


<b>Prüfbericht-Nr.:</b> <i>Test report no.:</i>	<b>CN26TBUE 001</b>	<b>Auftrags-Nr.:</b> <i>Order no.:</i>	<b>27224645</b>	Seite 1 von 102 Page 1 of 102
<b>Kunden-Referenz-Nr.:</b> <i>Client reference no.:</i>	<b>2752991</b>	<b>Auftragsdatum:</b> <i>Order date:</i>	<b>2026.03.18</b>	
<b>Auftraggeber:</b> <i>Client:</i>	SunEnergyXT Holdings S.à r.l. 1 Rue Jean Piret L-2350 Luxembourg Luxembourg			
<b>Prüfgegenstand:</b> <i>Test item:</i>	Hybrid Energy Storage System			
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type no.:</i>	SunEnergyXT 500 PRO, SunEnergyXT 500			
<b>Auftrags-Inhalt:</b> <i>Order content:</i>	TÜV Mark Approval			
<b>Prüfgrundlage:</b> <i>Test specification:</i>	EN 62109-1:2010, IEC 62109-1:2010 EN 62109-2:2011, IEC 62109-2:2011			
<b>Wareneingangsdatum:</b> <i>Date of sample receipt:</i>	2026.01.25			
<b>Prüfmuster-Nr.:</b> <i>Test sample no.:</i>	A004233168-001			
<b>Prüfzeitraum:</b> <i>Testing period:</i>	2026.01.25 - 2026.03.25			
<b>Ort der Prüfung:</b> <i>Place of testing:</i>	See page 5			
<b>Prüflaboratorium:</b> <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
<b>Prüfergebnis*:</b> <i>Test result*:</i>	Pass			
<b>erstellt von:</b> <i>created by:</i>	<i>Lucas Zheng</i> Lucas Zheng			
<b>Datum:</b> <i>Date:</i>	2026.04.02	<b>Ausstellungsdatum:</b> <i>Issue date:</i>	2026.04.02	
<b>Stellung / Position:</b>	Project Engineer	<b>Stellung / Position:</b>	Authorizer	
<b>Sonstiges /</b> <i>Other:</i>	1. For issuing TÜV Mark Approval certificate. 2. The report consists of 102 pages for IEC/EN 62109-1 (including this cover page), besides: - ATTACHMENT 1 – Test report of IEC/EN 62109-2: 2011 (24 pages) - ATTACHMENT 2 – EMF Assessment report (2 pages) - ATTACHMENT 3 – Photo Documentation (11 pages excluding cover page)			
<b>Zustand des Prüfgegenstandes bei Anlieferung:</b> <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
<p><b>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.</b>  <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></p>				

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Test report no.:

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**Anmerkungen**  
*Remarks*

1	<p>Alle eingesetzten Prüfmittel waren zum angegebenen Prüfzeitraum gemäß eines festgelegten Kalibrierungsprogramms unseres Prüfhauses kalibriert. Sie entsprechen den in den Prüfprogrammen hinterlegten Anforderungen. Die Rückverfolgbarkeit der eingesetzten Prüfmittel ist durch die Einhaltung der Regelungen unseres Managementsystems gegeben. Detaillierte Informationen bezüglich Prüfbedingungen, Prüfequipment und Messunsicherheiten sind im Prüflabor vorhanden und können auf Wunsch bereitgestellt werden.</p> <p><i>The equipment used during the specified testing period was calibrated according to our test laboratory calibration program. The equipment fulfils the requirements included in the relevant standards. The traceability of the test equipment used is ensured by compliance with the regulations of our management system. Detailed information regarding test conditions, equipment and measurement uncertainty is available in the test laboratory and could be provided on request.</i></p>
2	<p>Wie vertraglich vereinbart, wurde dieses Dokument nur digital unterzeichnet. Der TÜV Rheinland hat nicht überprüft, welche rechtlichen oder sonstigen diesbezüglichen Anforderungen für dieses Dokument gelten. Diese Überprüfung liegt in der Verantwortung des Benutzers dieses Dokuments. Auf Verlangen des Kunden kann der TÜV Rheinland die Gültigkeit der digitalen Signatur durch ein gesondertes Dokument bestätigen. Diese Anfrage ist an unseren Vertrieb zu richten. Eine Umweltgebühr für einen solchen zusätzlichen Service wird erhoben. Informationen zur Verifizierung der Authentizität unserer Dokumente erhalten Sie auf folgender Webseite: <a href="http://go.tuv.com/digital-signature">go.tuv.com/digital-signature</a></p> <p><i>As contractually agreed, this document has been signed digitally only. TUV Rheinland has not verified and unable to verify which legal or other pertaining requirements are applicable for this document. Such verification is within the responsibility of the user of this document. Upon request by its client, TUV Rheinland can confirm the validity of the digital signature by a separate document. Such request shall be addressed to our Sales department. An environmental fee for such additional service will be charged. For information on verifying the authenticity of our documents, please visit the following website: <a href="http://go.tuv.com/digital-signature">go.tuv.com/digital-signature</a></i></p>
3	<p>Prüfklausel mit der Note * wurden an qualifizierte Unterauftragnehmer vergeben und sind unter der jeweiligen Prüfklausel des Berichts beschrieben. Abweichungen von Prüfspezifikation(en) oder Kundenanforderungen sind in der jeweiligen Prüfklausel im Bericht aufgeführt.</p> <p><i>Test clauses with remark of * are subcontracted to qualified subcontractors and described under the respective test clause in the report. Deviations of testing specification(s) or customer requirements are listed in specific test clause in the report.</i></p>
4	<p>Die Entscheidungsregel für Konformitätserklärungen basierend auf numerischen Messergebnissen in diesem Prüfbericht basiert auf der "Null-Grenzwert-Regel" und der "Einfachen Akzeptanz" gemäß ILAC G8:2019 und IEC Guide 115:2021, es sei denn, in der auf Seite 1 dieses Berichts genannten angewandten Norm ist etwas anderes festgelegt oder vom Kunden gewünscht. Dies bedeutet, dass die Messunsicherheit nicht berücksichtigt wird und daher auch nicht im Prüfbericht angegeben wird. Zu weiteren Informationen bezüglich des Risikos durch diese Entscheidungsregel siehe ILAC G8:2019.</p> <p><i>The decision rule for statements of conformity, based on numerical measurement results, in this test report is based on the "Zero Guard Band Rule" and "Simple Acceptance" in accordance with ILAC G8:2019 and IEC Guide 115:2021, unless otherwise specified in the applied standard mentioned on Page 1 of this report or requested by the customer. This means that measurement uncertainty is not taken in account and hence also not declared in the test report. For additional information to the resulting risk based of this decision rule please refer to ILAC G8:2019.</i></p>

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

**Report Number**..... : **CN26TBUE 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** ..... : **SunEnergyXT Holdings S.à r.l.**  
**Address** ..... : 1 Rue Jean Piret L-2350 Luxembourg Luxembourg

**Test specification:**  
**Standard** ..... : IEC/EN 62109-1:2010  
**Test procedure**..... : TÜV Mark 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.  
 This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

<b>Test item description .....</b>	Hybrid Energy Storage System	
<b>Trade Mark .....</b>		
<b>Manufacturer .....</b>	Same as applicant	
<b>Model/Type reference.....</b>	SunEnergyXT 500 PRO, SunEnergyXT 500	
<b>Ratings .....</b>	MAX PV Input Voltage: 60Vdc, MAX BAT Input Voltage: 18Vdc, Rated Grid Voltage: 230Vac, W+N+PE	
<b>Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):</b>		
<input checked="" type="checkbox"/>	<b>Testing Laboratory:</b>	<b>TÜV Rheinland (Shenzhen) Co., Ltd.</b>
	<b>Testing location/ address .....</b>	See page 5
	<b>Tested by (name, function, signature) .....</b>	Lucas Zheng      See cover page
	<b>Approved by (name, function, signature) ..</b>	Eric Zeng      See cover page
<input type="checkbox"/>	<b>Associated CB Testing Laboratory:</b>	
	<b>Testing location/ address .....</b>	
	<b>Tested by (name, function, signature) .....</b>	
	<b>Approved by (name, function, signature) ..</b>	
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 1:</b>	
	<b>Testing location/ address .....</b>	
	<b>Tested by (name, function, signature) .....</b>	
	<b>Approved by (name, function, signature) ..</b>	
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 2:</b>	
	<b>Testing location/ address .....</b>	
	<b>Tested by (name + signature).....</b>	
	<b>Witnessed by (name, function, signature) . :</b>	
	<b>Approved by (name, function, signature) ..</b>	
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 3:</b>	
<input type="checkbox"/>	<b>Testing procedure: CTF Stage 4:</b>	
	<b>Testing location/ address .....</b>	
	<b>Tested by (name, function, signature) .....</b>	
	<b>Witnessed by (name, function, signature) . :</b>	
	<b>Approved by (name, function, signature) ..</b>	
	<b>Supervised by (name, function, signature) :</b>	

<b>List of Attachments (including a total number of pages in each attachment):</b> <ul style="list-style-type: none"> <li>- ATTACHMENT 1 – Test report of IEC 62109-2: 2011 (24 pages)</li> <li>- ATTACHMENT 2 – EMF Assessment report (2 pages)</li> <li>- ATTACHMENT 3 – Photo Documentation (11 pages excluding cover page)</li> </ul>	
<b>Summary of testing:</b>	
<b>Tests performed (name of test and test clause):</b> The critical tests were performed for this equipment included clauses 4.2.2.6, 4.2.2.7, 4.3, 4.4, 4.5, 4.6, 4.7, 5.1.2, 6.3, 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, 13.7 in scope of this standard, for temperature test the thermocouples method used, regarding fault condition test simulated faults applied.	<b>Testing location:</b> <b>TMP</b> CVC Testing Technology (Shenzhen) Co., Ltd. No. 1301-14&16, Guanguang Road, Xinlan Community, Guanlan Subdistrict, Longhua District, Shenzhen, Guangdong, China
<b>Summary of compliance with National Differences (List of countries addressed):</b> N/A.	

**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.

## Hybrid Energy Storage System

**PV Input**

Max PV Input Power:	2500W
PV Breakdown Voltage:	100Vdc
Max PV Input Voltage:	60Vdc
PV MPPT Voltage Range:	20-60Vdc
Max PV Input Current:	4*22Adc
PV Isc:	4*25Adc

**Battery Input/Output**

Rated Battery Input/Output Voltage:	16Vdc
Max Battery Input/Output Current:	160Adc/160Adc
Max Battery Input/Output Power:	2400W/2600W
Rated Capacity:	314Ah
Rated Energy:	5024Wh

**Grid Output**

Rated Grid Voltage:	230Vac
Rated Grid Frequency:	50/60Hz
Max Grid Output Apparent Power:	800VA
Rated Grid Output Power:	800W
Rated Output Current:	3.48Aac
Max Output Current:	3.86Aac

**Grid Input**

Max Grid Input Apparent Power:	2400VA
Max Grid Input Voltage:	253Vac
Max Grid Input Current:	12Aac

**Backup Output**

Rated Backup Voltage:	230Vac
Rated Backup Frequency:	50/60Hz
Max Backup Power:	2400W
Max Backup Current:	10.44Aac




**General Information**







System Model:	SunEnergyXT 500
Power Factor Range:	0.8 leading ~ 0.8 lagging
Ingress Protection:	IP65
Operating Temperature:	-20°C ~ +55°C
Protective Class:	Class I
Overvoltage Category:	DC II/ACIII

IFpP75/174/208/(1P5S)M/-10+50/95

**EU REP**

Importer: Safety Tax Free GmbH  
 Address: Zeppelinstr. 33, 85748 Garching b. München, Germany  
 Web: www.sunenergyxt.com Email: support@sunenergyxt.com  
 Manufacturer: SunEnergyXT Holdings S.à r.l.  
 Address: 1, Rue Jean Piret, L-2350 Luxembourg

Made in China

## Hybrid Energy Storage System

**PV Input**

Max PV Input Power:	2500W
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Rated Battery Input/Output Voltage:	16Vdc
Max Battery Input/Output Current:	160Adc/160Adc
Max Battery Input/Output Power:	2400W/2600W
Rated Capacity:	314Ah
Rated Energy:	5024Wh

**Grid Output**

Rated Grid Voltage:	230Vac
Rated Grid Frequency:	50/60Hz
Max Grid Output Apparent Power:	2400VA
Rated Grid Output Power:	2400W
Rated Output Current:	10.44Aac
Max Output Current:	11.6Aac

**Grid Input**

Max Grid Input Apparent Power:	2400VA
Max Grid Input Voltage:	253Vac
Max Grid Input Current:	12Aac

**Backup Output**

Rated Backup Voltage:	230Vac
Rated Backup Frequency:	50/60Hz
Max Backup Power:	2400W
Max Backup Current:	10.44Aac




**General Information**







System Model:	SunEnergyXT 500 PRO
Power Factor Range:	0.8 leading ~ 0.8 lagging
Ingress Protection:	IP65
Operating Temperature:	-20°C ~ +55°C
Protective Class:	Class I
Overvoltage Category:	DC II/ACIII

IFpP75/174/208/(1P5S)M/-10+50/95

**EU REP**

Importer: Safety Tax Free GmbH  
 Address: Zeppelinstr. 33, 85748 Garching b. München, Germany  
 Web: www.sunenergyxt.com Email: support@sunenergyxt.com  
 Manufacturer: SunEnergyXT Holdings S.à r.l.  
 Address: 1, Rue Jean Piret, L-2350 Luxembourg

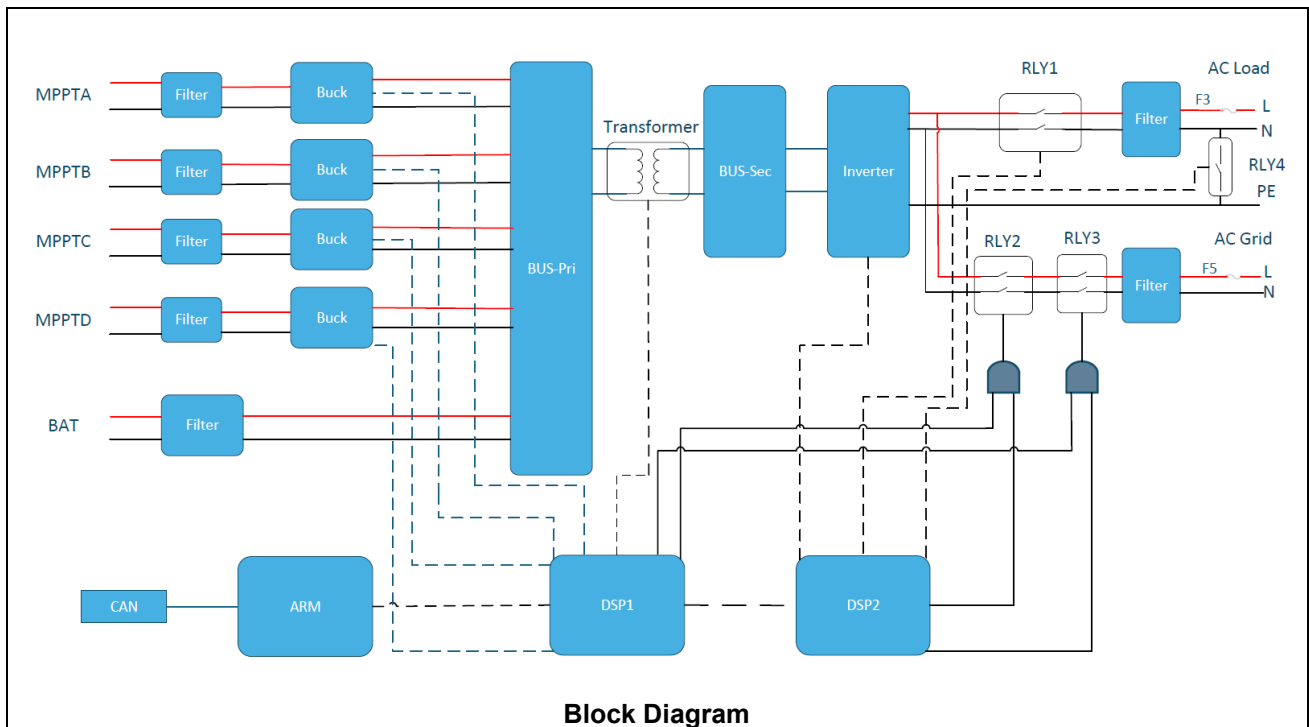




Made in China

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

<b>General remarks:</b>	
<p>“(See Enclosure #)” refers to additional information appended to the report.  “(See appended table)” refers to a table appended to the report.</p> <p><b>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</b></p>	
<b>Manufacturer’s Declaration per sub-clause 4.2.5 of IEC 62109-2:</b>	
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"/> <b>Yes</b> <input checked="" type="checkbox"/> <b>Not applicable</b>
<b>When differences exist; they shall be identified in the General product information section.</b>	
<b>Name and address of factory (ies) .....</b> :	<b>Huizhou Topband Electrical Technology Co., Ltd</b> No.113 Dongxin Avenue, Dongxing Area & 101, 102, 103, 201, 301, Building 3, Building 1 Xingyun East Road, Dongjiang High tech Industrial Park, Zhongkai High tech Zone, Huizhou City, Guangdong P.R. China
<b>History of amendments and modifications:</b>	
N/A	
<b>General product information:</b>	
<b>Product Description:</b>	
<p>The equipment with model name SunEnergyXT 500 PRO, SunEnergyXT 500 are single-phase Energy Storage System, which will be installed and connected to the grid after installation. The equipment shall be fixed to suitable manner as specified in the installation instruction.</p> <p>The EUTs contains filters for smoothing the output voltage and for EMC, switching and control circuits. Electronic circuits are mounted on a number of PCBs interconnected by appropriate connectors and wires. Power board including electronics components is mounted on the heat sink to earthing by metal screw and spring washer.</p> <p>This system includes a battery module model SunEnergyXT B500, which uses LiFePO<sub>4</sub> batteries. The PV input combine 4 string MPPT tracers and each MPPT tracer including 1 pair of PV input terminals. The AC output direct connected to grid and protective Earthing are provided by dedicated earthing terminals. The grid is protected by an isolation transformer and a set of relays as redundancy to ensure that the inverter is independently disconnected from the grid in the event of a relay failure.</p> <p>During fault condition defined in this standard, after the DSP receives the abnormal signal from the relevant protective detection circuit, the relays will operate to disconnect the DC active lines from grid automatically.</p> <p>The maximum ambient temperature permitted by the manufacturer’s specification is 55°C and derate the output power from 45°C.</p> <p>The battery pack has been evaluated according to standard IEC 62619:2022, with report number: CN26IOC4 001.</p>	



### **Model difference:**

The models SunEnergyXT 500 PRO, SunEnergyXT 500 are same as the construction, hardware, and software, expect the output voltage is different due to be adjusted by software.

### **1) Definition of circuits inside of the Energy Storage System**

#### I. PV input circuits

PV input circuits are directly connected to the PV array and the voltage can be up to 60Vdc.  
Decisive voltage A considered for the PV voltage side.

#### II. Battery circuits

The voltage in the battery circuit can be up to 18 Vdc.  
Decisive voltage A considered for the DC voltage side.

#### III. AC output to the AC mains

AC output is single-phase, 230 Vac.  
Decisive voltage C considered for the AC voltage side.

#### IV. Communication

The communication terminals included communication ports CAN which will be connected to the upper computer or network to monitor the status of the inverter by proprietary software.  
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 a heat sink.

### **4) Isolation between decisive voltage A and decisive voltage C**

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


<b>Model List</b>			
<b>MODELS LIST</b>		SunEnergyXT 500 PRO	SunEnergyXT 500
<b>PV Input</b>	V <sub>MAX</sub> PV [Vdc]	60	
	I <sub>SC</sub> PV [A]	4*25	
	MPPT Voltage Range V <sub>MPP</sub> [Vdc]	20-60	
	Max. Input Current I <sub>MAX</sub> [A]	4*22	
	MPPT Full Power Voltage Range [Vdc]	27.5-58	
	Number of MPPT	4	
	String per MPPT	1	
	Overvoltage Category (OVC)	II	
<b>Battery Input/output</b>	Battery Type	LiFePO <sub>4</sub>	
	Battery voltage range [V]	14-18	
	Rated battery voltage [V]	16	
	Max continuous charging/discharging current [A]	160/160	
	Max charging /discharging power [kW]	2.4/2.6	
	Rated Capacity [Ah]	314	
	Rated Energy [Wh]	5024	
	Overvoltage Category (OVC)	II	
<b>Grid Input</b>	Rated Input Voltage [Vac]	230, W+N+PE	
	Rated Input Frequency [Hz]	50/60	
	Rated Input Power [kW]	2.4	
	Max. Input Apparent power [kVA]	2.4	
	Max. Input Current [A]	12	
	Overvoltage Category (OVC)	III	
<b>Grid Output</b>	Rated Output Voltage [Vac]	230, W+N+PE	
	Rated Output Frequency [Hz]	50/60	

	Rated Output Power [kW]	2.4	0.8
	Max. Output Apparent power [kVA]	2.4	0.8
	Rated Output Current [A]	10.44	3.48
	Max. Output Current [A]	11.6	3.86
	Power Factor $\cos\phi$ [ $\lambda$ ]	0.8Leading - 0.8Lagging	
	Oversvoltage Category (OVC)	III	
<b>Backup Output</b>	Rated output power [kW]	2.4	
	Max. output apparent power [kVA]	2.4	
	Max output current [A]	10.44	
	Rated output voltage [Vac]	230, W+N+PE	
	Rated output frequency [Hz]	50/60	
	Oversvoltage Category (OVC)	III	
<b>CONSTRUCTION</b>	Firmware version	V2.1	
	Hardware version	V2.1	
	Type of inverter	Isolated	
	Type of NS Protection	Integrated	
	Protective Class	I	
	Enclosure Protection (IP)	IP65	
	Acoustic Noise	35dB	
	Operating Temperature Range [°C]	-20°C ~55°C (Derating above 45°C)	
	Pollution degree (PD)	3	
	Altitude [m]	2000m	
	Size W*H*D [mm]	536mm*379.7mm*307mm	
	Weight [kg]	58±1	
Note:			

<b>IEC 62109-1</b>			
Clause	Requirement – Test	Result – Remark	Verdict
<b>4</b>	<b>GENERAL TESTING REQUIREMENTS</b>		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	Max. 55°C rated ambient temperature tested.	P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment		P
4.2.2.4	Accessories		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		P
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		N/A
4.2.2.11	Available short circuit current	Considered.	P
4.3	Thermal testing	(See appended table 4.3)	P
4.3.1	General		P
4.3.2	Maximum temperatures		P
4.3.2.1	General	Max environment temperature of EUT is 55°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		N/A
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		P
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
<b>5</b>	<b>MARKING AND DOCUMENTATION</b>		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		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
	– the ingress protection (IP) rating as in 6.3 below	See copy of marking plate	P
5.1.5	Fuse identification		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	No such devices.	N/A

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	be fitted, the fuse voltage rating.		
	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.		P
	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
	– the letters “PE“; or		N/A
	– the colour coding green-yellow.		P
5.1.7	Switches and circuit-breakers		N/A
	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-		N/A

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	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.		
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	No such terminal boxes.	N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:		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 Annex C 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 depth or raised height of at least 0,5 mm.	Considered.	P
	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

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Clause	Requirement – Test	Result – Remark	Verdict
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		N/A
	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.		N/A
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		N/A
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).		N/A
5.2.3	Sonic hazard markings and instructions	No 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,		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
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.		N/A
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.		N/A
5.2.5	Excessive touch current	The touch current does not exceed 3.5 mA a.c. or 10 mA d.c.	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 makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1		P
	– WET LOCATIONS classification 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	2000m	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– <b>OVERVOLTAGE CATEGORY</b> 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	Provided in the instruction manual.	P
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 the installation position shall not prevent access to the disconnection means;		P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and external controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P

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Clause	Requirement – Test	Result – Remark	Verdict
	e) ventilation requirements;		P
	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.	P
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:	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		N/A
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		P
5.3.3	Information related to operation	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		P

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Clause	Requirement – Test	Result – Remark	Verdict
	the effects of adjustment;		
	– 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 information 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)		P
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.		P
5.3.4.1	Battery maintenance		P
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		P
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		P
	– When replacing batteries, replace with the same type and number of batteries or battery packs		P
	– General instructions regarding removal and installation of batteries		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		P
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		P
	– 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:		P
	a) Remove watches, rings, or other metal objects.		P
	b) Use tools with insulated handles.		P
	c) Wear rubber gloves and boots.		P
	d) Do not lay tools or metal parts on top of batteries		P
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		P
	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).		P
<b>6</b>	<b>ENVIRONMENTAL REQUIREMENTS AND CONDITIONS</b>		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
	– 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

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Clause	Requirement – Test	Result – Remark	Verdict
6.3	Ingress Protection	IP65	P
6.4	UV exposure		P
6.5	Temperature and humidity	-20°C~55°C, 0%~95% humidity	P
<b>7</b>	<b>PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS</b>		P
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 to table 6)	DVC-C for >50Vrms/71Vpeak. DVC-C for >120Vdc. DVC-A for <25Vrms/35.4Vpeak. DVC-A for <60Vdc.	P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions	No parts exceeds DVC-A level.	P
7.3.2.4	Requirements for protection (according to 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)	Nominal 230Va.c.	P
7.3.2.6.3	DC working voltage (see Figure 3)	PV: Max. 60Vd.c. Battery: Max 18Vd.c.	P
7.3.2.6.4	Pulsating working voltage (see Figure 4)	Considered.	P
7.3.3	Protective separation		P
	Protective separation shall be achieved by:		P
	<ul style="list-style-type: none"> <li>▪ double or reinforced insulation, or</li> </ul>	Protective separation applied between decisive voltage C and accessible unearthed parts with corresponding overvoltage category.	P
	<ul style="list-style-type: none"> <li>▪ 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</li> </ul>	Protective separation applied between decisive voltage C and accessible earthed metal enclosure with corresponding overvoltage category.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	<ul style="list-style-type: none"> <li>▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>▪ limitation of voltage according to 7.3.5.4.</li> </ul>		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact		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 measures 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).	Enclosure can't be removed without use of tools.	P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6		N/A
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Considered.	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	Considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	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
	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	PCE is not energized since DC input and AC output are	P

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Clause	Requirement – Test	Result – Remark	Verdict
		disconnected before servicing	
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		P
	– is limited in voltage according to 7.3.5.4		N/A
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with 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, PV terminal and Battery terminal applied.	P
7.3.5.3	Protection by means of protective impedance		P
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		P
7.3.5.3.1	Limitation of current through protective impedance		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		P
7.3.5.3.2	Limitation of discharging energy through protective impedance		P
	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.		P
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.		P
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 voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		N/A
	Where protection against indirect contact is dependent on means provided during installation,	The manual requires the PCE must be securely earthed.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	the installation instructions shall provide details of the required means and shall indicate the associated hazards.		
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.	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;		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 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.	No such parts used	N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material		P

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Clause	Requirement – Test	Result – Remark	Verdict
	has been investigated as suitable for protective bonding purposes.		
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 $\Omega$ during or at the end of the test below.		P
	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.		N/A
	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:		P
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;	Permanent connection	N/A
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.	In the end installation, the overcurrent device will be provided.	P
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
	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.		P
7.3.6.3.3.1	Test current, duration, and acceptance criteria		P
	The test current, duration of the test and acceptance criteria are as follows:	(see appended table 7.3.6.3.3)	P
	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 $\Omega$ .		P
	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.		N/A
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		P
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		P
	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		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
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:		P
	<ul style="list-style-type: none"> <li>▪ 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:</li> </ul>		P
	<ul style="list-style-type: none"> <li>▪ the test duration may be reduced to no less than 2 s</li> </ul>		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.		P
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		N/A
7.3.6.3.5	External protective earthing conductor	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
	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.		N/A
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		P
	<ul style="list-style-type: none"> <li>▪ 2,5 mm<sup>2</sup> if mechanical protection is provided;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>▪ 4 mm<sup>2</sup> if mechanical protection is not provided.</li> </ul>		P

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Clause	Requirement – Test	Result – Remark	Verdict
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.		N/A
7.3.6.3.6	Means of connection for the external protective 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
	<ul style="list-style-type: none"> <li>• symbol 7 of Annex C; or</li> </ul>		P
	<ul style="list-style-type: none"> <li>• the colour coding green-yellow</li> </ul>		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		P
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		P
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5 mA a.c. or mA d.c.	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.	The touch current does not exceed 3.5 mA.	N/A
	a) Permanently connected wiring, and:		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	<ul style="list-style-type: none"> <li>a cross-section of the protective earthing conductor of at least 10 mm<sup>2</sup> Cu or 16 mm<sup>2</sup> Al; or</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>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</li> </ul>		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm <sup>2</sup> as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Class I equipment.	N/A
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		N/A
	<ul style="list-style-type: none"> <li>equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-</li> </ul>		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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;		
	<ul style="list-style-type: none"> <li>metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>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;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>equipment employing protective class II shall be marked according to 5.1.8.</li> </ul>	Class I equipment.	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"> <li>pollution degree</li> </ul>	Pollution degree 2 internally	P
	<ul style="list-style-type: none"> <li>overvoltage category</li> </ul>	For DC side circuits: Overvoltage Category II For AC side circuits: Overvoltage Category III	P
	<ul style="list-style-type: none"> <li>supply earthing system</li> </ul>	TN system considered.	P
	<ul style="list-style-type: none"> <li>insulation voltage</li> </ul>	Considered	P
	<ul style="list-style-type: none"> <li>location of insulation</li> </ul>	Considered	P
	<ul style="list-style-type: none"> <li>type of insulation</li> </ul>	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"> <li>TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective</li> </ul>		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
	<ul style="list-style-type: none"> <li>• 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;</li> </ul>		N/A
	<ul style="list-style-type: none"> <li>• 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.</li> </ul>		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
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		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		P

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Clause	Requirement – Test	Result – Remark	Verdict
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		N/A
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		N/A
7.3.7.8.6	Potting materials	No such material.	N/A
7.3.7.9	Insulation requirements above 30 kHz	Considered.	N/A
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 or energy hazard from charge stored on capacitors after disconnection of the PCE.	Symbol 21 of Annex C and an indication of the discharge time used in a clearly visible position.	P
7.4	Protection against energy hazards	Permanent connection and symbol 21 was attached in product.	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:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	E = 0,5 CU <sup>2</sup>		
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		N/A
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	(see appended table 7.3.6.3.7)	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.5	Equipment with multiple sources of supply		P
<b>8</b>	<b>PROTECTION AGAINST MECHANICAL HAZARDS</b>		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		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.		N/A
8.2.1	Protection of service persons		P
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.		P
8.3	Stability		P
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.		P
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.		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.		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 that could cause a HAZARD if expelled in the event of a fault.		N/A
<b>9</b>	<b>PROTECTION AGAINST FIRE HAZARDS</b>		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		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
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 LEVEL; and		P
	– 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		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
9.1.3.3	Materials for components and other parts outside fire enclosures		P
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.		P
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 parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.		N/A
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA		N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	<b>COMBUSTIBLE SURFACE ONLY</b>		
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	<b>LIMITED POWER SOURCES</b>		N/A
9.2.1	General		N/A
9.2.2	Limited power source tests		N/A
9.3	Short-circuit and overcurrent protection		P
9.3.1	General		P
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.		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
<b>10</b>	<b>PROTECTION AGAINST SONIC PRESSURE HAZARDS</b>		N/A
10.1	General		N/A
	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 80dBA, no hazards	N/A
10.2	Sonic pressure and Sound level	See above.	N/A
10.2.1	Hazardous Noise Levels		N/A
<b>11</b>	<b>PROTECTION AGAINST LIQUID HAZARDS</b>	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		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	as a result of:		
	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
<b>12</b>	<b>CHEMICAL HAZARDS</b>		N/A
12.1	General		N/A
<b>13</b>	<b>PHYSICAL REQUIREMENTS</b>		P
13.1	Handles and manual controls		P
	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
	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

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Clause	Requirement – Test	Result – Remark	Verdict
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 <sup>2</sup> and greater		N/A
13.3.6	Disconnection from supply sources		N/A
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 wiring gauge is suitable for current intended to be carried.	P
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		N/A
13.5.1	Top and side openings		N/A
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
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		N/A
13.6.2.1	Stress relief test		N/A
13.6.3	Polymers serving as solid insulation		P
13.6.3.1	Resistance to arcing		N/A
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		N/A
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	2.0mm	P
<b>14</b>	<b>COMPONENTS</b>		P
14.1	General	(See appended table 14)	P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional		P

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Clause	Requirement – Test	Result – Remark	Verdict
	applicable safety requirements of the relevant IEC component standard;		
	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		N/A
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperature HAZARD, or a fire HAZARD, shall be protected by an over temperature or thermal protection device meeting the requirements of 14.3.		N/A
14.3	Over temperature protection devices		P
14.4	Fuse holders		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 printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		N/A
	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	Certified components used	P

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Clause	Requirement – Test	Result – Remark	Verdict
	spaced up to 1 min apart.		
14.8	Batteries		P
	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.		P
14.8.1	Battery Enclosure Ventilation		P
14.8.1.1	Ventilation requirements		P
14.8.1.2	Ventilation testing		P
14.8.1.3	Ventilation instructions		P
14.8.2	Battery Mounting		P
	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.		P
14.8.3	Electrolyte spillage		P
	Battery trays and cabinets shall have an electrolyte-resistant coating.		P
	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:		P
	a) reaching the PCE outer surfaces that can be contacted by the USER		P
	b) contaminating adjacent electrical components or materials; and		P
	c) bridging required electrical distances		P
14.8.4	Battery Connections		P
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		P
14.8.5	Battery maintenance instructions		P
	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.		P
14.8.6	Battery accessibility and maintainability		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		P
15	Software and firmware performing safety functions	Single fault tests simulated for equipment. No critical hazard listed in this standard occur.	P

A	<b>Annex A, Measurement of clearance and creepage distances (normative)</b>	<b>P</b>
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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

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Clause	Requirement – Test	Result – Remark	Verdict
B.2.1	Risk Analysis		N/A
B.2.1.1	A risk analysis shall be conducted to determine a set of risks and that the software addresses the identified risks. The risk analysis shall be conducted based on the safety requirements for the programmable component.		N/A
B.2.1.3	An analysis shall be conducted to identify the critical, non-critical, and supervisory parts of the software.		N/A
B.2.1.4	An analysis shall be conducted to identify transitions or states that can result in a risk.		N/A
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

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Clause	Requirement – Test	Result – Remark	Verdict
G.2	Creepage distance		N/A
H.	Annex J, Measuring Instrument for Touch Current Measurements		P
H.1	Measuring instrument	Considered.	P
H.2	Alternative measuring instrument	Not used.	N/A
I.	Annex K, Examples of Protection, Insulation, and Overvoltage Category Requirements for PCE		P
I.1	Protection, Insulation and Overvoltage	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	<b>TABLE: electrical data</b>					<b>P</b>
<b>SunEnergyXT 500 PRO</b>						
<b>1)PV-Grid</b>						
<b>Input (PV)</b>			<b>Output (Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
20.00	90.79	1815.84	230.06	6.65	1527.34	0.999
27.43	90.04	2469.07	229.82	10.39	2386.46	0.999
57.92	43.14	2498.06	229.82	10.38	2382.87	0.999
59.92	41.76	2501.57	229.82	10.39	2384.97	0.999
Tested at 60Hz						
20.06	90.70	1818.83	230.11	6.62	1525.34	0.999
27.49	90.01	2467.35	229.92	10.50	2389.46	0.999
58.05	43.10	2498.73	229.82	10.38	2382.68	0.999
59.88	41.74	2504.58	230.02	10.42	2388.30	0.999
<b>2)PV-BAT</b>						
<b>Input (PV)</b>			<b>Output (BAT)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
20.01	90.45	1809.62	16.10	101.67	-1637.07	--
27.50	90.25	2482.09	16.10	139.13	-2240.46	--
58.05	43.33	2515.12	16.10	142.98	-2302.33	--
60.05	42.18	2533.22	16.10	143.00	-2318.42	--
<b>3)PV-Off Grid</b>						
<b>Input (PV)</b>			<b>Output (Off Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
20.06	90.26	1810.84	231.01	6.85	1582.55	1.000
27.42	89.87	2463.83	230.91	9.30	2146.54	1.000
57.94	42.44	2454.58	230.90	10.39	2398.61	1.000
59.75	40.95	2443.40	230.91	10.38	2397.84	1.000
Tested at 60Hz						
20.08	90.29	1812.21	230.56	7.05	1587.54	1.000
27.47	89.9	2467.83	230.60	9.27	2143.53	1.000
57.96	42.41	2457.63	230.70	10.34	2403.59	1.000
59.85	40.93	2440.40	230.51	10.08	2395.84	1.000

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Clause	Requirement – Test			Result – Remark		Verdict
<b>4)Bat-Grid</b>						
<b>Input (Bat)</b>			<b>Output (Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
13.94	162.00	2251.46	229.80	8.61	1976.00	0.999
14.93	160.52	2385.16	229.81	9.25	2123.81	0.999
15.93	160.62	2504.03	229.85	9.88	2269.00	0.999
18.18	146.19	2592.71	229.83	10.35	2377.92	0.999
Tested at 60Hz						
13.86	162.00	2249.46	229.89	8.41	1970.99	1.000
14.94	160.47	2383.99	230.61	9.28	2126.65	1.000
16.16	160.49	2505.21	230.05	9.83	2266.00	1.000
18.08	146.17	2591.52	230.13	10.37	2376.94	1.000
<b>5)Grid-Bat</b>						
<b>Output (Bat)</b>			<b>Input (Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
13.95	153.96	2142.73	229.36	10.44	2392.10	0.999
14.95	144.71	2159.40	229.36	10.44	2393.22	0.999
15.95	136.53	2173.94	229.36	10.46	2396.78	0.999
17.94	101.02	1783.44	229.40	8.50	1947.53	0.999
Tested at 60Hz						
13.97	153.99	2143.82	229.66	10.64	2394.10	0.999
14.93	144.73	2158.41	229.55	10.64	2401.24	0.999
15.98	136.50	2174.95	229.56	10.44	2398.82	0.999
17.96	101.12	1783.48	229.65	8.52	1943.91	0.999
<b>6)Bat-Off Grid</b>						
<b>Input (Bat)</b>			<b>Output (Off Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
14.02	160.09	2200.73	231.11	8.54	1972.90	1.000
15.02	161.85	2381.38	231.14	9.27	2141.70	1.000
18.27	147.53	2630.49	230.83	10.40	2400.72	1.000
Tested at 60Hz						
14.01	160.10	2201.28	230.61	8.56	1974.07	1.000
15.00	161.86	2382.81	230.64	9.30	2146.70	1.000

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Clause	Requirement – Test			Result – Remark		Verdict
18.17	147.56	2631.38	230.43	10.43	2404.72	1.000
<b>7)Grid-Off Grid</b>						
<b>Input (Grid)</b>			<b>Output (Off-Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
230.10	10.60	2437.40	228.44	10.51	2401.21	1.000
Tested at 60Hz						
230.10	10.66	2432.40	228.94	10.49	2393.22	1.000
<b>SunEnergyXT 500</b>						
<b>1)PV-Grid</b>						
<b>Input (PV)</b>			<b>Output (Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
20.00	46.63	932.67	229.91	3.53	808.40	0.997
27.45	33.97	932.55	229.91	3.52	808.20	0.997
57.84	16.25	939.24	229.91	3.53	808.60	0.997
59.86	15.64	936.16	229.91	3.52	807.88	0.997
Tested at 60Hz						
20.00	46.63	932.67	230.01	3.55	810.40	0.997
27.55	33.98	934.55	230.01	3.53	809.69	0.998
58.04	16.27	941.24	229.96	3.54	810.26	0.998
59.85	15.62	934.15	229.94	3.53	809.87	0.997
<b>2)PV-BAT</b>						
<b>Input (PV)</b>			<b>Output (BAT)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
20.01	90.52	1811.06	16.10	101.74	1638.20	--
27.51	90.31	2484.13	16.11	139.22	2242.00	--
58.06	43.39	2518.87	16.10	143.19	2305.60	--
60.06	42.26	2537.93	16.10	144.29	2322.70	--
<b>3)PV-Off Grid</b>						
<b>Input (PV)</b>			<b>Output (Off Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
20.08	90.33	1812.78	231.03	6.85	1583.46	1.000
27.43	89.99	2466.77	230.93	9.30	2147.47	1.000
57.95	42.35	2454.31	230.68	10.33	2402.75	1.000

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Clause	Requirement – Test			Result – Remark		Verdict
59.84	40.87	2436.84	230.50	10.08	2395.1	1.000
Tested at 60Hz						
20.07	90.20	1810.11	230.55	7.05	1586.61	1.000
27.46	89.80	2464.67	230.59	9.26	2142.71	1.000
57.96	42.41	2457.63	230.70	10.34	2403.59	1.000
59.84	40.87	2436.84	230.49	10.08	2395.84	1.000
<b>4)Bat-Grid</b>						
<b>Input (Bat)</b>			<b>Output (Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
13.91	64.47	896.48	229.90	3.51	804.40	0.997
14.90	59.17	878.08	229.90	3.50	803.58	0.997
15.91	54.32	864.27	229.91	3.50	803.76	0.997
18.15	49.53	898.90	229.86	3.52	806.96	0.997
Tested at 60Hz						
13.92	64.49	898.48	229.90	3.49	802.40	0.998
14.91	59.16	877.58	229.93	3.48	802.88	0.998
15.92	54.33	865.27	229.91	3.51	806.76	0.998
18.16	49.54	899.89	229.87	3.52	808.23	0.998
<b>5)Grid-Bat</b>						
<b>Output (Bat)</b>			<b>Input (Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
13.95	154.13	2145.3	229.36	10.47	2398.50	0.999
14.95	144.99	2163.50	229.36	10.48	2401.40	0.999
15.95	136.79	2178.94	229.37	10.50	2408.50	0.999
17.94	101.38	1788.70	229.41	8.54	1959.00	0.999
Tested at 60Hz						
13.97	154.17	2146.40	229.66	10.67	2400.50	0.999
14.93	145.01	2162.50	229.55	10.68	2409.40	0.999
15.98	136.77	2179.30	229.56	10.49	2410.50	0.999
17.96	101.48	1788.70	229.66	8.56	1955.40	0.999
<b>6)Bat-Off Grid</b>						
<b>Input (Bat)</b>			<b>Output (Off Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						

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Clause	Requirement – Test			Result – Remark		Verdict
14.02	160.14	2201.62	231.13	8.54	1974.05	1.000
15.02	161.91	2382.35	231.15	9.27	2142.75	1.000
18.27	147.59	2631.83	230.84	10.40	2401.58	1.000
Tested at 60Hz						
14.01	160.15	2202.12	230.63	8.56	1975.25	1.000
15.00	161.92	2383.78	230.65	9.30	2147.75	1.000
18.17	147.63	2632.72	230.44	10.43	2405.58	1.000
<b>7)Grid-Off Grid</b>						
<b>Input (Grid)</b>			<b>Output (Off-Grid)</b>			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
Tested at 50Hz						
230.11	10.60	2437.40	228.46	10.51	2402.10	1.000
Tested at 60Hz						
230.10	10.66	2434.00	228.95	10.49	2394.1	1.000

Load step response of the output voltage						
SunEnergyXT 500 PRO						
Battery input (t=1.5s)			Off Grid/AC output (t=1.5s)			
U (V)	I (A)	P (W)	U (V)	Frequency (Hz)	I (A)	P (W)
230V50Hz, no load to full power						
18.27	3.01	20.31	231.46	50.02	0.01	0.25
18.27	146.76	2616.55	230.81	50.02	10.35	2388.37
230V50Hz, full power to no load						
18.27	147.54	2632.10	230.79	50.02	10.40	2399.80
18.27	3.22	23.67	231.46	50.02	0.01	1.89
230V60Hz, no load to full power						
18.26	3.02	18.01	231.06	60.02	0.01	1.00
18.29	146.74	2615.25	230.31	60.02	10.37	2385.36
230V60Hz, full power to no load						
18.28	147.53	2635.43	230.60	60.02	10.36	2393.92
18.29	2.97	23.46	231.26	60.02	0.04	0.57
<b>PV input</b>			<b>Off Grid/AC output (t=1.5s)</b>			
U (V)	I (A)	P (W)	U (V)	Frequency (Hz)	I (A)	P (W)
230V50Hz, no load to full power						
27.61	3.35	26.10	231.39	50.02	0.01	0.73

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Clause	Requirement – Test			Result – Remark		Verdict
27.52	87.26	2400.79	230.90	50.02	9.25	2135.25
58.00	0.48	27.09	231.38	50.02	0.01	1.12
57.94	41.62	2407.46	230.86	50.02	10.34	2387.68
230V50Hz, full power to no load						
27.52	89.61	2465.52	230.8937	50.02	9.282709	2143.31
27.61	3.41	26.48	231.3929	50.02	0.00545	0.62714
57.94	42.43	2454.27	230.8324	50.02	10.37085	2393.919
58.00	0.49	27.90	231.38	50.02	0.003	0.32
230V60Hz, no load to full power						
27.58	3.37	28.40	230.89	60.02	0.01	0.73
27.49	87.26	2398.79	230.40	60.02	9.23	2133.25
58.01	0.46	25.09	230.88	60.02	0.01	1.10
57.95	41.64	2406.13	230.36	60.02	10.31	2382.68
230V60Hz, full power to no load						
27.50	89.31	2459.52	230.49	60.02	9.26	2140.31
27.60	4.39	52.33	230.78	60.02	0.01	0.95
57.97	42.40545	2451.267	230.5324	60.02	10.32085	2389.919
57.97	0.51027	29.89881	231.083	60.02	0.00224	0.31706
<b>SunEnergyXT 500</b>						
<b>Battery input (t=1.5s)</b>			<b>Off Grid/AC output (t=1.5s)</b>			
U (V)	I (A)	P (W)	U (V)	Frequency (Hz)	I (A)	P (W)
230V50Hz, no load to full power						
18.26	3.00	21.02	231.44	50.02	0.01	0.88
18.27	146.66	2620.04	230.57	50.02	10.37	2390.35
230V50Hz, full power to no load						
18.28	147.54	2632.09	230.78	50.02	10.40	2399.52
18.27	3.22	23.67	231.46	50.02	0.01	1.34
230V60Hz, no load to full power						
18.27	2.92	17.91	231.26	60.02	0.01	0.65
18.28	147.03	2612.55	230.21	60.02	10.38	2387.77
230V60Hz, full power to no load						
18.29	147.33	2630.67	230.61	60.02	10.39	2395.13
18.28	2.98	21.87	231.25	60.02	0.04	0.38
<b>PV input</b>			<b>Off Grid/AC output (t=1.5s)</b>			
U (V)	I (A)	P (W)	U (V)	Frequency (Hz)	I (A)	P (W)

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Clause	Requirement – Test			Result – Remark		Verdict
230V50Hz, no load to full power						
27.57	3.37	26.10	231.39	50.02	0.01	0.73
27.55	88.46	2435.79	230.90	50.02	9.25	2135.33
58.00	0.48	27.09	231.38	50.02	0.01	1.12
57.94	41.52	2407.46	230.86	50.02	10.34	2387.68
230V50Hz, full power to no load						
27.53	89.61	2465.52	230.90	50.02	9.28	2104.31
27.58	3.41	26.48	231.41	50.02	0.01	0.63
57.94	42.33	2450.23	230.83	50.02	10.38	2394.01
58.00	0.40	23.30	231.40	50.02	0.003	0.32
230V60Hz, no load to full power						
27.55	3.37	28.40	230.89	60.02	0.01	0.73
27.52	87.26	2398.79	230.40	60.02	9.23	2130.82
58.01	0.46	25.09	230.88	60.02	0.01	1.00
57.98	41.64	2400.15	230.66	60.02	10.34	2372.77
230V60Hz, full power to no load						
27.53	89.31	2455.33	230.39	60.02	9.26	2128.39
27.58	4.39	52.33	230.78	60.02	0.01	0.44
57.97	42.32	2451.267	230.53	60.02	10.35	2377.33
57.98	0.52	29.90	231.09	60.02	0.01	0.33

IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
4.3	<b>TABLE: heating temperature rise measurements</b>					P
	test voltage (V) .....	See below				—
	t1 (°C) .....	See below				—
	t2 (°C) .....	See below				—
Thermocouple Locations		Max. temperature measured (°C)				Max. temperature limit, (°C)
		1	2	3	4	
<b>Whole Unit</b>						
1.	Ambient	55.19	55.38	45.50	46.30	--
2.	Top of enclose	60.84	61.14	50.92	50.01	70
3.	Left of enclose	64.21	64.67	55.26	53.75	70
4.	Right of enclose	60.15	60.56	49.87	49.23	70
5.	Mounting surface	63.44	63.80	54.29	53.04	70
6.	PV terminal	63.00	63.18	57.06	54.87	85
7.	AC Grid terminal	57.84	58.14	46.70	46.47	85
8.	AC Off Grid terminal	60.03	60.36	49.79	49.17	85
9.	PV input wire	66.66	66.45	64.87	61.51	105
10.	AC Grid wire	56.82	57.07	45.63	46.49	105
11.	AC Off Grid wire	57.37	57.63	46.22	46.52	105
12.	Heat sink	60.04	60.31	49.71	48.98	70
13.	Start button	61.65	61.98	52.13	51.25	85
14.	Battery input port	62.36	62.65	52.74	51.75	90
15.	Lamp board	63.54	63.72	54.21	53.13	85
<b>Power board</b>						
16.	Y cap CY40	76.71	76.93	73.83	68.18	125
17.	Y cap by batteries side CX2	75.85	75.14	74.35	69.02	125
18.	GS1	64.78	67.10	54.78	54.14	85
19.	F2	68.54	68.96	60.69	58.85	125
20.	Y cap. CY25	78.06	77.11	75.83	70.77	125
21.	INV inductor	72.26	65.82	58.95	52.51	150
22.	NTC	70.03	65.78	56.95	52.74	105
23.	LLC Transformer 1 winding	73.33	68.35	60.40	55.07	150
24.	LLC Transformer 1 core	73.53	68.31	60.67	55.01	150
25.	LLC inductor 1	71.00	67.60	58.09	54.30	150
26.	LLC Transformer 2 winding	72.16	67.44	59.22	54.58	150

IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
27.	LLC Transformer 2 core	72.72	67.62	59.85	54.72	150
28.	LLC inductor 2	70.96	67.34	57.98	54.41	150
29.	Q7	77.01	72.28	62.04	58.59	150
30.	Q5	76.07	72.00	61.94	58.30	150
31.	Q1	77.46	71.65	61.64	57.87	150
32.	Q3	76.33	72.88	62.78	59.01	150
33.	PVA inductor core	85.81	87.89	73.29	68.89	150
34.	Q3	77.56	71.15	60.32	57.90	150
35.	Q1	75.27	70.70	60.01	57.57	150
36.	Q5	75.69	69.79	58.73	56.90	150
37.	Q7	74.69	69.70	58.70	56.97	150
38.	PVB inductor winding	89.27	92.72	76.62	72.51	150
39.	PVB inductor core	86.61	89.07	74.13	69.69	150
40.	INV Q34	76.71	65.99	59.03	52.87	175
41.	INV Q39	78.77	66.00	59.15	52.80	175
42.	INV Q33	71.54	65.38	58.19	52.25	175
43.	INV Q38	70.60	65.41	57.54	52.28	175
44.	Q23	71.32	66.27	58.78	53.30	150
45.	Q21	71.48	66.84	58.78	53.83	150
46.	Q22	69.12	65.55	56.46	52.92	150
47.	Q24	68.79	64.88	56.26	52.26	150
48.	CX5	76.00	62.58	66.86	51.72	110
49.	CX3	90.69	63.81	81.74	52.62	110
50.	CX6	80.92	66.09	70.03	54.64	110
51.	RLY2	80.71	63.28	69.84	51.77	85
52.	RLY5	81.57	66.51	71.62	55.62	85
53.	LF8 common-mode inductor	100.83	63.23	92.79	52.38	155
54.	LF7 common-mode inductor	105.83	64.83	96.60	53.82	155
55.	LF5 common-mode inductor	105.37	69.60	101.46	58.24	155
56.	EC35	80.20	68.48	73.80	58.40	105
57.	EC37	79.69	71.15	70.39	60.59	105
58.	C345	72.88	67.03	64.41	56.36	125
59.	C264	77.94	71.60	68.05	60.74	125
60.	Q55	91.45	92.30	80.15	75.89	150
61.	Q54	92.86	93.33	80.32	77.12	150

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Clause	Requirement – Test	Result – Remark				Verdict
62. Q25		91.85	89.84	79.20	74.73	150
63. Q53		90.88	90.23	78.24	74.24	150
64. Q52		90.80	92.37	78.36	73.99	150
65. Q51		90.26	91.87	77.92	73.83	150
66. Q50		88.55	89.33	76.08	71.99	150
67. Q49		87.68	91.51	75.22	72.12	150
68. Q56		91.82	92.91	80.14	75.67	150
69. Q26		94.36	93.49	81.80	77.37	150
70. Q58		87.52	88.43	75.29	71.76	150
71. Q59		88.37	88.94	76.59	72.97	150
72. Q27		89.28	89.24	77.84	74.81	150
73. Q57		92.29	90.25	82.14	76.37	150
74. Q60		94.88	97.23	83.60	79.22	150
75. Q30		90.87	88.62	80.20	75.16	150
76. IC12		94.22	85.63	81.27	76.19	125
77. IC20		96.12	87.25	89.87	90.47	125
78. C260		77.28	71.46	67.09	60.67	125
79. T1 winding		87.07	86.54	76.72	75.27	155
80. T1 core		80.03	76.54	69.60	67.21	155
81. EC59		79.33	76.22	67.03	63.65	105
82. C339		73.90	67.88	64.39	57.27	125
83. EC73		80.19	77.40	67.82	64.45	105
84. EC93		94.03	92.41	82.88	79.34	105
85. EC75		99.06	97.24	88.04	82.96	105
86. EC44		75.76	72.31	63.91	60.41	105
87. PV RLY8		80.78	79.70	75.04	68.00	85
88. EC100		79.28	76.08	67.39	64.18	125
89. T2 winding		99.48	89.01	90.13	79.49	155
90. T2 core		97.61	87.45	88.15	77.94	155
91. PV RLY6		81.34	78.67	76.29	70.58	85
92. EC68		101.36	93.74	89.16	83.23	125
93. EC28		100.50	95.17	89.12	83.32	125
94. PV RLY9		81.46	78.38	77.95	83.15	85
95. PV RLY7		82.46	79.66	77.29	84.78	85
96. EC71		107.04	95.87	104.18	88.56	125

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
97. Auxiliary power mos	85.51	83.93	74.84	73.21	150	
<b>Control board</b>						
98. MCU2	87.11	81.03	77.13	71.58	125	
99. MCU1	85.04	79.11	74.71	69.00	105	
100. IC29	83.69	78.49	72.70	67.33	125	
<b>Communication board</b>						
101. U2	73.84	74.20	65.15	63.61	125	
<b>Battery board</b>						
102. F2	69.71	70.45	62.01	60.34	125	
103. Battery cell 1	56.36	56.39	47.30	46.61	65	
104. Battery cell 2	56.91	56.95	47.89	47.14	65	
105. U1	88.10	83.35	78.60	76.10	125	
106. Heat sink	66.65	64.73	55.19	54.78	70	
107. EC1	82.58	77.56	71.55	66.42	125	
108. BAT Wire internal	88.00	82.98	77.94	73.07	105	
Thermocouple Locations	Max. temperature measured (°C)				Max. temperature limit, (°C)	
	5	6	7	8		
<b>Whole Unit</b>						
1. Ambient	55.44	45.43	55.08	45.50	--	
2. Top of enclose	59.44	49.94	58.78	50.60	70	
3. Left of enclose	58.90	49.84	58.10	50.37	70	
4. Right of enclose	61.30	51.89	61.45	54.24	70	
5. Mounting surface	61.75	52.26	61.11	53.66	70	
6. PV terminal	57.08	47.31	55.58	47.17	85	
7. AC Grid terminal	58.25	47.83	58.41	49.80	85	
8. AC Off Grid terminal	62.13	51.69	62.26	54.79	85	
9. PV input wire	55.75	45.84	55.36	46.32	105	
10. AC Grid wire	56.53	46.40	57.63	49.17	105	
11. AC Off Grid wire	56.89	46.64	57.25	48.24	105	
12. Heat sink	58.35	48.36	57.75	49.22	70	
13. Start button	63.83	53.57	65.10	57.75	85	
14. Battery input port	71.19	60.47	72.48	67.00	90	
15. Lamp board	65.65	56.40	65.88	57.96	85	
<b>Power board</b>						

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Clause	Requirement – Test	Result – Remark				Verdict
16.	Y cap CY40	60.09	50.19	59.16	51.28	125
17.	Y cap by batteries side CX2	59.61	49.87	58.77	50.89	125
18.	GS1	69.63	58.57	70.51	65.38	85
19.	F2	72.68	62.30	71.35	65.07	125
20.	Y cap. CY25	60.72	50.97	59.89	52.09	125
21.	INV inductor	78.73	64.47	80.72	75.09	150
22.	NTC	76.88	62.91	76.00	70.69	105
23.	LLC Transformer 1 winding	89.43	76.03	84.16	76.66	150
24.	LLC Transformer 1 core	87.16	73.36	83.03	75.56	150
25.	LLC inductor 1	79.74	65.83	76.69	69.49	150
26.	LLC Transformer 2 winding	87.35	74.16	82.54	74.49	150
27.	LLC Transformer 2 core	86.43	73.01	82.35	74.27	150
28.	LLC inductor 2	82.36	69.18	78.75	70.77	150
29.	Q7	84.93	71.97	79.85	71.93	150
30.	Q5	86.91	74.14	80.39	72.72	150
31.	Q1	89.50	76.66	83.78	76.17	150
32.	Q3	86.46	73.49	80.64	73.10	150
33.	PVA inductor core	70.05	56.80	67.62	59.05	150
34.	Q3	83.56	71.07	78.18	69.88	150
35.	Q1	84.24	71.81	78.15	69.73	150
36.	Q5	81.76	69.07	77.39	68.70	150
37.	Q7	82.56	70.24	76.89	68.10	150
38.	PVB inductor winding	70.15	56.85	67.68	59.01	150
39.	PVB inductor core	70.69	57.23	68.45	59.60	150
40.	INV Q34	87.70	72.76	88.82	84.21	175
41.	INV Q39	88.94	73.94	90.43	86.06	175
42.	INV Q33	82.87	68.34	83.24	78.89	175
43.	INV Q38	80.88	66.49	80.72	76.12	175
44.	Q23	78.30	64.85	76.72	70.09	150
45.	Q21	79.77	66.29	77.19	69.95	150
46.	Q22	76.24	63.28	74.06	65.84	150
47.	Q24	74.72	61.84	73.42	65.32	150
48.	CX5	66.85	57.98	74.94	70.91	110
49.	CX3	69.80	60.42	86.44	84.20	110
50.	CX6	73.78	63.37	79.17	74.03	110

IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
51.	RLY2	70.84	60.17	77.19	71.69	85
52.	RLY5	77.18	67.46	82.17	77.38	85
53.	LF8 common-mode inductor	68.31	59.18	95.77	94.55	155
54.	LF7 common-mode inductor	72.56	62.80	98.65	97.03	155
55.	LF5 common-mode inductor	103.07	91.03	83.19	79.71	155
56.	EC35	81.11	74.46	82.31	81.99	105
57.	EC37	84.70	74.96	83.35	81.96	105
58.	C345	75.76	66.41	74.20	70.34	125
59.	C264	84.31	73.78	81.15	77.31	125
60.	Q55	68.74	55.48	66.50	57.49	150
61.	Q54	69.53	56.34	67.20	58.73	150
62.	Q25	72.86	59.70	69.95	61.90	150
63.	Q53	72.81	59.61	69.88	61.66	150
64.	Q52	69.25	56.07	66.94	58.25	150
65.	Q51	69.15	55.93	66.84	58.08	150
66.	Q50	72.95	59.75	70.01	61.62	150
67.	Q49	73.72	60.52	70.48	62.03	150
68.	Q56	69.39	56.13	67.00	58.13	150
69.	Q26	69.49	56.49	67.22	58.77	150
70.	Q58	73.34	60.11	70.17	61.62	150
71.	Q59	72.51	59.21	69.55	60.81	150
72.	Q27	68.16	54.73	66.03	56.83	150
73.	Q57	67.98	54.59	65.89	56.58	150
74.	Q60	71.85	58.47	69.05	60.06	150
75.	Q30	71.10	57.69	68.46	59.30	150
76.	IC12	70.89	58.05	68.62	60.42	125
77.	IC20	68.65	55.08	67.65	58.54	125
78.	C260	83.90	73.29	80.34	76.23	125
79.	T1 winding	97.55	86.08	93.46	87.75	155
80.	T1 core	78.90	68.03	73.86	71.55	155
81.	EC59	93.39	81.26	83.62	77.17	105
82.	C339	78.09	67.93	76.63	71.43	125
83.	EC73	89.29	76.74	81.21	74.45	105
84.	EC93	76.19	63.90	72.30	64.60	105
85.	EC75	77.41	65.19	72.75	65.19	105

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
86. EC44	88.42	77.63	79.97	73.76	105	
87. PV RLY8	71.41	60.78	68.43	62.21	85	
88. EC100	90.02	79.74	80.77	74.69	125	
89. T2 winding	97.94	87.21	99.03	95.86	155	
90. T2 core	96.58	85.96	97.12	94.05	155	
91. PV RLY6	72.85	61.78	69.98	63.86	85	
92. EC68	71.83	59.72	69.07	61.74	125	
93. EC28	70.84	58.68	68.24	60.76	125	
94. PV RLY9	67.88	55.98	65.24	57.73	85	
95. PV RLY7	69.87	58.10	66.73	59.44	85	
96. EC71	71.63	59.02	68.68	60.44	125	
97. Auxiliary power mos	101.01	89.51	96.04	89.30	150	
<b>Control board</b>						
98. MCU1	89.77	78.39	88.13	84.63	125	
99. MCU2	87.69	76.27	85.71	81.64	105	
100. IC29	89.00	77.36	86.09	80.99	125	
<b>Communication board</b>						
101. U2	78.42	68.32	77.80	71.18	125	
<b>Battery board</b>						
102. F2	73.91	63.83	70.74	66.18	125	
103. Battery cell 1	56.64	47.13	58.63	48.84	65	
104. Battery cell 2	57.00	47.37	58.25	47.91	65	
105. U1	78.29	66.76	75.85	70.14	125	
106. Heat sink	63.36	52.00	62.09	53.03	70	
107. EC1	88.03	76.36	84.97	79.82	125	
108. BAT Wire internal	92.72	82.22	83.62	78.47	105	
Thermocouple Locations	Max. temperature measured (°C)				Max. temperature limit, (°C)	
	9	10	11	12		
<b>Whole Unit</b>						
1. Ambient	55.11	55.16	45.54	45.55	--	
2. Top of enclose	60.77	60.80	50.61	50.76	70	
3. Left of enclose	62.42	62.49	51.60	51.95	70	
4. Right of enclose	61.88	62.14	52.58	52.72	70	
5. Mounting surface	64.47	64.60	54.16	54.60	70	

IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
6.	PV terminal	59.13	58.94	48.27	48.68	85
7.	AC Grid terminal	57.19	57.30	47.80	47.79	85
8.	AC Off Grid terminal	61.84	61.96	52.47	52.55	85
9.	PV input wire	64.50	62.18	48.56	49.35	105
10.	AC Grid wire	55.24	55.33	46.14	46.15	105
11.	AC Off Grid wire	55.88	55.96	46.46	46.47	105
12.	Heat sink	59.35	59.38	49.26	49.42	70
13.	Start button	64.95	65.11	55.32	55.41	85
14.	Battery input port	72.32	72.56	64.22	64.30	90
15.	Lamp board	65.08	65.98	55.95	56.98	85
<b>Power board</b>						
16.	Y cap CY40	74.39	73.68	54.58	55.48	125
17.	Y cap by batteries side CX2	71.99	71.27	57.67	59.43	125
18.	GS1	76.26	76.02	64.34	64.65	85
19.	F2	76.13	76.23	65.35	65.87	125
20.	Y cap. CY25	74.57	73.79	59.68	61.43	125
21.	INV inductor	88.56	89.36	72.31	72.20	150
22.	NTC	86.58	87.23	69.81	71.29	105
23.	LLC Transformer 1 winding	109.44	103.40	87.48	89.51	150
24.	LLC Transformer 1 core	107.25	101.14	84.75	87.08	150
25.	LLC inductor 1	97.49	92.81	75.37	78.32	150
26.	LLC Transformer 2 winding	103.68	101.86	84.50	86.66	150
27.	LLC Transformer 2 core	103.20	100.80	83.53	85.52	150
28.	LLC inductor 2	99.50	95.66	78.68	80.81	150
29.	Q7	107.24	103.83	85.78	91.33	150
30.	Q5	108.22	105.63	87.63	93.11	150
31.	Q1	114.42	108.17	90.23	95.93	150
32.	Q3	108.29	106.01	87.16	93.21	150
33.	PVA inductor core	104.25	109.78	82.24	96.40	150
34.	Q3	101.37	101.11	82.79	87.02	150
35.	Q1	100.51	101.39	82.70	86.69	150
36.	Q5	98.59	98.79	80.36	84.01	150
37.	Q7	98.34	99.40	80.58	84.12	150
38.	PVB inductor winding	109.38	105.08	85.94	102.37	150
39.	PVB inductor core	105.88	100.30	83.70	97.82	150

IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
40.	INV Q34	98.50	98.78	81.39	80.86	175
41.	INV Q39	100.82	100.80	83.42	82.82	175
42.	INV Q33	93.76	93.73	77.01	77.06	175
43.	INV Q38	91.58	91.63	74.88	75.33	175
44.	Q23	91.03	89.61	72.68	74.46	150
45.	Q21	94.20	91.88	74.60	76.93	150
46.	Q22	88.00	87.65	69.82	71.89	150
47.	Q24	85.83	85.67	67.95	69.69	150
48.	CX5	83.66	83.34	69.35	68.42	110
49.	CX3	99.05	96.07	84.64	82.05	110
50.	CX6	86.40	87.25	71.31	72.22	110
51.	RLY2	80.76	83.13	72.43	70.47	85
52.	RLY5	82.82	81.36	73.57	71.57	85
53.	LF8 common-mode inductor	106.08	106.26	96.62	92.03	155
54.	LF7 common-mode inductor	108.20	109.23	100.87	95.09	155
55.	LF5 common-mode inductor	93.78	93.98	78.32	78.18	155
56.	EC35	98.35	97.33	84.12	84.13	105
57.	EC37	98.56	97.50	84.18	84.09	105
58.	C345	86.69	87.29	71.22	72.49	125
59.	C264	97.74	95.99	81.43	82.53	125
60.	Q55	109.97	113.22	85.52	99.27	150
61.	Q54	111.12	115.04	88.40	103.51	150
62.	Q25	111.59	111.01	90.12	98.99	150
63.	Q53	111.36	112.59	89.51	100.54	150
64.	Q52	109.68	113.21	86.12	100.75	150
65.	Q51	109.06	112.90	85.23	100.22	150
66.	Q50	110.60	117.90	87.60	112.16	150
67.	Q49	110.95	125.14	87.02	99.69	150
68.	Q56	111.07	114.30	86.43	100.52	150
69.	Q26	111.61	113.65	89.89	102.08	150
70.	Q58	109.97	111.59	85.96	97.80	150
71.	Q59	109.49	111.46	86.04	97.56	150
72.	Q27	104.82	110.65	82.40	97.03	150
73.	Q57	107.06	110.04	84.59	95.06	150
74.	Q60	116.10	123.09	91.60	109.91	150

<b>IEC 62109-1</b>						
Clause	Requirement – Test	Result – Remark			Verdict	
75. Q30		108.28	109.49	86.56	94.76	150
76. IC12		108.26	101.88	89.45	88.25	125
77. IC20		107.73	98.40	84.37	83.31	125
78. C260		97.15	95.18	80.65	81.75	125
79. T1 winding		104.10	98.85	102.30	107.63	155
80. T1 core		104.20	104.38	85.98	95.02	155
81. EC59		99.79	101.07	94.33	99.23	105
82. C339		87.09	87.21	72.05	72.96	125
83. EC73		100.26	100.75	93.06	98.78	105
84. EC93		101.89	103.01	94.58	104.90	105
85. EC75		102.66	103.44	97.37	103.76	105
86. EC44		101.44	101.83	85.40	88.59	105
87. PV RLY8		80.53	74.53	73.14	69.40	85
88. EC100		105.76	106.18	89.42	93.14	125
89. T2 winding		108.87	105.62	98.08	98.96	155
90. T2 core		106.93	103.76	96.38	97.27	155
91. PV RLY6		80.76	76.46	71.14	70.93	85
92. EC68		118.87	109.24	97.47	96.74	125
93. EC28		118.15	111.64	96.36	99.03	125
94. PV RLY9		81.42	77.12	72.80	78.82	85
95. PV RLY7		79.86	75.59	72.01	79.22	85
96. EC71		122.40	109.25	98.92	94.46	125
97. Auxiliary power mos		126.30	116.95	101.96	104.99	150
<b>Control board</b>						
98. MCU1		102.33	101.88	86.65	88.85	125
99. MCU2		100.76	100.16	84.69	86.69	105
100. IC29		104.65	102.25	86.74	89.33	125
<b>Communication board</b>						
101. U2		81.37	81.46	70.99	71.45	125
<b>Battery board</b>						
102. F2		74.84	75.09	64.76	65.05	125
103. Battery cell 1		55.78	56.48	47.39	47.15	65
104. Battery cell 2		56.42	57.12	47.78	47.47	65
105. U1		95.39	96.23	77.34	81.27	125
106. Heat sink		68.49	71.45	53.57	54.74	100*

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

107. EC1	103.67	101.24	85.67	88.35	125
108. BAT Wire internal	97.10	95.98	80.27	82.78	105

**Note:**

## Supplementary information:

\*Marked with the hot surface marking of symbol 14 of Annex C.

Condition 1: The ambient temperature 55°C, PV input voltage 27.5Vdc, Battery output voltage 16 Vdc, the PCE output power with 100% power still the parts temperature steady. (PV to Battery)

Condition 2: The ambient temperature 55°C, PV input voltage 58Vdc, Battery output voltage 16 Vdc, the PCE output power with 100% power still the parts temperature steady. (PV to Battery)

Condition 3: The ambient temperature 45°C, PV input voltage 27.5Vdc, Battery output voltage 16 Vdc, the PCE output power with 100% power still the parts temperature steady. (PV to Battery)

Condition 4: The ambient temperature 45°C, PV input voltage 58Vdc, Battery output voltage 16 Vdc, the PCE output power with 100% power still the parts temperature steady. (PV to Battery)

Condition 5: The ambient temperature 55°C, Battery input voltage 15Vdc, AC output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady. (Battery to Grid)

Condition 6: The ambient temperature 45°C, Battery input voltage 15Vdc, AC output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady. (Battery to Grid)

Condition 7: The ambient temperature 55°C, Grid input voltage 230V (L-N), Load output and BAT output, the PCE output power with 100% power still the parts temperature steady. (Grid to BAT and Load)

Condition 8: The ambient temperature 45°C, Grid input voltage 230V (L-N), Load output and BAT output, the PCE output power with 100% power still the parts temperature steady. (Grid to BAT and Load)

Condition 9: The ambient temperature 55°C, PV input voltage 27.5Vdc, Grid output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady. (PV to Grid)

Condition 10: The ambient temperature 55°C, PV input voltage 58Vdc, Grid output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady. (PV to Grid)

Condition 11: The ambient temperature 45°C, PV input voltage 27.5Vdc, Grid output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady. (PV to Grid)

Condition 12: The ambient temperature 45°C, PV input voltage 58Vdc, Grid output voltage 230V (L-N), the PCE output power with 100% power still the parts temperature steady. (PV to Grid)

IEC 62109-1							
Clause	Requirement – Test				Result – Remark		Verdict
4.4	TABLE: fault condition tests						
	test voltage (V) .....						—
	Ambient temperature (°C) .....						
No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
<b>Abnormal operation condition</b>							
1.	PCE PV + and -	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "PV Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
2.	PCE BAT + and -	S-C	BAT 18Vdc Grid 230Vac	5min	--	--	Error message: "Bat Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
3.	PCE GRID L and N	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
4.	PCE GRID L and PE	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
5.	PCE BAT-PV	Backfeed current test	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Reverse connection of PV voltage". EUT shut down and disconnected from grid immediately. No damage. No hazard.
6.	Cooling failure	Heatsink wrap up in a blanket	PV 58Vdc Grid 230Vac	2H	--	--	Error message: "NTC OTP". EUT shut down and disconnected from grid immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
7.	PCE Output	Phase sequence before start up	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
8.	PCE Ouput	Phase mis-wiring grid connection	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
9.	PCE Input	Reverse	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Reverse connection of PV voltage". EUT shut down and disconnected from grid immediately. No damage. No hazard.
Power board							
10.	CF7	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Hardware overcurrent". EUT shut down and disconnected from grid immediately. No damage. No hazard.
11.	EC90	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Hardware overcurrent". EUT shut down and disconnected from grid immediately. No damage. No hazard.
12.	Q44 1 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "PV relay Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
13.	Q44 1 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
14.	Q44 2 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
15.	Boost Q24 G to D	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
16.	Boost Q24 G to S	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
17.	Boost Q24 S to D	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "BUS Abnormal". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
18.	C285	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "BUS Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
19.	INV Q39 1 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Overload". EUT shut down and disconnected from grid immediately. Q39 damage. No hazard.
20.	INV Q39 1 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Overload". EUT shut down and disconnected from grid immediately. No damage. No hazard.
21.	INV Q39 3 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Overload". EUT shut down and disconnected from grid immediately. No damage. No hazard.
22.	CV1	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Overload". EUT shut down and disconnected from grid immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
23.	C397	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Overload". EUT shut down and disconnected from grid immediately. No damage. No hazard.
24.	Sam bus-R328	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "BUS Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
25.	Sam bus-R328	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "BUS Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
26.	Sam L inner R343	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Overload". EUT shut down and disconnected from grid immediately. No damage. No hazard.
27.	Sam L inner R343	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Overload". EUT shut down and disconnected from grid immediately. No damage. No hazard.
28.	Grid RLY4	S-C before start	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Relay Abnormal". EUT can not start. No damage. No hazard.
29.	Grid RLY5	S-C before start	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Relay Abnormal". EUT can not start. No damage. No hazard.
30.	U9 pin 1 to pin 4	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Relay Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
31.	U9 pin 2 to pin 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Relay Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
32.	GS2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
33.	LF8 pin1 to pin2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard
34.	LF8 pin1 to pin4	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
35.	GS1	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
36.	MOV1	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
37.	F2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
38.	CY25	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
39.	+5 DSP failure C328	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
40.	EC15	O-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
41.	T1 pin1 to pin2 C200	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
42.	T1 pin8 to pin9 EC107	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
43.	Q17 1 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. Q17 damage. No hazard.
44.	Q17 1 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
45.	Q17 3 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message. EUT cannot start. No damage. No hazard.
46.	C108	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message. EUT cannot start. No damage. No hazard.
47.	EC5	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message. EUT cannot start. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
48.	F4	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
49.	TX3 pin7 to pin9 C359	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
50.	TX3 pin11 to pin12 C380	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
51.	Q32 1 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
52.	Q32 1 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. Q32 damage. No hazard.
53.	Q32 2 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
54.	TR1	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
55.	C375	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
56.	C38	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
57.	C12	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
58.	T2 pin9 to pin10 C228	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
59.	T2 pin5 to pin4 EC22	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
60.	T2 pin1 to pin2 EC25	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
61.	Q19 1 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
62.	Q19 1 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
63.	Q19 3 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
LLC board							
64.	Q2 1 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
65.	Q2 1 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
66.	Q2 3 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
67.	Q7 1 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
68.	Q7 1 to 3	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
69.	Q7 3 to 2	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "LLC Boost Soft-Start Timeout". EUT shut down and disconnected from grid immediately. Q24 damage. No hazard.
Main control board							
70.	EC2		PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
71.	EC8		PV 58Vdc Grid 230Vac	5min	--	--	No Error message. EUT cannot start. No damage. No hazard.
Control board							
72.	PVA voltage samp R144	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "PVA Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
73.	PVA voltage samp C165	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "PVA Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
74.	PVA current samp R111	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "PVA Relay Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
75.	PVA current samp C169	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "PVA Relay Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
76.	C88	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
77.	C85	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
78.	MCU1	power supply failure	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
79.	C1L1	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
80.	C182	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
81.	LLC current samp R220	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Overcurrent charging". EUT shut down and disconnected from grid immediately. No damage. No hazard.
82.	LLC current samp C81	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT Derating. No damage. No hazard.
83.	Temp. samp C47	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "temperature low". EUT shut down and disconnected from grid immediately. No damage. No hazard.
84.	Temp. samp C157	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "temperature low". EUT shut down and disconnected from grid immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
85.	BAT current samp R270	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Overcurrent charging". EUT shut down and disconnected from grid immediately. No damage. No hazard.
86.	BAT current samp C139	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Overcurrent charging". EUT shut down and disconnected from grid immediately. No damage. No hazard.
87.	V_BUSH IGH R92	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "BUS Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
88.	C117	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
89.	MCU2	power supply failure	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT cannot start. No damage. No hazard.
90.	Y1	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
91.	MCU1 and MCU2	Communication failure	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Communication Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
92.	C266	S-C	PV 58Vdc Grid 230Vac	5min	--	--	No Error message EUT work normal but Unable to parallelize. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
93.	Output current samp R134	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Off-grid current Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
94.	Output current samp C153	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Off-grid current Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
95.	sam_Lou t R126	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "BUS Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
96.	sam_Lou t C145	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "BUS Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
97.	sam_Lou t1 R322	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
98.	sam_Lou t1 C372	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Voltage Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
99.	RelayCheck_DSP R120	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Relay Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
100	RelayCheck_DSP C138	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Relay Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
101	Igrid_DSP R136	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Current Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
102	Igrid_DSP C151	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Grid Current Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
103	Igrid+ R93	O-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Current Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
104	Igrid+ C22	S-C	PV 58Vdc Grid 230Vac	5min	--	--	Error message: "INV Current Abnormal". EUT shut down and disconnected from grid immediately. No damage. No hazard.
BMS board							
105	TVS1	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
106	U9	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
107	C169	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT shut down immediately. No damage. No hazard.
108	Y1	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
109	C6	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT shut down immediately. No damage. No hazard.
110	U22	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
111	Z42	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal, Communication Abnormal. No damage. No hazard.
112	Q12 pin1 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
113	Q12 pin1 to pin3	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	Error message: "charger Abnormal". EUT shut down immediately. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
114	Q12 pin3 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	Error message: "charger Abnormal". EUT shut down immediately. No damage. No hazard.
115	C126	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
116	C123	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
117	C135	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT shut down immediately. F7 damage. No hazard.
118	Q30 pin1 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Discharge MOS driver Abnormal". EUT shut down immediately. No damage. No hazard.
119	Q30 pin1 to pin3	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Discharge MOS driver Abnormal". EUT shut down immediately. No damage. No hazard.
120	Q30 pin3 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.

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Clause	Requirement – Test					Result – Remark	Verdict
121	Q43 pin1 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Charge MOS driver Abnormal". EUT shut down immediately. No damage. No hazard.
122	Q43 pin1 to pin3	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	Error message: "Charge MOS driver Abnormal". EUT shut down immediately. No damage. No hazard.
123	Q43 pin3 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
124	TM1	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	Error message: "MOS OTP". EUT shut down immediately. No damage. No hazard.
125	F4	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
126	R561	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
127	Q118 pin1 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.

IEC 62109-1							
Clause	Requirement – Test					Result – Remark	Verdict
128	Q118 pin1 to pin3	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
129	Q118 pin3 to pin2	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.
130	R267	S-C	BAT 16Vdc PV 58Vdc Grid 230Vac	5min	--	--	No error message. EUT work normal. No damage. No hazard.

Note(s): s-c: short-circuited, o-c: open-circuited, o-l: overload.

7.3.6.3.3	TABLE: protective equipotential bonding				P
Measured between:	Test current (A)	Voltage drop (V)	Resistance (mΩ)	result	
PE terminal to metal enclosure1	64	0.70	11.0	pass	
PE terminal to metal enclosure2	64	0.61	9.7	pass	
PE terminal to metal enclosure3	64	0.79	14.2	pass	
supplementary information:					

7.3.6.3.7	TABLE: touch current measurement			P
Measured between:	Measured (mA)	Limit (mA)	Comments/conditions	
Metal enclosure to PE terminal	AC 1.176/ DC 5.304	AC 3.5/ DC 10	--	
Supplementary information:				

IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
<b>7.3.7</b>	<b>TABLE: clearance and creepage distance measurements</b>					<b>P</b>
Clearance cl and creepage distance dcr at/of:	System / Impulse voltage (V)	U r.m.s. (V)	Required cl (mm)	cl (mm)	Required dcr (mm)	dcr (mm)
<b>Power board</b>						
R149 to R130 (R)	60Vdc	230Vac	5.5	9.0	5.5	9.0
CY3 pri. to sec. (R)	60Vdc	230Vac	5.5	8.4	5.5	8.4
T2 pri. to sec. (R)	60Vdc	230Vac	5.5	8.2	5.5	8.2
T2 sec. to C244 (R)	60Vdc	230Vac	5.5	6.5	5.5	15.4
U1, U2 (R)	60Vdc	230Vac	5.5	7.4	5.5	7.4
CY13, CY14, CY15 (R)	60Vdc	230Vac	5.5	7.4	5.5	7.4
D31, D32 D33 D34 (R)	60Vdc	230Vac	5.5	7.8	5.5	7.8
U9, U10 (R)	60Vdc	230Vac	5.5	6.4	5.5	8.3
IC9 (R)	60Vdc	230Vac	5.5	7.4	5.5	7.4
T2- to U22's signal line (R)	60Vdc	230Vac	5.5	9.5	5.5	9.5
LF8 to P16 (B)	60Vdc	230Vac	3.0	6.7	3.0	6.7
CY25 pri. to sec. (B)	60Vdc	230Vac	3.0	4.3	3.0	4.3
L to N (F)	60Vdc	230Vac	3.0	4.1	3.0	4.1
N to P1 (B)	60Vdc	230Vac	3.0	6.3	3.0	6.3
CY18 to CN20 (B)	60Vdc	230Vac	3.0	4.3	3.0	4.3
CY46 pri. to sec. (B)	60Vdc	230Vac	3.0	4.3	3.0	4.3
RLY2 to P15(B)	60Vdc	230Vac	3.0	3.3	3.0	4.9
CY27 pri. to sec. (B)	60Vdc	230Vac	3.0	4.4	3.0	4.4
Q33 body to ground (B)	60Vdc	230Vac	3.0	5.5	3.0	5.5
CY18 to CN20 (B) (Inner layer)	60Vdc	230Vac	3.0	5.7	3.0	5.7
CY25 pri. to sec. (B) (Inner layer)	60Vdc	230Vac	3.0	5.1	3.0	5.1
CY21 sec. to LINE_N (B) (Inner layer)	60Vdc	230Vac	3.0	3.2	3.0	3.2
FINV_B to P6 (B) (Inner layer)	60Vdc	230Vac	3.0	3.1	3.0	3.1
T2 pri. to sec. (R) (Inner layer)	60Vdc	230Vac	5.5	8.2	5.5	8.2
CY3 pri. to sec. (R) (Inner layer)	60Vdc	230Vac	5.5	8.3	5.5	8.3
<b>IGBT board</b>						
T2, T5 to PE(B)	60Vdc	230Vac	3.0	3.7	3.0	3.7
T4, T1 to PE(B)	60Vdc	230Vac	3.0	3.7	3.0	3.7

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Clause	Requirement – Test	Result – Remark	Verdict

Control board							
IC29, U1(R)	60Vdc	230Vac	5.5	7.4	5.5	7.4	
IC29, U1 (R) (Inner layer)	60Vdc	230Vac	5.5	8.0	5.5	8.0	
Whole Unit							
L to N(F)	60Vdc	230Vac	3.0	9	3.0	9	
L to PE(B)	60Vdc	230Vac	3.0	18	3.0	18	
<p>Note(s): * F=functional insulation, B=basic insulation, S=supplementary insulation, R=reinforced insulation.            When determine the clearance:            For PV/DC circuits: Overvoltage Category II applied(impulse withstand voltage 800V)            For AC output circuits (connected to AC mains): Overvoltage Category III applied (impulse withstand voltage 4000V, temporary overvoltage 2120Vpeak considered.)            Interpolation is used.            Due to the max. altitude is 2000m, limit of clearance by the correction factor 1.00 considered.            Requirement about creepage distances for transformer and for the distance to the metal enclosure come from columns 7 and 8 of Table 14.            Requirement about creepage distances for part on PWB come from column 3 of table 14.            PCB with min. CTI 175 used.            Triple insulated wire used for insulation between pri. and sec. of transformer T2.</p>							

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	
AC mains circuits to enclosure: BI	2120dc	4000	--	P	
AC mains circuits to PV circuits: RI	4240dc	6000	--	P	
AC mains circuits to LCD Panel: RI	4240dc	6000	--	P	
AC mains circuits to communication port: RI	4240dc	6000	--	P	
Note(s):					

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Clause	Requirement – Test	Result – Remark	Verdict

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
<b>Whole product</b>						
Metal Enclosure	Shenzhen topband Co.,Ltd.	162011390	material:SGCC size: 314.4*536*307 mm, thickness: 1.5mm	EN/IEC 62109-1/-2	Tested with Appliance	
Heat sink	Shenzhen topband Co.,Ltd.	162011412	material:ADC12 size: 306.85*535.85*64.6mm, thickness: mm	EN/IEC 62109-1/-2	Tested with Appliance	
PV Input terminal (+)	Dongguan Vaconn Electronics Technology Co., Ltd.	VP-D4B-PTSM0	1100Vdc, 35A -40°C~+85°C IP68	IEC 62852:2014 +A1 EN 62852:2015 +A1	TUV R 50396796	
PV Input terminal (-)	Dongguan Vaconn Electronics Technology Co., Ltd.	VP-D4B-PTSF0	1100Vdc, 35A -40°C~+85°C IP68	IEC 62852:2014 +A1 EN 62852:2015 +A1	TUV R 50396796	
Output terminal-Grid	SenLianKe (S.Z) Technology Co.,Ltd	883-03G-XX	250Vac,30A V-0 -40°C~+85°C IP65	IEC 61984:2008 EN 61984:2009	TUV R 50702799	
Output terminal-Off Grid	Shenzhen Huaxinghui Electronics Technology Co.,Ltd	CE-1P-6	250Vac, 16A, V-0, UV f1, -20°C~+85°C IP65	IEC 60884-2-2:2006 IEC 60884-1:2002 VDE0620	TUV SUD No. B 097227 0007 Rev.	
PV input internal wire	GUANGDONG HAERKN NEW ENERGY CO.,LTD	3512	600V, 12AWG 200°C	UL 758	UL E300956	
AC output internal wire	GUANGDONG HAERKN NEW ENERGY CO.,LTD	3512	600V 18AWG 200°C	UL 758	UL E300956	
<b>Power Board</b>						
BUS CAP (EC34, EC35, EC36, EC37)	SAMXON	EHP337M2HP40 SZSHP	500V, 300uF -25°C~+105°C	EN/IEC 62109-1/-2	Tested with Appliance	
LLC Resonant CAP (C246, C244, C247, C260, C257,	Sichuan Zhongxing Electronic Co., Ltd	CBB84 series	1000Vdc,56nF, -40°C~125°C	EN/IEC 62109-1/-2	Tested with Appliance	

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

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
C261, C245, C248, C249, C264, C258, C263)						
Alt.	Shenzhen Jingwah Electronics Co.,Ltd	JMMB563J1000P 22.5E2Z4	1000V, 0.056µF -40~+105°C	EN/IEC 62109-1/-2	Tested with Appliance	
LLC Resonant CAP (C334, C339, C342, C343,C340, C341, C344, C345)	Sichuan Zhongxing Electronic Co., Ltd	CBB84 series	1000Vdc,56nF, -40°C~125°C	EN/IEC 62109-1/-2	Tested with Appliance	
Alt.	Shenzhen Jingwah Electronics Co.,Ltd	JMMB563J1000P 22	1000V, 0.056µF -40~+105°C	EN/IEC 62109-1/-2	Tested with Appliance	
Relay (RLY1, RLY2, RLY4, RLY5,RLY6, RLY7, RLY8, RLY9)	Sanyou Corporation Limited	SMIA-S-212DMG	16A ,250Vac, -40°C~85°C Cl:2mm	EN 61810-1:2015+A1	TUV R 50540860	
common-mode inductor (LF4)	Dongguan City Ruiguan Electronics Co.,LTD.	HSY-0117	13.5uH, Class F	EN/IEC 62109-1/-2	Tested with Appliance	
--wire	DONG GUAN YI DA INDUSTRY CO.,LTD	xPEW/155	155°C	UL 1446	UL E344055	
Alt.	DONG GUAN YI DA INDUSTRY CO.,LTD	QZx/155	155°C	UL 1446	UL E344055	
--Epoxy board	KINGBOARD LAMINATES HOLDINGS LTD	FR-4	130°C	UL 746	UL E123995	
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	180°C	UL 510	UL E218090	

IEC 62109-1					
Clause	Requirement – Test			Result – Remark	Verdict
<b>14</b>	<b>TABLE: Critical components information</b>				<b>P</b>
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>
-- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500 (XX)	130°C	UL 746	UL E218090
common-mode inductor (LF7)	Dongguan City Ruiguan Electronics Co.,LTD.	HSY-0119	12mH, Class F	EN/IEC 62109-1/-2	Tested with Appliance
--wire	DONG GUAN YI DA INDUSTRY CO.,LTD	xPEW/155	155°C	UL 1446	UL E344055
Alt.	DONG GUAN YI DA INDUSTRY CO.,LTD	QZx/155	155°C	UL 1446	UL E344055
--Epoxy board	KINGBOARD LAMINATES HOLDINGS LTD	FR-4	130°C	UL 746	UL E123995
-- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500 (XX)	130°C	UL 746	UL E218090
common-mode inductor (LF5, LF8)	Dongguan City Ruiguan Electronics Co.,LTD.	HSY-0118	9.5mH, Class F	EN/IEC 62109-1/-2	Tested with Appliance
--wire	DONG GUAN YI DA INDUSTRY CO.,LTD	xPEW/155	155°C	UL 1446	UL E344055
Alt.	DONG GUAN YI DA INDUSTRY CO.,LTD	QZx/155	155°C	UL 1446	UL E344055
--Epoxy board	KINGBOARD LAMINATES HOLDINGS LTD	FR-4	130°C	UL 746	UL E123995
-- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500 (XX)	130°C	UL 746	UL E218090
INV inductor	QIAO JING ELECTRONIC	T226-060E21	687.6uH, Class F	EN/IEC 62109-1/-2	Tested with Appliance

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

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
--wire	WUZHOU TOREAL COPPER CO LTD	xEIW/180, QZY-x/180/	155°C	UL 1446	UL E348247	
Alt.	DONG GUAN YIDA INDUSTRIAL CO LTD	EIW/180 , QZY-*/180	155°C	UL 1446	UL E344055	
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	180°C	UL 510	UL E165111	
Alt.	SHEN ZHEN XINHUAHUI ELECTRONIC MATERIALS CO LTD	HKT	180°C	UL 510	UL E328315	
PV inductor (PVA, PVB)	Dongguan City Ruiguan Electronics Co.,LTD.	EQF32	20.2uH, Class F	EN/IEC 62109-1/-2	Tested with Appliance	
--wire	GUANGDONG SUNTEK WIRE CO.,LTD	@*xEI/AIW 200	200°C	UL 1446	UL E234867	
Alt.	WELL ASCENT ELECTRONIC (GANZHOU) CO LTD	SFT-EI/AIWJ	220°C	UL 1446	UL E318511	
-- Epoxy board	KINGBOARD LAMINATES HOLDINGS LTD	FR-4	130°C	UL 746	UL E123995	
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF301	180°C	UL510	UL E165111	
Alt.	JINGJIANG FUWEI ADHESIVE PRODUCT CO LTD	FW-PI	180°C	UL510	UL E302608	
--Epoxy	DONGGUAN EATTO	E-500 (XX)	130°C	UL 746	UL E218090	

IEC 62109-1					
Clause	Requirement – Test			Result – Remark	Verdict
<b>14</b>	<b>TABLE: Critical components information</b>				<b>P</b>
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>
	ELECTRONIC MATERIAL CO LTD				
IGBT (Q33, Q34, Q38, Q39)	CR MICRO	CRG50T65BK5S D	650V,60A -40°C~175°C	EN/IEC 62109-1/-2	Tested with Appliance
Alt.	Suzhou Oriental Semiconductor Company Limited	OST90N60HCZF	600V,90A -55°C~150°C	EN/IEC 62109-1/-2	Tested with Appliance
LLC transformer (T1, T2)	SHEN ZHEN YIXING WENDA ELECTRONICS CO.,LTD	PQ50/39+PQ32/23	600 uH, Class F	EN/IEC 62109-1/-2	Tested with Appliance
--Wire	SHENZHEN DAYANG INDUSTRY CO.,LTD	xUEW-NY MW 83-C	180°C	UL 1446	UL E176101
Alt.	GUANGDONG LIZIWIRE ELECTRIC TECHNOLOGY CO.,LTD	@*UEW 180°C	180°C	UL 1446	UL E504985
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	180°C	UL 510	UL E165111
--Tube	SHENGZHEN HANGXUAN S&T CO LTD	XH-TFL	200°C	UL 746	UL E361862
--Epoxy	DONG GUAN SHI PAI HUA CHUANG MATERIAL FTY	H907-H##	130°C	UL 746	UL E304477
Transformer T1	Qiaojing Electronic Co.,Ltd	EE20	20uH, class B	EN/IEC 62109-1/-2	Tested with Appliance
--Bobbin	CHANG CHUN PLASTICS CO LTD	T375HF	V-0, 150°C	UL 746	UL E59481
--Wire	WUZHOU TOREAL COPPER CO LTD	xUEW/155, QA-x/155/	155°C	UL 1446	UL E348247

IEC 62109-1					
Clause	Requirement – Test			Result – Remark	Verdict
<b>14</b>	<b>TABLE: Critical components information</b>				<b>P</b>
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>
Alt.	DONG GUAN YIDA INDUSTRIAL CO LTD	*UEW/155, QA-*/155	155°C	UL 1446	UL E344055
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	180°C	UL 510	UL E165111
Alt.	SHEN ZHEN XINHUAHUI ELECTRONIC MATERIALS CO LTD	HKT	200°C	UL 510	UL E328315
--Varnish	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO LTD	E962 MW 28-C	130°C	UL 746	UL E335405
--Tube	HUIZHOU DONGJU FLUO TECH PLASTIC CO LTD	TFL	200°C	UL 746	UL E478618
--Epoxy	Dongguan Hong Chuang Electronic Materials Co Ltd	3300A-1/3300B-1/HCJ802	130°C	UL 746	UL E504240
--Triple wire	SHENZHEN DARUN SCIENCE AND TECHNOLOGY CO LTD	DRTIW-B	130°C	UL 1446	UL E335841
Alt.	SHENZHEN KAIZHONG HEDONG NEW MATERIALS CO LTD	TIW-B	130°C	UL 1446	UL E357240
Isolation transformer T2	Qiaojing Electronic Co.,Ltd	EF25	1.68mH, Class F	EN/IEC 62109-1/-2	Tested with Appliance
--Bobbin	CHANG CHUN PLASTICS CO LTD	T375HF	V-0, 150°C	UL 746	UL E59481
--Wire	WUZHOU TOREAL	xUEW/155, QA-x/155	155°C	UL 1446	UL E348247

IEC 62109-1					
Clause	Requirement – Test			Result – Remark	Verdict
<b>14</b>	<b>TABLE: Critical components information</b>				<b>P</b>
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>
	COPPER CO LTD/EQU				
--Tape	SHEN ZHEN XINHUAHUI ELECTRONIC MATERIALS CO LTD	HKT	200°C	CAN/UL 510A	UL E328315
--Varnish	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO LTD	E962 MW 28-C	130°C	UL 1446	UL E335405
--Tube	HUIZHOU DONGJU FLUO TECH PLASTIC CO LTD	TFL	200°C	UL 746	UL E478618
--Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500(XX)	130°C	UL 746	UL E218090
--Triple wire	SHENZHEN KAIZHONG HEDONG NEW MATERIALS CO LTD	TIW-F*	155°C	UL 1446	UL E357240
Isolation transformer TX6	DongguanCityRuiGuan Electronics Co.,Ltd.	EP7	450uH, Class F	EN/IEC 62109-1/-2	Tested with Appliance
--Bobbin	SUMITOMO BAKELITE CO LTD	PM-9820	150°C	UL 746	UL E41429
--Wire	DONGGUAN YIDA INDUSTRIAL CO LTD	2UEW-F	155°C	UL 1446	UL E344055
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF301	180°C	CAN/UL 510A	UL E165111
--Varnish	ZHUHAI CHANGXIAN CHEMICAL	E962	130°C	UL 1446	UL E335405

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
<b>14</b>	<b>TABLE: Critical components information</b>				<b>P</b>
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>
	TECHNOLOGY CO LTD				
Isolation IC (U1, U2)	Suzhou Novosense Microelectronics Co., Ltd.	NSI6602VB-DSWR	Isolation Rating:5.7KV -40°C~+125°C	EN IEC 60747-17 VDE 0884-17	VDE 40052820
PV input filter capacitor (EC28, EC30, EC61, EC65, EC71, EC88, EC89, EC106, EC32, EC58, EC62, EC68, EC70, EC87, EC104, EC105)	Shanghai Yongming Electronic Co., Ltd	NPT series	100V, 180uF, -55°C~+125°C	EN/IEC 62109-1/-2	Tested with Appliance
Alt.	X-CON	UMG series	100V 180uF -55°C~+125°C	EN/IEC 62109-1/-2	Tested with Appliance
Hall sensor (IC10)	Shanghai MagnTek Micro-electronics	MT9523CT series	50A, 450Vrms withstand voltage: 2.5kVrms -40°C~150°C	UL62368	JPTUV-138198
MOSFET (Q25, Q26, Q27, Q30, Q49, Q50, Q51, Q52, Q53, Q54, Q55, Q56, Q57, Q58, Q59, Q60)	Shenzhen Sanrise Technology Co., LTD.	SRT 10N030HTC-GL	100V, 117A -55°C~+155°C	EN/IEC 62109-1/-2	Tested with Appliance
Fuse (F2)	Dongguan Better Electronics Technology Co.,Ltd	524	15A, 250Vac, -55°C~+125°C	IEC 60127-1/-2	TUV J 50157552
Alt.	Dongguan Better Electronics Technology Co.,Ltd	524	20A, 250Vac, -55°C~+125°C	IEC 60127-1/-2	TUV J 50157552
Varistor (MOV1, MOV2, MOV4)	Centra Science Corp	CNR-10D561KBTSB	560Vdc, 2500A, -40°C~+105°C	IEC 61051	VDE 40008220

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

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
Alt.	Shantou High-New Technology Dev.	10D561KTS	560Vdc, 2500A, -40°C~+105°C	IEC61051	VDE 40023049	
Y-cap (CY28, CY30, CY32, CY34, CY36, CY38, CY40, CY42, CY16, CY19, CY20, CY26)	Guangdong South Hongming Electronic Science and Technology Co.,Ltd	F	3300pF,250Vac, -40°C~125°C, Y2	IEC 60384-14	VDE 40036246	
Alt.	Guangdong South Hongming Electronic Science and Technology Co.,Ltd	F	3300pF,250Vac, -40°C~125°C, Y2	IEC 60384 – 14	VDE 40036246	
Y-cap (CY23, CY25)	Guangdong South Hongming Electronic Science and Technology Co.,Ltd	F	1000pF,250Vac, -40°C~125°C, Y2	IEC 60384-14	VDE 40036246	
Y-cap (CY29, CY31, CY37, CY39, CY41, CY43, CY48)	SUCCESS ELECTRONICS (HUIZHOU) CO., LTD.	SF	6.8nF, 250Vac/300Vac -40~+125°C, Y2	EN IEC 60384-14	VDE 40016665	
Alt.	Guangdong South Hongming Electronic Science and Technology Co.,Ltd	F	6800pF,250Vac, -40°C~125°C, Y2	EN IEC 60384-14	VDE 40036246	
Y-cap (CY3)	Guangdong South Hongming Electronic Science and Technology Co.,Ltd	F	2200pF,500Vac -40~+125°C, Y1	EN IEC 60384-14	VDE 40036393	
Y-cap (C355)	Guangdong South Hongming Electronic	F	1000pF,500V -40~+125°C, Y1	EN IEC 60384-14	VDE 40036393	

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

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
	Science and Technology Co.,Ltd					
Y-cap (CY13, CY14)	Guangdong South Hongming Electronic Science and Technology Co.,Ltd	F	2200pF,500V -40~+125°C, Y1	EN IEC 60384-14	VDE 40036393	
X-cap (CX3)	Shenzhen Jinghao Capacitor Co.,Ltd	CBB62B	0.68µF,280Vac, -40°C~110°C,X2	EN 60384-14	VDE 40018690	
X-cap (CX5)	Sichuan Zhongxing Electronic Co.,Ltd	MKP61H-X2	3.3µF,350Vac, -40°C~110°C,X2	IEC 60384-14	ENEC HN 69262166	
Alt.	Shenzhen Jingwah Electronics Co., Ltd.	CBBX2	500V, 5.0µF -40°C~110°C	IEC 60384-14	VDE 40025597	
X-cap (CX6)	Shenzhen Jingwah Electronics Co., Ltd.	CBBX2	2.2µF,305Vac, -40°C~110°C,X2	IEC 60384-14	VDE 40025597	
Transformer (TX1)	FOSHAN SHUNDE WECAN ELECTRONICS CO.,LTD	EP7-25120503WK	400uH,Class F -20°C~105°C	EN/IEC 62109-1/-2	Tested with Appliance	
--Bobbin	CHANG CHUN PLASTICS CO LTD	T375HF	94V-0 150°C	UL 746	UL E59481	
Alt.	SUMITOMO BAKELITE CO LTD	PM-9820	94V-0 150°C	UL 746	UL E41429	
--Wire	DONG GUAN YIDA INDUSTRIAL CO LTD	xUEW/155, QA-x/155	155°C	ANSI/UL 1446	UL E344055	
Alt.	WUZHOU TOREAL COPPER CO LTD	xUEW/155, QA-x/155	155°C	ANSI/UL 1446	UL E348247	
--Tape	CHANGSHU CHANGJIANG TAPE CO LTD	K-CJ01-25	260°C	CAN/UL 510A	UL E300797	
--Varnish	GUANGZHOU FAITH SYNTHETIC	FS750(n)	200°C	UL 1446	UL E491168	

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

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
	MATERIALS CO LTD					
Alt.	YUEYANG GREEN TECHNOLOGY CO LTD	JX-1150*	155°C	UL 1446	UL E303754	
Alt.	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO LTD	E962	130°C	UL 1446	UL E335405	
Transformer (TX4, TX5)	Foshan Shunde District Qiaojing Electronic Co.,Ltd.	EE13	3.0mH, Class F	EN/IEC 62109-1/-2	Tested with Appliance	
--Bobbin	CHANG CHUN PLASTICS CO LTD	T375HF	150°C	UL 746	UL E59481	
--Wire	WUZHOU TOREAL COPPER CO LTD	xUEW/155,QA-x/155	155°C	UL 1446	UL E348247	
Alt.	DONG GUAN YIDA INDUSTRIAL CO LTD	xUEW/155 or QA-x/155	155°C	UL 1446	UL E344055	
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF*(d)(g)	180°C	CAN/UL 510A	UL E165111	
Alt.	SHEN ZHEN XINHUAHUI ELECTRONIC MATERIALS CO LTD	HKT	200°C	CAN/UL 510A	UL E328315	
--Varnish	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO LTD	E962	130°C	UL 1446	UL E335405	
Alt.	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155°C	UL 1446	UL E228349	
--Tube	HUIZHOU DONGJU FLUO	TFL	200°C	UL 224	UL E478618	

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

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
	TECH PLASTIC CO LTD					
Alt.	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200°C	UL 224	UL E180908	
--Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500(XX)	130°C	UL 746	UL E218090	
Alt.	Dongguan Hong Chuang Electronic Materials Co Ltd	HCJ802	130°C	UL 746	UL E504240	
Transformer (TX1, TX2, TX9, TX10)	Foshan Shunde District Qiaojing Electronic Co.,Ltd.	EE13	3.0mH, Class F	EN/IEC 62109-1/-2	Tested with Appliance	
--Bobbin	CHANG CHUN PLASTICS CO LTD	T375HF	150°C	UL 746	UL E59481	
--Wire	WUZHOU TOREAL COPPER CO LTD	xUEW/155,QA-x/155	155°C	UL 1446	UL E348247	
Alt.	DONG GUAN YIDA INDUSTRIAL CO LTD	xUEW/155 or QA-x/155	155°C	UL 1446	UL E344055	
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF*(d)(g)	180°C	CAN/UL 510A	UL E165111	
Alt.	SHEN ZHEN XINHUAHUI ELECTRONIC MATERIALS CO LTD	HKT	200°C	CAN/UL 510A	UL E328315	
--Varnish	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO LTD	E962	130°C	UL 1446	UL E335405	
Alt.	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155°C	UL 1446	UL E228349	

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

14	TABLE: Critical components information					P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>	
--Tube	HUIZHOU DONGJU FLUO TECH PLASTIC CO LTD	TFL	200°C	UL 224	UL E478618	
Alt.	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200°C	UL 224	UL E180908	
--Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500(XX)	130°C	UL 746	UL E218090	
Alt.	Dongguan Hong Chuang Electronic Materials Co Ltd	HCJ802	130°C	UL 746	UL E504240	
Transformer (TX3)	SHEN ZHEN YIXING WENDA ELECTRONICS CO.,LTD	EEL16	1.1mH, Class F	EN/IEC 62109-1/-2	Tested with Appliance	
--Wire	SHENZHEN DAYANG INDUSTRY CO.,LTD	xUEW/MW79-C	155°C	UL 1446	UL E176101	
Alt.	GUANGDONG LIZIWIRE ELECTRIC TECHNOLOGY CO.,LTD	@*UEW155	155°C	UL 1446	UL E504985	
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF*(d)(g)	180°C	CAN/UL 510A	UL E165111	
Alt.	SHENGZHEN HANGXUAN S&T CO LTD	XH-TFL	200°C	UL 224	UL E361862	
--Triple wire	SHENZHEN KAIZHONG HEDONG NEW MATERIAL CO LTD	TIW-F	155°C	ASNI/UL 2353	UL E357240	
--Varnish	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO LTD	E962	155°C	UL 1446	UL E335405	
--Bobbin	CHANG CHUN PLASTICS CO LTD	T375HF	150°C	UL 746	UL E59481	

IEC 62109-1					
Clause	Requirement – Test			Result – Remark	Verdict
<b>14</b>	<b>TABLE: Critical components information</b>				<b>P</b>
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity <sup>1)</sup>
Alt.	SUMITOMO BAKELITE CO LTD	PM-9823	150°C	UL 746	UL E41429
--Epoxy	DONG GUAN SHI PAI HUA CHUANG MATERIAL FTY	H907-H##	130°C	UL 746	UL E304477
<b>Control board</b>					
Isolation IC (IC29)	Suzhou Novosense Microelectronics Co., Ltd.	NSI8263W0- DSWR	Insulation voltage:5000Vrms -40°C~125°C	DIN VDE V 0084-11	TUV R 50574061
Alt.	Shanghai Chipanalog	CA-IS376	Insulation voltage:5000Vrms -40°C~125°C	DIN VDE V 0084-11	VDE 40052786
Isolation (U1)	NOVOSENSE	NSI1050-DSWR	Insulation voltage:5000Vrms -40°C~125°C	DIN VDE V 0084-11	VDE 40050121
<b>Battery module</b>					
Cell	EVE POWER Co., Ltd.	MB31	3.2V,314Ah	IEC 62619:2022	JPTUV -157371- A2/M3
Fuse (F1)	ADVANCED SURGETECH MATERIALS LTD	12 113 Series	6A, 72V -55°C~150°C	UL 248	UL E355868
Alt.	DONGGUAN BETTER ELECTRONICS TECHNOLOGY CO LTD	127 Series	6A, 72V -55°C~150°C	UL 248	UL E300003
MCU (U1)	GigaDevice	GD32F303VET6	100PIN, -40°C to +125°C	EN/IEC 62109-1/-2	Tested with Appliance
MOS (Q2, Q73)	Leshan Radio Company, LTD.	L2N7002SLT1G	60V -55°C~150°C	EN/IEC 62109-1/-2	Tested with Appliance
Alt.	Micro commercial Components	2N7002K	60V -55°C ~ +150°C	EN/IEC 62109-1/-2	Tested with Appliance
Alt.	BLUE ROCKET ELECTRONICS	BR2N7002K2	60V -55°C ~ +150°C	EN/IEC 62109-1/-2	Tested with Appliance
MOS (Q60, Q61)	BLUE ROCKET ELECTRONICS	2SD1815-R	100V -55°C ~ +150°C	EN/IEC 62109-1/-2	Tested with Appliance
Alt.	JIANGSU CHANGJIANG ELECTRONICS TECHNOLOGY CO., LTD	2SD1815	100V -55°C ~ +150°C	EN/IEC 62109-1/-2	Tested with Appliance
1) an asterisk indicates a mark which assures the agreed level of surveillance License available upon request.					

<b>IEC 62109-1</b>			
Clause	Requirement – Test	Result – Remark	Verdict

<b>Functional Components</b>		
Components which are required for performance purposes and not directly addressed by a component standard or product standard: Ripple capacitors, Mosfets, etc.		
Object/part No.	Type/ model (optional)	Technical data
MCU1	GD32G553VET7	100PIN,512KB, -40°C to105°C
MCU2	TMS320F2800157	SPNR_LQFP80, -40°C to125°C

**--End of test report--**

<b>TEST REPORT</b> <b>IEC 62109-2</b> <b>Safety of Power Converter for use in Photovoltaic Power Systems</b> <b>Part 2: Particular requirements for inverters</b>	
<b>Report Number</b> .....	CN26TBUE 001 attachment 1
<b>Date of issue</b> .....	See report CN26TBUE 001
<b>Total number of pages</b> .....	24 pages
<b>Name of Testing Laboratory preparing the Report</b> .....:	
	See cover page
<b>Applicant's name</b> .....:	
	See cover page
<b>Address</b> .....	
	See cover page
<b>Test specification:</b>	
<b>Standard</b> .....	IEC/EN 62109-2:2011
<b>Test procedure</b> .....:	TÜV Mark Approval
<b>Non-standard test method</b> .....:	N/A
<b>Test Report Form No.</b> .....:	IEC 62109_2B
<b>Test Report Form(s) Originator</b> .....:	LCIE - Laboratoire Central des Industries Electriques
<b>Master TRF</b> .....	Dated 2016-11
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<b>Test item description</b> ..... :	See report CN26TBUE 001	
<b>Trade Mark</b> ..... :	See report CN26TBUE 001	
<b>Manufacturer</b> .....	See report CN26TBUE 001	
<b>Model/Type reference</b> ..... :	See report CN26TBUE 001	
<b>Ratings</b> ..... :	See report CN26TBUE 001	
<b>Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):</b>		
<input checked="" type="checkbox"/> <b>Testing Laboratory:</b>	See report CN26TBUE 001	
<b>Testing location/ address</b> .....	See report CN26TBUE 001	
<input type="checkbox"/> <b>Testing procedure: CTF Stage 1:</b>		
<b>Testing location/ address</b> .....		
<b>Tested by (name, function, signature)</b> ..... :		
<b>Approved by (name, function, signature)</b> .. :		
<input type="checkbox"/> <b>Testing procedure: CTF Stage 2:</b>		
<b>Testing location/ address</b> .....		
<b>Tested by (name + signature)</b> ..... :		
<b>Witnessed by (name, function, signature)</b> . :		
<b>Approved by (name, function, signature)</b> .. :		
<input type="checkbox"/> <b>Testing procedure: CTF Stage 3:</b>		
<input type="checkbox"/> <b>Testing procedure: CTF Stage 4:</b>		
<b>Testing location/ address</b> .....		
<b>Tested by (name, function, signature)</b> ..... :		
<b>Witnessed by (name, function, signature)</b> . :		
<b>Approved by (name, function, signature)</b> .. :		
<b>Supervised by (name, function, signature)</b> :		

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

See report CN26TBUE 001.

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

See report CN26TBUE 001.

**Testing location:**

See report CN26TBUE 001.

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

See report CN26TBUE 001.

**Copy of marking plate:**

See report CN26TBUE 001.

<b>Test item particulars</b> .....:	
<b>Equipment mobility</b> .....	<input type="checkbox"/> movable <input type="checkbox"/> hand-held <input checked="" type="checkbox"/> stationary <input checked="" type="checkbox"/> fixed <input type="checkbox"/> transportable <input type="checkbox"/> for building-in
<b>Connection to the mains</b> .....:	<input type="checkbox"/> pluggable equipment <input type="checkbox"/> direct plug-in <input checked="" type="checkbox"/> permanent connection <input type="checkbox"/> for building-in
<b>Environmental category</b> .....	<input checked="" type="checkbox"/> outdoor <input type="checkbox"/> indoor unconditional <input type="checkbox"/> indoor conditional
<b>Over voltage category Mains</b> .....	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input checked="" type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
<b>Over voltage category PV</b> .....:	<input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
<b>Mains supply tolerance (%)</b> .....	<b>According to specified supply range</b>
<b>Tested for power systems</b> .....	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
<b>IT testing, phase-phase voltage (V)</b> .....	<b>N/A</b>
<b>Class of equipment</b> .....	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input type="checkbox"/> Not classified
<b>Mass of equipment (kg)</b> .....	<b>See report CN26TBUE 001.</b>
<b>Pollution degree</b> .....	<input type="checkbox"/> PD 1 <input type="checkbox"/> PD 2 <input checked="" type="checkbox"/> PD 3
<b>IP protection class</b> .....:	IP65
.....:	
<b>Possible test case verdicts:</b>	
- 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)
<b>Testing</b> .....:	
<b>Date of receipt of test item</b> .....	See report CN26TBUE 001.
<b>Date (s) of performance of tests</b> .....	See report CN26TBUE 001.
<b>General remarks:</b>	
"(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.	
<b>Manufacturer's Declaration per sub-clause 4.2.5 of IEC60335-1:</b>	
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
<b>When differences exist; they shall be identified in the General product information section.</b>	

**Name and address of factory (ies):** See report CN26TBUE 001.

**General product information:**

See report CN26TBUE 001.

Throughout the test report following abbreviations may be used:

- |       |                             |       |                          |
|-------|-----------------------------|-------|--------------------------|
| • cl  | clearance                   | • int | internal distance        |
| • dcr | creepage distance           | • o-c | open-circuit             |
| • dti | distance through insulation | • o-l | overload                 |
| • PCE | Power Conversion Equipment  | • s-c | short-circuit            |
| • BI  | basic insulation            | • SI  | supplementary insulation |
| • DI  | double insulation           | • RI  | reinforced insulation    |

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
<b>4</b>	<b>GENERAL TESTING REQUIREMENTS</b>		<b>P</b>
<b>4.4.4</b>	<b>Single fault conditions to be applied</b>		<b>P</b>
<b>4.4.4.15</b>	<b>Fault-tolerance of protection for grid-interactive inverters</b>		<b>P</b>
<b>4.4.4.15.1</b>	<b>Fault-tolerance of residual current monitoring according to 4.8.3.5: the residual current monitoring system operates properly</b>	<b>See appended table 4.4.4.15.1</b>	<b>P</b>
	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
<b>4.4.4.15.2</b>	<b>Fault-tolerance of automatic disconnecting means</b>		<b>P</b>
<b>4.4.4.15.2.1</b>	<b>The means provided for automatic disconnection of a grid-interactive inverter from the mains shall:</b>		<b>P</b>
	- 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
<b>4.4.4.15.2.2</b>	<b>Design of insulation or separation complies with requirements of 7.3.7 of Part 1: report here Part 1 comment and verdict.</b>		<b>P</b>
<b>4.4.4.15.2.3</b>	<b>For non-isolated inverter, automatic checking of the isolation provided by a disconnect means after single fault.</b>		<b>N/A</b>

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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		N/A
	- at least basic or simple separation shall be maintained between the PV input and the mains		N/A
	- the inverter shall not start operation		N/A
	- the inverter shall indicate a fault in accordance with 13.9		N/A
<b>4.4.4.16</b>	<b>A stand-alone inverter with a transfer switch to transfer AC loads from the mains or other AC bypass source to the inverter output:</b>		<b>N/A</b>
	- 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
<b>4.4.4.17</b>	<b>Cooling system failure – Blanking test</b> <b>No hazards according to the criteria of sub-clause 4.4.3 of Part 1 shall result from blanketing the inverter</b> <b>This test is not required for inverters restricted to use only in closed electrical operating areas.</b>	See following table 4.4.4.17.	<b>P</b>
	Test stop condition: time duration value or stabilized temperature .....		P
<b>4.7</b>	<b>ELECTRICAL RATINGS TESTS</b>		<b>P</b>
<b>4.7.4</b>	<b>Stand-alone Inverter AC output voltage and frequency</b>		<b>P</b>
<b>4.7.4.1</b>	<b>General</b>		<b>P</b>
<b>4.7.4.2</b>	<b>Steady state output voltage at nominal DC input</b> <b>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.</b>		<b>P</b>
<b>4.7.4.3</b>	<b>Steady state output voltage across the DC input range</b> <b>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.</b>		<b>P</b>
<b>4.7.4.4</b>	<b>Load step response of the output voltage at nominal DC input</b> <b>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.</b>		<b>P</b>
<b>4.7.4.5</b>	<b>Steady state output frequency</b> <b>The steady-state AC output frequency shall not vary from the nominal value by more than +4 % or –6 %.</b>		<b>P</b>
<b>4.7.5</b>	<b>Stand-alone inverter output voltage waveform</b>		<b>P</b>
<b>4.7.5.1</b>	<b>General</b>		<b>P</b>

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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 %.		P
4.7.5.3	<b>Non-sinusoidal output waveform requirements</b>		N/A
4.7.5.3.1	<b>General</b>		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/ $\mu$ s 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	<b>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.</b>		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.		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
<b>4.8</b>	<b>ADDITIONAL TESTS FOR GRID-INTERACTIVE INVERTERS</b>		<b>P</b>
<b>4.8.1</b>	<b>General requirements regarding inverter isolation and array grounding</b>		<b>P</b>
	- Type of Array grounding supported .....	Grounded	P
	- Inverter isolation .....	Isolated	P
<b>4.8.2</b>	<b>Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays</b>	(See attached table)	<b>P</b>
<b>4.8.2.1</b>	<b>Array insulation resistance detection for inverters for ungrounded arrays</b>		<b>N/A</b>
	Inverter shall have means to measure DC insulation resistance from PV input (array) to ground before starting operation		N/A
	Or Inverter shall be provided with instruction in		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	accordance with 5.3.2.11.		
	Measured DC insulation resistance: .....		N/A
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value $R = V_{max}/30mA$ under normal conditions		N/A
	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		N/A
	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:		N/A
	- shall indicate a fault in accordance with 13.9		N/A
	- shall not connect to the mains		N/A
<b>4.8.2.2</b>	<b>Array insulation resistance detection for inverters for functionally grounded arrays</b>		<b>N/A</b>
	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
<b>4.8.3</b>	<b>Array residual current detection</b>		<b>P</b>
<b>4.8.3.1</b>	<b>General</b>		<b>P</b>
<b>4.8.3.2</b>	<b>30 mA touch current type test for isolated inverters</b>	See appended test table 4.8.3.2 Test for detection of 30 mA touch current	<b>P</b>
<b>4.8.3.3</b>	<b>Fire hazard residual current type test for isolated inverters</b>	See appended test table 4.8.3.3 Test for detection of Fire hazard residual current	<b>P</b>
<b>4.8.3.4</b>	<b>Protection by application of RCD's</b>		<b>N/A</b>

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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 RCD 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
<b>4.8.3.5</b>	<b>Protection by residual current monitoring</b>		N/A
<b>4.8.3.5.1</b>	<b>General</b>		N/A
	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.		N/A
	The residual current monitoring means shall measure the total (both a.c. and d.c. components) RMS current.		N/A
	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:		N/A
	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:		N/A
	- maximum 300 mA for inverters with continuous output power rating $\leq 30$ kV;		N/A
	- maximum 10 mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.		N/A
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		N/A
	b) Sudden changes in residual current: The inverter shall disconnect from the mains within the time specified in Table 31		N/A
	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.		N/A
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		N/A
<b>4.8.3.5.2</b>	<b>Test for detection of excessive continuous residual current: test repeated 5 times and time to disconnect shall not exceed 0,3 s.</b>		N/A
<b>4.8.3.5.3</b>	<b>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.</b>		N/A
<b>4.8.3.6</b>	<b>Systems located in closed electrical operating areas</b>		N/A
	<b>The protection against shock hazard is not required if the installation information provided</b>		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	<b>with the inverter indicates the restriction for use in a closed electrical operating area, and</b>		
	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
<b>5</b>	<b>MARKING AND DOCUMENTATION</b>		<b>P</b>
<b>5.1</b>	<b>Marking</b>		<b>P</b>
<b>5.1.4</b>	<b>Equipment ratings</b>		<b>P</b>
	PV input ratings:		P
	- V <sub>max</sub> PV (absolute maximum) (d.c. V)		P
	- I <sub>sc</sub> 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:		P
	- Voltage (nominal or range) (a.c. V)		P
	- Current (maximum continuous) (a.c. A)		P
	- Frequency (nominal or range) (Hz)		P
	d.c. output ratings:		P
	- Voltage (nominal or range) (d.c. V)		P
	- Current (maximum continuous) (d.c. A)		P
	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
<b>5.2</b>	<b>Warning markings</b>		<b>P</b>
<b>5.2.2</b>	<b>Content for warning markings</b>		<b>P</b>
<b>5.2.2.6</b>	<b>Inverters for closed electrical operating areas</b>		<b>N/A</b>
	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
<b>5.3</b>	<b>Documentation</b>		<b>P</b>
<b>5.3.2</b>	<b>Information related to installation</b>		<b>P</b>
<b>5.3.2.1</b>	<b>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.</b>		<b>P</b>
	PV input quantities :		P
	- V <sub>max</sub> 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 <sub>sc</sub> PV (absolute maximum) (d.c. A)		P
	- I <sub>sc</sub> PV (absolute maximum) (d.c. A)		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- 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:		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
	d.c input (other than PV) quantities:		P
	- Voltage (nominal or range) (d.c. V)		P
	- Nominal battery voltage (d.c. V)		P
	- Current (maximum continuous) (d.c. A)		P
	d.c. output quantities:		P
	- Voltage (nominal or range) (d.c. V)		P
	- Nominal battery voltage (d.c. V)		P
	- Current (maximum continuous) (d.c. A)		P
	Protective class (I or II or III)		P
	Ingress protection (IP) rating per part 1		P
<b>5.3.2.2</b>	<b>Grid-interactive inverter setpoints</b>		<b>P</b>
	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
<b>5.3.2.3</b>	<b>Transformers and isolation</b>		<b>P</b>
	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.	Reinforced insulation	P
	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
	The instructions shall also indicate what the resulting installation requirements are regarding:		N/A

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Clause	Requirement + Test	Result - Remark	Verdict
	- earthing or not earthing the array		N/A
	- providing external residual current detection devices		N/A
	- requiring an external isolation transformer,		N/A
<b>5.3.2.4</b>	<b>Transformers required but not provided</b>		<b>N/A</b>
	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
<b>5.3.2.5</b>	<b>PV modules for non-isolated inverters</b>		<b>N/A</b>
	Non-isolated inverters shall be provided with installation instructions that require PV modules that have an IEC 61730 Class A rating		N/A
	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
<b>5.3.2.6</b>	<b>Non-sinusoidal output waveform information</b>		<b>N/A</b>
	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
<b>5.3.2.7</b>	<b>Systems located in closed electrical operating areas</b>		<b>N/A</b>
	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
<b>5.3.2.8</b>	<b>Stand-alone inverter output circuit bonding</b>		<b>P</b>
	Where required by 7.3.10, the documentation for an inverter shall include the following:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	- 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.	P
	- if the output circuit is intended to be floating, the documentation for the inverter shall indicate that the output is floating.		N/A
<b>5.3.2.9</b>	<b>Protection by application of RCD's</b>		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
<b>5.3.2.10</b>	<b>Remote indication of faults</b>		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
<b>5.3.2.11</b>	<b>External array insulation resistance measurement and response</b>		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
<b>5.3.2.12</b>	<b>Array functional grounding information</b>		P
	Where approach a) of 4.8.2.2 is used, the installation instructions for the inverter shall include all of the following:		P
	a) the value of the total resistance between the PV circuit and ground integral to the inverter .....		P

IEC 62109-2			
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 .....		P
	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 .....		P
	d) a warning that there is a risk of shock hazard if the total minimum resistance requirement is not met.		N/A
<b>5.3.2.13</b>	<b>Stand-alone inverters for dedicated loads</b>		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
<b>5.3.2.14</b>	<b>Identification of firmware version(s)</b>		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
<b>7</b>	<b>PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS</b>		P
<b>7.3</b>	<b>Protection against electric shock</b>		P
<b>7.3.10</b>	<b>Additional requirements for stand-alone inverters</b>		P
	One circuit conductor bonded to earth to create a grounded conductor and an earthed system.		P
	The means used to bond the grounded conductor to protective earth provided within the inverter or as part of the installation		P
	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,		P
	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.		P
	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.		P

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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		P
	Inverters intended to have a circuit conductor bonded to earth shall not impose any normal current on the bond except for leakage current.		P
	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
<b>7.3.11</b>	<b>Functionally grounded arrays</b>		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
<b>9</b>	<b>PROTECTION AGAINST FIRE HAZARDS</b>		P
<b>9.3</b>	<b>Short-circuit and overcurrent protection</b>		P
<b>9.3.4</b>	<b>Inverter backfeed current onto the array</b>		P
	The backfeed current testing and documentation requirements in Part 1 apply, including but not limited to the following.		P
	Inverter backfeed current onto the PV array maximum value.....		P
	This inverter backfeed current value shall be provided in the installation instructions regardless of the value of the current, in accordance with Table 33.		P
<b>13</b>	<b>PHYSICAL REQUIREMENTS</b>		P
<b>13.9</b>	<b>Fault indication</b>		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

<b>4.4.4</b>	<b>TABLE: Single fault condition to be applied</b>					<b>P</b>
	Ambient temperature (°C) .....	--				—
	Power source for EUT: Manufacturer, model/type, output rating .....	--				—
<b>4.4.4.15.1</b>	<b>Fault-tolerance of residual current monitoring</b>					
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 CN26TBUE 001.						

<b>4.4.4</b>	<b>TABLE: Single fault condition to be applied</b>					<b>P</b>
	Ambient temperature (°C) .....	--				—
	Power source for EUT: Manufacturer, model/type, output rating .....	--				—
<b>4.4.4.15.2</b>	<b>Fault-tolerance of automatic disconnecting means</b>					
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 CN26TBUE 001.						

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Clause	Requirement + Test	Result - Remark	Verdict
<b>4.4.4.17</b>	<b>Cooling system failure – Blanketing test</b>		<b>P</b>
	Test voltage (Vdc)..... :	<b>58</b>	—
	Test current (Idc) .....	<b>43.33</b>	—
	Test voltage (Vac)..... :	<b>230</b>	—
	Test current (Iac) .....	<b>10.43</b>	—
	t <sub>amb1</sub> (°C) .....	<b>See below</b>	—
	t <sub>amb2</sub> (°C) .....	<b>See below</b>	—
<b>maximum temperature T of part/at::</b>		<b>T (°C)</b>	<b>T<sub>max</sub> (°C)</b>
Enclosure		55.41	90
LED surface		55.82	90
Mounting surface		68.65	90
Ambient		43.00	--
<b>Supplementary information:</b>			

<b>4.7.4</b>	<b>TABLE: Steady state Inverter AC output voltage and frequency</b>			<b>P</b>
	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: See report CN26TBUE 001.				

<b>4.7.5.2</b>	<b>TABLE: Stand-alone inverter output voltage waveform</b>									<b>P</b>
Order number	Measurement									Limit
	5%Load			50%Load			100%Load			[%]
	L1	L2	L3	L1	L2	L3	L1	L2	L3	
2	0.04%	--	--	0.04%	--	--	0.05%	--	--	6%
3	0.49%	--	--	0.60%	--	--	0.59%	--	--	6%
4	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%
5	0.53%	--	--	0.40%	--	--	0.81%	--	--	6%
6	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%

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Clause	Requirement + Test						Result - Remark			Verdict
7	0.32%	--	--	0.15%	--	--	0.40%	--	--	6%
8	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%
9	0.21%	--	--	0.08%	--	--	0.32%	--	--	6%
10	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%
11	0.14%	--	--	0.09%	--	--	0.28%	--	--	6%
12	0.02%	--	--	0.02%	--	--	0.02%	--	--	6%
13	0.07%	--	--	0.12%	--	--	0.23%	--	--	6%
14	0.02%	--	--	0.01%	--	--	0.02%	--	--	6%
15	0.06%	--	--	0.13%	--	--	0.19%	--	--	6%
16	0.02%	--	--	0.02%	--	--	0.02%	--	--	6%
17	0.07%	--	--	0.12%	--	--	0.16%	--	--	6%
18	0.02%	--	--	0.02%	--	--	0.02%	--	--	6%
19	0.09%	--	--	0.10%	--	--	0.12%	--	--	6%
20	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%
21	0.08%	--	--	0.07%	--	--	0.09%	--	--	6%
22	0.02%	--	--	0.01%	--	--	0.02%	--	--	6%
23	0.07%	--	--	0.06%	--	--	0.08%	--	--	6%
24	0.02%	--	--	0.02%	--	--	0.01%	--	--	6%
25	0.07%	--	--	0.06%	--	--	0.07%	--	--	6%
26	0.02%	--	--	0.02%	--	--	0.02%	--	--	6%
27	0.06%	--	--	0.06%	--	--	0.06%	--	--	6%
28	0.02%	--	--	0.02%	--	--	0.01%	--	--	6%
29	0.06%	--	--	0.05%	--	--	0.05%	--	--	6%
30	0.03%	--	--	0.02%	--	--	0.01%	--	--	6%
31	0.06%	--	--	0.04%	--	--	0.05%	--	--	6%
32	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%
33	0.05%	--	--	0.03%	--	--	0.05%	--	--	6%
34	0.03%	--	--	0.02%	--	--	0.01%	--	--	6%
35	0.05%	--	--	0.03%	--	--	0.04%	--	--	6%
36	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%
37	0.05%	--	--	0.03%	--	--	0.04%	--	--	6%
38	0.03%	--	--	0.02%	--	--	0.02%	--	--	6%
39	0.07%	--	--	0.04%	--	--	0.03%	--	--	6%
40	0.02%	--	--	0.02%	--	--	0.01%	--	--	6%
THD	0.81%	--	--	0.78%	--	--	1.21%	--	--	10%

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

4.8.2	<b>TABLE: Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays</b>		N/A
4.8.2.1	<b>Array insulation resistance detection for inverters for ungrounded arrays</b>		N/A

DC Voltage below minimum operating voltage (V)	DC Voltage for inverter begin operation (V)	Resistance between ground and PV input terminal ( $\Omega$ )	Required Insulation resistance $R^* = (V_{MAX\ PV} / 30mA)$ ( $\Omega$ )	Result
<b>PV+</b>				
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
<b>PV-</b>				
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--

**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

\*Array Insulation Resistance Threshold Value  $R = --$  [ $k\Omega$ ] (Should be larger than  $R = V_{MAX\ PV} / 30mA$ .)

**Supplementary information:**

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Clause	Requirement + Test	Result - Remark	Verdict

4.8.3.2	TABLE: 30mA touch current type test for isolated inverters		P
Condition	Current (mA)	Limit (30mA)	
DC+ to PE	0.33	30mA	
DC- to PE	0.31	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		P
Condition	Current (mA)	Limit (300mA or 10mA per kVA)	
DC+ to PE	115.43	300mA	
DC- to PE	116.28	300mA	

**Supplementary information:**

4.8.3.5	TABLE: Protection by residual current monitoring		N/A
Test conditions:	Output power (kVA) : -- Input voltage (V <sub>DC</sub> ): -- Frequency (Hz): -- Output AC Voltage ( V <sub>AC</sub> ): --		

4.8.3.5.2	Test for detection of excessive continuous residual current			N/A
Fault Current (mA)		Disconnection time (ms)		
Measured Fault Current	Limit	Measured Disconnection time	Limit	
+ PV to N:				
--	300mA for output power ≤ 30 kVA 10mA per kVA for output power > 30 kVA	--	300	
--	300	--	300	
--	300	--	300	
--	300	--	300	
--	300	--	300	
- PV to N:				
--	300	--	300	
--	300	--	300	
--	300	--	300	
--	300	--	300	
--	300	--	300	

Note:

- maximum 300mA for inverters with continuous output power rating ≤30 kVA;
- maximum 10mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.

This test shall be repeated 5 times, and for all 5 tests the time to disconnect shall not exceed 0,3s.

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Clause	Requirement + Test	Result - Remark	Verdict
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.			
Supplementary information:			

4.8.3.5.3	TABLE: Test for detection of sudden changes in residual current		N/A
+PV to N			
Limit (mA)	U <sub>N</sub>		Limit (ms)
	Disconnection time (ms)		
30	--		300
30	--		300
30	--		300
30	--		300
30	--		300
60	--		150
60	--		150
60	--		150
60	--		150
60	--		150
150	--		40
150	--		40
150	--		40
150	--		40
150	--		40
-PV to N			
Limit (mA)	U <sub>N</sub>		Limit (ms)
	Disconnection time (ms)		
30	--		300
30	--		300
30	--		300
30	--		300
30	--		300
60	--		150
60	--		150
60	--		150
60	--		150
60	--		150
150	--		40
150	--		40
150	--		40
150	--		40
150	--		40

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Clause	Requirement + Test	Result - Remark	Verdict
<p>Note: The capacitive current is risen until disconnection. Test condition: <math>I_c + 30/60/150\text{mA} \leq I_{c\text{max}}</math>. R<sub>1</sub> is set that 30/60/150mA Flow and switch S is closed.</p>			
Supplementary information:			

--END--

<b>Test report no.: CN26TBUE 001 Attachment 2</b>		<b>Page 1 of 2</b>	
<i>Prüfbericht-Nr.:</i>		<i>Seite 1 von 2</i>	
<b>Clause</b> <i>Absatz</i>	<b>Requirements – Tests</b> <i>Anforderungen - Prüfungen</i>	<b>Measuring results – Remarks</b> <i>Messergebnisse – Bemerkungen</i>	<b>Result</b> <i>Ergebnis</i>

<p><b>Attachment 2</b> <b>EN IEC 62311</b></p> <p><b>Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz)</b></p>
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5	Performance of assessments	Eveluation refer to Page 2	P
5.1	Assessment methods		P
	- Simplified assessment (possible for particular cases)		N/A
	- Measurement		N/A
	- Calculation		N/A
5.2	Frequency range under assessment for unintentional radiation		P
5.3	General procedure for the assessment of equipment		P
6	Uncertainty		P
6.1	General		N/A
6.2	Consideration of uncertainty for compliance		N/A
7	Considerations on sources with multiple frequencies and non-uniformity of fields		N/A
7.1	Sources with multiple frequencies		N/A
7.2	Exposure to non-uniform fields		N/A
8	Evaluation of compliance to limits		P

<b>Test report no.: CN26TBUE 001 Attachment 2</b>		<b>Page 2 of 2</b>	
<i>Prüfbericht-Nr.:</i>		<i>Seite 2 von 2</i>	
<b>Clause</b> <i>Absatz</i>	<b>Requirements – Tests</b> <i>Anforderungen - Prüfungen</i>	<b>Measuring results – Remarks</b> <i>Messergebnisse – Bemerkungen</i>	<b>Result</b> <i>Ergebnis</i>

General Information	
<b>Auftraggeber:</b> <i>Client:</i>	See cover page.
<b>Prüfgegenstand:</b> <i>Test item:</i>	See cover page.
<b>Bezeichnung / Typ-Nr.:</b> <i>Identification / Type no.:</i>	See cover page.
<b>Prüfgrundlage:</b> <i>Test specification:</i>	EN IEC 62311: 2020

### Evaluation of Human Exposure to Electromagnetic Fields 0Hz-300GHz

The equipment is a Hybrid Energy Storage System with low power consumption, it does incorporate only non-intentional radiators, but does not contain radio transmitters; the typical usage, installation and physical characteristics make the equipment inherently compliant with all applicable EMF exposure levels according to Clause 5.3, EN IEC 62311: 2020.

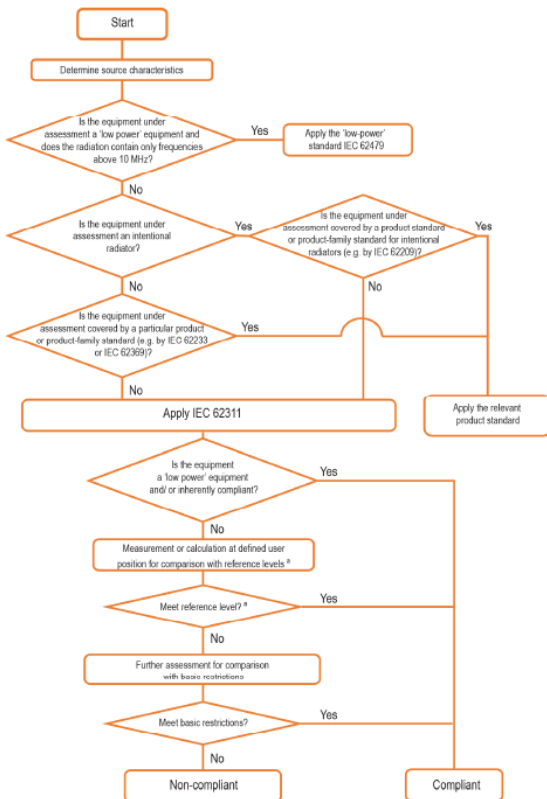


PHOTO DOCUMENTATION

CN26TBUE 001 ATTACHMENT 3

for

Hybrid Energy Storage System

SunEnergyXT 500 PRO, SunEnergyXT 500

SunEnergyXT Holdings S.à r.l.



This documentation consists of 11 pages (excluding this cover page)

**Model:** see cover page



Figure 1. Front view (Wi-Fi not supported)



Figure 2. Top view

**Model:** see cover page

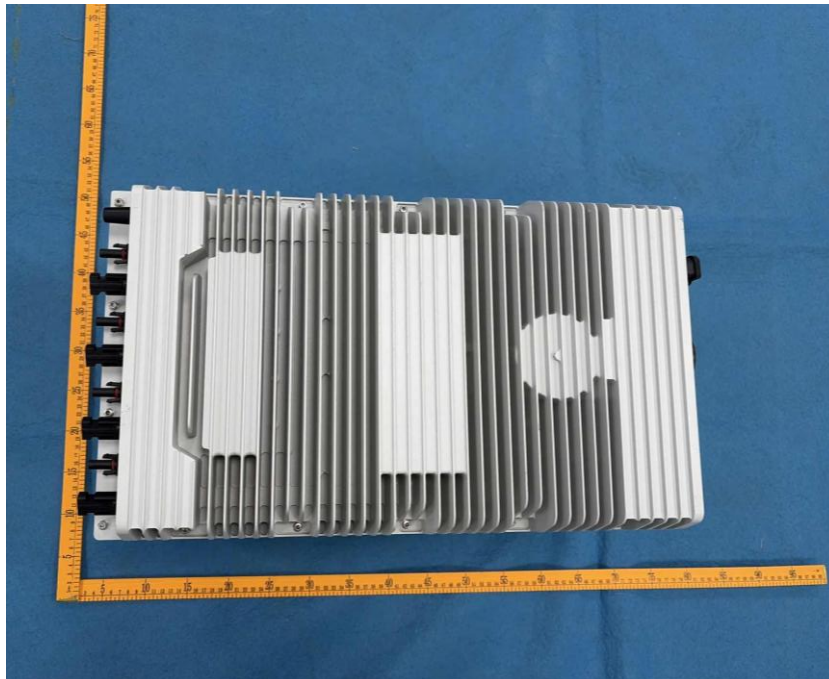


Figure 3. Back view



Figure 4. Right view

**Model:** see cover page



Figure 5. Left view

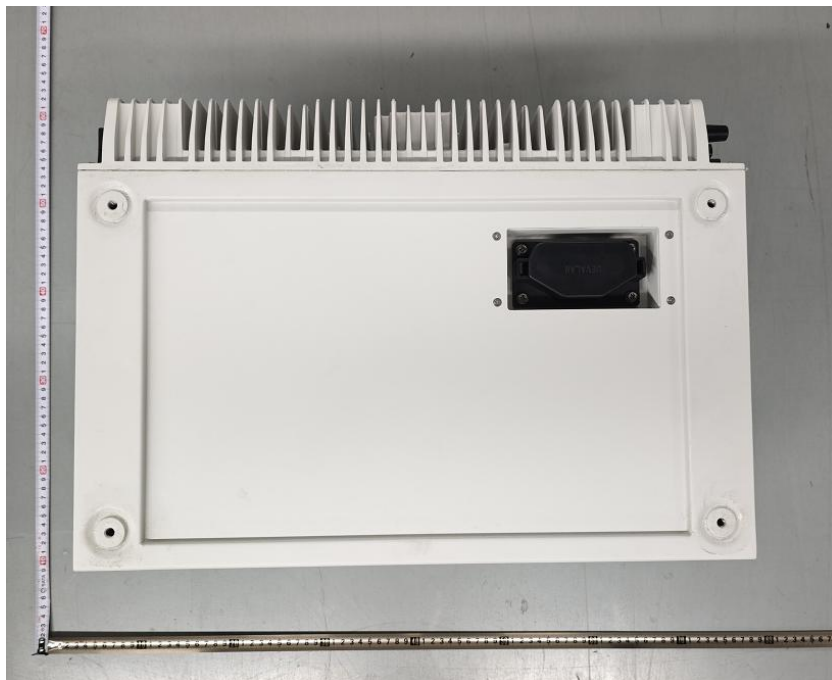


Figure 6. Bottom view

**Model:** see cover page



Figure 7. DC terminal view



Figure 8. AC terminal view

**Model:** see cover page



Figure 9. PE terminal view

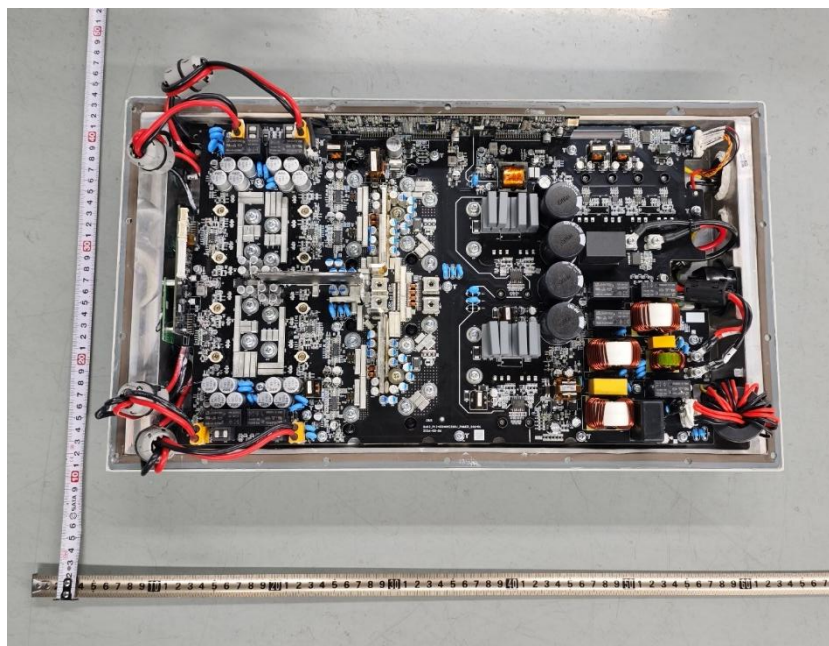


Figure10. Open view of inverter part 1

**Model:** see cover page

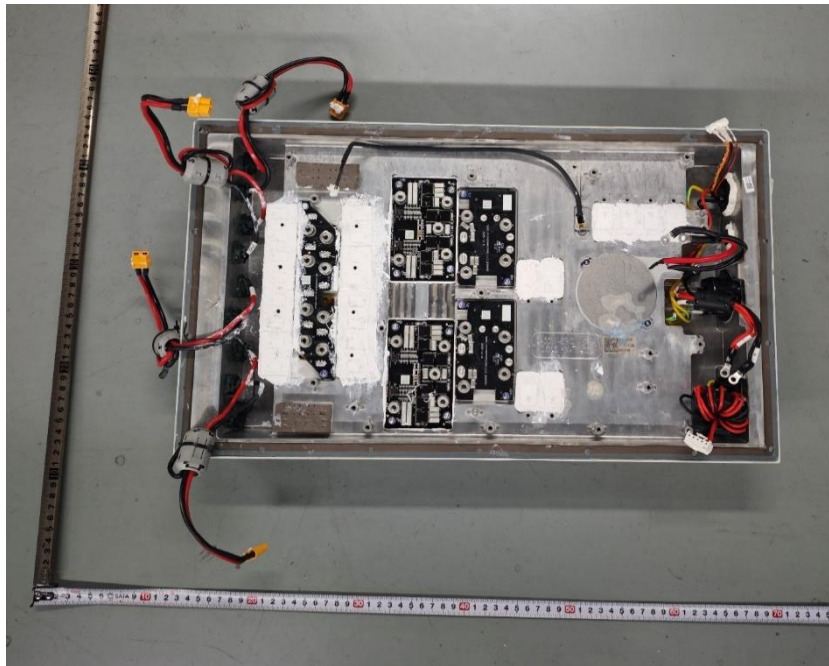


Figure 11. Open view of inverter part 2

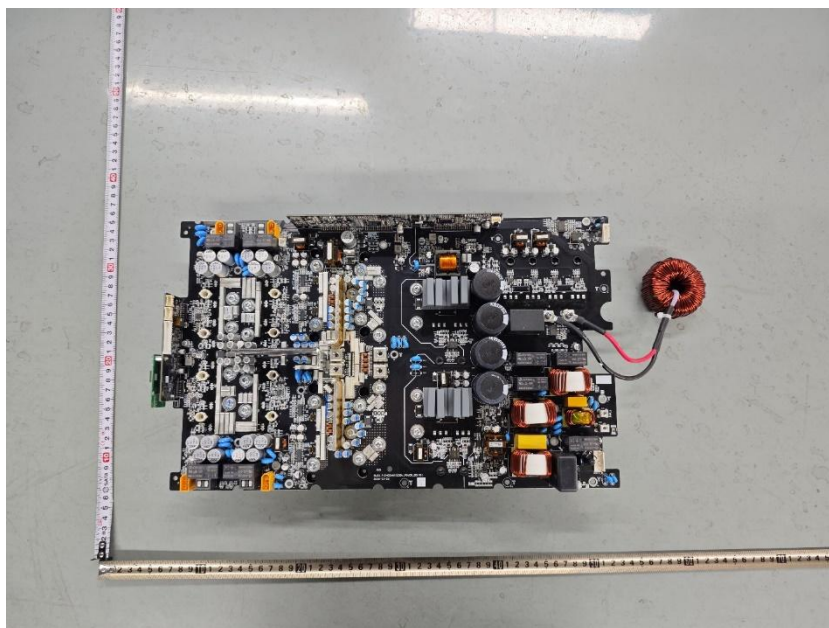


Figure 12. Power board front view of inverter part

**Model:** see cover page

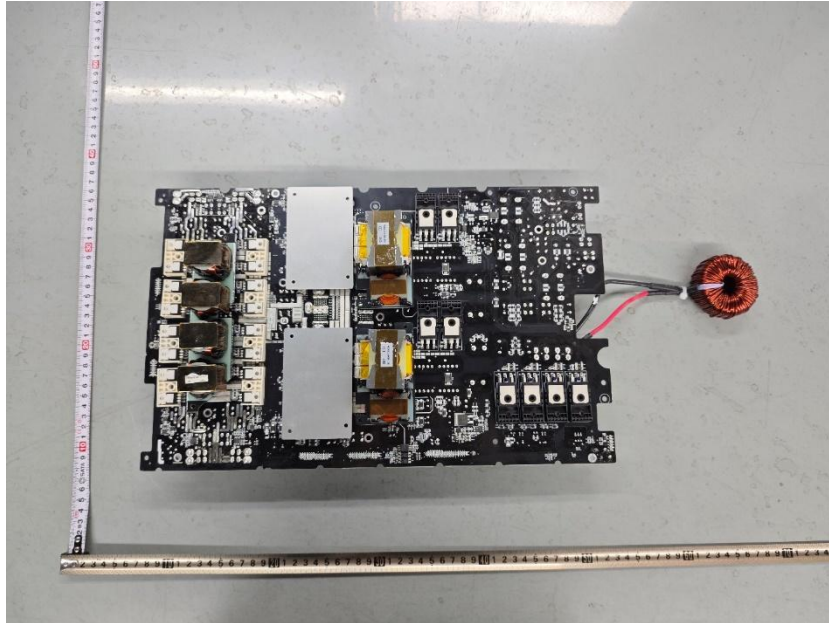


Figure 13. Power board back view of inverter part

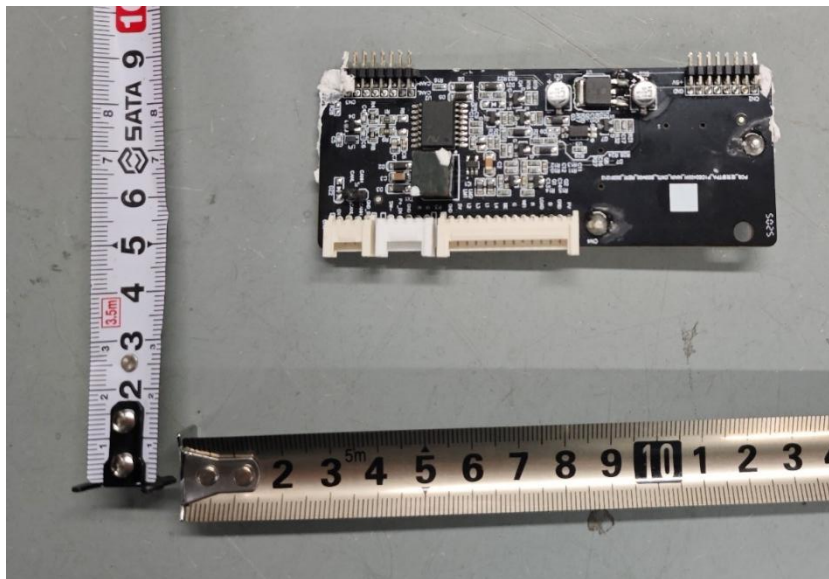


Figure 14. communication board front view of inverter part

**Model:** see cover page

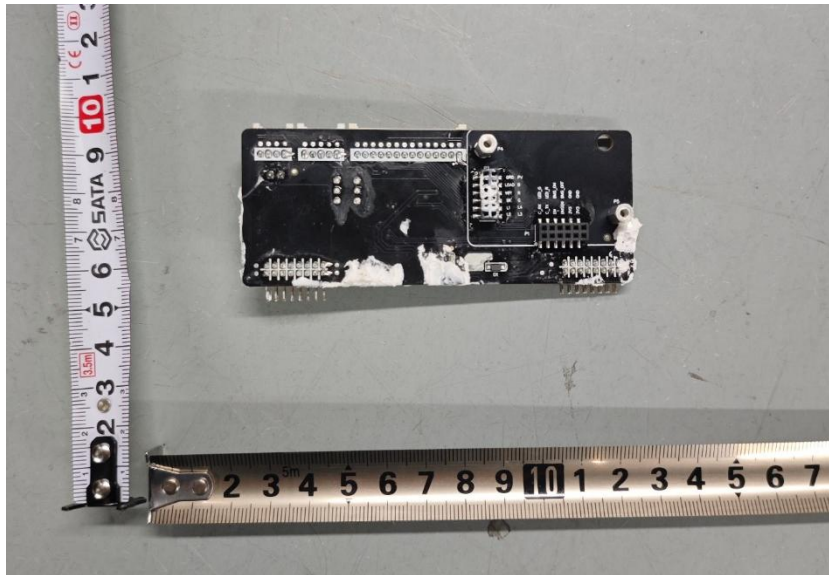


Figure15. communication board back view of inverter part

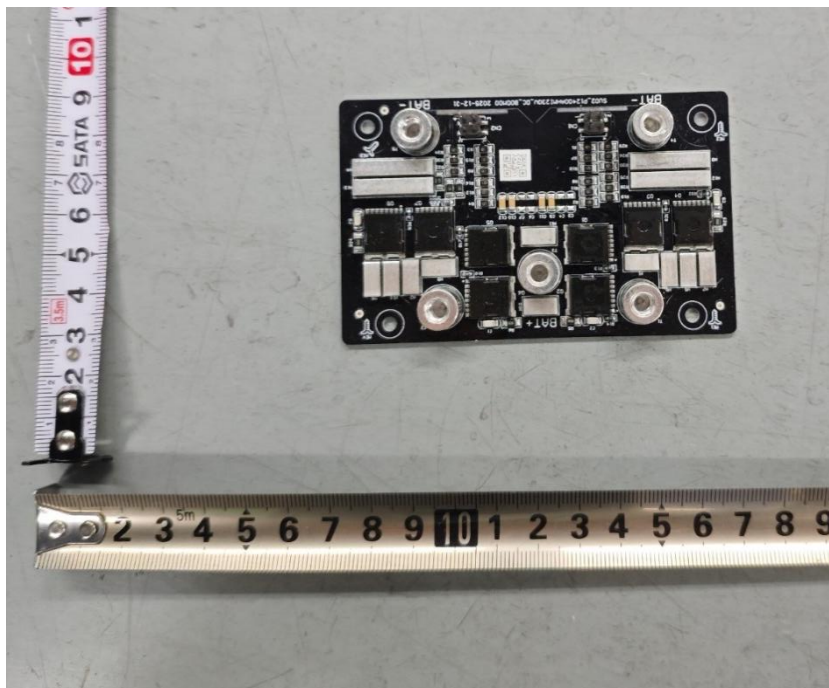


Figure 16. LLC board front view of inverter part

**Model:** see cover page

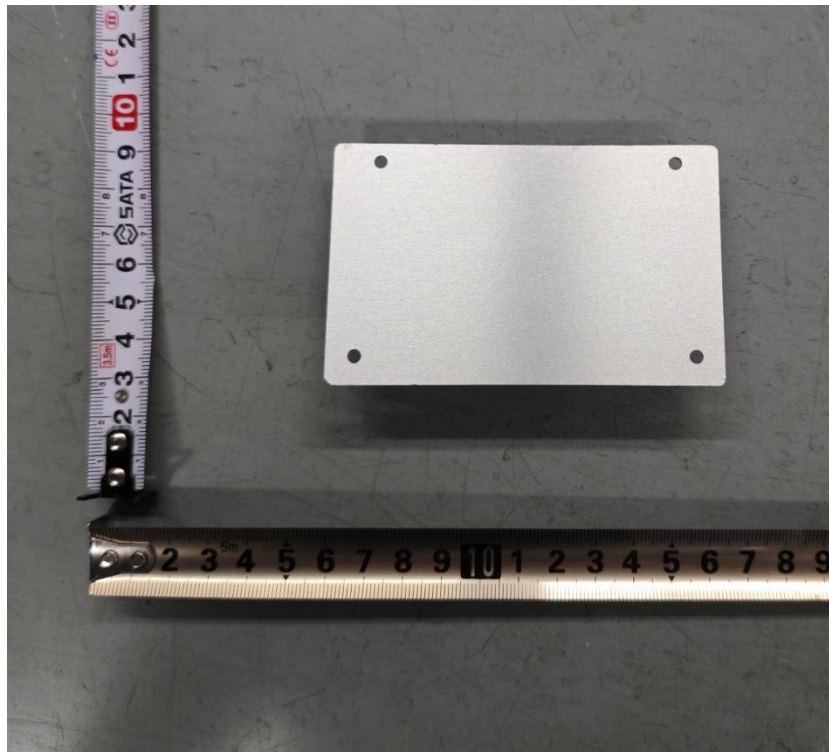


Figure 17. LLC board back view of inverter part

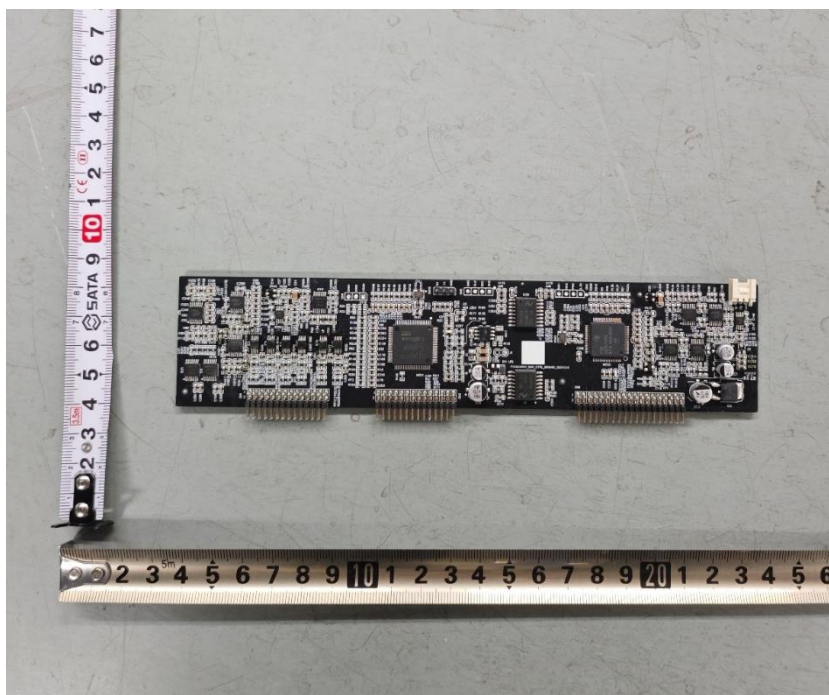


Figure 18. Control board front view of inverter part

**Model:** see cover page

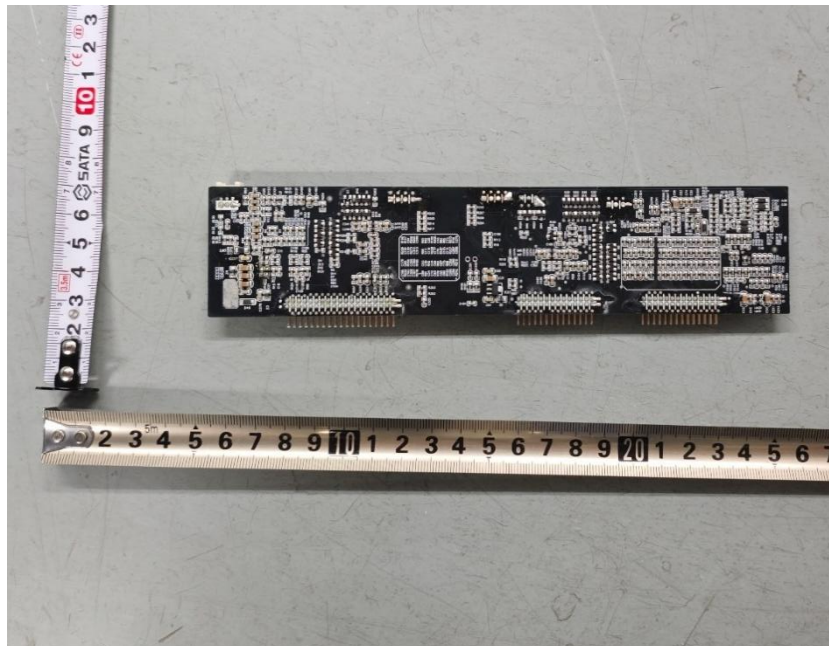


Figure 19. Control board front back of inverter part

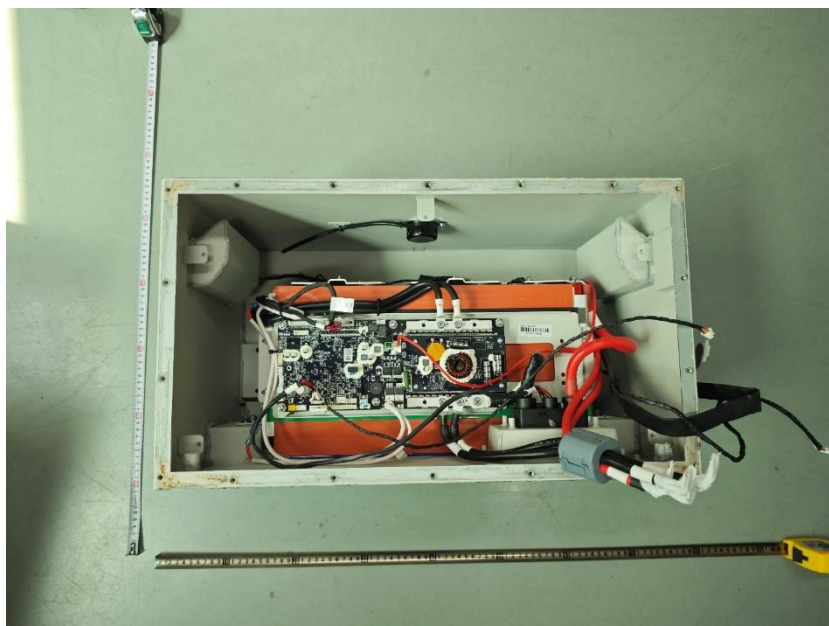


Figure 20. Open view of battery part

**Model:** see cover page

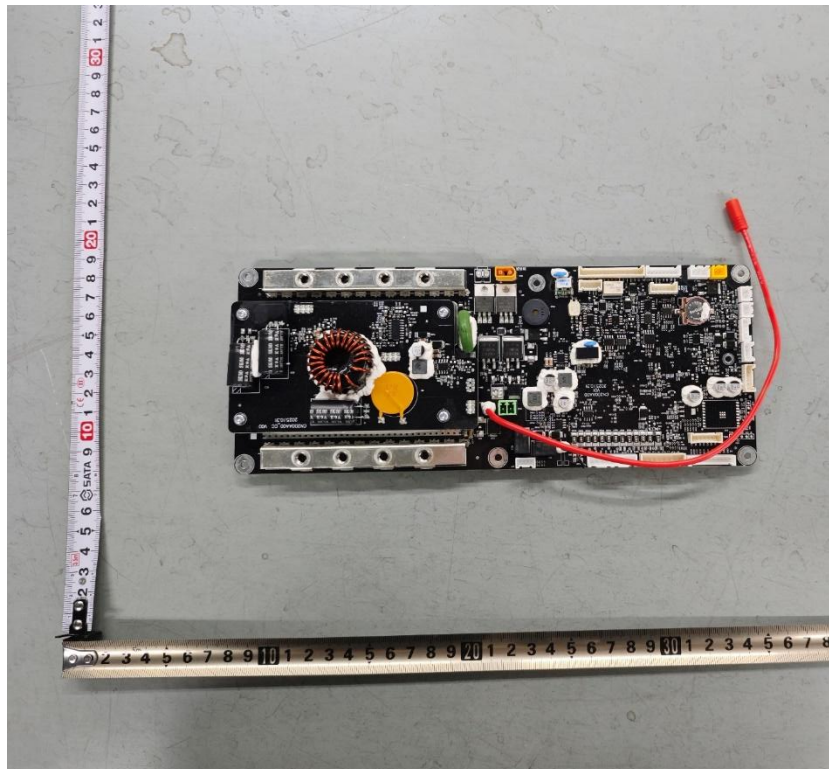


Figure 21. BMS board front view of battery part

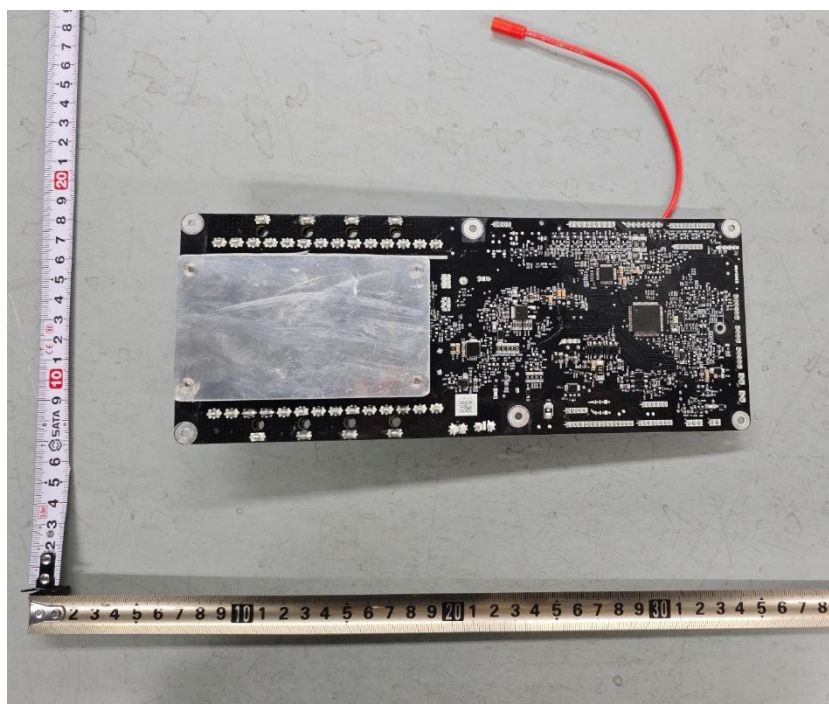


Figure 22. BMS board back view of battery part

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