




Prüfbericht-Nr.: <i>Test Report No.:</i>	CN220TXF 001	Auftrags-Nr.: <i>Order No.:</i>	168346650	Seite 1 von 87 <i>Page 1 of 87</i>
Kunden-Referenz-Nr.: <i>Client Reference No.:</i>	2026754	Auftragsdatum: <i>Order date:</i>	2021.12.07	
Auftraggeber: <i>Client:</i>	Guangzhou Sanjing Electric Co., Ltd. No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R.China			
Prüfgegenstand: <i>Test item:</i>	Grid-connected PV Inverter			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32, R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32, R6-25K-T3-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV, R6-20K-T3-32-LV			
Auftrags-Inhalt: <i>Order content:</i>	TÜV Rheinland LVD CoC approval			
Prüfgrundlage: <i>Test specification:</i>	EN 62109-1: 2010, IEC 62109-1: 2010 EN 62109-2: 2011, IEC 62109-2: 2011			
Wareneingangsdatum: <i>Date of receipt:</i>	2021.12.07			
Prüfmuster-Nr.: <i>Test sample No.:</i>	Engineering samples			
Prüfzeitraum: <i>Testing period:</i>	2021.12.07 – 2022.04.07			
Ort der Prüfung: <i>Place of testing:</i>	See Page 4			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co.,Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
erstellt von: <i>created by:</i>		genehmigt von: <i>authorized by:</i>		
Datum: 2022.04.19 <i>Date:</i>	Zhiwei Yan	Datum: 2022.04.19 <i>Date:</i>	Corney Zhang	
Stellung / Position	Project Engineer	Stellung / Position	Technical Certifier	
Sonstiges / Other: 1. For issuing LVD CoC approval certificate. 2. The report consists of 87 pages for IEC/EN 62109-1, 23 pages attachment 1 for IEC/EN 62109-2 and 12 pages attachment 2 for photo document.				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged</i>		
* 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				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

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

Report Number..... : CN220TXF 001

Date of issue See cover page

Total number of pages..... See cover page

Name of Testing Laboratory preparing the Report TÜV Rheinland (Shenzhen) Co., Ltd.

Applicant's name Guangzhou Sanjing Electric Co., Ltd.

Address No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R.China

Test specification:

Standard..... : IEC/EN 62109-1:2010 (First Edition)

Test procedure..... : TÜV Rheinland LVD CoC approval

Non-standard test method..... : N/A

Test Report Form No. : IEC62109_1B

Test Report Form(s) Originator..... : VDE Testing and Certification Institute

Master TRF Dated 2017-08

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

General disclaimer:

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

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Test item description	Grid-connected PV Inverter	
Trade Mark		
Manufacturer	Same as applicant	
Model/Type reference	R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32, R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32, R6-25K-T3-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV, R6-20K-T3-32-LV	
Ratings	See copy of marking label and model list.	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/> Testing Laboratory:	See cover page	
Testing location/ address	See page 4	
<input type="checkbox"/> Associated CB Testing Laboratory:		
Testing location/ address		
Tested by (name, function, signature)		
Approved by (name, function, signature) ..		
<input type="checkbox"/> Testing procedure: CTF Stage 1:		
Testing location/ address		
Tested by (name, function, signature)		
Approved by (name, function, signature) ..		
<input type="checkbox"/> Testing procedure: CTF Stage 2:		
Testing location/ address		
Tested by (name + signature)		
Witnessed by (name, function, signature) ..		
Approved by (name, function, signature) ..		
<input type="checkbox"/> Testing procedure: CTF Stage 3:		
<input type="checkbox"/> Testing procedure: CTF Stage 4:		
Testing location/ address		
Tested by (name, function, signature)		
Witnessed by (name, function, signature) ..		
Approved by (name, function, signature) ..		
Supervised by (name, function, signature) :		

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

- ATTACHMENT 1 – Test report of IEC/EN 62109-2: 2011 (23 pages)
- ATTACHMENT 2 – Photo Documentation (12 pages)

Summary of testing:**Tests performed (name of test and test clause):**

The critical tests were performed for this equipment included clauses 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1.2, 6.3, 6.4, 7.3.2.2, 7.3.2.3, 7.3.4.2.3, 7.3.7.4, 7.3.7.5, 7.3.9, 7.5.1, 7.5.2, 7.5.4, 8.2, 8.5, 10.2, 13.6.2.1, 13.7 in scope of this standard, for temperature test the thermocouples method used, regarding fault condition test simulated faults applied.

Testing location:**Guangzhou Sanjing Electric Co., Ltd.**

No.9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R.China






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






N/A





☒ 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 NCBS that own these marks.

 Guangzhou Sanjing Electric Co., Ltd. Tel: +86(20) 86608588 Fax: +86(20) 86608589 Web: www.saj-electric.com E-mail: service@saj-electric.com	
Grid-connected PV Inverter Type: R6-50K-T4-32	
PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32/32Adc
Short Circuit Current	38.4/38.4/38.4/38.4Adc
AC Output	
Rated Voltage	3/N/PE 220/230/380/400V
Rated Current	3*72.5A
Max. Continuous Current	3*75.8A
Rated Frequency	50/60Hz
Rated Power	50000W
Max. Apparent Power	50000VA
Power Factor	0.8i...1...0.8c
Operating Temperature Range: -40℃~60℃ Protective Class: I Overvoltage Category: II (DC), III (AC) Ingress protection: IP65 Inverter Topology: Non-isolated	
EN 50549-1, IEC 62109-1/2, EN 61000-6-1/2/3/4, PPDS, RD1669, RD413, UNE 217001 IEC 62116, IEC 61727, G98/G99, CEI 0-21, C10/11	
	
  	
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Grid-connected PV Inverter Type: R6-40K-T4-32	
PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32/32Adc
Short Circuit Current	38.4/38.4/38.4/38.4Adc
AC Output	
Rated Voltage	3/N/PE 220/230/380/400V
Rated Current	3*58A
Max. Continuous Current	3*66.7A
Rated Frequency	50/60Hz
Rated Power	40000W
Max. Apparent Power	44000VA
Power Factor	0.8i...1...0.8c
Operating Temperature Range: -40℃~60℃ Protective Class: I Overvoltage Category: II (DC), III (AC) Ingress protection: IP65 Inverter Topology: Non-isolated	
EN 50549-1, IEC 62109-1/2, EN 61000-6-1/2/3/4, PPDS, RD1669, RD413, UNE 217001 IEC 62116, IEC 61727, G98/G99, CEI 0-21, C10/11	
	
  	
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Grid-connected PV Inverter Type: R6-36K-T4-32			
PV Input			
Max. Input Voltage	1100Vdc		
MPPT Voltage Range	180V-1000Vdc		
Max. Input Current	32/32/32/32Adc		
Short Circuit Current	38.4/38.4/38.4/38.4Adc		
AC Output			
Rated Voltage	3/N/PE 220/230/380/400V		
Rated Current	3*52.2A		
Max. Continuous Current	3*60A		
Rated Frequency	50/60Hz		
Rated Power	36000W		
Max. Apparent Power	39600VA		
Power Factor	0.8i...1...0.8c		
Operating Temperature Range: -40℃~60℃ Protective Class: I Overvoltage Category: II (DC), III (AC) Ingress protection: IP65 Inverter Topology: Non-isolated			
EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4, PPDS, RD1669, RD413, UNE217001 IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11			
			
			
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Grid-connected PV Inverter Type: R6-36K-T3-32			
PV Input			
Max. Input Voltage	1100Vdc		
MPPT Voltage Range	180V-1000Vdc		
Max. Input Current	32/32/32/32Adc		
Short Circuit Current	38.4/38.4/38.4/38.4Adc		
AC Output			
Rated Voltage	3/N/PE 220/230/380/400V		
Rated Current	3*52.2A		
Max. Continuous Current	3*60A		
Rated Frequency	50/60Hz		
Rated Power	36000W		
Max. Apparent Power	39600VA		
Power Factor	0.8i...1...0.8c		
Operating Temperature Range: -40℃~60℃ Protective Class: I Overvoltage Category: II (DC), III (AC) Ingress protection: IP65 Inverter Topology: Non-isolated			
EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4, PPDS, RD1669, RD413, UNE217001 IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11			
			
			
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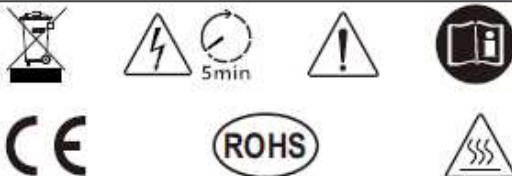
Grid-connected PV Inverter Type: R6-33K-T3-32

PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32Adc
Short Circuit Current	38.4/38.4/38.4Adc

AC Output	
Rated Voltage	3/N/PE 220/230/380/400V
Rated Current	3*47.8A
Max. Continuous Current	3*55A
Rated Frequency	50/60Hz
Rated Power	33000W
Max. Apparent Power	36300VA
Power Factor	0.8i...1...0.8c

Operating Temperature Range: -40℃~60℃
Protective Class: I
Overvoltage Category: II (DC), III (AC)
Ingress protection: IP65
Inverter Topology: Non-isolated

EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4,
PPDS, RD1669, RD413, UNE217001
IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11



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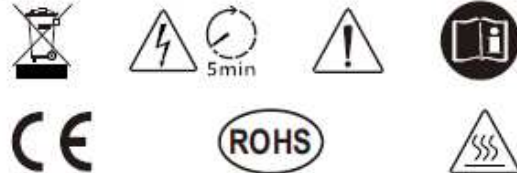
Grid-connected PV Inverter Type: R6-30K-T3-32

PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32Adc
Short Circuit Current	38.4/38.4/38.4Adc

AC Output	
Rated Voltage	3/N/PE 220/230/380/400V
Rated Current	3*43.5A
Max. Continuous Current	3*50A
Rated Frequency	50/60Hz
Rated Power	30000W
Max. Apparent Power	33000VA
Power Factor	0.8i...1...0.8c

Operating Temperature Range: -40℃~60℃
Protective Class: I
Overvoltage Category: II (DC), III (AC)
Ingress protection: IP65
Inverter Topology: Non-isolated

EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4,
PPDS, RD1669, RD413, UNE217001
IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11



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Tel: +86(20) 86608588 Fax: +86(20) 86608589
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Grid-connected PV Inverter Type: R6-25K-T3-32

PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32Adc
Short Circuit Current	38.4/38.4/38.4Adc

AC Output	
Rated Voltage	3/N/PE 220/230/380/400V
Rated Current	3*36.2A
Max. Continuous Current	3*41.7A
Rated Frequency	50/60Hz
Rated Power	25000W
Max. Apparent Power	27500VA
Power Factor	0.8i...1...0.8c

Operating Temperature Range: -40℃~60℃
Protective Class: I
Overvoltage Category: II (DC), III (AC)
Ingress protection: IP65
Inverter Topology: Non-isolated

EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4,
PPDS, RD1669, RD413, UNE217001
IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11



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Grid-connected PV Inverter Type: R6-30K-T4-32-LV

PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32Adc
Short Circuit Current	38.4/38.4/38.4Adc

AC Output	
Rated Voltage	3/N/PE 127V/220V
Rated Current	3*78.7A
Max. Continuous Current	3*78.7A
Rated Frequency	50/60Hz
Rated Power	30000W
Max. Apparent Power	30000VA
Power Factor	0.8i...1...0.8c

Operating Temperature Range: -40℃~60℃
Protective Class: I
Overvoltage Category: II (DC), III (AC)
Ingress protection: IP65
Inverter Topology: Non-isolated

EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4,
PPDS, RD1669, RD413, UNE217001
IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11





















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Grid-connected PV Inverter Type: R6-25K-T4-32-LV	
PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32/32Adc
Short Circuit Current	38.4/38.4/38.4/38.4Adc
AC Output	
Rated Voltage	3/N/PE 127V/220V
Rated Current	3*5.6A
Max. Continuous Current	3*7.2A
Rated Frequency	50/60Hz
Rated Power	25000W
Max. Apparent Power	27500VA
Power Factor	0.8i...1...0.8c
Operating Temperature Range: -40℃~60℃ Protective Class: I Overvoltage Category: II (DC), III (AC) Ingress protection: IP65 Inverter Topology: Non-isolated	
EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4, PPDS, RD1669, RD413, UNE217001 IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11	
    	
  	
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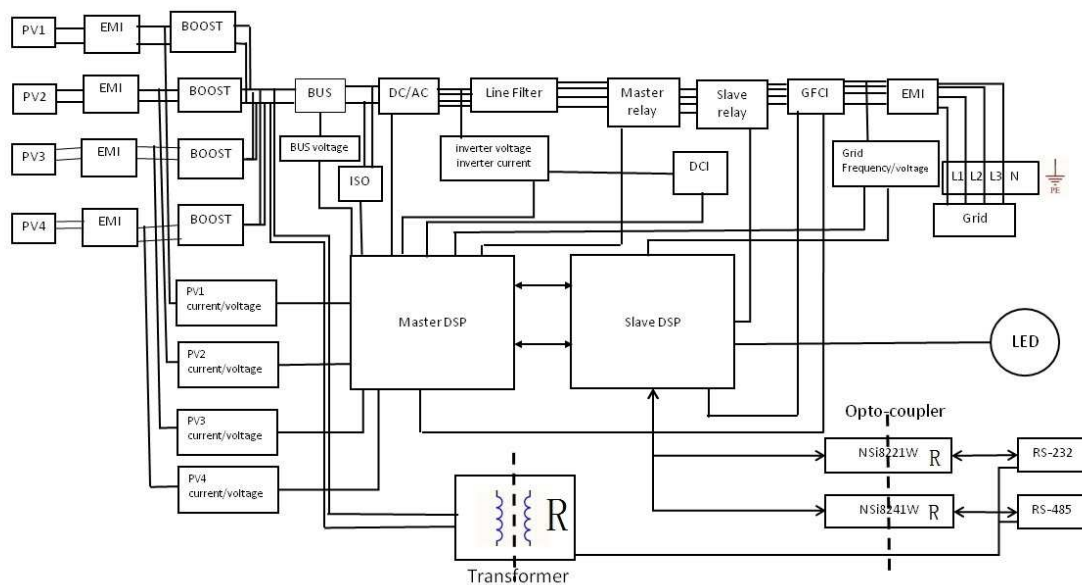
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Grid-connected PV Inverter Type: R6-20K-T3-32-LV	
PV Input	
Max. Input Voltage	1100Vdc
MPPT Voltage Range	180V-1000Vdc
Max. Input Current	32/32/32Adc
Short Circuit Current	38.4/38.4/38.4Adc
AC Output	
Rated Voltage	3/N/PE 127V/220V
Rated Current	3*5.2A
Max. Continuous Current	3*5.7A
Rated Frequency	50/60Hz
Rated Power	20000W
Max. Apparent Power	22000VA
Power Factor	0.8i...1...0.8c
Operating Temperature Range: -40℃~60℃ Protective Class: I Overvoltage Category: II (DC), III (AC) Ingress protection: IP65 Inverter Topology: Non-isolated	
EN 50549-1, IEC62109-1/2, EN61000-6-1/2/3/4, PPDS, RD1669, RD413, UNE217001 IEC 62116, IEC61727, G98/G99, CEI 0-21, C10/11	
    	
  	
S/N	
P/C	
Importer:	MADE IN CHINA

Test item particulars..... :			
Equipment mobility	<input type="checkbox"/> movable <input checked="" type="checkbox"/> fixed	<input type="checkbox"/> hand-held <input type="checkbox"/> transportable	<input type="checkbox"/> stationary <input type="checkbox"/> for building-in
Connection to the mains	<input type="checkbox"/> pluggable equipment <input checked="" type="checkbox"/> permanent connection		
	<input type="checkbox"/> direct plug-in <input type="checkbox"/> for building-in		
Environmental category	<input checked="" type="checkbox"/> outdoor <input type="checkbox"/> indoor unconditional <input type="checkbox"/> indoor conditional		
Over voltage category Mains	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input checked="" type="checkbox"/> OVC III <input type="checkbox"/> OVC IV		
Over voltage category DC	<input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV		
Mains supply tolerance (%)	According to the specified supply range		
Tested for power systems	TN		
IT testing, phase-phase voltage (V)	---		
Class of equipment	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input type="checkbox"/> Not classified		
Mass of equipment (kg)	See model lists.		
Pollution degree	<input type="checkbox"/> PD 1 <input type="checkbox"/> PD 2 <input checked="" type="checkbox"/> PD 3 (internal reduced to PD 2)		
IP protection class	IP65		
Possible test case verdicts:			
- test case does not apply to the test object: N/A			
- test object does meet the requirement: P (Pass)			
- test object was not evaluated for the requirement: N/E			
- test object does not meet the requirement: F (Fail)			
Testing.....:			
Date of receipt of test item : See cover page			
Date (s) of performance of tests : See cover page			

General remarks:																																										
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.																																										
Manufacturer's Declaration per sub-clause 4.2.5 of IEC62109-1:																																										
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided:								<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable																																		
When differences exist; they shall be identified in the General product information section.																																										
Name and address of factory (ies).....:								Guangzhou Sanjing Electric Co., Ltd. No. 9, Lizhishan Road, Science City, Guangzhou High-tech Zone, Guangdong, P.R. China.																																		
History of amendments and modifications: N/A																																										
General product information: <u>Product Description:</u> The equipment is a three-phase public interactive photovoltaic inverter, which will be installed and connected to the grid after installation. It contains filters for smoothing output voltage and EMC, switching and control circuits. Electronic circuits are mounted on multiple PCBs interconnected by appropriate connectors and wires. The power board including the electronic components is mounted on the radiator and grounded through metal screws and spring washers. Communication ports include USB, DRM and RS485, which are connected to a monitor to monitor the status of the inverter through proprietary software. PV input combiner with 3 or 4 MPPT tracers, and each MPPT tracer includes 4 PV input terminals (2 PV+ and 2PV-). The AC output is directly connected to the power grid, and the protective grounding is provided by a dedicated grounding terminal. The grid-connected protection combines the two series of relays as a redundant construction to ensure that the inverter can independently disconnect from the grid when the relay fails. In the case of a fault defined in this standard, after the DSP receives an abnormal signal from the relevant protection detection circuit, the relay will act to automatically disconnect the active circuit of the photovoltaic inverter from the grid, when any grid fault occurs, the master DSP and the slave DSP have the ability to disconnect from the grid independently,																																										
<u>Model difference:</u> The models R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32, R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32, R6-25K-T3-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV, R6-20K-T3-32-LV are same as the construction and hardware excepted the different as below table and the output power are different with adjusted by software. Details can be found below:																																										
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="width: 10%;">Model</td> <td style="width: 10%;">R6-50K-T4-32</td> <td style="width: 10%;">R6-40K-T4-32</td> <td style="width: 10%;">R6-36K-T4-32</td> <td style="width: 10%;">R6-36K-T3-32</td> <td style="width: 10%;">R6-33K-T3-32</td> <td style="width: 10%;">R6-30K-T3-32</td> <td style="width: 10%;">R6-25K-T3-32</td> <td style="width: 10%;">R6-30K-T4-32 - LV</td> <td style="width: 10%;">R6-25K-T4-32-LV</td> <td style="width: 10%;">R6-20K-T3-32-LV</td> </tr> <tr> <td>Parts</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Output Voltage</td> <td colspan="7">3N,PE, 230/400V</td> <td colspan="2">3N,PE, 127/220V</td> </tr> </table>											Model	R6-50K-T4-32	R6-40K-T4-32	R6-36K-T4-32	R6-36K-T3-32	R6-33K-T3-32	R6-30K-T3-32	R6-25K-T3-32	R6-30K-T4-32 - LV	R6-25K-T4-32-LV	R6-20K-T3-32-LV	Parts											Output Voltage	3N,PE, 230/400V							3N,PE, 127/220V	
Model	R6-50K-T4-32	R6-40K-T4-32	R6-36K-T4-32	R6-36K-T3-32	R6-33K-T3-32	R6-30K-T3-32	R6-25K-T3-32	R6-30K-T4-32 - LV	R6-25K-T4-32-LV	R6-20K-T3-32-LV																																
Parts																																										
Output Voltage	3N,PE, 230/400V							3N,PE, 127/220V																																		

Rated Output Power [W]	50000	40000	36000	36000	33000	30000	25000	30000	25000	20000
Max. AC Output Power [VA]	50000	44000	39600	39600	36300	33000	27500	30000	27500	22000
BOOST IGBT	IKQ75N120CH3*4 FGY75T120SQDN*4			IKQ75N120CH3*3 FGY75T120SQDN*3			IKQ75N120CH3*4 FGY75T120SQDN*4		IKQ75N120CH3*3 FGY75T120SQDN*3	
INV IGBT	IKQ75N120CH3*12 / FGY75T120SQDN*12 / IKQ100N60T*6	IKQ75N120CH3*12/ FGY75T120SQDN*12/ IKW75N60T*6/ 75T65MQD*6			IKQ50N120CH3*12/ IKQ75N120CH3*12/ FGY75T120SQDN*12/ IKW75N60T*6/ 75T65MQD*6			IKQ75N120CH3*12/ FGY75T120SQDN*12/ IKQ100N60T*6	IKQ75N120CH3*12/ FGY75T120SQDN*12/ IKW75N60T*6/ 75T65MQD*6	
BOOST Inductor	4pcs			3pcs			4pcs		3pcs	

The system diagram block is shown as below:



Block Diagram

1) Definition of circuits inside of Grid-connected PV Inverter.

I. PV input circuits

PV input circuits are directly connected to the PV array and the voltage can be up to 1100Vdc. Decisive voltage C considered for the PV voltage side.

II. AC output to the AC mains

AC output 230Vac (L-N) and 127Vac (L-N).

Decisive voltage C considered for the AC voltage side.

III. Communication

The communication terminal (RS485/DRM/USB) can be communicated to COM-port.

Decisive voltage A considered for the communication side.

2) Isolation used in the product

Protective separation applied between decisive voltage A and decisive voltage C with corresponding overvoltage category.

3) Cooling method

Physical cooling by metal heat sink and internal fans as well as external fans.

4) Isolation between decisive voltage A and decisive voltage C

Reinforced insulation provided in the product to separate those two parts.

MODELS LIST

Model list		R6-50K-T4-32	R6-40K-T4-32	R6-36K-T4-32	R6-36K-T3-32	R6-33K-T3-32	R6-30K-T3-32	R6-25K-T3-32	R6-30K-T4-32-LV	R6-25K-T4-32-LV	R6-20K-T3-32-LV
PV INPUT	VMAX PV [Vdc]	1100									
	ISC PV [A]	38.4/38.4/38.4/38.4			38.4/38.4/38.4				38.4/38.4/38.4/38.4		38.4/38.4/38.4
	MPPT Voltage Range VMPP [Vdc]	180-1000									
	Max. Input Current I _{MAX} [A] (A/B) (each MPPT if more than 1)	32/32/32/32			32/32/32				32/32/32/32		32/32 / 32
	MPPT Full Power Voltage Range [Vdc]	530-900	500-900	500-900	540-900	520-900	500-900	480-900	530-900	500-900	540-900
	Number of MPPT	4			3				4		3
	String per MPPT	2/2/2/2			2/2/2				2/2/2/2		2/2/2
	Backfeed Current [A]	0									
	Overvoltage Category(OVC)	II									
AC Side(ON-Grid)	Rated Output Voltage Ur [Vac]	3L/N/PE, 230/400							3L/N/PE, 127/220		
	Rated Output Frequency FNETZ [Hz]	50/60									
	Rated Output Power PE [W]	50000	40000	36000	36000	33000	30000	25000	30000	25000	20000
	Max. Apparent power S _E max [VA]	50000	44000	39600	39600	36300	33000	27500	30000	27500	22000
	Rated Output Current I _r [A]	72.5	58.0	52.2	52.2	47.8	43.5	36.2	78.7	65.6	52.5
	Max. Output Current I _{max} [A]	75.8	66.7	60.0	60.0	55.0	50.0	41.7	78.7	72.2	57.7
	Power Factor cosφ [λ]	0.8 leading~0.8 lagging									
	Efficiency max. η _{max}	98.8%									
	Efficiency Euro	98.5%									
	THD [V / I] (100% full power)	<3%									
	Acoustic Noise [dB]	<50									
	Overvoltage Category (OVC)	III									

CONSTRUCTION	Hardware [Version]	Main Power board: V1.3; Control board: V1.0					
	Firmware [Version]	V1.020					
	Array Insulation Resistance Detection [Ω]	150K					
	Type of inverter	Non-isolated					
	Separated by	Transformer less					
	Type of NS Protection	Integrated					
	Protective Class	Class I					
	Enclosure Protection (IP)	IP65					
	Operating Temperature Range [$^{\circ}\text{C}$]	-25 $^{\circ}\text{C}$ to +60 $^{\circ}\text{C}$ (45 $^{\circ}\text{C}$ to 60 $^{\circ}\text{C}$ with derating)					
	Pollution degree (PD)	PD3					
	Altitude [m]	3000					
	Size [mm]	473*659*240					
	Weight [kg]	37.5	37.0	35.5	37.5	37.0	35.5

General Test Conditions are:

All tests of Grid-connected PV Inverter were carried out under the most unfavorable combination within the manufacturer's operating specifications of the following parameters:

-PV input voltage Max. 1100Vd.c.

-operating temperature, Max. Ambient temperature 60 $^{\circ}\text{C}$ by the client.

-operating mode: continuous.

- AC output:

Rated voltage:

230V for R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32, R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32, R6-25K-T3-32


127V for R6-30K-T4-32-LV, R6-25K-T4-32-LV, R6-20K-T3-32-LV

The highest output power is 100% at the rated voltage.

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Clause	Requirement – Test	Result – Remark	Verdict
4	GENERAL TESTING REQUIREMENTS		P
4.1	General		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests	Considered.	P
4.2.2	Reference test conditions	Considered.	P
4.2.2.1	Environmental conditions		P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment		P
4.2.2.4	Accessories	Considered.	P
4.2.2.5	Covers and removable parts		P
4.2.2.6	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:	(see appended table 4.2.2.6)	P
4.2.2.7	Supply ports other than the mains	Considered.	P
4.2.2.7.1	Photovoltaic supply sources a) Open circuit voltage: b) Short-circuit current:		P
4.2.2.7.2	Battery inputs		N/A
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		P
4.2.2.11	Available short circuit current	Considered.	P
4.3	Thermal testing	(see appended table 4.3)	
4.3.1	General		P
4.3.2	Maximum temperatures		P
4.3.2.1	General	Maximum environment temperature of EUT is 60°C	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


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Clause	Requirement – Test	Result – Remark	Verdict
4.4.2.2	Duration of tests	Considered.	P
4.4.3	Pass/fail criteria for testing under fault conditions	Complied.	P
4.4.3.1	Protection against shock hazard		P
4.4.3.2	Protection against the spread of fire		P
4.4.3.3	Protection against other hazards		P
4.4.3.4	Protection against parts expulsion hazards		P
4.4.4	Single fault conditions to be applied	Complied.	P
4.4.4.1	Component fault tests	Considered.	P
4.4.4.2	Equipment or parts for short-term or intermittent operation		P
4.4.4.3	Motors		P
4.4.4.4	Transformer short circuit tests		P
4.4.4.5	Output short circuit		P
4.4.4.6	Backfeed current test for equipment with more than one source of supply		N/A
4.4.4.7	Output overload		P
4.4.4.8	Cooling system failure	Complied.	P
4.4.4.9	Heating devices	No such device.	N/A
4.4.4.10	Safety interlock systems	No such device.	N/A
4.4.4.11	Reverse d.c. connections		N/A
4.4.4.12	Voltage selector mismatch	No such device.	N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity		P
4.4.4.14	Printed wiring board short-circuit test		P
4.5	Humidity preconditioning	(see appended table 7.5)	P
4.5.1	General		P
4.5.2	Conditions		P
4.6	Backfeed voltage protection		P
4.6.1	Backfeed tests under normal conditions		P
4.6.2	Backfeed tests under single-fault conditions		P
4.6.3	Compliance with backfeed tests		P
4.7	Electrical ratings tests	(see appended table 4.2.2.6)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P

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Clause	Requirement – Test	Result – Remark	Verdict
5	MARKING AND DOCUMENTATION		P
5.1	Marking		P
5.1.1	General		P
	Equipment shall bear markings as specified in 5.1 and 5.2		P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.		P
	Graphic symbols shall be explained in the documentation provided with the PCE.		P
5.1.2	Durability of markings		P
	Markings required by this clause to be located on the PCE shall remain clear and legible under conditions of NORMAL USE and resist the effects of cleaning agents specified by the manufacturer	The label was subjected to the permanence of marking test. The label was rubbed with cloth soaked with water for 30 sec. And then again for 30 sec. With the cloth soaked with petroleum spirit. After this test there was no damage to the label. The marking on the label did not fade. There was no curling or lifting of the label edge.	P
5.1.3	Identification		P
	The equipment shall, as a minimum, be permanently marked with:		P
	a) the name or trade mark of the manufacturer or supplier	See copy of marking plate	P
	b) model number, name or other means to identify the equipment	See copy of marking plate	P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.	See copy of marking plate	P
5.1.4	Equipment ratings		P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	See copy of marking plate	P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	See copy of marking plate	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	See copy of marking plate	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– the ingress protection (IP) rating as in 6.3 below	See copy of marking plate	P
5.1.5	Fuse identification	No fuse use in devices	N/A
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.		N/A
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated		N/A
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.		N/A
5.1.6	Terminals, Connections, and Controls		P
	If necessary for safety, an indication shall be given of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.		P
	Push-buttons and actuators of emergency stop devices, and indicator lamps used only to indicate a warning of danger or the need for urgent action shall be coloured red.		N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other non-permanent material.		N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:		P
	– the sign “+” for positive and “-”, for negative; or		P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation	See only above.	N/A
5.1.6.1	Protective Conductor Terminals		P
	The means of connection for the protective earthing conductor shall be marked with:		P
	– symbol 7 of Annex C; or	 used for PE terminal	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– the letters “PE”; or		N/A
	– the colour coding green-yellow.		P
5.1.7	Switches and circuit-breakers		P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.	The DC/AC breaker has marked the “ON” position denote for running mode, “OFF” position denote for stopping mode.	P
5.1.8	Class II Equipment	Class I equipment	N/A
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections		P
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:	No such high temperature of terminals or parts	N/A
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A
5.2	Warning markings		P
5.2.1	Visibility and legibility requirements for warning markings		P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2,75 mm high	Considered.	P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the background	Considered.	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	Considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	depth or raised height of at least 0,5 mm.		
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C	Considered.	P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heat sinks and similar parts		N/A
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking may be on or adjacent to the heat sink and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heat sink exists.	No such heatsink.	N/A
5.2.2.2	Hot Surfaces		P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.	Symbol 14 of Annex C used	P
5.2.2.3	Coolant	No coolant used inside.	N/A
	A unit containing coolant that exceeds 70 °C shall be legibly marked externally where readily visible after installation with symbol 15 of Annex C. The documentation shall provide a warning regarding the risk of burns from hot coolant, and either:		N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or		N/A
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		N/A
5.2.2.4	Stored energy		P
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.	Marked with symbol 21 of Annex C and the time to discharge capacitors to safety voltage and energy levels.	P
5.2.2.5	Motor guarding		P
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the		P

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Clause	Requirement – Test	Result – Remark	Verdict
	guard).		
5.2.3	Sonic hazard markings and instructions	No sonic hazard	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can ensure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply		N/A
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.	 used and related information specified.	P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.		P
5.2.5	Excessive touch current		N/A
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.		N/A
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:		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, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– WET LOCATIONS classification for the intended external environment as per 6.1		P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2		P
	– INGRESS PROTECTION rating as per 6.3		P
	– Ambient temperature and relative humidity ratings		P
	– MAXIMUM altitude rating	3000m	P
	– OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories;	OVC III for AC side. OVC II for DC side.	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE		N/A
5.3.1.1	Language	English version specification and instruction provided	P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.		P
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	Paper version and electronic version will be sent to the customer once sold to end client.	P
	For equipment which requires the use of a computer for both installation and operation, documentation may be provided in electronic format without accompanying printed format.		P
5.3.2	Information related to installation	Provided in the instruction manual	P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		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		P

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Clause	Requirement – Test	Result – Remark	Verdict
	the installation position shall not prevent access to the disconnection means;		
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and externals controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)	Standard connector used.	N/A
	e) ventilation requirements;		N/A
	f) requirements for special services, for example cooling liquid;	No such special services.	N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;		N/A
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;		N/A
	i) tightening torque to be applied to wiring terminals;		P
	j) values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceed the max. rated current of the circuit, as per 4.4.4.6;		N/A
	k) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed; and		P
	l) compatibility with RCD and RCM;	Integrated RCMUs.	N/A
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:	Second protective earthing conductor not used.	N/A
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		N/A
	“This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.”		N/A
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type		P
	p) PV array configuration information, such as		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		
5.3.3	Information related to operation	All below related information provided in the user's manual.	P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:		P
	– Instructions for adjustment of controls including the effects of adjustment;		P
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and	Symbol 14 of Annex C used.	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 manual.	P
	Maintenance instructions shall include the following:		P
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		P
	– Part numbers and instructions for obtaining any required operator replaceable parts;		P
	– Instructions for safe cleaning (if recommended)		N/A
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.		P
5.3.4.1	Battery maintenance		N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	of instructions regarding maintenance of batteries:		
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	ENVIRONMENTAL REQUIREMENTS AND CONDITIONS		P
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below		P
	– Suitability for WET LOCATIONS or not		P
	– POLLUTION DEGREE rating in 6.2 below	See clause 6.2 below	P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	See clause 6.3 below	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– Ultraviolet (UV) exposure rating, as in 6.4 below	See clause 6.4 below	P
	– Ambient temperature and relative humidity ratings, as in 6.5 below	See clause 6.5 below	P
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor	Outdoor use.	P
6.1.2	Indoor, unconditioned		N/A
6.1.3	Indoor, conditioned		N/A
6.2	Pollution degree	PD3(External), PD2(Internal)	P
6.3	Ingress Protection	IP65	P
6.4	UV exposure		P
6.5	Temperature and humidity	-40-60°C, 0%-100% humidity	P
7	PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS		
7.1	General		P
7.2	Fault conditions	Suitable protection provided against electric shock under fault conditions.	P
7.3	Protection against electric shock		P
7.3.1	General	See below	P
7.3.2	Decisive voltage classification	Considered.	P
7.3.2.1	Use of decisive voltage class (DVC)		P
7.3.2.2	Limits of DVC (according table 6)	DVC-C for >50Vrms/71Vpeak. DVC-C for >120Vdc. DVC-A for <25Vrms or 35.4Vpeak. DVC-A for <60Vdc.	P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions	No parts were exceed DVC-A level.	P
7.3.2.4	Requirements for protection (according table 7)		P
7.3.2.5	Connection to PELV and SELV circuits	Considered.	P
7.3.2.6	Working voltage and DVC	DVC-A and DVC-C circuits within PCE.	P
7.3.2.6.1	General		P
7.3.2.6.2	AC working voltage (see Figure 2)	230/400V or 127/220V	P
7.3.2.6.3	DC working voltage (see Figure 3)	Max. 1100Vd.c.	P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		P
7.3.3	protective separation		P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or	Considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	<ul style="list-style-type: none"> 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 		P
	<ul style="list-style-type: none"> protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or 		N/A
	<ul style="list-style-type: none"> limitation of voltage according to 7.3.5.4. 		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE	Considered.	P
7.3.4	Protection against direct contact		P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).	Earthed metal enclosure used.	P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.		N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.		N/A
7.3.4.2	Protection by means of enclosures and barriers		P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.		P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).	Barrier can't be removed without use of tools	P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6		P
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts,		P

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Clause	Requirement – Test	Result – Remark	Verdict
	when tested as described below, is as follows:		
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Considered.	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	Considered.	P
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	Considered.	P
7.3.4.2.3	Access probe tests	No access with test finger and test pin to any hazardous parts.	P
	Compliance with 7.3.4.2.1 is checked by all of the following:	IP65 appliance.	P
	a) Inspection; and		P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuseholders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavourable position.		P
	The test finger and the test pin are applied as above, without appreciable force, in every possible position, except that floor-standing equipment having a mass exceeding 40 kg is not tilted.		P
	Equipment intended for building-in or rack mounting, or for incorporation in larger equipment, is tested with access to the equipment limited according to the method of mounting detailed in the installation instructions.		N/A
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to 30 N.	No such openings	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction $\pm 5^\circ$ only,		P
7.3.4.2.4	Service access areas		P
7.3.4.3	Protection by means of insulation of live parts		P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:	Considered.	P
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note “†” under Table 7)		P
7.3.5	Protection in case of direct contact		P
7.3.5.1	General		P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:		P
	– is of decisive voltage class A and complies with 7.3.5.2, or		P
	– is provided with protective impedance according to 7.3.5.3, or		N/A
	– is limited in voltage according to 7.3.5.4		P
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with protective separation. This applies for example to plug-in-sub-assemblies or other plug-in devices which can be plugged-in without the use of a tool (key) or which are accessible without the use of a tool.		P
	Conformity is checked by visual inspection and trial insertion.		P
7.3.5.2	Protection using decisive voltage class A	For communication terminal applied.	P
7.3.5.3	Protection by means of protective impedance	No such circuits.	N/A
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		
7.3.5.3.1	Limitation of current through protective impedance		N/A
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		N/A
7.3.5.3.2	Limitation of discharging energy through protective impedance		N/A
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		N/A
7.3.5.4	Protection by means of limited voltages		P
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		P
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		P
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact		P
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)		P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	See cl. 7.3.6.2 and 7.3.6.3	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	See cl. 7.3.6.4	P
	That part of PCE which meets the requirements of decisive voltage class A and in which no hazardous		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.		N/A
7.3.6.2	Insulation between live parts and accessible conductive parts		P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5	Basic insulation used to such parts except those covered by 7.3.6.3, the supplemental insulation will be considered in the final installation.	P
7.3.6.3	Protective class I – Protective bonding and earthing	Earthed metal enclosure used.	P
7.3.6.3.1	General		P
	Equipment of protective class I shall be provided with protective earthing, and with protective bonding to ensure electrical contact between accessible conductive parts and the means of connection for the external protective earthing conductor, except bonding is not required for:		P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or		P
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.		P
7.3.6.3.2	Requirements for protective bonding		P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:		P
	a) through direct metallic contact;	Applied for connection of top, front, and back of enclosure	P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		N/A
	c) through a dedicated protective bonding conductor;	Green/Yellow wire used	P
	d) through other metallic components of the PCE		N/A
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.		P
	For moving or removable parts, hinges or sliding	See cl. 7.3.6.3.3	P

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Clause	Requirement – Test	Result – Remark	Verdict
	contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.		
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.	No such parts used	P
7.3.6.3.3	Rating of protective bonding		P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		P
	Protective bonding shall meet following requirements:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2.5 V during or at the end of the test below.		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.	Cross-sectional area of phase conductors S is 16 or 25 mm ² , cross-sectional area the external protective earthing conductor as required in the installation instruction is min. 16 or 25 mm ² .	P
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		N/A
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	equipment installation instructions to be provided external to the equipment;		
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		N/A
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.		N/A
	On equipment where the protective earth connection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cable is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		N/A
7.3.6.3.3.1	Test current, duration, and acceptance criteria	Alternative method the clause 7.3.6.3.5 was considered.	N/A
	The test current, duration of the test and acceptance criteria are as follows:		N/A
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω .		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		N/A
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		N/A
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic,. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)		P
	If the continuity of the protective bonding is achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:	Considered.	P
	<ul style="list-style-type: none"> 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: 	Considered.	P
	<ul style="list-style-type: none"> the test duration may be reduced to no less than 2 s 	Considered.	P
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		P
7.3.6.3.5	External protective earthing conductor	External protective earthing terminal with symbol 7 of Annex C.	P
	A protective earthing conductor shall be connected at all times when power is supplied to PCE of protective class I. Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.	Screw terminal as protective earthing connection.	P
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:	Will be evaluated in the final installation.	P
	▪ 2,5 mm ² if mechanical protection is provided;		P
	▪ 4 mm ² if mechanical protection is not provided.		N/A
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.	No cord-connected.	N/A
7.3.6.3.6	Means of connection for the external protective earthing conductor		P
7.3.6.3.6.1	General		P
	<p>The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5.</p> <p>The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections.</p> <p>A separate means of connection shall be provided for each external protective earthing conductor.</p> <p>Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.</p>		P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		P
	• the colour coding green-yellow		P
	Marking shall not be done on easily changeable parts such as screws.	Not marked on changeable parts.	P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor	For serious work modes, maximum 2.7mA<3.5mA	P

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Clause	Requirement – Test	Result – Remark	Verdict
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		N/A
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5 mA a.c. or mA d.c.	Permanently connected equipment.	N/A
	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3,5 mA a.c. or 10 mA d.c.	Not exceed 3.5 mA a.c. and 10mA d.c.	N/A
	a) Permanently connected wiring, and:		N/A
	<ul style="list-style-type: none"> a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or 		N/A
	<ul style="list-style-type: none"> automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or 		N/A
	<ul style="list-style-type: none"> provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or 		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm ² as part of a multi-conductor power cable. Adequate strain relief shall be provided.	Screw terminals for connected to grid.	N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Class I equipment.	N/A
	Equipment or parts of equipment designed for		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		
	<ul style="list-style-type: none"> equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low voltage, protective impedance and limited discharging energy, according to 7.3.5. This basic insulation shall correspond to the rated voltage of the series-connected equipment; 		N/A
	<ul style="list-style-type: none"> metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor; 		N/A
	<ul style="list-style-type: none"> equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part; 		N/A
	<ul style="list-style-type: none"> equipment employing protective class II shall be marked according to 5.1.8. 		N/A
7.3.7	Insulation Including Clearance and Creepage Distance		P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	<ul style="list-style-type: none"> pollution degree 	Pollution degree 2 internally	P
	<ul style="list-style-type: none"> overvoltage category 	For PV side circuits: Overvoltage Category II For AC sidet circuits: Overvoltage Category III	P
	<ul style="list-style-type: none"> supply earthing system 	TN system considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	<ul style="list-style-type: none"> insulation voltage 	Considered	P
	<ul style="list-style-type: none"> location of insulation 	Considered	P
	<ul style="list-style-type: none"> type of insulation 	Considered	P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.		P
7.3.7.1.3	Supply earthing systems		P
	Three basic types of earthing system are described in IEC 60364-1. They are:		P
	<ul style="list-style-type: none"> TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor. 		P
	<ul style="list-style-type: none"> TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system; 		N/A
	<ul style="list-style-type: none"> IT system: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system. 		N/A
7.3.7.1.4	Insulation voltages	Considered	P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstands voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General		P
7.3.7.2.2	Circuits connected directly to the mains	Considered	P
7.3.7.2.3	Circuits other than mains circuits	Considered	P
7.3.7.2.4	Insulation between circuits	Considered	P
7.3.7.3	Functional insulating	Considered	P
7.3.7.4	Clearance distances	(see appended table 7.3.7)	P
7.3.7.4.1	Determination		P
7.3.7.4.2	Electric field homogeneity		P
7.3.7.4.3	Clearance to conductive enclosures		P
7.3.7.5	Creepage distances	(see appended table 7.3.7)	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.5.1	General		P
7.3.7.5.2	Voltage		P
7.3.7.5.3	Materials	Considered	P
7.3.7.6	Coating	No such coating used.	N/A
7.3.7.7	PWB spacings for functional insulating		P
7.3.7.8	Solid insulating	(see appended table 7.3.7)	P
7.3.7.8.1	General		P
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation		P
7.3.7.8.2.1	Basic, supplemental, reinforced, and double insulation	Approved plastic material used as basic.	P
7.3.7.8.2.2	Functional insulation		P
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm		P
7.3.7.8.3.3	Material thickness less than 0,2 mm		P
7.3.7.8.3.4	Compliance		P
7.3.7.8.4	Printed wiring boards		P
7.3.7.8.4.1	General		P
7.3.7.8.4.2	Use of coating materials		N/A
7.3.7.8.5	Wound components		P
7.3.7.8.6	Potting materials	No such material.	N/A
7.3.7.9	Insulation requirements above 30 kHz	Considered.	P
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility		P
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.	RCM used for detection.	P
7.3.9	Capacitor discharge		P
7.3.9.1	Operator access area		P
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.		P
7.3.9.2	Service access areas		P
	Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock	Symbol 21 of Annex C and an indication of the discharge time used in a clearly visible	P

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Clause	Requirement – Test	Result – Remark	Verdict
	or energy hazard from charge stored on capacitors after disconnection of the PCE.	position.	
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level		P
	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy, E, calculated from the following equation, exceeds 20J: $E = 0,5 CU^2$		P
7.4.2	Operator Access Areas	No risk of energy hazard in operator access areas from accessible circuits	N/A
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.		N/A
7.4.3	Services Access Areas	Symbol 21 of Annex C and an indication of the discharge time used in a clearly visible position.	P
7.5	Electrical tests related to shock hazard	(see appended table 7.5)	P
7.5.1	Impulse voltage test (type test)		P
7.5.2	Voltage test (dielectric strength test)		P
7.5.2.1	Purpose of test		P
7.5.2.2	Value and type of test voltage		P
7.5.2.3	Humidity pre-conditioning		P
7.5.2.4	Performing the voltage test		P
7.5.2.5	Duration of the a.c. or d.c. voltage test		P
7.5.2.6	Verification of the a.c. or d.c. voltage test		P
7.5.3	Partial discharge test		P
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	(see appended table 7.3.6.3.7)	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.5	Equipment with multiple sources of supply		N/A

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

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Clause	Requirement – Test	Result – Remark	Verdict
	that could cause a HAZARD if expelled in the event of a fault.		
9	PROTECTION AGAINST FIRE HAZARDS		P
9.1	Resistance to fire		P
	This subclause specifies requirements intended to reduce the risk of ignition and the spread of flame, both within the equipment and to the outside, by the appropriate use of materials and components and by suitable construction.		P
9.1.1	Reducing the risk of ignition and spread of flame		P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.		P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.		P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;		P
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY		P

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Clause	Requirement – Test	Result – Remark	Verdict
	LEVEL; and		
	– insulated wiring, except as permitted in 9.1.2.2.		P
9.1.2.2	Parts not requiring a fire enclosure		N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures	Metal enclosure used.	P
	If an enclosure material is not classified as specified below, a test may be performed on the final enclosure or part of the enclosure, in which case the material shall additionally be subjected to periodic SAMPLE testing.		N/A
9.1.3.3	Materials for components and other parts outside fire enclosures		N/A
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.		N/A
9.1.3.4	Materials for components and other parts inside fire enclosures	Internal components except small parts are V-2, HF-2 or better.	P
9.1.3.5	Materials for air filter assemblies	No such materials used	N/A
9.1.4	Openings in fire enclosures	IP65 appliance, no openings.	N/A
9.1.4.1	General		N/A
	For equipment that is intended to be used or installed in more than one orientation as specified in the product documentation, the following requirements apply in each orientation.		N/A
	These requirements are in addition to those in the following sections:		N/A
	– 7.3.4, Protection against direct contact;		N/A
	– 7.4, Protection against energy hazards;		N/A
	– 13.5, Openings in enclosures		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
	The bottom of a FIRE ENCLOSURE or individual barriers, shall provide protection against emission of flaming or molten material under all internal		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.		
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA		N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures		N/A
9.1.4.6	Additional requirements for openings in transportable equipment		N/A
9.2	LIMITED POWER SOURCES		N/A
9.2.1	General		N/A
9.2.2	Limited power source tests	(see appended table 9.2)	N/A
9.3	Short-circuit and overcurrent protection		N/A
9.3.1	General		P
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.		P
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		P
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.		P
10	PROTECTION AGAINST SONIC PRESSURE HAZARDS		P
10.1	General		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.	Sound pressure less than 70dBA, no hazards	P
10.2	Sonic pressure and Sound level	See above.	P
10.2.1	Hazardous Noise Levels		P
11	PROTECTION AGAINST LIQUID HAZARDS	No liquid used.	N/A
11.1	Liquid Containment, Pressure and Leakage		N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A
11.3	Oil and grease		N/A
12	CHEMICAL HAZARDS		N/A
12.1	General		N/A
13	PHYSICAL REQUIREMENTS		P
13.1	Handles and manual controls		N/A
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than self-hardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.		P
13.1.1	Adjustable controls		N/A
13.2	Securing of parts		P
13.3	Provisions for external connections		P
13.3.1	General		P
13.3.2	Connection to an a.c. Mains supply		P
13.3.2.1	General		P

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Clause	Requirement – Test	Result – Remark	Verdict
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:		P
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or		P
	– a non-detachable power supply cord for connection to the supply by means of a plug		N/A
	– an appliance inlet for connection of a detachable power supply cord; or		N/A
	– a mains plug that is part of direct plug-in equipment as in 13.3.8		N/A
13.3.2.2	Permanently connected equipment		P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord	No such device.	N/A
13.3.2.5	Cord anchorages and strain relief		N/A
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		N/A
	– the connecting points of the cord conductors are relieved from strain; and		N/A
	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage		P
13.3.3	Wiring terminals for connection of external conductors	Sizes specified in instruction manual	P
13.3.3.1	Wiring terminals		P
13.3.3.2	Screw terminals		P
13.3.3.3	Wiring terminal sizes		P
13.3.3.4	Wiring terminal design		P
13.3.3.5	Grouping of wiring terminals		P
13.3.3.6	Stranded wire		P
13.3.4	Supply wiring space		P
13.3.5	Wire bending space for wires 10 mm ² and greater		N/A
13.3.6	Disconnection from supply sources	Approved DC switch supplied.	P
13.3.7	Connectors, plugs and sockets		P
13.3.8	Direct plug-in equipment		N/A
13.4	Internal wiring and connections		P
13.4.1	General	Internal wiring is PVC insulated, rated VW-1. Internal	P

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Clause	Requirement – Test	Result – Remark	Verdict
		wiring gauge is suitable for current intended to be carried.	
13.4.2	Routing		P
13.4.3	Colour coding		P
13.4.4	Splices and connections		P
13.4.5	Interconnections between parts of the PCE		P
13.5	Openings in enclosures		P
13.5.1	Top and side openings		P
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		P
13.6	Polymeric Materials		P
13.6.1	General		P
13.6.1.1	Thermal index or capability		P
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards		P
13.6.2.1	Stress relief test		P
13.6.3	Polymers serving as solid insulation		P
13.6.3.1	Resistance to arcing		P
13.6.4	UV resistance		P
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation	Considered and approved material used.	P
13.7	Mechanical resistance to deflection, impact, or drop		P
13.7.1	General	Metal and approved plastic used enclosure used.	P
13.7.2	250-N deflection test for metal enclosures	Applied for external of metal enclosure	P
13.7.3	7-J impact test for polymeric enclosures		P
13.7.4	Drop test		N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General		P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal	2mm	P
14	COMPONENTS		P
14.1	General	(see appended table 14)	P

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Clause	Requirement – Test	Result – Remark	Verdict
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority,		P
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Over temperature Protection		P
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperature HAZARD, or a fire HAZARD, shall be protected by an over temperature or thermal protection device meeting the requirements of 14.3.	When internal and external fans are blocked, the PCE uses temperature sampling to control power derating.	P
14.3	Over temperature protection devices		P
14.4	Fuse holders	No fuse holder used.	N/A
14.5	MAINS voltage selecting devices	No such device.	N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.		P
	This requirement does not apply to thin-film flexible		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.	V-0 min. PCB used	P
14.7	Circuits or components used as transient overvoltage limiting devices		P
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.	Certified components used	P
14.8	Batteries		N/A
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.	No Batteries	N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A non-metallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	or materials; and		
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only,		N/A
14.8.6	Battery accessibility and maintainability		N/A
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions	Single fault tests simulated for equipment, no critical hazard listed in this standard occur.	P

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Clause	Requirement – Test	Result – Remark	Verdict
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
B.1.1	<p>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.</p> <p>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.</p> <p>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.</p> <p>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 reevaluation 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.</p>		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

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Clause	Requirement – Test	Result – Remark	Verdict
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
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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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	Considered.	P
I.2	Illustrative examples	Considered.	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

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Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.6/4.2.2.7	TABLE: : electrical data Output side (Grid connection)						P
DC side			AC side				
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF	
R6-50K-T4-32							
test at 50Hz							
180.5	127.0	23.1	L1:230.5 L2:230.4 L3:230.4	L1:32.2 L2:32.6 L3:32.8	22.4	0.998	
530.4	100.6	52.6	L1:230.8 L2:230.8 L3:230.8	L1:71.4 L2:72.5 L3:72.7	49.9	0.998	
600	87.4	52.1	L1:230.8 L2:230.8 L3:230.8	L1:71.0 L2:72.1 L3:72.3	49.7	1.000	
899.5	59.0	52.6	L1:230.8 L2:230.8 L3:230.8	L1:71.1 L2:72.4 L3:72.6	49.8	0.999	
997.4	55.15	53.90	L1:230.8 L2:230.8 L3:230.8	L1:71.2 L2:72.4 L3:72.6	49.8	0.999	
test at 60Hz							
180.7	127.4	22.5	L1:230.4 L2:230.4 L3:230.4	L1:30.9 L2:31.3 L3:31.5	21.5	0.999	
529.4	100.4	52.5	L1:230.8 L2:230.8 L3:230.8	L1:71.4 L2:72.6 L3:72.8	49.9	0.998	
601.2	87.6	52.44	L1:230.8 L2:230.8 L3:230.8	L1:71.4 L2:72.7 L3:72.9	50.0	0.999	
900.2	58.7	52.3	L1:230.8 L2:230.8 L3:230.8	L1:71.2 L2:72.4 L3:72.7	49.8	0.999	
998.3	54.1	53.2	L1:230.8 L2:230.7 L3:230.8	L1:71.2 L2:72.4 L3:72.7	49.8	0.998	
R6-40K-T4-32							

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
test at 50Hz						
180.2	127.5	23.1	L1:230.5 L2:230.4 L3:230.5	L1:32.2 L2:32.7 L3:32.8	22.5	0.998
502.4	84.5	41.8	L1:230.7 L2:230.7 L3:230.7	L1:56.9 L2:57.7 L3:57.9	39.7	0.998
600.7	70.0	41.7	L1:230.7 L2:230.7 L3:230.7	L1:57.1 L2:57.9 L3:58.1	39.9	0.998
899.7	47.4	42.12	L1:230.7 L2:230.7 L3:230.7	L1:57.2 L2:58.2 L3:58.4	40.0	0.998
997.7	43.4	42.4	L1:230.7 L2:230.7 L3:230.7	L1:57.2 L2:58.2 L3:58.4	40.0	0.999
test at 60Hz						
180.6	127.4	22.5	L1:230.5 L2:230.4 L3:230.4	L1:30.9 L2:31.3 L3:31.6	21.5	0.998
498.1	86.2	42.1	L1:230.7 L2:230.7 L3:230.7	L1:57.3 L2:58.2 L3:58.5	40.1	0.998
603.7	70.3	42.1	L1:230.7 L2:230.7 L3:230.7	L1:57.8 L2:58.7 L3:58.9	40.4	1.000
900.1	47.1	41.9	L1:230.7 L2:230.7 L3:230.7	L1:57.2 L2:58.2 L3:58.4	40.0	0.998
997.0	43.1	42.2	L1:230.7 L2:230.6 L3:230.6	L1:57.2 L2:58.2 L3:58.4	40.0	0.998
R6-36K-T4-32						
test at 50Hz						
181.4	128.5	22.7	L1: 230.6 L2: 230.5 L3: 230.5	L1: 29.74 L2: 30.49 L3: 30.80	20.98	1.000
500.4	79.26	37.9	L1: 230.7 L2: 230.6	L1: 50.91 L2: 52.45	36.0	1.000

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Clause	Requirement – Test			Result – Remark		Verdict
			L3: 230.7	L3: 52.92		
599.3	63.13	37.5	L1: 230.7 L2: 230.6 L3: 230.7	L1: 50.82 L2: 52.39 L3: 52.84	36.0	1.000
901.5	42.24	37.6	L1: 230.7 L2: 230.6 L3: 230.7	L1: 50.78 L2: 52.31 L3: 52.76	35.9	1.000
999.0	38.1	37.8	L1: 230.7 L2: 230.7 L3: 230.7	L1: 50.83 L2: 52.38 L3: 52.83	35.9	1.000
test at 60Hz						
181.3	128.4	22.7	L1: 230.5 L2: 230.5 L3: 230.5	L1: 29.76 L2: 30.50 L3: 30.85	21.0	1.000
500.5	79.3	37.9	L1: 230.7 L2: 230.6 L3: 230.6	L1: 51.00 L2: 52.49 L3: 52.99	36.0	1.000
601.2	63.2	37.7	L1: 230.7 L2: 230.6 L3: 230.6	L1: 51.00 L2: 52.49 L3: 52.97	36.0	1.000
903.9	42.4	37.9	L1: 230.7 L2: 230.6 L3: 230.6	L1: 50.93 L2: 52.44 L3: 52.90	36.0	1.000
995.7	38.2	37.7	L1: 230.7 L2: 230.6 L3: 230.6	L1: 50.93 L2: 52.43 L3: 52.90	36.0	1.000
R6-36K-T3-32						
test at 50Hz						
180.4	95.4	16.2	L1:230.4 L2:230.3 L3:230.3	L1:22.4 L2:22.7 L3:22.8	15.6	0.998
538.1	67.4	35.4	L1:230.6 L2:230.5 L3:230.6	L1:48.7 L2:49.3 L3:49.5	33.9	1.000
602.7	63.5	37.9	L1:230.6 L2:230.6 L3:230.6	L1:51.9 L2:52.7 L3:52.8	36.2	0.998
899.8	42.6	37.7	L1:230.6 L2:230.5	L1:51.4 L2:52.3	35.9	0.999

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
			L3:230.6	L3:52.4		
997.7	39.0	38.1	L1:230.6 L2:230.5 L3:230.6	L1:51.4 L2:52.3 L3:52.4	35.9	0.999
test at 60Hz						
180.4	95.7	16.2	L1:230.3 L2:230.2 L3:230.3	L1:22.5 L2:22.8 L3:22.9	15.7	0.999
540.7	70.1	37.3	L1:230.6 L2:230.5 L3:230.5	L1:51.1 L2:51.9 L3:52.1	35.7	37.3
601.6	63.1	37.7	L1:230.6 L2:230.5 L3:230.5	L1:51.8 L2:52.6 L3:52.8	36.2	0.998
902.3	42.5	37.8	L1:230.6 L2:230.5 L3:230.5	L1:51.7 L2:52.6 L3:52.8	36.1	0.998
998.0	38.8	37.9	L1:230.5 L2:230.5 L3:230.5	L1:51.4 L2:52.2 L3:52.5	35.9	0.998
R6-33K-T3-32						
test at 50Hz						
180.4	95.4	16.2	L1:230.4 L2:230.3 L3:230.3	L1:22.4 L2:22.7 L3:22.8	15.6	0.998
520.2	68.3	34.6	L1:230.6 L2:230.5 L3:230.5	L1:47.3 L2:47.9 L3:48.1	33.0	0.998
598.5	57.2	34.2	L1:230.6 L2:230.5 L3:230.5	L1:46.8 L2:47.4 L3:47.6	32.7	0.998
899.8	39.2	34.7	L1:230.6 L2:230.5 L3:230.5	L1:47.2 L2:48.0 L3:48.2	33.0	0.999
998.0	35.9	34.9	L1:230.6 L2:230.5 L3:230.5	L1:47.3 L2:48.1 L3:48.2	33.1	0.99
test at 60Hz						
180.4	95.6	16.2	L1: 230.3	L1:22.5	15.7	0.999

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
			L2: 230.3 L3: 230.3	L2:22.8 L3:22.9		
520.9	67.2	34.2	L1:230.5 L2:230.5 L3:230.5	L1:47.0 L2:47.7 L3:47.9	32.8	34.2
598.0	56.9	33.9	L1:230.6 L2:230.5 L3:230.5	L1:46.6 L2:47.4 L3:47.6	32.6	0.998
901.1	38.9	34.5	L1:230.5 L2:230.5 L3:230.5	L1:47.2 L2:48.0 L3:48.2	33.0	0.998
998.2	35.6	34.7	L1:230.5 L2:230.5 L3:230.5	L1:47.2 L2:48.0 L3:48.2	33.0	1.000
R6-30K-T3-32						
test at 50Hz						
180.4	95.4	16.2	L1:230.4 L2:230.3 L3:230.3	L1:22.4 L2:22.7 L3:22.8	16.2	0.998
501.9	66.3	31.5	L1:230.5 L2:230.5 L3:230.5	L1:42.9 L2:43.5 L3:43.6	29.9	0.998
600.0	52.7	31.2	L1:230.5 L2:230.5 L3:230.5	L1:42.9 L2:43.4 L3:43.7	29.9	0.998
900.2	35.9	31.6	L1:230.5 L2:230.5 L3:230.5	L1:43.1 L2:43.8 L3:44.0	30.1	1.000
998.0	32.8	31.7	L1:230.6 L2:230.5 L3:230.5	L1:42.8 L2:43.5 L3:43.7	29.9	1.000
test at 60Hz						
180.4	95.8	16.2	L1:230.3 L2:230.2 L3:230.3	L1:22.5 L2:22.8 L3:22.9	15.7	0.999
497.2	63.8	31.1	L1:230.5 L2:230.5 L3:230.5	L1:42.5 L2:43.1 L3:43.4	29.7	0.999
598.3	53.1	31.4	L1:230.5	L1:43.2	30.1	0.999

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
			L2:230.5 L3:230.5	L2:43.8 L3:44.0		
900.8	35.7	31.5	L1:230.5 L2:230.5 L3:230.5	L1:43.1 L2:43.8 L3:44.0	30.1	0.998
998.2	32.7	31.7	L1:230.5 L2:230.4 L3:230.5	L1:43.1 L2:43.8 L3:44.0	30.1	0.998
R6-25K-T3-32						
test at 50Hz						
180.4	95.44	16.2	L1:230.4 L2:230.3 L3:230.3	L1:22.4 L2:22.7 L3:22.8	15.6	0.998
482.5	58.5	26.2	L1:230.5 L2:230.4 L3:230.5	L1:36.0 L2:36.4 L3:36.6	25.1	0.998
601.2	44.5	26.3	L1:230.5 L2:230.5 L3:230.5	L1:36.0 L2:36.4 L3:36.6	25.1	0.998
900.8	30.0	26.2	L1:230.5 L2:230.5 L3:230.5	L1:35.9 L2:36.5 L3:36.6	25.1	1.000
998.0	27.9	26.6	L1:230.5 L2:230.5 L3:230.5	L1:35.9 L2:36.5 L3:36.6	25.1	1.000
test at 60Hz						
180.4	95.7	16.2	L1:230.3 L2:230.2 L3:230.3	L1:22.5 L2:22.8 L3:22.9	15.7	0.999
471.2	60.4	26.6	L1:230.5 L2:230.4 L3:230.4	L1:36.2 L2:36.7 L3:36.9	25.3	0.999
600.8	43.9	26.0	L1:230.5 L2:230.4 L3:230.4	L1:35.9 L2:36.4 L3:36.6	25.1	0.998
904.5	30.4	26.7	L1:230.5 L2:230.5 L3:230.5	L1:36.5 L2:37.1 L3:37.3	25.5	0.998
998.3	27.6	26.4	L1:230.4	L1:35.8	25.0	0.998

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
			L2:230.4 L3:230.4	L2:36.4 L3:36.6		
R6-30K-T4-32-LV						
test at 50Hz						
180.5	127.8	23.0	L1:127.2 L2:127.2 L3:127.2	L1:56.5 L2:57.6 L3:57.6	21.8	0.999
529.8	60.3	31.7	L1:127.8 L2:127.7 L3:127.7	L1:76.3 L2:77.8 L3:77.9	29.6	0.998
600.1	53.5	31.8	L1:127.8 L2:127.8 L3:127.8	L1:76.4 L2:77.9 L3:78.1	29.6	1.000
900.0	36.0	32.0	L1:127.8 L2:127.8 L3:127.8	L1:76.4 L2:77.9 L3:78.1	29.7	1.000
996.3	33.0	32.1	L1:127.8 L2:127.8 L3:127.8	L1:76.4 L2:77.9 L3:78.1	29.6	1.000
test at 60Hz						
180.5	127.8	22.9	L1:127.2 L2:127.2 L3:127.2	L1:56.6 L2:57.6 L3:57.7	21.8	0.998
530.2	59.8	31.4	L1:127.8 L2:127.8 L3:127.8	L1:76.4 L2:77.9 L3:78.1	29.6	0.998
600.5	53.2	31.6	L1:127.8 L2:127.8 L3:127.8	L1:76.4 L2:77.8 L3:77.9	29.6	0.998
900.3	36.1	31.9	L1:127.8 L2:127.8 L3:127.8	L1:76.4 L2:77.8 L3:78.1	29.6	0.998
997.8	33.0	32.1	L1:127.8 L2:127.8 L3:127.8	L1:76.4 L2:77.8 L3:78.0	29.6	0.998
R6-25K-T4-32-LV						
test at 50Hz						
180.5	127.8	22.9	L1:127.2 L2:127.2	L1:56.5 L2:57.5	21.8	0.999

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
			L3:127.2	L3:57.6		
500	54.3	26.9	L1:127.8 L2:127.7 L3:127.7	L1:64.7 L2:65.9 L3:66.1	25.1	0.998
600.0	45.2	26.7	L1:127.8 L2:127.7 L3:127.7	L1:64.7 L2:66.3 L3:66.1	25.1	1.000
902.9	30.6	27.1	L1:127.8 L2:127.7 L3:127.7	L1:64.7 L2:66.0 L3:66.1	25.1	1.000
996.2	27.4	26.9	L1:127.8 L2:127.7 L3:127.7	L1:64.7 L2:66.0 L3:66.1	25.1	1.000
test at 60Hz						
180.5	127.5	22.9	L1:127.2 L2:127.2 L3:127.2	L1:56.4 L2:57.5 L3:57.6	21.8	0.998
501.9	53.9	26.8	L1:127.7 L2:127.2 L3:127.2	L1:65.3 L2:66.6 L3:66.7	25.3	0.998
600.5	45.1	26.7	L1:127.7 L2:127.7 L3:127.7	L1:64.7 L2:65.9 L3:66.1	25.1	0.998
900.7	30.6	26.7	L1:127.7 L2:127.7 L3:127.7	L1:64.7 L2:65.9 L3:66.0	25.1	0.998
998.0	28.0	26.99	L1:127.7 L2:127.7 L3:127.7	L1:64.7 L2:65.9 L3:66.0	25.1	0.998
R6-20K-T3-32-LV						
test at 50Hz						
180.3	96.1	16.7	L1:127.0 L2:127.0 L3:127.0	L1:41.6 L2:42.3 L3:42.4	16.0	0.999
539.4	39.9	21.2	L1:127.6 L2:127.5 L3:127.5	L1:51.7 L2:52.7 L3:52.8	20.0	0.998
600.6	36.8	21.7	L1:127.6 L2:127.6	L1:52.4 L2:53.4	20.3	0.999

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Clause	Requirement – Test		Result – Remark		Verdict	
			L3:127.6	L3:53.5		
900.1	24.3	21.7	L1:127.6 L2:127.6 L3:127.6	L1:52.3 L2:53.3 L3:53.4	20.2	0.998
997.1	22.4	21.7	L1:127.6 L2:127.6 L3:127.6	L1:52.4 L2:53.4 L3:53.5	20.3	0.999
test at 60Hz						
180.0	95.8	16.6	L1:127.0 L2:127.0 L3:127.0	L1:41.4 L2:42.1 L3:42.2	15.9	0.998
539.2	39.9	21.2	L1:127.6 L2:127.6 L3:127.5	L1:51.7 L2:52.7 L3:52.8	20.0	0.998
601.2	36.5	21.6	L1:127.6 L2:127.6 L3:127.5	L1:52.3 L2:53.4 L3:53.4	20.3	0.998
901.5	25.1	21.6	L1:127.5 L2:127.5 L3:127.5	L1:52.3 L2:53.3 L3:53.4	20.3	0.998
998.0	22.9	21.7	L1:127.5 L2:127.5 L3:127.5	L1:52.3 L2:53.3 L3:53.4	20.2	0.998
Supplementary information:						

IEC 62109-1					
Clause	Requirement – Test			Result – Remark	Verdict
4.3	TABLE: heating temperature rise measurements				P
	test voltage (V)		See below	—	
	t1 (°C).....		See below	—	
	t2 (°C)		See below	—	
temperature rise dT of part/at:		Measured temperature [°C]			Allowed [°C]
R6-30K-T4-32-LV					
	Condition 1	Condition 2	Condition 3	Condition 4	
Q27 near PCB	89.3	90.3	88.0	89.8	130
Q46 near PCB	92.8	93.7	87.1	89.8	130
Q21 near PCB	62.7	66.6	59.9	67.5	130
Q28 near PCB	89.7	91.1	89.4	91.8	130
Q16 near PCB	92.3	93.0	86.7	89.6	130
D1 near PCB	89.8	90.2	74.4	79.9	130
D2 near PCB	94.0	94.3	75.5	80.7	130
Q44 near PCB	90.6	90.7	69.5	76.2	130
DC part X Cap. C88	80.8	82.7	73.6	80.0	85
GFCI L3 coil	79.6	80.8	74.7	78.8	110
Relay JK5	79.7	81.4	74.0	79.6	85
DC part X CAP. C243	81.2	82.7	72.3	78.6	85
Opto-coupler U14	83.5	85.3	77.4	82.9	130
Q29 near PCB	83.7	86.2	80.9	85.8	130
Q22 near PCB	82.9	85.5	88.0	90.7	130
Q20 near PCB	89.6	90.6	84.0	86.6	130
Q2 near PCB	64.6	68.3	61.5	69.0	130
Q26 near PCB	81.3	84.1	83.7	87.5	130
Transformer T2 bobbin	86.6	88.7	83.5	89.8	110
Filter inductor L2	96.8	96.8	93.1	93.1	110
Current sensor HCT1	81.4	82.5	72.7	78.5	105
Filter inductor L1	96.8	96.8	92.9	92.9	110
Transformer T2 coil	85.8	87.8	82.3	88.7	110
BUS Cap.C12	67.9	71.6	63.1	71.2	85
DC Switch	71.2	73.9	63.0	70.9	85
Mounting surface	46.5	53.6	45.8	56.9	90
AC terminal	92.0	92.0	89.9	90.3	120
Q48 near PCB	80.3	82.6	75.7	81.3	130

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Clause	Requirement – Test		Result – Remark		Verdict
Q27 near PCB	92.3	92.3	85.5	87.5	130
BUS cap.C32	85.5	85.7	73.4	78.3	85
Opto-coupler U3	85.1	86.9	81.1	86.1	130
Current sensor HCT2	80.1	81.7	74.6	79.7	105
Opto-coupler U36	74.2	76.8	68.1	75.2	110
INV R phase Inductor	85.3	85.8	101.7	102.1	110
BOOST inductor	66.7	71.1	51.8	63.2	110
Screen	58.5	65.0	53.5	64.7	70
Cover	59.2	65.2	53.3	64.1	70
Ambient	46.6	61.7	46.0	60.5	--
R6-50K-T4-32					
	Condition 5	Condition 6	Condition 7	Condition 8	
Mounting surface	62.7	68.9	57.3	65.1	90
Screen	49.9	64.9	48.8	65.3	70
Cover	57.5	65.5	49.6	65.5	70
GFCI L3 coil	79.1	81.1	70.8	73.1	110
BOOST inductor	98.1	98.1	55.1	64.3	110
DC part X CAP. C243	75.9	78.8	65.6	70.5	85
current sensor HCT2	77.1	80.4	67.3	71.9	105
DC part X Cap. C88	76.9	80.1	67.2	71.8	85
Transformer T2 bobbin	84.9	88.0	76.5	81.0	110
Current sensor HCT1	77.8	80.3	66.5	71.1	110
Transformer T2 coil	81.5	84.7	73.1	77.6	110
Opto-coupler U36	74.0	78.1	64.6	70.4	110
Filter inductor L1	87.9	87.9	79.4	79.3	110
INV R phase Inductor	80.3	81.8	82.6	84.6	110
Relay JK5	82.7	84.0	75.2	77.5	85
Q27 near PCB	87.5	87.5	72.6	74.7	130
Opto-coupler U3	81.9	84.4	72.9	76.5	130
AC terminal	69.2	73.2	62.2	67.2	120
DC Switch	70.2	74.6	60.2	66.4	85
Opto-coupler U14	79.9	82.6	69.4	74.0	130
BUS cap.C32	72.6	76.5	63.1	68.7	85
Filter Cap.C42	76.8	79.0	68.5	71.6	110

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Clause	Requirement – Test			Result – Remark	Verdict
BUS Cap.C24	75.8	78.8	65.6	70.1	85
Q48 near PCB	87.2	87.2	75.4	77.4	130
BUS Cap. C12	78.8	80.4	65.3	69.9	85
Ambient	45.6	61.4	46.1	62.0	--
	TABLE: Heating test, resistance method				N/A
	Test voltage (V) :				—
	Ambient, t1 (°C) :				—
	Ambient, t2 (°C) :				—
Temperature rise of winding	R1 (Ω)	R2 (Ω)	ΔT (K)	Max. dT (K)	Insulation class
Supplementary information:					
R6-30K-T4-32-LV					
Condition 1: The ambient temperature 45°C, PV input voltage 530Vdc, AC output voltage 127V (L-N), the PCE output power with 100% power still the parts temperature steady.					
Condition 2: The ambient temperature 60°C, PV input voltage 530Vdc, AC output voltage 127V (L-N), the PCE output power derating still the parts temperature steady.					
Condition 3: The ambient temperature 45°C, PV input voltage 900Vdc, AC output voltage 127V (L-N), the PCE output power with 100% power still the parts temperature steady.					
Condition 4: The ambient temperature 60°C, PV input voltage 900Vdc, AC output voltage 127V (L-N), the PCE output power derating still the parts temperature steady.					
R6-50K-T4-32					
Condition 1: The ambient temperature 45°C, PV input voltage 530Vdc, AC output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady.					
Condition 2: The ambient temperature 60°C, PV input voltage 530Vdc, AC output voltage 230V (L-N), the PCE output power derating still the parts temperature steady.					
Condition 3: The ambient temperature 45°C, PV input voltage 900Vdc, AC output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady.					
Condition 4: The ambient temperature 60°C, PV input voltage 900Vdc, AC output voltage 230V (L-N), the PCE output power derating still the parts temperature steady.					

4.4		TABLE: fault condition tests					P
		ambient temperature (°C) :				25	
		model/type of power supply :				-	
No.	component No.	fault	test voltage (V)	test time	fuse No.	Input current (A)	Result
1.	Output(L-L)	S-C	600Vdc 230Vac	5min.	--	--	Error message: "E041,Master HW Inv Current High", PV inverter disconnected from grid immediately, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
2.	Output(L-N)	S-C	600Vdc 230Vac	5min.	--	--	Error message: "E041,Master HW Inv Current High", PV inverter disconnected from grid immediately, No damage, no hazard.
3.	Output(L-PE)	S-C	600Vdc 230Vac	5min.	--	--	Error message: "E041,Master HW Inv Current High", PV inverter disconnected from grid immediately, No damage, no hazard.
4.	Output	O-L	600Vdc 230Vac	2H.	--	--	No Error message: PV inverter can't overload. No damage, no hazard.
5.	FAN	Motor stopped	600Vdc 230Vac	2H.	--	--	Error message: "E045/46/47/48, Master Fan1/Fan2/Fan3/Fan4 Error", Power derating. No damage, no hazard.
6.	Cooling system failure	opening blocked	600Vdc 230Vac	2H.	--	--	Error message: "E045/46/47/48, Master Fan1/Fan2/Fan3/Fan4 Error", Power derating. No damage, no hazard.
7.	Cooling system failure	Quilt	600Vdc 230Vac	5min.	--	--	Error message: "E045/46/47/48, Master Fan1/Fan2/Fan3/Fan4 Error", Power derating. No damage, no hazard.
8.	Backfeed current	Backfeed	600Vdc 230Vac	5min.	--	--	Error message: "E041,Master HW Inv Current High", PV inverter disconnected from grid immediately, No damage, no hazard.
9.	AC output	Phase sequence	600Vdc 230Vac	5min.	--	--	NO Error message Equipment normal operation. No damage, no hazard.
10.	AC output	Phase miswiring	600Vdc 230Vac	5min.	--	--	Error message: "E041,Master Grid NE Voltage Error", N-L1: Error message: E024, Master No Grid Error L1-Ground: NO Error message. PV inverter does not work. Grid Protection switch operated. No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
11.	PV input	Reverse d	600Vdc 230Vac	5min.	--	--	NO Error message, PV inverter disconnected from grid immediately, No damage, no hazard.
CNTL Board							
12.	R130	S-C	600Vdc 230Vac	3min.	--	--	NO Error message Equipment normal operation. No damage, no hazard.
13.	R134	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E062, Slave Phase1 Voltage Low", PV inverter disconnected from grid immediately, No damage, no hazard.
14.	C117	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E061, Slave Phase1 Voltage High", PV inverter disconnected from grid immediately, No damage, no hazard.
15.	R128	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E061, Slave Phase1 Voltage High", PV inverter disconnected from grid immediately, No damage, no hazard.
16.	C115	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E062, Slave Phase1 Voltage Low", PV inverter disconnected from grid immediately, No damage, no hazard.
17.	R133	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation. No damage, no hazard.
18.	R135	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E010, Master Phase1 Voltage Low", PV inverter disconnected from grid immediately, No damage, no hazard.
19.	C118	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E010, Master Phase1 Voltage Low", PV inverter disconnected from grid immediately, No damage, no hazard.
20.	R131	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E009, Master Phase1 Voltage High", PV inverter disconnected from grid immediately, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
21.	C116	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E009, Master Phase1 Voltage High", PV inverter disconnected from grid immediately, No damage, no hazard.
22.	R172	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E028, Master Phase1 DCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.
23.	C139	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E028, Master Phase1 DCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.
24.	C133	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E028, Master Phase1 DCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.
25.	R171	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation. No damage, no hazard.
26.	R170	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E028, Master Phase1 DCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.
27.	C142	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E027, Master GFCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.
28.	R178	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E027, Master GFCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.
29.	R175	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation, No damage, no hazard.
30.	R179	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E027, Master GFCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
31.	C144	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E027, Master GFCI Error", PV inverter disconnected from grid immediately, No damage, no hazard.
32.	R163	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E087, Master Arc Error", PV inverter disconnected from grid immediately, No damage, no hazard.
33.	D14	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E003, Master Temperature High Error", PV inverter disconnected from grid immediately, No damage, no hazard.
34.	C337	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E004, Master Temperature Low Error", PV inverter disconnected from grid immediately, No damage, no hazard.
35.	C221	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E084, Master PV Input Error", PV inverter disconnected from grid immediately, No damage, no hazard.
36.	D36	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E084, Master PV Input Error", PV inverter disconnected from grid immediately, No damage, no hazard.
37.	R376	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation, No damage, no hazard.
38.	C264	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation, No damage, no hazard.
39.	D53	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E031, Master ISO Error", PV inverter disconnected from grid immediately, No damage, no hazard.
40.	U44 PIN1-4	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
41.	X1	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E081, Lost Communication D<->C", PV inverter disconnected from grid immediately, No damage, no hazard.
42.	C80	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E002, Master EEPROM Error", PV inverter disconnected from grid immediately, No damage, no hazard.
43.	U7 PIN100	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E081, Lost Communication D<->C", PV inverter disconnected from grid immediately, No damage, no hazard.
44.	U7 PIN98	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E081, Lost Communication D<->C", PV inverter disconnected from grid immediately, No damage, no hazard.
45.	C3	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down, No damage, no hazard.
46.	C31	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down, No damage, no hazard.
47.	C20	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down, No damage, no hazard.
48.	C16	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down, No damage, no hazard.
49.	C5	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down, No damage, no hazard.
50.	C12	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down, No damage, no hazard.
MPB Board							
51.	C28	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV short circuit to ground, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
52.	C36	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E031, Master ISO Error", PV short circuit to ground, No damage, no hazard.
53.	C30	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down, No damage, no hazard.
54.	C33	S-C	600Vdc 230Vac	3min.	--	--	No Error message, Q1、 D1 damage, No hazard.
55.	R93	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation, No damage, no hazard.
56.	R94	S-C	600Vdc 230Vac	3min.	--	--	NO Error message, Equipment normal operation, No damage, no hazard.
57.	C82	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV short circuit to ground, No damage, no hazard.
58.	R522	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E031, Master ISO Error", Detection circuit abnormal, No damage, no hazard.
59.	R519	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E031, Master ISO Error", Detection circuit abnormal, No damage, no hazard.
60.	R523	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E031, Master ISO Error", Detection circuit abnormal, No damage, no hazard.
61.	C32	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error" PV inverter disconnected from grid, No damage, no hazard.
62.	Q21 G-C	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, Q21 damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
63.	Q24 G-C	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, Q24 damage, no hazard.
64.	Q18 G-C	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, Q18 damage, no hazard.
65.	Q27 G-C	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, Q27 damage, no hazard.
66.	R33	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, No damage, no hazard.
67.	R33	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, No damage, no hazard.
68.	R39	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, No damage, no hazard.
69.	R39	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, No damage, no hazard.
70.	JK3	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
71.	JK9	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error". PV inverter not start up or connected to grid, No damage, no hazard.
72.	JK4	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
73.	JK10	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
74.	JK5	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
75.	JK11	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
76.	JK6	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
77.	JK12	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
78.	JK7	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
79.	JK13	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
80.	JK8	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
81.	JK14	S-C before starting	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
82.	JK3 PIN 1	O-C	600Vdc 230Vac	3min.	--	--	Error message: "E001, Master Relay Error", PV inverter not start up or connected to grid, No damage, no hazard.
83.	TX3(PIN7-8)	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down or not start up, No damage, no hazard.
84.	T2(PIN8-9)	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down or not start up, No damage, no hazard.
85.	T2(PIN10-11)	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down or not start up, No damage, no hazard.
86.	T2(PIN12-14)	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down or not start up, No damage, no hazard.
87.	T2(PIN19-21)	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down or not start up, No damage, no hazard.

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Clause	Requirement – Test				Result – Remark		Verdict
88.	T2(PIN43-44)	S-C	600Vdc 230Vac	3min.	--	--	No Error message, PV inverter shut down or not start up, No damage, no hazard.
CAP Board							
89.	C1	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, Q24 damage, no hazard.
90.	C8	S-C	600Vdc 230Vac	3min.	--	--	Error message: "E032, Master Bus Voltage Balance Error", PV inverter disconnected from grid immediately, Q21 damage, no hazard.
Note(s): S-C: short-circuited; O-C: open-circuited; O-L: overload. The unit passed electric strength test after single fault test above.							

7.3.6.3.3	TABLE: protective equipotential bonding ;				N/A
Measured between:		Test current (A)	Voltage drop (V)	Resistance (mΩ)	result
PE terminal to metal enclosure		--	--	--	--
supplementary information:					

7.3.6.3.7	TABLE: touch current measurement			P
Measured between:	Measured (mA)	Limit (mA)	Comments/conditions	
PE to Metal Enclosure	AC 2.7 / DC 2.5	AC 3.5 / DC10	--	
Supplementary information: No failure of the protective earthing conductor.				

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Clause	Requirement – Test			Result – Remark		Verdict
7.3.7	TABLE: clearance and creepage distance measurements					P
clearance cl and creepage distance dcr at/of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Front View of Main power board						
M4(B*)	1100	230	4.6	6.1	5.5	6.1
M2(B*)	1100	230	4.6	6.5	5.5	6.5
M10(B*)	1100	230	4.6	6.1	5.5	6.1
M6(B*)	1100	230	4.6	6.1	5.5	6.1
M13(B*)	1100	230	4.6	5.6	5.5	5.6
CN22 to M11 Copper platoon(B*)	1100	230	4.6	5.2	5.5	6.0
CN26/CN25/CN22 to PE(B*)	1100	230	4.6	5.6	5.5	5.6
N to CN26(B*)	1100	230	4.6	5.6	5.5	5.6
M3(B*)	1100	230	4.6	5.8	5.5	5.8
M15(B*)	1100	230	4.6	5.6	5.5	5.6
M7(B*)	1100	230	4.6	9.4	5.5	9.4
M8(B*)	1100	230	4.6	5.7	5.5	5.7
M1(B*)	1100	230	4.6	6.3	5.5	6.3
C28 to M8(B*)	1100	230	4.6	8.4	5.5	8.4
Pri. to Sec. of T2(R*)	1100	230	7.4	7.9	11	13.4
C247 body to Sec. of T2(R*)	1100	230	7.4	7.9	11	18.9
C242 body to C85 body(R*)	1100	230	7.4	7.7	11	>11
R249 PCB circuit to C85 body(R*)	1100	230	7.4	7.5	11	11.9
R249 PCB circuit to CN11(R*)	1100	230	7.4	8.4	11	>11
Pri. of T2 to C237(R*)	1100	230	7.4	7.9	11	11.2
C62 to C85 body(R*)	1100	230	7.4	7.9	11	>11
IGBT to heat sink(B*)	1100	230	4.6	5.8	4.6 ³⁾	5.0
Back view of Main power board						
R269 to C85(R*)	1100	230	7.4	10.2	11	>11
PCB inner circuit to CN11(R*)	1100	230	7.4	9.0	7.4	9.0
TP74 circuit to CN11(R*)	1100	230	7.4	10.5	11	>11
Communication board						
PCB inner circuit(R*)	1100	230	7.4	8.7	7.4 ¹⁾	8.7
U12 body(R*)	1100	230	7.4	7.5	7.4 ²⁾	9.5
U12 on PCB(R*)	1100	230	7.4	7.5	11	11.2
U37 body(R*)	1100	230	7.4	7.5	7.4 ²⁾	9.7
U37 on PCB(R*)	1100	230	7.4	7.5	11	11.2
U36 body(R*)	1100	230	7.4	7.5	7.4 ²⁾	9.5
U36 on PCB(R*)	1100	230	7.4	7.5	11	11.2
Cap board						
C4 to M3(B*)	1100	230	4.6	6.0	5.5	6.0

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Clause	Requirement – Test			Result – Remark		Verdict
C14 to M4(B*)	1100	230	4.6	6.0	5.5	6.0
BUS- to M1(B*)	1100	230	4.6	6.7	5.5	6.7
BUS+ to M2(B*)	1100	230	4.6	6.7	5.5	6.7
Whole unit						
+ to –(F*)	1100	230	4.6	12.1	11	12.1
+ to metal enclosure (B*)	1100	230	4.6	8.2	11	>12.0
- to metal enclosure (B*)	1100	230	4.6	8.2	11	>12.0
L to N(F*)	1100	230	4.6	8.4	11	>12.0
L1/L2/L3 to metal enclosure (B*)	1100	230	4.6	8.4	11	>12.0
<p>Note(s): * F=functional insulation, B=basic insulation, S=supplementary insulation, R=reinforced insulation.</p> <p>1) For the inner layer of the PCB, pollution I was considered.</p> <p>2) U12, U37 and U36 with min. CTI 600 used, insulating material of group I was considered.</p> <p>3) For IGBT ceramic, the creepage distance equal the associated clearance.</p> <p>When determine the clearance:</p> <p>For DC input circuits: Overvoltage Category II applied(impulse withstand voltage 4772V)</p> <p>For AC output circuits (connected to AC mains): Overvoltage Category III applied (impulse withstand voltage 4000V, temporary overvoltage 2120Vpeak considered.)</p> <p>Interpolation is used.</p> <p>Due to the max. altitude is 3000m, limit of clearance by the correction factor 1.14 considered.</p> <p>Pollution 2 was considered.</p> <p>Requirement about creepage distances for the distance to the metal enclosure come from columns 7 and 8 of Table 11. Requirement about creepage distances for other parts come from column 3 of table 11.</p> <p>PCB with min. CTI 175 used.</p> <p>Triple insulated wire used for insulation between pri. and sec. of transformer T2.</p>						

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	TABLE: distance through insulation measurement			N/A
distance through insulation di at/of:	U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)
supplementary information: The component was certified.				

7.5	TABLE: electric strength measurements, impulse voltage test and partial discharge test			P
test voltage applied between:	test voltage (V)	impulse withstand voltage (V)	partial discharge extinction voltage (V)	result
DC to PE	2120 d.c	4000	--	P
AC to PE	1500 a.c.	4000	--	P
DC to communication circuit	4240 d.c.	6000	--	P
AC to communication circuit	3000 a.c.	6000	--	P
Two sides of the mylar sheet	2120 d.c	4000	--	P
Note(s):				

9.2	TABLE: Limited power sources					N/A
Circuit output tested:						
Note: Measured Uoc (V) with all load circuits disconnected:						
Components	Sample No.	Uoc (V)	I _{sc} (A)		VA	
			Meas.	Limit	Meas.	Limit
supplementary information:						
Sc=Short circuit, Oc=Open circuit						

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
Whole unit						
Face cover	Guangzhou Weizheng Metal Structure Co., Ltd	--	660*454*28mm, AL5052, 2mm	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Heat-sink for R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-36K-T4-32, R6-40K-T4-32, R6-20K-T3-32-LV	DONGGUAN YIHEXING HARDWARE PRODUCTS CO., LTD	--	330*209*98 mm, AL6063, 12mm	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Heat-sink for R6-50K-T4-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV	DONGGUAN YIHEXING HARDWARE PRODUCTS CO.,LTD	--	330*234*98mm, AL6063, 12mm	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
DC terminal	Stäubli Electrical Connectors AG	PV-KST4/6II-UR PV-KBT4/6II-UR	1250VDC, 39 A, 85°C, IP65	IEC 62852:2014	TUV R.H. R 60127181	
Alt.	Dongguan Vaconn Electronic Technology Co.,Ltd.	VP-D4B-PHSF0 VP-D4B-PHSM0	1100V,30A, 85°C, IP65	IEC 62852:2014/ EN 62852:2015	TUV R.H. R 50396796	
AC terminal	Shenzhen Connection Electronic Co., Ltd.	DRTB35-05-RST	AC600V, 100A, 120°C	UL 60062	UL E304128	
DC switch	BEIJING PEOPLE'S ELECTRIC PLANT CO.,LTD.	GHX5-32P/8P1000-32	DC-PV1, 1000V 32A 8P, 70°C	EN 60947	TUV R.H. R 50439884	
Alt.	BEIJING PEOPLE'S ELECTRIC PLANT CO.,LTD.	GHX5-32P/6P1000-32	DC-PV1, 1000V 32A 6P, 70°C	EN 60947	TUV R.H. R 50439884	
Alt.	PROJOY ELECTRIC CO LTD	PEDS150R-HM25-8	DC-PV2, 1500V 25A 8P, 85°C	EN 60947	TUV R.H. R 50417016	
Alt.	Santon International Bv	XBE+3810-2-D	DC-PV2, 1100V 25A 8P, 70°C	EN 60947	Dekra 71-107724	
Boost inductor	CHINA AMORPHOUS TECHNOLOGY CO.,LTD	25-50KW BOOST	530uH±10%, 130 °C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	Huizhou Baohui Electronics Technology Co., Ltd.	25-50KW BOOST	530uH±10%, 130 °C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
INV. Inductor	CHINA AMORPHOUS TECHNOLOGY CO.,LTD	25-50KW INV	210uH±10%, 130 °C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	Huizhou Baohui Electronics Technology Co., Ltd.	25-50KW INV	210uH±10%, 130 °C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Internal wire	DONGGUAN WENCHANG ELECTRONIC CO LTD	UL3530	6AWG,150°C, 1000V	UL758	UL E214500	
Alt.	DONGGUAN WENCHANG ELECTRONIC CO LTD	UL3530	8AWG,150°C, 1000V	UL758	UL E214500	
Alt.	DONGGUAN WENCHANG ELECTRONIC CO LTD	UL3530	10AWG,150°C, 1000V	UL758	UL E214500	
Alt.	DONGGUAN WENCHANG ELECTRONIC CO LTD	UL3530	12AWG,150°C, 1000V	UL758	UL E214500	
Fan	NMB Technologies Corporation	09225VE-12N-CU-01	12VDC, 0.52A	VDE 0805-1:2014-08	VDE 118626	
Alt.	NINGBO SHENGJIU THERMAL TECHNOLOGY CO LTD	SE120925B SAFR001	12VDC, 0.60A	EN 62368-1:2014+A11	TUV R.H. R 50438525	
Alt.	NINGBO SHENGJIU THERMAL TECHNOLOGY CO LTD	SE120925B UCFR001	12VDC, 0.44A	EN 62368-1:2014+A11	TUV R.H. R 50438525	
Alt.	Dongguan Protechnic Electric Co., Ltd.	MGT9212ZB -W25 K	12VDC, 0.48A	EN 62368-1:2014	TUV SUD B 0310230137	
PCB	JIANGMEN BENLIDA PRINTED CIRCUIT CO.,LTD	BLD	130°C, V-0	UL 796	UL E203640	
Alt.	HUIZHOU GLORYSKY ELECTRONICS CO.,LTD	GS-M	130°C, V-0	UL 796	UL E257384	
Alt.	Ganzhou KINGSUN Technology Co., Ltd	KS-D1	130°C, V-0	UL 796	UL E465853	
Control board& Main power board						
Varistor AC (RV1,RV2, RV3)	Hongzhi Enterprises Ltd.	HEL20D820 K	820Vd.c., 3000A, 130°C	DIN EN 61051-1:200	VDE 40037512	
Surge	SHENZHEN	PV20K-500	Ucpv:DC500V,	EN 61643-	TUV R.H.	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
Protector(DC side with Surge Protector version) (U27,U28,U29,U32,U33,U34))	HAIPENGXIN ELECTRONICS CO., LTD		In:10kA, I _{max} .: 20kA, 85°C	11:2012	R 50316472	
	HUNAN ZHONGPU TECHNOLOGY CO.,LTD.	DXH06-FD621	U _{cpv} :DC500V, In:10kA, I _{max} .: 20kA, 85°C	EN 50539-11:2013+A1	TUV R.H. R 50383393	
	SHENZHEN HAIPENGXIN ELECTRONICS CO., LTD	PV20K-670	U _{cpv} :DC670V, In:10kA, I _{max} .: 20kA, 85°C	EN 61643-11:2012	TUV R.H. R 50316472	
	HUNAN ZHONGPU TECHNOLOGY CO.,LTD.	DXH06-FD821 ZP	U _{cpv} :DC670V, In:10kA, I _{max} .: 20kA, 85°C	EN 50539-11:2013+A1	TUV R.H. R 50383393	
Varistor DC(DC side with varistor version) (RV4,RV5, RV6, RV7, RV8, RV9))	Hongzhi Enterprises Ltd.	HEL20D820 K	820Vd.c., 3000A, 130°C	DIN EN 61051-1:200	VDE 40037512	
Y capacitor (C3, C15, C200, C44, C50, C51, C52, C53, C66, C67, C75)	TDK (Zhuhai FTZ) Co., Ltd.	Y1, B81123	500VAC, 4.7nF, 110°C	IEC 60384-14:2013	VDE 40005566	
Alt.	JYH HSU (JEC) ELECTRONICS LTD.	Y1, JD	400 VAC, 4.7nF, 125°C	IEC 60384-14:2013	VDE 40038642	
DC filter X (C243, C245,C55 for R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV, C243, C245, C88, C55 for R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV)	Guangdong Fengming Electronic Technology Co., Ltd	DKMJ-P	1100V, 8μF ±10%, 85°C	EN 61071: 2007	TUV R.H. R 50321877	
Alt.	Snowrock	HDPB	1100V, 805k,	UL 810	UL E361496	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
	Investment Holding Co Ltd		105°C			
AC filter inductor (L1,L2)	CHINA AMORPHOUS TECHNOLOGY CO.,LTD	CA01-12554	1.0mH, 130°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	Huizhou Baohui Electronics Technology Co., Ltd.	D3L1004-01	1.0mH, 130°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
AC filter X capacitor (C38, C42, C43, C338, C342, C343)	EPCOS ELECTRONIC COMPONENTS S A	B32924C34 75M000	305VAC X2 110°C 475±20%	IEC 60384-14	VDE 40010694	
Alt.	Guangdong Fengming Electronic Technology Co., Ltd	1GFBH547A 310-118	4.7uF X2 310VAC 110°C	IEC 60384-14	VDE 40025702	
Alt.	Europtronic (SuZhou)	MPX	2.2UF, X2, 275V, 125°C	IEC 60384-14	VDE 40025981	
Alt.	Dong Guan Hongfarad Electronics Co.Ltd	HMKP	X2,225K,310VAC, 110°C	IEC 60384-14:2013	VDE 40044173	
Alt.	Guangdong Fengming Electronic Technology Co., Ltd	MKP-X2	2.2uF±10% 310VAC, 110°C	IEC 60384-14:2013	VDE 40025702	
Relay (JK3, JK5, JK7, JK4, JK6, JK8)	ZETTLER RELAY (XIAMEN) Co., Ltd.	AZSR165-1A-12DL	65A 480VAC 12VDC, 85°C	EN 61810-1:2015	TUV SUD B 0887930008	
Alt.	Xiamen HongfaElectroacoustic Co., Ltd.	HF176F/12-H3F	400VAC 65A 12VDC, 85°C	EN 61810-1:2015	TUV R.H. R 50411032	
DC current senor (HCT1, HCT2, HCT4 for R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV	Sinomags technology co., Ltd.	STK-32PL	105°C, 600V, 32A	IEC61010-1 IEC61010-2	TUV R.H. R 50428205	
DC current senor (HCT1, HCT2, HCT4, HCT5 for R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32,	Sinomags technology co., Ltd.	STK-32PL	105°C, 600V, 32A	IEC61010-1 IEC61010-2	TUV R.H. R 50428205	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
R6-25K-T4-32-LV, R6-30K-T4-32-LV						
Alt.	LEM SWITZERLAND S A	HLSR 32-P	85°C, 600V, 32A	UL 508	UL E189713	
GFCI CHOKE L3	Huizhou Baohui Electronics Technology Co., Ltd.	04-16-010 MP2303	Class B, 130°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	CHINA AMORPHOUS TECHNOLOGY CO.,LTD	CA01-12024 GFCI CROE	Class B, 130°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Transformer T2	Jiangxi suochen Electronics Co., Ltd	ER3542- 2.0mH	Class B, 130°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
-BOBBIN	CHANG CHUN PLASTICS CO LTD	T375J	150°C	UL 746C	UL E59481	
Alt.	SUMITOMO BAKELITE CO LTD	PM-9820 PM-9630	150°C	UL 746C	UL E41429	
- WIRE	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEW	155°C	UL 1446	UL E85640	
Alt.	PACIFIC ELECTRIC WIRE & CABLE(SHENZHEN) CO LTD	UEW/U	155°C	UL 1446	UL E201757	
-TRIPLE WIRE	FUYANG YOUHENG CABLE CO LTD	YH-B	130°C	UL 1446	UL E343241	
Alt.	GUANGZHOU WANBAO ELECTRONIC MATERIALCO LTD	DTW-B	130°C	UL 1446	UL E323485	
-TAPE	Jingjiang Yahua Pressure Sensitive Glue Co., Ltd.	CT	130°C	UL 510A	UL E165111	
Alt.	JINGJIANG FUWEI ADHESIVE P RODUCT CO LTD	FW	130°C	UL 510A	UL E302608	
-TUBE	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200°C	UL94	UL E156256	
Alt.	DONGGUAN CITY CHANGJIE METALS & PLASTIC PRODUCTS CO., LTD	CJ-TT-L	200°C	UL94	UL E338209	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
-VARNISH	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO., LTD	E962	130°C	UL 1446	UL E335405	
Alt.	ELANTAS ELECTRICAL INSULATION ELANTAS PDG INC	V1630FS	130°C	UL 1446	UL E75225	
Transformer T2 Alt.	Huizhou Baohui Electronics Technology Co., Ltd.	ER3542V 04-20-032D	Class B, 130°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
- WIRE	PACIFIC ELECTRIC WIRE & CABLE(SHENZHEN) CO LTD	UEW/U	155°C	UL 1446	UL E201757	
Alt	TAI-I COPPER(GUAN- ZHOU) CO LTD	UEW	155°C	UL 1446	UL E234896	
- WIRE	SHENZHEN JIAZHENGXIN INDUSTRIAL CO LTD	xUEW	155°C	UL 1446	UL E334055	
Alt	SHENZHEN YANCHENG COMPOUND LINE CO LTD	xUEW	155°C	UL 1446	UL E360434	
- WIRE	SHENZHEN KAIZHONG HEDONG NEW MATERIAL CO LTD	TIW-B	130°C	UL 1446	UL E357240	
Alt	HUIZHOU HUILI INDUSTRIAL CO LTD	PIW-B	130°C	UL 1446	UL E322908	
-TAPE	JINGJIANG YAHUA PRESSURESENSIT IVE GLUE	PF-301	180°C	UL 510A	UL E165111	
-TF TUBE	Shenzhen Woer Heat-Shrinkable Material Co., Ltd	WF(PTFE)	200°C	UL94	UL E203950	
-VARNISH	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	130°C	UL 1446	UL E228349	
-MARGIN TAPE	JINGJIANG YAHUA PRESSURESENSIT IVE GLUE	WF-	130°C	UL 510A	UL E165111	
-BOBBIN	SUMITOMO BAKELITE CO LTD	PM-9630 PM-9820	150°C	UL 746C	UL E41429	
Alt	CHANG CHUN	T375J	150°C	UL 746C	UL E59481	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
	PLASTICS CO LTD					
Opto-coupler for Control board (U37)	Suzhou Novosense Microelectronics Co., Ltd.	NSi8221W	Max.110°C, Cr.: ≥8 mm, Cl.: ≥8 mm	VDE V 0884-11: 2017-01	VDE 40052820	
Opto-coupler for Control board (U36,U12)	Suzhou Novosense Microelectronics Co., Ltd.	NSi8241W	Max.110°C, Cr.: ≥8 mm, Cl.: ≥8 mm	VDE V 0884-11: 2017-01	VDE 40052820	
Opto-coupler (U14,U5, U11, U8, U7, U10, U4, U13, U6, U9, U3, U12) (Non-isolated)	TEXAS INSTRUMENTS INCORPORATED	UCC23513	SO6 3A 5-kVRMS -40°C~130°C	UL 1577 VDE V 0884-11: 2017-01	VDE 40040142	
Alt.	FAIRCHILD SEMICONDUCTOR CORP	FOD8342	SO-6 3.0A, -40°C~100°C	EC60747-5-5	UL E90700	
Alt.	Toshiba (China) Co., Ltd	TLP5754	SO-6 4.0A -40°C~110°C	EN60747-5-5	UL E67349	
Alt.	Suzhou Novosense Microelectronics Co., Ltd.	NSi6801C-DSWFR	SO6 5A 5.7-kVRMS	UL 1577 VDE V 0884-11: 2017-01	VDE 40052820	
Bus capacitance (C31,C24,C12,C32)	Guangdong Fengming Electronic Technology Co., Ltd	DKMJ-P	75uF±10% 700VDC,85°C	UL 810	UL E215893	
Alt.	CRE	DMJ-PS	700VDC 75uF±10%, 105°C	UL 810	UL E496566	
IGBT INV (Q21, Q22, Q23, Q24, Q25, Q26) R6-25K-T3-32-32, R6-30K-T3-32-32, R6-33K-T3-32-32, R6-36K-T3-32, R6-36K-T4-32, R6-40K-T4-32-32, R6-20K-T3-32-LV	INFINEON	IKW75N60T	TO-3P, 75A, 600V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	INFINEON	IKW75N60T A	TO-3P, 75A, 600V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	FAIRCHILD	75T65MQD	75A ,650V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
IGBT INV (Q21, Q22, Q23, Q24, Q25, Q26) R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV	INFINEON	IKQ100N60 T	PG-TO247-3, 100A, 600V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
IGBT INV (Q29, Q48, Q28, Q50, Q27, Q49, Q20, Q47, Q19, Q46, Q18, Q45) R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32	INFINEON	IKQ50N120 CH3	50A, 1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	FAIRCHILD	FGY75T120 SQDN	75A ,1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	INFINEON	IKQ75N120 CH3	75A, 1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
IGBT INV (Q29, Q48, Q28, Q50, Q27, Q49, Q20, Q47, Q19, Q46, Q18, Q45) R6-36K-T3-32, R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-20K-T3-32-LV, R6-25K-T4-32-LV, R6-30K-T4-32-LV	FAIRCHILD	FGY75T120 SQDN	75A ,1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	INFINEON	IKQ75N120 CH3	75A, 1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
IGBT BOOST (Q1, Q2, Q5) for	FAIRCHILD	FGY75T120 SQDN	75A ,1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: list of critical components					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity1)	
R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV						
Alt.	INFINEON	IKQ75N120 CH3	75A, 1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	INFINEON	IKQ50N120 CH3	50A, 1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
IGBT BOOST (Q1, Q2, Q5, Q44) R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV	FAIRCHILD	FGY75T120 SQDN	75A ,1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	INFINEON	IKQ75N120 CH3	75A, 1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
Alt.	INFINEON	IKQ50N120 CH3	50A, 1200V, 175°C	IEC/EN62109-1 IEC/EN62109-2	Tested with appliance	
CAP board						
Bus capacitance (C6, C12, C5, C13, C7, C11, C4, C14)	Guangdong Fengming Electronic Technology Co., Ltd	DKMJ-P 75uF/700VDC	75uF±10% 700VDC, 85°C	UL 810	UL E215893	
Alt.	Snowrock Investment Holding Co Ltd	DPBG	700VDC 75uF±10%, 105°C	UL 810	UL E361496	
Alt.	Snowrock Investment Holding Co Ltd	HDPB	700VDC 75uF±10%, 105°C	UL 810	UL E361496	
Alt.	CRE	DMJ-PS	700VDC 75uF±10%, 105°C	UL 810	UL E496566	
1) an asterisk indicates a mark which assures the agreed level of surveillance						

--End of the report--

TEST REPORT IEC 62109-2 Safety of Power Converter for use in Photovoltaic Power Systems Part 2: Particular requirements for inverters	
Report Number.....	CN220TXF 001 attachment 1
Date of issue	See cover page
Total number of pages.....	See cover page
Name of Testing Laboratory preparing the Report.....	See cover page
Applicant's name	See cover page
Address	See cover page
Test specification:	
Standard.....	IEC 62109-2:2011
Test procedure.....	TÜV Rheinland LVD CoC approval
Non-standard test method.....	N/A
Test Report Form No.	IEC62109_2B
Test Report Form(s) Originator.....	LCIE - Laboratoire Central des Industries Electriques
Master TRF	Dated 2016-11
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Test item description :	See report CN220TXF 001.	
Trade Mark :	See report CN220TXF 001.	
Manufacturer :	See report CN220TXF 001.	
Model/Type reference :	See report CN220TXF 001.	
Ratings :	See report CN220TXF 001.	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/> Testing Laboratory:	See cover page	
Testing location/ address:	See cover page	
<input type="checkbox"/> Testing procedure: CTF Stage 1:		
Testing location/ address:		
Tested by (name, function, signature):		
Approved by (name, function, signature) ...:		
<input type="checkbox"/> Testing procedure: CTF Stage 2:		
Testing location/ address:		
Tested by (name + signature) :		
Witnessed by (name, function, signature)... :		
Approved by (name, function, signature) ...:		
<input type="checkbox"/> Testing procedure: CTF Stage 3:		
<input type="checkbox"/> Testing procedure: CTF Stage 4:		
Testing location/ address:		
Tested by (name, function, signature):		
Witnessed by (name, function, signature)... :		
Approved by (name, function, signature) ...:		
Supervised by (name, function, signature) :		

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

See report CN220TXF 001.

Summary of testing:**Tests performed (name of test and test clause):**

See report CN220TXF 001.

Testing location:

The laboratory described on the cover page.

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

List of countries addressed: See report CN220TXF 001.

Copy of marking plate:

See report CN220TXF 001.

Test item particulars	
Equipment mobility..... :	<input type="checkbox"/> movable <input type="checkbox"/> stationary <input type="checkbox"/> transportable <input type="checkbox"/> hand-held <input checked="" type="checkbox"/> fixed <input type="checkbox"/> for building-in
Connection to the mains	<input type="checkbox"/> pluggable equipment <input checked="" type="checkbox"/> permanent connection <input type="checkbox"/> direct plug-in <input type="checkbox"/> for building-in
Enviromental category	<input checked="" type="checkbox"/> outdoor <input type="checkbox"/> indoor unconditional <input type="checkbox"/> indoor conditional
Over voltage category Mains	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input checked="" type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
Over voltage category DC	<input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
Mains supply tolerance (%)..... :	According to specified supply range
Tested for power systems..... :	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
IT testing, phase-phase voltage (V)	N/A
Class of equipment	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input type="checkbox"/> Not classified
Mass of equipment (kg)..... :	See report CN220TXF 001.
Pollution degree	<input type="checkbox"/> PD 1 <input type="checkbox"/> PD 2 <input checked="" type="checkbox"/> PD 3
IP protection class..... :	IP65
Possible test case verdicts:	
- test case does not apply to the test object..... : N/A	
- test object does meet the requirement..... : P (Pass)	
- test object does not meet the requirement..... : F (Fail)	
Testing	See report CN220TXF 001.
Date of receipt of test item..... :	See report CN220TXF 001.
Date (s) of performance of tests	See report CN220TXF 001.
General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report.	
Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC62109_2B:	

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..... :	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable		
When differences exist; they shall be identified in the General product information section.			
Name and address of factory (ies): See report CN220TXF 001.			
General product information: See report CN220TXF 001.			
<u>Throughout the test report following abbreviations may be used:</u> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> • cl clearance • dcr creepage distance • dti distance through insulation • PCE Power Conversion Equipment • BI basic insulation • DI double insulation </td> <td style="width: 50%; vertical-align: top;"> <ul style="list-style-type: none"> • int internal distance • o-c open-circuit • o-l overload • s-c short-circuit • SI supplementary insulation • RI reinforced insulation </td> </tr> </table>		<ul style="list-style-type: none"> • cl clearance • dcr creepage distance • dti distance through insulation • PCE Power Conversion Equipment • BI basic insulation • DI double insulation 	<ul style="list-style-type: none"> • int internal distance • o-c open-circuit • o-l overload • s-c short-circuit • SI supplementary insulation • RI reinforced insulation
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Clause	Requirement + Test	Result - Remark	Verdict

4	GENERAL TESTING REQUIREMENTS		P
4.4.4	Single fault conditions to be applied		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 according to 4.8.3.5: the residual current monitoring system operates properly	See appended table 4.4.4.15.1	P
	a). - The inverter ceases to operate		P
	- Indicates a fault in accordance with §13.9		P
	- Disconnect from the mains		P
	- not re-connect after any sequence of removing and reconnecting PV power		P
	- not re-connect after any sequence of removing and reconnecting AC power		P
	- not re-connect after any sequence of removing and reconnecting both PV and AC power		P
	b). - The inverter continues to operate		N/A
	- the residual current monitoring system operates properly under single fault condition		N/A
	- Indicates a fault in accordance with §13.9		N/A
	c). - The inverter continues to operate regardless of loss of residual current monitoring functionality		N/A
	- not re-connect after any sequence of removing and reconnecting PV power		N/A
	- not re-connect after any sequence of removing and reconnecting AC power		N/A
	- not re-connect after any sequence of removing and reconnecting both PV and AC power		N/A
	- Indicates a fault in accordance with §13.9		N/A
4.4.4.15.2	Fault-tolerance of automatic disconnecting means		P
4.4.4.15.2.1	The means provided for automatic disconnection of a grid-interactive inverter from the mains shall:		P
	- disconnect all grounded current-carrying conductors from the mains		P
	- disconnect all ungrounded current-carrying conductors from the mains		P
	- be such that with a single fault applied to the disconnection means or to any other location in the inverter, at least basic insulation or simple separation is maintained between the PV array and the mains when the disconnecting means is intended to be in the open state.	See appended table 4.4.4.15.2 Fault-tolerance of automatic disconnecting	P
4.4.4.15.2.2	Design of insulation or separation complies with requirements of 7.3.7 of Part 1: report here Part 1 comment and verdict.		P
4.4.4.15.2.3	For non-isolated inverter, automatic checking of the isolation provided by a disconnect means after single fault.	See appended test table 4.4.4.15.2 Fault-tolerance of automatic disconnecting.	P

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Clause	Requirement + Test	Result - Remark	Verdict
	If the check fail: - any still-functional disconnection means shall be left in the open position		P
	- at least basic or simple separation shall be maintained between the PV input and the mains		P
	- the inverter shall not start operation		P
	- the inverter shall indicate a fault in accordance with 13.9		P
4.4.4.16	A stand-alone inverter with a transfer switch to transfer AC loads from the mains or other AC bypass source to the inverter output:		N/A
	- shall continue to operate normally		N/A
	- shall not present a risk of fire as the result of an out-of-phase transfer		N/A
	- shall not present a risk of shock as the result of an out-of-phase transfer		N/A
	- And having control preventing switching: components for malfunctioning		N/A
4.4.4.17	Cooling system failure – Blanketing test No hazards according to the criteria of sub-clause 4.4.3 of Part 1 shall result from blanketing the inverter This test is not required for inverters restricted to use only in closed electrical operating areas.	See following table 4.4.4.17.	P
	Test stop condition: time duration value or stabilized temperature		P
4.7	ELECTRICAL RATINGS TESTS		P
4.7.4	Stand-alone Inverter AC output voltage and frequency		N/A
4.7.4.1	General		N/A
4.7.4.2	Steady state output voltage at nominal DC input The steady-state AC output voltage shall not be less than 90 % or more than 110 % of the rated nominal voltage with the inverter supplied with its nominal value of DC input voltage.		N/A
4.7.4.3	Steady state output voltage across the DC input range The steady-state AC output voltage shall not be less than 85 % or more than 110 % of the rated nominal voltage with the inverter supplied with any value within the rated range of DC input voltage.		N/A
4.7.4.4	Load step response of the output voltage at nominal DC input The AC output voltage shall not be less than 85 % or more than 110 % of the rated nominal voltage for more than 1,5 s after application or removal of a resistive load.		N/A
4.7.4.5	Steady state output frequency The steady-state AC output frequency shall not vary from the nominal value by more than +4 % or –6 %.		N/A
4.7.5	Stand-alone inverter output voltage waveform		N/A
4.7.5.1	General		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
4.7.5.2	The AC output voltage waveform of a sinusoidal output stand-alone inverter shall have a total harmonic distortion (THD) not exceeding of 10 % and no individual harmonic at a level exceeding 6 %.		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	The total harmonic distortion (THD) of the voltage waveform shall not exceed 40 %.		N/A
4.7.5.3.3	The slope of the rising and falling edges of the positive and negative half-cycles of the voltage waveform shall not exceed 10 V/μs measured between the points at which the waveform has a voltage of 10 % and 90 % of the peak voltage for that half-cycle.		N/A
4.7.5.3.4	The absolute value of the peak voltage of the positive and negative half-cycles of the waveform shall not exceed 1,414 times 110 % of the RMS value of the rated nominal AC output voltage.		N/A
4.7.5.4	Information requirements for non-sinusoidal waveforms The instructions provided with a stand-alone inverter not complying with 4.7.5.2 shall include the information in 5.3.2.6.		N/A
4.7.5.5	Output voltage waveform requirements for inverters for dedicated loads. For an inverter that is intended only for use with a known dedicated load, the following requirements may be used as an alternative to the waveform requirements in 4.7.5.2 to 4.7.5.3.		N/A
	The combination of the inverter and dedicated load shall be evaluated to ensure that the output waveform does not cause any hazards in the load equipment and inverter, or cause the load equipment to fail to comply with the applicable product safety standards.	See attached document: 4.7.5.5 Evaluation of inverter for dedicated load	N/A
	The inverter shall be marked with symbols 9 and 15 of Table C.1 of Part 1.		N/A
	The installation instructions provided with the inverter shall include the information in 5.3.2.13.		N/A
4.8	ADDITIONAL TESTS FOR GRID-INTERACTIVE INVERTERS		P
4.8.1	General requirements regarding inverter isolation and array grounding		P
	- Type of Array grounding supported	Ungrounded	P
	- Inverter isolation	Non-isolated	P
4.8.2	Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	(See attached table)	P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays		P
	Inverter shall have means to measure DC insulation resistance from PV input (array) to ground before starting operation		P
	Or Inverter shall be provided with instruction in accordance with 5.3.2.11.		N/A
	Measured DC insulation resistance:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value $R = V_{max}/30mA$ under normal conditions		P
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value $R = V_{max}/30mA$ with ground fault in the PV array		P
	Isolated inverters shall indicate a fault if the insulation resistance is less than the limit value		N/A
	Isolated inverter fault indication maintained until insulation resistance has recovered to a value higher than the limit value		N/A
	Non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30:		P
	- shall indicate a fault in accordance with 13.9		P
	- shall not connect to the mains		P
4.8.2.2	Array insulation resistance detection for inverters for functionally grounded arrays		N/A
	a-1) The value of the total resistance, including the intentional resistance for array functional grounding, the expected insulation resistance of the array to ground, and the resistance of any other networks connected to ground (for example measurement networks) must not be lower than $R = (V_{MAX} PV/30 mA)$ ohms.		N/A
	a-2) The installation instructions shall include the information required in 5.3.2.12.		N/A
	b-1) As an alternative to a), or if a resistor value lower than in a) is used, the inverter shall incorporate means to detect, during operation, if the total current through the resistor and any networks (for example measurement networks) in parallel with it, exceeds the residual current values and times in Table 31		N/A
	b-2) Inverter shall either disconnect the resistor or limit the current by other means		N/A
	b-3) If the inverter is a non-isolated inverter, or has isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, it shall also disconnect from the mains.		N/A
	c) The inverter shall have means to measure the DC insulation resistance from the PV input to ground before starting operation, in accordance with 4.8.2.1.		N/A
4.8.3	Array residual current detection		P
4.8.3.1	General		P
4.8.3.2	30 mA touch current type test for isolated inverters	See appended table 4.8.3.2 30mA touch current type test for isolated inverters	N/A
4.8.3.3	Fire hazard residual current type test for isolated inverters	See appended table 4.8.3.3 Fire hazard residual current type test for isolated inverters	N/A
4.8.3.4	Protection by application of RCD's		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- The requirement for additional protection in 4.8.3.1 can be met by provision of an RCD with a residual current setting of 30 mA, located between the inverter and the mains..		N/A
	- The selection of the RCD type to ensure compatibility with the inverter must be made according to rules for RCD selection in Part 1.		N/A
	- The RCD provided integral to the inverter, or		N/A
	- The RDC provided by the installer if details of the rating, type, and location for the RCD are given in the installation instructions per 5.3.2.9.		N/A
4.8.3.5	Protection by residual current monitoring		P
4.8.3.5.1	General		P
	Where required by Table 30, the inverter shall provide residual current monitoring that functions whenever the inverter is connected to the mains with the automatic disconnection means closed.		P
	The residual current monitoring means shall measure the total (both a.c. and d.c. components) RMS current.		P
	As indicated in Table 30 for different inverter types, array types, and inverter isolation levels, detection may be required for excessive continuous residual current, excessive sudden changes in residual current, or both, according to the following limits:		P
	a) Continuous residual current: The inverter shall disconnect within 0,3 s and indicate a fault in accordance with 13.9 if the continuous residual current exceeds:		P
	- maximum 300 mA for inverters with continuous output power rating ≤ 30 kV;		N/A
	- maximum 10 mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.		P
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		P
	b) Sudden changes in residual current: The inverter shall disconnect from the mains within the time specified in Table 31		P
	The inverter indicates a fault in accordance with 13.9, if a sudden increase in the RMS residual current is detected exceeding the value in the table.		P
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		P
4.8.3.5.2	Test for detection of excessive continuous residual current: test repeated 5 times and time to disconnect shall not exceed 0,3 s.	See appended test table 4.8.3.5.2 Test for detection of excessive continuous residual current	P
4.8.3.5.3	Test for detection of sudden changes in residual current repeated 5 times and each of the 5 results shall not exceed the time limit indicated in for each row (30mA, 60mA and 150mA) of Table 31.		P
4.8.3.6	Systems located in closed electrical operating areas		N/A
	The protection against shock hazard is not required		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	if the installation information provided with the inverter indicates the restriction for use in a closed electrical operating area, and		
	Installation information indicates what forms of shock hazard protection are and are not provided integral to the inverter, in accordance with 5.3.2.7.		N/A
	The inverter shall be marked as in 5.2.2.6.		N/A
5	MARKING AND DOCUMENTATION		P
5.1	Marking		P
5.1.4	Equipment ratings		P
	PV input ratings:		P
	- V _{max} PV (absolute maximum) (d.c. V)		P
	- I _{sc} PV (absolute maximum) (d.c. A)		P
	a.c. output ratings:		P
	- Voltage (nominal or range) (a.c. V)		P
	- Current (maximum continuous) (a.c. A)		P
	- Frequency (nominal or range) (Hz)		P
	- Power (maximum continuous) (W or VA)		P
	- Power factor range		P
	a.c input ratings:		N/A
	- Voltage (nominal or range) (a.c. V)		N/A
	- Current (maximum continuous) (a.c. A)		N/A
	- Frequency (nominal or range) (Hz)		N/A
	d.c. output ratings:		N/A
	- Voltage (nominal or range) (d.c. V)		N/A
	- Current (maximum continuous) (d.c. A)		N/A
	Protective class (I or II or III)		P
	Ingress protection (IP) rating per part 1		P
	An inverter that is adjustable for more than one nominal output voltage shall be marked to indicate the particular voltage for which it is set when shipped from the factory.		N/A
5.2	Warning markings		P
5.2.2	Content for warning markings		P
5.2.2.6	Inverters for closed electrical operating areas		N/A
	Where required by 4.8.3.6, an inverter not provided with full protection against shock hazard on the PV array shall be marked with a warning that the inverter is only for use in a closed electrical operating area, and referring to the installation instructions.		N/A
5.3	Documentation		P
5.3.2	Information related to installation		P
5.3.2.1	Ratings. Subclause 5.3.2 of Part 1 requires the documentation to include ratings information for each input and output. For inverters this information shall be as in Table 33 below. Only those ratings that are applicable based on the type of inverter are required.		P
	PV input quantities :		P
	- V _{max} PV (absolute maximum) (d.c. V)		P
	- PV input operating voltage range (d.c. V)		P
	- Maximum operating PV input current (d.c. A)		P
	- I _{sc} PV (absolute maximum) (d.c. A)		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- Isc PV (absolute maximum) (d.c. A)		P
	- Max. inverter backfeed current to the array (a.c. or d.c. A)		P
	a.c. output quantities:		P
	- Voltage (nominal or range) (a.c. V)		P
	- Current (maximum continuous) (a.c. A)		P
	- Current (inrush) (a.c. A, peak and duration)		P
	- Frequency (nominal or range) (Hz)		P
	- Power (maximum continuous) (W or VA)		P
	- Power factor range		P
	- Maximum output fault current (a.c. A, peak and duration or RMS)		P
	- Maximum output overcurrent protection (a.c. A)		P
	a.c. input quantities:		N/A
	- Voltage (nominal or range) (a.c. V)		N/A
	- Current (maximum continuous) (a.c. A)		N/A
	- Current (inrush) (a.c. A, peak and duration)		N/A
	- Frequency (nominal or range) (Hz)		N/A
	d.c input (other than PV) quantities:		N/A
	- Voltage (nominal or range) (d.c. V)		N/A
	- Nominal battery voltage (d.c. V)		N/A
	- Current (maximum continuous) (d.c. A)		N/A
	d.c. output quantities:		N/A
	- Voltage (nominal or range) (d.c. V)		N/A
	- Nominal battery voltage (d.c. V)		N/A
	- Current (maximum continuous) (d.c. A)		N/A
	Protective class (I or II or III)		P
	Ingress protection (IP) rating per part 1		P
5.3.2.2	Grid-interactive inverter setpoints		P
	For a grid-interactive unit with field adjustable trip points, trip times, or reconnect times, the presence of such controls, the means for adjustment, the factory default values, and the limits of the ranges of adjustability shall be provided in the documentation for the PCE or in other format such as on a website. Provided solution:		P
	The setting of field adjustable setpoints shall be accessible from the PCE		P
5.3.2.3	Transformers and isolation		N/A
	whether an internal isolation transformer is provided, and if so, what level of insulation (functional, basic, reinforced, or double) is provided by that transformer. The instructions shall also indicate what the resulting installation requirements are regarding such things as earthing or not earthing the array, providing external residual current detection devices, etc.		N/A
	An inverter shall be provided with information to the installer regarding:		N/A
	- providing of internal isolation transformer		N/A
	- the level of insulation (functional, basic, reinforced, or double)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	The instructions shall also indicate what the resulting installation requirements are regarding:		N/A
	- earthing or not earthing the array		N/A
	- providing external residual current detection devices		N/A
	- requiring an external isolation transformer,		N/A
5.3.2.4	Transformers required but not provided		N/A
	An inverter that requires an external isolation transformer not provided with the unit, shall be provided with instructions that specify, and for the external isolation transformer with which it is intended to be used:		N/A
	- the configuration type		N/A
	- electrical ratings		N/A
	- environmental ratings		N/A
5.3.2.5	PV modules for non-isolated inverters		P
	Non-isolated inverters shall be provided with installation instructions that require PV modules that have an IEC 61730 Class A rating		P
	If the maximum AC mains operating voltage is higher than the PV array maximum system voltage then the instructions shall require PV modules that have a maximum system voltage rating based upon the AC mains voltage.		N/A
5.3.2.6	Non-sinusoidal output waveform information		N/A
	The instruction manual for a stand-alone inverter not complying with 4.7.5.2 shall include a warning that:		N/A
	- the waveform is not sinusoidal,		N/A
	- some loads may experience increased heating,		N/A
	- the user should consult the manufacturers of the intended load equipment before operating that load with the inverter		N/A
	The inverter manufacturer shall provide information regarding:		N/A
	- what types of loads may experience increased heating		N/A
	- recommendations for maximum operating times with such loads		N/A
	The inverter manufacturer shall specify for the waveforms as determined by the testing in 4.7.5.3.2 through 4.7.5.3.4.:		N/A
	- THD		N/A
	- slope		N/A
	- peak voltage		N/A
5.3.2.7	Systems located in closed electrical operating areas		N/A
	Where required by 4.8.3.6, an inverter not provided with full protection against shock hazard on the PV array shall be provided with installation instructions:		N/A
	- requiring that the inverter and the array must be installed in closed electrical operating areas		N/A
	- indicating which forms of shock hazard protection are and are not provided integral to the inverter (for example the RCD, isolation transformer complying with the 30 mA touch current limit, or residual current monitoring for sudden changes)		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
5.3.2.8	Stand-alone inverter output circuit bonding		N/A
	Where required by 7.3.10, the documentation for an inverter shall include the following:		N/A
	- if output circuit bonding is required but is not provided integral to the inverter, the required means shall be described in the installation instructions, including which conductor is to be bonded and the required current carrying capability or cross-section of the bonding means;	Described in the installation instructions	N/A
	- if the output circuit is intended to be floating, the documentation for the inverter shall indicate that the output is floating.		N/A
5.3.2.9	Protection by application of RCD's		N/A
	Where the requirement for additional protection in 4.8.3.1 is met by requiring an RCD that is not provided integral to the inverter, as allowed by 4.8.3.4, the installation instructions shall state the need for the RCD,.		N/A
	and shall specify its rating, type, and required circuit location		N/A
5.3.2.10	Remote indication of faults		N/A
	The installation instructions shall include an explanation of how to properly make connections to (where applicable), and use, the electrical or electronic fault indication required by 13.9.		N/A
5.3.2.11	External array insulation resistance measurement and response		N/A
	The installation instructions for an inverter for use with ungrounded arrays that does not incorporate all the aspects of the insulation resistance measurement and response requirements in 4.8.2.1, must include:		N/A
	- for isolated inverters: an explanation of what aspects of array insulation resistance measurement and response are not provided, and		N/A
	- an instruction to consult local regulations to determine if any additional functions are required or not;		N/A
	- for non-isolated inverters: an explanation of what external equipment must be provided in the system, and		N/A
	- what the setpoints and response implemented by that equipment must be, and:		N/A
	- how that equipment is to be interfaced with the rest of the system.		N/A
5.3.2.12	Array functional grounding information		N/A
	Where approach a) of 4.8.2.2 is used, the installation instructions for the inverter shall include all of the following:		N/A
	a) the value of the total resistance between the PV circuit and ground integral to the inverter		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	b) the minimum array insulation resistance to ground that system designer or installer must meet when selecting the PV panel and system design, based on the minimum value that the design of the PV functional grounding in the inverter was based on		N/A
	c) the minimum value of the total resistance $R = V_{MAX} PV/30 \text{ mA}$ that the system must meet, with an explanation of how to calculate the total		N/A
	d) a warning that there is a risk of shock hazard if the total minimum resistance requirement is not met.		N/A
5.3.2.13	Stand-alone inverters for dedicated loads		N/A
	Where the approach of 4.7.5.5 is used, the installation instructions for the inverter shall include a warning that the inverter is only to be used with the dedicated load for which it was evaluated, and shall specify the dedicated load.		N/A
5.3.2.14	Identification of firmware version(s)		P
	An inverter utilizing firmware for any protective functions shall provide means to identify the firmware version.		P
	This can be a marking, but the information can also be provided by a display panel, communications port or any other type of user interface.....		P
7	PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS		P
7.3	Protection against electric shock		P
7.3.10	Additional requirements for stand-alone inverters		N/A
	One circuit conductor bonded to earth to create a grounded conductor and an earthed system.		N/A
	The means used to bond the grounded conductor to protective earth provided within the inverter or as part of the installation		N/A
	If not provided integral to the inverter, the required means shall be described in the installation instructions as per 5.3.2.8.		N/A
	The means used to bond the grounded conductor to protective earth shall comply with the requirements for protective bonding in Part 1,		N/A
	If the bond can only ever carry fault currents in stand-alone mode, the maximum current for the bond is determined by the inverter maximum output fault current.		N/A
	Output circuit bonding arrangements shall ensure that in any mode of operation, the system only has the grounded circuit conductor bonded to earth in one place at a time.		N/A
	Switching arrangements may be used, in which case the switching device used is to be subjected to the bond impedance test along with the rest of the bonding path		N/A

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	Inverters intended to have a circuit conductor bonded to earth shall not impose any normal current on the bond except for leakage current.		N/A
	Outputs that are intentionally floating with no circuit conductor bonded to ground, must not have any voltages with respect to ground that are a shock hazard in accordance with Clause 7 of Parts 1 and 2.		N/A
	The documentation for the inverter shall indicate that the output is floating as per 5.3.2.8.		N/A
7.3.11	Functionally grounded arrays		N/A
	All PV conductors in a functionally grounded array shall be treated as being live parts with respect to protection against electric shock.		N/A
9	PROTECTION AGAINST FIRE HAZARDS		P
9.3	Short-circuit and overcurrent protection		P
9.3.4	Inverter backfeed current onto the array		N/A
	The backfeed current testing and documentation requirements in Part 1 apply, including but not limited to the following.		N/A
	Inverter backfeed current onto the PV array maximum value.....		N/A
	This inverter backfeed current value shall be provided in the installation instructions regardless of the value of the current, in accordance with Table 33.		N/A
13	PHYSICAL REQUIREMENTS		P
13.9	Fault indication		P
	Where this Part 2 requires the inverter to indicate a fault, both of the following shall be provided:		P
	a) a visible or audible indication, integral to the inverter, and detectable from outside the inverter, and		P
	b) an electrical or electronic indication that can be remotely accessed and used.		P
	The installation instructions shall include information regarding how to properly make connections (where applicable) and use the electrical or electronic means in b) above, in accordance with 5.3.2.10.		P

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.4.4	TABLE: Single fault condition to be applied					P
	Ambient temperature (°C)					—
	Power source for EUT: Manufacturer, model/type, output rating					—
4.4.4.15.1	Fault-tolerance of residual current monitoring					
Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
Check that the residual current monitoring operates properly						
Supplementary information: See report CN220TXF 001.						

4.4.4	TABLE: Single fault condition to be applied					P
	Ambient temperature (°C)					—
	Power source for EUT: Manufacturer, model/type, output rating					—
4.4.4.15.2	Fault-tolerance of automatic disconnecting means					
Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
Check that the relays fulfil the basic insulation or simple separation based on the PV circuit working voltage.						
Each active phase can be switched. (L and N)						
Supplementary information: See report CN220TXF 001.						

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
4.4.4.17	Cooling system failure – Blanketing test		P
	Test voltage (Vdc)	530V	—
	Test current (Idc)	32/32/32/32A	—
	Test voltage (Vac).....	230V	—
	Test current (Iac)	3*72.5A	—
	t_{amb1} (°C)	See below	—
	t_{amb2} (°C)	See below	—
maximum temperature T of part/at::		T (°C)	T_{max} (°C)
Case surface		58.7	90
LED surface		58.3	90
Mounting surface		47.8	90
Ambient		45.9	--
Supplementary information:			

4.7.4	TABLE: Steady state Inverter AC output voltage and frequency		N/A
	Nominal DC input (V)		
	Nominal output AC voltage (V) :		
AC output U (V)	Frequency (Hz)	Condition/status	Comments
		Without load	
		Resistive load application	
		Resistive load removal	
Supplementary information:			

IEC 62109-2				
Clause	Requirement + Test			Verdict
4.8.2	TABLE: Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays			P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays			P
DC Voltage below minimum operating voltage (V)	DC Voltage for inverter begin operation (V)	Resistance between ground and PV input terminal (Ω)	Required Insulation resistance $R^* = (V_{MAX\ PV} / 30mA) (\Omega)$	Result
DC+				
180	200	135K	150K	I.F.
180	200	135K	150K	I.F.
180	200	165K	150K	N.O.
180	200	165K	150K	N.O.
DC-				
180	200	135K	150K	I.F.
180	200	135K	150K	I.F.
180	200	165K	150K	N.O.
180	200	165K	150K	N.O.
Note: For isolated inverters, shall indicate a fault in accordance with 13.9 (operation is allowed); the fault indication shall be maintained until the array insulation resistance has recovered to a value higher than the limit above For non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, shall indicate a fault in accordance with 13.9, and shall not connect to the mains; the inverter may continue to make the measurement, may stop indicating a fault and may connect to the mains if the array insulation resistance has recovered to a value higher than the limit above. It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel. I.F.: Isolation Fault, N.O.: Normal Operation $R^* = \text{Array Insulation Resistance Detection Setting} = 150K\Omega \geq (V_{MAX\ PV} / 30mA)\Omega$				
Supplementary information:				

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict

4.8.3.2	TABLE: 30mA touch current type test for isolated inverters		N/A
Condition		Current (mA)	Limit (30mA)
DC+ to PE			30mA
DC- to PE			30mA
Supplementary information: The touch current measurement circuit of IEC 60990, Figure 4 is connected from each terminal of the array to ground, one at a time.			

4.8.3.3	TABLE: Fire hazard residual current type test for isolated inverters		N/A
Condition		Current (mA)	Limit (300mA or 10mA per kVA)
DC+ to PE			10mA/kW
DC- to PE			10mA/kW
Supplementary information:			

4.8.3.5	TABLE: Protection by residual current monitoring		P
Test conditions: Output power (kVA) : 50 Input voltage (V_{DC}): 600 Frequency (Hz): 50 Output AC Voltage (V_{AC}): 230			
4.8.3.5.2	Test for detection of excessive continuous residual current		P
Fault Current (mA)		Disconnection time (ms)	
Measured Fault Current	Limit 300mA for output power \leq 30 kVA 10mA per kVA for output power $>$ 30 kVA	Measured Disconnection time	Limit
+ PV to N:			
273	500	97	300
272	500	94	300
273	500	88	300
267	500	100	300
269	500	95	300
- PV to N:			
266	500	90	300
263	500	91	300
262	500	84	300
263	500	106	300
261	500	94	300
Note: – maximum 300mA for inverters with continuous output power rating \leq 30 kVA; – maximum 10mA per kVA of rated continuous output power for inverters with continuous output			

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
<p>power rating > 30 kVA.</p> <p>This test shall be repeated 5 times, and for all 5 tests the time to disconnect shall not exceed 0,3s.</p> <p>The test is repeated for each PV input terminal. It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.</p> <p>Supplementary information:</p>			

4.8.3.5.3	TABLE: Test for detection of sudden changes in residual current		P
+PV to N			
Limit (mA)	U _N	Limit (ms)	
	Disconnection time (ms)		
30	254	300	
30	253	300	
30	260	300	
30	246	300	
30	238	300	
60	93	150	
60	98	150	
60	83	150	
60	86	150	
60	94	150	
150	11	40	
150	9	40	
150	16	40	
150	13	40	
150	25	40	
-PV to N			
Limit (mA)	U _N	Limit (ms)	
	Disconnection time (ms)		
30	246	300	
30	258	300	
30	258	300	
30	250	300	
30	243	300	
60	92	150	
60	90	150	
60	82	150	
60	89	150	
60	95	150	
150	27	40	
150	14	40	
150	27	40	

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
150	18		40
150	19		40
Note: The capacitive current is raised until disconnection. Test condition: $I_c + 30/60/150\text{mA} \leq I_{c\text{max}}$. R₁ is set that 30/60/150mA Flow and switch S is closed.			
Supplementary information:			

- End of test report -

PHOTO DOCUMENTATION

CN220TXF 001 ATTACHMENT 2

for

Grid-connected PV Inverter

R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32,
R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32,
R6-25K-T3-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV,
R6-20K-T3-32-LV

Guangzhou Sanjing Electric Co., Ltd.



This documentation consists of 12 pages (excluding this cover page)

Model: as cover



Figure 1. Front view of R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32, R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32, R6-25K-T3-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV, R6-20K-T3-32-LV



Figure 2. Back view of R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32, R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32, R6-25K-T3-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV, R6-20K-T3-32-LV

Model: as cover



Figure 3. Left view of R6-50K-T4-32, R6-40K-T4-32, R6-36K-T4-32, R6-36K-T3-32, R6-33K-T3-32, R6-30K-T3-32, R6-25K-T3-32, R6-30K-T4-32-LV, R6-25K-T4-32-LV, R6-20K-T3-32-LV



Figure 4. Terminal view of R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV

Model: as cover



Figure 5. Terminal view of R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV



Figure 6. Internal view of R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV

Model: as cover



Figure 7. Internal view of R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV

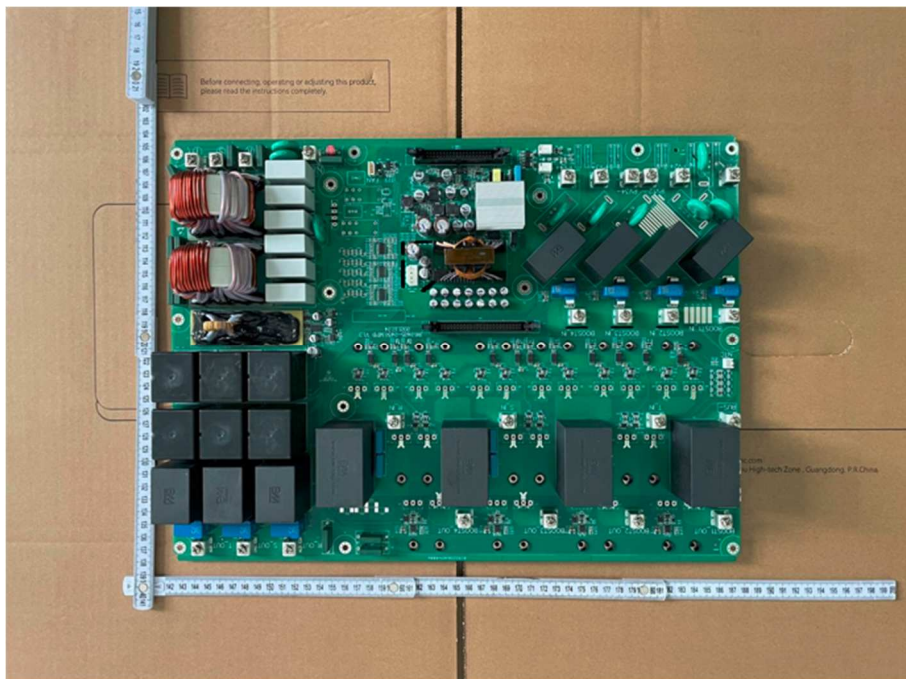


Figure 8. Front view of Main power board for R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV(AC side with varistor)

Model: as cover



Figure 9. Back view of Main power board for R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV(AC side with varistor)

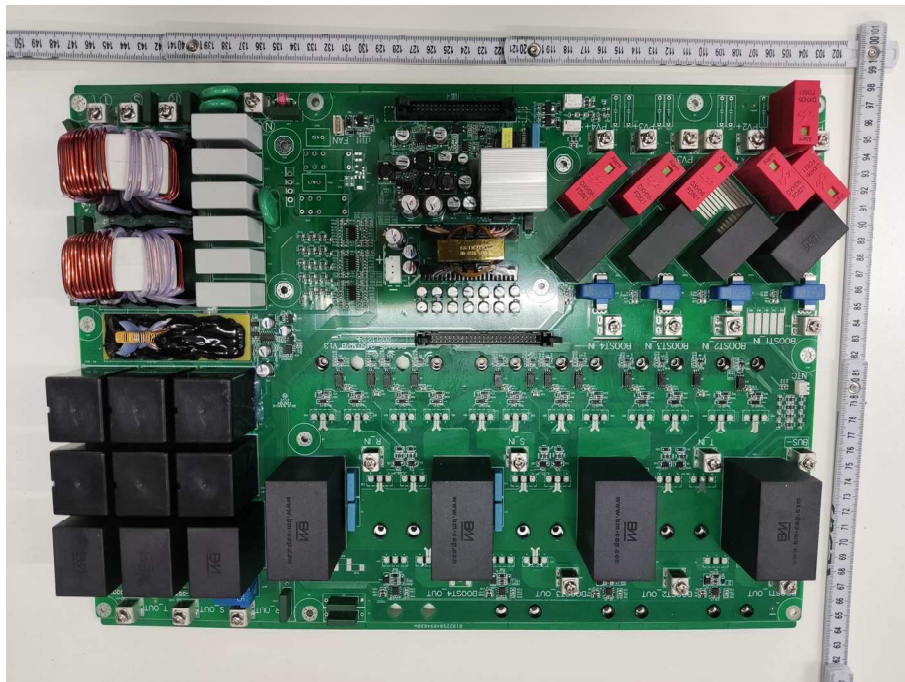


Figure 10. Front view of Main power board for R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV(AC side with Surge Protector version)

Model: as cover



Figure 11. Back view of Main power board for R6-36K-T4-32, R6-40K-T4-32, R6-50K-T4-32, R6-25K-T4-32-LV, R6-30K-T4-32-LV(AC side with Surge Protector version)



Figure 12. Front view of Main power board for R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV(AC side with varistor)

Model: as cover

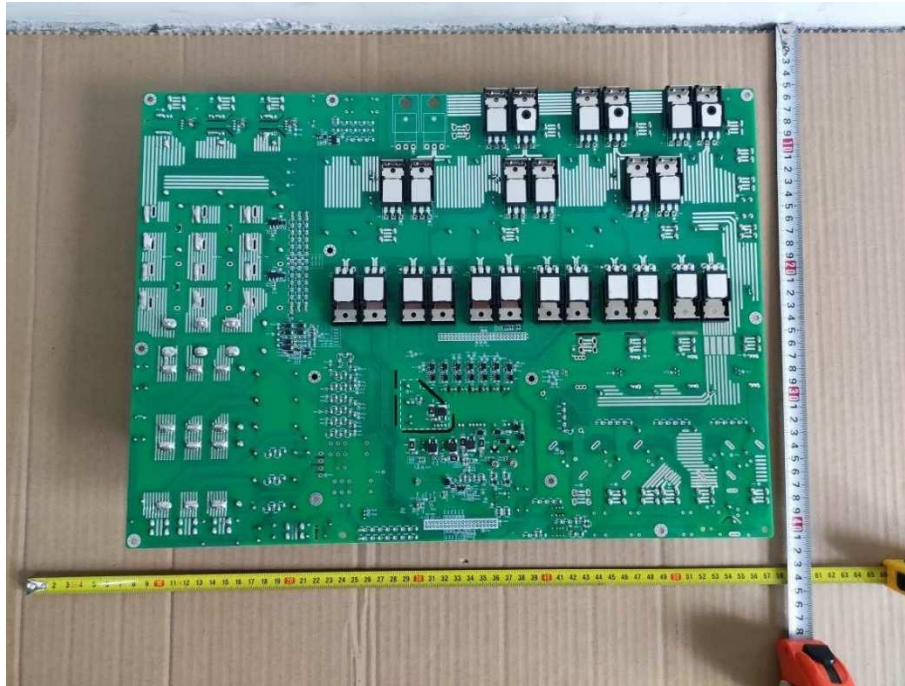


Figure 13. Back view of Main power board for R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV(AC side with varistor)

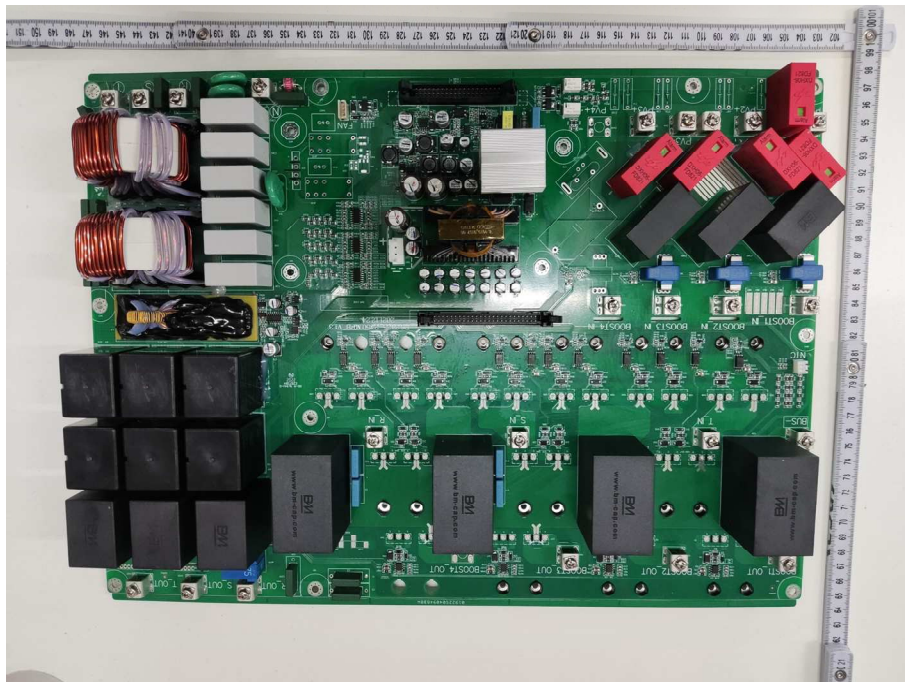


Figure 14. Front view of Main power board for R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV(AC side with Surge Protector version)

Model: as cover



Figure 15. Back view of Main power board for R6-25K-T3-32, R6-30K-T3-32, R6-33K-T3-32, R6-36K-T3-32, R6-20K-T3-32-LV(AC side with Surge Protector version)



Figure 16. Front view of Control communication board

Model: as cover

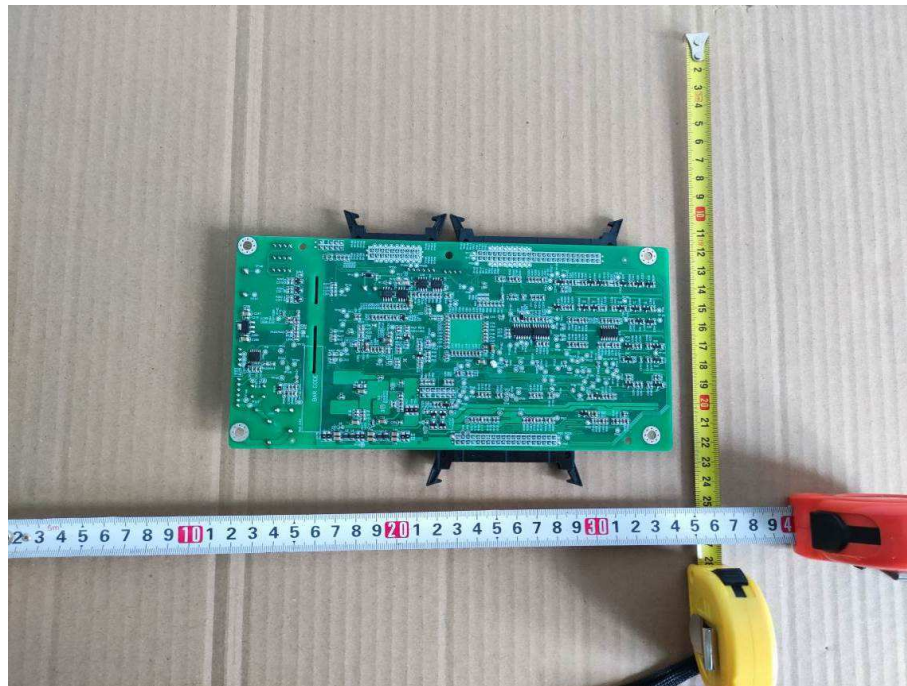


Figure 17. Back view of Control communication board



Figure 18. Front view of Display board

Model: as cover

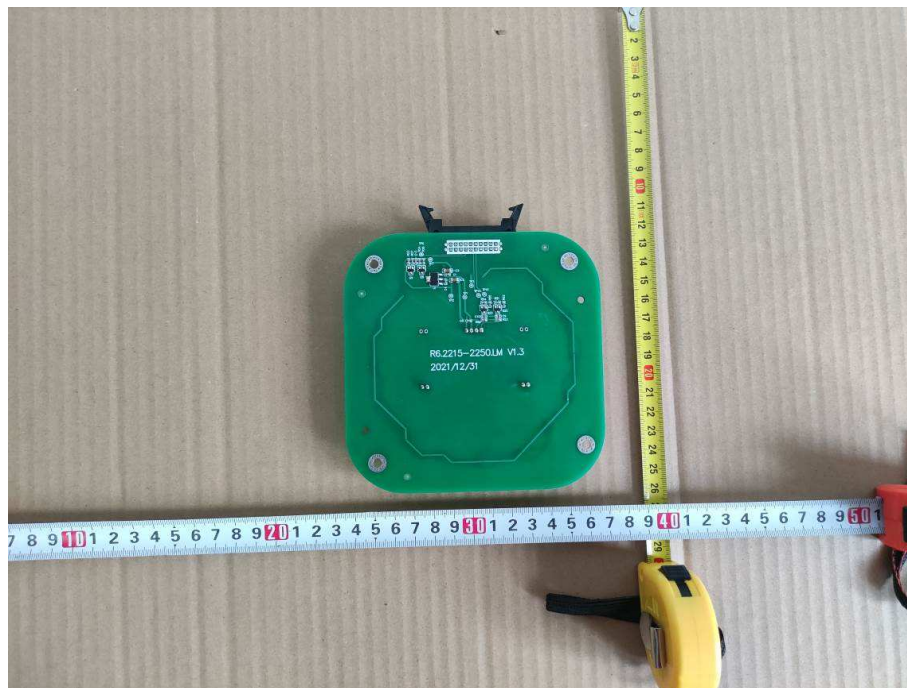


Figure 19. Back view of Display board



Figure 20. Front view of Capacitance. board

Model: as cover

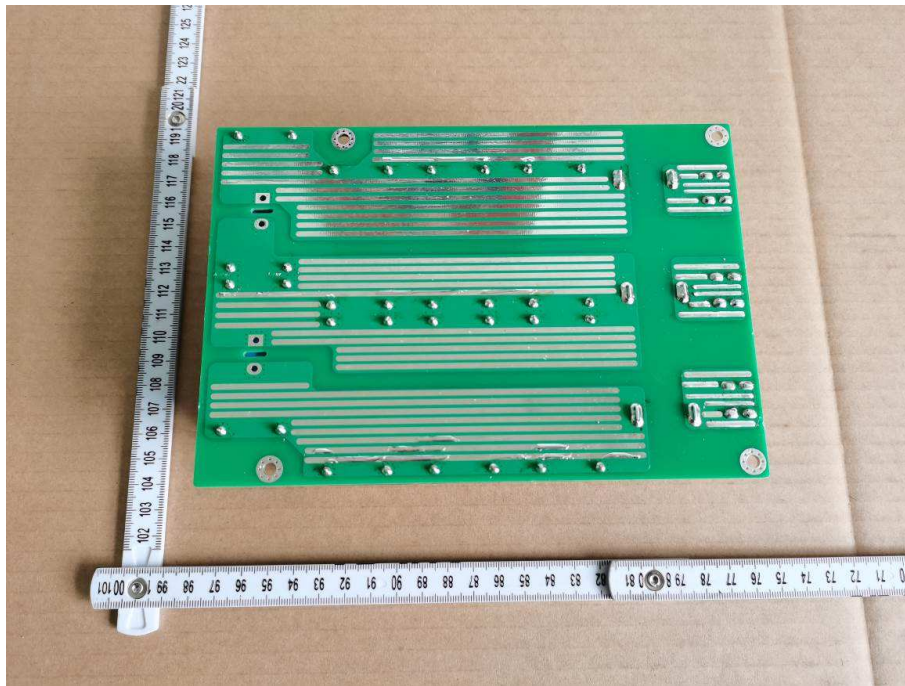


Figure 21. Back view of Capacitance. board

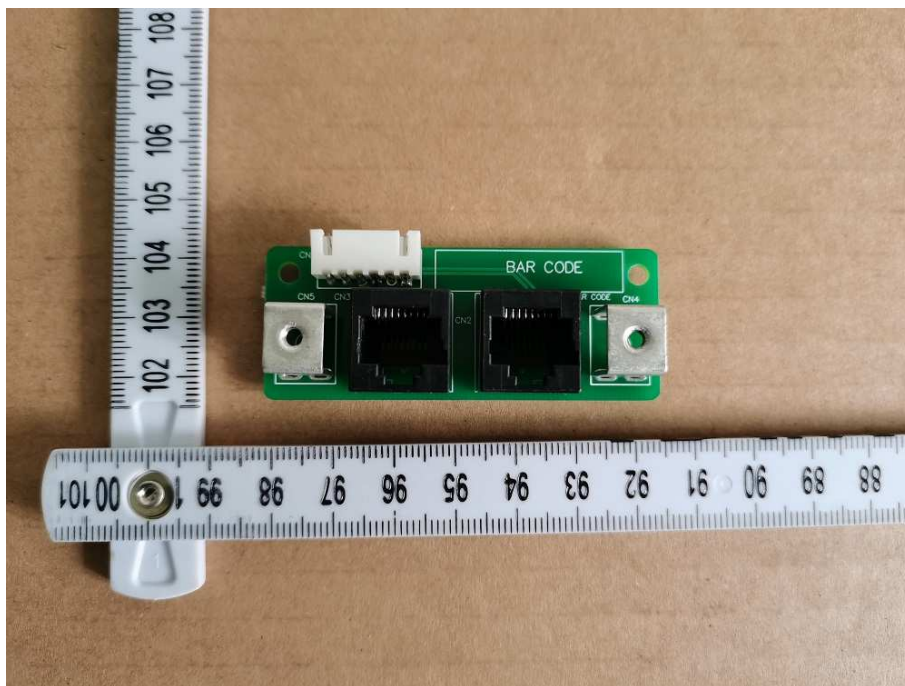


Figure 22. Front view of Communication board

Model: as cover

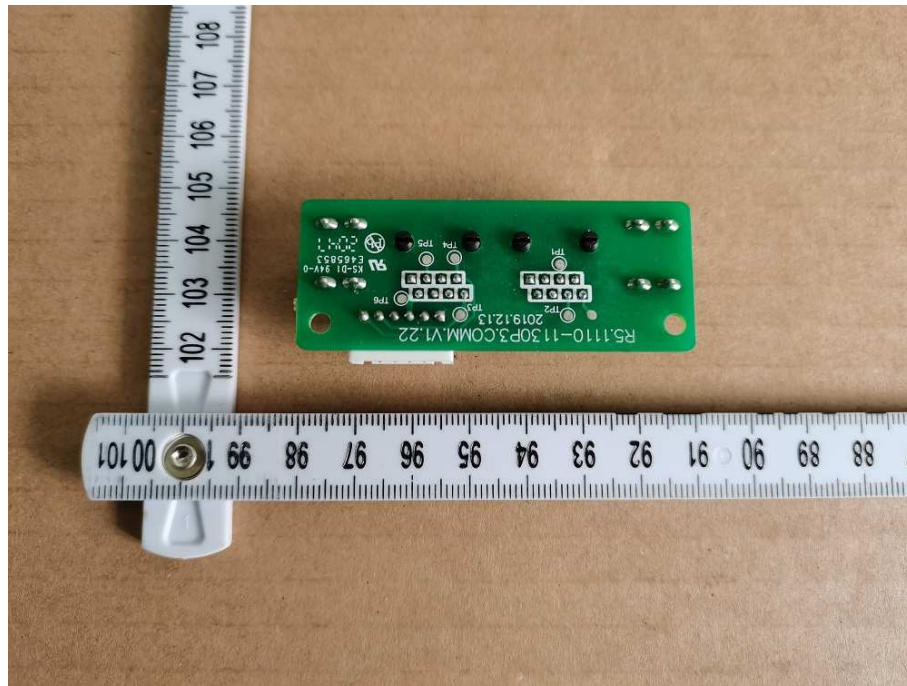


Figure 23. Back view of Communication board