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

Report Number..... :	70.409.19.175.04-00 part 1 of 2
Date of issue..... :	2019-12-06
Total number of pages..... :	77
TÜV SÜD Branch..... :	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
Applicant's name..... :	Huawei Technologies Co., Ltd.
Address..... :	Administration Building Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA
Test specification:	
Standard..... :	EN 62109-1:2010
Test procedure..... :	CE_LVD
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 2016-04

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.

Test item description ..... :	SOLAR INVERTER
Trade Mark ..... :	HUAWEI
Manufacturer ..... :	Huawei Technologies Co., Ltd.
Model/Type reference ..... :	SUN2000-125KTL-M0, SUN2000-110KTL-M0, SUN2000-100KTL-M0, SUN2000-100KTL-M1, SUN2000-100KTL-INM0
Ratings ..... :	See rating labels on page 4 to 5

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**TÜV SÜD Branch:**	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch	
Location/ address ..... :		3-13, No.151 Heng Tong Road, 200070, Shanghai, P.R. China	
☒	**Associated Testing Laboratory:**	CQC - Trusted(Jiangsu) Testing Technology Co., Ltd.	
Testing location/ address ..... :		No.99, Wenlan Road, Xianlin University Zone, Xianlin Street, Qixia District, NanJing, China	
Tested by (name, function, signature)..... :		*Shan Huang*	Shan Huang
Approved by (name, function, signature) .. :		*Kai Zhao*	Kai Zhao
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address ..... :			
Tested by (name, function, signature)..... :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address ..... :			
Tested by (name + signature)..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address ..... :			
Tested by (name, function, signature)..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			
Supervised by (name, function, signature) :			

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

Tests against:

EN 62109-1:2010, EN 62109-2:2011

Total test reports contains 2 parts and 1 attachments listed in below table:

Item	Description	Pages
Part 1	EN 62109-1:2010 test report	77
Part 2	EN 62109-2:2011 test report	35
Attachment	Data form for electrical and electronic component(CDF)	13

Summary of testing:

All the tests results are confirmed to the requirements of the standard.

Tests performed (name of test and test clause):

Family products design, full tests were conducted on representative model **SUN2000-125KTL-M0**, additional test of electrical ratings on all other models and heating test were conducted on Max. output current model **SUN2000-110KTL-M0 and SUN2000-100KTL-M0**.

☒ Visual inspection – clauses as available;
☒ Mains supply electrical data in normal condition & electrical ratings tests – 4.2.2.6 & 4.7;
☒ Durability and legibility of marking – 5.1.2;
☒ Thermal test and single fault test – 4.3 & 4.4;
☒ Humidity preconditioning – 4.5;
☒ Voltage Back-feed Protection, as combined with –4,4;
☒ Enclosure integrity – 6.3;
☒ Non-accessibility – 7.3.4.2.3;
☒ Protective bonding – 7.3.6.3.3;
☒ Capacitor discharge – 7.3.5.3.2 & 7.3.9;
☒ Clearance and creepage distances - 7.3.7;
☒ Capacitor discharge – 7.3.9 & 7.4;
☒ Energy hazards – 7.4;
☒ Electrical tests – 7.5;
☐ Stability test – 8.3;
☒ Provisions for lifting and carrying – 8.4;
☒ Wall mounting loading – 8.5;
☐ Material tests – 9.1.3;
☒ Limited power sources – 9.2;
☒ Sonic pressure hazards – 10;
☒ Actuating parts of controls (Knob pull and limitation of movement) – 13.1;
☐ Physical tests on power supply cords – 13.3.2.5;
☒ 8 mm stripping test – 13.3.3.6;
☐ Mould stress relief test – 13.6.2.1;
☒ Deformation tests – 13.7;
☐ Battery – 14.8;
☒ Annex B operational test as combined with 4,4;

Remark: Touch current test was conducted at nominal frequency 60Hz(considered more severity), and other tests were conducted at nominal frequency 50Hz.

Testing location:

1. CQC - Trusted(Jiangsu) Testing Technology Co., Ltd.

No.99, Wenlan Road, Xianlin University Zone, Xianlin Street, Qixia District, NanJing, China

All tests except IP 66 test

2. Guangdong Sushi Guangbo Testing Technology Co., Ltd. (CNAS L12110)

Modern enterprise accelerator 4, No. 24 industrial East Road, Songshan Lake High Technology Development Zone, Dongguan, China

IP 66 test: report No. GDGT-H/R-2019-459-XG

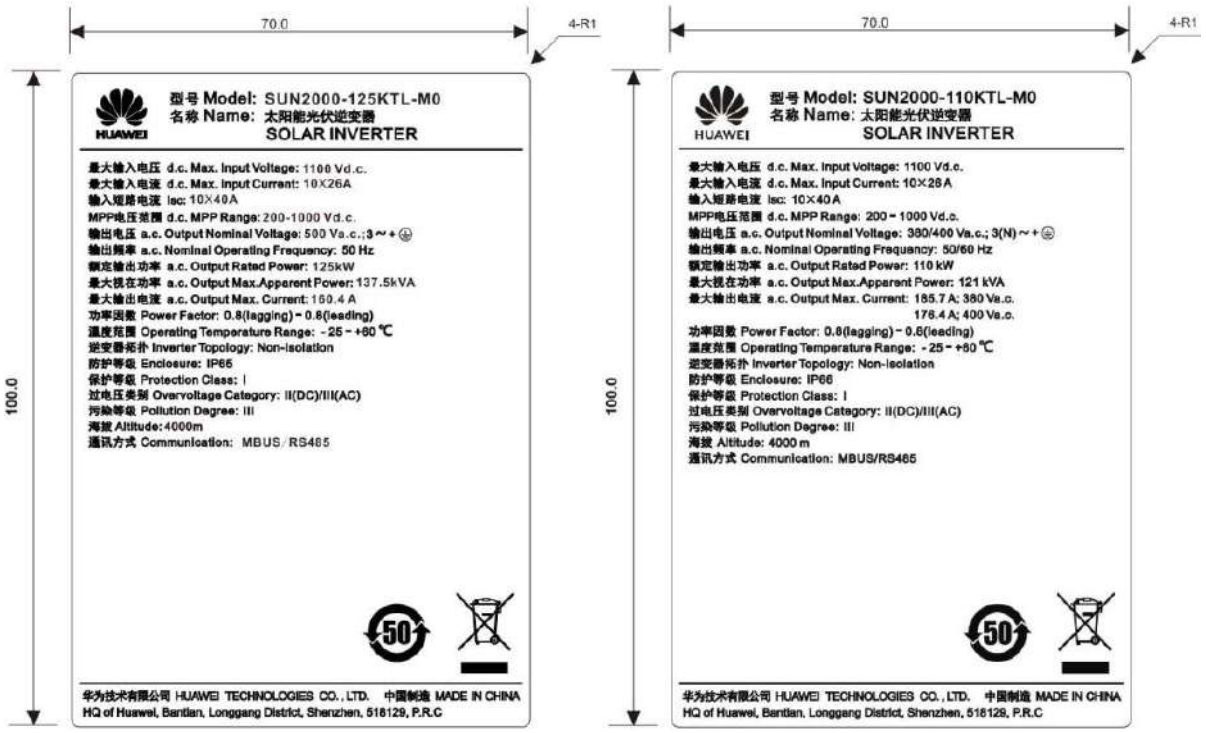
Summary of compliance with National Differences (List of countries addressed):

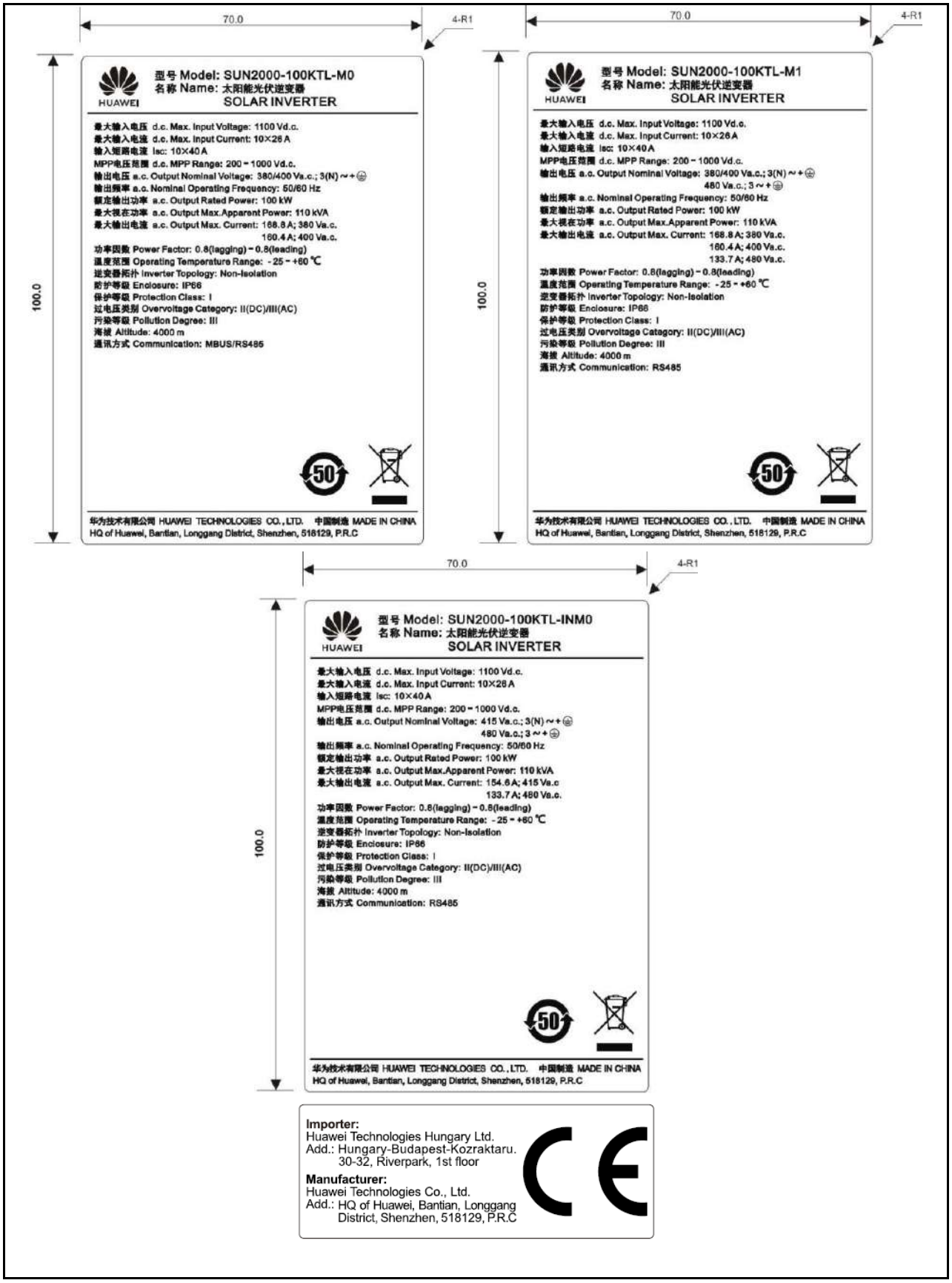
All tests were carried out according to EN 62109-1:2010.

The text of IEC 62109-1(ed.1) was approved by CENELEC as a European Standard without any modification. Also compliance with EN 62109-1:2010, Annex ZA of EN 62109-1:2010 is recorded at the end of this report.

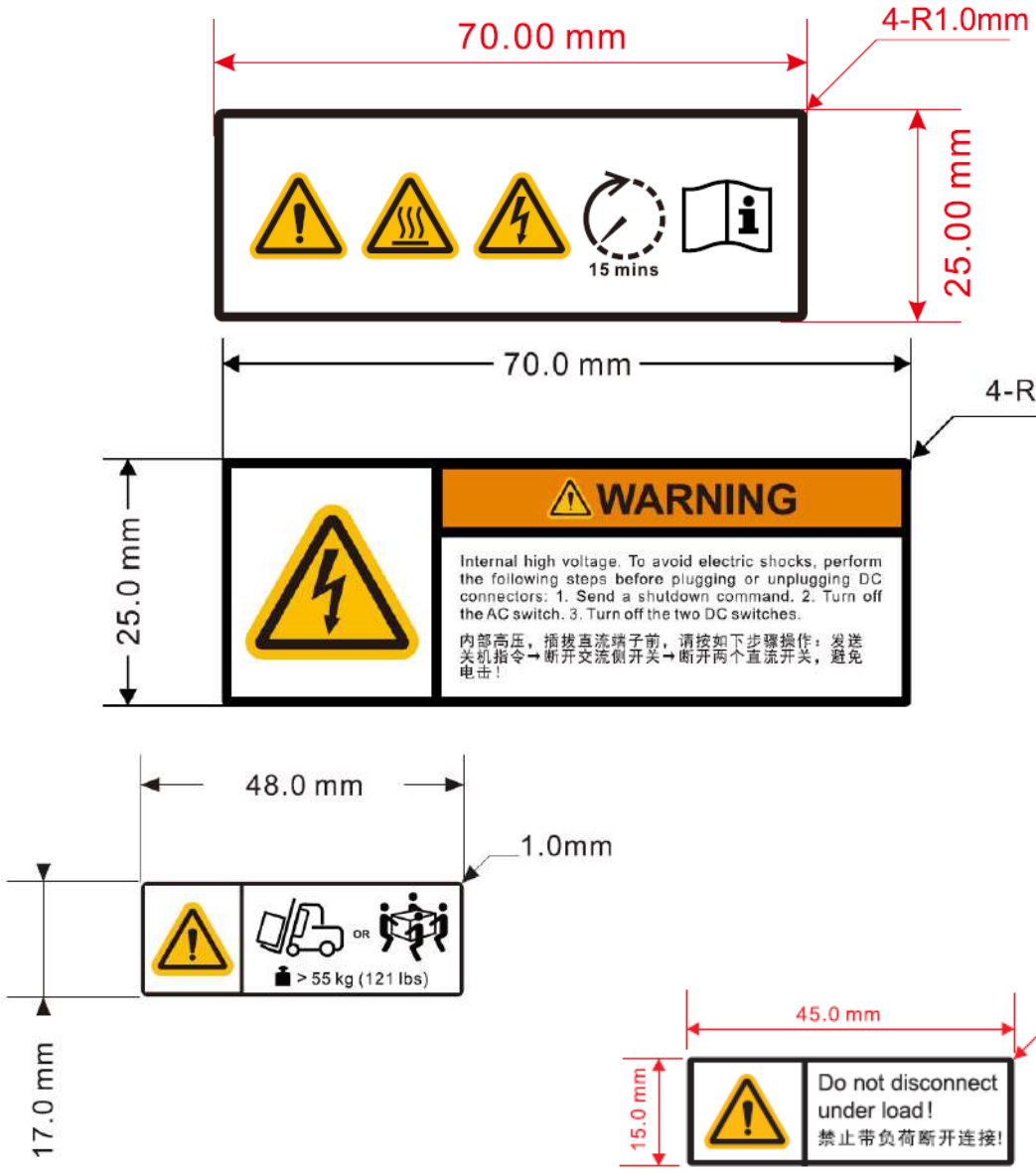
☒ **The product fulfils the requirements of EN 62109-1:2010**

Copy of marking plate:




70.0
4-R1
100.0
HUAWEI
型号 Model: SUN2000-100KTL-M0
名称 Name: 太阳能光伏逆变器
SOLAR INVERTER
最大输入电压 d.c. Max. Input Voltage: 1100 Vd.c.
最大输入电流 d.c. Max. Input Current: 10×26 A
输入短路电流 Isc: 10×40 A
MPP电压范围 d.c. MPP Range: 200 ~ 1000 Vd.c.
输出电压 a.c. Output Nominal Voltage: 380/400 Va.c.; 3(N) ~ + ⏚
输出频率 a.c. Nominal Operating Frequency: 50/60 Hz
额定输出功率 a.c. Output Rated Power: 100 kW
最大视在功率 a.c. Output Max.Apparent Power: 110 kVA
最大输出电流 a.c. Output Max. Current: 168.8 A; 380 Va.c.
160.4 A; 400 Va.c.
功率因数 Power Factor: 0.8(lagging) ~ 0.8(leading)
温度范围 Operating Temperature Range: -25 ~ +60 ℃
逆变器拓扑 Inverter Topology: Non-Isolation
防护等级 Enclosure: IP66
保护等级 Protection Class: I
过电压类别 Overvoltage Category: II(DC)/III(AC)
污染等级 Pollution Degree: III
海拔 Altitude: 4000 m
通讯方式 Communication: MBUS/RS485
50
华为技术有限公司 HUAWEI TECHNOLOGIES CO., LTD. 中国制造 MADE IN CHINA
HQ of Huawei, Bantian, Longgang District, Shenzhen, 518129, P.R.C
70.0
4-R1
100.0
HUAWEI
型号 Model: SUN2000-100KTL-M1
名称 Name: 太阳能光伏逆变器
SOLAR INVERTER
最大输入电压 d.c. Max. Input Voltage: 1100 Vd.c.
最大输入电流 d.c. Max. Input Current: 10×26 A
输入短路电流 Isc: 10×40 A
MPP电压范围 d.c. MPP Range: 200 ~ 1000 Vd.c.
输出电压 a.c. Output Nominal Voltage: 380/400 Va.c.; 3(N) ~ + ⏚
480 Va.c.; 3 ~ + ⏚
输出频率 a.c. Nominal Operating Frequency: 50/60 Hz
额定输出功率 a.c. Output Rated Power: 100 kW
最大视在功率 a.c. Output Max.Apparent Power: 110 kVA
最大输出电流 a.c. Output Max. Current: 168.8 A; 380 Va.c.
160.4 A; 400 Va.c.
133.7 A; 480 Va.c.
功率因数 Power Factor: 0.8(lagging) ~ 0.8(leading)
温度范围 Operating Temperature Range: -25 ~ +60 ℃
逆变器拓扑 Inverter Topology: Non-Isolation
防护等级 Enclosure: IP66
保护等级 Protection Class: I
过电压类别 Overvoltage Category: II(DC)/III(AC)
污染等级 Pollution Degree: III
海拔 Altitude: 4000 m
通讯方式 Communication: RS485
50
华为技术有限公司 HUAWEI TECHNOLOGIES CO., LTD. 中国制造 MADE IN CHINA
HQ of Huawei, Bantian, Longgang District, Shenzhen, 518129, P.R.C
70.0
4-R1
100.0
HUAWEI
型号 Model: SUN2000-100KTL-INM0
名称 Name: 太阳能光伏逆变器
SOLAR INVERTER
最大输入电压 d.c. Max. Input Voltage: 1100 Vd.c.
最大输入电流 d.c. Max. Input Current: 10×26 A
输入短路电流 Isc: 10×40 A
MPP电压范围 d.c. MPP Range: 200 ~ 1000 Vd.c.
输出电压 a.c. Output Nominal Voltage: 415 Va.c.; 3(N) ~ + ⏚
480 Va.c.; 3 ~ + ⏚
输出频率 a.c. Nominal Operating Frequency: 50/60 Hz
额定输出功率 a.c. Output Rated Power: 100 kW
最大视在功率 a.c. Output Max.Apparent Power: 110 kVA
最大输出电流 a.c. Output Max. Current: 154.6 A; 415 Va.c
133.7 A; 480 Va.c.
功率因数 Power Factor: 0.8(lagging) ~ 0.8(leading)
温度范围 Operating Temperature Range: -25 ~ +60 ℃
逆变器拓扑 Inverter Topology: Non-Isolation
防护等级 Enclosure: IP66
保护等级 Protection Class: I
过电压类别 Overvoltage Category: II(DC)/III(AC)
污染等级 Pollution Degree: III
海拔 Altitude: 4000 m
通讯方式 Communication: RS485
50
华为技术有限公司 HUAWEI TECHNOLOGIES CO., LTD. 中国制造 MADE IN CHINA
HQ of Huawei, Bantian, Longgang District, Shenzhen, 518129, P.R.C
Importer:
Huawei Technologies Hungary Ltd.
Add.: Hungary-Budapest-Kozraktaru.
30-32, Riverpark, 1st floor
Manufacturer:
Huawei Technologies Co., Ltd.
Add.: HQ of Huawei, Bantian, Longgang
District, Shenzhen, 518129, P.R.C
CE

Additional warning labels:

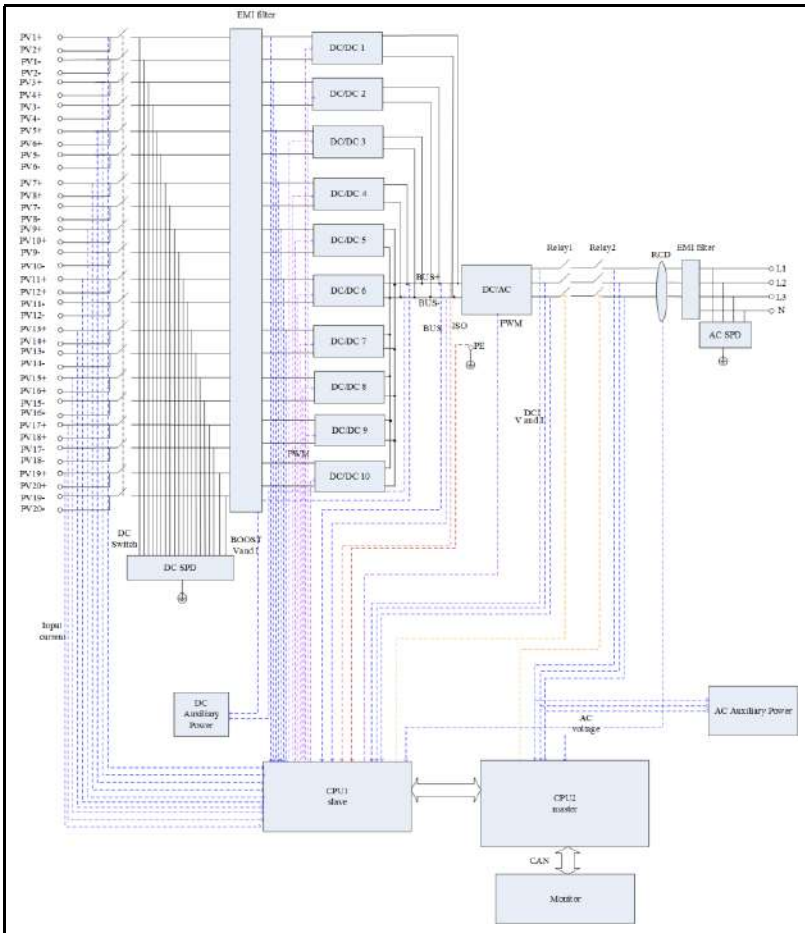


Marking plate material: pressure-sensitive unprinted label stocks stamped into aluminum surface; Suitable for outdoor use with respect to exposure to Ultraviolet Light, Water Exposure and thermal transfer printed label stock applications, -60°C to 95°C

An additional PET film provided to cover label.

Test item particulars.....	
Equipment mobility.....	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains.....	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Environmental category.....	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains.....	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV.....	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%).....	±10 %
Tested for power systems.....	IT / TN / TT
Testing of phase-phase voltage (V).....	480/500VAC (IT), 380/400/415VAC (TN, TT)
Class of equipment	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg)	See page 11
Pollution degree.....	3(external environment), 2(internal environment)
IP protection class.....	IP66
.....	
Possible test case verdicts:	
- test case does not apply to the test object.....	N/A
- test object does meet the requirement	P (Pass)
- test object was not evaluated for the requirement.....	N/E
- test object does not meet the requirement.....	F (Fail)
Testing	
Date of receipt of test item.....	2019-10-22
Date (s) of performance of tests	2019-10-22 to 2019-11-14

General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☒ comma / ☐ point is used as the decimal separator.**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided……	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) ……	1) Huawei Machine Co., Ltd. No. 2, New City Avenue, Songshan Lake Sci. & Tech. Industry Park, 523808 Dongguan, Guangdong, PEOPLE'S REPUBLIC OF CHINA 2) Shenzhen Fugui Precision Industry Co., Ltd. D7-2F, D8-1F & 3F Foxconn Science and Technology Industrial Park, East side of Min Qing Road, Longhua Subdistrict, Longhua District 518109 Shenzhen, PEOPLE'S REPUBLIC OF CHINA 3) DongGuan Fuyi Precision Industry Co.,Ltd. Floor 1st-4th, Building 12, No.6, Songshui Road, Songmu Village, Weifeng Industrial City, Dalang Town, 523770 Dongguan, Guangdong, PEOPLE'S REPUBLIC OF CHINA 4) Dongguan Yang Tian Electronic Technology Co., Ltd. (i-Brights) No.152, Luyuan Rd., Keyuancheng, Tangxia Town 523710 Dongguan City, Guangdong Province, PEOPLE'S REPUBLIC OF CHINA
General product information: These devices are grid-connected PV inverters(without isolating transformer inside) which converts direct current optimized by photovoltaic DC conditioner to alternating current, and they are intended to be connected in parallel with the public grid via an external isolated transformer depend on the rated output voltage of inverter. The winding ratio is adapted according to the voltage level of inverter output and connection point at public grid. They are intended for professional incorporation into PV system, and they are assessed on a component test basis. Firmware Version: V500R001 Topological diagram:	



The following documentations are retained on file:
- Photograph;
- Circuit diagrams;
- PCB layout drawing;
- PCB foil pattern assembly drawing;
- Specification sheets for components;
- Instruction manual.
- Manufacturer's work instruction and declaration for 100% routing test as required by EN 62109-1:2010, EN 62109-2:2011.

For models differences, pls. see as in table below (exact from user manual directly for reference):

DC Input

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Max. input voltage	1100 V	1100 V	1100 V	1100 V	1100 V
Max. input current (per MPPT circuit)	26 A	26 A	26 A	26 A	26 A
Max. short-circuit current per MPPT route	40 A	40 A	40 A	40 A	40 A

Max. backfeed current to the array	0 A	0 A	0 A	0 A	0 A
Min. start-up voltage	200 V	200 V	200 V	200 V	200 V
MPP voltage range	200-1000 V	200-1000 V	200-1000 V	200-1000 V	200-1000 V
MPP voltage range at full load	625-850 V	540-800 V	540-800 V	540-800 V (380/400 Vac) 625-850V (480 Vac)	540-800 V (400/380 Vac) 625-850V (480 Vac)
Rated input voltage	750 V	600 V	600 V	600 V (380/400 Vac) 720 V (480Vac)	620 V (380/400 Vac) 720 V (480Vac)
Number of inputs	20	20	20	20	20
Number of MPPT circuits	10	10	10	10	10

AC Output

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Rated output power	125 kW	110 kW	100 kW	100 kW	100 kW
Max. apparent power	137,5 kVA	121 kVA	110 kVA	110 kVA	110 kVA
Max. output power (cos φ = 1)	137,5 kW	121 kW	110 kW	110 kW	110 kW
Rated output line voltage	500 V	380/400 V	380/400 V	380/400 V 480 V	415/480 V
Output frequency	50 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Max. output current	160,4 A	185,7 A (380Vac) 176,4 A (400Vac)	168,8 A (380Vac) 160,4 A (400Vac)	168,8 A (380Vac) 160,4 A (400Vac) 133,7 A (480Vac)	154,6 A (415Vac) 133,7 A (480Vac)
Power factor	0,8 leading … 0,8 lagging				
Max. total harmonic distortion (THD)	< 3%				

Protection

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Input DC switch	Supported				
Anti-islanding protection	Supported				
Output overcurrent protection	Supported				
Input reverse-connection protection	Supported				
PV string fault detection	Supported				
DC surge protection	Type II				
AC surge protection	Type II				
Insulation resistance detection	Supported				
Residual current detection	Supported				

Display and Communication

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Display	LED indicator, Bluetooth module + app, USB data cable + app				
RS485	Supported				
MBUS	Supported				

General Data

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Dimensions (W x H x D)	1035 mm x 700 mm x 365 mm				
Weight	81 kg	90 kg			
Operating temperature	-25°C to +60°C				
Cooling	Smart air cooling				
Operating altitude	4000 m				
Humidity	0%-100% RH				
Input terminal	PV-ADSP4-S2/6-UR				
Output terminal	OT connector				
Protection level	IP66				
Protective class	Class I				
Topology	Transformerless				

Noise	≤ 65 dB(A)
Firmware version	V500R001

The following safety parameters are factory set and fixed per EN 62109-2:2011.

Default interface protection settings

Parameters	Normative requirements		Internal threshold setting	
	Maximum clearance time	Trip limit	Maximum clearance time (factory setting)	Factory setting trip value
PV array Insulation resistance measurement before starting operation	-	≥1100V/30mA= 36,7 kΩ	-	50 kΩ as default Adjustable range: 50 kΩ - 1500 kΩ
Continuous residual current monitoring(functional)	300 ms	10 mA/kVA	300 ms	10 mA RMS per kVA based on inverter ratings
Sudden changes in residual current(functional)	300 ms	30 mA	300 ms	30 mA
	150 ms	60 mA	150 ms	60 mA
	40 ms	150 mA	40 ms	150 mA

Alteration of the above settings or full setting range of the interface protection may cause a breach of the type-certificate marking.

Unauthorised access to factory safety parameters setting and software should be prohibited.

A reset to the factory safety parameters requires retesting and verification in conjunction with the end-use system.

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

4	**GENERAL TESTING REQUIREMENTS**		P
4.1	General		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests		P
4.2.2	Reference test conditions		P
4.2.2.1	Environmental conditions		P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment	Installed in accordance with the manufacturer's instructions, in the configuration that results in the worst-case test conditions	P
4.2.2.4	Accessories		P
4.2.2.5	Covers and removable parts	No accessories or operator interchangeable parts	N/A
4.2.2.6	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:		P
4.2.2.7	Supply ports other than the mains	PV input	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	No batteries for energy storage	N/A
4.2.2.8	Conditions of loading for output ports	DC-AC inverter. a.c. output port was loaded with linear loads to obtain the maximum rated output power. Continuous operation ratings, until steady conditions are established.	P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		P
4.2.2.11	Available short circuit current		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		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.3.2.2	Touch temperatures		P
4.3.2.3	Temperature limits for mounting surfaces		P
4.4	Testing in single fault condition	(see appended table 4.4)	P
4.4.1	General		P
4.4.2	Test conditions and duration for testing under fault conditions		P
4.4.2.1	General		P
4.4.2.2	Duration of tests		P
4.4.3	Pass/fail criteria for testing under fault conditions		P
4.4.3.1	Protection against shock hazard		P
4.4.3.2	Protection against the spread of fire		P
4.4.3.3	Protection against other hazards		P
4.4.3.4	Protection against parts expulsion hazards		P
4.4.4	Single fault conditions to be applied		P
4.4.4.1	Component fault tests		P
4.4.4.2	Equipment or parts for short-term or intermittent operation	Not for short-term or intermittent operation	N/A
4.4.4.3	Motors		P
4.4.4.4	Transformer short circuit tests		P
4.4.4.5	Output short circuit		P
4.4.4.6	Backfeed current test for equipment with more than one source of supply		P
4.4.4.7	Output overload		P
4.4.4.8	Cooling system failure		P
4.4.4.9	Heating devices	No heating device	N/A
4.4.4.10	Safety interlock systems	No safety interlock	N/A
4.4.4.11	Reverse d.c. connections		P
4.4.4.12	Voltage selector mismatch	No voltage selector	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.6.3	Compliance with backfeed tests		P
4.7	Electrical ratings tests	(see appended table 4.7)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P
5	**MARKING AND DOCUMENTATION**		P
5.1	Marking		P
5.1.1	General	The markings on external surface of enclosure, side enclosure with rating label and warning substance, warning symbols, and installation indication or switch position provided at close up of external connection interface. Graphic symbols per Annex C or IEC 60417, refer to section “copy of marking plate”	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.	The explanations are provided in the user manual	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	Tested with Isopropyl alcohol for 30s	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	refer to section “copy of marking plate”	P
	b) model number, name or other means to identify the equipment	refer to section “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.	Marking on equipment	P
5.1.4	Equipment ratings	Replaced, refer to EN 62109-2:2011 test report	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:		N/A
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input		N/A
	– 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		N/A
	– the ingress protection (IP) rating as in 6.3 below		N/A
5.1.5	Fuse identification		P
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.		P
	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.		P
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.	PV input: twenty inputs at ten MPP trackers marked with PV1 to PV20, MPPT1 to MPPT10, polarity + and -. Three DC switches are integrated in inverter, marked with DC switch 1 to 3. ON/OFF position is marked with ON/OFF. The AC output is connected by non-detachable cable with cable gland. For installation, pls. refer to installation manual. The symbol from Table C-7 is used for the PE and green-yellow wire used as well.	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.	Indicator lamps used for dangerous failure	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other non-permanent material.		N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:		P
	– the sign "+" for positive and "-„ for negative; or	The "+" and "-" marking provided adjacent to the PV input terminal	P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation		N/A
5.1.6.1	Protective Conductor Terminals	symbol 7 of Annex C adjacent to earth terminal	P
	The means of connection for the protective earthing conductor shall be marked with:		P
	– symbol 7 of Annex C; or		P
	– the letters "PE"; or		N/A
	– the colour coding green-yellow.		N/A
5.1.7	Switches and circuit-breakers	The components DC switch is integrated in inverter. Output overcurrent protection maybe provided by external circuit breaker specified in user manual in additional to the internal protection of inverter.	P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.	The letter "ON" and "OFF" is clearly marked for DC switch	P
5.1.8	Class II Equipment	Class I	N/A
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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:		P
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking	Symbol 9 of Table C marked on label	P
5.2	Warning markings		P
5.2.1	Visibility and legibility requirements for warning markings		P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2,75 mm high		P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the background		P
	– Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in colour from the background, shall have a depth or raised height of at least 0,5 mm.		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		P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual	explained in the manual	P
5.2.2	Content for warning markings	See warning marking and user manual	P
5.2.2.1	Ungrounded heat sinks and similar parts	With grounded heat sink and similar metal 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.		N/A
5.2.2.2	Hot Surfaces		P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.	“hot surface” symbol used in warning marking	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
5.2.2.3	Coolant	Air cooling	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.	Symbol  used for warning on marking plate for installation, operation and maintenance	P
5.2.2.5	Motor guarding	No energy with power source removed for internal cooling fan	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).		P
5.2.3	Sonic hazard markings and instructions	Measured <<80dBA@1m, no hazard	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can ensure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply	PV and mains as sources of supply	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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.	Symbol 13 of Annex C used, and with the following substance in manual: Both ac and dc voltage sources are terminated inside this equipment. Each circuit must be individually disconnected before servicing. When the photovoltaic array is exposed to light, it supplies a dc voltage to this equipment.	P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.	Located outside of the unit	P
5.2.5	Excessive touch current	Max. measured >3,5mA r.m.s. Permanently connected wiring and a cross-section of the protective earthing conductor of at least 10 mm^2 if copper, or 16 mm^2 if aluminum required in user manual; additional second protective earthing terminal provided on enclosure as well	P
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.	symbol 15 of Annex C marked information refer to user manual	P
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:		P
	a) explanations of equipment makings, including symbols used	Refer to user manual	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:	As specified in user manual, refer to “Technical data”	P
	– ENVIRONMENTAL CATEGORY as per 6.1	Meet requirements for outdoor use	P
	– WET LOCATIONS classification fort he intended external environment as per 6.1	Meet requirements for wet location use	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– POLLUTION DEGREE classification for the intended external environment as per 6.2	3	P
	– INGRESS PROTECTION rating as per 6.3	IP66	P
	– Ambient temperature and relative humidity ratings	-25˚C...+60˚C Relative humidity:0…100%	P
	– MAXIMUM altitude rating	4000m	P
	– OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories;	PV: II Mains: III	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE	Refer to user manual	P
5.3.1.1	Language	English	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	Documentation provided in printed form and is to be delivered with the equipment	P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.		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.		N/A
5.3.2	Information related to installation	As specified in user manual, refer to information related to installation	P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and externals controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P
	e) ventilation requirements;		P
	f) requirements for special services, for example cooling liquid;		P
	g) instructions and information relating to sound pressure level if required by 10.2.1;	Measured <<80dBA@1m	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;	No such components	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;		P
	k) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed; and		P
	l) compatibility with RCD and RCM;	RCMU integrated in PCE	P
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:		P
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		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	No charged battery	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
5.3.3	Information related to operation	As specified in user manual, refer to information related to operation	P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:		P
	– Instructions for adjustment of controls including the effects of adjustment;		P
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and		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	Maintenance made only by professional service personal who is familiar with product	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	Without battery	N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		P
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below	Meet requirements for outdoor use	P
	– Suitability for WET LOCATIONS or not	Meet requirements for wet location use	P
	– POLLUTION DEGREE rating in 6.2 below	PD 3 external, PD 2 internal	P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	IP66	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– Ultraviolet (UV) exposure rating, as in 6.4 below	Metal enclosure used except with plastic window, DC switch, DC connector, AC cable gland, communication coupler with polymeric material UV resistant	P
	– Ambient temperature and relative humidity ratings, as in 6.5 below	-25˚C…+60˚C Relative humidity:0…100%	P
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor		P
6.1.2	Indoor, unconditioned		N/A
6.1.3	Indoor, conditioned		N/A
6.2	Pollution degree		P
6.3	Ingress Protection		P
6.4	UV exposure		P
6.5	Temperature and humidity		P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		P
7.1	General	See 7.3.7 Table: Clearance and creepage distance measurement “insulation diagram”	P
7.2	Fault conditions	Refer to subclause and table 4.4.4.	P
7.3	Protection against electric shock		P
7.3.1	General		P
7.3.2	Decisive voltage classification	Accessible communication circuit: DVC A; Power circuit and other circuits: DVC B, DVC C	P
7.3.2.1	Use of decisive voltage class (DVC)		P
7.3.2.2	Limits of DVC (according table 6)		P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions		P
7.3.2.4	Requirements for protection (according table 7)	See 7.3.7 Table: Clearance and creepage distance measurement “insulation diagram”	P
7.3.2.5	Connection to PELV and SELV circuits		P
7.3.2.6	Working voltage and DVC		P
7.3.2.6.1	General		P
7.3.2.6.2	AC working voltage (see Figure 2)	AC Vmax: 500V considered for insulation with tolerance ±10%	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.2.6.3	DC working voltage (see Figure 3)	DC Vmax: 1100V considered for insulation	P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		N/A
7.3.3	protective separation		P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or		P
	▪ protective screening, i.e. by a conductive screen connected to earth by protective bonding in the PCE, or connected to the protective earth conductor itself, whereby the screen is separated from live parts by at least basic insulation, or		P
	▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or		N/A
	▪ limitation of voltage according to 7.3.5.4.		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact	Protection against eclectic shock by means of earthed metal enclosure	P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).		P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.		N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.		N/A
7.3.4.2	Protection by means of enclosures and barriers	Protection against eclectic shock by means of earthed metal enclosure	P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.		P
7.3.4.2.1	General		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).		P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6	Plastic panel for light indicator	P
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Communication interface	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	Not access	P
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	Not access	P
7.3.4.2.3	Access probe tests		P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and		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.	IP66 without openings on enclosure, for mechanical enclosure test finger cannot access to live parts and approved external connecting device used	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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.		P
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±5 ° only.	No openings on top enclosure	N/A
7.3.4.2.4	Service access areas	The manufacturer's manual with the following substance: No use-serviceable parts inside, before servicing and in the event of internal malfunction the unit, send the inverter to authorized representative or manufacture! Never operate this product and change any part of inverter by yourself. Only trained and authorized professional personnel who are familiar with the requirements of safety is allowed to perform servicing and maintenance work. Always disconnect the unit from the MAINS and PV supply by the external customer installed disconnecting devices before installation, servicing and maintenance works	N/A
7.3.4.3	Protection by means of insulation of live parts	See 7.3.7 Table: Clearance and creepage distance measurement "insulation diagram"	P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		P
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		P
7.3.5	Protection in case of direct contact		P
7.3.5.1	General		P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:		P
	– is of decisive voltage class A and complies with 7.3.5.2, or		P
	– is provided with protective impedance according to 7.3.5.3, or		N/A
	– is limited in voltage according to 7.3.5.4		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	Communication interface	P
7.3.5.3	Protection by means of protective impedance		N/A
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		N/A
7.3.5.3.1	Limitation of current through protective impedance		N/A
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		N/A
7.3.5.3.2	Limitation of discharging energy through protective impedance		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		N/A
7.3.5.4	Protection by means of limited voltages		N/A
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		N/A
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		N/A
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact		P
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)	protective class I part: basic insulation plus protective earthing. protective class II part(PV connector, DC switch, LED cover): reinforced insulation protective class III part (operator access communication port): DVC A	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		P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	Plastic panel, DC switch and PV connector	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.		P
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.		N/A
7.3.6.2	Insulation between live parts and accessible conductive parts	See 7.3.7 Table: Clearance and creepage distance measurement “insulation diagram”	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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		P
7.3.6.3	Protective class I – Protective bonding and earthing		P
7.3.6.3.1	General		P
	Equipment of protective class I shall be provided with protective earthing, and with protective bonding to ensure electrical contact between accessible conductive parts and the means of connection for the external protective earthing conductor, except bonding is not required for:	PE arrangement: external protective earthing is to be connected to terminal near AC terminal block, and an second protective earthing conductor is bonded to metal case, refer to installation manual	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;	As tightening with torque specified in user manual	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;		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.	the paint removed in the area of contact	P
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.		N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.		N/A
7.3.6.3.3	Rating of protective bonding		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		P
	Protective bonding shall meet following requirements:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.		N/A
	As alternative to a) and b) the protective bonding may designed according to the requirements for the external protective earthing conductor in 7.3.6.3.5, in which case no testing is required.		P
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		N/A
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		N/A
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.		N/A
	On equipment where the protective earth connection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cab le is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		N/A
7.3.6.3.3.1	Test current, duration, and acceptance criteria		N/A
	The test current, duration of the test and acceptance criteria are as follows:		N/A
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.		N/A
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		N/A
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)	Manufacturer's work instruction and declaration based on this clause	N/A
	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:		N/A
	▪ the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:		N/A
	▪ the test duration may be reduced to no less than 2 s		N/A
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		N/A
7.3.6.3.5	External protective earthing conductor	required >35 mm^2 (copper) or >50 mm^2 (Aluminum or Aluminum Alloy) detail refer to user manual	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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:	External cable prepared by Installer, should follow with this rule and user manual	P
	▪ 2,5 mm² if mechanical protection is provided;		N/A
	▪ 4 mm² if mechanical protection is not provided.		P
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.		P
7.3.6.3.6	Means of connection for the external protective earthing conductor	Connection means for main earthing conductor: separate terminal provided near the AC terminal block Connection means for second earthing conductor: terminal provided on enclosure through locking washer, nut, isolating washer and UL approved ring terminal	P
7.3.6.3.6.1	General		P
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.		P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		P
	• the colour coding green-yellow		N/A
	Marking shall not be done on easily changeable parts such as screws.		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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.	Not a pluggable type A 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.	Max. measured >3,5mA r.m.s. after IP test, thermal testing, single fault, and humidity preconditioning, See 7.3.6.3.7 Table	P
	a) Permanently connected wiring, and:		P
	• a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or		P
	• automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or		N/A
	• 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	A second protective earthing terminal provided on the enclosure	P
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.	Symbol 15 used in warning marking	P
	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)	Not allowed	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		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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:		P
	• equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low voltage, 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;		P
	• metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	• equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	• equipment employing protective class II shall be marked according to 5.1.8.	Class I equipment	N/A
7.3.7	Insulation Including Clearance and Creepage Distance	See 7.3.7 Table: Clearance and creepage distance measurement “insulation diagram”	P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	• pollution degree	PD 3 external, PD 2 internal	P
	• overvoltage category	PV: II; Mains: III	P
	• supply earthing system	TN, TT, IT	P
	• insulation voltage	1100VDC(PV) and 500VAC(Mains)	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	• location of insulation	See 7.3.7 Table: Clearance and creepage distance measurement “insulation diagram”	P
	• type of insulation	See 7.3.7 Table: Clearance and creepage distance measurement “insulation diagram”	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
	• TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor.		P
	• TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system;		P
	• 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.		P
7.3.7.1.4	Insulation voltages		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	500 V(IT), OVC III (4000 V impulse voltage, 1500 Vrms temporary overvoltage) for the AC ouput terminal and 1100 V, OVC II (4772 V impulse voltage, no temporary overvoltage) for the PV input terminal	P
7.3.7.2.2	Circuits connected directly to the mains		P
7.3.7.2.3	Circuits other than mains circuits		P
7.3.7.2.4	Insulation between circuits		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.3	Functional insulating		P
7.3.7.4	Clearance distances		P
7.3.7.4.1	Determination		P
7.3.7.4.2	Electric field homogeneity	Inhomogeneous electric field is considered for PCE	N/A
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	PV Maximum 1100 Vd.c. system voltage is used for the RMS voltage across insulation	P
7.3.7.5.2	Voltage		P
7.3.7.5.3	Materials	Certified PWB used. Other material are considered IIIb The inside parts are considered pollution degree 2	P
7.3.7.6	Coating	No coating provided insulation	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
7.3.7.8.2.2	Functional insulation		P
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm		P
7.3.7.8.3.3	Material thickness less than 0,2 mm		P
7.3.7.8.3.4	Compliance		P
7.3.7.8.4	Printed wiring boards		P
7.3.7.8.4.1	General		P
7.3.7.8.4.2	Use of coating materials		N/A
7.3.7.8.5	Wound components		P
7.3.7.8.6	Potting materials	For potting material used cover protective optocoupler, used as solid insulation	P
7.3.7.9	Insulation requirements above 30 kHz	Evaluated according to Annex G	P
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility	RCMU integrated for PV side protection, refer to EN 62109-2:2011 test report	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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.	If an external RCD or residual current breaker is required, must follow with local regulation, type B should be used for main side.	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.	Not access for operator from outside. Symbol  used for warning on marking plate for installation, operation and maintenance.	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.	For repairing and internal maintenance, only by professional service personal who is familiar with product. Symbol  used for warning on marking plate for installation, operation and maintenance.	P
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level		P
	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.	Access to internal power circuit, tool required. No user serviceable parts inside the device per manufacturer's manual. Operator access: communication interface circuit, external connecting device for PV generator and MAINs connection: approved installation coupler used or cable gland used	P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5\ CU^2$		P
7.4.2	Operator Access Areas		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.	Only access DVC A circuit(communication interface), no risk of energy hazard in operator access area from accessible circuits.	P
7.4.3	Services Access Areas	For repairing and internal maintenance, only by professional service personal who is familiar with product.  Symbol used for warning on marking plate for installation, operation and maintenance. <20J after 15 min inside	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	(see appended table 7.5)	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.		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
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		P
8.1	General		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.	Edges, projections, corners, openings, guards, handles and the like, that are accessible to the OPERATOR are smooth and rounded	P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		N/A
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.	No moving parts are accessible from outside	P
8.2.1	Protection of service persons	Power sources need to be removed when servicing and no moving part inside	N/A
	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.		N/A
8.3	Stability		N/A
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	Wall mounting	N/A
8.4	Provisions for lifting and carrying		P
	If carrying handles or grips are fitted to, or supplied with, the equipment, they shall be capable of withstanding a force of four times the weight of the equipment.	Weight: 74kg×4 for from zero to full load in 5 s to 10 s, then maintained for 1 min, handles/grips not break loose from the equipment and not be any permanent distortion, cracking or other evidence of failure.	P
	Equipment or parts having a mass of 18 kg or more shall be provided with a means for lifting and carrying or directions shall be given in the manufacturer's documentation.		P
8.5	Wall mounting		P
	Mounting brackets on equipment intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the equipment.	Weight: 74kg×4 for from zero to full load in 5 s to 10 s, then maintained for 1 min, no damage to mounting brackets	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
8.6	Expelled parts		N/A
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.	No such parts	N/A
9	**PROTECTION AGAINST FIRE HAZARDS**		P
9.1	Resistance to fire		P
	This subclause specifies requirements intended to reduce the risk of ignition and the spread of flame, both within the equipment and to the outside, by the appropriate use of materials and components and by suitable construction.		P
9.1.1	Reducing the risk of ignition and spread of flame	Method 1 used	P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.		P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.		P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		N/A
	– 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;		N/A
	– 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;		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– 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	DC switch with open-contacts and plastic components of fire enclosure located more than 13 mm through air from parts that arc under normal conditions	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		P
	If an enclosure material is not classified as specified below, a test may be performed on the final enclosure or part of the enclosure, in which case the material shall additionally be subjected to periodic SAMPLE testing.		N/A
9.1.3.3	Materials for components and other parts outside fire enclosures	V-0 material used	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.	Fire enclosure also as mechanical enclosure and electrical enclosure	P
9.1.3.4	Materials for components and other parts inside fire enclosures	All internal components are rated V-2 or better or mounded on PCB rated V-0.	P
9.1.3.5	Materials for air filter assemblies		N/A
9.1.4	Openings in fire enclosures	IP66 electrical enclosure without 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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures		P
9.1.4.6	Additional requirements for openings in transportable equipment		N/A
9.2	LIMITED POWER SOURCES		P
9.2.1	General		P
9.2.2	Limited power source tests	(see appended table 9.2.2)	P
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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.		P
10	**PROTECTION AGAINST SONIC PRESSURE HAZARDS**		P
10.1	General		P
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.		P
10.2	Sonic pressure and Sound level	Measured <<80dBA@1m	P
10.2.1	Hazardous Noise Levels		N/A
11	**PROTECTION AGAINST LIQUID HAZARDS**		N/A
11.1	Liquid Containment, Pressure and Leakage	Without liquid containment system	N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A
11.3	Oil and grease	Not used	N/A
12	**CHEMICAL HAZARDS**		N/A
12.1	General		N/A
13	**PHYSICAL REQUIREMENTS**		P
13.1	Handles and manual controls		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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.	DC switch, PV connector and Communication connector on bottom and cable gland	P
13.1.1	Adjustable controls	Without 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	Terminal block for AC cable connection with cable gland for tightening	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
13.3.2.2	Permanently connected equipment		P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord		N/A
13.3.2.5	Cord anchorages and strain relief	Not provided together with power cord for connecting to AC terminals, for installer, should be followed with user manual and test maybe confirmed	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
13.3.3	Wiring terminals for connection of external conductors		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 mm² and greater		P
13.3.6	Disconnection from supply sources	Disconnect the unit from the MAINS by automatic disconnecting relays in all live conductor and PV supply by the DC integrated switches	P
13.3.7	Connectors, plugs and sockets	Approved PV connector used	P
13.3.8	Direct plug-in equipment		P
13.4	Internal wiring and connections		P
13.4.1	General		P
13.4.2	Routing		P
13.4.3	Colour coding	Conductor having green-and-yellow insulation is used only for protective earthing and bonding connection	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
13.6	Polymeric Materials		P
13.6.1	General	UL approved material used. plastic cover of LED cover, DC switch, DC connector, communication port coupler, cable gland: V-0, suitable for outdoor use with respect to exposure to Ultraviolet Light, Water Exposure and Immersion in accordance with UL 746C	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
13.6.1.1	Thermal index or capability	Thermal index of Polymeric Materials used higher than the maximum measured operating temperature in heating test	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		P
13.6.4	UV resistance		P
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation		P
13.7	Mechanical resistance to deflection, impact, or drop		P
13.7.1	General		P
13.7.2	250-N deflection test for metal enclosures		P
13.7.3	7-J impact test for polymeric enclosures	LED cover	P
13.7.4	Drop test		N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General	Conformity is checked by the test as specified in clause 13.7	P
13.8.2	Cast metal		P
13.8.3	Sheet metal		N/A
14	**COMPONENTS**		P
14.1	General	(see appended table 14)	P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Over Temperature Protection		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	Power limited by temperature control in single fault condition or high temperature environment condition	P
14.4	Fuse holders	Not replaced by operator	N/A
14.5	MAINS voltage selecting devices		N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.	PCB material approved by UL with UL94 V-0 rating	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.		P
14.7	Circuits or components used as transient overvoltage limiting devices		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.		P
14.8	Batteries		N/A
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.		N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A non-metallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions	IEC 60730-1 Annex H considered	P

	EN 62109-1:2010		P
Annex ZA	Normative references to international publications with their corresponding European publications	Considered	P

4.7	TABLE: Mains supply electrical data in normal condition & electrical ratings tests					P
Type	U dc (V)	I dc (A)	P dc (W)	U ac (V)	I ac (A)	P ac (W/VA)
SUN2000-125KTL-M0@500V						
Min. full load MPP voltage	622,24	204,62	127315	288,32	143,44	124073
				288,32	143,44	
				288,34	143,43	
Max. full load MPP voltage	848,93	150,21	127471	288,21	144,01	124516
				288,32	143,96	
				288,24	143,99	
Rated MPP voltage at max. power	749,01	170,09	127428	288,32	143,44	125194
				288,39	143,44	
				288,29	143,43	
Verification for Idc max and max. active power indicated on marking plate	621,57	225,57	140210	288,32	158,85	137395
				288,32	158,85	
				288,34	158,83	
Verification for Iac max and max. apparent power indicated on marking plate	694,57	161,49	112168	288,32	158,87	137415 (PF=0,8)
				288,32	158,86	
				288,34	158,83	
Max. inrush current at start up and shut down	10,1A peak@12,1ms					
SUN2000-110KTL-M0@380V						
Min. full load MPP voltage	540,73	204,64	112819	220,33	166,77	110233
				220,41	166,71	
				220,26	166,82	
Max. full load MPP voltage	799,67	141,07	112803	220,42	165,97	109749
				220,39	165,99	
				220,28	166,07	
Rated MPP voltage at max. power	600,25	186,61	111933	220,37	165,22	109231
				220,41	165,19	
				220,31	165,27	
Verification for Idc max and max. active power indicated on marking plate	540,21	231,58	125101	220,37	183,17	121098
				220,41	183,14	
				220,31	183,22	
Verification for Iac max and max. apparent power indicated on marking plate	588,86	171,34	100895	220,37	184,51	121973 (PF=0,8)
				220,41	184,46	
				220,31	184,53	
Max. inrush current at start up and shut down	8,9A peak@15,1ms					
SUN2000-110KTL-M0@400V						
Min. full load MPP voltage	540,73	204,64	112820	230,51	159,40	110.23
				230,35	159,52	
				230,44	159,45	
Max. full load MPP voltage	799,67	141,07	112800	230,28	158,86	109.75
				230,36	158,81	
				230,28	158,86	
Rated MPP voltage at max. power	600,25	186,61	111930	230,37	158,05	109.23
				230,47	157,98	
				230,41	158,02	
Verification for Idc max and max. active power	540,21	231,58	125101	230,37	175,22	121098
				230,41	175,19	

indicated on marking plate				230,31	175,27	
Verification for Iac max and max. apparent power indicated on marking plate	588,86	171,34	100895	230,37 230,41 230,31	175,90 175,84 175,91	121564 (PF=0,8)
Max. inrush current at start up and shut down	8,9A peak@15,1ms					
SUN2000-100KTL-M0@380V						
Min. full load MPP voltage	540,46	190,60	103011	220,26 220,23 220,41	152,01 152,03 151,90	100443
Max. full load MPP voltage	801,13	128,58	102974	220,63 220,14 220,29	151,68 152,02 151,91	100395
Rated MPP voltage at max. power	600,89	171,34	102889	220,31 220,52 220,67	151,78 151,64 151,54	100318
Verification for Idc max and max. active power indicated on marking plate	540,46	209,31	113121	220,53 220,61 220,71	166,29 166,23 166,15	110014
Verification for Iac max and max. apparent power indicated on marking plate	699,14	129,44	90495	220,53 220,61 220,71	166,66 166,71 166,49	110296 (PF=0,8)
Max. inrush current at start up and shut down	10,6A peak@16,1ms					
SUN2000-100KTL-M0@400V						
Min. full load MPP voltage	540,46	190,6	103011	230,26 230,23 230,41	145,40 145,42 145,31	100443
Max. full load MPP voltage	801,13	128,58	102974	230,63 230,14 230,29	145,10 145,41 145,31	100395
Rated MPP voltage at max. power	600,89	171,34	102889	230,31 230,52 230,67	145,19 145,06 144,96	100318
Verification for Idc max and max. active power indicated on marking plate	540,46	209,31	113121	230,53 230,61 230,71	159,07 159,02 158,94	110014
Verification for Iac max and max. apparent power indicated on marking plate	699,14	129,44	90495	230,53 230,61 230,71	159,41 159,41 159,28	110277 (PF=0,8)
Max. inrush current at start up and shut down	10,6A peak@16,1ms					
SUN2000-100KTL-M1@380V						
Min. full load MPP voltage	540,46	190,60	103011	220,26 220,23 220,41	152,01 152,03 151,90	100443
Max. full load MPP voltage	801,13	128,58	102974	220,63 220,14 220,29	151,68 152,02 151,91	100395
Rated MPP voltage at max. power	600,89	171,34	102889	220,31 220,52 220,67	151,78 151,64 151,54	100318

Verification for Idc max and max. active power indicated on marking plate	540,46	209,31	113121	220,53 220,61 220,71	166,29 166,23 166,15	110014
Verification for Iac max and max. apparent power indicated on marking plate	699,14	129,44	90495	220,53 220,61 220,71	166,83 166,80 166,77	110414 (PF=0,8)
Max. inrush current at start up and shut down	9A peak@13,7ms					
SUN2000-100KTL-M1@400V						
Min. full load MPP voltage	540,46	190,6	103011	230,26 230,23 230,41	145,40 145,42 145,31	100443
Max. full load MPP voltage	801,13	128,58	102974	230,63 230,14 230,29	145,10 145,41 145,31	100395
Rated MPP voltage at max. power	600,89	171,34	102889	230,31 230,52 230,67	145,19 145,06 144,96	100318
Verification for Idc max and max. active power indicated on marking plate	540,46	209,31	113121	230,53 230,61 230,71	159,07 159,02 158,94	110014
Verification for Iac max and max. apparent power indicated on marking plate	699,14	129,44	90495	230,53 230,61 230,71	159,35 159,31 159,31	110237 (PF=0,8)
Max. inrush current at start up and shut down	9A peak@13,7ms					
SUN2000-100KTL-M1@480V						
Min. full load MPP voltage	540,46	190,6	103011	277,26 277,23 277,41	120,81 120,63 120,59	100443
Max. full load MPP voltage	801,13	128,58	102974	277,63 277,14 277,29	120,62 120,75 120,73	100395
Rated MPP voltage at max. power	600,89	171,34	102889	277,31 277,52 277,67	120,42 120,36 120,64	100318
Verification for Idc max and max. active power indicated on marking plate	540,46	209,31	113121	277,53 277,61 277,71	131,95 132,18 132,06	110014
Verification for Iac max and max. apparent power indicated on marking plate	699,14	129,44	90495	277,53 277,61 277,71	132,98 133,12 132,81	110565 (PF=0,8)
Max. inrush current at start up and shut down	9A peak@13,7ms					
SUN2000-100KTL-INM0@415V						
Min. full load MPP voltage	540,46	190,6	103011	240,64 240,79 240,16	139,13 139,05 139,41	100443
Max. full load MPP voltage	801,13	128,58	102974	240,64 240,97 240,15	139,07 138,88 139,35	100395
Rated MPP voltage at	600,89	171,34	102889	240,26	139,18	100318

max. power				240,77	138,88	
				240,69	138,93	
Verification for Idc max and max. active power indicated on marking plate	540,46	209,31	113121	240,31	152,60	110014
				240,61	152,41	
				240,88	152,24	
Verification for Iac max and max. apparent power indicated on marking plate	699,14	129,44	90495	240,13	152,61	110156 (PF=0,8)
				240,61	152,60	
				240,55	152,53	
Max. inrush current at start up and shut down	9,4A peak@13,3ms					
SUN2000-100KTL-INM0@480V						
Min. full load MPP voltage	540,46	190,6	103011	277,26	120,81	100443
				277,23	120,63	
				277,41	120,59	
Max. full load MPP voltage	801,13	128,58	102974	277,63	120,62	100395
				277,14	120,75	
				277,29	120,73	
Rated MPP voltage at max. power	600,89	171,34	102889	277,31	120,42	100318
				277,52	120,36	
				277,67	120,64	
Verification for Idc max and max. active power indicated on marking plate	540,46	209,31	113121	277,53	131,95	110014
				277,61	132,18	
				277,71	132,06	
Verification for Iac max and max. apparent power indicated on marking plate	699,14	129,44	90495	277,19	133,35	110815 (PF=0,8)
				277,22	133,12	
				277,13	133,11	
Max. inrush current at start up and shut down	9,4A peak@13,3ms					
Supplementary information:						

4.3	**TABLE: heating temperature rise measurements (SUN2000-100KTL-M0)**						**P**
Test voltage(PV Input)(V)	540	800	540	800	540	800	-
Test voltage(AC Output)(V)	380	380	380	380	380	380	-
Test frequency(Hz)	50	50	50	50	50	50	-
maximum temperature T of part/at:	T (°C)						TMAX (°C)
Ambient Temperature	40,0	40,0	60,0	60,0	60,0	40,0	-
Mounting surface	43,2	42,5	63,8	62,3	62,8	41,7	90
LED indicator panel	40,9	40,8	56,4	60,1	64,0	40,5	85
Metal enclosure	53,4	50,2	69,4	72,9	71,7	42,7	90
Boost inductor	102,0	79,6	92,3	80,3	99,6	63,7	130(Class F)
PCB	85,0	83,0	85,6	84,2	87,2	50,2	130
BST conductor	84,2	84,3	85,8	85,1	80,2	47,9	105
ISO Relay Coil(K1)	87,4	89,6	87,6	88,9	90,6	49,5	130(Class F)
DC switch (outside)	41,8	41,8	60,5	61,5	62,1	41,2	75
Drive Transformer winding(T5)	89,7	92,7	89,5	90,6	94,3	68,3	130(Class F)
Optocoupler(U13)	92,6	95,4	91,6	93,1	96,1	70,5	100
SPD(F13)	84,2	84,8	83,2	82,7	82,4	51,9	85

Filter Capacitor(C407)	84,4	90,3	87,4	88,4	87,9	55,9	105
Current Hall(U51)	93,8	90,5	90,2	90,3	87,5	58,7	105
Filter Capacitor(C10)	78,9	81,4	82,1	82,9	87,9	55,9	105
Current Hall(U62)	85,7	86,8	86,7	86,6	88,5	59,1	105
INV Module(U1)	98,0	97,3	94,9	97,5	95,4	53,5	130
INV Module(U2)	98,8	97,2	96,2	98,0	104,1	58,3	130
INV Module(U3)	96,5	95,0	95,3	96,7	93,5	61,6	130
Boost Module(U4)	81,2	65,8	84,8	76,5	94,3	69,7	130
Boost Module(U5)	82,1	67,3	85,1	77,2	95,1	71,2	130
Boost Module(U6)	85,4	67,4	85,4	77,7	92,6	68,8	130
Boost Module(U7)	82,2	67,4	85,7	77,0	87,8	55,7	130
Boost Module(U8)	82,8	66,1	86,6	77,2	87,9	55,1	130
Y Capacitor(C294)	86,9	88,6	87,2	87,5	87,3	54,5	125
Drive Transformer winding(T3)	88,7	92,1	88,6	90,2	94,3	68,3	130(Class F)
Current Hall(U9)	92,6	95,4	91,6	93,1	95,8	66,6	100
Output wire	90,4	92,8	87,7	89,1	95,3	52,0	105
INV inductor (Phase A)	121,8	142,2	95,3	105,2	106,3	61,5	150(Class H)
INV inductor (Phase B)	125,3	139,8	93,5	101,3	104,7	58,5	150(Class H)
INV inductor (Phase C)	121,9	133,7	90,8	100,8	109,1	61,2	150(Class H)
INV conductor	93,8	96,8	90,4	91,9	98,5	62,5	105
Output terminal	47,6	42,2	62,2	60,8	61,8	41,1	105
PV input wire (near switch)	86,8	89,2	86,8	87,8	86,1	53,1	105
Cooling fan	78,3	75,6	75,7	74,2	79,2	48,7	85
Current Hall(U85)	86,4	89,4	88,4	86,9	86,5	52,7	95
Relay(K10)	82,0	84,3	81,2	83,1	84,7	50,5	85
PV input connector	44,5	42,3	61,0	59,9	60,8	41,6	75
AC aux transformer winding(T2)	98,3	96,5	93,1	91,0	93,5	62,3	130(Class F)
AC aux transformer bobbin(T2)	86,0	83,7	81,1	79,1	85,8	56,3	130(Class F)
DSP(U100)	89,6	93,4	90,3	91,9	97,8	66,8	105
DSP(U101)	92,0	96,1	92,3	94,2	95,6	65,6	105
CPLD(U102)	88,4	92,2	88,9	90,6	91,7	61,4	105
DC aux transformer winding(T1)	95,4	92,4	99,2	97,0	98,6	62,5	130(Class F)
DC aux transformer bobbin(T1)	85,0	82,0	88,4	86,8	89,1	58,8	130(Class F)
Optocoupler(U13)	89,9	93,9	90,6	92,3	94,5	62,8	130
BUS capacitor(C32)	83,6	92,2	81,2	82,3	85,2	49,9	105
RCD Hall(U34)	101,2	102,3	93,7	96,5	86,9	50,7	105
Filter capacitor(C734)	85,2	83,1	80,2	80,6	87,9	58,6	105
X Capacitor(C501)	81,6	78,6	79,9	78,1	81,6	49,9	105

Supplementary information:
Lowest full load MPP voltage with rated power output @40°C (without power derating)
Highest full load MPP voltage with rated power output @40°C (without power derating)
Lowest full load MPP voltage with rated power output @60°C (power derating to thermal steady)
Highest full load MPP voltage with rated power output @60°C (power derating to thermal steady)
Lowest full load MPP voltage and blanketing with rated power output @60°C (power derating to thermal steady)
Highest full load MPP voltage and cooling fan disconnected with rated power output @40°C (power derating to thermal steady)

4.3	TABLE: heating temperature rise measurements (SUN2000-110KTL-M0)							P
Test voltage(PV Input)(V)	540	600	800	540	600	800	540	-
Test voltage(AC Output)(V)	380	380	380	380	380	380	380	-
Test frequency(Hz)	50	50	50	50	50	50	50	-
maximum temperature T of part/at:	T (°C)							TMAX (°C)
Ambient Temperature	41,5	41,1	40,3	59,2	59,1	58,3	39,9	-
BST inductor	87,9	47,7	47,0	80,5	63,5	62,7	56,2	150(Class H)
SPD(F3)	77,1	71,7	69,8	77,5	76,5	74,1	50,1	85
Filter capacitor(C407)	81,1	77,8	76,6	79,8	79,9	77,6	56,9	105
Current Hall(U51)	81,1	77,0	75,2	80,1	79,7	77,3	58,8	105
BUS capacitor(C32)	77,4	76,4	82,1	77,8	78,9	79,7	59,8	105
Drive Transformer winding(T3)	90,0	86,8	84,2	86,4	86,8	83,6	74,5	130(Class F)
Relay(K1)	80,3	77,2	74,3	79,8	79,9	76,8	53,9	85
DC wire (near K1)	85,7	81,9	78,7	81,9	81,9	78,4	57,4	105
Relay(K2)	80,7	77,6	75,2	79,8	79,9	77,0	54,9	85
Filter capacitor(C10)	71,6	68,3	65,8	75,0	74,6	72,1	45,6	105
BUS wire	75,8	74,2	76,2	77,2	77,6	76,8	62,1	105
Filter capacitor(C5)	71,1	67,9	65,1	74,8	74,4	71,7	45,5	125
Filter capacitor(C15)	69,6	66,8	64,2	74,3	73,9	71,2	45,5	105
DC wire (near switch)	84,3	80,1	76,5	81,0	80,8	77,4	57,5	105
PWB board(near AC relay)	117,0	111,2	102,4	97,4	100,3	90,8	103,6	130
Inductor(L2)	114,3	111,9	105,3	94,1	97,0	90,2	90,4	130
AC output wire(B phase)	100,0	97,5	90,0	86,7	88,6	82,2	68,6	105
AC current hall(U85)	91,3	88,1	84,1	85,0	86,2	81,6	76,5	105
AC output relay(K10)	82,0	79,2	77,0	79,3	80,0	76,8	81,2	85
CPLD(U102)	84,8	81,9	79,9	84,5	84,9	82,1	69,0	105
AC output relay(K9)	83,2	80,4	77,8	80,9	81,6	78,4	72,4	105
RCD hall(U34)	91,2	88,6	85,3	83,2	84,6	80,8	75,6	105
DC aux transformer winding(T1)	86,0	83,0	82,3	86,4	86,4	85,0	63,0	130(Class F)
Optocoupler(U56)	84,9	81,6	80,1	83,9	84,3	81,6	67,6	110
Inductor coil(T7)	116,9	114,9	104,2	93,7	96,9	88,5	81,3	130(Class F)
Inductor coil(L6)	116,9	115,6	108,4	94,2	97,4	91,3	81,6	130(Class F)
Capacitor(C190)	79,9	77,0	75,0	79,4	79,6	76,9	56,8	125
DSP(U100)	90,3	87,6	85,8	90,1	90,6	88,2	74,3	105
DSP(U101)	89,1	86,2	84,0	88,4	89,0	86,2	74,7	105
INV inductor (Phase A)	110,1	114,6	111,7	90,1	95,7	90,2	61,6	150(Class H)
INV inductor (Phase B)	104,9	104,9	101,3	89,8	92,7	88,2	65,6	150(Class H)
INV inductor (Phase C)	111,7	111,6	108,2	93,5	96,9	92,3	67,2	150(Class H)
Y-cap(C294)	83,5	79,9	77,9	81,4	81,3	78,5	54,0	105
SPD(F13)	77,7	72,1	70,6	78,3	77,2	74,9	51,5	85
Capacitor(C49)	84,2	81,4	78,4	80,5	81,3	77,8	69,9	105
INV Module(U1)	102,9	98,9	93,8	91,0	91,8	86,7	90,8	130
INV Module(U3)	106,3	101,4	94,9	92,6	93,2	87,2	88,7	130
ISO Relay Coil(K1)	82,1	79,0	77,1	80,4	80,7	78,3	60,5	130

INV Module(U2)	107,3	102,2	96,3	93,0	93,9	87,7	90,3	130
SPD(F3)	75,5	68,5	66,8	76,8	75,0	72,6	50,0	85
Drive Transformer winding(T5)	83,3	79,8	78,4	81,5	81,5	79,0	68,9	150(Class H)
Front panel	54,8	53,6	52,5	65,8	65,9	64,7	44,2	70
Metal enclosure	44,0	43,1	41,9	60,5	60,3	59,5	41,6	70
mounting surface	48,1	46,9	45,6	62,1	61,9	60,9	42,1	90
PV input connector	53,2	49,4	48,4	66,2	64,4	63,4	47,9	75

Supplementary information:
Lowest full load MPP voltage with rated power output @40°C (without power derating)
Rated full load MPP voltage with rated power output @40°C (without power derating)
Highest full load MPP voltage with rated power output @40°C (without power derating)
Lowest full load MPP voltage with rated power output @60°C (power derating to thermal steady)
Rated full load MPP voltage with rated power output @60°C (power derating to thermal steady)
Highest full load MPP voltage with rated power output @60°C (power derating to thermal steady)
Lowest full load MPP voltage and cooling fan disconnected with rated power output @40°C (power derating to thermal steady)

4.3	**TABLE: heating temperature rise measurements (SUN2000-125KTL-M0)**						**P**
Test voltage(PV Input)(V)	625	850	625	850			-
Test voltage(AC Output)(V)	500	500	500	500			-
Test frequency(Hz)	50	50	50	50			-
maximum temperature T of part/at:	T (°C)						TMAX (°C)
Ambient Temperature	40,0	40,0	60,0	60,0			-
Heat sink	77,2	77,9	89,3	80,9			90
Drive transformer T5	73,8	74,3	90,0	83,6			130(Class F)
Optocoupler U13	75,5	73,4	92,2	83,1			100
SPD F13	69,9	65,9	84,6	76,4			85
Filter capacitor C407	71,4	70,6	86,6	82,9			105
Current Hall U51	71,3	70,6	87,1	80,8			105
Film Capacitor C2	61,6	58,6	78,3	68,1			105
Film Capacitor C334	69,8	70,0	84,7	79,1			105
Optocoupler U9	74,4	76,1	88,7	82,6			100
PCB	78,6	78,5	92,5	80,1			105
SPD F2	69,7	66,2	84,9	76,8			85
INV conductor	77,5	80,2	89,4	84,2			105
BST conductor	65,0	59,0	82,9	70,7			105
Y Capacitor C407	65,0	60,1	80,0	69,9			105
Y Capacitor C294	75,8	77,1	88,6	87,8			105
INV Wire	76,9	79,8	92,6	96,1			105
PV input conductor	69,0	66,4	83,7	74,9			105
BUS Capacitor	67,8	72,8	81,5	84,0			105
Y Capacitor C946	70,3	69,3	85,2	78,6			105
Current Hall U85	78,1	77,2	93,2	81,8			105
Relay K10 coil	77,0	76,8	90,7	86,7			130(Class F)

AC Aux Power Transformer T2 winding	69,7	72,0	83,9	82,3			130(Class F)
DSP U100	80,1	73,4	93,9	81,5			105
DSP U101	81,4	74,1	95,5	82,8			105
CPLD U102	75,3	73,1	88,4	81,5			105
DC Aux Power Transformer T1 winding	77,0	79,2	92,4	95,0			130(Class F)
DC Aux Power Transformer T1 bobbin	70,9	75,4	84,4	84,6			130(Class F)
Optocoupler U110	72,2	73,0	86,4	83,3			110
Inductor T7	83,7	94,7	92,7	96,5			150(Class H)
Inductor L6	79,2	96,4	88,9	101,6			150(Class H)
RCD Hall U34	78,1	79,7	89,0	87,4			105
Filter capacitor C501	71,0	72,3	83,9	82,9			105
Output conductor	76,2	77,9	87,3	84,1			105
Internal Fan	66,8	67,3	81,6	79,0			85
DC Switch (inside)	67,4	64,9	81,6	75,6			85
PV input connector (inside)	64,6	57,4	81,1	67,8			85
X capacitor C01	68,8	71,2	82,6	83,4			105
INV module U2	75,4	75,3	90,1	85,6			130
Boost Module U4	77,2	77,1	92,4	89,4			130
ISO Relay Coil	76,3	82,2	91,7	103,6			130
INV inductor	115,3	130,7	113,0	111,0			150(Class H)
BST inductor	120,9	136,6	117,0	112,0			150(Class H)

supplementary information:
Lowest full load MPP voltage with rated power output @40°C (without power derating)
Highest full load MPP voltage with rated power output @40°C (without power derating)
Lowest full load MPP voltage with rated power output @60°C (power derating to thermal steady)
Highest full load MPP voltage with rated power output @60°C (power derating to thermal steady)

4.4	**TABLE: fault condition tests**						P
	ambient temperature (°C) :					N/A(at the prevailing ambient temperature)	—
No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	Result
1	Complete PCE	overload	MAINS:500 PV: 750	Steady condition	-	-	Refer to table 4.7, For a specified overload current (160,4A) is reached, the overload is slowly increased to the point of maximum output power (137,5kW). No excessive temperature observed. Temperature of components: INV inductor 125°C, BST inductor 122°C, INV IGBT 91°C, BST IGBT 90°C. No other hazard.

2	Output L1 to G	Short, note 3	MAINS:500 PV: 750	10 min	-	-	Inverter shutdown immediately after short-circuit without obvious impact current. No output no power feed into grid. No component damage, no hazard.
	Output L2 to G	Short, note 3	MAINS:500 PV: 750	10 min	-	-	Inverter shutdown immediately after short-circuit without obvious impact current. No output no power feed into grid. No component damage, no hazard.
	Output L3 to G	Short, note 3	MAINS:500 PV: 750	10 min	-	-	Inverter shutdown immediately after short-circuit without obvious impact current. No output no power feed into grid. No component damage, no hazard.
	Output L1/L2/L3 to N	Short, note 3	MAINS:500 PV: 750	10 min	-	-	Inverter shutdown immediately after short-circuit without obvious impact current. No output no power feed into grid. No component damage, no hazard. (for 380/400/415V model)
3	Output L1 to L2	Short, note 3	MAINS:500 PV: 750	10 min	-	-	Inverter shutdown immediately after short-circuit. Max. current: 126,1A r.m.s. as the 3-cycle RMS value No output no power feed into grid. No component damage, no hazard.
	Output L1 to L3	Short, note 3	MAINS:500 PV: 750	10 min	-	-	Inverter shutdown immediately after short-circuit. Max. current: 138,1A r.m.s. as the 3-cycle RMS value No output no power feed into grid. No component damage, no hazard.
	Output L2 to L3	Short, note 3	MAINS:500 PV: 750	10 min	-	-	Inverter shutdown immediately after short-circuit. Max. peak current: 124,2A, total impulse duration: approx. 1ms No output no power feed into grid. No component damage, no hazard.

4	DC+ to DC -	Short	MAINS:500 PV: 750	10min	-	-	Inverter shutdown for a few seconds after short-circuit. No backfeed current observed to PV side. No output no power feed into grid. No component damage, no hazard.
		standby, software fault	MAINS:500 PV: 750	10min	-	-	Start-up normally. Then inverter shutdown after a few seconds. Again, start-up repeated. No backfeed current observed to PV side. No output no power feed into grid. No component damage, no hazard.
5	DC source disconnected	Disconnected without additional fault	MAINS:500 PV: 750	10min	-	-	Inverter shutdown immediately due to DC under voltage. No backfeed voltage observed onto PV side. Only energy stored in bus capacitor discharge voltage remained on DC terminals, but not access for operator. No output no power feed into grid. No component damage, no hazard.
		IGBT shorted, short one relay contacts as well	MAINS:500 PV: 750	10min	-	-	Inverter damaged and shutdown immediately. No backfeed voltage observed onto PV side. No component damage, no hazard.
	Mains outage	disconnected	MAINS:500 PV: 750	10min	-	-	Inverter shutdown for immediately due to islanding detection. No backfeed voltage observed onto Mains side. No output no power feed into grid. No component damage, no hazard.
		IGBT shorted, short one relay contacts as well	MAINS:500 PV: 750	10min	-	-	Inverter damaged and shutdown immediately. No backfeed voltage observed onto Mains side. No output no power feed into grid. No component damage, no hazard.
6	L1/L2/L3	reversed	MAINS:500 PV: 750	10min	-	-	The inverter operated normally.
7	AC output	Over-voltage	MAINS:550 PV: 750				Inverter shutdown immediately. No component damage, no hazard.
8	DC input	Over-voltage	MAINS:500 PV: 1150				Inverter shutdown immediately. No component damage, no hazard.

9	Inverter	Cooling system failure, fan blocked, blanketing	MAINS:500 PV: 750	7h	-	-	Inverter protected by over-temperature protection and until thermal steady. All external surface did not exceed 90°C. No damage, no hazard.
10	Bus-capacitor, C23	short	MAINS:500 PV: 750	30min	-	-	PV inverter shut down. Bus-capacitor break down, 30A fuse not open, no damage, no hazard.
11	Half-bus	short	MAINS:500 PV: 750	30min	-	-	PV inverter shut down. Bus-capacitor break down, 30A fuse not open, no damage, no hazard.
12	SPD, F12	short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard
13	Boost IGBT U4, pin 3 – pin 7	short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. U6 breakdown. No other component damage, 30A fuse not open, no hazard.
	Boost IGBT U4, pin 5 – pin 6	short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. U6 breakdown. No other component damage, 30A fuse not open, no hazard.
14	INV IGBT U1, pin 3 – pin 7	short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. U1 breakdown. No other component damage, 30A fuse not open, no hazard.
	INV IGBT U1, pin 5 – pin 6	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. U1 breakdown. No other component damage, 30A fuse not open, no hazard.
15	Q37, D-S	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. U1,U2,U3 Relay breakdown. No other component damage, 30A fuse not open, no hazard.
16	Q3, D-S	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. R442,R443,R444 and Q1 breakdown. No other component damage, 30A fuse not open, no hazard.
17	T1, pin 1 – pin 2	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	T1, pin 4 – pin 7	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	T1, pin 9 – pin 12	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	T1, pin 13 – pin 14	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	T1, pin 20 – pin 22	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.

	T1, pin 22 – pin 24	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
18	T2, pin 1 – pin 2	short	MAINS:500 PV: 750	10min	-	-	Alternative power supply. The inverter operated normally.
	T2, pin 3 – pin 4	short	MAINS:500 PV: 750	10min	-	-	Alternative power supply. The inverter operated normally.
	T2, pin 5 – pin 6	short	MAINS:500 PV: 750	10min	-	-	Alternative power supply. The inverter operated normally.
	T2, pin 7 – pin 9	short	MAINS:500 PV: 750	10min	-	-	Alternative power supply. The inverter operated normally.
	T2, pin 9 – pin 12	short	MAINS:500 PV: 750	10min	-	-	Alternative power supply. The inverter operated normally.
	T2, pin 15 – pin 16	short	MAINS:500 PV: 750	10min	-	-	Alternative power supply. The inverter operated normally.
19	AC relay K5, contacts	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. Then start-up again with same result. No component damage, no hazard.
	Relay monitoring and control, C956	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
	Relay monitoring and control, Q5, G-S	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
	Relay monitoring and control, Q5, G-S	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	Relay monitoring and control, Q14, G-S	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
	Relay monitoring and control, Q14, G-S	short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	Relay monitoring and control, R104	open before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
	Relay monitoring and control, R104	open	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	Relay monitoring and control, C28	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
20	PV array insulation resistance monitoring, R1058	open before start-up	MAINS:500 PV: 750	10min	-	-	The inverter operated normally with ISO checking function normally.

	PV array insulation resistance monitoring, R1058	open	MAINS:500 PV: 750	10min	-	-	The inverter operated normally with ISO checking function normally.
	PV array insulation resistance monitoring, Q7, C-E	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter operated normally with ISO checking function normally.
	PV array insulation resistance monitoring, Q7, C-E	short	MAINS:500 PV: 750	10min	-	-	The inverter operated normally with ISO checking function normally.
	PV array insulation resistance monitoring, D98	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter operated normally with ISO checking function normally.
	PV array insulation resistance monitoring, D98	short	MAINS:500 PV: 750	10min	-	-	The inverter operated normally with ISO checking function normally.
21	RCMU detect, Q14, D-S	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
	RCMU detect, Q14, D-S	short	MAINS:500 PV: 750	10min	-	-	The inverter operated normally. No component damage, no hazard.
	RCMU detect, R126	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
	RCMU detect, R126	short	MAINS:500 PV: 750	10min	-	-	The inverter shutdown. AC relays in open status. No component damage, no hazard.
	RCMU detect, R461	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
	RCMU detect, R461	short	MAINS:500 PV: 750	10min	-	-	The inverter shutdown. AC relays in open status. No component damage, no hazard.
	RCMU detect, U34	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
	RCMU detect, U34	short	MAINS:500 PV: 750	10min	-	-	The inverter shutdown. AC relays in open status. No component damage, no hazard.

22	CPU, U1	+3,3V power decrease continuously	MAINS:500 PV: 750	10min	-	-	The inverter shut down. DSP protect by itself for low voltage No component damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
	CPU, U1	+3,3V power rise continuously	MAINS:500 PV: 750	10min	-	-	The inverter shut down. DSP broken at last. No components damage, no hazard.
	CPU, U1	Oscillator disabled	MAINS:500 PV: 750	10min	-	-	The inverter shut down. DSP protect by itself. No components damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
23	CPU, U2	+3,3V power decrease continuously	MAINS:500 PV: 750	10min	-	-	The inverter shut down. DSP protect by itself for low voltage. No components damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
	CPU, U2	+3,3V power rise continuously	MAINS:500 PV: 750	10min	-	-	The inverter shut down. DSP broken at last. No other components damage, no hazard.
	CPU, U2	Oscillator disabled	MAINS:500 PV: 750	10min	-	-	The inverter shut down. DSP protect by itself. No component damage, no hazard. Inverter can be restarted and operated normally when the fault was removed
24	Communication between CPUs	Disconnect	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
25	Oscillator, U1	Short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No component damage, no hazard.
	Oscillator, U2	Short	MAINS:500 PV: 750	10min	-	-	The inverter shut down. No other components damage, no hazard

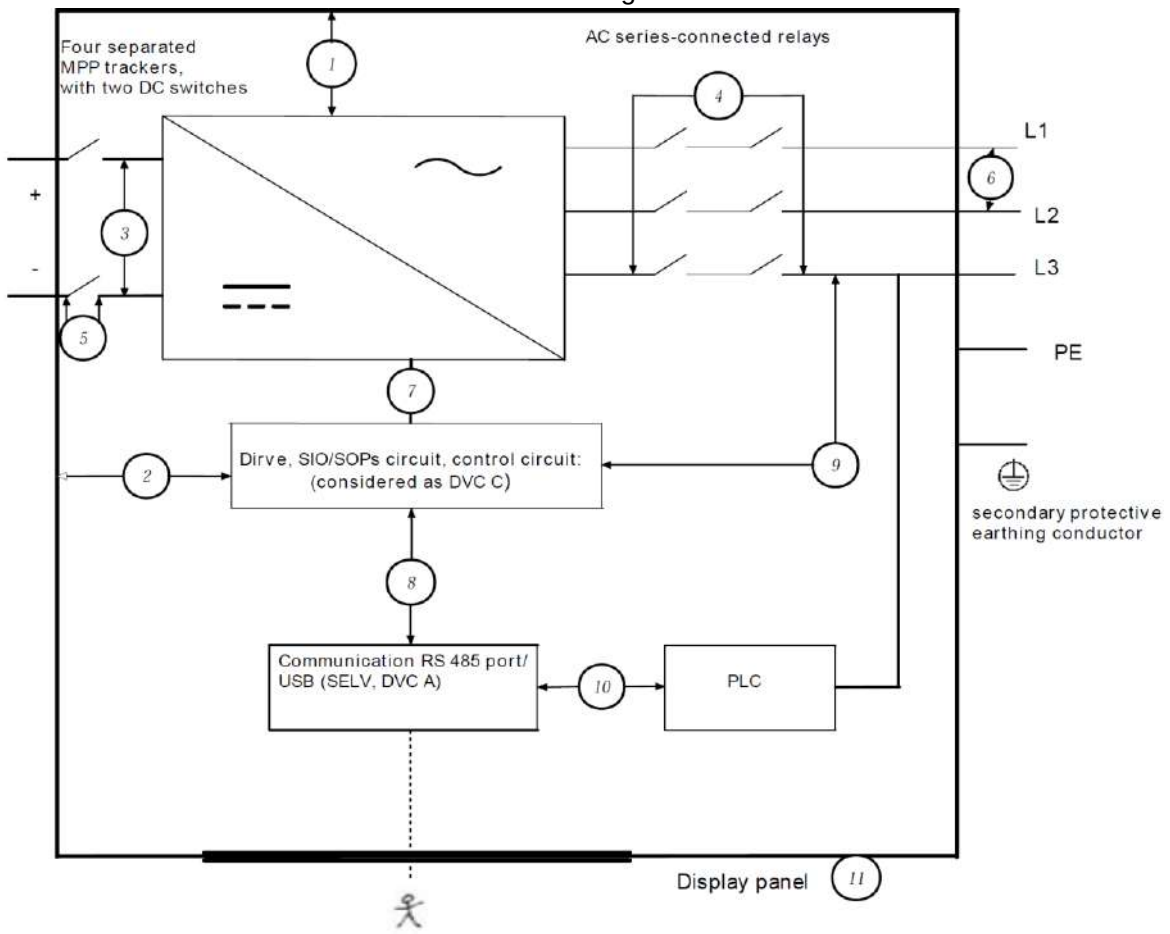
Supplementary information
Note 1: Abnormal and component failure tests were conducted with the AC output protected by external circuit breaker (rated 250A) provided in all live connections to the AC supply as specified in user manual. A 30A non-time-delay fuse connected between the protective earthing terminal and the protective earthing conductor to determined that the fault did not result in any damage to the protective earthing conductor or terminal, or to protective bonding means.
Note 2: The equipment was placed on white tissue-paper covering a softwood surface and covering the equipment with cheesecloth during the fault testing, no emission of molten metal, burning insulation, or flaming or glowing particles from the fire enclosure, and there was no charring, glowing, or flaming of the cheesecloth.
Note 3: No other hazard(e.g. chemical, expulsion) observed after each test.

7.3.6.3.3	**TABLE: protective equipotential bonding;**			N/A
Measured between:	Test current (A)	Voltage drop (V)	Resistance (mΩ)	result
Protective earthing terminal to farthest point of case	-	-	-	-
Second protective earthing terminal to farthest point of case	-	-	-	-
Supplementary information: external protective earthing conductor according to 7.3.6.3.5.				

7.3.6.3.7	**TABLE: touch current measurement**			P (Note 2)
Measured between:		Measured (mA)	Limit (mA)	Comments/conditions
means of connection for the external protective earthing conductor and the external protective earthing conductor itself		4,6	3,5	Max. current recorded after clause 4.3, thermal testing and 4.5, single fault condition test, humidity pre-conditioning and IP66 test
supplementary information: Note 1: Max. current recorded after all models test. For a PCE to be connected to an isolated system or impedance system, the neutral shall be connected through a resistance of 1 kΩ to the external protective earthing conductor, which shall be connected to each input phase in turn. The highest value will be taken as the definitive result. Note 2: External protective earthing conductor cross-section required in user manual as >35 mm^2 (copper) or >50 mm^2 (Aluminum), and a second protective earthing terminal provided on the enclosure.				

7.3.7	**TABLE: clearance and creepage distance measurements**	P

Insulation diagram



Transformer-less inverter insulation diagram

Isolation components and areas:

Area	Insulation related information					
Insulation area 1: Across power circuit(DC/AC) to earth(BI);		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	II	1100	4772	1100	
	Mains	III	288(rated voltage 500V, IT system)	4000	550	
Insulation area 2: Across drive, SIO/SOPs circuit, control circuit to earth(BI);		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	II	1100	4772	1100	
	Mains	III	288(rated voltage 500V, IT system)	4000	550	
Insulation area 3: Between PV different polarities (FI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	I	1100	3078	1100	
	Mains	II	288(rated voltage 500V, IT system)	2500	-	
Insulation area 4: Across contacts of relays (BI+SI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	II	1100	4772	1100	
	Mains	III	288(rated voltage 500V, IT system)	4000	550	
Insulation area 6: Across contacts of DC switch (BI/SI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	II	1100	4772	1100	
	Mains	III	288(rated voltage 500V, IT system)	4000	550	
Insulation area 7: Between PV circuit and Drive, SIO/SOPs circuit, control circuit (FI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	I	1100	3078	1100	
	Mains	II	288(rated voltage 500V, IT system)	2500	550	

Insulation area 8: Between drive, SIO/SOPs circuit, control circuit and communication RS485 port/USB (DI/RI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	II	1100	6772	1100	
	Mains	III	288(rated voltage 500V, IT system)	6000	550	
Insulation area 9: Between drive, SIO/SOPs circuit, control circuit and AC circuit after AC relay (FI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	I	1100	3078	-	
	Mains	II	288(rated voltage 500V, IT system)	2500	550	
Insulation area 10: Between AC live conductors and communication RS485 port/USB (RI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	II	1100	6772	-	
	Mains	III	288(rated voltage 500V, IT system)	6000	550	
Insulation area 11: Between internal live parts to Display panel/LCD cover (RI)		OVC	System voltage(V)	Impulse voltage to determine cl. (V)	Max. working voltage to determine cr. (V)	
	PV	II	1100	6772	1100	
	Mains	III	288(rated voltage 500V, IT system)	6000	550	

clearance cl and creepage distance dcr at / of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Insulation area 1 and 2: Across power circuit(DC/AC)/ drive, SIO/SOPs circuit, control circuit to earth(BI);	Refer to above table	Refer to above table	5,2	↓	PV side: PCB: 5,5 other insulator:11,0 Mains side: PCB: 5,2 other insulator:5,5	↓
- PV circuit to earthed metal enclosure and accessible surface(not on PCB)	↑	↑	↑	>20	↑	>20
- Mains circuit to earthed metal enclosure and accessible surface(not on PCB)	↑	↑	↑	>20	↑	>20

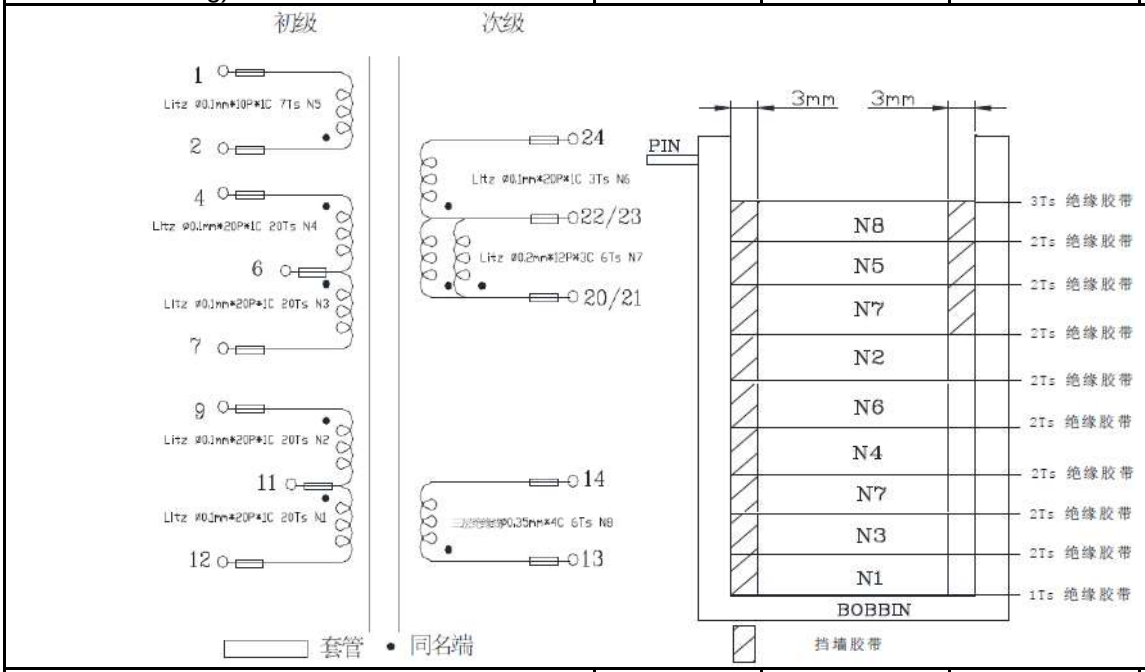
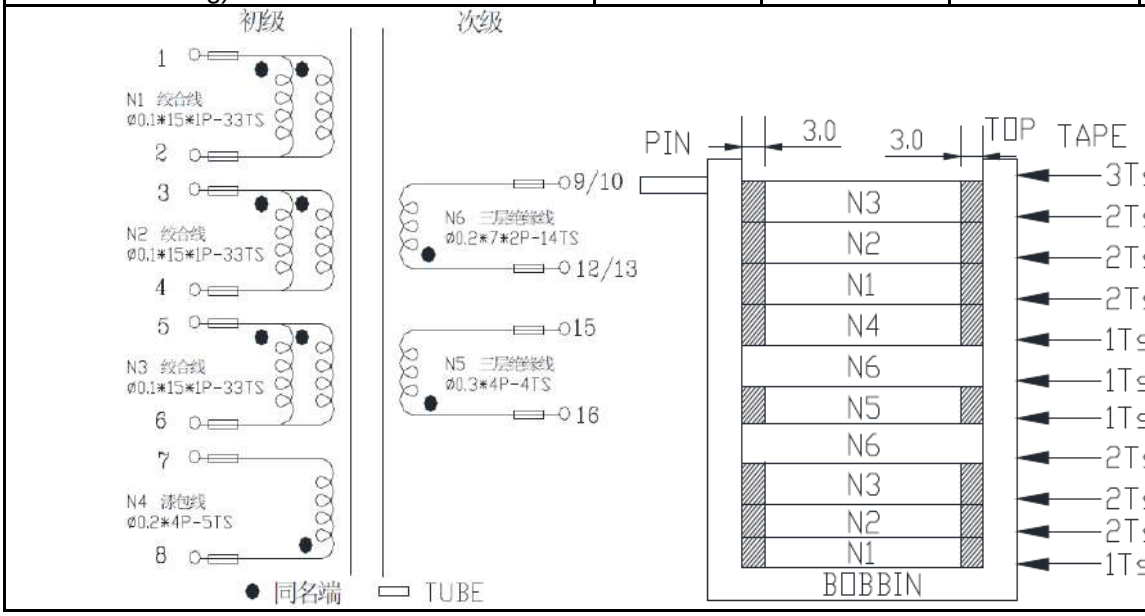
- PV circuit to earthed metal enclosure and accessible surface(on PCB)	↑	↑	↑	≥5,6	↑	≥5,6
- Mains circuit to earthed metal enclosure and accessible surface(on PCB)	↑	↑	↑	≥5,6	↑	≥5,6
On boost inductor	↑	↑	↑	potting material filled, verified by impulse and dielectric strength test	↑	potting material filled, verified by impulse and dielectric strength test
On conversion inductor	↑	↑	↑	potting material filled, verified by impulse and dielectric strength test	↑	potting material filled, verified by impulse and dielectric strength test
IGBT module	↑	↑	↑	verified by impulse and dielectric strength test	↑	verified by impulse and dielectric strength test
Insulation area 3: Between PV different polarities (FI)	Refer to above table	Refer to above table	2,7	↓	PCB: 5,5 other insulator:11,0	↓
- on DC switch body	↑	↑	↑	≥11,0	↑	≥11,0
Remark: DC switch approved by TUV, outer cl. and cr. was checked and inner cl. and cr. was not checked						
- PV circuit (on PCB)	↑	↑	↑	≥5,5	↑	≥5,5
Insulation area 4: Across contacts of series connected relays (BI+SI)	Refer to above table	Refer to above table	5,2 (BI/SI)	↓	5,5	↓
- on AC relays	↑	↑	↑	cl.=3,6mm between each pair contacts Approved by third party	↑	cr.>5,5mm Approved by third party
Insulation area 5: Across contacts of DC switch (BI/SI)	Refer to above table	Refer to above table	5,2 (BI/SI)	↓	11,0	↓
- on DC switch	↑	↑	↑	Approved by third party	↑	Approved by third party

Insulation area 6: Between AC live conductors (FI)	Refer to above table	Refer to above table	2,7	↓	Mains side: PCB: 2,8 other insulator: 5,5	↓
- shortest distance across AC live conductors (Mains side, not on PCB)	↑	↑	↑	>20	↑	>20
- shortest distance PCB foil trace and on components (Mains side, on PCB)	↑	↑	↑	>2,8	↑	>2,8
Insulation area 7: Between PV circuit and Drive, SIO/SOPs circuit, control circuit (FI)	Refer to above table	Refer to above table	2,7	↓	PCB: 5,5 other insulator:11,0	↓
Insulation area 9: Between drive, SIO/SOPs circuit, control circuit and AC circuit after AC relay (FI)	Refer to above table	Refer to above table	2,7	↓	PCB: 5,5 other insulator:11,0	↓
Remark: the insulation between PV circuit and AC circuit after AC relay shall be at least basic insulation and provided by insulation area 7 plus insulation area 9, and passed the impulse and hi-pot test of basic insulation requirements						
Insulation area 8: Between drive, SIO/SOPs circuit, control circuit and communication RS485 port/USB (DI/RI)	Refer to above table	Refer to above table	8,4	↓	PV side: PCB: 11,0	↓
- shortest distance PCB foil trace and on components on PCB (control to SELV)	↑	↑	↑	11,2	↑	11,2
Insulation area 10: Between AC live conductors and communication RS485 port/USB (RI)	Refer to above table	Refer to above table	8,4	↓	Mains side: PCB: 8,4	↓
- shortest distance PCB foil trace and on components on PCB (Mains to SELV)	↑	↑	↑	8,5	↑	8,5
Insulation area 11: Between internal live parts to Display panel/LED cover (RI)	Refer to above table	Refer to above table	8,4	↓	22,0	↓

- internal live parts to Display panel/LED cover	↑	↑	↑	>8,4 verified by impulse and dielectric strength test	↑	>22,0 verified by impulse and dielectric strength test

Supplementary information:

1) Maximum operation altitude: 4000 m was taken into consideration, because requirements specified in EN 62109-1:2010 are only included for adjustment of clearance distances for higher elevations, but not for other factors related to elevation, such as thermal considerations.
2) Symbol ↑ means to refer to cell above this arrow, symbol ↓ means to refer to cell under this arrow.
3) For Cl. and Cr. in circuit of insulation above 30 kHz are found less severity of above table by evaluating according to Annex G, and harmonized to above table.
4) Spacings for functional insulation on a PWB which do not comply with 7.3.7.4 and 7.3.7.5 are permitted because of all the following are satisfied:
   - the PWB has flammability rating of V-0 (see IEC 60695-11-10)
   - the PWB base material has a minimum CTI of 175
   - the equipment complies with the PWB short-circuit test

7.3.7	TABLE: distance through insulation measurement			P
distance through insulation di at/of:	U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)
LED cover(RI)	<DC1100 <AC500/288	AC 3000/ DC 4242	0,2	3,0
Insulation sheet between primary winding and secondary winding of isolating transformer T1(DI, three layers insulation sheet + triple insulated winding)	<DC1100 <AC500/288	Ditto	-	-
				
Insulation sheet between primary winding and secondary winding of isolating transformer T2(DI, three layers insulation sheet + triple insulated winding)	<DC1100 <AC500/288	Ditto	-	-
				

Potting material filling protection area of optocoupler	<DC1100 <AC500/288	Ditto	0,2	>0,4
Epoxy resin used to fill inverter and boost inductor(BI)	<DC1100 <AC500/288	AC 1500/ DC 2121	-	-
Insulation sheet cover inverter and boost inductor(BI)	<DC1100 <AC500/288	Ditto	-	-
Insulation sheet between IGBT, MOSFET, DIODE body and heatsink(BI)	<DC1100 <AC500/288	Ditto	-	-
Supplementary information: other components, such as optocoupler, power module are checked by certificates and specification.				

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
Insulation area 1: Across power circuit(DC/AC) to earth(BI), note 1	AC 1500/ DC 2121, note 6, note 3	4772(for cl. verification and components test), note 6, note 3	N/A, note 4	P
Insulation area 2: Across drive, SIO/SOPs circuit, control circuit to earth(BI); note 1	AC 1500/ DC 2121, note 6, note 3	4772(for cl. verification and components test), note 6, note 3	N/A, note 4	P
Insulation area 3: Between PV different polarities (FI); note 1	N/A, note 5	N/A, note 5	N/A, note 5	N/A, note 5
Insulation area 4: Across contacts of relays (BI+SI); note 1	AC 1500/ DC 2121, note 6, note 3	4772(for cl. verification and components test), note 6, note 3	N/A, note 4	P
Insulation area 5: Across contacts of DC switch (BI/SI); note 1	AC 3000/ DC 4242, note 6, note 3	4772(for cl. verification and components test), note 6, note 3	N/A, note 4	P
Insulation area 6: Between AC live conductors (FI); note 1	N/A, note 5	N/A, note 5	N/A, note 5	N/A, note 5

Insulation area 7: Between PV circuit and Drive, SIO/SOPs circuit, control circuit (FI); note 1	N/A, note 5	N/A, note 5	N/A, note 5	N/A, note 5
Insulation area 8: Between drive, SIO/SOPs circuit, control circuit and communication RS485 port/USB (DI/RI); note 1	AC 3000/ DC 4242, note 6, note 3	6772(for cl. verification and components test), note 2, note 3	Upd:1100V for isolating components, note 4	P
Insulation area 9: Between drive, SIO/SOPs circuit, control circuit and AC circuit after AC relay (FI); note 1	N/A, note 5	N/A, note 5	N/A, note 5	N/A, note 5
Insulation area 10: Between AC live conductors and communication RS485 port/USB (RI); note 1	AC 3000/ DC 4242, note 6, note 3	6772(for cl. verification and components test), note 2, note 3	N/A, note 4	P
Insulation area 11: Between internal live parts to Display panel/LED cover (RI); note 1	AC 3000/ DC 4242, note 6, note 3	6772(for cl. verification and components test), note 2, note 3	N/A, note 4	P

TEST REPORT
IEC 62109-2
Safety of Power Converter for use in Photovoltaic Power Systems Part 2: Particular requirements for inverters

Report Number..... :	70.409.19.175.04-00 part 2 of 2
Date of issue..... :	2019-12-06
Total number of pages.....	35
TÜV SÜD Branch.....:	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch
Applicant's name..... :	Huawei Technologies Co., Ltd.
Address..... :	Administration Building Headquarters of Huawei Technologies Co., Ltd., Bantian, Longgang District, 518129 Shenzhen, PEOPLE'S REPUBLIC OF CHINA
Test specification:	
Standard..... :	EN 62109-2:2011
Test procedure..... :	CE_LVD
Non-standard test method.....:	N/A
Test Report Form No..... :	IEC62109_2B
Test Report Form(s) Originator ... :	LCIE - Laboratoire Central des Industries Electriques
Master TRF..... :	Dated 2016-08

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

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.

Test item description ..... :	SOLAR INVERTER
Trade Mark ..... :	HUAWEI
Manufacturer ..... :	Huawei Technologies Co., Ltd.
Model/Type reference ..... :	SUN2000-125KTL-M0, SUN2000-110KTL-M0, SUN2000-100KTL-M0, SUN2000-100KTL-M1, SUN2000-100KTL-INM0
Ratings ..... :	See rating labels on pages 4 to 5

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):

☒	**TÜV SÜD Branch:**	TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch	
Location/ address ..... :		3-13, No.151 Heng Tong Road, 200070, Shanghai, P.R. China	
☒	**Associated Testing Laboratory:**	CQC - Trusted(Jiangsu) Testing Technology Co., Ltd.	
Testing location/ address ..... :		No.99, Wenlan Road, Xianlin University Zone, Xianlin Street, Qixia District, NanJing, China	
Tested by (name, function, signature)..... :		*Shan Huang*	Shan Huang
Approved by (name, function, signature) .. :		*Kai Zhao*	Kai Zhao
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address ..... :			
Tested by (name, function, signature)..... :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address ..... :			
Tested by (name + signature)..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address ..... :			
Tested by (name, function, signature)..... :			
Witnessed by (name, function, signature) . :			
Approved by (name, function, signature) .. :			

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

Tests against:

EN 62109-1:2010, EN 62109-2:2011

Total test reports contain 2 parts and 1 attachments listed in below table:

Item	Description	Pages
Part 1	EN 62109-1:2010 test report	77
Part 2	EN 62109-2:2011 test report	35
Attachment	Data form for electrical and electronic component(CDF)	13

Summary of testing:

All the tests results are confirmed to the requirements of the standard.

Tests performed (name of test and test clause):

Family products design, full tests were conducted on representative model **SUN2000-125KTL-M0,** except blanketing test on models **SUN2000-100KTL-M0** and **SUN2000-110KTL-M0**.

☒ Fault-tolerance of residual current monitoring – 4.4.4.15.1;
☒ Fault-tolerance of automatic disconnecting means - 4.4.4.15.2;
☒ Cooling system failure – Blanketing test – 4.4.4.17;
☒ Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays - 4.8.2;
☒ Array residual current detection - 4.8.3;
☒ Inverter backfeed current onto the array -9.3.4 as combined with 4,4 in EN 62109-1;

Testing location:

CQC - Trusted(Jiangsu) Testing Technology Co., Ltd.

No.99, Wenlan Road, Xianlin University Zone, Xianlin Street, Qixia District, NanJing, China

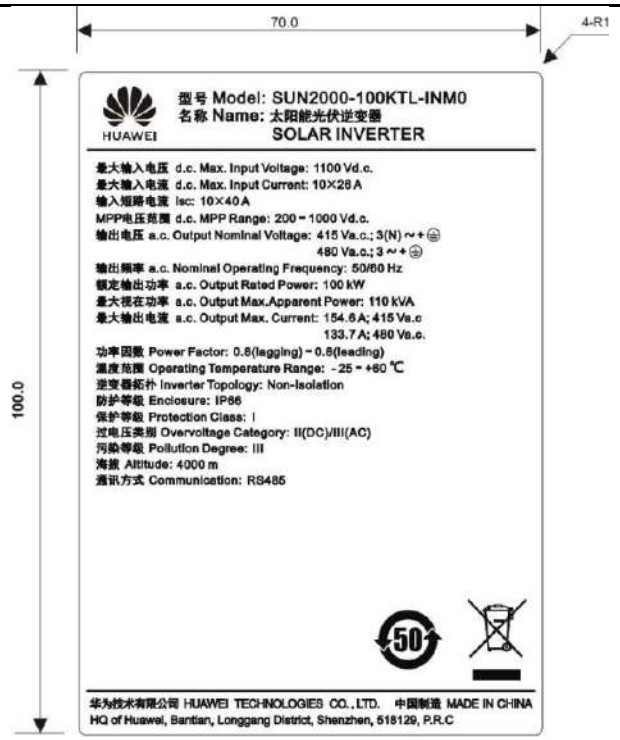
Summary of compliance with National Differences (List of countries addressed):

All tests were carried out according to EN 62109-2:2011.

The text of IEC 62109-2(ed.1) was approved by CENELEC as a European Standard without any modification. Also compliance with EN 62109-2:2011, Annex ZA of EN 62109-1:2011 is recorded at the end of this report.

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

Copy of marking plate:

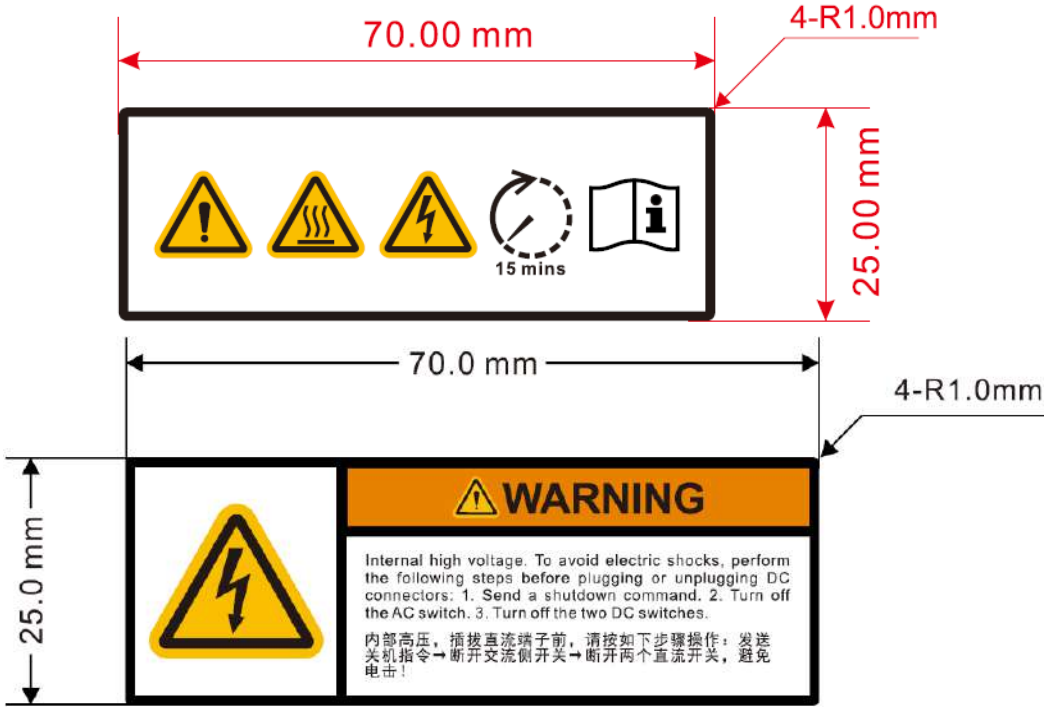


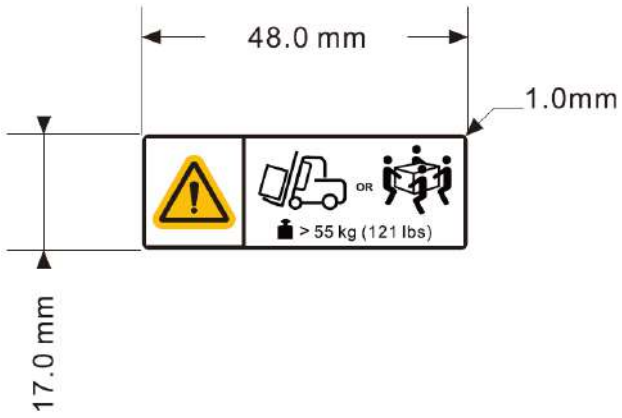
Importer:
Huawei Technologies Hungary Ltd.
Add.: Hungary-Budapest-Kozraktaru. 30-32, Riverpark, 1st floor

Manufacturer:
Huawei Technologies Co., Ltd.
Add.: HQ of Huawei, Bantian, Longgang District, Shenzhen, 518129, P.R.C

CE

Additional warning labels:





Marking plate material: pressure-sensitive unprinted label stocks stamped into aluminum surface; Suitable for outdoor use with respect to exposure to Ultraviolet Light, Water Exposure and thermal transfer printed label stock applications, -60°C to 95°C

An additional PET film provided to cover label.

Test item particulars.....:	
Equipment mobility.....:	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains.....:	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category .....:	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains.....:	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV .....:	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%).....:	±10 %
Tested for power systems.....:	IT / TN / TT
IT testing, phase-phase voltage (V).....:	480/500VAC (IT), 380/400/415VAC (TN, TT)
Class of equipment .....:	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) .....:	See page 11
Pollution degree.....:	3(external environment), 2(internal environment)
IP protection class .....:	IP66
.....:	
Possible test case verdicts:	
- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement..... :	P (Pass)
- test object does not meet the requirement ..... :	F (Fail)
Testing..... :	
Date of receipt of test item..... :	2019-10-22
Date (s) of performance of tests ..... :	2019-10-22 to 2019-11-14

General remarks:

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.

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

Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:	☐ **Yes** ☒ **Not applicable**

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

Name and address of factory (ies)……:

1) Huawei Machine Co., Ltd.

No. 2, New City Avenue, Songshan Lake Sci. & Tech. Industry Park, 523808 Dongguan, Guangdong, PEOPLE'S REPUBLIC OF CHINA

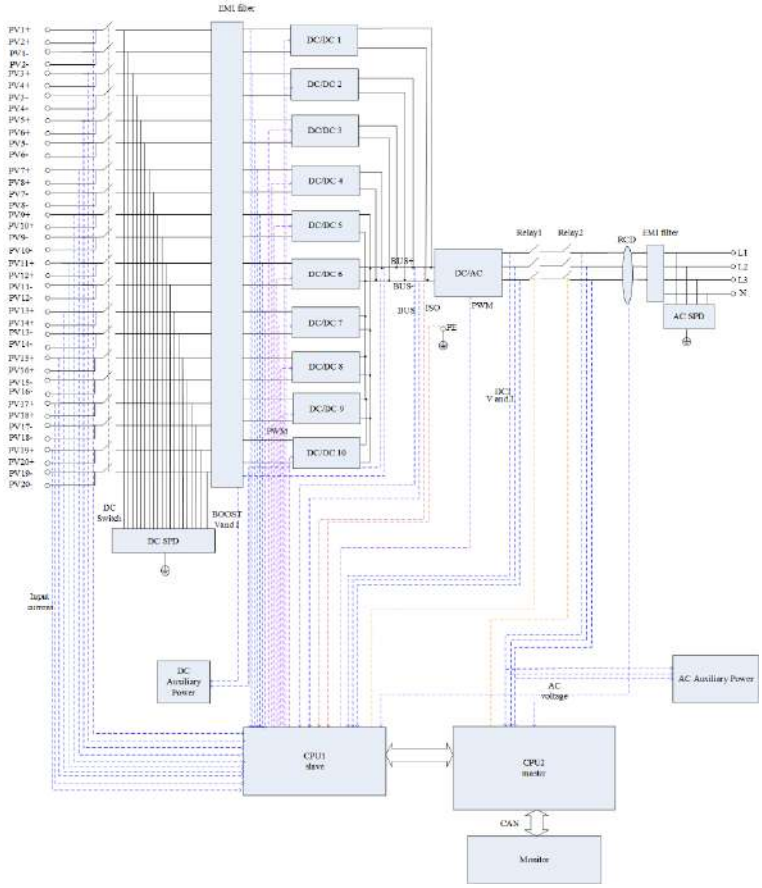
2) Shenzhen Fugui Precision Industry Co., Ltd.

D7-2F, D8-1F & 3F Foxconn Science and Technology Industrial Park, East side of Min Qing Road, Longhua Subdistrict, Longhua District 518109 Shenzhen, PEOPLE'S REPUBLIC OF CHINA

3) DongGuan Fuyi Precision Industry Co., Ltd.
Floor 1st-4th, Building 12, No.6, Songshui Road, Songmu Village, Weifeng Industrial City, Dalang Town, 523770 Dongguan, Guangdong, PEOPLE'S REPUBLIC OF CHINA
4) Dongguan Yang Tian Electronic Technology Co., Ltd. (i-Brights)
No.152, Luyuan Rd., Keyuancheng, Tangxia Town, 523710 Dongguan City, Guangdong Province PEOPLE'S REPUBLIC OF CHINA

General product information:

These devices are grid-connected PV inverters(without isolating transformer inside) which converts direct current optimized by photovoltaic DC conditioner to alternating current, and they are intended to be connected in parallel with the public grid via an external isolated transformer depend on the rated output voltage of inverter. The winding ratio is adapted according to the voltage level of inverter output and connection point at public grid.
They are intended for professional incorporation into PV system, and they are assessed on a component test basis.
Firmware Version: V500R001
Topological diagram:



The following documentations are retained on file:
- Photograph;

- Circuit diagrams;
- PCB layout drawing;
- PCB foil pattern assembly drawing;
- Specification sheets for components;
- Instruction manual.
- Manufacturer's work instruction and declaration for 100% routing test as required by EN 62109-1:2010, EN 62109-2:2011.

For models differences, pls. see as in table below (exact from user manual directly for reference):

DC Input

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Max. input voltage	1100 V	1100 V	1100 V	1100 V	1100 V
Max. input current (per MPPT circuit)	26 A	26 A	26 A	26 A	26 A
Max. short-circuit current per MPPT route	40 A	40 A	40 A	40 A	40 A
Max. backfeed current to the array	0 A	0 A	0 A	0 A	0 A
Min. start-up voltage	200 V	200 V	200 V	200 V	200 V
MPP voltage range	200-1000 V	200-1000 V	200-1000 V	200-1000 V	200-1000 V
MPP voltage range at full load	625-850 V	540-800 V	540-800 V	540-800 V (380/400 Vac) 625-850V (480 Vac)	540-800 V (400/380 Vac) 625-850V (480 Vac)
Rated input voltage	750 V	600 V	600 V	600 V (380/400 Vac) 720 V (480Vac)	620 V (380/400 Vac) 720 V (480Vac)
Number of inputs	20	20	20	20	20
Number of MPPT circuits	10	10	10	10	10

AC Output

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Rated output power	125 kW	110 kW	100 kW	100 kW	100 kW

Max. apparent power	137,5 kVA	121 kVA	110 kVA	110 kVA	110 kVA
Max. output power (cos φ = 1)	137,5 kW	121 kW	110 kW	110 kW	110 kW
Rated output line voltage	500 V	380/400 V	380/400 V	380/400 V 480 V	415/480 V
Output frequency	50 Hz	50/60 Hz	50/60 Hz	50/60 Hz	50/60 Hz
Max. output current	160,4 A	185,7 A (380Vac) 176,4 A (400Vac)	168,8 A (380Vac) 160,4 A (400Vac)	168,8 A (380Vac) 160,4 A (400Vac) 133,7 A (480Vac)	154,6 A (415Vac) 133,7 A (480Vac)
Power factor	0,8 leading … 0,8 lagging				
Max. total harmonic distortion (THD)	< 3%				

Protection

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Input DC switch	Supported				
Anti-islanding protection	Supported				
Output overcurrent protection	Supported				
Input reverse-connection protection	Supported				
PV string fault detection	Supported				
DC surge protection	Type II				
AC surge protection	Type II				
Insulation resistance detection	Supported				
Residual current detection	Supported				

Display and Communication

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Display	LED indicator, Bluetooth module + app, USB data cable + app				
RS485	Supported				
MBUS	Supported				

General Data

Technical specifications	SUN2000-125KTL-M0	SUN2000-110KTL-M0	SUN2000-100KTL-M0	SUN2000-100KTL-M1	SUN2000-100KTL-INM0
Dimensions (W x H x D)	1035 mm x 700 mm x 365 mm				
Weight	81 kg	90 kg			
Operating temperature	-25°C to +60°C				
Cooling	Smart air cooling				
Operating altitude	4000 m				
Humidity	0%-100% RH				
Input terminal	PV-ADSP4-S2/6-UR				
Output terminal	OT connector				
Protection level	IP66				
Protective class	Class I				
Topology	Transformerless				
Noise	≤ 65 dB(A)				
Firmware version	V500R001				

The following safety parameters are factory set and fixed per EN 62109-2:2011.

Default interface protection settings

Parameters	Normative requirements		Internal threshold setting	
	Maximum clearance time	Trip limit	Maximum clearance time (factory setting)	Factory setting trip value
PV array Insulation resistance measurement before starting operation	-	≥1100V/30mA= 36,7 kΩ	-	50 kΩ as default Adjustable range: 50 kΩ - 1500 kΩ
Continuous residual current monitoring(functional)	300 ms	10 mA/kVA	300 ms	10 mA RMS per kVA based on inverter ratings
Sudden changes in residual current(functional)	300 ms	30 mA	300 ms	30 mA
	150 ms	60 mA	150 ms	60 mA
	40 ms	150 mA	40 ms	150 mA

Alteration of the above settings or full setting range of the interface protection may cause a breach of the type-certificate marking.

Unauthorised access to factory safety parameters setting and software should be prohibited.
A reset to the factory safety parameters requires retesting and verification in conjunction with the end-use system.

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

4	**GENERAL TESTING REQUIREMENTS**		P
4.4.4	Single fault conditions to be applied		P
4.4.4.15	Fault-tolerance of protection for grid-interactive inverters		P
4.4.4.15.1	Fault-tolerance of residual current monitoring according to 4.8.3.5: the residual current monitoring system operates properly	External isolating transformer is required for in parallel operation with grid, but RCMU is necessary based on analysis when multiple inverters in parallel operation with connection to the same winding of external transformer.	P
	a). - The inverter ceases to operate		P
	- Indicates a fault in accordance with §13.9		P
	- Disconnect from the mains		P
	- not re-connect after any sequence of removing and reconnecting PV power		P
	- not re-connect after any sequence of removing and reconnecting AC power		P
	- not re-connect after any sequence of removing and reconnecting both PV and AC power		P
	b). - The inverter continues to operate		P
	- the residual current monitoring system operates properly under single fault condition		P
	- Indicates a fault in accordance with §13.9		P
	c). - The inverter continues to operate regardless of loss of residual current monitoring functionality		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
	- Indicates a fault in accordance with §13.9		P
4.4.4.15.2	Fault-tolerance of automatic disconnecting means		P
4.4.4.15.2.1	The means provided for automatic disconnection of a grid-interactive inverter from the mains shall:		P
	- disconnect all grounded current-carrying conductors from the mains	Not allowed to be used in grounded current-carrying system.	N/A
	- disconnect all ungrounded current-carrying conductors from the mains		P

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- 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.		P
4.4.4.15.2 .2	Design of insulation or separation complies with requirements of 7.3.7 of Part 1: report here Part 1 comment and verdict.	Consider the Vmax of PV array, overvoltage category, pollution degree, impulse withstand voltage of 4772V, the minimum required cl.5,2mm of contacts for altitude≤4000m, the detail see report of Part 1	P
4.4.4.15.2 .3	For non-isolated inverter, automatic checking of the isolation provided by a disconnect means after single fault.		P
	If the check fail: - any still-functional disconnection means shall be left in the open position		P
	- at least basic or simple separation shall be maintained between the PV input and the mains		P
	- the inverter shall not start operation		P
	- the inverter shall indicate a fault in accordance with 13.9		P
4.4.4.16	A stand-alone inverter with a transfer switch to transfer AC loads from the mains or other AC bypass source to the inverter output:	Not stand-alone inverter	N/A
	- shall continue to operate normally		N/A
	- shall not present a risk of fire as the result of an out-of-phase transfer		N/A
	- shall not present a risk of shock as the result of an out-of-phase transfer		N/A
	- And having control preventing switching: components for malfunctioning ……..:		N/A
4.4.4.17	Cooling system failure – Blanketing test No hazards according to the criteria of sub-clause 4.4.3 of Part 1 shall result from blanketing the inverter This test is not required for inverters restricted to use only in closed electrical operating areas.		P
	Test stop condition: time duration value or stabilized temperature ……..:	Stabilize without external surface of the inverter exceed 90˚C	P
4.7	ELECTRICAL RATINGS TESTS		N/A
4.7.4	Stand-alone Inverter AC output voltage and frequency		N/A
4.7.4.1	General		N/A
4.7.4.2	Steady state output voltage at nominal DC input The steady-state AC output voltage shall not	See appended test table 4.7.4 Steady state Inverter AC output voltage and frequency	N/A

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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.		
4.7.4.3	Steady state output voltage across the DC input range The steady-state AC output voltage shall not be less than 85 % or more than 110 % of the rated nominal voltage with the inverter supplied with any value within the rated range of DC input voltage.	See appended test table 4.7.4 Steady state Inverter AC output voltage and frequency	N/A
4.7.4.4	Load step response of the output voltage at nominal DC input The AC output voltage shall not be less than 85 % or more than 110 % of the rated nominal voltage for more than 1,5 s after application or removal of a resistive load.	See appended test table 4.7.4 Steady state Inverter AC output voltage and frequency	N/A
4.7.4.5	Steady state output frequency The steady-state AC output frequency shall not vary from the nominal value by more than +4 % or –6 %.	See appended test table 4.7.4 Steady state Inverter AC output voltage and frequency	N/A
4.7.5	Stand-alone inverter output voltage waveform		N/A
4.7.5.1	General		N/A
4.7.5.2	The AC output voltage waveform of a sinusoidal output stand-alone inverter shall have a total harmonic distortion (THD) not exceeding of 10 % and no individual harmonic at a level exceeding 6 %.		N/A
4.7.5.3	Non-sinusoidal output waveform requirements		N/A
4.7.5.3.1	General		N/A
4.7.5.3.2	The total harmonic distortion (THD) of the voltage waveform shall not exceed 40 %.		N/A
4.7.5.3.3	The slope of the rising and falling edges of the positive and negative half-cycles of the voltage waveform shall not exceed 10 V/µs measured between the points at which the waveform has a voltage of 10 % and 90 % of the peak voltage for that half-cycle.		N/A
4.7.5.3.4	The absolute value of the peak voltage of the positive and negative half-cycles of the waveform shall not exceed 1,414 times 110 % of the RMS value of the rated nominal AC output voltage.		N/A
4.7.5.4	Information requirements for non-sinusoidal waveforms The instructions provided with a stand-alone inverter not complying with 4.7.5.2 shall include the information in 5.3.2.6.		N/A
4.7.5.5	Output voltage waveform requirements for inverters for dedicated loads. For an inverter that is intended only for use with a known dedicated load, the following requirements may be used as an alternative to the waveform requirements in 4.7.5.2 to 4.7.5.3.		N/A
	The combination of the inverter and dedicated	See attached document:	N/A

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	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.	4.7.5.5 Evaluation of inverter for dedicated load	
	The inverter shall be marked with symbols 9 and 15 of Table C.1 of Part 1.		N/A
	The installation instructions provided with the inverter shall include the information in 5.3.2.13.		N/A
4.8	ADDITIONAL TESTS FOR GRID-INTERACTIVE INVERTERS		P
4.8.1	General requirements regarding inverter isolation and array grounding		P
	- Type of Array grounding supported ……:	Ungrounded array	P
	- Inverter isolation ……..……..……..……..…..:	Transformer-less solar inverter, but required an isolating transformer between the MAINS and inverter	P
4.8.2	Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	(See attached table)	P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays	Minimum Insulation Resistance before connection to the MAINS: 1100V/30mA=36,7 kΩ	P
	Inverter shall have means to measure DC insulation resistance from PV input (array) to ground before starting operation		P
	Or Inverter shall be provided with instruction in accordance with 5.3.2.11.	The expected insulation resistance of the array to ground shall be calculated based on an array insulation resistance of 40 MΩ per m^2 either known according to 61730, calculate the practice PV system resistance with the surface area of the parallel and series panels and the set value maybe adjusted with agreement of authority agency.	P
	Measured DC insulation resistance: ……..……..…..:	50kΩ x 0,9=45 kΩ	P
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value R= Vmax/30mA under normal conditions		P
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value R= Vmax/30mA with ground fault in the PV array	First with one pole grounded fault occurred, following an insulation resistance below limit simulated, then allow the inverter to start, the inverter shall not connect to the mains.	P
	Isolated inverters shall indicate a fault if the insulation resistance is less than the limit		P

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	value		
	Isolated inverter fault indication maintained until insulation resistance has recovered to a value higher than the limit value		P
	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
4.8.2.2	Array insulation resistance detection for inverters for functionally grounded arrays	Not for functionally grounded arrays	N/A
	a-1)The value of the total resistance, including the intentional resistance for array functional grounding, the expected insulation resistance of the array to ground, and the resistance of any other networks connected to ground (for example measurement networks) must not be lower than R = (VMAX PV/30 mA) ohms.		N/A
	a-2) The installation instructions shall include the information required in 5.3.2.12.		N/A
	b-1) As an alternative to a), or if a resistor value lower than in a) is used, the inverter shall incorporate means to detect, during operation, if the total current through the resistor and any networks (for example measurement networks) in parallel with it, exceeds the residual current values and times in Table 31		N/A
	b-2) Inverter shall either disconnect the resistor or limit the current by other means ……..…..:		N/A
	b-3) If the inverter is a non-isolated inverter, or has isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, it shall also disconnect from the mains.		N/A
	c) The inverter shall have means to measure the DC insulation resistance from the PV input to ground before starting operation, in accordance with 4.8.2.1.		N/A
4.8.3	Array residual current detection		P
4.8.3.1	General		P
4.8.3.2	30 mA touch current type test for isolated inverters	See appended test table 4.8.3.2	P
4.8.3.3	Fire hazard residual current type test for isolated inverters	See appended test table 4.8.3.3	P
4.8.3.4	Protection by application of RCD's		N/A

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- The requirement for additional protection in 4.8.3.1 can be met by provision of an RCD with a residual current setting of 30 mA, located between the inverter and the mains..		N/A
	- The selection of the RCD type to ensure compatibility with the inverter must be made according to rules for RCD selection in Part 1.		N/A
	- The RCD provided integral to the inverter, or		N/A
	- The RDC provided by the installer if details of the rating, type, and location for the RCD are given in the installation instructions per 5.3.2.9.		N/A
4.8.3.5	Protection by residual current monitoring	RCM is provided integrated in inverter	P
4.8.3.5.1	General		P
	Where required by Table 30, the inverter shall provide residual current monitoring that functions whenever the inverter is connected to the mains with the automatic disconnection means closed.		P
	The residual current monitoring means shall measure the total (both a.c. and d.c. components) RMS current.		P
	As indicated in Table 30 for different inverter types, array types, and inverter isolation levels, detection may be required for excessive continuous residual current, excessive sudden changes in residual current, or both, according to the following limits:		P
	a) Continuous residual current: The inverter shall disconnect within 0,3 s and indicate a fault in accordance with 13.9 if the continuous residual current exceeds:		P
	- maximum 300 mA for inverters with continuous ouput power rating ≤30kV;		N/A
	- maximum 10 mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.		P
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		P
	b) Sudden changes in residual current: The inverter shall disconnect from the mains within the time specified in Table 31		P
	The inverter indicates a fault in accordance with 13.9, if a sudden increase in the RMS residual current is detected exceeding the value in the table.		P
	- 30mA@0,3s		P
	- 60mA@0,15s		P
	- 150mA@0,04s		P

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		P
4.8.3.5.2	Test for detection of excessive continuous residual current: test repeated 5 times and time to disconnect shall not exceed 0,3 s.	See appended test table 4.8.3.5.2 Test for detection of excessive continuous residual current	P
4.8.3.5.3	Test for detection of sudden changes in residual current repeated 5 times and each of the 5 results shall not exceed the time limit indicated in for each row (30mA, 60mA and150mA) of Table 31.	See appended test table 4.8.3.5.3 Test for detection of sudden changes in residual current	P
4.8.3.6	Systems located in closed electrical operating areas	Based on risk analysis, area between inverter side of that isolation transformer and mains shall be protected as systems located in closed electrical operating areas, indicating which forms of shock hazard protection are and are not provided integral to the inverter in installation instructions. All operation, installation and maintenance shall be followed with HUAWEI instruction strictly.	P
	The protection against shock hazard is not required if the installation information provided with the inverter indicates the restriction for use in a closed electrical operating area, and		P
	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.		P
	The inverter shall be marked as in 5.2.2.6.		P
5	**MARKING AND DOCUMENTATION**		P
5.1	Marking		P
5.1.4	Equipment ratings		P
	PV input ratings:	All applicable parameters refer to marking plate	P
	- Vmax PV (absolute maximum) (d.c. V)		P
	- Isc PV (absolute maximum) (d.c. A)		P
	a.c. output ratings:		P
	- Voltage (nominal or range) (a.c. V)		P
	- Current (maximum continuous) (a.c. A)		P
	- Frequency (nominal or range) (Hz)		P
	- Power (maximum continuous) (W or VA)		P
	- Power factor range		P
	a.c input ratings:		N/A
	- Voltage (nominal or range) (a.c. V)		N/A
	- Current (maximum continuous) (a.c. A)		N/A
	- Frequency (nominal or range) (Hz)		N/A

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	d.c. output ratings:		N/A
	- Voltage (nominal or range) (d.c. V)		N/A
	- Current (maximum continuous) (d.c. A)		N/A
	Protective class (I or II or III)	Class I	P
	Ingress protection (IP) rating per part 1	IP66	P
	An inverter that is adjustable for more than one nominal output voltage shall be marked to indicate the particular voltage for which it is set when shipped from the factory.		N/A
5.2	Warning markings		P
5.2.2	Content for warning markings		P
5.2.2.6	Inverters for closed electrical operating areas		P
	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.		P
5.3	Documentation		P
5.3.2	Information related to installation		P
5.3.2.1	Ratings. Subclause 5.3.2 of Part 1 requires the documentation to include ratings information for each input and output. For inverters this information shall be as in Table 33 below. Only those ratings that are applicable based on the type of inverter are required.		P
	PV input quantities:	All applicable parameters refer to user manual	P
	- Vmax 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
	- Isc PV (absolute maximum) (d.c. A)		P
	- Max. inverter backfeed current to the array (a.c. or d.c. A)		P
	a.c. output quantities:		P
	- Voltage (nominal or range) (a.c. V)		P
	- Current (maximum continuous) (a.c. A)		P
	- Current (inrush) (a.c. A, peak and duration)		P
	- Frequency (nominal or range) (Hz)		P
	- Power (maximum continuous) (W or VA)		P
	- Power factor range		P
	- Maximum output fault current (a.c. A, peak and duration or RMS)		P
	- Maximum output overcurrent protection (a.c. A)		P
	a.c. input quantities:		N/A
	- Voltage (nominal or range) (a.c. V)		N/A
	- Current (maximum continuous) (a.c. A)		N/A
	- Current (inrush) (a.c. A, peak and duration)		N/A
	- Frequency (nominal or range) (Hz)		N/A

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	d.c input (other than PV) quantities:		N/A
	- Voltage (nominal or range) (d.c. V)		N/A
	- Nominal battery voltage (d.c. V)		N/A
	- Current (maximum continuous) (d.c. A)		N/A
	d.c. output quantities:		N/A
	- Voltage (nominal or range) (d.c. V)		N/A
	- Nominal battery voltage (d.c. V)		N/A
	- Current (maximum continuous) (d.c. A)		N/A
	Protective class (I or II or III)	Class I	P
	Ingress protection (IP) rating per part 1	IP66	P
5.3.2.2	Grid-interactive inverter setpoints		P
	For a grid-interactive unit with field adjustable trip points, trip times, or reconnect times, the presence of such controls, the means for adjustment, the factory default values, and the limits of the ranges of adjustability shall be provided in the documentation for the PCE or in other format such as on a website. Provided solution: …….…….…….……..	Refer to user manual	P
	The setting of field adjustable setpoints shall be accessible from the PCE	Special software via communication with password protected	P
5.3.2.3	Transformers and isolation		P
	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.	No internal isolation transformer	N/A
	An inverter shall be provided with information to the installer regarding:		N/A
	- providing of internal isolation transformer		N/A
	- the level of insulation (functional, basic, reinforced, or double)		N/A
	The instructions shall also indicate what the resulting installation requirements are regarding:		P
	- earthing or not earthing the array	Unearthed array	P
	- providing external residual current detection devices	Pls. follow national regulations	P
	- requiring an external isolation transformer,		P
5.3.2.4	Transformers required but not provided	Required, pls. refer to HUAWEI technical information about transformer	P
	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:		P
	- the configuration type		P
	- electrical ratings		P

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	- environmental ratings		P
5.3.2.5	PV modules for non-isolated inverters		P
	Non-isolated inverters shall be provided with installation instructions that require PV modules that have an IEC 61730 Class A rating	IEC 61730 Class A rating required	P
	If the maximum AC mains operating voltage is higher than the PV array maximum system voltage then the instructions shall require PV modules that have a maximum system voltage rating based upon the AC mains voltage.		N/A
5.3.2.6	Non-sinusoidal output waveform information		N/A
	The instruction manual for a stand-alone inverter not complying with 4.7.5.2 shall include a warning that:		N/A
	- the waveform is not sinusoidal,		N/A
	- some loads may experience increased heating,		N/A
	- the user should consult the manufacturers of the intended load equipment before operating that load with the inverter		N/A
	The inverter manufacturer shall provide information regarding:		N/A
	- what types of loads may experience increased heating		N/A
	- recommendations for maximum operating times with such loads		N/A
	The inverter manufacturer shall specify for the waveforms as determined by the testing in 4.7.5.3.2 through 4.7.5.3.4.:		N/A
	- THD		N/A
	- slope		N/A
	- peak voltage		N/A
5.3.2.7	Systems located in closed electrical operating areas		N/A
	Where required by 4.8.3.6, an inverter not provided with full protection against shock hazard on the PV array shall be provided with installation instructions:		N/A
	- requiring that the inverter and the array must be installed in closed electrical operating areas		N/A
	- indicating which forms of shock hazard protection are and are not provided integral to the inverter (for example the RCD, isolation transformer complying with the 30 mA touch current limit, or residual current monitoring for sudden changes)		N/A
5.3.2.8	Stand-alone inverter output circuit bonding		N/A
	Where required by 7.3.10, the documentation for an inverter shall include the following:		N/A

IEC 62109-2			
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;		N/A
	- if the output circuit is intended to be floating, the documentation for the inverter shall indicate that the output is floating.		N/A
5.3.2.9	Protection by application of RCD's		N/A
	Where the requirement for additional protection in 4.8.3.1 is met by requiring an RCD that is not provided integral to the inverter, as allowed by 4.8.3.4, the installation instructions shall state the need for the RCD,.	If required strictly, should be type B	N/A
	and shall specify its rating, type, and required circuit location		N/A
5.3.2.10	Remote indication of faults		P
	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.	Refer to user manual of SUN2000 APP	P
5.3.2.11	External array insulation resistance measurement and response	IRM function integrated in inverter	N/A
	The installation instructions for an inverter for use with ungrounded arrays that does not incorporate all the aspects of the insulation resistance measurement and response requirements in 4.8.2.1, must include:		N/A
	- for isolated inverters: an explanation of what aspects of array insulation resistance measurement and response are not provided, and		N/A
	- an instruction to consult local regulations to determine if any additional functions are required or not;		N/A
	- for non-isolated inverters: an explanation of what external equipment must be provided in the system, and		N/A
	- what the setpoints and response implemented by that equipment must be, and:		N/A
	- how that equipment is to be interfaced with the rest of the system.		N/A
5.3.2.12	Array functional grounding information	Not functional ground array used	N/A
	Where approach a) of 4.8.2.2 is used, the installation instructions for the inverter shall include all of the following:		N/A
	a) the value of the total resistance between the PV circuit and ground integral to the inverter ……		N/A

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 ……..……..……;		N/A
	c) the minimum value of the total resistance R = VMAXPV/30 mA that the system must meet, with an explanation of how to calculate the total ……..……..……..……..…… ……;		N/A
	d) a warning that there is a risk of shock hazard if the total minimum resistance requirement is not met.		N/A
5.3.2.13	Stand-alone inverters for dedicated loads		N/A
	Where the approach of 4.7.5.5 is used, the installation instructions for the inverter shall include a warning that the inverter is only to be used with the dedicated load for which it was evaluated, and		N/A
	shall specify the dedicated load.		N/A
5.3.2.14	Identification of firmware version(s)		P
	An inverter utilizing firmware for any protective functions shall provide means to identify the firmware version.	V500R001	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……..……..…	Refer to user manual of SUN2000 APP	P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		N/A
7.3	Protection against electric shock		N/A
7.3.10	Additional requirements for stand-alone inverters		N/A
	One circuit conductor bonded to earth to create a grounded conductor and an earthed system.		N/A
	The means used to bond the grounded conductor to protective earth provided within the inverter or		N/A
	as part of the installation		N/A
	If not provided integral to the inverter, the required means shall be described in the installation instructions as per 5.3.2.8.		N/A
	The means used to bond the grounded conductor to protective earth shall comply with the requirements for protective bonding in Part 1,		N/A

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	If the bond can only ever carry fault currents in stand-alone mode, the maximum current for the bond is determined by the inverter maximum output fault current.		N/A
	Output circuit bonding arrangements shall ensure that in any mode of operation, the system only has the grounded circuit conductor bonded to earth in one place at a time.		N/A
	Switching arrangements may be used, in which case the switching device used is to be subjected to the bond impedance test along with the rest of the bonding path		N/A
	Inverters intended to have a circuit conductor bonded to earth shall not impose any normal current on the bond except for leakage current.		N/A
	Outputs that are intentionally floating with no circuit conductor bonded to ground, must not have any voltages with respect to ground that are a shock hazard in accordance with Clause 7 of Parts 1 and 2.		N/A
	The documentation for the inverter shall indicate that the output is floating as per 5.3.2.8.		N/A
7.3.11	Functionally grounded arrays		N/A
	All PV conductors in a functionally grounded array shall be treated as being live parts with respect to protection against electric shock.		N/A
9	**PROTECTION AGAINST FIRE HAZARDS**		P
9.3	Short-circuit and overcurrent protection		P
9.3.4	Inverter backfeed current onto the array		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……..……..……..….	Maximum inverter backfeed current form grid to the array is 0A based on test/circuit topology analysis.	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.	Refer to user manual	P
13	**PHYSICAL REQUIREMENTS**		P
13.9	Fault indication		P
	Where this Part 2 requires the inverter to indicate a fault, both of the following shall be provided:		P
	a) a visible or audible indication, integral to the inverter, and detectable from outside the inverter, and	Visible indication	P

IEC 62109-2			
Clause	Requirement + Test	Result - Remark	Verdict
	b) an electrical or electronic indication that can be remotely accessed and used.	Communication method for remote 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.	Refer to user manual of SUN2000 APP	P

	EN 62109-2:2010		P
Annex ZA	Normative references to international publications with their corresponding European publications	Considered	P

4.4.4	TABLE: Single fault condition to be applied		P
	Ambient temperature (°C) .....:	N/A(at the prevailing ambient temperature)	—
	Power source for EUT: Manufacturer, model/type, output rating .....:	DC source: Keysight, N8957APV, 1500V, 30A AC source: California Instruments, RS90, 90kW	—

4.4.4.15.1	Fault-tolerance of residual current monitoring					
Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
RCMU detect, Q14, D-S	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
RCMU detect, Q14, D-S	short	MAINS:500 PV: 750	10min	-	-	The inverter operated normally. No component damage, no hazard.
RCMU detect, R126	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
RCMU detect, R126	short	MAINS:500 PV: 750	10min	-	-	The inverter shutdown. AC relays in open status. No component damage, no hazard.
RCMU detect, R461	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
RCMU detect, R461	short	MAINS:500 PV: 750	10min	-	-	The inverter shutdown. AC relays in open status. No component damage, no hazard.
RCMU detect, U34	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relays in open status. No component damage, no hazard.
RCMU detect, U34	short	MAINS:500 PV: 750	10min	-	-	The inverter shutdown. AC relays in open status. No component damage, no hazard.
CPU, U1	+3,3V power decrease continuously	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself for low voltage. No component damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
CPU, U1	+3,3V power rise continuously	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. DSP broken at last. No other components damage, no hazard.

CPU, U1	Oscillator disabled	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself. No component damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
CPU, U2	+3,3V power decrease continuously	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself for low voltage. No components damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
CPU, U2	+3,3V power rise continuously	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. DSP broken at last. No other components damage, no hazard.
CPU, U2	Oscillator disabled	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself. No component damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
Communication between CPUs	Disconnect	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Oscillator, U1	Short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Oscillator, U2	Short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Check that the residual current monitoring operates properly						Yes
Supplementary information:						

4.4.4	TABLE: Single fault condition to be applied		P
	Ambient temperature (°C) .....:	N/A(at the prevailing ambient temperature)	—
	Power source for EUT: Manufacturer, model/type, output rating .....:	DC source: Keysight, N8957APV, 1500V, 30A AC source: California Instruments, RS90, 90kW	—
4.4.4.15.2	Fault-tolerance of automatic disconnecting means		

Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
AC relay K5, contacts	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. Then start-up again with same result. No component damage, no hazard.
Relay monitoring and control, C956	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
Relay monitoring and control, Q5, G-S	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
Relay monitoring and control, Q5, G-S	short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Relay monitoring and control, Q14, G-S	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
Relay monitoring and control, Q14, G-S	short	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Relay monitoring and control, R104	open before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
Relay monitoring and control, R104	open	MAINS:500 PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Relay monitoring and control, C28	short before start-up	MAINS:500 PV: 750	10min	-	-	The inverter could not start up. AC relay in open status. No components damage, no hazard.
CPU, U1	+3,3V power decrease continuously	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself for low voltage. No component damage, no hazard. Inverter can be restarted and operated normally when the fault was removed.
CPU, U1	+3,3V power rise continuously	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. DSP broken at last. No other components damage, no hazard.

CPU, U1	Oscillator disabled	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself. No component damage, no hazard Inverter can be restarted and operated normally when the fault was removed.
CPU, U2	+3,3V power decrease continuously	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself for low voltage. No component damage, no hazard Inverter can be restarted and operated normally when the fault was removed.
CPU, U2	+3,3V power rise continuously	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. DSP broken at last. No other components damage, no hazard.
CPU, U2	Oscillator disabled	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. DSP protect by itself. No component damage, no hazard Inverter can be restarted and operated normally when the fault was removed.
Communication between CPUs	Disconnect	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Oscillator, U1	Short	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Oscillator, U2	Short	MAINS:500; PV: 750	10min	-	-	PV inverter shut down. No component damage, no hazard.
Check that the relays fulfil the basic insulation or simple separation based on the PV circuit working voltage.						Yes
Each active phase can be switched. (L and N)						Yes
Supplementary information:						

4.4.4.17	**TABLE: Cooling system failure – Blanketing test (SUN2000-100KTL-M0)**		P
	Test voltage (V) .....:	540VDC/380VAC	—
Max. temperature T of part/at:		T (°C)	Permitted T (°C)
Ambient Temperature		60,0	-
Mounting surface		62,8	90
LED indicator panel		64,0	90
Metal enclosure		71,7	90
Boost inductor		99,6	-
PCB		87,2	-
BST conductor		80,2	-
ISO Relay Coil(K1)		90,6	-
DC switch (outside)		62,1	-
Drive Transformer winding(T5)		94,3	-
Optocoupler(U13)		96,1	-
SPD(F13)		82,4	-

Filter Capacitor(C407)	87,9	-
Current Hall(U51)	87,5	-
Filter Capacitor(C10)	87,9	-
Current Hall(U62)	88,5	-
INV Module(U1)	95,4	-
INV Module(U2)	104,1	-
INV Module(U3)	93,5	-
Boost Module(U4)	94,3	-
Boost Module(U5)	95,1	-
Boost Module(U6)	92,6	-
Boost Module(U7)	87,8	-
Boost Module(U8)	87,9	-
Y Capacitor(C294)	87,3	-
Drive Transformer winding(T3)	94,3	-
Current Hall(U9)	95,8	-
Output wire	95,3	-
INV inductor (Phase A)	106,3	-
INV inductor (Phase B)	104,7	-
INV inductor (Phase C)	109,1	-
INV conductor	98,5	-
Output terminal	61,8	-
PV input wire (near switch)	86,1	-
Cooling fan	79,2	-
Current Hall(U85)	86,5	-
Relay(K10)	84,7	-
PV input connector	60,8	90
AC aux transformer winding(T2)	93,5	-
AC aux transformer bobbin(T2)	85,8	-
DSP(U100)	97,8	-
DSP(U101)	95,6	-
CPLD(U102)	91,7	-
DC aux transformer winding(T1)	98,6	-
DC aux transformer bobbin(T1)	89,1	-
Optocoupler(U13)	94,5	-
BUS capacitor(C32)	85,2	-
RCD Hall(U34)	86,9	-
Filter capacitor(C734)	87,9	-
X Capacitor(C501)	81,6	-
Supplementary information: 1. Lowest full load MPP voltage with max. power output @40°C (Blanketing test). 2. No over temperature observed in components, no other hazard observed.		

4.4.4.17	**TABLE: Cooling system failure – Blanketing test (SUN2000-110KTL-M0)**		P
	Test voltage (V) ……:	540VDC/380VAC	—
Max. temperature T of part/at:		T (°C)	Permitted T (°C)
Ambient Temperature		40,0	-
BST inductor		85,9	-
SPD(F3)		82,1	-
Filter capacitor(C407)		86,9	-
Current Hall(U51)		86,5	-
BUS capacitor(C32)		83,8	-
Drive Transformer winding(T3)		95,8	-
Relay(K1)		86,0	-

DC wire (near K1)	91,7	-
Relay(K2)	86,4	-
Filter capacitor(C10)	76,2	-
BUS wire	82,2	-
Filter capacitor(C5)	76,0	-
Filter capacitor(C15)	74,6	-
DC wire (near switch)	89,8	-
PWB board(near AC relay)	120,3	-
Inductor(L2)	119,8	-
AC output wire(B phase)	99,1	-
AC current hall(U85)	95,8	-
AC output relay(K10)	85,1	-
CPLD(U102)	91,2	-
AC output relay(K9)	88,9	-
RCD hall(U34)	100,9	-
DC aux transformer winding(T1)	93,8	-
Optocoupler(U56)	90,4	-
Inductor coil(T7)	123,8	-
Inductor coil(L6)	121,5	-
Capacitor(C190)	85,5	-
DSP(U100)	96,5	-
DSP(U101)	95,8	-
INV inductor (Phase A)	116,1	-
INV inductor (Phase B)	109,8	-
INV inductor (Phase C)	114,8	-
Y-cap(C294)	89,8	-
SPD(F13)	83,2	-
Capacitor(C49)	86,2	-
INV Module(U1)	105,9	-
INV Module(U3)	110,0	-
ISO Relay Coil(K1)	88,6	-
INV Module(U2)	110,1	-
SPD(F3)	80,9	-
Drive Transformer winding(T5)	90,1	-
Front panel	58,0	90
Metal enclosure	45,7	90
mounting surface	51,5	90
PV input connector	61,8	90
Supplementary information: 1. Lowest full load MPP voltage with max. power output @40°C(Blanketing test). 2. No over temperature observed in components, no other hazard observed.		

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

4.8.2	TABLE: Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays			P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays			P
DC Voltage below minimum operating voltage (V)	DC Voltage for inverter begin operation (V)	Resistance between ground and PV input terminal (kΩ)	Required Insulation resistance R = (VMAXPV / 30mA) (kΩ)	Result
ISO setting=50kΩ DC1+ to earth				
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
DC1- to earth				
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
DC1+ earthed to DC-				
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
180	200	45	50	P
DC1- earthed to DC+				
180	200	45	50	P
180	200	45	50	P

180	200	45	50	P
180	200	45	50	P
180	200	45	50	P

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.

Supplementary information:
Additional test with first one pole ground fault, following an insulation resistance below limit simulated, then allow the inverter to start, the inverter shall not connect to the mains.

4.8.3.2	TABLE: 30mA touch current type test for isolated inverters	N/A

Condition	Current (mA)	Limit

Supplementary information: Not isolated inverter.

4.8.3.3	TABLE: Fire hazard residual current type test for isolated inverters	N/A

Condition	Current (mA)	Limit (300mA or 10mA per kVA)

Supplementary information: Not isolated inverter.

4.8.3.5	TABLE: Protection by residual current monitoring (only for RCM function)	P
Test conditions:	Output power (kVA): 125 Input voltage (VDC): 600 Frequency (Hz): 50 Output AC Voltage (VAC): 500	
4.8.3.5.2	Test for detection of excessive continuous residual current	P

Fault Current (mA)		Disconnection time (ms)	
Measured Fault Current	Limit 300mA for output power ≤ 30 kVA 10mA per kVA for output power > 30 kVA	Measured Disconnection time	Limit
Default: 1250mA@300ms PV1+ to earth:			
1167	1250	282,5	300
1125	1250	280,0	300

1229	1250	281,0	300
1188	1250	283,5	300
1146	1250	282,0	300
PV1- to earth:			
1188	1250	287,0	300
1167	1250	288,0	300
1188	1250	286,0	300
1187	1250	278,0	300
1187	1250	276,0	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. 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.			

4.8.3.5.3	TABLE: Test for detection of sudden changes in residual current(only for RCM function)	P
PV1+ to earth:		
Limit (mA)	UN Disconnection time (ms)	Limit (ms)
Default: 30mA@300ms		
30	267,0	300
30	268,0	300
30	195,2	300
30	156,4	300
30	202,0	300
Default: 60mA@150ms		
60	130,2	150
60	101,9	150
60	113,1	150
60	135,6	150
60	96,5	150
Default: 150mA@40ms		
150	21,5	40
150	32,4	40
150	36,8	40
150	34,1	40
150	29,0	40
PV1- to earth		
Limit (mA)	UN Disconnection time (ms)	Limit (ms)
Default: 30mA@300ms		
30	150,8	300
30	245,6	300
30	243,0	300
30	241,0	300
30	242,5	300

Default: 60mA@150ms		
60	127,8	150
60	132,4	150
60	132,8	150
60	134,4	150
60	134,0	150
Default: 150mA@40ms		
150	26,7	40
150	37,1	40
150	34,3	40
150	29,1	40
150	35,2	40
Note: The capacitive current is risen until disconnection. Test condition: Ic + 30/60/150mA <= Icmax. R1 is set that 30/60/150mA Flow and switch S is closed.		
Supplementary information: Same design on other MPP trackers, it is not required to test on other MPP trackers because analysis of the design indicates that other MPP trackers expected to have the same result.		

……**End of test report**……

Supplementary information:

Note 1: See also insulation diagram incorporated in table clearance and creepage distance measurements.

Note 2: Impulse withstand voltage is 6772(for cl. verification and components test), and dielectric strength test voltage is AC 3000V/DC 4242V, the test voltage in above table shows the actual voltage applied for described insulation barriers.

Note 3: Voltage test (dielectric strength test) was performed after:

1) Humidity pre-conditioning as specified in clause 4.5 of EN 62109-1:2010;
   The device is classed IP66 for outdoor use. The Voltage test was performed immediately after the humidity pre-conditioning.
2) Thermal testing as specified in clause 4.3 of EN 62109-1:2010;
3) Testing in single fault condition as specified in clause 4.4 of EN 62109-1:2010;
4) IP66 test as specified in clause 6.3 of EN 62109-1:2010;
5) Mechanical resistance to deflection, impact, or drop as specified in clause 13.7 of EN 62109-1:2010.

Note 4: Protection separation shall withstand the partial discharge test according to 7.5.3, only if the recurring peak working voltage across the insulation is greater than 700 V and the voltage stress on the insulation is greater than 1 kV/mm, so rated discharge voltage is equal to sum of the recurring peak voltages in each of the circuits separated by the insulation.

Note 5: Functional insulation shall comply with the requirements of clause 7.3.7.3. For parts or circuits in overvoltage category II, III, or IV, functional insulation is designed according to the applicable impulse voltage as determined by 7.3.7.1.4. Testing is not required. See cl. and cr. distance for functional insulation.

Note 6: Impulse withstand voltage is 4772(for cl. verification and components test), and dielectric strength test voltage is AC 1500V/DC 2121V, the test voltage in above table shows the actual voltage applied for described insulation barriers.

Note 7: To make sure that this voltage in not stress on basic or supplementary insulation barriers and non-applied insulating area are accidentally tested, this test is applied on individual parts only.

9.2	**TABLE: Limited power sources**					P
Circuit output tested: USB						
Note: Measured Uoc (V) with all load circuits disconnected:						
Components	Sample No.	Uoc (V)	I_{sc} (A)		VA	
			Meas.	Limit	Meas.	Limit
USB power	1	5,0	0,8	8,0	4,0	5*Uoc
supplementary information:						
Sc=Short circuit, Oc=Open circuit						

14	**TABLE: list of critical components(Data form for electrical and electronic component(CDF))**				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
[1]) an asterisk indicates a mark which assures the agreed level of surveillance					

……**End of test report**……