

TEST REPORT

IEC 62109-1

Safety of Power Converter for use in Photovoltaic Power Systems Part 1: General requirements

Report Number..... : 64.290.17.04706.01 part 1 of 2

Date of issue : 8 December 2017

Total number of pages : 101 pages

Name of Testing Laboratory preparing the Report..... : TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
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West, Guangzhou 510656, P. R. China

Applicant's name : EAST Group Co., Ltd.

Address..... : No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industry Park, 523808 DongGuan City, Guangdong Province,
PEOPLE'S REPUBLIC OF CHINA

Test specification:

Standard..... : IEC/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

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TRF_IEC62109_1B

Project No: 64.290.17.04706.01 part 1 of 2

Rev.: 00

Date: 2017-12-08

Page: 1 of 101

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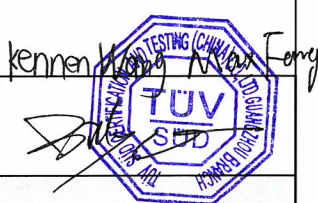
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5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou, 510656, P.R.China



Test item description	Engineering prototype (Hybrid Solar Inverter)	
Trade Mark		
Manufacturer	EAST Group Co., Ltd.	
Model/Type reference	EA3KHD, EA3.6KHD	
Ratings	See page 8	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	Testing Laboratory:	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
Testing location/ address		5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China
Tested by (name, function, signature)		Max Fang (Fang Wensong) Kennan Wang (Wang Kaixiang)
Approved by (name, function, signature) ...:		Billy Qiu (Qiu Bili)
		

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

This test report contains 2 parts listed in below table:

Item	Description	Pages
Part 1	IEC/EN 62109-1:2010 test report	101
Part 2	IEC/EN 62109-2:2011 test report	32

This test report shall be also used in conjunction with 11 pages of photo documentation and 32 pages of CDF.

Summary of testing:

All tests were carried out according to IEC 62109-1:2010. The text of IEC 62109-1:2010 was approved by CENELEC as a European Standard without any modification.

Tests performed (name of test and test clause):

Clause	Requirement
4.3	Thermal testing
4.4	Testing in single fault condition
4.5	Humidity preconditioning
4.6	Backfeed voltage protection
4.7	Electrical ratings tests
5.1.2	Durability of markings
6.3	Ingress protection
7.3	Protection against electric shock
7.4	Protection against energy hazards
7.5	Electrical tests related to shock hazard
8.5	Wall mounting
15	Software and firmware performing safety functions.

Note: If no special indicated, Model EA3.6KHD is selected as typical test sample.

Copy of marking plate:

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

Below electric ratings and warnings are silk-screen on label and affixed side of enclosure.

Hybrid Solar Inverter MODEL :EA3KHD



PV input

Max. input power	4500W
Rated input voltage	360Vdc
Max. input voltage	500Vdc
MPPT voltage range	250Vdc-450Vdc
PV short circuit current	18A

Battery

Rated voltage	48Vdc(Lead-acid)/51.2 Vdc(Li-ion)
Max.charge current	25A
Max.discharge current	100A

AC grid

Rated output voltage	230Vac
Rated grid frequency	50Hz/60Hz
Rated output current	13A
Rated output power	3000VA/3000W
Power factor range	0.9 leading ~ 0.9 lagging
Input voltage range	170 ~ 280 Vac
Rated input current	13A
Rated input power	3000VA/3000W

Load output

Rated output power	3000VA/3000W
Rated output voltage	230Vac
Rated output current	13A
Rated output frequency	50Hz/60Hz

General data

Dimensions(W×H×D)	410 ×470 ×123mm
Weight	14.4kg
Protection rating	IP20
Operating temperature	0-40℃
Protection class:	I



S/N: 0031606070001



EAST GROUP CO.,LTD.

No.6 Northern Industry Road, songshan lake SCI&TECH Industry Park, 523808, Dongguan City, Guangdong Province, P.R China



Hybrid Solar Inverter MODEL :EA3.6KHD



PV input

Max. input power	4500W
Rated input voltage	360Vdc
Max. input voltage	500Vdc
MPPT voltage range	250Vdc-450Vdc
PV short circuit current	18A

Battery

Rated voltage	48Vdc(Lead-acid)/51.2 Vdc(Li-ion)
Max.charge current	25A
Max.discharge current	100A

AC grid

Rated output voltage	230Vac
Rated grid frequency	50Hz/60Hz
Rated output current	15.6A
Rated output power	3600VA/3600W
Power factor range	0.9 leading ~ 0.9 lagging
Input voltage range	170 ~ 280 Vac
Rated input current	8.7A
Rated input power	2000VA/2000W

Load output

Rated output power	2000VA/2000W
Rated output voltage	230Vac
Rated output current	8.7A
Rated output frequency	50Hz/60Hz

General data

Dimensions(W×H×D)	410 ×470 ×123mm
Weight	14.4kg
Protection rating	IP20
Operating temperature	0-40℃
Protection class:	I



S/N: 0031606070001



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Importer:

Address:

Test item particulars	
Equipment mobility	<input type="checkbox"/> movable <input type="checkbox"/> hand-held <input checked="" type="checkbox"/> stationary <input checked="" type="checkbox"/> fixed <input type="checkbox"/> transportable <input type="checkbox"/> for building-in
Connection to the mains	<input type="checkbox"/> pluggable equipment <input type="checkbox"/> direct plug-in <input checked="" type="checkbox"/> permanent connection <input type="checkbox"/> for building-in
Environmental category	<input type="checkbox"/> outdoor <input type="checkbox"/> indoor unconditional <input checked="" type="checkbox"/> indoor conditional
Over voltage category Mains	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input checked="" type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
Over voltage category PV	<input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
Mains supply tolerance (%)	+/- 10%
Tested for power systems	TN or TT system
IT testing, phase-phase voltage (V)	N/A
Class of equipment	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input type="checkbox"/> Not classified
Mass of equipment (kg)	Net weight: 14.4 kg (Approx.)
Pollution degree	PD II
IP protection class	IP 20 (indoor use only)
Testing	
Date of receipt of test item(s)	11 August 2017
Dates tests performed	22 September 2017 – 30 November 2017
Possible test case verdicts:	
<ul style="list-style-type: none"> – test case does not apply to the test object N/A – test object does meet the requirement..... Pass (P) – test object was not evaluated for the require- N/E ment – test object does not meet the requirement..... Fail (F) 	
General remarks:	
<p>"(see Attachment #)" refers to additional information appended to the report.</p> <p>"(see appended table)" refers to a table appended to the report.</p> <p>The tests results presented in this report relate only to the object tested.</p> <p>This report shall not be reproduced except in full without the written approval of the testing laboratory.</p> <p>Additional test data and/or information provided in the attachments to this report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p> <p>This TRF was modified by TUV SUD Guangzhou branch by adding Cl.4 and Annex A to J.</p>	
Abbreviations used in the report:	
Basic insulation (BI); Supplementary insulation (SI); Double insulation (DI); Reinforced insulation (RI); Functional insulation (FI); Single fault condition (SFC); Normal condition (NC); Mains overvoltage category (OVC); Pollution degree (PD), CDF (Construction Data form)	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable

has been provided	
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies).....:	
Factory name: EAST Group Co., Ltd.	
Address: No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industry Park, 523808 DongGuan City, Guangdong Province, PEOPLE'S REPUBLIC OF CHINA	

General product information:

- (1) The Hybrid solar inverter is non-isolated (transformerless) which apply to existing systems with battery to store energy, it is intends to be connected into household generation systems.
- (2) The unit is an unidirectional converter with power flow from PV and battery to grid and load, and it has two operating modes: grid-connected mode, off-grid mode.
- (3) The unit has 4 connection terminals: PV input terminal, grid terminal, battery terminal and AC load terminal. It's intended to utilizes solar power, utility power and battery power to ensure continuous power supply.
- (4) The unit shall be used at specified ambient conditions. Indoor, conditioned, temperature range: 0 ~ +40 °C. Altitude: <1000 m, Auto-derating above 1000 m; Overvoltage category: III (Grid), II(PV); Relative humidity range: 4 ~ 90 %.
- (5) If certain functions are not permitted by local regulation, the function shall be disabled by hardware or software setting (if applicable) by the manufacturer before putting into the market. For example, it's not permissible to draw electricity from the grid and then feed it back in order to claim statutory reimbursement in some nations.
- (6) Low voltage electrical installations shall comply with national and local regulation. Only qualified electricians are allowed to install and maintain the converter.
- (7) In order to protect the PCE, user and installer, external DC and AC circuit breaker shall be equipped at the end-use application.
- (8) Firmware version: Inverter master: V1.04, display screen: V2.5.

Model differences:

- (1) The EA3KHD has the other modes: bypass mode, while the grid is disconnected or is unavailable, the battery will supply to load.

Ratings:

Model	EA3KHD	EA3.6KHD
PV input rating		
Max. input power	4500 W	4500 W
Rated input voltage	360 Vd.c.	360 Vd.c.
Max. input voltage	500 Vd.c.	500 Vd.c.
MPPT voltage range	250 Vd.c. – 450 Vd.c.	250 Vd.c. – 450 Vd.c.
Max. input current	18 Ad.c.	18 Ad.c.
PV short circuit current	18 Ad.c.	18 Ad.c.
Battery input/output rating		
Battery type	Lithium / Lead-acid	Lithium / Lead-acid
Rated voltage (Lithium)	51.2 Vd.c.	51.2 Vd.c.
Battery voltage range(Lithium)	46.4 Vd.c. - 57.6 Vd.c.	46.4 Vd.c. - 57.6 Vd.c.
Rated voltage(Lead-acid)	48.0 Vd.c.	48.0 Vd.c.
Battery voltage range(Lead-acid)	40.0 Vd.c. - 58.0 Vd.c.	40.0 Vd.c. - 58.0 Vd.c.
Max. charging power	1500 W	1500 W
Max. charging current	25 Ad.c.	25 Ad.c.

TRF_IEC62109_1B

Rated discharging power	3000W	2000 W
Max. discharging current	100 Ad.c	100 Ad.c
Grid input rating		
Rated input voltage	230 Va.c.	230 Va.c.
Rated grid frequency	50/60 Hz	50/60 Hz
Rated input apparent power	3000 VA	2000 VA
Rated input active power	3000 W	2000 W
Rated input current	13.0 Aa.c.	8.7 Aa.c.
Grid output rating		
Rated output apparent power	3000 VA	3600 VA
Rated output active power	3000 W	3600 W
Rated output voltage	230 Va.c.	230 Va.c.
Rated output current	13.0 Aa.c	15.6 Aa.c
Rated output frequency	50/60 Hz	50/60 Hz
Power factor	0.9 leading - 0.9 lagging	0.9 leading - 0.9 lagging
AC load output rating		
Rated output apparent power	3000 VA	2000 VA
Rated output active power	3000 W	2000 W
Rated output voltage	230 Va.c.	230 Va.c.
Rated output current	13.0 Aa.c.	8.7 Aa.c.
Rated output frequency	50/60 Hz	50/60 Hz
General		
Operating temperature range	0 °C to 40 °C	0 °C to 40 °C
Protective class	I	I
Ingress protection	IP 20	IP 20

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
	Unless otherwise specified, the following ambient environmental conditions shall exist in the test location: a) temperature of 15 °C to 40 °C b) a relative humidity of not more than 75 % and not less than 5% c) an air pressure of 75 kPa to 106 kPa. d) no frost, dew, percolating water, rain, solar radiation, etc.		P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment	The equipment were 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	No accessories or operator interchangeable parts	N/A
4.2.2.5	Covers and removable parts		P
4.2.2.6	Main supply	230 Va.c. (90% to 110% tolerance), 50/60 Hz, TN and TT system considered.	P
4.2.2.7	Supply ports other than the mains	DC input	P
4.2.2.7.1	Photovoltaic supply sources	PV input	P
4.2.2.7.2	Battery inputs	External battery pack can connected to the unit	P
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		P
	Controls which the operator can adjust shall be set to any position except that	Control is set to max. AC output power. But it is not intended for user	P
	a) mains selection devices shall be set to the correct value unless otherwise noted in this standard;	No mains selection devices.	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	b) Combinations of settings shall not be made if they are prohibited by the manufacturer's instructions provided with the equipment.	No combinations of settings devices	N/A
4.2.2.11	Available short circuit current		N/A
4.3	Thermal testing		P
4.3.1	General		P
4.3.2	Maximum temperature	Tests of equipment rated for use in ambient temperatures up to 40 °C	P
4.3.2.1	General		P
	Materials and components shall be selected so that under the most severe rated operating conditions, the temperatures do not exceed the temperature limits.		P
	Conformity is verified by measuring temperatures under the conditions given in 4.2 for each rated operating condition or mode of the PCE that could affect the resulting temperatures.		P
	The temperature limits specified below are total temperature limits (not temperature rise limits).		P
	Tests of equipment rated for use in ambient temperatures up to 50°C may be conducted at any ambient temperature in the range given in 4.2.2.1, in which case the difference between the maximum rated ambient temperature and the test ambient is to be subtracted from or added to (as appropriate) the measured temperatures for comparison to the limits specified below.	Maximum rated ambient temperature of the unit: 40 °C. (see appended table)	P
	PCE rated for use in ambient temperatures more than 50°C shall be tested at the maximum rated ambient temperature +/- 5°C. the difference between the maximum rated ambient temperature and the test ambient is to be subtracted from or added to the measured temperatures for comparison to the limits specified.		N/A
	PCE with different output ratings or with automatic derating for different ambient temperatures shall be tested under as many conditions as are necessary to record worst-case temperatures, including at least the maximum ambient before derating, and the maximum ambient with derating.		P
	During thermal testing within NORMAL CONDITIONS protective devices shall not operate.		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Temperatures are to be measured by thermocouples, except that for coils the change of resistance method may be used.	Method of thermocouples is used, including transformers, inductors, and other coils. Multiple embedded thermocouples, where the thermocouples are attached during winding of the part, are more likely to record hot-spot temperatures.	P
	Limits: - for coils and their insulation systems, the temperature limits in Table 1 apply.		P
	- for other components the measured temperatures shall not exceed the lower of:	(see appended table)	P
	- the applicable IEC component standards		P
	- the component or material's rated manufacturer's operating temperature		P
	- if neither of the above exists, temperature limits are given in Table 2.		P
4.3.2.2	Touch temperatures		P
	The maximum temperature for accessible parts of the PCE shall be in compliance with table 3	(see appended table)	P
	It is permitted that accessible parts that are required to get hot as part of their intended function (for example heatsinks) may have temperatures up to 100 °C, if the parts are marked with the hot surface marking of symbol 14 of Annex C. For products only for use in a closed electrical operating area the 100 °C limit does not apply.	For metal enclosure, heatsinks, the limit 100 °C apply and hot surface marking is used.	P
4.3.2.3	Temperature limits for mounting surfaces		P
	In order to protect against long-term degradation of building materials, surfaces of the PCE that will be in contact with the mounting surface shall not exceed a maximum total temperature of 90 °C.		P
4.4	Testing in single fault condition		P
4.4.1	General		P
	Testing in single fault conditions is done to determine that no hazards result from reasonably expected fault conditions that may arise in normal service or from reasonably expected misuse.		P
	Fault testing shall be done unless it can be conclusively demonstrated that no hazards could arise from a particular fault condition, or unless alternative methods of checking conformity are specified in this standard in place of fault testing.		P
4.4.2	Test conditions and duration for testing under fault conditions		P

TRF_IEC62109_1B

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.4.2.1	General		P
	The equipment shall be operated under the combination of conditions in 4.2, which is least favourable for the particular fault test being performed.		P
	Fault conditions are to be applied only one at a time and shall be applied in turn in any convenient order. Multiple simultaneous faults shall not be applied, but a subsequent fault may arise as a consequence from an applied fault. Separate samples of the EUT may be used for each separate fault test applied, or the same sample may be used for many tests if damage from previous fault tests has been repaired or will not affect the results of further tests.		P
4.4.2.2	Duration of tests		P
	The equipment shall be operated until further change as a result of the applied fault is unlikely, as determined by (for example) opening of a device that removes the influence of the fault, stabilization of temperatures, etc.		P
	If a non-resettable, manual, or automatically resetting protective device or circuit operates in such a way as to interrupt or mitigate the fault condition, the test duration is as follows:		P
	- automatic reset devices or circuits: allow the protection to cycle on and off until no further change as a result of the applied fault is likely, until the ultimate result is obtained, or until temperatures stabilize		P
	- manual reset devices or circuits: three cycles, with the device or circuit reset as soon as possible after tripping		N/A
	- non-resettable devices or circuits: one cycle		N/A
4.4.3	Pass/fail criteria for testing under fault conditions		P
4.4.3.1	Protection against shock hazard		P
	Compliance with requirements for protection against electric shock is checked after the application of single faults as follows:	(see appended table)	P
	a) by making measurements to check that no accessible DVC-A circuits have become shock-hazardous using the steady state limits for DVC-A in Table 6 and the short-term limits of 7.3.2.3, and that such circuits remain separated from live parts at voltages greater than DVC A with at least basic insulation. Compliance is checked by the test of 7.5.2 (without humidity preconditioning) for basic insulation; and		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	b) by performing a dielectric strength test as per 7.5.2 (without humidity preconditioning) in the following cases:		P
	i) on reinforced or double Insulation, using the test level for Basic insulation, and		P
	ii) on basic insulation in Protective Class I equipment, using the test level for Basic insulation, unless it can be determined that the fault did not result in any damage to the protective earthing conductor or terminal, or to protective bonding means; and		P
	c) by inspection to ensure a fuse connected between the protective earthing terminal and the protective earthing conductor in the test setup has not opened; the fuse shall be rated 3A non-time-delay (for equipment rated for use on circuits protected by overcurrent protection rated 30A or less) or 30A to 35A non-time-delay (for equipment rated for use on circuits protected by overcurrent protection rated more than 30A); the enclosure is not to be contacting earth in any other location during the testing; and		P
	d) by inspection of the enclosure to ensure that no damage has resulted that allows access to parts that are hazardous live.		P
4.4.3.2	Protection against the spread of fire		P
	Compliance with requirements for protection against the spread of fire is checked by placing the equipment on white tissue-paper covering a soft-wood surface and covering the equipment with cheesecloth or surgical cotton during the fault testing. As an alternative, the cheesecloth or surgical cotton may be placed only over the openings of large equipment.		P
	There shall be no emission of molten metal, burning insulation, or flaming or glowing particles from the fire enclosure, and there shall be no charring, glowing, or flaming of the tissue paper, cheesecloth, or glowing or flaming of surgical cotton.		P
4.4.3.3	Protection against other hazards		P
	Conformity with requirements for protection against other HAZARDS after application of the fault tests is checked as specified elsewhere in this standard.		P
4.4.3.4	Protection against parts expulsion hazards		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Failure of any component within the PCE shall not release parts outside the PCE enclosure with sufficient energy to lead to a hazard, for example, expulsion of material into an area occupied by personnel.		P
4.4.4	Single Fault conditions to be applied		P
4.4.4.1	Component fault tests	(see appended table)	P
	The following faults are simulated:		P
	a) Short circuit or open circuit of relevant components		P
	b) Short circuit or open circuit of any components or insulation where failure could adversely affect supplementary insulation or reinforced insulation.		P
	c) In addition, where required by Method 2 of 9.1.1, components that could result in a fire hazard are to be overloaded unless they comply with the requirements of 9.1.3		P
4.4.4.2	Equipment or parts for short-term or intermittent operation	Not for short-term or intermittent operation	N/A
	Components such as motors, relays, other electromagnetic devices and heaters, which are normally operated only intermittently, shall be operated continuously if continuous operation could occur in a single fault conditions.	No components normally operated only intermittently	N/A
4.4.4.3	Motors		P
	Motors shall be stopped while fully energized or prevented from starting, whichever is less favourable.	DC fans are tested.	P
4.4.4.4	Transformer short circuit tests	(see appended table)	P
	The output windings of transformers shall be short-circuited one at a time. A transformer damaged during one test may be repaired or replaced before the next test.		P
4.4.4.5	Output short circuit		P
	Testing is required to be performed on all combinations of terminals for the port under consideration, two at a time, including neutral and earth terminals, and one test with all current-carrying terminals of the port shorted together at once.	(1) AC output (2) Battery output (3) Load output Above three combinations of output terminals are tested one a time. The PCE max. output short-circuit current is 480 A peak impulse (0.4 ms, duration) when single fault (2) was applied.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	the short-circuit currents are to be recorded and if they exceed the maximum rated current of the circuit, the maximum measured current shall be provided in the installation manual for the purpose of coordination of overcurrent protection of the external circuit conductors.		P
4.4.4.6	Backfeed current test		P
	For equipment intended to be connected simultaneously to more than one source of supply, each input of the PCE shall be tested one at a time, to determine if hazardous conditions can result from current from one source of supply flowing into the wiring for another source under fault conditions.	DC and AC consider as source of supply.	P
	With the PCE operating under normal conditions, a short circuit shall be applied at the field wiring terminals of the circuit under consideration, with all intended other sources connected to the PCE through the over current protective devices (if any) intended to be present in the installation.		P
	the short-circuit currents are to be recorded and if they exceed the maximum rated current for the port, the maximum measured current shall be provided in the installation manual for the purpose of coordination of overcurrent protection of the external circuit conductors	The battery input max. short-circuit current is 542 Apeak impulse (0.4 ms)	P
4.4.4.7	Output overload		P
	Each output of the PCE, and each section of a tapped output, shall be overloaded in turn, one at a time. The other windings are loaded or not loaded, whichever load condition of normal use is less favorable. Overloading is carried out by connecting a variable resistor across the winding. The resistor is adjusted as quickly as possible and readjusted, if necessary, after 1 min to maintain the applicable overload. No further readjustments are then permitted.		P
	If over-current protection is provided by a current-sensitive device or circuit, the overload test current is the maximum current which the over-current protection device is just capable of passing for 1 h. If this value cannot be derived from the specification, it is to be established by test. Before the test, the device is made inoperative or replaced by a link with negligible impedance.		N/A
	For equipment in which the output voltage is designed to collapse when a specified overload current is reached, the overload is slowly increased to the point of maximum output power before the point which causes the output voltage to collapse.		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	In all other cases, the loading is the maximum power output obtainable from the output.		P
4.4.4.8	Cooling system failure		P
4.4.4.9	Heating devices	No heating devices used	N/A
	In equipment incorporating heating devices, the following faults shall be applied one at a time: a) timers which limit the heating period shall be overridden to energize the heating circuit continuously; b) temperature control devices or circuits shall have single fault conditions applied such that control over the heater is lost. Over-temperature protection devices meeting the requirements of 14.3 are left operational during the test.		N/A
4.4.4.10	Safety interlock	No safety interlock	N/A
4.4.4.11	Reverse d.c. connections	(see appended table)	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	(see appended table)	P
4.4.4.14	PWB short-circuit test		P
4.5	Humidity preconditioning		P
4.5.1	General		P
4.5.2	Conditions		P
	Relative humidity (%), temperature (°C)	92.5% RH., 40 °C, 48 h	P
4.6	Voltage Backfeed protection		P
4.6.1	Backfeed tests under normal conditions	The PV input terminal is not accessible to people after installation. The discharge time after disconnection from DC and AC sources is tested in Cl. 7.3.9.2. For service access, the unit was marked with discharge time	P
4.6.2	Backfeed tests under single-fault conditions		P
4.6.3	Compliance with backfeed tests		P
	The PCE is compliant with the requirements if during the tests in 4.6.1 and 4.6.2 no hazardous voltage or energy is present on the PCE terminals for the source under test. Measurements are taken 15 s or 1 s after the source is de-energized or disconnected, as follows:		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	- 15 s for sources that are connected by fixed wiring		P
	- 1 s for sources that are cord-connected or use connectors that can be opened without the use of a tool		N/A
4.7	Electrical ratings tests		P
4.7.1	Input ratings	(see appended table)	P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P

5	MARKING AND DOCUMENTATION		P
5.1	Marking		P
5.1.1	General		P
	Equipment shall bear markings as specified in 5.1 and 5.2	Label are marked on the PCE and graphic symbol is explained in user manual	P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.		P
	Graphic symbols shall be explained in the documentation provided with the PCE.		P
5.1.2	Durability of markings		P
	Markings required by this clause to be located on the PCE shall remain clear and legible under conditions of NORMAL USE and resist the effects of cleaning agents specified by the manufacturer		P
5.1.3	Identification		P
	The equipment shall, as a minimum, be permanently marked with:		P
	a) the name or trade mark of the manufacturer or supplier	Trade mark	P
	b) model number, name or other means to identify the equipment	Model number	P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.	See marking label	P
5.1.4	Equipment ratings	See below	P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	Special requirement as per IEC 62109-2.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	Refer to the marking label	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	Refer to the marking label	P
	– the ingress protection (IP) rating as in 6.3 below	IP20	P
5.1.5	Fuse identification		P
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.		N/A
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated		N/A
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.		P
5.1.6	Terminals, Connections, and Controls	PV input, grid connection, load connection, battery connection and communication interface	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.	Symbol 9 are marked on the PCE and user manual indicate the installation and safety of connection of connector, control and indicator.	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.	No emergency stop	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other nonpermanent material.	No setting is accessible to user	N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:	See below	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– the sign “+” for positive and “-”, for negative; or	The PV input and battery terminals for each module and whole unit are silk-screen with sign “+” for positive and “-” for negative	P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation	Not provided	N/A
5.1.6.1	Protective Conductor Terminals		P
	The means of connection for the protective earthing conductor shall be marked with:	The PE terminal is connected via AC output cable	N/A
	– symbol 7 of Annex C; or		P
	– the letters “PE”; or		N/A
	– the colour coding green-yellow.		P
5.1.7	Switches and circuit-breakers		P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.		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	No such terminal boxes.	N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:		N/A
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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.		N/A
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C	The manual provide necessary information for the warning marking.	P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heatsinks and similar parts	Ungrounded heatsink	P
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking may be on or adjacent to the heatsink and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heatsink exists.	Symbol 13 marked on heatsink	P
5.2.2.2	Hot Surfaces	See below	N/A
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.	Symbol 14 marked on PCE	P
5.2.2.3	Coolant	Coolant is not used	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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 21 is marked on PCE	P
5.2.2.5	Motor guarding		P
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).	DC fan's blade can't be touch with finger.	P
5.2.3	Sonic hazard markings and instructions	No sonic hazard	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can ensure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply	PV array, battery and AC mains.	P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.	Symbol 13 provided on PCE	P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.		P
5.2.5	Excessive touch current		N/A
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.		N/A
5.3	Documentation		P
5.3.1	General		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:		P
	a) explanations of equipment makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1	Indor	P
	– WET LOCATIONS classification for the intended external environment as per 6.1	Suitable for wet location	P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2	3	P
	– INGRESS PROTECTION rating as per 6.3	IP20	P
	– Ambient temperature and relative humidity ratings	Max. 40 °C and 90%RH	P
	– MAXIMUM altitude rating	Up to 1000 m	P
	– OVERVOLTAGE CATEGORY assigned to each input and output port as per 7.3.7.1.2, accompanied by guidance regarding how to ensure that the installation complies with the required overvoltage categories;	OVC II (PV), OVC III (Mains)	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE		P
5.3.1.1	Language	English provide	P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.	For other country language, further evaluation is needed.	N/A
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	Printed form provided and is to be delivered with 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.		P
5.3.2	Information related to installation		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		P
	a) assembly, location, and mounting requirements;		P
	b) ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including instructions that the installation position shall not prevent access to the disconnection means;		P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and external controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P
	e) ventilation requirements;		P
	f) requirements for special services, for example cooling liquid;	No cooling liquid or other special service	N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;		N/A
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;	No such battery	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 exceeds 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;		N/A
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed;	Provided in the installation manual.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		P
	“This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.”		P
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type		P
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		P
5.3.3	Information related to operation		P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:		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		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;	No replaceable parts	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– 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	No energy storage battery inside	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
	– 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

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

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	Indoor use	P
	– Suitability for WET LOCATIONS or not	Suitability for wet locations	P
	– POLLUTION DEGREE rating in 6.2 below	External: PD3, Internal: PD2	P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	IP20	P
	– Ultraviolet (UV) exposure rating, as in 6.4 below	Indoor use	N/A
	– Ambient temperature and relative humidity ratings, as in 6.5 below		P
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor		N/A
6.1.2	Indoor, unconditioned		N/A
6.1.3	Indoor, conditioned		P
6.2	Pollution degree	External: PD3, Internal: PD2	P
6.3	Ingress Protection	IP20	P
6.4	UV exposure		N/A
6.5	Temperature and humidity	Max. 40 °C and 90%RH	P

7	PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS		P
7.1	General		P
7.2	Fault conditions	Normal and single fault condition are considered	P
7.3	Protection against electric shock		P
7.3.1	General	<p>In the PCE the earthed metal enclosure is evaluated by means of basic insulation from DVC C circuit.</p> <p>DVC A circuit and unearthed accessible parts are evaluated by means of double insulation or reinforce insulation from DVC C.</p> <p>DVC C: The PV input and mains output.</p> <p>DVC A: the communication interface.</p>	P

TRF_IEC62109_1B

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.2	Decisive voltage classification		P
7.3.2.1	Use of decisive voltage class (DVC)	Working voltage and protective measures are considered.	P
7.3.2.2	Limits of DVC (according table 6)	Wet location is considered for PCE outside only	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)	Single fault condition is considered. Accessible earthed conductive parts are separated from DVC-C circuits by basic insulation. Accessible unearthed conductive parts separated from DVC C circuit by double insulation.	P
7.3.2.5	Connection to PELV and SELV circuits	The external signal communication interface are considered as SELV	P
7.3.2.6	Working voltage and DVC		P
7.3.2.6.1	General	Transients and voltage fluctuations are disregarded. And worst case normal operating condition is considered	P
7.3.2.6.2	AC working voltage (see Figure 2)	230 Vr.m.s, 325 Vpeak considered	P
7.3.2.6.3	DC working voltage (see Figure 3)	Max. DC open voltage: 500 V	P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		N/A
7.3.3	protective separation	See description in Cl. 7.3.1	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		P
	▪ 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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.4	Protection against direct contact		P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).	Enclosure provided	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.	End use product	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.	No use under this condition	N/A
7.3.4.2	Protection by means of enclosures and barriers		P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.	Enclosure provided to prevent access to inside live parts	P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).	Secured by screws	P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6		P
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	The communication interface is considered as DVC A	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	The DVC B circuit is not accessible by probe	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,	The DVC C circuit is not accessible by probe	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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 unfavorable position.		P
	The test finger and the test pin are applied as above, without appreciable force, in every possible position, except that floor-standing equipment having a mass exceeding 40 kg is not tilted.		P
	Equipment intended for building-in or rack mounting, or for incorporation in larger equipment, is tested with access to the equipment limited according to the method of mounting detailed in the installation instructions.		N/A
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to 30 N.	air-intakes for cooling fans.	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 $\pm 5^\circ$ only.		N/A
7.3.4.2.4	Service access areas	39.6 s@60 Vpeak bus after disconnecting DC side. Inside PCE are not intentionally touched with energized parts when installation and maintenance. Symbol 21 of Annex C are marked on PCE and explained in user manual.	P
7.3.4.3	Protection by means of insulation of live parts	The earthed enclosure is with basic insulation from the live parts inside	P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note “†” under Table 7)		P
7.3.5	Protection in case of direct contact	The communication interface are direct contact and evaluated with double insulation from live parts	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:	Considered	P
	– is of decisive voltage class A and complies with 7.3.5.2, or	The communication interface is DVC A and double insulation from the live parts by means of isolation transformer with isolation power supply and opto-coupler	P
	– is provided with protective impedance according to 7.3.5.3, or	At least five resistors (total resistance >3.8MΩ) in series for voltage sampling.	P
	– is limited in voltage according to 7.3.5.4		N/A
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with protective separation. This applies for example to plug-in-sub-assemblies or other plug-in devices which can be plugged-in without the use of a tool (key) or which are accessible without the use of a tool.	Considered	P
	Conformity is checked by visual inspection and trial insertion.		P
7.3.5.2	Protection using decisive voltage class A	The communication interface is DVC A and double insulation from the live parts by means of isolation transformer with isolation power supply and opto-coupler	P
7.3.5.3	Protection by means of protective impedance	At least five resistors (total resistance >3.8MΩ) in series for voltage sampling.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		P
7.3.5.3.1	Limitation of current through protective impedance		P
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		P
7.3.5.3.2	Limitation of discharging energy through protective impedance		P
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		P
7.3.5.4	Protection by means of limited voltages	No such design	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)		P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	The earthed metal enclosure meet this requirement	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	The communication interface is double insulated from live parts inside.	P
	That part of PCE which meets the requirements of decisive voltage class A and in which no hazardous voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		N/A
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.	The manual require the PCE must be securely earthed	P
7.3.6.2	Insulation between live parts and accessible conductive parts	See Cl. 7.3.7.4 and Cl. 7.3.7.5	P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5		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:		P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or		N/A
	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:	The PCE provide internal and external optional earthing screws for protective earthing.	P
	a) through direct metallic contact;		P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		N/A
	c) through a dedicated protective bonding conductor;		P
	d) through other metallic components of the PCE		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.		P
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.	No such design	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.	No such design	N/A
7.3.6.3.3	Rating of protective bonding		P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		P
	Protective bonding shall meet following requirements:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.		P
	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:		P
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A

TRF_IEC62109_1B

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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;	Fixed equipment	P
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		N/A
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.	Measured from the farthest part of earthed metal enclosure to the input earth terminal	P
	On equipment where the protective earth connection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cable is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.	Figure 11 used	P
7.3.6.3.3.1	Test current, duration, and acceptance criteria		P
	The test current, duration of the test and acceptance criteria are as follows:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 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.	0.28 V	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		P
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.	DC supply	P
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is 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.		P
7.3.6.3.4	Protective bonding impedance (routine test)		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:	Declared by Manufacturer and working instruction checked during factory inspection	N/A
	<ul style="list-style-type: none"> the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means: 		N/A
	<ul style="list-style-type: none"> 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		N/A
	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.		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		N/A
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:	External protective earthing conductor is integrated with output cable	N/A
	▪ 2,5 mm ² if mechanical protection is provided;		N/A
	▪ 4 mm ² if mechanical protection is not provided.		N/A
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.		N/A
7.3.6.3.6	Means of connection for the external protective earthing conductor		P
7.3.6.3.6.1	General		P
	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.	Integrated within output cable	P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		N/A
	• the colour coding green-yellow		P
	Marking shall not be done on easily changeable parts such as screws.		N/A
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.	The measured touch current is 1.7 mA.	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.		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.		N/A
	a) Permanently connected wiring, and:		N/A
	<ul style="list-style-type: none"> a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or 		P
	<ul style="list-style-type: none"> automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or 		N/A
	<ul style="list-style-type: none"> provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or 		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm ² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Communication interface is evaluated with double insulation from live part inside. Comply with clause 7.3.4.3	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:		N/A
	<ul style="list-style-type: none"> equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment 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; 		N/A
	<ul style="list-style-type: none"> metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor; 		N/A
	<ul style="list-style-type: none"> equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part; 		N/A
	<ul style="list-style-type: none"> equipment employing protective class II shall be marked according to 5.1.8. 		N/A
7.3.7	Insulation Including Clearance and Creepage Distance		P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	<ul style="list-style-type: none"> pollution degree 	PD3 outside, PD2 inside	P
	<ul style="list-style-type: none"> overvoltage category 	PV (OVC II), Mains (OVC III)	P
	<ul style="list-style-type: none"> supply earthing system 	TN or TT system considered.	P
	<ul style="list-style-type: none"> insulation voltage 	PV input: max. 500 Vd.c. and Mains: 230 Va.c.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	<ul style="list-style-type: none"> location of insulation 	See table 7.3.7.4 and 7.3.7.5 for detail	P
	<ul style="list-style-type: none"> type of insulation 	See table 7.3.7.4 and 7.3.7.5 for detail	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:	Inverter is intended to installed in TN or TT system.	P
	<ul style="list-style-type: none"> TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor. 		P
	<ul style="list-style-type: none"> TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system; 	Considered.	P
	<ul style="list-style-type: none"> IT sytem: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system. 		N/A
7.3.7.1.4	Insulation voltages	See table 7.3.7.4 and 7.3.7.5 for detail	P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstand voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	<p>General</p> <p>Basic, supplementary and reinforced insulation between a circuit and its surroundings shall be designed according to:</p> <p>Impulse voltage;</p> <p>temporary overvoltage;</p> <p>working voltage of the circuit;</p>	<p>230Va.c., OVC III (4000 V impulse voltage, 1500 Vrms temporary overvoltage) for the AC mains output;</p> <p>500 Vd.c. system voltage, OVC II (4000 V impulse voltage, no temporary overvoltage for the PV input;</p> <p>No isolation between PV and AC mains output.</p> <p>Basic isolation between PV, AC mains and battery terminal.</p>	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.2.2	Circuit connected directly to the mains Clearance and solid insulation between circuit connected directly to the mains and their surroundings shall be designed according to the impulse voltage, temporary overvoltage, or working voltage, whichever gives the most severe requirement	System voltage for mains is 300 Vrms according to table 12. 4000 V impulse voltage gives the most severe requirement	P
7.3.7.2.3	Circuit other than mains circuit Clearance and solid insulation between circuit other than the mains and their surroundings shall be designed according to impulse voltage and recurring peak voltage	System voltage for PV is 500 Vd.c.	P
7.3.7.2.4	Insulation between circuits a) For clearances and insulation, the requirements are determined by the circuit having the higher impulse voltage; b) For creepages, r.m.s. working voltage across the insulation determines the requirements.	Impulse voltage (4000 V) is calculated from table 12 for clearance before basic isolation transformer for PV and AC mains side. Impulse voltage (2500 V) is calculated from table 12 for clearance after basic isolation transformer for battery side. Working voltage (500 Vd.c.) across insulation is used for creepage.	P
7.3.7.3	Functional insulation For parts or circuit in OVC I, functional insulation shall be designed according to the working voltage across the insulation For parts or circuit in OVC II, functional insulation shall be designed according to the applicable impulse voltage as determined by 7.3.7.1.4		P
7.3.7.4	Clearance distances		P
7.3.7.4.1	Determination Table 13 defines the minimum clearance distances required to provide functional, basic, or supplementary insulation		P
	Clearance for use in altitudes above 2000 m shall be calculated with correction factor according to Table A.2 of IEC 60664-1	Not attended to use in altitudes above 2000 m	N/A
	For reinforced insulation, the value corresponding to the next higher impulse voltage, or 1.6 times the temporary overvoltage, or 1.6 times the working voltage shall be used, whichever results in the most severe requirement		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.4.2	Electric field homogeneity For homogeneous electric field and impulse voltage is equal to or greater than 6000V for a circuit connected directly to the mains or 4000V within a circuit, the clearance may be reduced to the requirement by Table F.2 Case B of IEC 60664-1. In this case, impulse voltage test shall be performed on the clearance	Inhomogeneous electric field is considered for PCE	N/A
7.3.7.4.3	Clearance to conductive enclosures Clearance shall be measured following the deformation test of 13.7 for conductive enclosures		P
7.3.7.5	Creeage distances		P
7.3.7.5.1	General Creepage distances shall be large enough to prevent long-term degradation of the surface of solid insulators. For reinforced insulation, the value is doubled. If less than clearance, it shall be increased to that clearance	PV Maximum 500 Vd.c. system voltage is used for the RMS voltage across insulation	P
7.3.7.5.2	Voltage r.m.s. value of working voltage is used. Interpolation is permitted		P
7.3.7.5.3	Materials		P
7.3.7.6	Coating		N/A
7.3.7.7	PWB spacings for functional insulation	PWB rated V-0 and has a minimum CTI of 175, short-circuit test are considered	P
7.3.7.8	Solid insulation		P
7.3.7.8.1	General Material for solid insulation shall be able to withstand mechanical, electrical, thermal and climatic stresses in normal use and ageing during the expected lifetime. Compliance is evaluated by test and inspection.	Insulation tape, sheet, optical Isolator, isolation power supply and transformer.	P
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation		P
7.3.7.8.2.1	Basic and supplementary, reinforced, and double insulation. Solid insulation shall withstand the impulse voltage test 7.5.1 and voltage test 7.5.2.		P
	In addition, if recurring peak working voltage across the insulation is greater than 700 V and voltage stress on insulation is greater than 1kV/mm, double and reinforced insulation shall withstand the partial discharge test according to 7.5.3		N/A
7.3.7.8.2.2	Functional insulation		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General Insulation of thin sheet or tape less than 0,7 mm is subject to this requirement		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm		P
	Basic or supplementary insulation shall consist of at least one layer of material, and shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic or supplementary insulation.	Communication transformer with isolation power supply consider as double insulation.	P
	Double insulation shall consist of at least two layers of material. Each layer shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic insulation, and the partial discharge requirements of 7.3.7.8.2.1. The two or more layers together shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for double insulation.		P
	Reinforced insulation shall consist of a single layer of material, which will meet the impulse, a.c. or d.c. voltage, and partial discharge test requirements 7.3.7.8.2.1 for reinforced insulation.	Insulation sheet cover on display consider as reinforced insulation.	P
7.3.7.8.3.3	Material thickness less than 0,2 mm		P
	Basic or supplementary insulation shall consist of at least one layer of material, and shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic or supplementary insulation.		P
	Double insulation shall consist of at least three layers of material. Each layer shall meet the impulse and a.c. or d.c. voltage test requirements of 7.3.7.8.2.1 for basic insulation any two layers together shall meet the impulse, a.c. or d.c. voltage, and partial discharge test requirements of 7.3.7.8.2.1 for double insulation.		P
	Reinforced insulation consisting of a single layer of material less than 0,2 mm thick is not permitted.		N/A
7.3.7.8.3.4	Compliance Component, sub-assembly, or material is checked by applicable tests 7.5.1 to 7.5.3 according to 7.3.7.8.		P
7.3.7.8.4	Printed wiring boards (PWBs)		P
7.3.7.8.4.1	General Insulation between conductor layers in double-sided single-layer PWBs, multi-layer PWBs and metal core PWBs, shall meet the requirements for solid insulation in 7.3.7.8.		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	For the inner layers of multi-layer PWBs, the insulation between adjacent tracks on the same layer shall be treated as either:		P
	a creepage distance for pollution degree 1 and a clearance as in air (see Annex A, figure A.13); or		N/A
	as solid insulation, in which case it shall meet the requirements of 7.3.7.8.		P
7.3.7.8.4.2	Use of coating materials		N/A
	A coating material used to provide a microenvironment or to provide functional, basic, supplementary and reinforced insulation shall meet the requirement as specified below.		N/A
	Type 1 protection (as defined in IEC 60664-3) improves the microenvironment (Pollution Degree) of the parts under protection. The clearance and creepage distance of Table 13 and Table 14 for pollution degree 1 apply under the protection. Between two conductive parts, it is a requirement that one or both conductive parts, together with all the spacing between them, are covered by the protection.		N/A
	Type 2 protection is considered to be similar to solid insulation. Under the protection, the requirements for solid insulation specified in 7.3.7.8 are applicable and spacings shall not be less than those specified in Table 1 of IEC 60664-3. The requirements for clearance and creepage in Table 13 and Table 14 do not apply. Between two conductive parts, it is a requirement that both conductive parts, together with the spacing between them, are covered by the protection so that no airgap exists between the protective material, the conductive parts and the printed wiring boards.		N/A
	The coating material used to provide Type 1 and Type 2 protection shall be designed to withstand the stresses anticipated to occur during the expected lifetime of the PCE.		P
	Compliance is checked by a type test on representative PWB's, conducted according to IEC 60664-3 Clause 5.		P
	For the Cold test (5.7.1), a temperature of –25 °C shall be used, and for the rapid change of temperature test (5.7.3): –25 °C to +125 °C, except that if the temperature rating of the PCE is lower than –25 °C, the low temperature limit for the test is reduced to the rating of the PCE.		P
7.3.7.8.5	Wound components		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Varnish or enamel insulation of wires shall not be used for basic, supplementary, double or reinforced insulation.	Varnish are not considered as insulation and voltage test performed as routine test. See also Cl.7.3.7.8.1 to Cl.7.3.7.8.2	P
	Wound components shall meet the requirements of 7.3.7.8.1 and 7.3.7.8.2.		N/A
	The component itself shall pass the requirements given in 7.3.7.8.1 and 7.3.7.8.2. If the component has reinforced or double insulation, the voltage test in 7.5.2 shall be performed as a routine test.		P
7.3.7.8.6	Potting materials		N/A
	A potting material may be used to provide solid insulation or to act as a coating to protect against pollution. If used as solid insulation, it shall comply with the requirements of 7.3.7.8.1 and 7.3.7.8.2. If used to protect against pollution, the requirements for Type 1 protection in 7.3.7.8.4.2 apply.	Potting materials used in boost inductor and inverting inductor are not intended to provide solid insulation or to act a coating to protect against pollution.	N/A
7.3.7.9	Insulation requirements above 30 kHz		N/A
	Where voltages across insulation have fundamental frequencies greater than 30 kHz, further considerations apply. Requirements for this are provided in IEC 60664-4, and the more severe of these and the requirements of 7.3.7.1 to 7.3.7.8 shall be applied.		N/A
	Annex G contains flow-charts for the determination of clearance and creepage distances under these circumstances. For convenience, Tables 1 and 2 of IEC 60664-4 are also included in Annex G.		P
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility.	Internal RCM is used according to IEC 62109-2 test.	P
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.		N/A
7.3.9	Protection against shock hazard due to stored energy		P
7.3.9.1	Operator access area	Accessible communication interface is DVC A	P
	In the case of plugs, connectors, or similar devices that can be disconnected without the use of a tool, the withdrawal of which results in the exposure of conductors (e.g. pins), the discharge time to reduce the voltage to DVC A (see 7.3.2.2) or, for capacitors, to a stored charge level below the limits specified in 7.3.5.3.2, shall not exceed 1 s.		P
7.3.9.2	Service access areas		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Capacitors and other energy storage devices located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from stored charge after disconnection of the PCE.		P
	Capacitors within a PCE shall be discharged to a voltage less than DVC A (see 7.3.2.2), or an energy level below the limits specified in 7.3.5.3.2, within 10 s after the removal of power from the PCE. If this requirement is not achievable for functional or other reasons, the warning symbol 21 of Annex C and an indication of the discharge time shall be placed in a clearly visible position on the enclosure, the capacitor protective barrier, or at a point close to the capacitor(s) concerned (depending on the construction) (see 5.2.2.4).	39.6s@60 Vpeak bus after disconnecting DC side. Inside capacitor discharge to DVC A and no energy hazard level within 60 seconds.	P
	For energy storage devices (such as batteries or ultra capacitors) the intended function of which is to maintain charge even with the PCE off and disconnected from external sources, a barrier or insulation shall be provided so that unintentional contact with hazardous live parts is prevented. The warning symbol 21 of Annex C shall be placed in a clearly visible position on or adjacent to the barrier or insulation, where it will be seen before removal of the barrier or insulation.	Warning symbol 21 of Annex C is marked on PCE	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	Condition b is considered	P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		N/A
	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: $E = 0,5 CU^2$	See below Cl.7.4.3 $C=470 \mu F \times 5=2350 \mu F$ $U=130.5 V_{peak}@20 J$	P
7.4.2	Operator Access Areas	No energized parts accessible by user	P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.		P
7.4.3	Services Access Areas		P
	Energy storage devices located behind panels that are removable for servicing, installation or disconnection shall present no risk of electric energy hazard from charge stored after disconnection of the PCE.		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Energy storage devices within a PCE shall be discharged to an energy level less than 20 J, as in 7.4.1, within 10 s after the removal	Warning symbol 21 of Annex C is marked	P
7.5	Electrical tests related to shock hazard		P
7.5.1	Impulse voltage test (type test)		P
7.5.2	Voltage test (dielectric strength test) (type test)		P
7.5.3	Partial discharge test (type test or sample test)		N/A
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	Measured touch current is 1.7 mA. See clause 7.3.6.3.7	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.5	Equipment with multiple sources of supply		N/A

8	PROTECTION AGAINST MECHANICAL HAZARDS		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.		P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		P
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.	Fan's blade are protected by barriers.	P
8.2.1	Protection of service persons		P
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.	The fans stopped operating during servicing.	P
8.3	Stability		N/A

TRF_IEC62109_1B

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	Wall mounted	N/A
8.4	Provisions for lifting and carrying		P
	If carrying handles or grips are fitted to, or supplied with, the equipment, they shall be capable of withstanding a force of four times the weight of the equipment.		P
	Equipment or parts having a mass of 18 kg or more shall be provided with a means for lifting and carrying or directions shall be given in the manufacturer's documentation.	About 14.4 kg(net weight)	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.	It is intended to be mounted on concrete wall	P
8.6	Expelled parts		N/A
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.		N/A

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.	Components are witnessed at normal condition and abnormal tests are verified	P
9.1.1	Reducing the risk of ignition and spread of flame		P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.	Method 1 used	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;		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;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and	Certified relay with fire enclosure	N/A
	– insulated wiring, except as permitted in 9.1.2.2.	PVC wire	N/A
9.1.2.2	Parts not requiring a fire enclosure	Fire enclosure used	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.	1. V-0 PCB as part of fire enclosure. 2. V-0 barrier used. 3. LPS for display circuit.	P
9.1.3.3	Materials for components and other parts inside fire enclosures	At least V-1 material used inside fire enclosure, PCB rated V-0 and internal wire rated VW-1	P
9.1.3.4	Materials for air filter assemblies		N/A
9.1.4	Openings in fire enclosures		P
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.	The equipment is intended to be used one orientation	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	These requirements are in addition to those in the following sections:		N/A
	– 7.3.4, Protection against direct contact;		N/A
	– 7.4, Protection against energy hazards;		N/A
	– 13.5, Openings in enclosures		N/A
9.1.4.2	Side openings treated as bottom openings		N/A
9.1.4.3	Openings in the bottom of a fire enclosure		N/A
	The bottom of a FIRE ENCLOSURE or individual barriers, shall provide protection against emission of flaming or molten material under all internal parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.	Metal bottom screens with mesh opening less than 2mm.	N/A
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA	Not intend use at this 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	No door or cover operated by user.	N/A
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	For display circuit, $U_{oc}=12\text{ V}$, $I_{sc}=0.6\text{ A}$, Maximum output power =12 VA.	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		P
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.	External circuit breaker shall be used for AC side.	P

10	PROTECTION AGAINST SONIC PRESSURE HAZARDS		P
10.1	General		P
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.		P
10.2	Sonic pressure and Sound level		P
10.2.1	Hazardous Noise Levels		P

11	PROTECTION AGAINST LIQUID HAZARDS		N/A
11.1	Liquid Containment, Pressure and Leakage	No 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		N/A

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

12	CHEMICAL HAZARDS		N/A
12.1	General		N/A

13	PHYSICAL REQUIREMENTS		P
13.1	Handles and manual controls		P
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than selfhardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.		P
13.1.1	Adjustable controls		N/A
13.2	Securing of parts		P
13.3	Provisions for external connections		P
13.3.1	General		P
13.3.2	Connection to an a.c. Mains supply	AC connector	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	permanent connection to the supply.	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		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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage		P
13.3.3	Wiring terminals for connection of external conductors		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		N/A
13.3.4	Supply wiring space		N/A
13.3.5	Wire bending space for wires 10 mm ² and greater		N/A
13.3.6	Disconnection from supply sources	Installation manual instruct the disconnect device shall be provided before connecting AC mains, PV array and battery.	P
13.3.7	Connectors, plugs and sockets	No such connectors, plugs and sockets employed	N/A
13.3.8	Direct plug-in equipment		N/A
13.4	Internal wiring and connections		P
13.4.1	General		P
13.4.2	Routing	Internal wire is routed to avoid sharp edge and overheat	P
13.4.3	Colour coding	Green-yellow wire used as protective bonding only	P
13.4.4	Splices and connections		P
13.4.5	Interconnections between parts of the PCE	No such interconnections	N/A
13.5	Openings in enclosures		P
13.5.1	Top and side openings	No openings in the chamber.	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		P
13.6.1.1	Thermal index or capability		P
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards	Polymers serving as barriers preventing access to hazards	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
13.6.2.1	Stress relief test		P
13.6.3	Polymers serving as solid insulation		N/A
13.6.3.1	Resistance to arcing	Arcing parts are enclosed inside certified relay	N/A
13.6.4	UV resistance		N/A
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation		N/A
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		P
13.7.4	Drop test		N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General		P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal		N/A

14	COMPONENTS		P
14.1	General		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
	1. 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
	2. the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	3. if there is no relevant IEC standard, the requirements of this standard;		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	4. 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	Overtemperature protection devices		N/A
14.4	Fuse holders		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.	V-0	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.		N/A
14.7	Circuits or components used as transient overvoltage limiting devices		N/A
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.		N/A
14.8	Batteries		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.	No battery used.	N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	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 nonmetallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions		P
Annex A	Measurement of clearances and creepage distances (see 7.3.7.4 and 7.3.7.5)		P
Annex B	Programmable Equipment		P
B.1	Software or firmware that perform safety critical functions		P
B.1.1	Firmware or software that performs a critical safety function/s, the failure of which can result in a risk of fire, electric shock or other hazard as specified by this standard, shall be evaluated by one of the following means.		P
	a) All software or firmware limits or controls shall be disabled before the test to evaluate the hardware circuitry during the abnormal test condition related to the safety function.		P
	b) Protective controls employing software or firmware to perform their function(s), shall be so constructed that they comply with IEC 60730-1 Annex H to address the risks identified in B.2.1.		N/A
B.2	Evaluation of controls employing software		P
Annex C	Symbols to be used in equipment markings		P
Annex D	Test Probes for Determining Access		P
Annex E	RCDs		N/A
Annex F	Altitude correction for clearances		N/A
Annex G	Clearance and creepage distance determination for frequencies greater than 30 kHz		P
Annex H	Measuring Instrument for Touch Current Measurements		P
H.1	Measuring instrument		P
H.2	Alternative measuring instrument		N/A



IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
Annex I	Examples of Protection, Insulation, and Overvoltage Category Requirements for PCE		P
Annex J	Ultraviolet light conditioning test	LCD cover is approved by UL according to UV resistance.	P

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

4.7#1	TABLE: mains supply electrical data in normal condition					P
Model	U (V) d.c.	I (A) d.c.	P (kW) d.c.	U (V) a.c.	I (A) a.c.	P (kW) a.c.
EA3.6KHD	150	16.8	2.52	230	10.3	2.37
	250	15.2	3.80	207	17.2	3.56
	250	15.2	3.80	230	15.5	3.57
	250	15.1	3.78	253	14.1	3.57
	360	10.5	3.78	207	17.2	3.56
	360	10.4	3.74	230	15.5	3.57
	360	10.4	3.74	253	14.1	3.57
	450	8.4	3.78	207	17.3	3.58
	450	8.4	3.78	230	15.6	3.59
	450	8.3	3.74	253	14.1	3.57
Remark: PV to Grid, no AC load						
EQ No.:						

4.7#2	TABLE: mains supply electrical data in normal condition					P
Model	U (V) d.c.	I (A) d.c.	P (kW) d.c.	U (V) a.c.	I (A) a.c.	P (kW) a.c.
EA3.6KHD	250	8.8	2.20	230	8.9	2.05
	360	6.0	2.16	230	8.7	2.00
	450	4.6	2.08	230	8.7	2.00
Remark: PV to AC load, off grid mode						
EQ No.:						

4.#3	TABLE: mains supply electrical data in normal condition						P		
Model	U (V) d.c.	I (A) d.c.	P (kW) d.c.	U (V) a.c.	I (A) a.c.	P (kW) a.c.	Battery		
							U (V) d.c.	I (A) d.c.	P (kW) d.c.
EA3.6KHD	250	17.9	4.48	230	12.5	2.88	56.8	-25.1	-1.43
	360	12.4	4.46	230	12.5	2.88	56.8	-25.1	-1.43
	450	10.0	4.50	230	12.7	2.92	56.8	-25.0	-1.42
Remark: PV to grid and battery									

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

4.7#4	TABLE: mains supply electrical data in normal condition					P
Model	U (V) d.c.	I (A) d.c.	P (kW) d.c.	U (V) a.c.	I (A) a.c.	P (kW) a.c.
EA3.6KHD	50.4	41.6	2.10	229.0	8.8	2.02
Remark: Battery to grid						

4.7#5	TABLE: mains supply electrical data in normal condition					P
Model	U (V) d.c.	I (A) d.c.	P (kW) d.c.	U (V) a.c.	I (A) a.c.	P (kW) a.c.
EA3.6KHD	50.4	41.4	2.09	229.3	8.7	1.99
Remark: Battery to AC load, off grid mode						

4.3		Thermal testing (by thermocouples)									P	
Model		EA3.6KHD										
No.	Ambient (°C)	Humidity (RH)	Test time	PV			Grid			Battery		
				U d.c.	Ad.c.	W	Va.c.	Aa.c.	W	Vd.c.	Ad.c.	W
(1)	40 °C	50%	120 minutes	361.0	12.4	4476.4	228.9	15.9	3576.0	56.6	-13.4	-745.0
(2)	40 °C	50%	121 minutes	361.0	12.4	4474.0	233.1	12.6	2898.0	56.9	-25.2	-1412.0
(3)	40 °C	50%	172 minutes	451.2	9.9	4487.0	227.3	15.9	3574.0	56.7	-13.4	-747.0
(4)	40 °C	50%	118 minutes	451.1	9.9	4477.0	233.4	12.6	2899.0	56.9	-25.2	-1412.0
(5)	40 °C	50%	112 minutes	251.8	17.8	4474.0	228.6	15.9	3578.0	56.6	-13.4	-744.0
(6)	40 °C	50%	96 minutes	251.8	17.9	4476.0	228.6	12.9	2898.0	56.9	-25.2	-1412.0
(7)	40 °C	50%	118 minutes	0.0	0.0	0.0	234.2	12.9	2970.0	50.1	+62.4	+3070.0
No	Temperature rise (°C) of part/at:					Measured temperature (°C)				Permitted (°C)		
						(1)	(2)	(3)	(4)			
01	Test ambient temperature					40.0	40.0	40.0	40.0	Ref.		
02	Q2 on PV-INVERTER board					78.0	70.4	76.7	67.7	175		
03	Grid input connector (internal)					41.2	40.9	41.7	41.0	105		
04	Grid input internal wire					41.9	41.9	43.4	42.0	105		

IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
05	40 Aa.c. fuse on PV-INVERTER board	49.4	46.3	50.8	46.4	175
06	R182 on PV-INVERTER board	41.7	41.9	43.3	42.0	105
07	C37 on PV-INVERTER board	41.9	42.0	43.3	42.1	125
08	Core of inductor L3 on PV-INVERTER board	41.5	41.8	43.2	41.9	110
09	Wire of inductor L3 on PV-INVERTER board	43.3	43.0	45.0	43.2	110
10	Relay RLY8 on PV-INVERTER board	50.5	49.3	52.4	49.2	60
11	CT4 on PV-INVERTER board	43.9	44.1	45.1	43.7	85
12	Core of inductor L2 on PV-INVERTER board	46.5	45.8	47.4	45.3	110
13	Wire of inductor L2 on PV-INVERTER board	45.2	44.5	46.5	44.5	110
14	CT3 on PV-INVERTER board	45.5	42.8	44.1	42.8	105
15	C21 on PV-INVERTER board	46.4	45.6	47.8	45.5	105
16	Core of inductor L5 on PV-INVERTER board	65.0	57.6	68.8	59.6	110
17	Wire of inductor L5 on PV-INVERTER board	80.6	68.2	86.2	71.6	110
18	PCB near BUS	46.2	46.5	47.4	46.4	130
19	BUS cup C15 on PV-INVERTER board	45.3	44.2	45.3	44.2	85
20	J11 on PV-INVERTER board	45.9	46.4	47.1	45.7	75
21	D24 on PV-INVERTER board	70.3	67.4	65.2	61.0	175
22	Q5 on PV-INVERTER board	60.1	58.4	52.8	49.7	150
23	Core of inductor L10 on PV-INVERTER board	54.9	55.4	53.3	51.5	110
24	Wire of inductor L10 on PV-INVERTER board	55.0	55.6	53.4	51.6	110
25	CT1 on PV-INVERTER board	42.7	41.9	42.6	41.9	85
26	C3 on PV-INVERTER board	41.0	40.9	41.8	41.0	125
27	Core of inductor L12 on PV-INVERTER board	41.5	41.9	42.7	41.8	110
28	Wire of inductor L12 on PV-INVERTER board	41.5	42.1	42.7	41.8	110
29	R4 on PV-INVERTER board	41.3	40.9	41.9	41.0	125
30	PV input connector (internal)	41.1	41.0	41.8	41.0	105
31	PV input internal wire	40.8	41.4	42.2	41.4	105
32	Core of T1 on PV-INVERTER board	42.8	43.2	44.5	43.2	110

TRF_IEC62109_1B

Project No: 64.290.17.04706.01 part 1 of 2
Rev.: 00
Date: 2017-12-08
Page: 60 of 101

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IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
33	CT5 on PV-INVERTER board	48.1	47.6	48.0	46.2	110
34	Wire of L14 on DC/DC board	47.2	48.1	48.5	48.2	110
35	C160 on DC/DC board	49.4	50.6	51.0	50.8	105
36	Chip U1 on DC/DC board	53.5	54.6	55.1	54.8	--
37	Bobbin of T1 on DC/DC board	53.7	54.8	55.3	55.1	110
38	D11 on DC/DC board	55.6	57.3	57.4	57.4	175
39	L12 on DC/DC board	41.3	41.4	42.1	41.4	110
40	Chip U5 on DC/DC board	56.9	58.5	58.4	58.4	--
41	Bobbin of T6 on DC/DC board	47.4	51.1	47.1	46.1	110
42	Q5 on DC/DC board	41.7	41.7	41.9	41.7	150
43	Insulation paper under Q5 on DC/DC board	41.9	42.1	42.1	42.3	130
44	D34 on DC/DC board	46.7	57.8	47.9	58.3	175
45	SW2 on DC/DC board	42.3	45.1	43.8	45.2	180
46	Q25 on DC/DC board	47.9	55.7	49.1	56.3	150
47	Fuse F4 on DC/DC board	40.7	45.1	41.8	44.3	175
48	C82 on DC/DC board	44.2	48.6	43.7	48.3	105
49	C30 on DC/DC board	41.2	42.9	42.3	43.0	105
50	C33 on DC/DC board	41.6	42.2	42.3	42.2	85
51	Bobbin of T7 on DC/DC board	42.1	43.4	43.7	43.4	110
52	L13 on DC/DC board	41.5	42.3	42.5	42.3	110
53	Core of T3 on DC/DC board	42.0	41.5	41.8	41.5	110
54	Wire of T3 on DC/DC board	41.9	41.9	42.0	41.9	110
55	D16 on DC/DC board	42.1	41.4	41.7	41.4	150
56	L15 on DC/DC board	40.4	42.9	41.7	42.6	110
57	Core of T4 on DC/DC board	56.0	64.0	54.5	62.2	110
58	Wire of T4 on DC/DC board	64.2	81.2	61.0	79.5	110
59	Core of L9 on DC/DC board	48.0	58.6	48.9	61.9	110
60	Wire of L9 on DC/DC board	46.8	56.5	47.8	59.5	110
61	Core of L1 on DC/DC board	46.3	47.1	44.6	47.5	110
62	Wire of L1 on DC/DC board	46.5	44.2	43.3	44.3	110
63	PCB near BAT+	40.9	42.1	41.9	42.1	130
64	Battery connector (internal)	40.7	41.6	41.9	41.7	120
65	Battery internal wire	40.8	42.7	42.2	42.7	90
66	Fan	40.7	41.6	42.3	41.7	70
67	Enclosure	41.2	42.0	42.3	42.1	100

TRF_IEC62109_1B

Project No: 64.290.17.04706.01 part 1 of 2
Rev.: 00
Date: 2017-12-08
Page: 61 of 101

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

68	Display panel	42.0	42.8	43.6	42.9	80
No	Temperature rise (°C) of part/at:	Measured temperature (°C)				Permitted (°C)
		(5)	(6)	(7)	(8)	
01	Test ambient temperature	40.0	40.0	40.0	--	Ref.
02	Q2 on PV-INVERTER board	84.0	75.0	64.8	--	175
03	Grid input connector (internal)	41.5	40.5	42.1	--	105
04	Grid input internal wire	43.2	41.6	41.9	--	105
05	40 Aa.c. fuse on PV-INVERTER board	51.1	46.2	42.0	--	175
06	R182 on PV-INVERTER board	43.1	41.5	42.0	--	105
07	C37 on PV-INVERTER board	43.4	41.7	41.9	--	125
08	Core of inductor L3 on PV-INVERTER board	42.9	41.4	41.7	--	110
09	Wire of inductor L3 on PV-INVERTER board	44.6	42.6	41.7	--	110
10	Relay RLY8 on PV-INVERTER board	51.7	48.4	48.2	--	60
11	CT4 on PV-INVERTER board	45.9	44.0	43.3	--	85
12	Core of inductor L2 on PV-INVERTER board	48.5	45.8	43.7	--	110
13	Wire of inductor L2 on PV-INVERTER board	46.7	44.4	44.3	--	110
14	CT3 on PV-INVERTER board	44.2	42.6	42.7	--	105
15	C21 on PV-INVERTER board	48.3	45.7	44.7	--	105
16	Core of inductor L5 on PV-INVERTER board	66.7	57.8	56.9	--	110
17	Wire of inductor L5 on PV-INVERTER board	82.0	68.2	67.2	--	110
18	PCB near BUS	49.8	48.3	45.6	--	130
19	BUS cup C15 on PV-INVERTER board	47.8	46.7	42.9	--	85
20	J11 on PV-INVERTER board	51.5	49.8	43.5	--	75
21	D24 on PV-INVERTER board	79.1	75.1	51.5	--	175
22	Q5 on PV-INVERTER board	72.7	69.1	47.9	--	150
23	Core of inductor L10 on PV-INVERTER board	79.9	78.8	41.8	--	110
24	Wire of inductor L10 on PV-INVERTER board	79.1	77.8	41.7	--	110
25	CT1 on PV-INVERTER board	43.6	42.6	42.4	--	85
26	C3 on PV-INVERTER board	41.6	40.4	41.8	--	125

TRF_IEC62109_1B

Project No: 64.290.17.04706.01 part 1 of 2
Rev.: 00
Date: 2017-12-08
Page: 62 of 101

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IEC 62109-1						
Clause	Requirement – Test	Result – Remark				Verdict
27	Core of inductor L12 on PV-INVERTER board	43.3	42.2	41.7	--	110
28	Wire of inductor L12 on PV-INVERTER board	43.8	42.8	41.8	--	110
29	R4 on PV-INVERTER board	41.7	40.5	41.5	--	125
30	PV input connector (internal)	41.9	40.8	41.6	--	105
31	PV input internal wire	42.9	41.9	41.6	--	105
32	Core of T1 on PV-INVERTER board	44.5	42.9	43.4	--	110
33	CT5 on PV-INVERTER board	50.3	47.9	45.7	--	110
34	Wire of L14 on DC/DC board	49.8	48.8	47.3	--	110
35	C160 on DC/DC board	51.5	51.1	49.6	--	105
36	U1 on DC/DC board	55.9	55.4	54.2	--	--
37	Bobbin of T1 on DC/DC board	55.6	55.0	52.7	--	110
38	D11 on DC/DC board	57.3	57.2	54.4	--	175
39	L12 on DC/DC board	41.9	40.9	42.0	--	110
40	U5 on DC/DC board	58.8	58.9	58.9	--	--
41	Bobbin of T6 on DC/DC board	45.6	44.7	42.1	--	110
42	Q5 on DC/DC board	41.5	41.1	47.4	--	150
43	Insulation paper under Q5 on DC/DC board	41.8	41.6	48.3	--	130
44	D34 on DC/DC board	48.6	57.6	50.0	--	175
45	SW2 on DC/DC board	43.6	44.7	49.1	--	180
46	Q25 on DC/DC board	49.3	55.6	50.2	--	150
47	Fuse F4 on DC/DC board	41.8	41.3	51.7	--	175
48	C82 on DC/DC board	44.2	48.7	52.7	--	105
49	C30 on DC/DC board	42.1	41.3	59.3	--	105
50	C33 on DC/DC board	42.0	41.3	50.7	--	85
51	Bobbin of T7 on DC/DC board	43.2	42.2	47.0	--	110
52	L13 on DC/DC board	42.0	41.2	48.1	--	110
53	Core of T3 on DC/DC board	41.3	41.5	59.4	--	110
54	Wire of T3 on DC/DC board	41.5	41.0	69.8	--	110
55	D16 on DC/DC board	41.3	40.4	59.4	--	150
56	L15 on DC/DC board	41.4	40.6	46.2	--	110
57	Core of T4 on DC/DC board	57.3	64.4	53.2	--	110
58	Wire of T4 on DC/DC board	65.8	82.9	53.4	--	110
59	Core of L9 on DC/DC board	49.4	59.0	50.2	--	110

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
60	Wire of L9 on DC/DC board	48.2	56.6	49.6	--	110
61	Core of L1 on DC/DC board	44.6	46.5	53.7	--	110
62	Wire of L1 on DC/DC board	43.1	43.4	53.3	--	110
63	PCB near BAT+	41.6	40.8	45.5	--	130
64	Battery connector (internal)	41.5	41.0	45.3	--	120
65	Battery internal wire	41.8	41.8	47.8	--	90
66	Fan	41.9	41.0	43.4	--	70
67	Enclosure	41.9	41.3	43.9	--	100
68	Display panel	43.5	42.6	42.6	--	80
Supplementary information:						

4.4		TABLE: fault condition tests					P
		Ambient temperature(°C) :			25		—
		Relative humidity.....:			40%		—
No.	component No.	fault	Input (V)	Output (V, W)	Test time	Observation	
Clause 4.4.4.1 Component fault tests							
Below component single fault applied on PV_INVERTER BOARD							
1	Q5 (C-E)	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “NO PV”. No output. No hazard. No damage. Can resettable.	
2	D24	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BUS UNDER VOLT”. The unit will automatically restart shortly afterwards. No output. No hazard. No damage. Can resettable.	
3	C17	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BUS UNDER VOLT”. No output. The IGBT Q1, Q4 was damage. No hazard.	

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
4	Q1 (C-E)	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BUS UNDER VOLT”. No output. The IGBT Q3 was damage. No hazard.
5	R65	O-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “GRID OVER VOLT”. No output. No hazard. No damage. Can resettable.
6	Q25 (C-E)	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
7	D13	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
8	R239	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
9	C41	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “INV LEAKAGE OVER LEVEL”. No output. No hazard. No damage. Can resettable.
10	C71	S-C	360 Vd.c. 3.6 kW	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BOOST OVER CURR HARD”. No output. No hazard. No damage. Can resettable.
Below component single fault applied on DCPOWER BOARD						
11	D1	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
12	Q2(2-3)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays shut down shortly afterwards. No output. The R1 was damage. No hazard.

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
13	Q3 (C-E)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays and shut down shortly afterwards. No output. No damage. No hazard.
14	Q42 (C-E)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
15	D20	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays and shut down shortly afterwards. No output. The R1 and C123 was damage. No hazard.
16	C31	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “NO BAT” and shut down shortly afterwards. No output. The fuse F3, F4, F5 was damage. No hazard.
17	D14	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BUS UNDER VOLT”. No output. The D16 was damage. No hazard.
18	R277	O-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
19	Q6 (D-S)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BUS UNDER VOLT” and shut down shortly afterwards. No output. The IGBT Q9, Q10, Q11, Q12 was damage. No hazard.

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
20	Q11 (D-S)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BUS UNDER VOLT” and shut down shortly afterwards. No output. The IGBT Q5, Q6, Q7, Q8 was damage. No hazard.
21	R71	O-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
22	D37	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
23	R252	O-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
24	Q29(C-E)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “BUS UNDER VOLT” and shut down shortly afterwards. No output. The IGBT Q5, Q6, Q7, Q8 was damage. No hazard.
25	U1(PIN2-PIN3)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays shut down shortly afterwards. No output. No damage. No hazard.
26	U12(PIN2-PIN3)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “DISCHG OVER CURR HARD”. No output. No hazard. No damage. Can resettable.
Below component single fault applied on control board						

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
27	U22(PIN4-PIN5)	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "TIPS DSP COM FAIL". No output. The fuse Q2, Q3 was damage. No hazard.
28	U13(PIN2-PIN3)	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "INV OVER VOLT". No output. No hazard. No damage. Can resettable.
29	R15	O-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "INV OVER VOLT". No output. No hazard. No damage. Can resettable.
30	D10	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can resettable.
Clause 4.4.4.3 Motors						
31	Fan1	blocked	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "FAN FAULT". No output. No hazard. No damage. Can resettable.
32	Fan2	blocked	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "FAN FAULT". No output. No hazard. No damage. Can resettable.
Clause 4.4.4.4 Transformer short circuit tests						
33	T1 on PV_INVERTER (PIN6-GND)	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can resettable.

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
34	T6 on DCPOWER (PIN7-PIN9)	S-C	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit operating as normal, after restart, the unit can't connect to the grid, the displays shut down and the unit loss the fault record. No hazard. No damage. Can resettable.
35	T7 on DCPOWER (PIN7-PIN9)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit operating as normal, after restart, the unit can't connect to the grid, the displays shut down and the unit loss the fault record. No hazard. No damage. Can resettable.
36	T2 on DCPOWER (PIN19- GND)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "BUS UNDER VOLT". No output. No hazard. No damage. Can resettable.
37	T3 on DCPOWER (PIN11- GND)	S-C	51.6 Vd.c.	230.0 Va.c. 2.0 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "BUS UNDER VOLT". No output. No hazard. No damage. Can resettable.
38	T4 on DCPOWER (PIN7- GND)	S-C	360 Vd.c.	57.0 Vd.c. 1.5 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down to supply to battery, the red LED flashes and LCD displays alarmed "BAT CHG OVER CURR HARD". No output. The fuse was damage. No hazard. Can resettable.

IEC 62109-1						
Clause	Requirement – Test			Result – Remark		Verdict
39	T5 on DCPOWER (PIN7- GND)	S-C	360 Vd.c.	57.0 Vd.c. 1.5 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down to supply to battery, the red LED flashes and LCD displays alarmed "EQUAL CHG". No output. No hazard. No damage. Can resettable.
Clause 4.4.4.7 Output overload						
40	AC output & Load output	overload	360 Vd.c.	230.0 Va.c. 2.0 kW	--	Grid-connected mode: The unit operating as normal. Off-grid mode: While the PV power is sufficient, the unit will remind different alarm with "OVER LOAD 110%", "OVER LOAD 125%", "OVER LOAD 150%", "BOOST OVER CURR HARD". While the PV power is insufficient, LCD displays alarmed "BUS UNDER VOLT". No hazard. No damage. Can re-settable.
Clause 4.4.4.8 Cooling system failure						
44	Fan1 and fan2	disconnection	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "FAN FAULT". No output. No hazard. No damage. Can resettable.
Clause 4.4.4.11 Reverse d.c. connections						
45	PV+ and PV-	Recersed	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied before the unit operation, the unit can't connect to grid and LCD displays alarmed "PV REVERSE". No output. No hazard. No damage. Can resettable.
46	Battery+ and Battery-	Recersed	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The fault applied before the unit operation, the unit can't connect to grid and LCD displays alarmed "BATT REVERSE". No output. The D34 and D35 was damage. No hazard. Can resettable.

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

Clause 4.4.4.13 Mis-wiring with incorrect phase sequence or polarity						
47	L and N	Mis-wiring	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
48	L and PE	Mis-wiring	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit can't connect to grid. No hazard. No damage. Can re-settable.
49	PE conductor	Not connect- ed before energized	360 Vd.c.	230.0 Va.c. 3.6 kW	5 mins	The unit operating as normal. No hazard. No damage. Can re-settable.
Supplementary information:						
(1) S-C: short circuit						
(2) PV simulator used for apply these fault condition test.						

7.3.7	TABLE: Creepage distances and clearances for appliances					P
clearance cl and creepage distance dcr at/of:	System voltage (V)	OVC	required cl (mm)	cl (mm)	required cr (mm)	dcr (mm)
Ground screw H1 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	6.4	3.0	6.4
Ground screw H2 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	4.5	3.0	4.5
Ground screw H7 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	6.1	3.0	6.1
Ground screw H8 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	4.4	3.0	4.4
Ground screw H9 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	5.2	3.0	5.2
Ground screw H11 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	4.7	3.0	4.7
Ground screw H3 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	5.7	3.0	5.7
Ground screw H10 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	5.2	3.0	5.2
Ground screw H12 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	3.2	3.0	3.2
Ground screw H17 to hazardous part (BI) (PV_INVERTER board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	7.7	3.0	7.7

IEC 62109-1							
Clause	Requirement – Test			Result – Remark			Verdict
Ground screw H7 to hazardous part (BI) (DC/DC board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	3.3	3.0	3.3	
Ground screw H6 to hazardous part (BI) (DC/DC board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	4.7	3.0	4.7	
Ground screw H14 to hazardous part (BI) (DC/DC board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	5.5	3.0	5.5	
Ground screw H8 to hazardous part (BI) (DC/DC board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	4.4	3.0	4.4	
Ground screw H1 to hazardous part (BI) (DC/DC board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	6.3	3.0	6.3	
Ground screw H2 to hazardous part (BI) (DC/DC board)	DC: 500 AC: 230	II (PV) III (AC)	3.0	4.1	3.0	4.1	
Between live part on power PCB board and internal earthing enclosure (BI)	DC: 500 AC: 230	II (PV) III (AC)	3.0	5.8	3.0	5.8	
Between primary and secondary circuit of isolation transformer for battery(T2, T3) (BI)	DC: 500 AC: 230	II (PV) III (AC)	3.0	5.0	3.0	5.0	
Between primary and secondary circuit through the isolation transformer T1 and isolation power supply U7 for communication (BI+SI)	DC: 500 AC: 230	II (PV) III (AC)	5.5	5.0+7.6=12.6	5.5	5.0+7.6=12.6	
Between primary and secondary circuit through the high impedance resistance and isolation opto-coupler for communication (BI+SI)	DC: 500 AC: 230	II (PV) III (AC)	5.5	7.1+8.2=15.3	5.5	7.1+8.2=15.3	
Supplementary information: (1) For AC mains circuit, nominal voltage is 230 V and overvoltage category is OVC III, impulse voltage correspond to mains circuit is 4000 V; (2) For PV circuit, system voltage is 500 V and overvoltage category is OVC II, impulse voltage correspond to PV circuit is 2768 V; (3) For battery circuit, is evaluated with basic insulation from AC mains and PV circuit, impulse voltage is 2500 V;							

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

7.3.7.8.3.2 to 7.3.7.8.3.3 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)
Insulation sheet between PCB and enclosure(BI)	500 Vd.c. 230 Vr.m.s	1500 Vr.m.s	--	Certified
Insulation cover sheet on display (RI)	500 Vd.c. 230 Vr.m.s	3000 Vr.m.s	--	Certified
Supplementary information:				

7.5 TABLE: electric strength measurements, impulse voltage test and partial discharge test				P
test voltage applied between:	test voltage (V)	impulse with- stand voltage (V)	partial discharge extinction voltage (V)	result
PV+ & PV- to enclosure(BI)	1500 Vr.m.s	4000 V _{peak}	N/A	No breakdown
AC terminals to enclosure(BI), relay contact short-circuit	1500 Vr.m.s	4000 V _{peak}	N/A	No breakdown
AC load terminals to enclosure(BI), re- lay contact short-circuit	1500 Vr.m.s	4000 V _{peak}	N/A	No breakdown
All input and output terminal to battery terminal (BI), relay contact short-circuit	1500 Vr.m.s	4000 V _{peak}	N/A	No breakdown
PV+ & PV- to communication port (DI)	3000 Vr.m.s	6000 V _{peak}	N/A	No breakdown
AC terminals to communication port (DI), relay contact short-circuit	3000 Vr.m.s	6000 V _{peak}	N/A	No breakdown
AC load terminals to communication port (DI), relay contact short-circuit	3000 Vr.m.s	6000 V _{peak}	N/A	No breakdown
PV+ & PV- to accessible display (RI)	3000 Vr.m.s	6000 V _{peak}	N/A	No breakdown
AC terminals to accessible display (RI), relay contact short-circuit	3000 Vr.m.s	6000 V _{peak}	N/A	No breakdown
AC load terminals to accessible dis- play (RI), relay contact short-circuit	3000 Vr.m.s	6000 V _{peak}	N/A	No breakdown
Supplementary information: Circuit breakers, contactors are closed before apply these tests.				

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

14	list of critical components				
Object / part No.	Manufacturer/ trademark	Type / model	Technical data	Standard	Mark(s) of conformity
--Below list is the critical components of all models					
Metal enclosure	EAST Group Co., Ltd.	Sheet metal	360 mm * 405 mm * 150mm	IEC 62109-1 IEC 62109-2	Tested with appliance
PCB	BAOYUEJIA ELECTRONICS CO LTD	BY-3, BYJ-3	V-0, 130 °C, CTI>175	UL 746C UL 94 UL 746B	UL E230225
Fan	Protechnic Electric Co.,Ltd	MGT801 2UB-R25	12 Vd.c., 0.66A, -10 °C to 70 °C	UL 507	UL E187236
PV input connector	SHENZHEN CONECTION ELECTRONICS CO., LTD.	DRTB10 -NR1	600 Vd.c., 65 Ad.c., 20 AWG - 6 AWG, 105 °C	UL 1059 UL 486E UL 60947-1	UL E304128
Battery input connector	SHENZHEN CONNECTION ELECTRONIC CO LTD	DRTB35 -RST	600 Vd.c., 100 Ad.c., 16 AWG - 2 AWG, -40 °C to 120 °C	UL 1059 UL 486E UL 60947-1	UL E304128
AC and load output connector	SHENZHEN CONNECTION ELECTRONIC CO LTD	DRTB10 -NR1	600 Vd.c., 65 Ad.c., 20 AWG - 6 AWG, 105 °C	UL 1059 UL 486E UL 60947-1	UL E304128
Material of all connector	TORAY INDUSTRIES INC	3004-V0(rr), CM3004 -V0(rr)	Polyamide 66, V-0, 130 °C	UL 746B UL 94	UL E41797
Internal earthing wire	ZHONGLI SCIENCE & TECHNOLOGY GROUP CO LTD	1015	10 AWG,VW-1, 105 °C, 600 Va.c.	UL 758	UL E156525
Internal earthing wire (alternative)	GUANGDONG HICHAIN ELECTRICITY CO LTD	1032	10 AWG,VW-1, 90 °C, 1000 Va.c./1200 Vd.c.	UL 758	UL E304337
Internal wire of AC side and PV side	ZHONGLI SCIENCE & TECHNOLOGY GROUP CO LTD	1015	11 AWG,VW-1, 105 °C, 600 Va.c./750 Vd.c.	UL 758	UL E156525
Internal wire of battery side	GUANGDONG HICHAIN ELECTRICITY CO LTD	1032	6 AWG,VW-1, 90 °C, 1000 Va.c./1200 Vd.c.	UL 758	UL E304337

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
Plastic isolation sheet between upper and lower enclosure	EAST Group Co., Ltd.	Sheet metal	360 mm * 405 mm * 150mm	IEC 62109-1 IEC 62109-2	Tested with Appliance
Material of plastic isolation sheet between upper and lower enclosure	SICHUAN DONGFANG INSULATING MATERIAL CO LTD	DF6025	V-0, 105 °C	UL 746C UL 94 UL 746B	UL E199019
Material of plastic isolation cover sheet on LCD display	SICHUAN LONGHUA FILM CO LTD	PC-1860A-ECO	V-0, 80 °C	UL 746C UL 94 UL 746B	UL E254551
LCD display	SHENZHEN TOPWAY TECHNOLOGY CO., LTD.	LM2561 60BFW	-20 °C to 70 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
LCD display (alternative)	SHENZHEN TOPWAY TECHNOLOGY CO., LTD.	LM6063 CCW-1	-25 °C to 85 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Material of J11, J12, J13	DONGGUAN CITY FENG TONG PLASTIC CO LTD	ST-PBT 301	V-0, 75 °C	UL 746C UL 94 UL 746B	UL E352852
--Below list is the critical components on the PV_INVERTER board of all models					
Heat sink	EAST Group Co., Ltd.	Sheet metal	280 mm * 40 mm * 75 mm	IEC 62109-1 IEC 62109-2	Tested with appliance
Fuse on the AC side	CONQUER ELECTRONICS CO.,LTD.	ABE/AB P-A series	250 Va.c., 40 Aa.c., 175 °C	UL 248-1 UL 248-14	UL E82636
Bus capacitor (C12, C13, C14, C15, C16)	HUNAN AIHUA GROUP CO.,LTD	ELK2H M471R5 0TT	500 Vd.c., 470 uF, -25 °C to 85 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
-alternative	Nantong Jianghai Capacitor Co.,Ltd	ECS2H BZ471M SA3500 50	500 Vd.c., 470 uF, -25 °C to 85 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Bus filter capacitor (C17, C18, C19, C20, C90)	SHENZHEN SURONG CAPACITORS CO., LTD.	MPP474 J624081 5P0	630 Vd.c, 0.47 uF, -40 °C to 85 °C	IEC 62109-1 IEC 62109-2	Tested with appliance

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
Filter capacitor (C21)	XIAMEN FARATRONIC CO LTD	C6AE26 55KF00 402	475 Vd.c., 6.5 uF, -40 °C to 105 °C	UL 810 CSA C22.2.No19 0	UL E256238
X capacitor (C45, C71)	XIAMEN FARATRONIC CO LTD	C42P22 25KBSC 400	275 Va.c., 2.2 uF, -40 °C to 110 °C	IEC/EN6038 4-14 CAN/CSA-E60384-14	VDE 40000358 UL E186600
Y capacitor (C3, C4, C5, C6)	NAN JING YUYUE ELECTRONICS CO LTD	CT708b Y5U102 M400Va cB	400 Va.c., 1000 pF, -25 °C to 125 °C	IEC/EN6038 4-14 UL 60384-14	VDE 40008010 UL E237728
Y capacitor (C36, C37, C38, C39, C40, C41, C42, C43, C67, C68, C69, C70, C118, C119)	NAN JING YUYUE ELECTRONICS CO LTD	CT712b Y5V472 M400Va cB	400 Va.c., 4700 pF, -25 °C to 125 °C	IEC/EN6038 4-14 UL 60384-14	VDE 40008010 UL E237728
Boost IGBT (Q5)	Fairchild Semiconductor	FGA40N 65SMD	650 V, 40 A, -55 °C to 175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
-alternative	Infineon Technologies AG	IKW40N 65H5	650 V, 40 A, -40 °C to 175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Inverter IGBT (Q1, Q2, Q3, Q4)	Infineon Technologies AG	IKW60N 60H3	600 V, 60 A, -40 °C to 175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
-alternative	Fairchild Semiconductor	FGA60N 65SMD	650 V, 60 A, -55 °C to 175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Boost free-wheel diode(D24)	IXYS Corporation	DSEC 30-06A	600 V, 2x 15 A, -55 °C to 175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Relay (RLY3, RLY5, RLY6, RLY7, RLY8)	PANASONIC CORPORATION	ALFG2P F12	Contact 250 Va.c., 31 Aa.c., coil 12V d.c. -40 °C to 60 °C	UL 60947-1	UL E43028
Current sensor (CT1)	Nanjing Chieful Science & TECHNOLOGY CO.,LTD.	CSM015 NPT	5 Vd.c., 15 A, -25 °C to 85 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
-alternative	Sinomags Technology Co., LTD.	SHK-25-LTS	2.5 Vd.c., 25 A, -40 °C to 85 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Current sensor (CT3)	LEM SWITZERLAND S A	CKSR 25-NP	5 Vd.c., 25 A, -40 °C to 105 °C	UL 508	UL E189713

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
Leakage current sensor (CT4)	MAGTRON INDUSTRY CO LTD	RCMU1 01S-3P6	2.5 Vd.c., 0.5 A, -40 °C to 85 °C	UL 1741	UL E366147
Current sensor (CT5)	SHENZHEN FERROCOIL ELECTRONICS TECHNOLOGY CO.,LTD	EI28	N1(4-1): $\Phi 0.11 \times 1P \times 1000.5Ts$ N2(3-2): $\Phi 1.0 \times 1P \times 1Ts$ N2(6-5): $\Phi 1.0 \times 1P \times 1Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 °C	UL 746 UL 94	UL E59481
- Copper wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U	130 °C	UL 1446	UL E201757
- Tape	XINYU SHENGDAFENG ELECTRIC MATERIAL CO LTD	SDF-312	130 °C	UL 510A	UL E317896
- Teflon tube	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200 °C	UL 224	UL E180908
- Varnish	HANG CHEUNG COATINGS (HUIYANG) LTD	8562*	155 °C	UL 1446	UL E200154
Current sensor (CT5) (alternative)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	LC28-045	N1(4-1): $\Phi 0.11 \times 1P \times 1000.5Ts$ N2(3-2): $\Phi 1.0 \times 1P \times 1Ts$ N2(6-5): $\Phi 1.0 \times 1P \times 1Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 °C	UL 746 UL 94	UL E59481
--alternative	E I DUPONT DE NEMOURS & CO INC	101L	V-0, 130 °C	UL 746 UL 94	UL E41938
- Copper wire	SHENZHEN CHENGWEI INDUSTRY CO LTD	UEW	130 °C	UL 1446	UL E227475
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT	130 °C	UL 510A	UL E165111

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	130 °C	UL 510A	UL E165111
- Teflon tube	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200 ° C	UL 224	UL E180908
- Varnish	HANG CHEUNG COATINGS (HUIYANG) LTD	8562*	155 °C	UL 1446	UL E200154
Current sensor (CT5) (alternative)	SHENZHEN CLICK TECHNOLOGY CO.LTD	DB2801 -123	N1(4-1): $\Phi 0.11 \times 1P \times 1000.5Ts$ N2(3-2): $\Phi 1.0 \times 1P \times 1Ts$ N2(6-5): $\Phi 1.0 \times 1P \times 1Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T373J	V-0, 150 °C	UL 746 UL 94	UL E59481
- Copper wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U	130 °C	UL 1446	UL E201757
- Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PZ	130 °C	UL 510A	UL E165111
- Tube	FLUO TECH INDUSTRIES CO LTD	TFL	200 ° C	UL 224	UL E175982
- Varnish	ELANTAS ELECTRICAL INSULATION ELANTAS PDG INC	V 1630FS	180 °C	UL 1446	UL E75225
High Frequency Inductor (L2)	HUIZHOU YONG JIN ELECTRIC CO.LTD	EA3-5KLPV	N1: $\phi 1.8 \times 2P \times 9Ts$, 3.6mH N2: $\phi 1.8 \times 2P \times 9Ts$, 3.6mH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	JUNG SHING WIRE CO LTD	EIAIW	200 °C	UL 1446	UL E174837
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	EIW H	200 °C	UL 1446	UL E85640
--alternative	GUANGZHOU TIANSHUN ELECTRIC EQUIPMENT CO LTD	TS MW35-C	200 °C	UL 1446	UL E210986

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	ET-90(a)	180 °C	UL 1446	UL E228349
- Epoxy	DONG GUAN SHI PAI HUA CHUANG MATERIAL FTY	H907-H##	V-0, 130 °C	UL 746C	UL E304477
- Spacer	KINGBOARD LAMINATES HOLDINGS LTD	KB-5150 KB-6150C	V-0, 130 °C	CAN/CSA-C22.2 No. 0.17	UL E123995
High Frequency Inductor (L2) (alternative)	SHENZHEN SPITZER ELECTRONIC CO.,LTD	SPT-40H628 3-L	N1: $\phi 1.8 \times 2P \times 9Ts$, 3.6mH N2: $\phi 1.8 \times 2P \times 9Ts$, 3.6mH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	WUXI JUFENG COMPOUND LINE CO LTD	xEIW	180 °C	UL 1446	UL E206882
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	SMEIW	180 °C	UL 1446	UL E85640
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	130 °C	UL 510A	UL E165111
- Epoxy	GUANGZHOU POCHELY NEW MATERIAL TECHNOLOGY CO LTD	5225A/B	130 °C	UL 746C	UL E204979
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C	V-0, 130 °C	UL 1694 UL 94 UL 746A	UL E123995
High Frequency Inductor (L3, L11, L12)	HUIZHOU YONG JIN ELECTRIC CO.LTD	EA3-5KLPV	N1: $\phi 2.0 \times 2P \times 9Ts$, 1.4mH N2: $\phi 2.0 \times 2P \times 9Ts$, 1.4mH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	JUNG SHING WIRE CO LTD	EIAIW	200 °C	UL 1446	UL E174837
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	EIW H	200 °C	UL 1446	UL E85640
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT	130 °C	UL 510A	UL E165111

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
--alternative	CHANG SHU LIANG YI TAPE INDUSTRY CO LTD	LY-XX (a)(b)	130 °C	UL 510A	UL E246820
--alternative	JINGJIANG JINGYI ADHESIVE PRODUCT CO LTD	JY25-A (b)	130 °C	UL 510A	UL E246950
- Varnish	GUANGZHOU BETTER NEW MATERIALS CO LTD	BETTE R 116 (n)	200 °C	UL 1446	UL E230067
- Epoxy	GUANG DONG TIAN HUAN INNOVATION TECHNOLOGY CO LTD	TH320	V-0, 90 °C	UL 746C	UL E257593
- Spacer	KINGBOARD LAMINATES HOLDINGS LTD	KB-5150 KB- 6150C	V-0, 130 °C	CAN/CSA- C22.2 No. 0.17	UL E123995
High Frequen- cy Inductor (L3, L11, L12) (al- ternative)	SHENZHEN SPITZER ELECTRONIC CO.,LTD	SPT- 42H628 4-L	N1: $\phi 2.0 \times 2P \times 10Ts$, 1.4mH N2: $\phi 2.0 \times 2P \times 10Ts$, 1.4mH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	WUXI JUFENG COMPOUND LINE CO LTD	xEIW	180 °C	UL 1446	UL E206882
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	SMEIW	180 °C	UL 1446	UL E85640
- Insulation film	DUPONT TEIJIN FILMS U S L P	Melinex 238	130 °C	UL 746C UL 94	UL E93687
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	130 °C	UL 510A	UL E165111
- Epoxy	GUANGZHOU POCHELY NEW MATERIAL TECHNOLOGY CO LTD	5225A/B	130 °C	UL 746C	UL E204979
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB- 6160C	V-0, 130 °C	UL 1694 UL 94 UL 746A	UL E123995
High Frequen- cy Inductor (L4, L5, L6, L10)	SHENZHEN YUYUAN POWER CO.,LTD	PPI1840 40	N1: $\phi 1.3 \times 2P \times 66Ts$, 784.1uH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	PEWH/U	180 °C	UL 1446	UL E201757
- Varnish	SHEN ZHEN NOBLE FLOWER TECHNOLOGY INDUSTRIAL CO LTD	RT9669	260 °C	UL 746E UL 94	UL E480212
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C	V-0, 130 °C	UL 1694 UL 94 UL 746A	UL E123995
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT	130 °C	UL 510A	UL E165111
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 °C	UL 746C	UL E218090
High Frequency Transformer (T1)	ShenZhen JiaMe-iRui ELECTRONICS CO.,LTD	JBK-13E-259	N1: $\phi 0.20 \times 1P \times 21Ts$ N2: $\phi 0.20 \times 1P \times 20Ts$ N3: $\phi 0.20 \times 1P \times 21Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 °C	UL 1694 UL 94 UL 746A	UL E59481
- Wire	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEWB	130 °C	UL 1446	UL E85640
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 °C	UL 510A	UL E165111
- Triple layer wire	FURUKAWA ELECTRIC CO LTD	TEX-E	130 °C	UL 1446	UL E206440
- Varnish	ZHUHAI CHANGXIAN NEW MATERIALS TECHNOLOGY CO LTD	E962	130 °C	UL 1446	UL E335405

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
High Frequency Transformer (T1) (alternative)	SHENZHEN CLICK TECHNOLOGY CO.LTD	EP13-330	N1: $\phi 0.20 \times 1P \times 21Ts$ N2: $\phi 0.20 \times 1P \times 20Ts$ N3: $\phi 0.20 \times 1P \times 21Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	PM-9820	V-0, 150 °C	UL 1694 UL 94 UL 746A	UL E41429
- Triple layer wire	FURUKAWA ELECTRIC CO LTD	TEX-E	130 °C	UL 1446	UL E206440
--alternative	COSMOLINK CO LTD	TIW-M	130 °C	UL2353 UL 60950-1	UL E213764
- Wire	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEWB	130 °C	UL 1446	UL E85640
--alternative	HENG YA ELECTRIC (DONGGUAN) LTD	UEWB	130° C	UL 1446	UL E197768
--alternative	FENG CHING METAL CORP	xUEW	130 °C	UL 1446	UL E172395
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT	130 °C	UL 510A	UL E165111
- Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 °C	UL 224	UL E156256
- Varnish	KYOCERA CORPORATION	TVB218 0T*(a)	155 °C	UL 1446	UL E83702
Piezo Resistor (R3, R4)	THINKING ELECTRONIC INDUSTRIAL CO LTD	TVR208 21, TVR208 21KSC4 ANCY	Max. surge current: 6500 A, varistor Voltage: 800 V, - 40 °C to 125 °C	UL 1449	UL E314979
Piezo Resistor (R181, R182, R183)	HONGZHI ENTERPRISES LTD	HEL 20D561 K	Max. surge current: 6500 A, varistor Voltage: 561 V, - 40 °C to 105 °C	UL 1449	UL E324904
PCB(PCB1-PCB5)	BAOYUEJIA ELECTRONICS CO LTD	BY-2	V-0, 130 °C, CTI>175	UL 94 UL 796	UL E230225
Thermostat switch(SW1, SW2)	Dongguan Heng Hao Electric Co., Ltd	JUC-31F 85 °C	-55 °C to 180 °C	IEC 62109-1 IEC 62109-2	Tested with appliance

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
Insulation paper between IGBT and Heat sink	KUNSHAN ZHONGDI MATERIALS TECHNOLOGY CO LTD	TSP-10 &	V-0, 130 °C, 26mmx20mmx0.15mm	UL 1694 UL 94 UL 746A	UL E343369
--Below list is the critical components on the DCPOWER board of all models					
Heat sink	EAST Group Co., Ltd.	Sheet metal	280 mmx 40 mmx 75mm	IEC 62109-1 IEC 62109-2	Tested with appliance
Heat sink	EAST Group Co., Ltd.	Sheet metal	85 mmx 04 mmx 75mm	IEC 62109-1 IEC 62109-2	Tested with appliance
Heat sink	EAST Group Co., Ltd.	Sheet metal	123 mmx 15 mmx 75mm	IEC 62109-1 IEC 62109-2	Tested with appliance
Y capacitor (C162, C163, C164, C165, C167, C168)	NAN JING YUYUE ELECTRONICS CO LTD	CT7-08bY5U 102M40 0VacB	400 Va.c., 1000 pF, -25 °C to 125 °C	IEC/EN6038 4-14 UL 60384-14	VDE 40008010 UL E237728
Y capacitor (C125, C126, C127)	GUANGDONG FENGHUA ADVANCED TECHNOLOGY HOLDING CO., LTD ZHENGHUA CERAMIC DISC CAPACITOR BRANCH CO	CT7-X6Y5V3 E222MS EW	250 Va.c., 2200 pF, -25 °C to 85 °C	IEC/EN6038 4-14 UL 60384-14	VDE 40013874 UL E219015
Y capacitor (C26, C27, C28, C29)	SHANTOU HIGH-NEW TECHNOLOGY DEVELOPMNT ZONE SONGTIAN ENTERPRISE CO LTD	CE series, Y2-250VAC -Y5V-103M	250 Va.c., 10000 pF, -25 °C to 125 °C	IEC/EN6038 4-14 UL 60384-14	VDE 40025748 UL E208107
Fuse on the Battery side (F3, F4, F5)	CONQUER ELECTRONICS CO.,LTD.	ABP, ABP-A, ABE-A series	250 Va.c., 40 Aa.c., 175 °C	UL 248-1 UL 248-14	UL E82636
Fuse on the Battery side (F1)	WALTER ELECTRONIC CO LTD	ICP Series	250 Va.c., 4 Aa.c., -55 °C to 125 °C	UL 248-1	UL E56092
Filker capacitor (C33)	EACO Capacitor Inc	STH-250-20-44#	250 Va.c., 20 uF, -40 °C to 85 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
E capacitor (C30, C31)	HUNAN AIHUA GROUP CO.,LTD	ELH1JM 472P50 KC	63 Vd.c., 4700 uF, -40 °C to 105 °C	IEC 62109-1 IEC 62109-2	Tested with appliance

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
E capacitor (C81, C82)	DONGGUAN WIN SHINE ELECTRONIC CO., LTD.	063SH3 32M224 0C40J	63 Vd.c, 3300 uF, -55 °C to 105 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Optocoupler U4	LITE-ON TECHNOLOGY CORP	LTV-816S-TA1	Isolation 5000 Vr.m.s, -30 °C to 110 °C	UL 1577	UL E113898
MOSFET (Q5 – Q12)	IXYS Corporation	IXFH15 0N20T	-55 °C to 150 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
MOSFET (Q5 – Q12) (alternative)	Infineon Technologies AG	IRFP46 68PBF	-55 °C to 175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Commutation diode(D14-D17)	Advanced Power Technology Inc	APT30D Q120BG *	-55 °C to 175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Commutation diode(D14-D17) (alternative)	IXYS Corporation	DSEI30-10A	-40 °C to 150 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
LLC MOSFET (Q24, Q25)	Infineon Technologies AG	SPW47 N60C3	-55 °C to 150 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
LLC MOSFET (Q24, Q25) (alternative)	Vishay Intertechnology, Inc.	SiHG47 N60E	-55 °C to 150 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
LLC commutation diode (D34, D35)	ST Microelectronics Inc.	STPS30 170C	175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
LLC commutation diode (D34, D35) (alternative)	IXYS Corporation	DSSK 30-018A	175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Insulation paper between MOSFET and Heat sink	KUNSHAN ZHONGDI MATERIALS TECHNOLOGY CO LTD	TSP-10 &	V-0, 130 °C, 26mmx20mmx0.15mm	UL 1694 UL 94 UL 746A	UL E343369
High Frequency Inductor (L9)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	BCK300 1-096	N1: LITZ, $\phi 0.06 \times 400P \times 2C \times 12Ts$, 22.6 uH, Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Insulation paper	E I DUPONT DE NEMOURS & CO INC	Nomex 410	220 °C	UL 1694 UL 94 UL 746A	UL E34739

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	Flame retardant+, 180 °C	UL 510A	UL E165111
--alternative	SHENZHEN MEIXIN ELECTRONIC CO LTD	MXPI-310F	180 °C	UL 510A	UL E304309
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500 (XX)	V-0, 130 °C	UL 746C	UL E218090
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C	V-0, 130 °C	UL 1694 UL 94 UL 746A	UL E123995
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155 ° C	UL 1446	UL E228349
High Frequency Inductor (L1)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	LC47-061	N1: $\phi 1.2 \times 2P \times 65Ts$, 304 uH, Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	FENG CHING METAL CORP	xPEW	155 ° C	UL 1446	UL E172395
--alternative	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	PEW	155 ° C	UL 1446	UL E201757
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	PEW	155 ° C	UL 1446	UL E85640
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 °C	UL 510A	UL E165111

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Epoxy baffle	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C	V-0, 130 °C	UL 1694 UL 94 UL 746A	UL E123995
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 °C	UL 746C	UL E218090
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155 °C	UL 1446	UL E228349
High Frequency Inductor (L1) (alternative)	SHENZHEN YUYUAN POWER CO.,LTD	T184-8	N1: $\phi 1.2 \times 2P \times 65Ts$, 304 uH, Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 °C	UL 1446	UL E201757
--alternative	FENG CHING METAL CORP	xUEW-2	130 °C	UL 1446	UL E172395
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C/ KB-6168	V-0, 130 °C	UL 1694 UL 94 UL 746A	UL E123995
- Varnish	SHEN ZHEN NOBLE FLOWER TECHNOLOGY INDUSTRIAL CO LTD	RT9669	260 °C	UL 746E UL 94	UL E480212
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 °C	UL 746C	UL E218090
High Frequency Inductor (L1) (alternative)	SHENZHEN FERROCOIL ELECTRONICS TECHNOLOGY CO.,LTD	T184-8	N1: $\phi 1.2 \times 2P \times 65Ts$, 304 uH, Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 °C	UL 1446	UL E201757

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Varnish	SHENZHEN HUAJINGMEI CHEMICAL CO LTD	8562/a	155 ° C	UL 1446	UL E322508
- Baffle	HON TAI MATERIAL CO LTD	HT-E3502	V-0, 130 ° C	UL 746E UL 94 UL 746A	UL E122230
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 ° C	UL 746C	UL E218090
- Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PZ* (b)	Flame retardant+, 130 ° C	UL 510A	UL E165111
High Frequency Inductor (L11)	SHENZHEN SPITZER ELECTRONIC CO.,LTD	SPT-25H558 8-L	N1: $\phi 1.5 \times 2P \times 5Ts$, 150 uH N2: $\phi 1.5 \times 2P \times 5Ts$, 150 uH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	WUXI JUFENG COMPOUND LINE CO LTD	xEIW	180 ° C	UL 1446	UL E206882
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	SMEIW	180 ° C	UL 1446	UL E85640
- Epoxy	GUANGZHOU POCHELY NEW MATERIAL TECHNOLOGY CO LTD	5225A/B	130 ° C	UL 746C	UL E204979
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C/ KB-6168	V-0, 130 ° C	UL 1694 UL 94 UL 746A	UL E123995
Inductor (L10, L13)	SHENZHEN CLICK TECHNOLOGY CO.LTD	LC12-177	N1: $\phi 0.2 \times 1P \times 100Ts$ N2: $\phi 2.0 \times 1P \times 1Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	E I DUPONT DE NEMOURS & CO INC	FR530(I)(+)(f1), FR530(L)(I)(+)(f1)	V-0, 155 ° C	UL 1694 UL 94 UL 746A	E41938
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 ° C	UL 510A	UL E165111

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 ° C	UL 1446	UL E201757
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6150	V-0, 130 ° C	UL 1694 UL 94 UL 746A	UL E123995
Inductor (L10, L13) (alternative)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	LC12-028	N1: $\phi 0.2 \times 1P \times 100Ts$ N2: $\phi 2.0 \times 1P \times 1Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	E I DUPONT DE NEMOURS & CO INC	FR530(I)(+)(f1), FR530L(I)(+)(f1)	V-0, 155 ° C	UL 94 UL 746A	UL E41938
- Wire	SHENZHEN CHENGWEI INDUSTRY CO LTD	(x)UEW-B-(&)-(*)	130 ° C	UL 1446	UL E227475
--alternative	FENG CHING METAL CORP	xUEW-2	130 ° C	UL 1446	UL E172395
--alternative	SHENZHEN CHENGWEI INDUSTRY CO LTD	(x)PEW(EI)-F	155 ° C	UL 1446	UL E227475
--alternative	FENG CHING METAL CORP	xPEW	155 ° C	UL 1446	UL E172395
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 ° C	UL 746C	UL E218090
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 ° C	UL 510A	UL E165111
- Epoxy baffle	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C	V-0, 130 ° C	UL 1694 UL 94 UL 746A	UL E123995
High Frequency Inductor (L14)	SHENZHEN YUYUAN POWER CO.,LTD	T16*12*8C	N1: $\phi 1.2 \times 2P \times 10Ts$, 580 uH N2: $\phi 1.2 \times 2P \times 10Ts$, 580 uH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	PEWH/U	180 ° C	UL 1446	UL E201757
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6150	V-0, 130°C	UL 1694 UL 94 UL 746A	UL E123995
- Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 ° C	UL 746C	UL E218090
- Varnish	SHEN ZHEN NOBLE FLOWER TECHNOLOGY INDUSTRIAL CO LTD	RT9669	260 ° C	UL 746E UL 94	UL E480212
High Frequency Transformer (T7)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	BCK250 1-373	N1: $\phi 0.40 \times 1P \times 12Ts$ N2: $\phi 0.20 \times 1P \times 80Ts$ N3: $\phi 0.20 \times 1P \times 8Ts$ N4: $\phi 0.40 \times 1P \times 12Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481
- Wire	FENG CHING METAL CORP	xUEW-2	130 ° C	UL 1446	UL E172395
--alternative	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 ° C	UL 1446	UL E201757
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEWB	130 ° C	UL 1446	UL E85640
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 ° C	UL 510A	UL E165111

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
--alternative	3M COMPANY ELECTRICAL MARKETS DIV (EMD)	1350F-1 (b)	Flame retardant+, 130 °C	UL 510A	UL E17385
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
- Teflon Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256
--alternative	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200 ° C	UL 224	UL E180908
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T- 4260(a)	155 ° C	UL 1446	UL E228349
High Frequen- cy Transformer (T7) (alterna- tive)	SHENZHEN FERROCOIL ELECTRONICS TECHNOLOGY CO.,LTD	EI25	N1: $\phi 0.40 \times 1P \times 12Ts$ N2: $\phi 0.20 \times 1P \times 80Ts$ N3: $\phi 0.20 \times 1P \times 8Ts$ N4: $\phi 0.40 \times 1P \times 12Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 ° C	UL 1446	UL E201757
- Insulating tape	XINYU SHENGDAFENG ELECTRIC MATERIAL CO LTD	SDF- 317	130 ° C	UL 510A	UL E317896
- Varnish	HANG CHEUNG COATINGS (HUIYANG) LTD	8562*	155 ° C	UL 1446	UL E200154
- Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
Bus High Frequency Transformer(T1)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	BCK290 1-049	N1: $\phi 0.40 \times 1P \times 27Ts$ N2: $\phi 0.20 \times 1P \times 8Ts$ N3: $\phi 0.20 \times 1P \times 6Ts$ N4: $\phi 0.60 \times 4P \times 2Ts$ N5: $\phi 0.60 \times 4P \times 4Ts$ N6: $\phi 0.40 \times 1P \times 27Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481
- Wire	SHENZHEN CHENGWEI INDUSTRY CO LTD	(x)UEW-B-(&)-(*)	130 °C	UL 1446	UL E227475
--alternative	FENG CHING METAL CORP	xUEW-NY	130 ° C	UL 1446	UL E172395
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 °C	UL 510A	UL E165111
--alternative	3M COMPANY ELECTRICAL MARKETS DIV (EMD)	1350F-1 (b)	Flame retardant+, 130 °C	UL 510A	UL E305006
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
--alternative	3M COMPANY ELECTRICAL MARKETS DIV (EMD)	44 (a)	No flame retardant+, 130 °C	UL 510A	UL E17385
- Teflon Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256
--alternative	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200 ° C	UL 224	UL E180908

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155 ° C	UL 1446	UL E228349
Bus High Frequency Transformer(T1) (alternative)	SHENZHEN FERROCOIL ELECTRONICS TECHNOLOGY CO.,LTD	ETD29	N1: $\phi 0.40 \times 1P \times 27Ts$ N2: $\phi 0.20 \times 1P \times 8Ts$ N3: $\phi 0.20 \times 1P \times 6Ts$ N4: $\phi 0.60 \times 4P \times 2Ts$ N5: $\phi 0.60 \times 4P \times 4Ts$ N6: $\phi 0.40 \times 1P \times 27Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481
- Teflon Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U@	130 ° C	UL 1446	UL E201757
- Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PZ* (b)	Flame retardant+, 130 ° C	UL 510A	UL E165111
- Varnish	HANG CHEUNG COATINGS (HUIYANG) LTD	8562*	155 ° C	UL 1446	UL E200154
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 ° C	UL 510A	UL E165111
Bus High Frequency Transformer(T1) (alternative)	BO LUO DA XIN ELECTRONICS CO., LTD	KB1650-25458	N1: $\phi 0.40 \times 1P \times 27Ts$ N2: $\phi 0.20 \times 1P \times 8Ts$ N3: $\phi 0.20 \times 1P \times 6Ts$ N4: $\phi 0.60 \times 4P \times 2Ts$ N5: $\phi 0.60 \times 4P \times 4Ts$ N6: $\phi 0.40 \times 1P \times 27Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Wire	HUIZHOU GOLDEN OCEAN MAGNET WIRE FACTORY	xUEW-F	155 ° C	UL 1446	UL E225143
--alternative	HOI LUEN ELECTRICAL MFR CO LTD	XUEW-F	155 ° C	UL 1446	UL E164409
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 ° C	UL 510A	UL E165111
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 ° C	UL 510A	UL E165111
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155 ° C	UL 1446	UL E228349
- Teflon Tube	SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO LTD	WF	200 ° C	UL 224	UL E203950
Bus High Frequency Transformer(T1) (alternative)	SHENZHEN CLICK TECHNOLOGY CO.,LTD	BCK290 1-169	N1: $\phi 0.40 \times 1P \times 27Ts$ N2: $\phi 0.20 \times 1P \times 8Ts$ N3: $\phi 0.20 \times 1P \times 6Ts$ N4: $\phi 0.60 \times 4P \times 2Ts$ N5: $\phi 0.60 \times 4P \times 4Ts$ N6: $\phi 0.40 \times 1P \times 27Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481
- Wire	HUIZHOU GOLDEN OCEAN MAGNET WIRE FACTORY	LZ-UEWB	130 ° C	UL 1446	UL E84201
--alternative	FENG CHING METAL CORP	xUEW-2	130 ° C	UL 1446	UL E172395
--alternative	ROSHOW TECHNOLOGY CO LTD	xUEW@/130, QA@-x/130	130 ° C	UL 1446	UL E215691

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEW	130 ° C	UL 1446	UL E85640
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 ° C	UL 510A	UL E165111
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 ° C	UL 510A	UL E165111
- Varnish	KYOCERA CORPORATION	TVB218 0T*(a)	155 ° C	UL 1446	UL E83702
- Teflon Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500 (XX)	V-0, 130 ° C	UL 746C	UL E218090
High Frequency Transformer (T6)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	BCK250 1-374	N1: $\phi 0.20 \times 1P \times 48Ts$ N2: $\phi 0.25 \times 1P \times 80Ts$ N3: $\phi 0.20 \times 1P \times 8Ts$ N4: $\phi 0.20 \times 1P \times 48Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481
- Wire	FENG CHING METAL CORP	xUEW-2	130 ° C	UL 1446	UL E172395
--alternative	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 ° C	UL 1446	UL E201757
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEWB	130 ° C	UL 1446	UL E85640
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 ° C	UL 510A	UL E165111

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
--alternative	3M COMPANY ELECTRICAL MARKETS DIV (EMD)	1350F-1 (b)	Flame retardant+, 130 °C	UL 510A	UL E17385
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
- Teflon Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256
--alternative	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200 ° C	UL 224	UL E180908
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T- 4260(a)	155 ° C	UL 1446	UL E228349
High Frequency Transformer (T6) (alternative)	SHENZHEN FERROCOIL ELECTRONICS TECHNOLOGY CO.,LTD	EI25	N1: $\phi 0.20 \times 1P \times 48Ts$ N2: $\phi 0.25 \times 1P \times 80Ts$ N3: $\phi 0.20 \times 1P \times 8Ts$ N4: $\phi 0.20 \times 1P \times 48Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 ° C	UL 1694 UL 94 UL 746A	UL E59481
- Tube	FLUO TECH INDUSTRIES CO LTD	TFL	200 ° C	UL 224	UL E175982
- Wire	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 ° C	UL 1446	UL E201757
- Tape	XINYU SHENGDAFENG ELECTRIC MATERIAL CO LTD	SDF- 317	130 ° C	UL 510A	UL E317896
- Varnish	HANG CHEUNG COATINGS (HUIYANG) LTD	8562*	155 ° C	UL 1446	UL E200154

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
High Frequency Transformer (T5)	SHENZHEN SPITZER ELECTRONIC CO.,LTD	SPT-13P459 1-T	N1: $\phi 0.20 \times 1P \times 20Ts$ N2: $\phi 0.20 \times 1P \times 24Ts$ N3: $\phi 0.20 \times 1P \times 24Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 °C	UL 1694 UL 94 UL 746A	UL E59481
- Multi insulated wire	COSMOLINK CO LTD	TIW-M	130 °C	UL2353 UL 60950-1	UL E213764
- Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PZ* (b)	Flame retardant+, 130 °C	UL 510A	UL E165111
--alternative	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	Flame retardant+, 180 °C	UL 510A	UL E165111
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155 °C	UL 1446	UL E228349
- Teflon Tube	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200 °C	UL 224	UL E180908
- Epoxy	GUANGZHOU POCHELY NEW MATERIAL TECHNOLOGY CO LTD	5225A/B	130 °C	UL 746C	UL E204979
High Frequency Transformer (T4)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	BCK420 1-244	N1: COPPER FOIL, $\phi 0.075 \times 28mm \times 7.5Ts$ N2: COPPER FOIL, $\phi 0.25 \times 28mm \times 4Ts$ N3: COPPER FOIL, $\phi 0.25 \times 28mm \times 4Ts$ N4: COPPER FOIL, $\phi 0.075 \times 28mm \times 6.5Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Insulation paper	E I DUPONT DE NEMOURS & CO INC	Nomex 410	220 °C	UL 1694 UL 94 UL 746A	UL E34739
- Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	Flame retardant+, 180 °C	UL 510A	UL E165111
--alternative	SHENZHEN MEIXIN ELECTRONIC CO LTD	MXPI-310F	180 °C	UL 510A	UL E304309
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
--alternative	XINYU SHENGDAFENG ELECTRIC MATERIAL CO LTD	SDF-317	130 °C	UL 510A	UL E317896
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 °C	UL 746C	UL E218090
- Bobbin	KINGBOARD LAMINATES HOLDINGS LTD	KB-6160C	V-0, 130 °C	UL 1694 UL 94 UL 746A	UL E123995
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155 °C	UL 1446	UL E228349
High Frequency Transformer (T4) (alternative)	SHENZHEN FERROCOIL ELECTRONICS TECHNOLOGY CO.,LTD	EE42	N1: COPPER FOIL, $\phi 0.075$ x 28mm x 7.5Ts N2: COPPER FOIL, $\phi 0.25$ x 28mm x 4Ts N3: COPPER FOIL, $\phi 0.25$ x 28mm x 4Ts N4: COPPER FOIL, $\phi 0.075$ x 28mm x 6.5Ts Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	CHANG CHUN PLASTICS CO LTD	T375J	V-0, 150 °C	UL 1694 UL 94 UL 746A	UL E59481

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Insulation paper	E I DUPONT DE NEMOURS & CO INC	Nomex 410	220 °C	UL 1694 UL 94 UL 746A	UL E34739
- Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	PF* (d)(g)	Flame retardant+, 180 °C	UL 510A	UL E165111
- Baffle	HON TAI MATERIAL CO LTD	HT-E3502	V-0, 130 °C	UL 746E UL 94 UL 746A	UL E122230
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	130 °C	UL 510A	UL E165111
- Epoxy	SHAW HUOW ENTERPRISE CO LTD	9001A/9001B	V-0, 90 °C	UL 746C	UL E218090
- Varnish	HANG CHEUNG COATINGS (HUIYANG) LTD	8562*	155 °C	UL 1446	UL E200154
High Frequency Transformer (T2, T3)	JEPULS TECHNOLOGY (SHENZHEN) CO.,LTD	BCK550 1-204	N1: LITZ, $\phi 0.28 \times 20P \times 2P \times 8Ts$ N2: COPPER FOIL, $\phi 0.25 \times 30mm \times 4Ts$ N3: COPPER FOIL, $\phi 0.25 \times 30mm \times 4Ts$ N4: LITZ, $\phi 0.28 \times 20P \times 2P \times 8Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	E I DUPONT DE NEMOURS & CO INC	FR530(I) (+)(f1), FR530L(I) (+)(f1)	V-0, 155 °C	UL 1694 UL 94 UL 746A	E41938
- Wire	FENG CHING METAL CORP	xUEW-2	130 °C	UL 1446	UL E172395
--alternative	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 °C	UL 1446	UL E201757
--alternative	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEWB	130 °C	UL 1446	UL E85640

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-280B	No flame retardant+, 130 °C	UL 510A	UL E165111
--alternative	3M COMPANY ELECTRICAL MARKETS DIV (EMD)	1350F-1 (b)	Flame retardant+, 130 °C	UL 510A	UL E17385
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
--alternative	3M COMPANY ELECTRICAL MARKETS DIV (EMD)	44 (a)	No flame retardant+, 130 °C	UL 510A	UL E17385
- Teflon Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 ° C	UL 224	UL E156256
--alternative	CHANGYUAN ELECTRONICS GROUP CO LTD	CB-TT-L	200 ° C	UL 224	UL E180908
- Varnish	SUZHOU TAIHU ELECTRIC ADVANCED MATERIAL CO LTD	T-4260(a)	155 ° C	UL 1446	UL E228349
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500 (XX)	V-0, 130 °C	UL 746C	UL E218090
High Frequency Transformer (T2, T3) (alternative)	SHENZHEN CLICK TECHNOLOGY CO.,LTD	BCK550 1-1063	N1: LITZ, $\phi 0.28 \times 20P \times 2P \times 8Ts$ N2: COPPER FOIL, $\phi 0.25 \times 30mm \times 4Ts$ N3: COPPER FOIL, $\phi 0.25 \times 30mm \times 4Ts$ N4: LITZ, $\phi 0.28 \times 20P \times 2P \times 8Ts$ Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Bobbin	E I DUPONT DE NEMOURS & CO INC	FR530(I) (+)(f1), FR530L(I)(+)(f1)	V-0, 155 ° C	UL 1694 UL 94 UL 746A	E41938
- Wire	TAI-I ELECTRIC WIRE & CABLE CO LTD	UEWB	130 ° C	UL 1446	UL E85640

TRF_IEC62109_1B

Project No: 64.290.17.04706.01 part 1 of 2
Rev.: 00
Date: 2017-12-08
Page: 99 of 101

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TÜV SÜD Certification and Testing (China) Co., Ltd.
Guangzhou Branch, TÜV SÜD Group
5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou, 510656, P.R.China

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
--alternative	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEF1/U @	130 °C	UL 1446	UL E201757
--alternative	FENG CHING METAL CORP	xUEW	130 °C	UL 1446	UL E172395
- Mylar tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT	130 °C	UL 510A	UL E165111
- Margin tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	WF* (c)(h)	Flame retardant+, 130 °C	UL 510A	UL E165111
- Varnish	KYOCERA CORPORATION	TVB218 0T*(a)	155 °C	UL 1446	UL E83702
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500 (XX)	V-0, 130 °C	UL 746C	UL E218090
- Tube	GREAT HOLDING INDUSTRIAL CO LTD	TFL	200 °C	UL 224	UL E156256
Thermostat switch(SW1, SW2)	Dongguan Heng Hao Electric Co., Ltd	JUC-31F 85 °C	-55 °C to 180 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
High voltage power schottky rectifier (D11)	STMicroelectronics	STPS8H 100	175 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Electrolytic capacitor(C160)	HUNAN AIHUA GROUP CO., LTD	EW2H M220K2 50T	500 Vd.c, 22 uF, -25 °C to 105 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Electrolytic capacitor(C160) (alternative)	Nantong Jianghai Capacitor Co., Ltd	CD263 series	500 Vd.c, 22 uF, -25 °C to 105 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
Common inductor(L12, L15)	SHENZHEN YUYUAN POWER CO.,LTD	CH10	N1: 2.0 mH N2: 2.0 mH Class B	IEC 62109-1 IEC 62109-2	Tested with appliance
- Wire	FENG CHING METAL CORP	xUEW-2	130 °C	UL 1446	UL E172395
--alternative	PACIFIC ELECTRIC WIRE & CABLE (SHENZHEN) CO LTD	UEW/U @	130 °C	UL 1446	UL E201757

TRF_IEC62109_1B

IEC 62109-1					
Clause	Requirement – Test		Result – Remark		Verdict
- Varnish	SHEN ZHEN NOBLE FLOWER TECHNOLOGY INDUSTRIAL CO LTD	RT9669	260 °C	UL 746E UL 94	UL E480212
- Spacer	KINGBOARD LAMINATES HOLDINGS LTD	KB-6150C	V-0, 130 °C	CAN/CSA-C22.2 No. 0.17	UL E123995
- Epoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/3300B-1	V-0, 130 °C	UL 746C	UL E218090
--Below list is the critical components on the control board of all models					
MCU (U22)	Texas Instruments	TMS320 F28062	-40 °C to 125 °C	IEC 62109-1 IEC 62109-2	Tested with appliance
--Below list is the critical components on the communication board of all models					
Optocoupler U8, U9, U10, U11, U12, U13, U14, U15	LITE-ON TECHNOLOGY CORP	LTV-816S-TA1	Isolation 5000 Vr.m.s, -30 °C to 110 °C	UL 1577	UL E113898
Isolated power supply U7	MORNSUN GUANGZHOU SCIENCE & TECHNOLOGY LTD	B0505D - 1WR2[*r]	Isolation 3000 Vd.c., -40 °C to 105 °C	UL 60950-1	UL E235235
Note: (1) If no special indicate, list of critical components are applied for all models. (2) Throughout this file (CDF) a comma is used as the decimal separator.					

..... End of test report

TEST REPORT
IEC 62109-2:2011
Safety of power converters for use in photovoltaic power systems –
Part 2: Particular requirements for inverters

Report Number..... : 64.290.17.04706.01 part 2 of 2

Date of issue..... : 8 December 2017

Total number of pages 32 pages

Applicant's name EAST Group Co., Ltd.

Address..... : No.6 Northern Industry Road, Songshan Lake Sci. & Tech.
 Industry Park, 523808 DongGuan City, Guangdong Province,
 PEOPLE'S REPUBLIC OF CHINA

Test specification:

Standard IEC/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

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

General disclaimer:

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

This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.



Test item description	Engineering prototype (Hybrid Solar Inverter)	
Trade Mark	EAST ®	
Manufacturer	EAST Group Co., Ltd.	
Model/Type reference	EA3KHD, EA3.6KHD	
Ratings	See 64.290.17.04706.01 part 1 of 2, page 7	
Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
<input checked="" type="checkbox"/>	Testing Laboratory:	TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch
Testing location/ address.....:		5F, Communication Building, 163 Pingyun Rd, Huangpu Ave. West, Guangzhou 510656, P. R. China
Tested by (name, function, signature)		Max Fang (Fang Wensong) Kennen Wang (Wang Kaixiang)
Approved by (name, function, signature) ...:		Billy Qiu (Qiu Bili)

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

This test report contains 2 parts listed in below table:

Item	Description	Pages
Part 1	IEC/EN 62109-1:2010 test report	101
Part 2	IEC/EN 62109-2:2011 test report	32

This test report shall be also used in conjunction with 11 pages of photo documentation and 32 pages of CDF.

Summary of testing:

All tests were carried out according to IEC 62109-2(ed.1). The text of IEC 62109-2(ed.1) was approved by CENELEC as a European Standard without any modification.

Tests performed (name of test and test clause):

Clause	Requirement
4.4.4.15	Fault-tolerance of protection for grid-interactive inverters
4.4.4.17	Cooling system failure – Blanketing test
4.7.4.2	Steady state output voltage at nominal DC input
4.7.4.3	Steady state output voltage across the DC input range
4.7.4.4	Load step response of the output voltage at nominal DC input
4.7.4.5	Steady state output frequency
4.7.5.2	Sinusoidal output voltage waveform requirements
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays
4.8.3.5	Protection by residual current monitoring

Note: If no special indicated, Model EA3.6KHD is selected as typical test sample.

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

☐ The product fulfils the requirements of _____ (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable)

Copy of marking plate:

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

See Report No.: 64.290.17.04706.01 part 1 of 2.

Test item particulars	
Equipment mobility	<input type="checkbox"/> movable <input type="checkbox"/> hand-held <input checked="" type="checkbox"/> stationary <input checked="" type="checkbox"/> fixed <input type="checkbox"/> transportable <input type="checkbox"/> for building-in
Connection to the mains	<input type="checkbox"/> pluggable equipment <input type="checkbox"/> direct plug-in <input checked="" type="checkbox"/> permanent connection <input type="checkbox"/> for building-in
Environmental category	<input type="checkbox"/> outdoor <input type="checkbox"/> indoor <input checked="" type="checkbox"/> indoor <div style="text-align: right;">Unconditional conditional</div>
Over voltage category Mains	<input type="checkbox"/> OVC I <input type="checkbox"/> OVC II <input checked="" type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
Over voltage category PV	<input type="checkbox"/> OVC I <input checked="" type="checkbox"/> OVC II <input type="checkbox"/> OVC III <input type="checkbox"/> OVC IV
Mains supply tolerance (%)	+/- 10%
Tested for power systems	TN or TT system
IT testing, phase-phase voltage (V)	N/A
Class of equipment	<input checked="" type="checkbox"/> Class I <input type="checkbox"/> Class II <input type="checkbox"/> Class III <input type="checkbox"/> Not classified
Mass of equipment (kg)	Net weight: 14.4 kg (Approx.)
Dimensions (Width x High x Depth mm)	360*405*150
Pollution degree	PD II
IP protection class	IP 20 (indoor use only)
Testing	
Date of receipt of test item	11 August 2017
Date (s) of performance of tests	22 September 2017 – 30 November 2017
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)
General remarks: "(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. The tests result presented in this report relate only to the object tested. This report shall not be reproduced except in full without the written approval of the testing laboratory. List of test equipment must be kept on file and available for review. Additional test data and/or information provided in the attachments to this report. Throughout this report a <input checked="" type="checkbox"/> comma / <input type="checkbox"/> point is used as the decimal separator. Abbreviations used in the report: Basic insulation (BI); Supplementary insulation (SI); Double insulation (DI); Reinforced insulation (RI); Functional insulation (FI); Single fault condition (SFC); Normal condition (NC); Supply overvoltage category (OVC); Pollution degree (PD), CDF (Data form for electrical equipment and machinery)	
Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:	

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided:	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
--	--

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

Name and address of factory (ies).....:

Factory name: EAST Group Co., Ltd.

Address: No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industry Park, 523808 DongGuan City, Guangdong Province, PEOPLE'S REPUBLIC OF CHINA

General product information:

See Report No.: 64.290.17.04706.01 part 1 of 2

Model different:

See Report No.: 64.290.17.04706.01 part 1 of 2

Electrical Ratings:

See Report No.: 64.290.17.04706.01 part 1 of 2

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		P
	a)...- The inverter ceases to operate	(see appended table) 4.4.4.15.1	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		N/A
	- not re-connect after any sequence of removing and reconnecting PV power		N/A
	- not re-connect after any sequence of removing and reconnecting AC power		N/A
	- not re-connect after any sequence of removing and reconnecting both PV and AC power		N/A
	- Indicates a fault in accordance with §13.9		N/A
4.4.4.15.2	Fault-tolerance of automatic disconnecting means		P
4.4.4.15.2.1	The means provided for automatic disconnection of a grid-interactive inverter from the mains shall:		P
	- disconnect all grounded current-carrying		P

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	conductors from the mains		
	- disconnect all ungrounded current-carrying conductors from the mains		P
	- be such that with a single fault applied to the disconnection means or to any other location in the inverter, at least basic insulation or simple separation is maintained between the PV array and the mains when the disconnecting means is intended to be in the open state.	See appended table 4.4.4.15.2 Fault-tolerance of automatic disconnecting	P
4.4.4.15.2.2	Design of insulation or separation complies with requirements of 7.3.7 of Part 1: report here Part 1 comment and verdict.		P
4.4.4.15.2.3	For non-isolated inverter, automatic checking of the isolation provided by a disconnect means after single fault.	(see appended table)	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:	Stand-alone mode was checked by the tests accordingly for model: EA3KHD	P
	- shall continue to operate normally		P
	- shall not present a risk of fire as the result of an out-of-phase transfer		P
	- shall not present a risk of shock as the result of an out-of-phase transfer		P
	- And having control preventing switching: components for malfunctioning		P
4.4.4.17	Cooling system failure – Blanketing test No hazards according to the criteria of sub-clause 4.4.3 of Part 1 shall result from blanketing the inverter. This test is not required for inverters restricted to use only in closed electrical operating areas.	See appended test table Cooling system failure – Blanketing test.	P

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	Test stop condition: time duration value or stabilized temperature		P
4.7	Electrical ratings tests		P
4.7.4	Stand-alone Inverter AC output voltage and frequency		P
4.7.4.1	General		P
4.7.4.2	Steady state output voltage at nominal DC input The steady-state AC output voltage shall not be less than 90 % or more than 110 % of the rated nominal voltage with the inverter supplied with its nominal value of DC input voltage.	(See attached table)	P
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 attached table)	P
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 attached table)	P
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 attached table)	P
4.7.5	Stand-alone inverter output voltage waveform		P
4.7.5.1	General		P
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 %.	(See attached table)	P
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/ μ s measured between the points at which the waveform has a voltage of 10 % and 90 % of the peak voltage for		N/A

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	that half-cycle.		
4.7.5.3.4	The absolute value of the peak voltage of the positive and negative half-cycles of the waveform shall not exceed 1,414 times 110 % of the RMS value of the rated nominal AC output voltage.		N/A
4.7.5.4	Information requirements for non-sinusoidal waveforms The instructions provided with a stand-alone inverter not complying with 4.7.5.2 shall include the information in 5.3.2.6.		N/A
4.7.5.5	Output voltage waveform requirements for inverters for dedicated loads. For an inverter that is intended only for use with a known dedicated load, the following requirements may be used as an alternative to the waveform requirements in 4.7.5.2 to 4.7.5.3.		N/A
	The combination of the inverter and dedicated load shall be evaluated to ensure that the output waveform does not cause any hazards in the load equipment and inverter, or cause the load equipment to fail to comply with the applicable product safety standards.		N/A
	The inverter shall be marked with symbols 9 and 15 of Table C.1 of Part 1.		N/A
	The installation instructions provided with the inverter shall include the information in 5.3.2.13.		N/A
4.8	Additional tests for grid-interactive inverters		P
4.8.1	General requirements regarding inverter isolation and array grounding		P
	- Type of Array grounding supported	Ungrounded.	P
	- Inverter isolation	Transformer-less type.	P
4.8.2	Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	Ungrounded.	P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays		P
	Inverter shall have means to measure DC insulation resistance from PV input (array) to ground before starting operation		P
	Or Inverter shall be provided with instruction in accordance with 5.3.2.11.		N/A
	Measured DC insulation resistance:		P
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value	The limit of the PV array insulation resistance:	P

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	R= $V_{max}/30mA$ under normal conditions	$V_{max} PV = 500 V_{d.c.}$ (see appended table)	
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value $R = V_{max}/30mA$ with ground fault in the PV array		P
	Isolated inverters shall indicate a fault if the insulation resistance is less than the limit value		N/A
	Isolated inverter fault indication maintained until insulation resistance has recovered to a value higher than the limit value		N/A
	Non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30:		P
	- shall indicate a fault in accordance with 13.9		P
	- shall not connect to the mains		P
4.8.2.2	Array insulation resistance detection for inverters for functionally grounded arrays		N/A
	a-1) The value of the total resistance, including the intentional resistance for array functional grounding, the expected insulation resistance of the array to ground, and the resistance of any other networks connected to ground (for example measurement networks) must not be lower than $R = (V_{MAX} PV/30 mA)$ ohms.		N/A
	a-2) The installation instructions shall include the information required in 5.3.2.12.		N/A
	b-1) As an alternative to a), or if a resistor value lower than in a) is used, the inverter shall incorporate means to detect, during operation, if the total current through the resistor and any networks (for example measurement networks) in parallel with it, exceeds the residual current values and times in Table 31		N/A
	b-2) Inverter shall either disconnect the resistor or limit the current by other means		N/A
	b-3) If the inverter is a non-isolated inverter, or has isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, it shall also disconnect from the mains.		N/A
	c) The inverter shall have means to measure the DC insulation resistance from the PV input to ground before starting operation, in accordance with 4.8.2.1.		N/A
4.8.3	Array residual current detection		P

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
4.8.3.1	General		P
4.8.3.2	30 mA touch current type test for isolated inverters	Transformer- less type	N/A
4.8.3.3	Fire hazard residual current type test for isolated inverters	Transformer- less type	N/A
4.8.3.4	Protection by application of RCD's		N/A
	- The requirement for additional protection in 4.8.3.1 can be met by provision of an RCD with a residual current setting of 30 mA, located between the inverter and the mains.		N/A
	- The selection of the RCD type to ensure compatibility with the inverter must be made according to rules for RCD selection in Part 1.		N/A
	- The RCD provided integral to the inverter, or		N/A
	- The RDC provided by the installer if details of the rating, type, and location for the RCD are given in the installation instructions per 5.3.2.9.		N/A
4.8.3.5	Protection by residual current monitoring		P
4.8.3.5.1	General		P
	Where required by Table 30, the inverter shall provide residual current monitoring that functions whenever the inverter is connected to the mains with the automatic disconnection means closed.		P
	The residual current monitoring means shall measure the total (both a.c. and d.c. components) RMS current.		P
	As indicated in Table 30 for different inverter types, array types, and inverter isolation levels, detection may be required for excessive continuous residual current, excessive sudden changes in residual current, or both, according to the following limits:		P
	a) Continuous residual current: The inverter shall disconnect within 0,3 s and indicate a fault in accordance with 13.9 if the continuous residual current exceeds:		P
	- maximum 300 mA for inverters with continuous output power rating ≤ 30 kV;		P
	- maximum 10 mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.		N/A
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		N/A
	b) Sudden changes in residual current: The inverter shall disconnect from the mains within the time		P

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	specified in Table 31		
	The inverter indicates a fault in accordance with 13.9, if a sudden increase in the RMS residual current is detected exceeding the value in the table.		P
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.		N/A
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.		P
4.8.3.5.3	Test for detection of sudden changes in residual current repeated 5 times and each of the 5 results shall not exceed the time limit indicated in for each row (30mA, 60mA and 150mA) of Table 31.		P
4.8.3.6	Systems located in closed electrical operating areas		N/A
	The protection against shock hazard is not required if the installation information provided with the inverter indicates the restriction for use in a closed electrical operating area, and		N/A
	Installation information indicates what forms of shock hazard protection are and are not provided integral to the inverter, in accordance with 5.3.2.7.		N/A
	The inverter shall be marked as in 5.2.2.6.		N/A
5	MARKING AND DOCUMENTATION		P
5.1	Marking		P
5.1.4	Equipment ratings		P
	PV input ratings:	See marking label.	P
	- V _{max} PV (absolute maximum) (d.c. V)		P
	- I _{sc} PV (absolute maximum) (d.c. A)		P
	a.c. output ratings:	See marking label.	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:	See marking label.	P
	- Voltage (nominal or range) (a.c. V)		P
	- Current (maximum continuous) (a.c. A)		P

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	- Frequency (nominal or range) (Hz)		P
	d.c. output ratings:		P
	- Voltage (nominal or range) (d.c. V)		P
	- Current (maximum continuous) (d.c. A)		P
	Protective class (I or II or III)	I	P
	Ingress protection (IP) rating per part 1	IP 20	P
	An inverter that is adjustable for more than one nominal output voltage shall be marked to indicate the particular voltage for which it is set when shipped from the factory.		N/A
5.2	Warning markings		P
5.2.2	Content for warning markings		P
5.2.2.6	Inverters for closed electrical operating areas		N/A
	Where required by 4.8.3.6, an inverter not provided with full protection against shock hazard on the PV array shall be marked with a warning that the inverter is only for use in a closed electrical operating area, and referring to the installation instructions.		N/A
5.3	Documentation		P
5.3.2	Information related to installation		P
5.3.2.1	Ratings. Subclause 5.3.2 of Part 1 requires the documentation to include ratings information for each input and output. For inverters this information shall be as in Table 33 below. Only those ratings that are applicable based on the type of inverter are required.		P
	PV input quantities :	See user manual	P
	- V _{max} PV (absolute maximum) (d.c. V)		P
	- PV input operating voltage range (d.c. V)		P
	- Maximum operating PV input current (d.c. A)		P
	- I _{sc} PV (absolute maximum) (d.c. A)		P
	- 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

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	- Power (maximum continuous) (W or VA)		P
	- Power factor range		P
	- Maximum output fault current (a.c. A, peak and duration or RMS)		P
	- Maximum output overcurrent protection (a.c. A)		P
	a.c. input quantities:		P
	- Voltage (nominal or range) (a.c. V)		P
	- Current (maximum continuous) (a.c. A)		P
	- Current (inrush) (a.c. A, peak and duration)		P
	- Frequency (nominal or range) (Hz)		P
	d.c input (other than PV) quantities:		P
	- Voltage (nominal or range) (d.c. V)		P
	- Nominal battery voltage (d.c. V)		P
	- Current (maximum continuous) (d.c. A)		P
	d.c. output quantities:		P
	- Voltage (nominal or range) (d.c. V)		P
	- Nominal battery voltage (d.c. V)		P
	- Current (maximum continuous) (d.c. A)		P
	Protective class (I or II or III)		P
	Ingress protection (IP) rating per part 1		P
5.3.2.2	Grid-interactive inverter setpoints	Non-adjustable to operator, setted by manufacture before shipment	N/A
	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:		N/A
	The setting of field adjustable setpoints shall be accessible rom the PCE		N/A
5.3.2.3	Transformers and isolation	Transformer-less	N/A

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	whether an internal isolation transformer is provided, and if so, what level of insulation (functional, basic, reinforced, or double) is provided by that transformer. The instructions shall also indicate what the resulting installation requirements are regarding such things as earthing or not earthing the array, providing external residual current detection devices, etc.		N/A
	An inverter shall be provided with information to the installer regarding:		P
	- providing of internal isolation transformer		N/A
	- the level of insulation (functional, basic, reinforced, or double)		N/A
	The instructions shall also indicate what the resulting installation requirements are regarding:		N/A
	- earthing or not earthing the array	Not earthing	P
	- providing external residual current detection devices		N/A
	- requiring an external isolation transformer,		N/A
5.3.2.4	Transformers required but not provided		N/A
	An inverter that requires an external isolation transformer not provided with the unit, shall be provided with instructions that specify, and for the external isolation transformer with which it is intended to be used:		N/A
	- the configuration type		N/A
	- electrical ratings		N/A
	- environmental ratings		N/A
5.3.2.5	PV modules for non-isolated inverters		P
	Non-isolated inverters shall be provided with installation instructions that require PV modules that have an IEC 61730 Class A rating		P
	If the maximum AC mains operating voltage is higher than the PV array maximum system voltage then the instructions shall require PV modules that have a maximum system voltage rating based upon the AC mains voltage.		N/A
5.3.2.6	Non-sinusoidal output waveform information		N/A
	The instruction manual for a stand-alone inverter not complying with 4.7.5.2 shall include a warning that:		N/A
	- the waveform is not sinusoidal,		N/A
	- some loads may experience increased heating,		N/A

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	- 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		P
	Where required by 7.3.10, the documentation for an inverter shall include the following:		P
	- 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;		P
	- 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

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	Where the requirement for additional protection in 4.8.3.1 is met by requiring an RCD that is not provided integral to the inverter, as allowed by 4.8.3.4, the installation instructions shall state the need for the RCD,.		N/A
	and shall specify its rating, type, and required circuit location		N/A
5.3.2.10	Remote indication of faults		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.		P
5.3.2.11	External array insulation resistance measurement and response		N/A
	The installation instructions for an inverter for use with ungrounded arrays that does not incorporate all the aspects of the insulation resistance measurement and response requirements in 4.8.2.1, must include:		N/A
	- for isolated inverters: an explanation of what aspects of array insulation resistance measurement and response are not provided, and		N/A
	- an instruction to consult local regulations to determine if any additional functions are required or not;		N/A
	- for non-isolated inverters: an explanation of what external equipment must be provided in the system, and		N/A
	- what the setpoints and response implemented by that equipment must be, and:		N/A
	- how that equipment is to be interfaced with the rest of the system.		N/A
5.3.2.12	Array functional grounding information		N/A
	Where approach a) of 4.8.2.2 is used, the installation instructions for the inverter shall include all of the following:		N/A
	a) the value of the total resistance between the PV circuit and ground integral to the inverter		N/A
	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

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	c) the minimum value of the total resistance $R = V_{MAX} / 30 \text{ mA}$ that the system must meet, with an explanation of how to calculate the total		N/A
	d) a warning that there is a risk of shock hazard if the total minimum resistance requirement is not met.		N/A
5.3.2.13	Stand-alone inverters for dedicated loads		N/A
	Where the approach of 4.7.5.5 is used, the installation instructions for the inverter shall include a warning that the inverter is only to be used with the dedicated load for which it was evaluated, and		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.		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.....	The firmware version can be identified on the display panel.	P
7	Protection against electric shock and energy hazards		P
7.3	Protection against electric shock		P
7.3.10	Additional requirements for stand-alone inverters		P
	One circuit conductor bonded to earth to create a grounded conductor and an earthed system.		P
	The means used to bond the grounded conductor to protective earth provided within the inverter or		P
	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,		P
	If the bond can only ever carry fault currents in stand-alone mode, the maximum current for the bond is determined by the inverter maximum output fault current.		P

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	Output circuit bonding arrangements shall ensure that in any mode of operation, the system only has the grounded circuit conductor bonded to earth in one place at a time..		P
	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.		P
	Outputs that are intentionally floating with no circuit conductor bonded to ground, must not have any voltages with respect to ground that are a shock hazard in accordance with Clause 7 of Parts 1 and 2.		N/A
	The documentation for the inverter shall indicate that the output is floating as per 5.3.2.8.		P
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.....		P
	This inverter backfeed current value shall be provided in the installation instructions regardless of the value of the current, in accordance with Table 33.		P
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

IEC 62109-2			
Clause	Requirement – Test	Result – Remark	Verdict
	a) a visible or audible indication, integral to the inverter, and detectable from outside the inverter, and		P
	b) an electrical or electronic indication that can be remotely accessed and used.		P
	The installation instructions shall include information regarding how to properly make connections (where applicable) and use the electrical or electronic means in b) above, in accordance with 5.3.2.10.		P

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

4.4.4	TABLE: Single fault condition to be applied					P
	Ambient temperature (°C)	25 °C				—
	Power source for EUT: Manufacturer, model/type, output rating	--				—
4.4.4.15.1	Fault-tolerance of residual current monitoring					
Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
U25 (pin 1 – pin 4)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "TIPS DSP COM FAIL". No output. The IGBT Q3, Q4 was damage. No hazard.
J6 (pin 1 – pin 7)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit operating as normal. Can not restart, the red LED flashes and LCD displays alarmed "ISO FAULT". No output. No hazard. No damage. Can resettable.
J6 (pin 17 – pin 18)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed "INV OVER CURR HARD". No output. No hazard. No damage. Can resettable.

IEC 62109-2						
Clause	Requirement – Test			Result – Remark		Verdict
CT4 (pin 4 – pin 5)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays alarmed “INV LEAKAGE OVER LEVEL”. No output. No hazard. No damage. Can resettable.
R167	Open circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit operating as normal. Can not restart and LCD displays alarmed “INV LEAKAGE OVER LEVE”. No output. No hazard. No damage. Can resettable.
U10 (pin 2 – pin 3)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays alarmed “BOOST OVER CURR HARD”. No output. No hazard. No damage. Can resettable.
U1 (pin 5 – pin 7)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately, the red LED flashes and LCD displays alarmed “INV LEAKAGE OVER LEVEL”. No output. No hazard. No damage. Can resettable.

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

CT3 (pin 1 – pin 2)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays alarmed “INV OVER CURR HARD”. No output. No hazard. No damage. Can resettable.
CT1 (pin 8 – pin 9)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays alarmed “INV OVER CURR HARD”. No output. No hazard. No damage. Can resettable.
T1 (pin 11 after D12 -GND)	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit shut down immediately and LCD displays can not work normally. No output. No hazard. No damage. Can resettable.
Supplementary information:						

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

4.4.4	TABLE: Single fault condition to be applied					P
	Ambient temperature (°C)	25 °C				—
	Power source for EUT: Manufacturer, model/type, output rating	--				—
4.4.4.15.2	Fault-tolerance of automatic disconnecting means					
Component No.	Fault	Grid voltage (V)	Test time	Fuse #	Fuse current (A)	Observation
RLY5	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit operating as normal. Can not restart, the red LED flashes and LCD displays alarmed "GLID RELAY FAULT". No output. No hazard. No damage. Can resettable.
RLY6	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	Same as above
RLY7	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	The fault applied during the unit operation, after applied the fault, the unit operating as normal. Can not restart and LCD displays alarmed "INV RELAY FAULT". No output. No hazard. No damage. Can resettable.
RLY8	Short circuit	PV: 330 Vd.c. AC: 230 Va.c.	5min	--	--	Same as above
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: The investor can disconnect from grid during a relay occurred a single failure.						

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

4.4.4.17	Cooling system failure – Blanketing test		P
	Test voltage (Vd.c.)	360 Vd.c.	—
	Test current (Id.c.)	12.4 Ad.c.	—
	Test voltage (Va.c.)	230 Va.c.	—
	Test current (Ia.c.)	15.6 Aa.c.	—
	t _{amb1} (°C)	24.6 °C	—
	t _{amb2} (°C)	26.2 °C	—
	Test duration.....	7 hours	
maximum temperature T of part/at::		T (°C)	T _{max} (°C)
Enclosure outer surface, rear		45.5	90
Enclosure outer surface, front		44.9	90
Enclosure outer surface, left side		47.3	90
Mounting surfaces		53.2	90
Supplementary information:			
Operation mode: PV supply to grid and battery (4.5kw), during the test, no hazard.			

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

4.7.4.2#1	Steady state output voltage at nominal DC input							P
Model	EA3.6KHD							
PV terminal			Battery Terminal			AC Load output terminal		
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)
360.5	0.5	180.3	--	--	--	230.1	0.3	69.0
360.5	6.1	2199.1	--	--	--	230.1	8.9	2047.9
Supplementary information: PV supply to AC load output								

4.7.4.2#2	Steady state output voltage at nominal DC input							P
Model	EA3.6KHD							
PV terminal			Battery Terminal			AC Load output terminal		
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)
--	--	--	51.5	1.4	72.1	229.2	0.3	68.8
--	--	--	50.4	43.8	2207.5	230.4	8.9	2050.6
Supplementary information: Battery supply to AC load output								

4.7.4.3#1	Steady state output voltage across the DC input range							P
Model	EA3.6KHD							
PV terminal			Battery Terminal			AC Load output terminal		
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)
249.9	0.7	174.9	--	--	--	229.7	0.3	68.9
249.7	9.0	2247.3	--	--	--	230.2	9.1	2094.8
450.9	0.1	45.1	--	--	--	230.9	0.3	69.3
450.7	4.8	2163.4	--	--	--	229.9	8.8	2023.1
Supplementary information: PV supply to AC load output								

4.7.4.3#2	Steady state output voltage across the DC input range							P
Model	EA3.6KHD							
PV terminal			Battery Terminal			AC Load output terminal		
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)
--	--	--	46.4	1.5	69.6	230.2	0.3	69.1
--	--	--	45.2	49.2	2223.8	230.2	8.9	2048.8
--	--	--	57.7	1.6	92.3	229.8	0.3	68.9
--	--	--	56.8	39.2	2226.6	229.7	8.9	2044.3
Supplementary information: Battery supply to AC load output								

4.7.4.4#1	Load step response of the output voltage at nominal DC input							P
Model	EA3.6KHD							
PV terminal			Battery Terminal			AC load output terminal		

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

U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)
360.0	0.2	72.0	--	--	--	230.3	0.3	69.1
360.0	6.2	2232.0	--	--	--	230	9	2070.0
360.0	0.2	72.0	--	--	--	229.6	0.3	68.9

Supplementary information: PV supply to AC load output

4.7.4.4#2	Load step response of the output voltage at nominal DC input							P
Model	EA3.6KHD							
PV terminal			Battery Terminal			AC load output terminal		
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)
--	--	--	51.6	1.4	72.2	229.3	0.3	68.8
--	--	--	50.6	44.2	2236.5	230	8.9	2047.0
--	--	--	51.6	1.5	77.4	229.1	0.3	68.7

Supplementary information: Battery supply to AC load output

4.7.4.5#1	Steady state output frequency								P
Model	EA3.6KHD								
PV terminal			Battery Terminal			AC Load output terminal			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	F (Hz)
358.0	0.5	179.0	--	--	--	230.1	0.1	23.0	50.01
359.0	6.1	2189.9	--	--	--	230.8	8.7	2008.0	50.01
359.0	0.5	179.5	--	--	--	230.3	0.1	23.0	50.00
250.0	0.7	175.0	--	--	--	230.5	0.1	23.1	49.99
250.0	8.9	2225.0	--	--	--	231.2	8.8	2034.6	50.00
250.0	0.2	50.0	--	--	--	229.5	0.1	23.0	50.00
450.0	0.2	90.0	--	--	--	231.3	0.1	23.1	50.00
450.0	4.9	2205.0	--	--	--	231.1	8.8	2033.7	50.00
450.0	0.1	45.0	--	--	--	229.3	0.1	22.9	50.00

Supplementary information: PV supply to AC load output

4.7.4.5#2	Steady state output frequency								P
Model	EA3.6KHD								
PV terminal			Battery Terminal			AC Load output terminal			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	F (Hz)
--	--	--	51.6	0.5	25.8	230.7	0.2	46.1	50.00
--	--	--	49.7	45.1	2241.5	231.7	8.9	2062.1	50.00
--	--	--	51.6	0.5	25.8	230.7	0.2	46.1	50.00
--	--	--	46.4	0.4	18.6	230.5	0.2	46.1	50.01
--	--	--	44.4	50.2	2228.9	230.7	8.9	2053.2	50.00
--	--	--	46.5	0.4	18.6	229.8	0.2	46.0	50.00
--	--	--	57.6	0.6	34.6	230.4	0.2	46.1	50.01
--	--	--	55.9	39.1	2185.7	231.2	8.8	2034.6	50.00
--	--	--	57.6	0.6	34.6	230.4	0.2	46.1	50.01

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

Supplementary information: Battery supply to AC load output

4.7.5.2	Sinusoidal output voltage waveform requirements			P
Model	EA3.6KHD			
Harmonic. Nr.(U)	P/ P _{rated} : % of rated output power			Limits (% of Fundamental)
	5%	50%	100%	
2	0.027%	0.017%	0.026%	6%
3	0.389%	0.256%	0.164%	6%
4	0.008%	0.007%	0.006%	6%
5	0.145%	0.140%	0.226%	6%
6	0.005%	0.016%	0.014%	6%
7	0.053%	0.212%	0.215%	6%
8	0.003%	0.019%	0.010%	6%
9	0.023%	0.092%	0.200%	6%
10	0.002%	0.012%	0.008%	6%
11	0.008%	0.084%	0.174%	6%
12	0.002%	0.003%	0.005%	6%
13	0.006%	0.179%	0.134%	6%
14	0.002%	0.015%	0.006%	6%
15	0.003%	0.148%	0.089%	6%
16	0.003%	0.018%	0.010%	6%
17	0.007%	0.035%	0.069%	6%
18	0.002%	0.009%	0.011%	6%
19	0.004%	0.157%	0.104%	6%
20	0.003%	0.008%	0.013%	6%
21	0.004%	0.244%	0.150%	6%
22	0.005%	0.022%	0.011%	6%
23	0.004%	0.197%	0.177%	6%
24	0.016%	0.029%	0.018%	6%
25	0.007%	0.041%	0.169%	6%
26	0.007%	0.009%	0.009%	6%
27	0.008%	0.228%	0.122%	6%
28	0.008%	0.018%	0.015%	6%
29	0.010%	0.348%	0.047%	6%
30	0.007%	0.029%	0.017%	6%

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

31	0.006%	0.203%	0.047%	6%
32	0.005%	0.015%	0.016%	6%
33	0.005%	0.049%	0.098%	6%
34	0.003%	0.003%	0.012%	6%
35	0.003%	0.076%	0.112%	6%
36	0.002%	0.005%	0.006%	6%
37	0.002%	0.075%	0.103%	6%
38	0.002%	0.004%	0.003%	6%
39	0.002%	0.053%	0.074%	6%
40	0.002%	0.002%	0.004%	6%
THD (2-40)	0.421%	0.749%	0.616%	10%

Supplementary information: PV supply to AC load output

4.7.5.2	Sinusoidal output voltage waveform requirements			P
Model	EA3.6KHD			
Harmonic. Nr.(U)	P/ P _{rated} : % of rated output power			Limits (% of Fundamental)
	5%	50%	100%	
2	0.087%	0.020%	0.026%	6%
3	0.610%	0.342%	0.171%	6%
4	0.032%	0.002%	0.014%	6%
5	0.265%	0.010%	0.280%	6%
6	0.020%	0.018%	0.009%	6%
7	0.107%	0.140%	0.276%	6%
8	0.008%	0.025%	0.004%	6%
9	0.043%	0.121%	0.254%	6%
10	0.006%	0.023%	0.007%	6%
11	0.017%	0.035%	0.213%	6%
12	0.005%	0.007%	0.012%	6%
13	0.011%	0.056%	0.149%	6%
14	0.002%	0.012%	0.018%	6%
15	0.003%	0.090%	0.086%	6%
16	0.003%	0.025%	0.021%	6%
17	0.006%	0.061%	0.091%	6%
18	0.002%	0.023%	0.021%	6%
19	0.004%	0.039%	0.154%	6%

IEC 62109-2				
Clause	Requirement – Test		Result – Remark	Verdict
20	0.003%	0.010%	0.017%	6%
21	0.003%	0.107%	0.209%	6%
22	0.005%	0.015%	0.013%	6%
23	0.004%	0.136%	0.228%	6%
24	0.016%	0.037%	0.016%	6%
25	0.006%	0.093%	0.199%	6%
26	0.006%	0.034%	0.011%	6%
27	0.008%	0.049%	0.122%	6%
28	0.006%	0.014%	0.016%	6%
29	0.008%	0.188%	0.034%	6%
30	0.005%	0.027%	0.017%	6%
31	0.005%	0.192%	0.089%	6%
32	0.003%	0.032%	0.015%	6%
33	0.003%	0.079%	0.138%	6%
34	0.002%	0.019%	0.010%	6%
35	0.002%	0.022%	0.138%	6%
36	0.002%	0.005%	0.005%	6%
37	0.003%	0.048%	0.112%	6%
38	0.001%	0.004%	0.003%	6%
39	0.002%	0.052%	0.072%	6%
40	0.002%	0.006%	0.004%	6%
THD (2-40)	0.682%	0.550%	0.758%	10%
Supplementary information: Battery supply to AC load output				

4.8.2	TABLE: Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays				P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays				P
DC Voltage below minimum operating voltage (V)	DC Voltage for inverter begin operation (V)	Resistance between ground and PV input terminal (Ω)	Required Insulation resistance $R = (V_{MAX\ PV} / 30mA)$ (Ω)	Result	
115	150	15 k	16.7 k	The unit can't operate, the red LED flashes, LCD indicate an error "ISO fault".	

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

115	150	15 k	16.7 k	The unit can't operate, the red LED flashes, LCD indicate an error "ISO fault".
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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:

1. The setting isolation resistor value is 20 kΩ.
2. All model have the same setting, EA3.6KHD is chosen for type test
3. All above tests indicate a fault in accordance with clause 13.9

4.8.3.5		TABLE: Protection by residual current monitoring							P
Test conditions:		See below							
4.8.3.5.2		Test for detection of excessive continuous residual current							P
Tracker No.	PV (+ or -)	Input (Vd.c.)	Output (Va.c., kW)	Baseline trigger current (mA)	Measured trigger time (ms), shall < 300 ms (repeat 5 times)				
1	+	360	230/3.6	298	10	17	23	21	22
1	-	360	230/3.6	295	14	16	17	16	10

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 300 ms. The test is repeated for each PV input terminal. It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Supplementary information:

4.8.3.5		TABLE: Protection by residual current monitoring							P
Test conditions:		See below							

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

4.8.3.5.3		TABLE: Test for detection of sudden changes in residual current							P
Tracker No.	PV (+ or -)	Input (Vd.c.)	Output (Va.c., kW)	Baseline trigger current (mA)	Measured trigger time (ms), shall < 300 ms for (30 mA); <150 ms for (60 mA); <40 ms for (150 mA) (repeat 5 times)				
30 mA sudden changes in residual current									
1	+	360	230/3.6	30	127	123	132	135	131
1	-	360	230/3.6	30	129	129	123	131	134
60 mA sudden changes in residual current									
1	+	360	230/3.6	60	108	107	112	112	99
1	-	360	230/3.6	60	110	103	109	115	104
150 mA sudden changes in residual current									
1	+	360	230/3.6	150	24	23	19	14	12
1	-	360	230/3.6	150	15	20	22	18	20
Note:									
The capacitive current is risen until disconnection.									
Test condition: $I_c + 30/60/150\text{mA} \leq I_{c\text{max}}$. R ₁ is set that 30/60/150mA Flow and switch S is closed.									
Supplementary information:									

.....End of test report.....