall be evaluated as specified in the remainder of Annex B. Exception: For units with firmware/software that has been found to be compliant with the remainder of Annex B, subsequent firmware/software revisions may be entitled to a limited revaluation for the revised firmware or software. The scope of the re-evaluation shall be defined by the potential impact of the firmware or software revisions and the applicable portions of IEC 60730-1 Annex H shall be reapplied.		N/A
B.2	Evaluation of Controls Employing Software	Refer to subclause 15.	N/A
B.2.1	Risk Analysis		N/A
B.2.1.1	A risk analysis shall be conducted to determine a set of risks and that the software addresses the identified risks. The risk analysis shall be conducted based on the safety requirements for the programmable component.		N/A
B.2.1.3	An analysis shall be conducted to identify the critical, non-critical, and supervisory parts of the software.		N/A
B.2.1.4	An analysis shall be conducted to identify transitions or states that can result in a risk.		N/A

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Clause	Requirement – Test	Result - Remark	Verdict
B.2.1.5	Risks to be considered include, but are not limited to function associated with the following: a) Temperature control, monitoring and response (ie. Coolant, internal ambient, device) b) Safety interlocks c) Synchronization between multiple AC sources e) Emergency stop of operation (including staged shutdown/sequencing) f) Connection/Disconnection – from an input source and output source g) RCD functions h) Over current protection or control i) The software must detect a hardware or software malfunction and place the device in a safe state as indicated per the “Risks Addressed State” definition.		N/A

C.	Annex C, Symbols to be used in Equipment Marking (normative)	P

D.	Annex D, Test Probes for Determining Access (informative)	P

E.	Annex E, RCDs (informative)		N/A
E.1	Selection of RCD type in AC circuits		N/A

F.	Annex F, Altitude correction for clearances (informative)	P

G.	Annex G, Clearance and creepage distance determination for frequencies greater than 30kHz		N/A
G.1	Clearance		N/A
G.2	Creepage distance		N/A

H.	Annex J, Measuring Instrument for Touch Current Measurements		P
H.1	Measuring instrument	Considered.	P
H.2	Alternative measuring instrument	Not used.	N/A

I.	Annex K, Examples of Protection, Insulation, and Overvoltage Category Requirements for PCE		P
I.1	Protection, Insulation and Overvoltage	Consided.	P
I.2	Illustrative examples	Consided.	P

J.	Annex J, Instruction of the ultraviolet light conditioning test		N/A
J.1	General requirement		N/A
J.2	Requirement of mounting of the samples		N/A
J.3	Instruction of the Carbon-arc light-exposure apparatus		N/A
J.4	Instruction of the Xenon-arc light-exposure apparatus		N/A

4.3	TABLE: Thermal testing		P
	test voltage (V)	See below	—
	t1 (°C)	--	—
	t2 (°C)	--	—

Maximum temperature T of part/at:	T (°C)				allowed T_{max} (°C)
Supplied Voltage:	DC550V AC198V	DC550V AC242V	DC850V AC207V	DC850V AC253V	--
Ambient	46.84	49.20	47.33	47.18	--
Transformer	68.03	67.91	68.44	67.22	130
AC current sensor	62.88	62.14	60.90	61.19	105
Relay	63.04	62.18	61.21	61.08	85
AC discharge tube	61.80	61.21	60.05	59.70	130
PV input line	63.52	60.20	56.53	57.98	105
Isolation chip	59.22	58.60	56.13	56.66	125
AC connection line	64.58	64.54	60.95	62.27	105
DC switch body	49.80	50.33	48.45	48.39	85
Control panel （Main MCU)	69.26	61.72	60.44	67.14	125
Y capacitance	64.35	63.27	61.95	62.30	110
AC common mode inductance	76.28	74.34	70.47	72.91	130
Drive optocoupler	70.37	69.08	67.22	68.03	100
X capacitance	63.98	63.06	61.36	61.62	110
DC discharge tube	63.87	62.34	60.70	60.67	105
Film capacitor C54	65.18	63.16	61.32	61.92	105
Bus film capacitor	63.85	63.00	62.41	62.14	105
DC common mode inductance	77.00	71.52	64.11	66.76	130
Shell	54.62	58.03	53.41	56.83	70
Leakage current sensor	63.19	62.83	61.16	61.21	105
Ambient temperature （internal)	61.64	60.93	59.75	59.73	--
Inverter inductance	71.22	69.23	78.97	73.56	130
AC Varistor	62.90	62.16	61.15	60.88	105

DC switch body (internal)	62.94	59.27	55.15	57.18	85
Storage diode	78.30	73.84	69.91	70.87	175
Inverter IGBT Q8	87.62	70.77	69.62	89.05	175
BOOST IGBT	82.40	75.61	74.27	73.99	175
Inverter IGBT Q9	98.27	97.12	98.21	98.00	175
DC current sensor	64.02	61.76	59.97	60.54	105
DC Varistor	64.92	62.69	60.96	61.27	105
LCD button	49.24	48.99	48.24	50.03	75
DC connector	51.39	52.77	50.58	49.56	85

Temperature T of winding:	R_1 (Ω)	R_2 (Ω)	T (°C)	allowed T_{max} (°C)	insulation class
--	--	--	--	--	--

Note(s):
"*" means PV inverter marked with the hot surface marking of symbol 14 of Annex C.

4.3	TABLE: Thermal testing		P
	test voltage (V)	See below	—
	t1 (°C)	--	—
	t2 (°C)	--	—

Maximum temperature T of part/at:	T (°C)				allowed T_{max} (°C)
Supplied Voltage:	DC550V AC198V	DC550V AC242V	DC850V AC207V	DC850V AC253V	--
Ambient	66.99	69.08	67.35	66.91	--
Transformer	78.79	78.30	78.84	77.67	130
AC current sensor	73.56	72.74	71.25	71.53	105
Relay	73.60	72.80	71.42	71.48	85
AC discharge tube	72.05	71.39	70.60	70.30	130
PV input line	74.31	70.90	66.83	68.45	105
Isolation chip	69.48	68.80	66.78	67.13	125
AC connection line	75.03	74.81	71.51	72.60	105

DC switch body	69.22	69.70	69.40	69.97	85
Control panel （Main MCU)	79.86	72.05	70.64	77.65	125
Y capacitance	74.73	73.81	72.20	72.61	110
AC common mode inductance	86.45	84.96	80.77	83.55	130
Drive optocoupler	80.49	79.76	77.85	78.24	100
X capacitance	74.30	73.32	71.73	71.98	110
DC discharge tube	74.17	72.59	70.92	71.19	105
Film capacitor C54	75.50	73.77	71.85	72.14	105
Bus film capacitor	74.28	73.32	73.03	72.53	105
DC common mode inductance	87.35	82.00	74.62	77.15	130
Shell	64.88	63.78	64.08	63.44	70
Leakage current sensor	73.86	73.01	71.50	70.07	105
Ambient temperature （internal)	72.25	71.34	70.24	68.97	--
Inverter inductance	81.93	79.69	89.55	84.25	130
AC Varistor	73.45	72.87	71.41	71.43	105
DC switch body （internal)	73.41	69.68	65.39	67.72	85
Storage diode	88.63	84.18	80.36	81.31	175
Inverter IGBT Q8	98.35	81.45	80.03	99.47	175
BOOST IGBT	93.16	86.09	84.76	84.20	175
Inverter IGBT Q9	108.90	107.75	108.55	108.37	175
DC current sensor	74.24	72.42	70.39	70.78	105
DC Varistor	75.46	73.16	71.31	71.52	105
LCD button	69.37	69.77	67.52	70.12	75
DC connector	73.44	74.99	71.15	69.92	85

Temperature T of winding:	R_1 (Ω)	R_2 (Ω)	T (°C)	allowed T_{max} (°C)	insulation class
--	--	--	--	--	--

Note(s):
“*” means PV inverter marked with the hot surface marking of symbol 14 of Annex C.

4.4	TABLE: fault condition tests		P
	test voltage (V) .....:		—
	Ambient temperature (°C) .....:		

No.	com-ponent No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1.	PCE input	Reversed	DC 550/850	30min	--	--	DC Input: 0Vdc / 0A / 0W AC Output: 0Vac / 0A / 0kW FID: The inverter does not work. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
2.	PCE input	s-c	DC 550/850	30min	--	--	DC Input: 0Vdc / 0A / 0W AC Output: 0Vac / 0A / 0kW FID: The inverter does not work. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
3.	PCE input	Over-voltage	DC 550/850	30min	--	--	DC Input: 1050Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F55' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

4.	PCE input (only for multi-string)	Different input MPP1: low input MPP2: high input	DC 550/850	30min	--	--	DC Input: mpp1：550Vdc/ 22.9A / 12.6kW mpp2：850Vdc/14.8A / 12.7kW AC Output: 230Vac / 36.2A / 25kW FID: The inverter works normally. MT: n.a SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
5.	PCE input (only for multi-string)	Same input (MPP1 & MPP2 from same power source)	DC 550/850	30min	--	--	DC Input: mpp1：850Vdc/14.8A / 12.6kW mpp2：850Vdc/14.8A / 12.6kW AC Output: 230Vac / 36.2A / 25kW FID: The inverter works normally. MT: n.a SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
6.	PCE output	Power over-feed (OCP & OTP function controlled by DSP / software is disable)	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F18' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
7.	PCE output	Over-voltage (OVP function controlled by DSP / software is disable)	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 300Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F26' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

8.	PCE output (A to B)	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F18' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
9.	PCE output (A to C)	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID:The inverter stopped working immediately, and the LCD showed that 'F18' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
10.	PCE output (B to C)	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F18' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
11.	PCE output	Phase sequence or polarity incorrect	DC 550/850	30min	--	--	DC Input: 850Vdc / 29.8A / 25.3kW AC Output: 230Vac / 36.2A / 25kW FID: The inverter works normally. MT: n.a SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

12.	PCE output	A-Phase mis-wiring grid connection	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F42' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
13.	PCE output	B-Phase mis-wiring grid connection	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F42' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
14.	PCE output	C-Phase mis-wiring grid connection	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F42' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
15.	PCE Cooling system failure	Fan locked (MF1)	DC 550/850	3h	--	--	DC Input: 550Vdc / 45.6A / 25kW AC Output: 198Vac / 41.7A / 24.7kW FID: The inverter works normally. MT: Ambient=67.5°C, Transformer =89.4°C, Inductor=99.9°C, IGBT=118.8°C. SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

16.	PCE Cooling system failure	Over load	DC 550/850	3h	--	--	DC Input: 550Vdc / 45.6A / 25kW AC Output: 198Vac / 41.7A / 24.7kW FID: The inverter works normally. MT: Ambient=66.8°C, Transformer =89.2°C, Inductor=92.1°C, IGBT=119.4°C. SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
17.	PCE Cooling system failure	blanket test	DC 550/850	3h	--	--	DC Input: 550Vdc / 45.6A / 25kW AC Output: 198Vac / 41.7A / 24.7kW FID: The inverter works normally. MT: Ambient=67.0°C, Enclosure=66.3°C SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
MCU or DPS processer failure							
18.	DSP failure	+1.8V power supply disable	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'comm error' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
19.	DSP failure	+3.3V power supply disable	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'comm error' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

20.	DSP failure	+5V power supply disable	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'comm error' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
Loss of control & Function check fault							
21.	IGBT PMW	Loss / failure (no power)	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F26' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
22.	IGBT PMW	Loss / failure (one bridge on always)	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, the IGBT QR2 are damaged, and the LCD showed that 'F26' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☐ Yes /☒ No, NCD: ☐ Yes /☒ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
23.	IGBT PMW	Loss / failure (No driver)	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F26' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

24.	PV/DC Voltage detector C30 S-C	Loss / failure	DC 550/850	30min	--	--	DC Input: 0Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, the LCD showed that 'F41' was faulty, and the DC indicator on the LCD is off . MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
25.	PV/DC current detector R110 O-C	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, the LCD showed that 'F41' was faulty, and the DC indicator on the LCD is off . MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
26.	BUS Voltage detector C24 S-C	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F56' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
27.	Inverter current detector U3 3 to 4 S-C	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F26' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

28.	Inverter voltage detector R127 S-C	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 260Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F41' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
29.	Grid/AC voltage detector R331 S-C	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 260Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F41' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
30.	PV isolation device function check R39 S-C	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 260Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F24' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
31.	Relay / Contactor function check (RY1 o-c)	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F30' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

32.	Relay / Contactor function check (RY3 o-c)	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F30' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
33.	Relay / Contactor function check (RY5 o-c)	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F30' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
34.	RCD/RCM function check	Loss / failure	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F23' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
35.	Heat-sink temperature detector C38S-C	Loss / failure (s-c)	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F64' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

36.	Heat-sink temperature detector R51O-C	Loss / failure(o-c)	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F64' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
Components single fault condition and Functional insulation on PWB short circuit test							
37.	IGBT (IGBT D-S) Q8 D-S S-C	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the IGBT Q8,Q9 are damaged. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☐ Yes /☒ No, NCD: ☐ Yes /☒ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
38.	DC input Bus capacitor (820μF) C141 S-C	s-c	DC 550/850	30min	--	--	DC Input: 1100Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the Bus capacitor C142,C18,C30,C39,C50 are damaged. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☐ Yes /☒ No, NCD: ☐ Yes /☒ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
39.	DC input filter capacitor C153 S-C	s-c	DC 550/850	30min	--	--	DC Input: 0Vdc / 0A / 0W AC Output: 0Vac / 0A / 0kW FID: The inverter does not work. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

40.	LC filter capacitor C28 S-C	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F18' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
41.	Power supply transformer (T1) 1 to 3 S-C	s-c	DC 550/850	30min	--	--	DC Input: 0Vdc / 0A / 0W AC Output: 0Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD turns off. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
42.	Power supply transformer (T1) 4 to 5 S-C	s-c	DC 550/850	30min	--	--	DC Input: 0Vdc / 0A / 0W AC Output: 0Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD turns off. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
43.	Power supply transformer (T1) 6 to 7 S-C	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F41' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

44.	Power supply transformer (T1) 9 to 10 S-C	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 29.8A / 25.3kW AC Output: 230Vac / 36.2A / 25kW FID: The inverter works properly, but wifi does not work properly. MT: n.a SD: ☐ Yes /☒ No, GD: ☐ Yes /☒ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
45.	Power supply transformer (T1) 12 to 13 S-C	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F41' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
46.	Power supply transformer (T1) 14 to 15 S-C	s-c	DC 550/850	30min	--	--	DC Input: 850Vdc / 0A / 0W AC Output: 230Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD showed that 'F23' was faulty. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.
47.	Power supply transformer (T1) 15 to 16 S-C	s-c	DC 550/850	30min	--	--	DC Input: 0Vdc / 0A / 0W AC Output: 0Vac / 0A / 0kW FID: The inverter stopped working immediately, and the LCD turns off. MT: n.a SD: ☒ Yes /☐ No, GD: ☒ Yes /☐ No RO: ☒ Yes /☐ No, NCD: ☒ Yes /☐ No NH: ☒ Pass / ☐ Fail. DST: ☒ Pass / ☐ Fail.

Legend (Special evaluation for PV Inverter abnormal test)

FID	Fault Indication	MT	Max. Temperature
SD	PCE Shut Down:	DG	Disconnection To Grid
RO	Recovered to Operate after removing the single fault setting	NCD	No comp. or parts damaged
NH	No hazards occurred	DST	Dielectric strength test

s-c	short-circuited	o-c	open-circuited
o-l	Over-load.		
Note(s):			

4.7	TABLE: electrical data (in normal conditions)	P

SUN-25K-G05

P/P_n [%]	I/P rated	PV / DC Input			O/P rated	Grid / AC Output					Testing cond.
	I [A]	U [V]	I [A]	P [kW]	I [A]	U [V]	I [A]	P [kW]	F[Hz]	Power Factor	
100	26*2	549.03	46.91	25.75	36.2/ 36.2/ 36.2	230.09/ 230.11/ 230.32	36.11/ 36.34/ 36.15	24.99	50	1.0	A
100	26*2	599.02	42.96	25.73	36.2/ 36.2/ 36.2	230.06/ 230.07/ 230.33	36.07/ 36.37/ 36.17	24.99	50	1.0	B
100	26*2	849.38	30.16	25.61	36.2/ 36.2/ 36.2	230.06/ 230.08/ 230.33	36.00/ 36.31/ 36.11	24.94	50	1.0	C
100	26*2	549.43	46.66	25.64	37.9/ 37.9/ 37.9	220.08/ 219.80/ 220.30	37.58/ 37.81/ 38.10	24.97	50	1.0	D
100	26*2	850.47	30.40	25.85	37.9/ 37.9/ 37.9	220.09/ 219.78/ 220.29	37.65/ 37.86/ 38.19	25.01	50	1.0	E
100	26*2	549.43	46.65	25.63	37.9/ 37.9/ 37.9	220.16/ 219.83/ 220.31	37.58/ 37.78/ 38.11	24.97	60	1.0	F

SUN-20K-G05

P/P_n [%]	I/P rated	PV / DC Input			O/P rated	Grid / AC Output					Testing cond.
	I [A]	U [V]	I [A]	P [kW]	I [A]	U [V]	I [A]	P [kW]	F[Hz]	Power Factor	
100	26*2	499.16	41.10	20.51	29.0/ 29.0/ 29.0	230.09/ 230.16/ 230.38	28.85/ 29.08/ 28.90	19.99	50	1.0	A
100	26*2	599.23	34.41	20.62	29.0/ 29.0/ 29.0	230.04/ 230.02/ 230.28	28.92/ 29.17/ 28.96	20.03	50	1.0	B

100	26*2	849.55	23.91	20.31	29.0/ 29.0/ 29.0	230.08/ 230.09/ 230.34	28.84/ 29.09/ 28.94	19.99	50	1.0	C
100	26*2	499.48	41.10	20.53	30.3/ 30.3/ 30.3	220.16/ 219.83/ 220.23	30.08/ 30.29/ 30.54	20.00	50	1.0	D
100	26*2	850.63	24.21	20.59	30.3/ 30.3/ 30.3	220.11/ 219.82/ 220.23	30.04/ 30.20/ 30.48	19.96	50	1.0	E
100	26*2	499.47	41.13	20.54	30.3/ 30.3/ 30.3	220.12/ 219.76/ 220.17	30.10/ 30.29/ 30.57	20.01	60	1.0	F
SUN-18K-G05											
P/P_n [%]	I/P rated	PV / DC Input			O/P rated	Grid / AC Output					Testing cond.
	I [A]	U [V]	I [A]	P [kW]	I [A]	U [V]	I [A]	P [kW]	F[Hz]	Power Factor	
100	26*2	499.25	36.87	18.40	26.1/ 26.1/ 26.1	230.07/ 230.15/ 230.35	25.97/ 26.14/ 26.01	17.98	50	1.0	A
100	26*2	599.37	30.52	18.29	26.1/ 26.1/ 26.1	230.09/ 230.15/ 230.37	25.96/ 26.13/ 25.98	17.97	50	1.0	B
100	26*2	849.59	21.77	18.50	26.1/ 26.1/ 26.1	230.04/ 230.08/ 230.32	25.93/ 26.17/ 26.02	17.98	50	1.0	C
100	26*2	499.49	36.91	18.43	27.3/ 27.3/ 27.3	220.10/ 219.82/ 220.20	27.05/ 27.23/ 27.47	17.99	50	1.0	D
100	26*2	850.25	21.77	18.51	27.3/ 27.3/ 27.3	220.07/ 219.79/ 220.17	27.04/ 27.17/ 27.43	17.95	50	1.0	E
100	26*2	499.46	36.97	18.47	27.3/ 27.3/ 27.3	220.08/ 219.73/ 220.11	27.09/ 27.26/ 27.52	18.01	60	1.0	F

Note(s): Testing Conditions. A. I/P: V_{MPP} min; O/P: 230V, Max. Output power, 50Hz. B. I/P: $V_{Nominal}$, O/P: 230V, Max. Output power, 50Hz. C. I/P: V_{MPP} max; O/P: 230V, Max. Output power, 50Hz. D. I/P: V_{MPP} min; O/P: 220V, Max. Output power, 50Hz. E. I/P: V_{MPP} max; O/P: 220V, Max. Output power, 50Hz. F. I/P: V_{MPP} min; O/P: 220V, Max. Output power, 60Hz.

7.3.4.2.3	TABLE: List of accessible parts		N/A
Item	Description	Determination method (NOTE 3)	Exception
1			
2			
3			
NOTE 1 – Test fingers and pins are to be applied without force unless a force is specified NOTE 2 – Special consideration should be given to inadequate insulation and high voltage parts NOTE 3 – The determination methods are: V = visual; R = rigid test finger; J = jointed test finger; P = test pin; P2.5 = pin 2.5 mm diameter.			

7.3.6.3	TABLE: Protective Bonding Test	N/A
Location	Resistance measured (mΩ) or voltage drop (V)	Comments
PE terminal to metal enclosure		
PE terminal to metal enclosure		
Note(s):		

7.3.7.5.2	Table: working voltage measurement				N/A
No.	From	To	Peak voltage (V)	RMS voltage (V)	Comments
Note: Common reference GND established by connecting PE to N – neutral (TN power system) and to secondary GND (or output –). * The value in bracket is the rated voltage.					

7.3.7.4 & 7.3.7.5	TABLE: clearance and creepage distance measurements	P

Clearance cl and creepage distance dcr at/of:	System / Impulse voltage (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required dcr (mm)	dcr (mm)
PCE unit (Vmax PV: OVCII 1000Vdc, OVC III 230Vac, 50Hz)						
PV supply circuits to metal chassis: BI	4464	1000Vdc	3.6*1.29 = 4.7	**See below**	10	**See below**
- at DC switch	--	--	--	>30	--	>30
- at IGBT	--	--	--	5.2	--	5.2 CTI>600
-at PCB board	--	--	--	14	--	>15
PV supply circuits line to line: FI	4464	1000Vdc	3.6*1.29 = 4.7	**>30**	10	**>30**
AC mains circuits L1 to L2 to L3 : FI	4464	1000Vdc	3.6*1.29 = 4.7	**>20**	10	**>20**
AC mains circuits/ to metal chassis: BI (components)	4464	1000Vdc	3.6*1.29 = 4.7	**13**	10	>15
Main board (SUN-18-25K-G05-2MPPT-MAIN)						
PV supply circuits / AC mains circuits to Communication circuits: RI	4464	1000Vdc	5.5 *1.29 = 7.1	**See below**	10	**See below**
-T1 primary pin 12 to secondary pin 9,10 trace	--	--	--	10.1	--	10.1
-Primary R64 to P2 secondary trace	--	--	--	10.3	--	10.3
- Primary C103 to secondary trace	--	--	--	13	--	13
- PV supply circuits line to line: FI	4464	1000Vdc	3.6*1.29 = 4.7	5.1	5	5.1
-BUS+ to GND:BI	4464	1000Vdc	3.6*1.29 = 4.7	5.1	5	5.1
AC mains circuits L1 to L2 to L3 : FI	4464	1000Vdc	3.6*1.29 = 4.7	**5.1**	5	**5.1**
AC mains circuits/ to metal chassis: BI (components)	4464	1000Vdc	3.6*1.29 = 4.7	**See below**	5	**See below**
-Y Cap C4	--	--	--	5.1	--	5.1
-Y Cap C58	--	--	--	5.1	--	5.1
-Y Cap C43	--	--	--	5.1	--	5.1
-X Cap C28	--	--	--	5.1	--	5.1
Communication Board (SUN-485-232-INONE-V1.1)						

PV supply circuits / AC mains circuits to Communication circuits: RI	4464	1000Vdc	5.5 *1.29 = 7.1	**See below**	10	**See below**
-U1	4464	1000Vdc	5.5 *1.29 = 7.1	14	10	14
-VDD485 to 3.3V	4464	1000Vdc	5.5 *1.29 = 7.1	7.4	10	12.2
-TX2-485 to 3.3V	4464	1000Vdc	5.5 *1.29 = 7.1	7.9	10	10.2

Independence components						

Circuits Definition:	
Communication Circuits: DVC-A	PV Circuits: DVC-C
AC mains / Grid Circuits: DVC-C	
Protection Separation	
Accessible Parts Earthed to PV Circuits: BI	Accessible Parts Earthed to AC mains /Grid Circuits: BI
Communication Circuits to PV Circuits: RI	Communication Circuits to AC mains / Grid Circuits: RI

Legend			
BI	Basic insulation	SI	Supplementary insulation
DI	Double insulation	RI	Reinforced insulation
FI	Functional insulation	O.V.C	Overvoltage category
PD	Pollution degree	MG	Insulating material group
PPI	Protection by Protective Impedance	DVC	Decision Voltage Classification
s-c	Shorted Circuits	o-c	Opened Circuits

Note:
$V_{MAX\ PV}$ (V) = 1000 Vd.c, AC output voltage = 230 Va.c
PV supply circuits = O.V.C II, AC mains circuits = O.V.C. III, DC Power Supply Voltage = O.V.C II.
PD = PD2 (IP65), MG = IIIa/b, Altitude = 4000m (1.29 factor)
Communication Circuits in PCE is considered as DVC-A with reinforced insulation from DVC-C circuits.
Communication circuits in PCE are considered as DVC-A which could be accessible.
PV side: SPD were provided between PV circuits and earth.
Grid side: SPD were provided between AC mains circuits and mains to earth as well.
1. Annex I of SPD or varistor for reducing impulse voltage was considered in this test report.
2. Interpolation is permitted in general, except for impulse withstand voltage decision.
3. Functional insulation was shorted circuit tests and consideration. see sub-clause 5.3.4 c).

7.3.7.8	TABLE: Distance Through Insulation Measurements				P
Distance through insulation di at/of:		U r.m.s. (V)	Test voltage (V)	Required di (mm)	di (mm)
Bobbin of Isolated Transformer T1		1100	--	0.2	>0.4
Bobbin of Isolated Transformer T2		1100	--	0.2	>0.4
Legend					
BI	Basic insulation	SI	Supplementary insulation		
DI	Double insulation	RI	Reinforced insulation		
FI	Functional insulation	O.V.C	Overvoltage category		
Supplementary information: "* " means approved components.					

7.3.9	TABLE: discharge test			Ambient: 25º C	**P**
Condition	τ calculated (s)	τ measured → DVC A (s)	t limit → DVC A (s)	Comments	
Bus "+" to "-"	--	1.143	10	Switch "ON" position, Test at 850V, rated load	
Bus "+" to "-"	--	1.122	10	Switch "ON" position, Test at 850V, no load	
Output L1 - L2	--	0.555	10	Switch "ON" position, output 1.1 time Vr	
Output L2 - L3	--	0.589	10	Switch "ON" position, output 1.1 time Vr	
Output L3 - L1	--	0.577	10	Switch "ON" position, output 1.1 time Vr	
Output L1 - N	--	0.615	10	Switch "ON" position, output 1.1 time Vr	
Output L2 - N	--	0.623	10	Switch "ON" position, output 1.1 time Vr	
Output L3 - N	--	0.585	10	Switch "ON" position, output 1.1 time Vr	
Output L1 - PE	--	1.329	10	Switch "ON" position, output 1.1 time Vr	

Output L2 - PE	--	1.321	10	Switch “ON” position, output 1.1 time Vr
Output L3 - PE	--	1.306	10	Switch “ON” position, output 1.1 time Vr
PV supply input terminal	--	3.352	10	Test at 1000V, no load
Overall capacity :				
Discharge resistor :				

7.5.1, 7.5.2 & 7.5.3	TABLE: electric strength measurements, impulse voltage test and partial discharge test			P
test voltage applied between:	test voltage (V)	impulse withstand voltage (kV) 1.2/50 µs	partial discharge extinction voltage (V)	result
DC input terminal to earthed enclosure	2120Vdc	6.0	--	Pass
AC output terminal to earthed enclosure	2120Vdc	6.0	--	Pass
DC input terminal to communication port	4240Vdc	8.0	--	Pass
AC output terminal to communication port	4240Vdc	8.0	--	Pass

Legend			
BI	Basic insulation	SI	Supplementary insulation
DI	Double insulation	RI	Reinforced insulation
FI	Functional insulation	O.V.C	Overvoltage category
Note(s):			

7.5.4	TABLE: Touch Current Measurement			P
Condition	Measurement (mA)	Limit (mA)	Comments	
EUT Earthing terminal and external protective earthing conductor	1.8	3.5	PE disconnected	

Legend			
BI	Basic insulation	SI	Supplementary insulation
DI	Double insulation	RI	Reinforced insulation
FI	Functional insulation	O.V.C	Overvoltage category
Note(s):			

13.7	TABLE: Mechanical Resistance		P
Impacts per surface	Surface tested	Impact energy (Nm)	Comments
--	250N for metal enclosure	--	--
Supplementary information:			

14	TABLE:List of critical components				P
Object/part no.	Manufacturer/ trademark	Type/model	Technical data	Standard	Mark(s) of conformity[1)]
Note(s): See CN229UFF 001 CDF.					

14.8	TABLE: Batteries								N/A
The tests are applicable only when appropriate battery data is not available									
Is it possible to install the battery in a reverse polarity position?									
	Non-rechargeable batteries			Rechargeable batteries					
	Discharging		Un-intentional charging	Charging		Discharging		Reversed charging	
	Meas. current	Manuf. Specs.		Meas. current	Manuf. Specs.	Meas. current	Manuf. Specs.	Meas. current	Manuf. Specs.
Max. current during normal condition									
Max. current during fault condition									
Test results:									Verdict
- Chemical leaks									
- Explosion of the battery									
- Emission of flame or expulsion of molten metal									
- Electric strength tests of equipment after completion of tests									
Supplementary information:									

- End of test report -

Test Report issued under the responsibility of:

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TEST REPORT
IEC 62109-2
Safety of power converters for use in photovoltaic power systems – Part2: Particular requirements for inverters

Report Reference No.	CN229UFF 001 attachment 1.	
Tested by (name + signature)	See cover page	.....
Witnessed by (name + signature)...	N/A	.....
Supervised by (name + signature) .	N/A	.....
Approved by (name + signature)	See cover page	.....
Date of issue.....	See cover page	

Testing Laboratory	TÜV Rheinland (Shanghai) Co., Ltd.
Address	B1-13/F, No.177, Lane 777, West Guangzhong Road, Zhabei District, Shanghai 200072, P. R. China
Testing location/ procedure	CBTL☐ TMP☐ WMT☐ SMT☐ RMT☐ CCATL☒
Testing location/ address	See cover page

Applicant's name	See cover page
Address	See cover page

Test specification:	
Standard.....	IEC/EN 62109-2: 2011
Test procedure.....	TÜV Bauart
Non-standard test method……..:	N/A

Test Report Form No.	IEC 62109-2: 2011
Test Report Form(s) Originator	TÜV Rheinland Group
Master TRF.....	2011-08

Test item description.....	See report CN229UFF 001.
Trade Mark	See report CN229UFF 001.
Manufacturer	See report CN229UFF 001.
Model/Type reference	See report CN229UFF 001.
Ratings	See report CN229UFF 001.

Testing procedure and testing location:	
☐ **CB Testing Laboratory:**	
Testing location/ address.....:	
☐ **Associated CB Test Laboratory:**	
Testing location/ address.....:	
Tested by (name + signature) .... :	See cover page
Approved by (+ signature)..... :	See cover page
☐ Testing procedure: TMP	
Tested by (name + signature) .... :	
Approved by (+ signature)..... :	
Testing location/ address.....:	
☐ Testing procedure: WMT	
Tested by (name + signature) .... :	
Witnessed by (+ signature) ..... :	
Approved by (+ signature)..... :	
Testing location/ address.....:	
☐ Testing procedure: SMT	
Tested by (name + signature) .... :	
Approved by (+ signature)..... :	
Supervised by (+ signature) ..... :	
Testing location/ address.....:	
☐ Testing procedure: RMT	
Tested by (name + signature) .... :	
Approved by (+ signature)..... :	
Supervised by (+ signature) ..... :	
Testing location/ address.....:	

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

See report CN229UFF 001.

Summary of testing

Tests performed (name of test and test clause):	**Testing location:**
The critical tests were performed for this equipment, included clauses 4.4.4.15.1, 4.4.4.15.2, 4.8.2.1, 4.8.3.5.2, 4.8.3.5.3 in scope of this standard.	The laboratory described on cover page.

Summary of compliance with National Differences

List of countries addressed: None.

☒ The product fulfils the requirements of EN 62109-2: 2011.

Copy of marking plate:

See report CN229UFF 001.

Equipment mobility	:	☐ movable	☐ hand-held	
		☐ stationary	☒ fixed (Wall mounted)	
Connection to the mains	:	☐ pluggable equipment	☐ direct plug-in	
		☒ permanent connection	☐ for building-in	
Enviromental category	:	☒ outdoor	☐ indoor conditional	☐ indoor unconditional
Operating condition	:	☒ continuous	☐ short-time	☐ intermittent
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 (%)	:	According to specified supply range		
Tested for IT power systems	:	☐ Yes	☒ No	
IT testing, phase-phase voltage (V)	:	N/A		
Class of equipment	:	☒ Class I	☐ Class II	
		☐ Class III	☐ Not classified	
Mass of equipment (kg)	:	See model list		
Pollution degree	:	☐ PD 1	☒ PD 2 (inside)	☒ PD 3 (outside)
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: Pass (P)
- test object does not meet the requirement: Fail (F)

Testing:

Date of receipt of test items: See report CN229UFF 001

Date(s) of performance of tests: See report CN229UFF 001

General remarks:

"(see Attachment #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

The tests results presented in this report relate only to the object tested.

This report shall not be reproduced except in full without the written approval of the testing laboratory.

List of test equipment must be kept on file and available for review.

Additional test data and/or information provided in the attachments to this report.

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

Determination of the test results includes consideration of measurement uncertainty from the test equipment and methods.

Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided :

☐ Yes

☒ Not applicable

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

Name and address of factory (ies) : See report CN229UFF 001

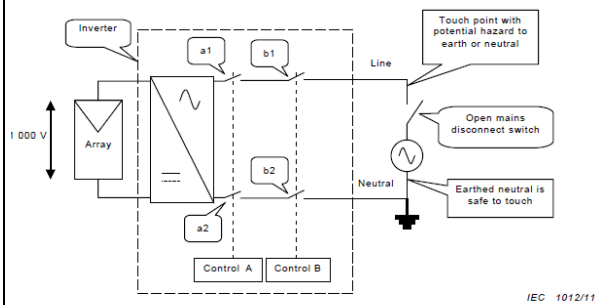
General product information:

See report CN229UFF 001

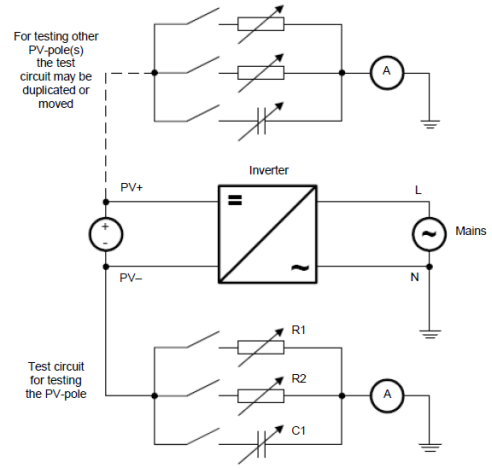
Throughout the test report following abbreviations may be used:

- input	i/p	- Test repeated, similar result(3 times)	TRSR
- output	o/p	- No indication of dielectric breakdown	NB
- short-circuited	s-c	- Cheesecloth remained intact	NC
- overloaded	o-l	- Tissue paper remained intact	NT
- open-circuited	o-c	- No hazards	NH
- normal conditions	N.C.	- The PCE can recover to operate automaticly after removing the abnormal condition	RO
- single fault conditions	SFC	- functional insulation	FI
- between parts of opposite polarity	BOP	- basic insulation	BI
- internal protection operated	IPO	- supplementary insulation	SI
- Component damage (list damaged component)	CD	- double insulation	DI
- No component damaged	NCD	- reinforced insulation	RI

Indicate used abbreviations (if any)

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
4	General testing requirements *This clause of Part 1 is applicable with the following exceptions:*		P
4.4	Testing in SINGLE FAULT CONDITIONS		P
4.4.4	SINGLE FAULT CONDITIONS to be applied: *Additional subclauses:*	The PCE could detect and indicate the fault condition and disconnect from or not connect to the grid in case of single fault condition. Refer to the appended table 4.4 of IEC/EN 62109-1 test report CN229UFF 001.	P
4.4.4.15	Fault-tolerance of protection for GRID-INTERACTIVE INVERTERS		P
4.4.4.15.1	Fault-tolerance of residual current monitoring		P
4.4.4.15.2	Fault-tolerance of automatic disconnecting means		P
4.4.4.15.2.1	General		P
4.4.4.15.2.2	Design of insulation or separation  **Figure 20 – Example system discussed in Note 2 above**		P
4.4.4.15.2.3	Automatic checking of the disconnect means		P
4.4.4.16	Stand-alone inverters-load transfer test	Grid-connected PV Inverter.	N/A
4.4.4.17	Cooling system failure – Blanketing test	Enclosure: 68.6 ºC	P
4.7	Electrical Ratings Tests *Additional subclauses:*	Refer to the appended table 4.7 of IEC/EN 62109-1 test report CN229UFF 001.	P
4.7.3	Measurement requirements for AC output ports for stand-alone inverters	Grid-connected PV Inverter.	N/A
4.7.4	Stand-alone Inverter AC output voltage and frequency	Grid-connected PV Inverter.	N/A
4.7.4.1	General		N/A

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
4.7.4.2	Steady state output voltage at nominal DC input		N/A
4.7.4.3	Steady state output voltage across the DC input range		N/A
4.7.4.4	Load step response of the output voltage at nominal DC input		N/A
4.7.4.5	Steady state output frequency		N/A
4.7.5	Stand-alone inverter output voltage waveform		N/A
4.7.5.1	General		N/A
4.7.5.2	Sinusoidal output voltage waveform requirements		N/A
4.7.5.3	Non-sinusoidal output waveform requirements		N/A
4.7.5.3.1	General		N/A
4.7.5.3.2	Total harmonic distortion		N/A
4.7.5.3.3	Waveform slope		N/A
4.7.5.3.4	Peak voltage		N/A
4.7.5.4	Information requirements for non-sinusoidal waveforms		N/A
4.7.5.5	Output voltage waveform requirements for inverters for dedicated loads		N/A
4.8	Additional tests for grid-interactive inverters	See below.	P
4.8.1	General requirements regarding inverter isolation and array grounding	Non-isolated inverters for ungrounded arrays.	P
4.8.2	Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	See below.	P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays	Inverter indicated the insulation fault and didn't connect to the grid when a resistor below 40 kΩ (required above 33.3 kΩ) linked between PV+/- to earth.	P
4.8.2.2	Array insulation resistance detection for inverters for functionally grounded arrays	See above.	N/A
4.8.3	Array residual current detection		P
4.8.3.1	General		P
4.8.3.2	30mA touch current type test for isolated inverters	See appended table.	P
4.8.3.3	Fire hazard residual current type test for isolated inverters	See appended table.	N/A

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
4.8.3.4	Protection by application of RCD's	The RCD provided integral to the inverter	P
4.8.3.5	Protection by residual current monitoring		P
4.8.3.5.1	General	See below.	P
	Table 31 – Response time limits for sudden changes in residual current Residual current sudden change / Max. time to inverter disconnection from the mains 30 mA / 0,3 s 60 mA / 0,15 s 150 mA / 0,04 s NOTE These values of residual current and time are based on the RCD standard IEC61008-1.	See appended table.	P
	 For the continuous residual current test, R1 establishes a baseline current just below the trip point, and R2 is switched in to cause the current to exceed the trip point. Capacitor C1 is not used. For the sudden change residual current test, C1 establishes a baseline current and R1 or R2 is switched in to cause the desired value of sudden change. The other resistor is not used. IEC 1013/11 **Figure 21 – Example test circuit for residual current detection testing**	See appended table.	P
4.8.3.5.2	Test for detection of excessive continuous residual current	See appended table.	P
4.8.3.5.3	Test for detection of sudden changes in residual current	See appended table.	P
4.8.3.6	Systems located in closed electrical operating areas	Not specified to be located in closed electrical operating area.	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
5	Marking and documentation *This clause of Part 1 is applicable with the following exceptions:*	See report CN229UFF 001.	P
5.1	Marking		P
5.1.4	Equipment ratings *Replacement:*		P
5.2	Warning markings		P
5.2.2	Content for warning markings		P
5.2.2.6	Inverters for closed electrical operating areas		P
5.3	Documentation		P
5.3.2	Information related to installation *Additional subclauses:*		P
5.3.2.1	Ratings		P
5.3.2.2	Grid-interactive inverter setpoints	No adjustable setting available. Only the factory default values, however the adjustment shall be performed by distribution network operator.	N/A
5.3.2.3	Transformers and isolation	Transformerless PCE.	N/A
5.3.2.4	Transformers required but not provided	Transformerless PCE	N/A
5.3.2.5	PV modules for non-isolated inverters		P
5.3.2.6	Non-sinusoidal output waveform information	Grid-connection inverter.	N/A
5.3.2.7	Systems located in closed electrical operating areas	Not specified to be located in closed electrical operating area.	N/A
5.3.2.8	Stand- alone inverter output circuit bonding	Grid-connection inverter.	N/A
5.3.2.9	Protection by application of RCD's	Integrated RCM provided in inverter.	N/A
5.3.2.10	Remote indication of faults	The instructions are specified in section of "Connecting Communications Cables " in the user's manual.	P
5.3.2.11	External array insulation resistance measurement and response	Subclause 4.8.2.1 compliance.	N/A
5.3.2.12	Array functional grounding information	No such requirements.	N/A
5.3.2.13	Stand-alone inverters for dedicated loads	Grid-connection inverter.	N/A

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Clause	Requirement – Test	Result - Remark	Verdict
5.3.2.14	Identification of firmware version(s)	The firmware version is displayed on LCD display panel and disclosed by communication interface.	P
6	Environmental requirements and conditions *This clause of Part 1 is applicable.*		P
7	Protection against electric shock and energy hazards *This clause of Part 1 is applicable except for the following additions:*	See report CN229UFF 001.	P
7.3	Protection against electric shock *Additional subclauses:*		P
7.3.10	Additional requirements for stand-alone inverters	Grid-connection inverter	N/A
	Stand-alone inverter output circuit bonding		N/A
	Stand-alone inverter isolation and protection of DVC-A circuits		N/A
7.3.11	Functionally grounded arrays		N/A
8	Protection against mechanical hazards *This clause of Part 1 is applicable.*	See report CN229UFF 001.	P
9	Protection against fire hazards *This clause of Part 1 is applicable with the following exceptions:*	See report CN229UFF 001.	P
9.3	Short-circuit and overcurrent protection *Additional subclause:*		P
9.3.4	Inverter backfeed current onto the array		P
10	Protection against sonic pressure hazards *This clause of Part 1 is applicable*	See report CN229UFF 001.	P
11	Protection against liquid hazards *This clause of Part 1 is applicable*	See report CN229UFF 001.	P
12	Protection against chemical hazards *This clause of Part 1 is applicable*	See report CN229UFF 001.	P

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Clause	Requirement – Test	Result - Remark	Verdict
13	Physical requirements *This clause of Part 1 is applicable with the following exception:* *Additional subclause:*	See report CN229UFF 001.	P
13.9	Fault indication		P
	a) a visible or audible indication, integral to the inverter, and detectable from outside the inverter, and	LCD panel is available for fault indication.	P
	b) an electrical or electronic indication that can be remotely accessed and used.	The error message also can be remotely accessed and used	P
14	Components *This clause of Part 1 is applicable*	See report CN229UFF 001.	P

4.8.2.1	TABLE: Insulation resistance measurement				P
Conditions	Measurement [I.F. / N.O.]				Identification
	PV / DC Supply Voltage [Vdc]				
	160V	500V	600V	850V	
PV+ to PE: 30 [kΩ]	I.F	I.F	I.F	I.F	I.F.: Isolation Fault N.O.: Normal Operation
PV- to PE: 30 [kΩ]	I.F	I.F	I.F	I.F	
PV+ to PE: 40 [kΩ]	N.O	N.O	N.O	N.O	
PV- to PE: 40 [kΩ]	N.O	N.O	N.O	N.O	
PV+ to PE: 50 [kΩ]	N.O	N.O	N.O	N.O	
PV- to PE: 50 [kΩ]	N.O	N.O	N.O	N.O	
Note: Array Insulation Resistance Threshold Value R = 40 [kΩ] (Should be larger than R = $V_{MAX\ PV}$ / 30mA.)					

4.8.3.2, 4.8.3.3	TABLE: Touch current and fire hazard residual current measurement			N/A
Condition	PV power supply " + " → terminal A [mA]	PV power supply " - " →terminal A [mA]	Limit [mA]	Comments
Condition	PV power supply " + " → earthing [mA]	PV power supply " - " → earthing [mA]	Limit [mA]	Comments
Note: Using measurement circuit of IEC 60990 figure 4 for testing touch current. Using ammeter for testing fire hazard residual current.				

4.8.3.5.1	TABLE: Residual current monitoring test	P

Conditions	Steadily Residual current threshold value	
	Measurement [mA]	Limit [mA]
	U_N	
PV+ to Neutral	256.4	300
	259.1	300
	257.2	300
	260.5	300
	261.2	300
PV- to Neutral	257.8	300
	260.4	300
	256.7	300
	259.1	300
	261.5	300
Note: 100% output power and Vmppmax input voltage		

4.8.3.5.1	TABLE: Residual current monitoring test	P

Conditions	Steadily Residual current threshold value	
	Measurement [ms]	Limit [ms]
	U_N	
PV+ to Neutral	112.0	300
	113.8	300
	128.2	300
	108.2	300
	109.8	300
PV- to Neutral	107.6	300
	134.4	300
	129.4	300
	120.4	300
	123.4	300
Note: 100% output power and Vmppmax input voltage		

4.8.3.5.1	TABLE: Residual current monitoring test	P

Conditions	Trigger disconnection maximum time	
	Measurement [ms]	Limit [ms]
	U_N	
Sudden residual current ≥ 30mA		
PV+ to Neutral	126.4	300
	127.2	300
	112.8	300
	107.2	300
	119.2	300
PV- to Neutral	120.4	300
	118.8	300
	133.6	300
	123.6	300
	109.2	300
Sudden residual current ≥ 60mA		
PV+ to Neutral	51.6	150
	54.8	150
	53.2	150
	54.4	150
	57.6	150
PV- to Neutral	52.8	150
	52.0	150
	51.2	150
	56.0	150
	55.6	150
Sudden residual current ≥ 150mA		
PV+ to Neutral	13.4	40
	14.8	40
	11.6	40
	12.0	40
	12.8	40
PV- to Neutral	11.8	40
	11.4	40
	12.4	40

	13.6	40
	14.0	40
Note: 100% output power and Vmppmax input voltage		

- End of test report -