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

Report Number. ..... :	6052106.50A
Date of issue..... :	2019-08-16
Total number of pages ..... :	90
Name of Testing Laboratory preparing the Report..... :	DEKRA Testing and Certification (Suzhou) Co., Ltd.
Applicant's name..... :	EAST Group Co., Ltd.
Address..... :	No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industrial Park, Dongguan City, Guangdong Province, China
Test specification:	
Standard ..... :	IEC 62109-1:2010 (First Edition)
Test procedure ..... :	Type test
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	IEC62109_1B
Test Report Form(s) Originator.... :	VDE Testing and Certification Institute
Master TRF..... :	Dated 2016-04

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

General disclaimer:

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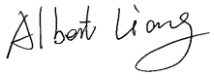
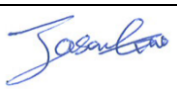
The measurement result is considered in conformance with the requirement if it is within the prescribed limit, It is not necessary to account the uncertainty associated with the measurement result.
The information provided by the customer in this report may affect the validity of the results, the test lab is not responsible for it.
This report is only for reference and is not used for legal proof function in China market.

Test item description ..... :	Grid-connected PV Inverter
Trade Mark ..... :	EAST
Manufacturer ..... :	EAST Group Co., Ltd. No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industrial Park, Dongguan City, Guangdong Province, China
Model/Type reference ..... :	EA5KTSI, EA6KTSI, EA8KTSI, EA10KTSI, EA13KTSI, EA16KTSI
Ratings ..... :	EA5KTSI: PV input: Max. 1000 Vdc, MPPT voltage range: 120-950 Vdc, max 11A /11 A, Isc PV: 12 A/12 A Output: 230/400 Vac, 3/N/PE, 50 Hz, 5000 VA, max 7.3 A EA6KTSI: PV input: Max. 1000 Vdc, MPPT voltage range: 120-950 Vdc, max 11 A/11 A, Isc PV: 12 A/12 A Output: 230/400 Vac, 3/N/PE, 50 Hz, 6000 VA, max 8.7 A EA8KTSI: PV input: Max. 1000 Vdc, MPPT voltage range: 120-950 Vdc, max 11 A/11 A, Isc PV: 12 A/12 A Output: 230/400 Vac, 3/N/PE, 50 Hz, 8000 VA, max 11.6 A EA10KTSI: PV input: Max. 1000 Vdc, MPPT voltage range: 200-950 Vdc, max 11 A, Isc PV: 12 A/12 A Output: 230/400 Vac, 3/N/PE, 50 Hz, 10000 VA, max 14.5 A EA13KTSI: PV input: Max. 1000 Vdc, MPPT voltage range: 200-950 Vdc, max 22 A/11 A, Isc PV: 24 A/12 A Output: 230/400 Vac, 3/N/PE, 50 Hz, 13000 VA, max 18.9 A EA16KTSI: PV input: Max. 1000 Vdc, MPPT voltage range: 200-950 Vdc, max 22 A/11 A, Isc PV: 24 A/12 A Output: 230/400 Vac, 3/N/PE, 50 Hz, 16000 VA, max 23.2 A

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

☒ **Testing Laboratory:**	DEKRA Testing and Certification (Suzhou) Co., Ltd.	
Testing location/ address ..... :	No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China	
☐ ~~**Associated CB Testing Laboratory:**~~		
~~**Testing location/ address ..... :**~~		
Tested by (name, function, signature) ..... :	Albert Liang	
Approved by (name, function, signature) .. :	Jason Guo	
☐ ~~**Testing procedure: CTF Stage 1:**~~		
~~**Testing location/ address ..... :**~~		

~~Tested by (name, function, signature) ..... :~~		
~~Approved by (name, function, signature) .. :~~		
☐ ~~Testing procedure: CTF Stage 2:~~		
~~Testing location/ address ..... :~~		
~~Tested by (name + signature) ..... :~~		
~~Witnessed by (name, function, signature) . :~~		
~~Approved by (name, function, signature) .. :~~		
☐ ~~Testing procedure: CTF Stage 3:~~		
☐ ~~Testing procedure: CTF Stage 4:~~		
~~Testing location/ address ..... :~~		
~~Tested by (name, function, signature) ..... :~~		
~~Witnessed by (name, function, signature) . :~~		
~~Approved by (name, function, signature) .. :~~		
~~Supervised by (name, function, signature) :~~		

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

This test report contains 2 parts listed as below:

- 6052106.50A covering IEC/EN 62109-1:2010 and pictures (90 pages)
- 6052106.50B covering IEC/EN 62109-2:2011 (28 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Full applicable clauses test according standards: IEC/EN 62109-1:2010	DEKRA Testing and Certification (Suzhou) Co., Ltd. No. 99, Hongye Road, Suzhou Industrial Park Suzhou, 215006, P.R. China

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

N/A

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

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.

Rating label:

EAST

PV Inverter	
Model	EA5KTSI
Max.Input Voltage	1000Vd.c.
MPPT Voltage Range	120~950Vd.c.
Max.Input Current	11A/11A
Isc PV	12A/12A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Rated Output Current	7.3A
Rated Output Power	5000W
Rated Apparent Power	5000VA
Power Factor Range	0.8 cap.~0.8 ind.
Inverter topology	Non-isolated
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA5KTSI 201908290001 Protection Class I

5min

EAST

PV Inverter	
Model	EA6KTSI
Max.Input Voltage	1000Vd.c.
MPPT Voltage Range	120~950Vd.c.
Max.Input Current	11A/11A
Isc PV	12A/12A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Rated Output Current	8.7A
Rated Output Power	6000W
Rated Apparent Power	6000VA
Power Factor Range	0.8 cap.~0.8 ind.
Inverter topology	Non-isolated
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA6KTSI 201908290001 Protection Class I

5min

EAST

PV Inverter	
Model	EA8KTSI
Max.Input Voltage	1000Vd.c.
MPPT Voltage Range	120~950Vd.c.
Max.Input Current	11A/11A
Isc PV	12A/12A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Rated Output Current	11.6A
Rated Output Power	8000W
Rated Apparent Power	8000VA
Power Factor Range	0.8 cap.~0.8 ind.
Inverter topology	Non-isolated
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA8KTSI 201908290001 Protection Class I

5min

EAST

PV Inverter	
Model	EA10KTSI
Max.Input Voltage	1000Vd.c.
MPPT Voltage Range	200~950Vd.c.
Max.Input Current	11A/11A
Isc PV	12A/12A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Rated Output Current	14.5A
Rated Output Power	10000W
Rated Apparent Power	10000VA
Power Factor Range	0.8 cap.~0.8 ind.
Inverter topology	Non-isolated
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA10KTSI 201908290001 Protection Class I

5min

EAST

PV Inverter	
Model	EA13KTSI
Max.Input Voltage	1000Vd.c.
MPPT Voltage Range	200~950Vd.c.
Max.Input Current	22A/11A
Isc PV	24A/12A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Rated Output Current	18.9A
Rated Output Power	13000W
Rated Apparent Power	13000VA
Power Factor Range	0.8 cap.~0.8 ind.
Inverter topology	Non-isolated
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA13KTSI 201908290001 Protection Class I

5min

EAST

PV Inverter	
Model	EA16KTSI
Max.Input Voltage	1000Vd.c.
MPPT Voltage Range	200~950Vd.c.
Max.Input Current	22A/11A
Isc PV	24A/12A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Rated Output Current	23.2A
Rated Output Power	16000W
Rated Apparent Power	16000VA
Power Factor Range	0.8 cap.~0.8 ind.
Inverter topology	Non-isolated
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA16KTSI 201908290001 Protection Class I

5min

Remark:

According to customer's requirement, these models were evaluated under the grid frequency of 50 Hz.

DRM label:

DRM0 ✕	DRM1	DRM2
DRM3	DRM4	DRM5 ✕
DRM6 ✕	DRM7 ✕	DRM8 ✕

Test item particulars..... :	
Equipment mobility ..... :	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains ..... :	☒ pluggable equipment ☐ direct plug-in ☐ permanent connection ☐ for building-in
Environmental category ..... :	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains..... :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%) ..... :	-90 / +110 %
Tested for power systems..... :	TN
IT testing, phase-phase voltage (V)..... :	- - -
Class of equipment..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg)..... :	25
Pollution degree ..... :	Outside PD3; Inside PD2
IP protection class..... :	IP65
Possible test case verdicts:	
- test case does not apply to the test object .....:	N/A
- test object does meet the requirement .....:	P (Pass)
- test object was not evaluated for the requirement .....:	N/E
- test object does not meet the requirement .....:	F (Fail)
Testing.....:	
Date of receipt of test item .....:	2019-04-15 (samples provided by applicant)
Date (s) of performance of tests.....:	2019-04-15 to 2019-07-31

General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... :	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) ..... :	EAST Group Co., Ltd. No.6 Northern Industry Road, Songshan Lake Sci. & Tech. Industrial Park, Dongguan City, Guangdong Province, China

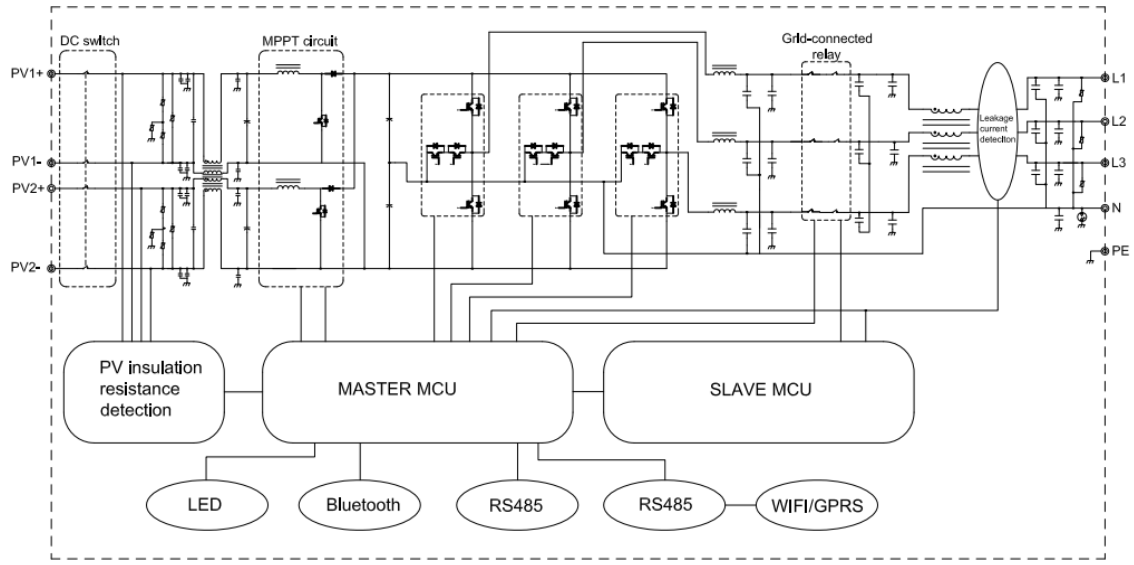
General product information:

The products are grid-connected photovoltaic inverter converts DC voltage into AC voltage, the unit is providing EMC filtering at the input and output towards mains.

The output was switched off redundant by the high power switching bridge and relay in series. This designation assures that the disconnection of the output circuit from the grid will also operate in case of one error.

The internal control is redundant built. It consists of two Microcontrollers (master DSP U1, slave DSP U22). The master DSP can control the relays; detect the PV voltage, PV current and BUS voltage, measures grid voltage, frequency, AC current with injected DC, insulation resistance to ground and residual current. The slave CPU (U22) were also detected grid voltage, injected DC current and residual current. Both microcontrollers communicate with each other. Any abnormal of those electrical parameter will trigger the disconnection of the inverter from the grid.

Block Diagram



Model difference:

1) The model EA5KTSI is identical with EA6KTSI; EA8KTSI is identical with EA10KTSI; EA13KTSI is identical with EA16KTSI in hardware and just power derating according to setting variations parameter in software.
2) The models EA5KTSI, EA6KTSI, EA8KTSI, EA10KTSI and EA13KTSI are identical with EA16KTSI in topological schematic circuit diagram of hardware except for the bus capacitors number (EA5KTSI and EA6KTSI with 2 bus capacitors, EA8KTSI and EA10KTSI with 4 bus capacitors, EA13KTSI and EA16KTSI with 6 bus capacitors); boost current sensor rating; inductive reactance of INV inductors and Boost inductors; Boost diode rating; Internal fan (Only model EA13KTSI and EA16KTSI designed with internal fan); the type designation and the input/output electrical rating.

The product was tested on:

Hardware version: 00C

Software version: HornetV008

Unless otherwise specified, all the tests were performed on model EA16KTSI and also applicable for all other models stated in this report. According to the user manual and testing, the product was evaluated for maximum ambient temperature of 60°C and will derating the output power above 45°C.

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4	**GENERAL TESTING REQUIREMENTS**		P
4.1	General		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests		P
4.2.2	Reference test conditions		P
4.2.2.1	Environmental conditions		P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment	The equipment was installed in accordance with the manufacturer's instructions.	P
4.2.2.4	Accessories	No such device.	N/A
4.2.2.5	Covers and removable parts	Covers cannot remove without using a tool.	P
4.2.2.6	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:	(see appended table 4.2.2.6)	P
4.2.2.7	Supply ports other than the mains		P
4.2.2.7.1	Photovoltaic supply sources a) Open circuit voltage: b) Short-circuit current:	(see appended table 4.2.2.7)	P
4.2.2.7.2	Battery inputs		N/A
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		P
4.2.2.11	Available short circuit current		P
4.3	Thermal testing	(see appended table 4.3)	P
4.3.1	General		P
4.3.2	Maximum temperatures		P
4.3.2.1	General		P
4.3.2.2	Touch temperatures		P
4.3.2.3	Temperature limits for mounting surfaces		P
4.4	Testing in single fault condition	(see appended table 4.4)	P
4.4.1	General		P
4.4.2	Test conditions and duration for testing under fault		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	conditions		
4.4.2.1	General		P
4.4.2.2	Duration of tests		P
4.4.3	Pass/fail criteria for testing under fault conditions		P
4.4.3.1	Protection against shock hazard		P
4.4.3.2	Protection against the spread of fire		P
4.4.3.3	Protection against other hazards		P
4.4.3.4	Protection against parts expulsion hazards		P
4.4.4	Single fault conditions to be applied		P
4.4.4.1	Component fault tests		P
4.4.4.2	Equipment or parts for short-term or intermittent operation	Continuous operation equipment.	N/A
4.4.4.3	Motors	Model EA13KTSI and EA16KTSI designed with internal fan.	P
4.4.4.4	Transformer short circuit tests		P
4.4.4.5	Output short circuit		P
4.4.4.6	Backfeed current test for equipment with more than one source of supply		P
4.4.4.7	Output overload		P
4.4.4.8	Cooling system failure		P
4.4.4.9	Heating devices	No such device.	N/A
4.4.4.10	Safety interlock systems	No such device.	N/A
4.4.4.11	Reverse d.c. connections		P
4.4.4.12	Voltage selector mismatch	No such device.	N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity		P
4.4.4.14	Printed wiring board short-circuit test	Measured function insulation spacings on PWB are more than those specified in Table 7 and Table 8 of clause 7.3.7.7	N/A
4.5	Humidity preconditioning	(see appended table 7.5)	P
4.5.1	General		P
4.5.2	Conditions		P
4.6	Backfeed voltage protection	No hazardous voltage and energy was present on the terminals, with the PV supply de-energized or disconnected.	P
4.6.1	Backfeed tests under normal conditions		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.6.2	Backfeed tests under single-fault conditions		P
4.6.3	Compliance with backfeed tests		P
4.7	Electrical ratings tests	(see appended table 4.2.2.6)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P
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	The marking plate is on the outer surface of enclosure.	P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.	The used graphic symbols are in accordance with Annex C.	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	After this test, the marking remain clear and legible, there was no curling or lifting on the label.	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	The trade mark is provided on the marking plate.	P
	b) model number, name or other means to identify the equipment	The model name is provided on the marking plate.	P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.	The serial number is provided on the marking plate.	P
5.1.4	Equipment ratings		P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	Refer to IEC 62109-2:2011 test report no. 6052106.50B.	P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	Provided on the marking plate	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c.	Provided on the marking plate	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	outputs, either the power or power factor for each output		
	– the ingress protection (IP) rating as in 6.3 below	Provided on the marking plate	P
5.1.5	Fuse identification		N/A
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.	No such device.	N/A
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated	No such fuse.	N/A
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.		N/A
5.1.6	Terminals, Connections, and Controls		P
	If necessary for safety, an indication shall be given of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.	The indications were provided adjacent to PV and AC terminal.	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 such device.	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other non-permanent material.	No such device.	N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:		P
	– the sign “+” for positive and “-” for negative; or	The “+” and “-” marking were provided adjacent to the PV input terminal.	P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation		N/A
5.1.6.1	Protective Conductor Terminals		P
	The means of connection for the protective earthing		P

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Clause	Requirement – Test	Result – Remark	Verdict
	conductor shall be marked with:		
	– symbol 7 of Annex C; or	Provided.	P
	– the letters “PE”; or		N/A
	– the colour coding green-yellow.	Green-yellow wire was used as protective bonding.	N/A
5.1.7	Switches and circuit-breakers		P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.	The letter “ON” and “OFF” is clearly marked.	P
5.1.8	Class II Equipment	Class I equipment.	N/A
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections	No such parts	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
	– the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	– a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A
5.2	Warning markings		P
5.2.1	Visibility and legibility requirements for warning markings		P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2.75 mm high	The symbols were more than 2.75 mm high.	P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the background	The symbols were more than 1.5 mm high.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– 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.	The symbols and text were printed on the marking plate.	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		P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heat sinks and similar parts		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 heat sink and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heat sink exists.	The symbol 13 of Annex C was provided on marking plate.	P
5.2.2.2	Hot Surfaces		P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.	The symbol 14 of Annex C was provided on marking plate.	P
5.2.2.3	Coolant	No coolant 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
	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.		P
5.2.2.5	Motor guarding		N/A
	Where required by 8.2 a marking shall be provided	No such devices which can	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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).	conduct injury to service personal.	
5.2.3	Sonic hazard markings and instructions	No such 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		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.		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		P
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.	The symbol 15 of Annex C was provided on marking plate and installation manual.	P
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:	All related required information was provided in the user's manual.	P
	a) explanations of equipment makings, including symbols used	See the user manual.	P
	b) location and function of terminals and controls	See the user manual.	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	See the user manual.	P

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	resulting installation requirements:		
	– ENVIRONMENTAL CATEGORY as per 6.1	The PCE is intended for outdoor use, the specifications were provided in the instruction manual	P
	– WET LOCATIONS classification fort he intended external environment as per 6.1		P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2	Pollution degree 3 for external environment, pollution degree 2 for internal environment by the use of IP65 enclosure.	P
	– INGRESS PROTECTION rating as per 6.3	IP65	P
	– Ambient temperature and relative humidity ratings	-20 to +60 °C, 4% to 100%RH, condensation	P
	– MAXIMUM altitude rating	Max altitude: 2000m	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 for PV input; OVC III for MAINS.	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE	See the user manual.	P
5.3.1.1	Language		P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.	In English, the user manual will be translated into the language that is acceptable in the country where the equipment is to be installed.	P
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	The user manual is printed and delivered with the PV inverter.	P
	For equipment which requires the use of a computer for both installation and operation, documentation may be provided in electronic format without accompanying printed format.		N/A
5.3.2	Information related to installation		P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	a) assembly, location, and mounting requirements:	See the user manual.	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;	See the user manual.	P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and externals controls, colour coding of leads, or overcurrent protection needed;	See the user manual.	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)	See the user manual.	P
	e) ventilation requirements;	See the user manual.	P
	f) requirements for special services, for example cooling liquid;	No cooling liquid used	P
	g) instructions and information relating to sound pressure level if required by 10.2.1;	No hazardous sound level	P
	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 used in the PCE.	N/A
	i) tightening torque to be applied to wiring terminals;		P
	j) values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceed the max. rated current of the circuit, as per 4.4.4.6;	See the user manual.	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	See the user manual.	P
	l) compatibility with RCD and RCM;		P
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:		P
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		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	See the user manual.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.“		
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	The PEC was not intended to charge battery.	N/A
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.	See the user manual.	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	See the user manual.	P
	Maintenance instructions shall include the following:		P
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		P
	– Part numbers and instructions for obtaining any required operator replaceable parts;		P
	– Instructions for safe cleaning (if recommended)		P
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the		P

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Clause	Requirement – Test	Result – Remark	Verdict
	equipment.		
5.3.4.1	Battery maintenance	Without integrated battery	N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		N/A
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		P
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below	See below	P
	– Suitability for WET LOCATIONS or not	See below	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– POLLUTION DEGREE rating in 6.2 below	See below	P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	See below	P
	– Ultraviolet (UV) exposure rating, as in 6.4 below	See below	P
	– Ambient temperature and relative humidity ratings, as in 6.5 below	See below	P
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor		P
6.1.2	Indoor, unconditioned	Outdoor used.	N/A
6.1.3	Indoor, conditioned	Outdoor used.	N/A
6.2	Pollution degree	Pollution degree 3 for external environment, pollution degree 2 for internal environment by the use of IP 65 enclosure.	P
6.3	Ingress Protection	IP65	P
6.4	UV exposure	Metal enclosure	P
6.5	Temperature and humidity	-25 to +60 °C, 0 to 100%RH	P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		P
7.1	General		P
7.2	Fault conditions		P
7.3	Protection against electric shock		P
7.3.1	General		P
7.3.2	Decisive voltage classification	Accessible circuit: DVC-A; PV circuit: DVC-C; AC MAINS: DVC-C	P
7.3.2.1	Use of decisive voltage class (DVC)		P
7.3.2.2	Limits of DVC (according table 6)		P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions		P
7.3.2.4	Requirements for protection (according table 7)		P
7.3.2.5	Connection to PELV and SELV circuits	Communication port is considered as DVC A part.	P
7.3.2.6	Working voltage and DVC		P
7.3.2.6.1	General		P
7.3.2.6.2	AC working voltage (see Figure 2)		P
7.3.2.6.3	DC working voltage (see Figure 3)		P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		P
7.3.3	protective separation		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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	All accessible metal parts were earthed and separated from live parts by basic insulation.	P
	▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or	The PV / bus / grid voltage sample circuit was used protective impedance.	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
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).		P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.		N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.		N/A
7.3.4.2	Protection by means of enclosures and barriers		P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.		P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).		P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Communication port considers as DVC A part.	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts		N/A
	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,	There was no opening in enclosure, the DVC C circuit is separated from the accessible part by reinforce insulation	P
7.3.4.2.3	Access probe tests		P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and		P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuseholders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavourable position.	No opening of PCE and the cover only can be removed with tool by trained personnel	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.		P
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of 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	There was no opening on the top surfaces.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	repeated except that the finger is applied using any necessary force up to 30 N.		
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±5 ° only.	There was no opening on the top surfaces.	N/A
7.3.4.2.4	Service access areas		P
7.3.4.3	Protection by means of insulation of live parts		P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		P
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		P
7.3.5	Protection in case of direct contact		P
7.3.5.1	General		P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:		P
	– is of decisive voltage class A and complies with 7.3.5.2, or		P
	– is provided with protective impedance according to 7.3.5.3, or	The PV / bus / grid voltage sample circuit was used protective impedance.	P
	– is limited in voltage according to 7.3.5.4	No such parts	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.		N/A
	Conformity is checked by visual inspection and trial insertion.		N/A
7.3.5.2	Protection using decisive voltage class A	Communication port is considered as DVC A part.	P
7.3.5.3	Protection by means of protective impedance		P

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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	The PV / bus / grid voltage sample circuit was used 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.	The measured current through protective impedance to earth 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		N/A
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		N/A
7.3.5.4	Protection by means of limited voltages	No such parts.	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)	The part of earth metal enclosure complied with protective class I.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	Defined as protective class I	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.		N/A
	That part of PCE which meets the requirements of decisive voltage class A and in which no hazardous voltages are derived, is defined as protective class III. No shock hazard is present in such circuits.		P
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.		N/A
7.3.6.2	Insulation between live parts and accessible conductive parts		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	The clearances specified in 7.3.7.4 and creepages specified in 7.3.7.5 are complied.	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:	Protective earthing is provided and the accessible conductive parts are earthed	P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or		P
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.		P
7.3.6.3.2	Requirements for protective bonding		P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:		P
	a) through direct metallic contact;		P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		P
	c) through a dedicated protective bonding conductor;		P
	d) through other metallic components of the PCE		P
	Where direct metallic contact is used and one or		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
	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.		P
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.		N/A
7.3.6.3.3	Rating of protective bonding		P
	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.	See appended table	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.		N/A
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		P
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A

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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;		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.	Overcurrent device is not part of the PCE.	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.		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 cab le is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		N/A
7.3.6.3.3.1	Test current, duration, and acceptance criteria		P
	The test current, duration of the test and acceptance criteria are as follows:	(see appended table 7.3.6.3.3)	P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0.1 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	See appended table.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	end of the test, shall not exceed 2.5 V.		
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		P
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		P
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic,. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)		P
	If the continuity of the protective bonding is achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:		P
	▪ 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:		P
	▪ the test duration may be reduced to no less than 2 s		P
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0.1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2.5 V divided by the test current required by 7.3.6.3.3.1b).		P
7.3.6.3.5	External protective earthing conductor		P
	A protective earthing conductor shall be connected at all times when power is supplied to PCE of protective class I. Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		P
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		P
	▪ 2.5 mm² if mechanical protection is provided;		P
	▪ 4 mm² if mechanical protection is not provided.		P
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.		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.		P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		P
	• the colour coding green-yellow		N/A
	Marking shall not be done on easily changeable parts such as screws.		P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		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 10 mA d.c.	Pluggable B equipment.	N/A
	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3.5 mA a.c. or 10 mA d.c.	The measured touch current did not exceeds 3.5 mA ac. or 10 mA dc.	P
	a) Permanently connected wiring, and:		N/A
	• a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or		N/A
	• automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or		N/A
	• provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2.5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		P
	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.	In addition, the caution symbol 15 of Annex C was provided on label and user manual.	P
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Class I equipment	N/A
	Equipment or parts of equipment designed for protective class II shall have insulation between live		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		
	• 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
	• metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	• equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	• equipment employing protective class II shall be marked according to 5.1.8.		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
	• pollution degree	Pollution degree 3 for external environment, pollution degree 2 for internal environment by the use of IP 65 enclosure.	P
	• overvoltage category	PV: OVC II; Mains: OVC III.	P
	• supply earthing system	TN system	P
	• insulation voltage	See table clearance and	P

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Clause	Requirement – Test	Result – Remark	Verdict
		creepage distance measurements.	
	• location of insulation		P
	• type of insulation	Reinforce insulation between DVC C circuit and DVC A circuit.	P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.	See table clearance and creepage distance measurements.	P
7.3.7.1.3	Supply earthing systems		P
	Three basic types of earthing system are described in IEC 60364-1. They are:		P
	• TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor.		P
	• TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system;		P
	• IT system: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system.		P
7.3.7.1.4	Insulation voltages		P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstands voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General	Considered.	P
7.3.7.2.2	Circuits connected directly to the mains	For circuits direct connected to the mains the working voltage was used.	P
7.3.7.2.3	Circuits other than mains circuits	For PV circuits the PV open circuit voltage was used.	P
7.3.7.2.4	Insulation between circuits	Considered.	P
7.3.7.3	Functional insulating		P
7.3.7.4	Clearance distances	(see appended table 7.3.7)	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.4.1	Determination		P
7.3.7.4.2	Electric field homogeneity		P
7.3.7.4.3	Clearance to conductive enclosures		P
7.3.7.5	Creepage distances	(see appended table 7.3.7)	P
7.3.7.5.1	General		P
7.3.7.5.2	Voltage		P
7.3.7.5.3	Materials		P
7.3.7.6	Coating	Coating materials not provided.	N/A
7.3.7.7	PWB spacings for functional insulating	The spacings were complying with 7.3.7.4 and 7.3.7.5.	N/A
7.3.7.8	Solid insulating	(see appended table 7.3.7)	P
7.3.7.8.1	General		P
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation		P
7.3.7.8.2.1	Basic, supplemental, reinforced, and double insulation		P
7.3.7.8.2.2	Functional insulation		P
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General		P
7.3.7.8.3.2	Material thickness not less than 0.2 mm	Bobbin used in transformer.	P
7.3.7.8.3.3	Material thickness less than 0.2 mm	Insulation tape used in transformer.	P
7.3.7.8.3.4	Compliance		P
7.3.7.8.4	Printed wiring boards		P
7.3.7.8.4.1	General		P
7.3.7.8.4.2	Use of coating materials	Coating materials not provided	N/A
7.3.7.8.5	Wound components		P
7.3.7.8.6	Potting materials		N/A
7.3.7.9	Insulation requirements above 30 kHz		N/A
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility		P
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.		P
7.3.9	Capacitor discharge		P
7.3.9.1	Operator access area		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.	No such operator area can access without the use of a tool.	P
7.3.9.2	Service access areas		P
	Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from charge stored on capacitors after disconnection of the PCE.	The warning symbol 21 of Table C.1 and an indication of the discharge time provided in the label.	P
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level		P
	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0.5\ CU^2$		P
7.4.2	Operator Access Areas		P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.	All hazardous energy parts were enclosed within earthed metal enclosure.	P
7.4.3	Services Access Areas		P
7.5	Electrical tests related to shock hazard	(see appended table 7.5)	P
7.5.1	Impulse voltage test (type test)	The impulse voltage test is performed with a voltage having a 1,2/50 µs waveform. (see appended table 7.5)	P
7.5.2	Voltage test (dielectric strength test)		P
7.5.2.1	Purpose of test	Considered.	P
7.5.2.2	Value and type of test voltage	(see appended table 7.5)	P
7.5.2.3	Humidity pre-conditioning	Considered.	P
7.5.2.4	Performing the voltage test		P
7.5.2.5	Duration of the a.c. or d.c. voltage test	The duration of the test at least 60 s for the type test and 1 s for the routine test.	P
7.5.2.6	Verification of the a.c. or d.c. voltage test		P
7.5.3	Partial discharge test	No double and reinforced insulation also have the recurring peak working voltage across the insulation	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
		is greater than 700 V and the voltage stress on the insulation is greater than 1 kV/mm.	
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	(see appended table 7.3.6.3.7)	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.5	Equipment with multiple sources of supply		P
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.		P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		P
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.		P
8.2.1	Protection of service persons		P
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.		P
8.3	Stability		N/A
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	The PCE is wall mounted equipment.	N/A
8.4	Provisions for lifting and carrying		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		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.	The mounted bracket withstands the force of four times the weight of the PCE	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.		P
9.1.1	Reducing the risk of ignition and spread of flame		P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.		P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.	Metal enclosure	P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;		P
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and		P
	– insulated wiring, except as permitted in 9.1.2.2.		P
9.1.2.2	Parts not requiring a fire enclosure	Communication interface supplied by limited power source.	P
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures	Metal enclosure.	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.		P
9.1.3.3	Materials for components and other parts outside fire enclosures		P
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.	Approved connector.	P
9.1.3.4	Materials for components and other parts inside fire enclosures	Inside fire enclosures, materials for components and other parts meet the flammability requirements of a relevant IEC component standard which includes such	P

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Clause	Requirement – Test	Result – Remark	Verdict
		requirements.	
9.1.3.5	Materials for air filter assemblies	No air filter	N/A
9.1.4	Openings in fire enclosures	No opening in fire enclosure	N/A
9.1.4.1	General		N/A
	For equipment that is intended to be used or installed in more than one orientation as specified in the product documentation, the following requirements apply in each orientation.		N/A
	These requirements are in addition to those in the following sections:		N/A
	– 7.3.4, Protection against direct contact;		N/A
	– 7.4, Protection against energy hazards;		N/A
	– 13.5, Openings in enclosures		N/A
9.1.4.2	Side openings treated as bottom openings		N/A
9.1.4.3	Openings in the bottom of a fire enclosure		N/A
	The bottom of a FIRE ENCLOSURE or individual barriers, shall provide protection against emission of flaming or molten material under all internal parts, including partially enclosed components or assemblies, for which Method 2 of 9.1.1 has not been fully applied and complied with.		N/A
9.1.4.4	Equipment for use in a CLOSED ELECTRICAL OPERATING AREA		N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures		N/A
9.1.4.6	Additional requirements for openings in transportable equipment		N/A
9.2	LIMITED POWER SOURCES	Communication port.	P
9.2.1	General		P
9.2.2	Limited power source tests		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,		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		P
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.		P
10	**PROTECTION AGAINST SONIC PRESSURE HAZARDS**		N/A
10.1	General		N/A
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.		N/A
10.2	Sonic pressure and Sound level		N/A
10.2.1	Hazardous Noise Levels		N/A
11	**PROTECTION AGAINST LIQUID HAZARDS**		N/A
11.1	Liquid Containment, Pressure and Leakage	No liquid used.	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

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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 self-hardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.		P
13.1.1	Adjustable controls		P
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	Approved installation connectors.	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	No such part	N/A
	– a non-detachable power supply cord for connection to the supply by means of a plug	No such part	N/A
	– an appliance inlet for connection of a detachable power supply cord; or	Certificated AC connector	P
	– a mains plug that is part of direct plug-in equipment as in 13.3.8	No such part	N/A
13.3.2.2	Permanently connected equipment		N/A
13.3.2.3	Appliance inlets	Certificated AC connector	P
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
	– the outer covering of the cord is protected from abrasion.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
13.3.2.6	Protection against mechanical damage		P
13.3.3	Wiring terminals for connection of external conductors	Connector used.	N/A
13.3.3.1	Wiring terminals		N/A
13.3.3.2	Screw terminals		N/A
13.3.3.3	Wiring terminal sizes		N/A
13.3.3.4	Wiring terminal design		N/A
13.3.3.5	Grouping of wiring terminals		N/A
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 mm² and greater		N/A
13.3.6	Disconnection from supply sources		P
13.3.7	Connectors, plugs and sockets	Certified connectors used for PV / AC side	P
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		P
13.4.3	Colour coding	The green-yellow wire only used for protective bonding conductor.	P
13.4.4	Splices and connections		P
13.4.5	Interconnections between parts of the PCE		P
13.5	Openings in enclosures		N/A
13.5.1	Top and side openings	No opening in the enclosure	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	Metal enclosure used.	N/A
13.6.2.1	Stress relief test		N/A
13.6.3	Polymers serving as solid insulation	Certified connectors used for PV / AC side.	P
13.6.3.1	Resistance to arcing		P

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Clause	Requirement – Test	Result – Remark	Verdict
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	Metal enclosure provided	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	Impact test applied on the LED screen cover.	P
13.7.4	Drop test	Not hand-held, direct plug-in and transportable equipment.	N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General	The metal enclosure complied with 13.7.	P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal		N/A
14	**COMPONENTS**		P
14.1	General	(see appended table 14)	P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Over temperature Protection		P
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperature HAZARD, or a fire HAZARD, shall be protected by an over temperature or thermal protection device meeting the requirements of 14.3.		P
14.3	Over temperature 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.	PCB approved by UL with 94 V-0 rating.	P
	This requirement does not apply to thin-film flexible printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		P
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.		P
14.7	Circuits or components used as transient overvoltage limiting devices		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.	No such device.	N/A
14.8	Batteries		N/A
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.	No integrate battery used.	N/A
14.8.1	Battery Enclosure Ventilation		N/A

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14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A non-metallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions	After evaluation, there was no risk of fire, electric shock or other hazard as specified by	P

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		this standard if the protection functions were disabled.	

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4.2.2.6	**TABLE: electrical data Output side (Grid connection)**					**P**
Type	U ac (V)	Iac max (A)	Power (kW)	Frequency (Hz)	-	-
EA5KTSI	230.1	7.24	4.998	50	-	-
EA6KTSI	230.2	8.70	6.013	50	-	-
EA8KTSI	230.1	11.60	8.014	50	-	-
EA10KTSI	230.4	14.49	10.072	50	-	-
EA13KTSI	230.2	18.84	13.035	50	-	-
EA16KTSI	230.3	23.21	16.051	50	-	-
Supplementary information:						

4.2.2.7	**TABLE: electrical data Input side (PV – Generator)**					**P**
Type	U dcmax (V)	U dcmin (V)	U mppmin (V)	U mppmax (V)	I dcmax (A)	Pmax (kW)
EA5KTSI	1000	180.1	125.9	950.6	21.8	6.53
EA6KTSI	1000	180.4	124.3	949.8	21.8	7.78
EA8KTSI	1000	180.5	125.9	951.1	21.9	10.38
EA10KTSI	1000	250.3	202.3	951.2	32.9	13.15
EA13KTSI	1000	250.2	201.6	951.7	32.7	17.01
EA16KTSI	1000	250.2	201.9	950.8	32.8	20.78
Supplementary information:						

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4.3	**TABLE: heating temperature rise measurements - Test 1**		**P**
	test voltage (V) ..... :	500 Vdc, 230 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	64.4	85
DC internal wire (PV1+)	92.3	105
Wire of CON100 (near the metal)	92.7	105
Wire of CON102 (near the metal)	77.5	105
PCB near the X-capacitor C103	77.9	130
PV1+ wire (near panel)	85.8	105
DC switch (top surface of body)	69.2	85
Y-capacitor, C109	76.5	110
MOV (RV100)	79.3	85
MOV (RV102)	77.8	85
Capacitor, C103 body	80.2	110
Input inductor, L100	91.2	130
Capacitor, C104 body	76.3	105
Bus capacitor, C335	71.8	105
Current transducer, CT200	82.6	105
Screw wire terminal, CON100	92.4	130
PCB of input board near CON201	93.2	130
Boost inductor lead wire near CON200	81.8	105
Boost inductor (back of Boost inductor box)	82.0	100
PCB near boost diode D209	80.9	130
Optocoupler, U200	87.4	100
Capacitor, C213	83.4	110
Bus Capacitor, C319	78.9	105
Bus Capacitor, C305	80.1	105
IGBT module above internal heat sink	78.7	130
PCB of power board near IGBT module	92.9	105
Capacitor C331	78.2	105
Capacitor C333	77.1	105
Transformer coil, T100	79.8	130
Y-capacitor, C516	78.4	110
Inverter inductor (back of Boost inductor	78.5	100

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Clause	Requirement – Test	Result – Remark	Verdict

box)		
Inverter inductor lead wire (CON402)	79.4	130
Current transducer HCT400	75.1	85
Capacitor, C400	74.7	105
Capacitor, C508	77.1	105
Capacitor, C501	77.2	105
Relay, K401	85.1	105
Relay, K403	87.2	105
Leakage current sensor, HCT500	77.9	105
Inductance winding, L503	88.7	130
X-capacitor, C524	78.1	110
Capacitor, C502	76.3	105
Y-capacitor, C510	75.3	110
MOV, RV500	81.9	85
Output PCB near capacitor C520	84.1	105
AC output wire (R-phase) near metal connector	110.7	125
Output terminal body (R-phase) (internal)	95.6	105
Output terminal body (R-phase) (external)	61.0	105
Top enclosure of internal DC fan	69.1	70
Control board Input wire (CON3)	77.2	105
Connector, CON800	77.3	85
Capacitor, C605	75.1	105
MOSFET of SPS, Q600	71.1	130
Resistance, R630	78.1	130
Transformer coil, T600	75.9	130
Optocoupler, U602	80.8	130
PCB of Control board near U1	79.7	130
Optocoupler, U45	75.3	130
Accessible enclosure surface (Front cover near heat source)	66.5	70
LED Display panel	62.7	95
Accessible enclosure surface (Side)	71.2	100
Accessible enclosure surface (Top)	74.5	100
Mounting surface (back of heat sink)	84.1	90
Switch knob	61.3	85
CPU U1	83.3	130

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Clause	Requirement – Test	Result – Remark	Verdict

Interface Panel (near LED)	65.2	85
Supplementary information: Note 1: Run the device EA16KTSI at conditions of 60 °C ambient temperature until steady condition established; test voltage: 500 Vdc.(PV input); 230 Vac (MAINS). Note 2: The printed circuit board is rated 130 °C. Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.		

4.3	**TABLE: heating temperature rise measurements - Test 2**		**P**
	test voltage (V) ..... :	500 Vdc, 250 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	65.5	85
DC internal wire (PV1+)	92.8	105
Wire of CON100 (near the metal)	93.6	105
Wire of CON102 (near the metal)	79.4	105
PCB near the X-capacitor C103	80.5	130
PV1+ wire (near panel)	87.1	105
DC switch (top surface of body)	67.3	85
Y-capacitor, C109	79.1	110
MOV (RV100)	81.1	85
MOV (RV102)	79.9	85
Capacitor, C103 body	82.3	110
Input inductor, L100	94.3	130
Capacitor, C104 body	79.1	105
Bus capacitor, C335	73.2	105
Current transducer, CT200	85.9	105
Screw wire terminal, CON100	93.4	130
PCB of input board near CON201	96.1	130
Boost inductor lead wire near CON200	85.6	105
Boost inductor (back of Boost inductor box)	90.9	100
PCB near boost diode D209	82.9	130
Optocoupler, U200	90.8	100
Capacitor, C213	85.9	110
Bus Capacitor, C319	79.6	105
Bus Capacitor, C305	80.5	105

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Clause	Requirement – Test	Result – Remark	Verdict

IGBT module above internal heat sink	79.0	130
PCB of power board near IGBT module	92.5	105
Capacitor C331	78.7	105
Capacitor C333	77.7	105
Transformer coil, T100	80.6	130
Y-capacitor, C516	78.1	110
Inverter inductor (back of Boost inductor box)	78.3	100
Inverter inductor lead wire (CON402)	79.1	130
Current transducer HCT400	75.4	85
Capacitor, C400	75.2	105
Capacitor, C508	77.3	105
Capacitor, C501	77.5	105
Relay, K401	83.7	105
Relay, K403	85.9	105
Leakage current sensor, HCT500	77.9	105
Inductance winding, L503	87.3	130
X-capacitor, C524	78.0	110
Capacitor, C502	76.7	105
Y-capacitor, C510	75.4	110
MOV, RV500	81.3	85
Output PCB near capacitor C520	83.2	105
AC output wire (R-phase) near metal connector	106.2	125
Output terminal body (R-phase) (internal)	93.6	105
Output terminal body (R-phase) (external)	61.5	105
Top enclosure of internal DC fan	69.2	70
Control board Input wire (CON3)	77.8	105
Connector, CON800	77.9	85
Capacitor, C605	76.2	105
MOSFET of SPS, Q600	72.1	130
Resistance, R630	78.4	130
Transformer coil, T600	77.3	130
Optocoupler, U602	81.1	130
PCB of Control board near U1	80.1	130
Optocoupler, U45	75.6	130
Accessible enclosure surface (Front	67.4	70

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Clause	Requirement – Test	Result – Remark	Verdict

cover near heat source)		
LED Display panel	63.6	95
Accessible enclosure surface (Side)	73.4	100
Accessible enclosure surface (Top)	75.0	100
Mounting surface (back of heat sink)	84.0	90
Switch knob	62.4	85
CPU U1	83.5	130
Interface Panel (near LED)	66.0	85
Supplementary information: Note 1: Run the device EA16KTSI at conditions of 60 °C ambient temperature until steady condition established; test voltage: 500 Vdc.(PV input); 250 Vac (MAINS). Note 2: The printed circuit board is rated 130 °C. Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.		

4.3	**TABLE: heating temperature rise measurements - Test 3**		**P**
	test voltage (V) ..... :	850 Vdc, 230 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	60.7	85
DC internal wire (PV1+)	74.2	105
Wire of CON100 (near the metal)	73.7	105
Wire of CON102 (near the metal)	70.3	105
PCB near the X-capacitor C103	69.3	130
PV1+ wire (near panel)	69.8	105
DC switch (top surface of body)	69. 2	85
Y-capacitor, C109	69.9	110
MOV (RV100)	69.1	85
MOV (RV102)	69.1	85
Capacitor, C103 body	69.8	110
Input inductor, L100	74.3	130
Capacitor, C104 body	69.9	105
Bus capacitor, C335	69.4	105
Current transducer, CT200	75.3	105
Screw wire terminal, CON100	73.5	130
PCB of input board near CON201	81.7	130
Boost inductor lead wire near CON200	74.3	105

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Clause	Requirement – Test	Result – Remark	Verdict

Boost inductor (back of Boost inductor box)	69.1	100
PCB near boost diode D209	73.8	130
Optocoupler, U200	81.1	100
Capacitor, C213	74.8	110
Bus Capacitor, C319	76.9	105
Bus Capacitor, C305	78.9	105
IGBT module above internal heat sink	79.9	130
PCB of power board near IGBT module	95.5	105
Capacitor C331	77.2	105
Capacitor C333	75.3	105
Transformer coil, T100	79.1	130
Y-capacitor, C516	76.5	110
Inverter inductor (back of Boost inductor box)	81.7	100
Inverter inductor lead wire (CON402)	79.0	130
Current transducer HCT400	73.4	85
Capacitor, C400	73.3	105
Capacitor, C508	75.9	105
Capacitor, C501	76.0	105
Relay, K401	81.6	105
Relay, K403	83.1	105
Leakage current sensor, HCT500	76.3	105
Inductance winding, L503	84.8	130
X-capacitor, C524	76.1	110
Capacitor, C502	75.0	105
Y-capacitor, C510	74.2	110
MOV, RV500	79.5	85
Output PCB near capacitor C520	82.0	105
AC output wire (R-phase) near metal connector	106.3	125
Output terminal body (R-phase) (internal)	94.0	105
Output terminal body (R-phase) (external)	60.7	105
Top enclosure of internal DC fan	69.2	70
Control board Input wire (CON3)	75.9	105
Connector, CON800	75.8	85
Capacitor, C605	74.4	105

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MOSFET of SPS, Q600	70.8	130
Resistance, R630	77.8	130
Transformer coil, T600	75.6	130
Optocoupler, U602	80.5	130
PCB of Control board near U1	78.6	130
Optocoupler, U45	74.1	130
Accessible enclosure surface (Front cover near heat source)	65.7	70
LED Display panel	62.4	95
Accessible enclosure surface (Side)	65.7	100
Accessible enclosure surface (Top)	73.1	100
Mounting surface (back of heat sink)	84.3	90
Switch knob	60.7	85
CPU U1	82.1	130
Interface Panel (near LED)	64.6	85
Supplementary information: Note 1: Run the device EA16KTSI at conditions of 60 °C ambient temperature until steady condition established; test voltage: 850 Vdc.(PV input); 230 Vac (MAINS). Note 2: The printed circuit board is rated 130 °C. Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.		

4.3	**TABLE: heating temperature rise measurements - Test 4**		**P**
	test voltage (V) ..... :	850 Vdc, 250 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	62.3	85
DC internal wire (PV1+)	75.6	105
Wire of CON100 (near the metal)	75.0	105
Wire of CON102 (near the metal)	71.0	105
PCB near the X-capacitor C103	69.9	130
PV1+ wire (near panel)	71.5	105
DC switch (top surface of body)	69.2	85
Y-capacitor, C109	70.4	110
MOV (RV100)	69.9	85
MOV (RV102)	69.8	85
Capacitor, C103 body	70.7	110

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Clause	Requirement – Test	Result – Remark	Verdict

Input inductor, L100	74.9	130
Capacitor, C104 body	70.2	105
Bus capacitor, C335	69.6	105
Current transducer, CT200	75.4	105
Screw wire terminal, CON100	74.7	130
PCB of input board near CON201	82.5	130
Boost inductor lead wire near CON200	74.4	105
Boost inductor (back of Boost inductor box)	68.5	100
PCB near boost diode D209	74.4	130
Optocoupler, U200	81.4	100
Capacitor, C213	74.9	110
Bus Capacitor, C319	77.3	105
Bus Capacitor, C305	79.4	105
IGBT module above internal heat sink	79.8	130
PCB of power board near IGBT module	94.9	105
Capacitor C331	77.7	105
Capacitor C333	76.0	105
Transformer coil, T100	79.6	130
Y-capacitor, C516	77.5	110
Inverter inductor (back of Boost inductor box)	81.7	100
Inverter inductor lead wire (CON402)	79.5	130
Current transducer HCT400	74.2	85
Capacitor, C400	74.1	105
Capacitor, C508	76.9	105
Capacitor, C501	77.0	105
Relay, K401	82.2	105
Relay, K403	84.0	105
Leakage current sensor, HCT500	77.2	105
Inductance winding, L503	85.9	130
X-capacitor, C524	77.2	110
Capacitor, C502	75.9	105
Y-capacitor, C510	74.9	110
MOV, RV500	80.5	85
Output PCB near capacitor C520	82.6	105
AC output wire (R-phase) near metal	106.8	125

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connector		
Output terminal body (R-phase) (internal)	95.0	105
Output terminal body (R-phase) (external)	62.0	105
Top enclosure of internal DC fan	69.3	70
Control board Input wire (CON3)	76.8	105
Connector, CON800	76.6	85
Capacitor, C605	75.1	105
MOSFET of SPS, Q600	71.4	130
Resistance, R630	78.6	130
Transformer coil, T600	76.2	130
Optocoupler, U602	81.2	130
PCB of Control board near U1	79.4	130
Optocoupler, U45	75.0	130
Accessible enclosure surface (Front cover near heat source)	66.7	70
LED Display panel	63.6	95
Accessible enclosure surface (Side)	66.5	100
Accessible enclosure surface (Top)	73.6	100
Mounting surface (back of heat sink)	84.1	90
Switch knob	62.0	85
CPU U1	83.0	130
Interface Panel (near LED)	65.7	85

Supplementary information:

Note 1: Run the device EA16KTSI at conditions of 60 °C ambient temperature until steady condition established; test voltage: 850 Vdc (PV input); 250 Vac (MAINS).

Note 2: The printed circuit board is rated 130 °C.

Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.

4.3	**TABLE: heating temperature rise measurements - Test 5**		**P**
	test voltage (V) ..... :	500 Vdc, 230 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	51.4	85
DC internal wire (PV1+)	84.4	105
Wire of CON100 (near the metal)	87.6	105
Wire of CON102 (near the metal)	75.0	105

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PCB near the X-capacitor C103	76.8	130
PV1+ wire (near panel)	75.3	105
DC switch (top surface of body)	69.2	85
Y-capacitor, C109	76.7	110
MOV (RV100)	75.7	85
MOV (RV102)	75.1	85
Capacitor, C103 body	80.3	110
Input inductor, L100	96.4	130
Capacitor, C104 body	79.1	105
Bus capacitor, C335	69.4	105
Current transducer, CT200	84.0	105
Screw wire terminal, CON100	87.6	130
PCB of input board near CON201	91.2	130
Boost inductor lead wire near CON200	82.2	105
Boost inductor (back of Boost inductor box)	88.4	100
PCB near boost diode D209	79.5	130
Optocoupler, U200	86.7	100
Capacitor, C213	83.3	110
Bus Capacitor, C319	77.7	105
Bus Capacitor, C305	77.6	105
IGBT module above internal heat sink	71.6	130
PCB of power board near IGBT module	89.8	105
Capacitor C331	75.0	105
Capacitor C333	73.4	105
Transformer coil, T100	76.3	130
Y-capacitor, C516	73.2	110
Inverter inductor (back of Boost inductor box)	77.8	100
Inverter inductor lead wire (CON402)	76.3	130
Current transducer HCT400	69.7	85
Capacitor, C400	69.8	105
Capacitor, C508	74.7	105
Capacitor, C501	74.0	105
Relay, K401	79.5	105
Relay, K403	83.1	105
Leakage current sensor, HCT500	74.8	105

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Clause	Requirement – Test	Result – Remark	Verdict

Inductance winding, L503	88.9	130
X-capacitor, C524	74.5	110
Capacitor, C502	72.5	105
Y-capacitor, C510	71.2	110
MOV, RV500	78.7	85
Output PCB near capacitor C520	83.5	105
AC output wire (R-phase) near metal connector	93.3	125
Output terminal body (R-phase) (internal)	101.8	105
Output terminal body (R-phase) (external)	46.9	105
Top enclosure of internal DC fan	69.3	70
Control board Input wire (CON3)	72.7	105
Connector, CON800	72.8	85
Capacitor, C605	71.5	105
MOSFET of SPS, Q600	63.2	130
Resistance, R630	73.7	130
Transformer coil, T600	72.7	130
Optocoupler, U602	77.1	130
PCB of Control board near U1	74.2	130
Optocoupler, U45	69.6	130
Accessible enclosure surface (Front cover near heat source)	57.7	70
LED Display panel	51.8	95
Accessible enclosure surface (Side)	64.2	100
Accessible enclosure surface (Top)	68.0	100
Mounting surface (back of heat sink)	77.8	90
Switch knob	49.0	85
CPU U1	77.5	130
Interface Panel (near LED)	55.4	85

Supplementary information:

Note 1: Run the device EA16KTSI at full load conditions of 45 °C ambient temperature until steady condition established; test voltage: 500 Vdc.(PV input); 230 Vac (MAINS).

Note 2: The printed circuit board is rated 130 °C.

Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	TABLE: heating temperature rise measurements - Test 6		P
	test voltage (V) ..... :	500 Vdc, 250 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	52.1	85
DC internal wire (PV1+)	86.9	105
Wire of CON100 (near the metal)	90.5	105
Wire of CON102 (near the metal)	76.7	105
PCB near the X-capacitor C103	79.4	130
PV1+ wire (near panel)	77.6	105
DC switch (top surface of body)	69.3	85
Y-capacitor, C109	79.2	110
MOV (RV100)	78.1	85
MOV (RV102)	77.2	85
Capacitor, C103 body	82.5	110
Input inductor, L100	99.9	130
Capacitor, C104 body	81.7	105
Bus capacitor, C335	69.6	105
Current transducer, CT200	87.6	105
Screw wire terminal, CON100	90.7	130
PCB of input board near CON201	93.6	130
Boost inductor lead wire near CON200	86.3	105
Boost inductor (back of Boost inductor box)	99.7	100
PCB near boost diode D209	80.2	130
Optocoupler, U200	89.1	100
Capacitor, C213	85.2	110
Bus Capacitor, C319	77.1	105
Bus Capacitor, C305	76.5	105
IGBT module above internal heat sink	70.8	130
PCB of power board near IGBT module	87.6	105
Capacitor C331	73.9	105
Capacitor C333	73.4	105
Transformer coil, T100	76.2	130
Y-capacitor, C516	71.9	110
Inverter inductor (back of Boost inductor	75.1	100

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Clause	Requirement – Test	Result – Remark	Verdict

box)		
Inverter inductor lead wire (CON402)	74.3	130
Current transducer HCT400	68.9	85
Capacitor, C400	69.1	105
Capacitor, C508	73.4	105
Capacitor, C501	73.0	105
Relay, K401	77.3	105
Relay, K403	80.3	105
Leakage current sensor, HCT500	73.3	105
Inductance winding, L503	85.4	130
X-capacitor, C524	73.5	110
Capacitor, C502	71.4	105
Y-capacitor, C510	70.1	110
MOV, RV500	77.4	85
Output PCB near capacitor C520	80.6	105
AC output wire (R-phase) near metal connector	93.7	125
Output terminal body (R-phase) (internal)	86.9	105
Output terminal body (R-phase) (external)	46.8	105
Top enclosure of internal DC fan	68.5	70
Control board Input wire (CON3)	72.1	105
Connector, CON800	72.4	85
Capacitor, C605	72.0	105
MOSFET of SPS, Q600	63.1	130
Resistance, R630	72.9	130
Transformer coil, T600	73.5	130
Optocoupler, U602	76.0	130
PCB of Control board near U1	73.3	130
Optocoupler, U45	68.9	130
Accessible enclosure surface (Front cover near heat source)	57.5	70
LED Display panel	51.6	95
Accessible enclosure surface (Side)	65.3	100
Accessible enclosure surface (Top)	67.3	100
Mounting surface (back of heat sink)	76.5	90
Switch knob	49.0	85
CPU U1	76.6	130

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Clause	Requirement – Test	Result – Remark	Verdict

Interface Panel (near LED)	55.2	85
Supplementary information: Note 1: Run the device EA16KTSI at full load conditions of 45 °C ambient temperature until steady condition established; test voltage: 500 Vdc.(PV input); 250 Vac (Mains). Note 2: The printed circuit board is rated 130 °C. Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.		

4.3	**TABLE: heating temperature rise measurements - Test 7**		**P**
	test voltage (V) ..... :	850 Vdc, 230 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	47.2	85
DC internal wire (PV1+)	68.6	105
Wire of CON100 (near the metal)	68.0	105
Wire of CON102 (near the metal)	63.1	105
PCB near the X-capacitor C103	62.3	130
PV1+ wire (near panel)	60.1	105
DC switch (top surface of body)	67.6	85
Y-capacitor, C109	62.9	110
MOV (RV100)	61.9	85
MOV (RV102)	61.2	85
Capacitor, C103 body	63.5	110
Input inductor, L100	71.0	130
Capacitor, C104 body	63.0	105
Bus capacitor, C335	63.4	105
Current transducer, CT200	66.2	105
Screw wire terminal, CON100	67.9	130
PCB of input board near CON201	61.6	130
Boost inductor lead wire near CON200	62.4	105
Boost inductor (back of Boost inductor box)	54.9	100
PCB near boost diode D209	66.2	130
Optocoupler, U200	66.2	100
Capacitor, C213	63.6	110
Bus Capacitor, C319	76.7	105
Bus Capacitor, C305	77.6	105

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Clause	Requirement – Test	Result – Remark	Verdict

IGBT module above internal heat sink	74.2	130
PCB of power board near IGBT module	94.8	105
Capacitor C331	74.9	105
Capacitor C333	72.0	105
Transformer coil, T100	75.1	130
Y-capacitor, C516	74.7	110
Inverter inductor (back of Boost inductor box)	85.0	100
Inverter inductor lead wire (CON402)	79.4	130
Current transducer HCT400	69.3	85
Capacitor, C400	69.3	105
Capacitor, C508	76.0	105
Capacitor, C501	74.9	105
Relay, K401	80.0	105
Relay, K403	84.5	105
Leakage current sensor, HCT500	75.9	105
Inductance winding, L503	90.9	130
X-capacitor, C524	75.3	110
Capacitor, C502	72.6	105
Y-capacitor, C510	71.9	110
MOV, RV500	81.6	85
Output PCB near capacitor C520	86.2	105
AC output wire (R-phase) near metal connector	98.1	125
Output terminal body (R-phase) (internal)	90.2	105
Output terminal body (R-phase) (external)	47.0	105
Top enclosure of internal DC fan	69.3	70
Control board Input wire (CON3)	71.9	105
Connector, CON800	70.9	85
Capacitor, C605	68.3	105
MOSFET of SPS, Q600	62.2	130
Resistance, R630	75.2	130
Transformer coil, T600	68.8	130
Optocoupler, U602	78.8	130
PCB of Control board near U1	75.1	130
Optocoupler, U45	70.2	130
Accessible enclosure surface (Front	56.4	70

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Clause	Requirement – Test	Result – Remark	Verdict

cover near heat source)		
LED Display panel	50.8	95
Accessible enclosure surface (Side)	52.3	100
Accessible enclosure surface (Top)	66.5	100
Mounting surface (back of heat sink)	80.5	90
Switch knob	47.5	85
CPU U1	78.7	130
Interface Panel (near LED)	54.6	85
Supplementary information: Note 1: Run the device EA16KTSI at full load conditions of 45 °C ambient temperature until steady condition established; test voltage: 850 Vdc.(PV input); 230 Vac (MAINS). Note 2: The printed circuit board is rated 130 °C. Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.		

4.3	**TABLE: heating temperature rise measurements - Test 8**		**P**
	test voltage (V) ..... :	850 Vdc, 250 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
PV terminal (PV1+)	47.2	85
DC internal wire (PV1+)	67.5	105
Wire of CON100 (near the metal)	66.9	105
Wire of CON102 (near the metal)	62.1	105
PCB near the X-capacitor C103	61.3	130
PV1+ wire (near panel)	59.4	105
DC switch (top surface of body)	66.0	85
Y-capacitor, C109	61.8	110
MOV (RV100)	60.8	85
MOV (RV102)	60.7	85
Capacitor, C103 body	62.4	110
Input inductor, L100	70.0	130
Capacitor, C104 body	62.0	105
Bus capacitor, C335	61.4	105
Current transducer, CT200	65.3	105
Screw wire terminal, CON100	66.7	130
PCB of input board near CON201	60.0	130
Boost inductor lead wire near CON200	61.3	105

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Clause	Requirement – Test	Result – Remark	Verdict

Boost inductor (back of Boost inductor box)	54.0	100
PCB near boost diode D209	64.2	130
Optocoupler, U200	64.6	100
Capacitor, C213	62.0	110
Bus Capacitor, C319	72.6	105
Bus Capacitor, C305	73.9	105
IGBT module above internal heat sink	70.2	130
PCB of power board near IGBT module	89.4	105
Capacitor C331	71.6	105
Capacitor C333	68.4	105
Transformer coil, T100	72.4	130
Y-capacitor, C516	70.6	110
Inverter inductor (back of Boost inductor box)	79.0	100
Inverter inductor lead wire (CON402)	74.9	130
Current transducer HCT400	66.5	85
Capacitor, C400	66.6	105
Capacitor, C508	72.5	105
Capacitor, C501	71.6	105
Relay, K401	75.9	105
Relay, K403	79.4	105
Leakage current sensor, HCT500	72.2	105
Inductance winding, L503	84.5	130
X-capacitor, C524	72.3	110
Capacitor, C502	69.5	105
Y-capacitor, C510	68.7	110
MOV, RV500	77.2	85
Output PCB near capacitor C520	80.9	105
AC output wire (R-phase) near metal connector	91.7	125
Output terminal body (R-phase) (internal)	87.0	105
Output terminal body (R-phase) (external)	46.4	105
Top enclosure of internal DC fan	66.5	70
Control board Input wire (CON3)	69.3	105
Connector, CON800	68.7	85
Capacitor, C605	66.9	105

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Clause	Requirement – Test	Result – Remark	Verdict

MOSFET of SPS, Q600	60.0	130
Resistance, R630	71.7	130
Transformer coil, T600	67.3	130
Optocoupler, U602	75.2	130
PCB of Control board near U1	72.1	130
Optocoupler, U45	67.2	130
Accessible enclosure surface (Front cover near heat source)	54.9	70
LED Display panel	50.0	95
Accessible enclosure surface (Side)	51.5	100
Accessible enclosure surface (Top)	63.7	100
Mounting surface (back of heat sink)	75.9	90
Switch knob	47.3	85
CPU U1	75.6	130
Interface Panel (near LED)	53.3	85

Supplementary information:

Note 1: Run the device EA16KTSI at full load conditions of 45 °C ambient temperature until steady condition established; test voltage: 850 Vdc.(PV input); 250 Vac (MAINS).

Note 2: The printed circuit board is rated 130 °C.

Note 3: The metal enclosure bear with the hot surface symbol 14 of Annex C of IEC 62109-1.

4.4	**TABLE: fault condition tests**		P
	ambient temperature (°C) .....:	25.0	—

No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1	BUS Voltage detection (R374)	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected immediately. Error message: “Bus Over Volt Trans Err”. No damage, no hazard.
2	BUS Voltage detection (R374)	short circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Bus Volt Plus-Minus Unbalance Err”. No damage, no hazard.
3	Inv voltage detection R(R423)	short circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start up. Error message: “Inv soft Start Fail Err”. No damage, no hazard.

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Clause	Requirement – Test	Result – Remark	Verdict

4	Inv voltage detection R (R423)	Open Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start up. Error message: “Inv soft Start Fail Err”. No damage, no hazard.
5	Inv voltage detection N(R144)	Open Circuit before start up	620Vdc 230Vac	10min	--	--	The PCE can’t start up. Error message: “Output Relay Err”. No damage, no hazard.
6	Power supply +12V (T612-T614)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected immediately. No error massage. No damage, no hazard.
7	Power supply +7V (T616-T619)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected immediately. No error massage. No damage, no hazard.
8	Power supply +15V (T609-T610)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected immediately. No error massage. No damage, no hazard.
9	Power supply +15V2 (T604-T606)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected immediately. Error message: “Inv soft Start Fail Err”. No damage, no hazard.
10	ISO detection relay (RY900)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start up. Error message: “ISO Fail Err”. No damage, no hazard.
11	BUS Capacitor (C301)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start up. Error message: “Bus Over Volt Trans Err”. No damage, no hazard.
12	Output L1-N	shorted	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Inv Short Circuit Err”. No damage, no hazard.
13	Output L1-PE	shorted	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Inv Short Circuit Err”. No damage, no hazard.
14	Output L1-L2	shorted	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Inv Short Circuit Err”. No damage, no hazard.

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Clause	Requirement – Test	Result – Remark	Verdict

15	Output Phase line	Mis-wiring with incorrect phase sequence	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Inv Short Circuit Err”. No damage, no hazard.
16	PV+ to PV-	Shorted	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage. No damage, no hazard.
17	PV+ to PV-	Reversed	620Vdc 230Vac	10min	--	--	PCE shutdown No error massage. No damage, no hazard.
18	Leakage current detection (R579)	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “GFCI Sensor Err”. No damage, no hazard.
19	Leakage current detection (R580)	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “GFCI Sensor Err”. No damage, no hazard.
20	Off grid voltage detection (R164)	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Grid Over Volt Err”. No damage, no hazard.
21	INV Current detection (R75)	Open Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start up. Error message: “Inv Over Curr Trans Err”. No damage, no hazard.
22	Grid frequency detection (R408)	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Grid Under Freq Err”. No damage, no hazard.
23	Output Relay (K400)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start-up, Error message: “Relay check fail”, No damage, no hazard.
24	Output Relay (K401)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start-up, Error message: “Relay check fail. No damage, no hazard.
25	Output Relay (K402)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start-up, Error message: “Relay check fail”. No damage, no hazard.

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Clause	Requirement – Test	Result – Remark	Verdict

26	Output Relay (K403)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start-up, Error message: “Relay check fail”. No damage, no hazard.
27	Output Relay (K404)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start-up, Error message: “Relay check fail”. No damage, no hazard.
28	Output Relay (K405)	Short Circuit before start up	620Vdc 230Vac	10min	--	--	PCE cannot start-up, Error message: “Relay check fail”. No damage, no hazard.
29	DSP power supply loss 3.3V (C240)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage, No damage, no hazard.
30	Crystal Oscillator defect (C183)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SMCU Grid Freq Err”. No damage, no hazard.
31	BUS Voltage detection (R550)	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “PV above BUS volt Err”. No damage, no hazard.
32	Grid voltage detection R540	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Grid Under Volt Err1”. No damage, no hazard.
33	Grid voltage detection R540	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Grid Over Volt Err1”. No damage, no hazard.
34	N-PE voltage detection R678	Open Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Ground Connection Err”. No damage, no hazard.
35	N-PE voltage detection R678	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Ground Connection Err”. No damage, no hazard.

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Clause	Requirement – Test	Result – Remark	Verdict

36	Crystal Oscillator defect (C182)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SMCU Grid Freq Err”. No damage, no hazard.
37	Communication defect between DSP (R28 pin 2 to pin 7)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. no damage, no hazard.
38	Communication defect between DSP (R28 pin 4 to pin 5)	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. No damage, no hazard.
39	Internal cooling Fan	Locked	620Vdc 230Vac	60min	--	--	PCE working normally. No damage, no hazard.
40	Bus capacitor, C334	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Q303 damaged, no hazard.
41	IGBT, Q300 C to E	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Q309 damaged, no hazard.
42	IGBT, Q300 C to G	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Q300, D314 and drive board damaged, no hazard.
43	IGBT, Q300 E to G	Short Circuit	620Vdc 230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. R32 and drive board damaged, no hazard.
supplementary information PCE means power conversion equipment under test in this document.							
See technical documentation.							

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.6.3.3	**TABLE: protective equipotential bonding**			P
Measured between:	Test current (A)	Voltage drop (V)	Resistance (mΩ)	Duration of the test (min)
PE-terminal to front enclosure cover	64	0.44	7	4
PE-terminal to side enclosure cover	64	0.38	6	4
PE-terminal to enclosure heatsink	64	0.45	7	4
supplementary information				

7.3.6.3.7	**TABLE: touch current measurement**		P
Measured between:	Measured (mA)	Limit (mA)	Comments/conditions
Metal enclosure→ground	1.30	3.5	Normal condition
Communication port→ground	0.66	3.5	Normal condition
supplementary information			

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	**TABLE: clearance and creepage distance measurements**					P
clearance cl and creepage distance dcr at / of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Main Board AC circuit:						
BI between AC circuit (Grid_T) to Earth through PCB (through C532)	1000	1000	3.6	4.9	5.0	6.3
BI between AC circuit (Grid_N) to Earth through PCB	1000	1000	3.6	6.6	5.0	6.6
BI between AC circuit (INVT+) to Earth through PCB	1000	1000	3.6	3.7	5.0	5.6
BI between AC circuit (INVT-) to Earth through PCB	1000	1000	3.6	3.7	5.0	5.6
BI between AC circuit (INVS-) to Earth through PCB	1000	1000	3.6	3.7	5.0	9.2
BI between AC circuit (INVT+) to Earth(Fan case) through PCB	1000	1000	3.6	5.9	5.0	5.9
BI between AC circuit (Load_N) to Earth through PCB	1000	1000	3.6	5.9	5.0	5.9
Main Board PV circuit:						
BI between PV circuit (PV1+) to Earth through PCB C107	1000	1000	3.6	5.4	5.0	5.4
BI between PV circuit (PV1-) to Earth through PCB RV102	1000	1000	3.6	6.7	5.0	6.7
BI between PV circuit (PV2+) to Earth through PCB C115	1000	1000	3.6	4.3	5.0	5.4
BI between PV circuit (PV2-) to Earth through PCB C108	1000	1000	3.6	7.2	5.0	7.2
BI between PV circuit (BUS+) to Earth through PCB (through D209 A to screw)	1000	1000	3.6	6.5	5.0	6.5
FI between PV circuit PV1+ to PV1- through PCB	1000	1000	3.6	3.7	5.0	5.5
FI between PV circuit BUS+ to BUS- through PCB	1000	1000	3.6	5.0	5.0	5.3
FI between PV circuit PV2+ to PV2- through PCB	1000	1000	3.6	4.1	5.0	5.2
FI between AC circuit Phase R to Phase S through PCB	1000	1000	3.6	3.8	5.0	5.1
BI between PV circuit Boost1- to Earth through D201	1000	1000	3.6	6.3	5.0	6.3
BI between PV circuit Boost2- to Earth through PCB	1000	1000	3.6	6.3	5.0	6.3

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	**TABLE: clearance and creepage distance measurements**					P
BI between PV circuit Boost1+ to Earth through Connector	1000	1000	3.6	6.6	5.0	6.6
BI between Pin of Relay K04 to Earth through Mounting screw	1000	1000	3.6	8.7	5.0	8.7
Main Board near SPS transformer T600:						
DI between SPS primary side and communication power supply through PCB.	1000	1000	5.5	9.0	10.0	10.1
BI between communication circuit and control circuit through PCB near connector CON801.	1000	1000	3.6	10.2	5.0	10.2
BI between primary side of SPS and control circuit through PCB under SPS transformer.	1000	1000	3.6	5.1	5.0	5.1
Transformer T600 body:						
DI between communication power supply and primary side of SPS through transformer T600.	1000	1000	5.5	10.4	10.0	10.4
BI between communication circuit and control circuit through SPS transformer T600.	1000	1000	3.6	12.8	5.0	12.8
BI between primary side of SPS and control circuit through SPS transformer T600.	1000	1000	3.6	12.8	5.0	12.8
Control Board:						
BI between communication circuit and control circuit through PCB under optocoupler (U35, U36, U37, U38, U39, U40, U42, U46, U48, U54)	1000	1000	3.6	7.8	5.0	7.8
BI between communication circuit and control circuit through optocoupler (U35, U36, U37, U38, U39, U40, U42, U46, U48, U54)	1000	1000	3.6	8.1	5.0	8.1
BI between communication circuit and control circuit through PCB under optocoupler (U43, U45).	1000	1000	3.6	6.9	5.0	6.9
BI between communication circuit and control circuit through opto-coupler (U43, U45).	1000	1000	3.6	8.2	5.0	8.2
BI between communication circuit and control circuit through PCB near connector CON13.	1000	1000	3.6	7.6	5.0	7.6
BI between communication circuit and control circuit through PCB near	1000	1000	3.6	7.5	5.0	7.5

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	**TABLE: clearance and creepage distance measurements**					P
U5.						
PCE Unit:						
BI between AC output conductor to metal enclosure	1000	1000	3.6	16.4	5.0	16.4
BI between DC input conductor to metal enclosure	1000	1000	3.6	28.2	5.0	31.1
BI between DC input conductor to metal enclosure across DC switch	1000	1000	3.6	20.3	5.0	20.3
BI between PV circuit (Boost-) to Earth through screw to heat sink	1000	1000	3.6	8.9	10	14.2
BI between INV circuit (INV-) to Earth through screw to heat sink	1000	1000	3.6	8.9	10	14.2

Supplementary information:

Maximum DC voltage was considered for maximum working voltage of PV and MAINS combined. From Table 12 of IEC 62109-1:2010, the impulse voltage withstand rating for PV circuit system voltage of 1000 V dc is 4464 V. From Table 13, the required clearance distance is 3.6 mm for basic insulation, From Table 14, the calculate creepage distance is 5.0 mm for basic insulation.

The PCB comparative tracking index (CTI) ≥ 175.

The insulator for Boost, INV IGBT to heat sink is ceramic which do not track.

BI: Basic insulation;

SI: Supplementary insulation;

FI: Functional insulation;

RI: Reinforced insulation;

DI: Double insulation.

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Clause	Requirement + Test	Result - Remark	Verdict

7.3.7	TABLE: distance through insulation measurement			P
distance through insulation di at/of:	U r.m.s. (V)	test voltage (Vac)	required di (mm)	di (mm)
Insulation sheet between IGBT (Boost) and heatsink mainboard for basic insulation.	230Vac	1500Vac	0.2	1.22
Insulation sheet between IGBT (Inverter) and heatsink mainboard for basic insulation.	230Vac	1500Vac	0.2	1.22

7.5	TABLE: electric strength measurements, impulse voltage test and partial discharge test			P
test voltage applied between:	test voltage (Vdc)	impulse withstand voltage (V)	partial discharge extinction voltage (V)	result
DC input terminal to earthed enclosure	2121	6000	-	No breakdown
AC output terminal to earthed enclosure	2121	4000	-	No breakdown
DC input terminal to communication port	4242	8000	-	No breakdown
AC output terminal to communication port	4242	6000	-	No breakdown

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Clause	Requirement + Test	Result - Remark	Verdict

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
PV input connector	Amphenol	H4CFM4D-M	1000 V, 35 A, -40 °C to +85 °C	EN 62852:2015	TUV R 50388083
DC Switch	PROJOY	PEDS150R-HM25-4	Ue: 1100 Vdc, Ie: 25 A, 4P, -40°C to +85 °C, DC-PV2	IEC 60947-3 AS 60947.3: 2018 AS/NZS IEC 60947.1:2015	TUV R 50417016 SAA SAA-190350-EA
Alternate	Beijing People's Electric Plant Co., Ltd.	GHX5-32P	Ue: 1100 Vdc, Ie: 25 A, 4P, -40°C to +85 °C, DC-PV2	IEC 60947-3 AS 60947.3: 2018 AS/NZS IEC 60947.1:2015	TUV B 083266 0038 SAA SAA-191146-EA
AC output connector	EXCEEDONN	EN050-1136-00	500 Vac, 25 A IP68, -40 °C to +85 °C	EN 61535	TUV B 170177046022
Internal AC cable (Grid side)	Zhongli Group	UL10269	1000 V, 10 AWG, 105 °C	UL 758 UL 1581	UL E156525
Capacitor (C104, C112)	FARATRONIC	C3D3A206KF0A402	20 µF, 1000 Vdc, 42mm*45mm*30mm, -40°C ~105°C	EN 61071:2007 EN 61881-1: 2011	TUV R 50266108
X-Capacitor Output (C523, C524, C525)	FARATRONIC	MKP65	1.5µF, 440 Vac, X1, 40/110 /56/B	IEC 60384-14:2005	VDE 40021925
CBB capacitor (C400, C407, C422)	FARATRONIC	CBB61	3.5 µF, 350 Vac -40 °C to +85 °C	IEC 60252-1: 2011	VDE 40023504
Bus capacitor on bus board (C301,C302, C303, C334, C335, C336)	FARATRONIC	C3D2H117KM0A402	110 µF, 500 Vdc, 57mm*35mm*50mm, -40 °C to +105 °C	EN 61071:2007 EN 61881-1: 2011	TUV R 50266108
Y-Capacitor Output (C100,C101,C105, C106,C109,C110, C114,C115,C300, C340,C401,C402, C403,C404,C408, C424,C530,C532, C534,C600,C602, C607,C608,C645, C646)	FARATRONIC	MKP63	4.7nF, 300Vac, 13mm*9mm*4mm -40°C to +105°C	EN 60384-14:2013	Intertek SE/0366-2C
Capacitor (C501, C502, C504, C508, C520, C521)	SHENGHAI	CBB61 SH	4.7 uF, 350 Vac 30mm*37mm*20mm, -40°C to +70°C	EN 60252-1:2011+A1	TUV 1419035246

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
C605	FARATRONIC	C3D	2.0 uF, 1200 V	IEC 61071:2007 IEC 61881-1: 2010	TUV R AN 50267748
PCB (Main board)	BAOYUEJIA	BYJ-4	460mm*347mm*2 mm, V-0, 130°C	UL 94	UL E230225
PCB (Control board)	BAOYUEJIA	BYJ-4	158mm*123mm*2 mm, V-0, 130°C	UL 94	UL E230225
Screw base of boost and Inv Inductors	ASAHI KASEI	G701V	CTI:400~600, V-1, 105°C	UL746	UL E88268
Inductor component (L100)	CLICK	LC49-014	0.5 mH, 3 mΩ Φ=2.3 mm	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Copper wire of inductor(L100)	Pacific Electric Wire & Cable	MW35-C(HAI/U)	200 °C	UL 1446	UL E201757
--Epoxy of inductor(L100)	Dongguan Eatto	3300A-1	130 °C	UL 746C	UL E218090
--Teflon tube of inductor(L100)	Great Holding Industrial	TFL	200 °C	UL 224	UL E156256
--Varnish of inductor (L100)	Kyocera Chemical Corp	TVB2180T	130 °C	UL 1446	UL E83702
Inductor component(BOOST1)	CLICK	BCK6001-037	649.8 uH, 3 mΩ max	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Copper wire of inductor (BOOST1)	TIANSHUN	MW36-C	0.7 mm*9.0 mm, 200 °C	UL 1446	UL E210986
--Epoxy of inductor (BOOST1)	Emerson & Cuming	G500	-40 °C to +180 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Kapton tape of inductor (BOOST1)	YAHUA	PF	180 °C	UL 510A	UL E165111
--Inductor component (BOOST2)	CLICK	LC185-030	1.409 mH±10%, 75 mΩ max, Φ1.6*2P	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Copper wire of inductor (BOOST2)	Pacific Electric Wire & Cable	MW5	155 °C	UL 1446	UL E201757
--Mylar tape of inductor (BOOST2)	YAHUA	PF	180 °C	UL 510A	UL E165111
AC choke (INV1)	CLICK	BCK6001-034	649.8 μH, 3 mΩ max	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Copper wire of inductor (INV1)	TIANSHUN	MW36-C	0.7 mm*9.0 mm, 200 °C	UL 1446	UL E210986
--Epoxy of inductor (INV1)	Emerson & Cuming	G500	-40 °C to +180 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
--Kapton tape of inductor (INV1)	YAHUA	PF	180 °C	UL 510A	UL E165111
AC choke(INV2)	CLICK	BCK6001-035	649.8 μH, 3 mΩ max	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Copper wire of inductor (INV2)	TIANSHUN	MW36-C	0.7 mm*9.0 mm, 200 °C	UL1446	UL E210986
--Epoxy of inductor(INV2)	Emerson & Cuming	G500	-40 °C to +180 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Kapton tape of inductor (INV2)	YAHUA	PF	180 °C	UL 510A	UL E165111
AC choke(INV3)	CLICK	BCK6001-036	649.8 μH, 3 mΩ max	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Copper wire of inductor (INV3)	TIANSHUN	MW36-C	0.7*9.0mm, 200 °C	UL 1446	UL E210986
--Epoxy of inductor(INV3)	Emerson & Cuming	G500	-40 °C to +180 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Kapton tape of inductor (INV3)	YAHUA	PF	180 °C	UL 510A	UL E165111
Inductor component (L503)	SPITZER	SPT-47H9796-L	1.4 mH±25%, Φ=2.6 mm, 3.0 mΩ	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Copper wire of inductor(L503)	Tai-I Copper	MW30C QZ-2Φ2.6mm	180 °C	UL 1446	UL E85640
Epoxy of inductor(L503)	Dongguan Eatto	5225A/B	130 °C	UL 746C	UL E218090
Base of inductor(L503)	KINGBOARD	KB-3150N	130 °C	UL 746E	UL E123995
Varnish of inductor(L503)	Wu Jiang Taihu Insulating Material Co Ltd	T-4260(G)	155 °C	UL 1446	UL E228349
High frequency transformer (T600)	CLICK	BCK2801-2829	2.037 mH±5%, 4.5 ΩMax	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Copper wire of inductor (T600)	Pacific Electric Wire & Cable Co., Ltd.	MW75-C	130 °C	UL 1446	UL E201757
--Epoxy of inductor(T600)	Dongguan Eatto	E-500(xx)	130 °C	UL 746C	UL E218090
--Teflon tube of inductor(T600)	Great Holding Industrial Co., Ltd.	TFL	200 °C	UL 224	UL E156256
--Mylar tape of inductor (T600)	YAHUA	PF	180 °C	UL 510A	UL E165111
--Varnish of inductor (T600)	Kyocera Chemical Corp	TVB2180T*(a)	130 °C	UL 1446	UL E83702
--Copper wire of	Tai-Electric	UEW Polyester	155 °C	UL 1446	UL E85640

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
inductor (T601)	Wire & Cable Co., Ltd.	MW 79C			
--Varnish of inductor (T601)	Wells Electronic	EPOXY/6020H 94V-0	90 °C	UL 746C	UL E229633
--Base of inductor (T601)	Chang Chun Plastics Co., Ltd.	T375J	150 °C	UL 746C	UL E59481
High frequency transformer (T100)	CLICK	BCK2001-1151	25 µH, 130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
--Copper wire of inductor (T100)	Feng Ching Metal Corp	MW75 (UEW/U)	130 °C	UL 1446	UL E172395
--Epoxy of inductor (T100)	Dongguan Eatto	E-500(xx)	130 °C	UL 746C	UL E218090
--Teflon tube of inductor (T100)	Great Holding Industrial	TFL	200 °C	UL 224	UL E156256
--Mylar tape of inductor (T100)	YAHUA	CT	130 °C	UL 510A	UL E165111
--Varnish of inductor (T100)	Kyocera Chemical	TVB2180T*(a)	130 °C	UL 1446	UL E83702
Film capacitor (C103, C111, C213)	TDK	B32654A0334 J000	1000 V, 0.33 µF -55 °C to +110 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Thermistor NTC (RT600)	Kemin	NTC 10D-9	10 Ω, 2 A, -40 °C to +200 °C	EN 60539-1: 2008	TUV B 151093844001
GAS DISCHARGETUBE	Brightking	2RP600L-8	600 VDC, 20 kA 40 °C to +85 °C	UL 1449 CSA C22.2 No. 269	UL E237997
Relay ISO	Songchuan	894-2AH1-F-C	240 Vac, 8 A 85 °C	UL 60947	UL E88991
Relay output	Panasonic	ALFG2PF12	277 Vac, 31 A 85 °C	IEC 61810-1	VDE 40023067
Current sensor – DC (HCT200)	LEM	HLSR 20-P	1000 V, 20 A, -40 °C to +105 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Current sensor – DC (HCT201)	LEM	HLSR 10-P	1000 V, 10 A, -40 °C to +105 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Current sensor AC	VAC	4646-X661	25 A, 300 V	UL 508	UL E317483
MOV (RV100, RV101, RV102, RV103, RV104, RV105, RV400, RV401, RV402, RV500, RV501, RV502)	Thinking Electronic Industrial Co., Ltd.	TVR20821KSC4ANCY	820 V, 6500 A	IEC 61051-1 IEC 61051-2 IEC 61051-2/ AMD1 IEC 61051-2-2 DIN EN 61051-1	VDE 005944
Transistor Switching power	IXYS	IXFH6N120P	1200 V, 6 A	IEC/EN62109-1 IEC/EN62109-2	Test with appliance

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

14	**TABLE: list of critical components**				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
(Q602, Q600)					
IGBT (Q300, Q301, Q302, Q309, Q310, Q311)	ON semiconductor	NGTB40N120 FL3WG	1200 V, 40 A, -40 °C to +130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Alternate	Infineon	IKW40N120H3	1200V,40A, -40°C to +130°C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Diode (D200, D208)	IXYS	DLA60I1200H A	1200 V, 60 A, -40 °C to +130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Alternate	Fairchild	RHRG75120	1200 V, 75 A, -65 °C to +175 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Diode (D209)	Fairchild	RHRG30120	1200V, 30A, -40°C to +130°C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Diode (D201)	CREE	C4D20120D	1200 V, 33 A, -40 °C to +130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Alternate	Global Power Technology Co., Ltd.	G3S12030B	1200 V, 15*2 A, -40 °C to +130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Alternate	Global Power Technology Co., Ltd.	G3S12040B	1200V, 20*2 A, -40 °C to +130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
IGBT(Q303, Q304, Q305, Q306, Q307, Q308)	Infineon	IKW40N65H5	650 V, 40 A, -40 °C to +130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Alternate	On Semiconductor	FGA40T65SH D	650 V, 40 A, -40 °C to +130 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
Optocoupler on control board (U35, U36, U37, U38, U39, U40, U42, U46, U48, U52)	Lite-On	LTV-816	2.5 A, 30 V, -55 °C to +115 °C	EN 60647	VDE 40015248
Optocoupler on control board (U43, U45)	Fairchild	6N137	2.5 A, 30 V, -40 °C to +110 °C	EN 60647	VDE 40018398
Residual Current Monitor	Magtron Intelligent Technology	RCMU101SN-3P6A-5S	10 µF,16 V, -40 °C to +105 °C	UL 508 IEC/EN62109-1 IEC/EN62109-2	UL E492115 Test with appliance
Alternate	SINOMAGS	SFG-1.5P/P2	-40 °C to +105 °C	EN 61326-1:2013	TUV R AE50428896
CPU1	TI	TMS320F2837 7SZWTT	-40 °C to +105 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
CPU2	TI	MSP430F2252 TRHAR	-40 °C to +105 °C	IEC/EN62109-1 IEC/EN62109-2	Test with appliance
[1]) an asterisk indicates a mark which assures the agreed level of surveillance					

Appendix 1: IP65 Test Result

Summary of IP65 test results:

The test performed on EA16KTSI is valid for EA13KTSI, EA10KTSI, EA8KTSI, EA6KTSI and EA5KTSI due to that they have same metal enclosure. After test, no deposit of dust is observable inside the enclosure and no water entered into the enclosure of sample.

According to standard of IEC 60529:2013 (Edition 2.2) / IEC 60529:1989+A1:1999+A2:2013, EN 60529:1991+A1:2000+A2:2013, IEC 62109-1:2010 (clause 6.3), the test result is accepted.

The test results shown in this report relate only to the tests performed according to the test program. The test object has not been submitted to a full test program.

Test program:

This test is according to clause 12.2, 13.4 & 13.6 (IP6X) & 14.2.5 (IPX5) & 14.3 of IEC/EN 60529.

Acceptance condition for first characteristic numeral 6:

The enclosure of the unit under test was considered as Category 1: Enclosures where the normal working cycle of the equipment causes reductions in air pressure within the enclosure below that of the surrounding air.

The protection is satisfactory if no deposit of dust is observable inside the enclosure at the end of the test.

Acceptance condition for secondary characteristic numeral 5:

It is the responsibility of the relevant technical committee to specify the amount of water which may be allowed to enter the enclosure and the details of a dielectric strength test, if any.

14.3 Acceptance conditions:

After testing in accordance with the appropriate requirements of 14.2.1 to 14.2.8 the enclosure shall be inspected for ingress of water.

It is the responsibility of the relevant technical committee to specify the amount of water which may be allowed to enter the enclosure and the details of a dielectric strength test, if any.

In general, if any water has entered, it shall not:

– be sufficient to interfere with the correct operation of the equipment or impair safety;

– deposit on insulation parts where it could lead to tracking along the creepage distances;

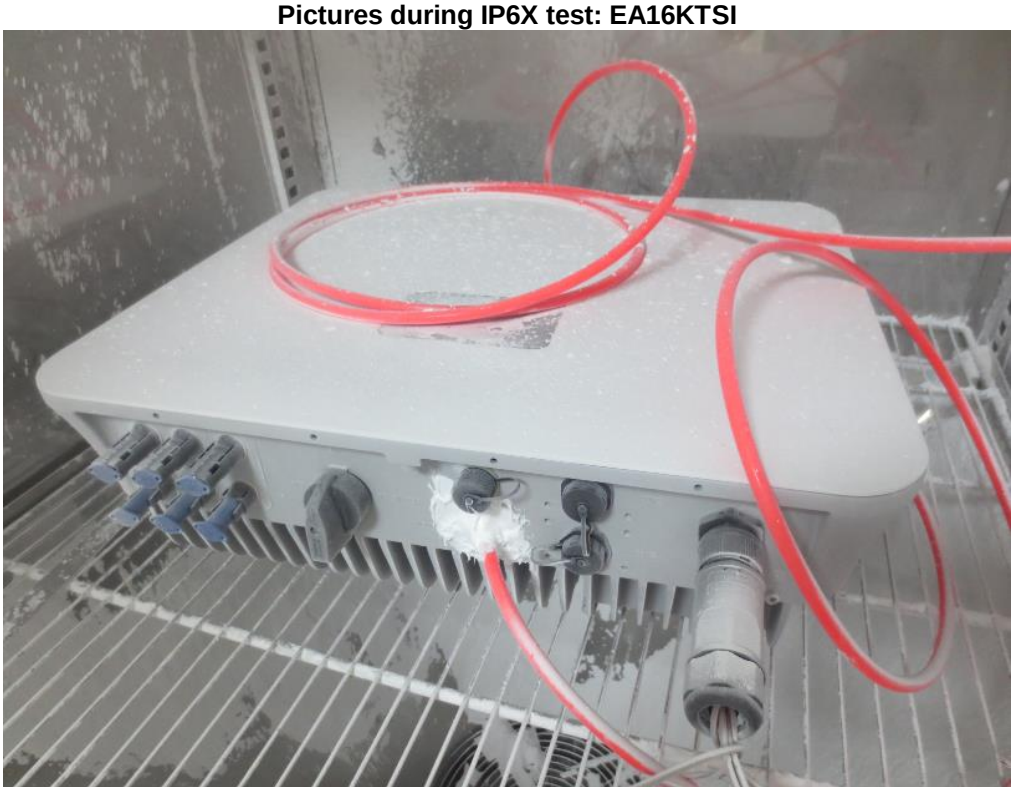
– reach live parts or windings not designed to operate when wet;

– accumulate near the cable end or enter the cable if any.

If the enclosure is provided with drain-holes, it should be proved by inspection that any water which enters does not accumulate and that it drains away without doing any harm to the equipment.

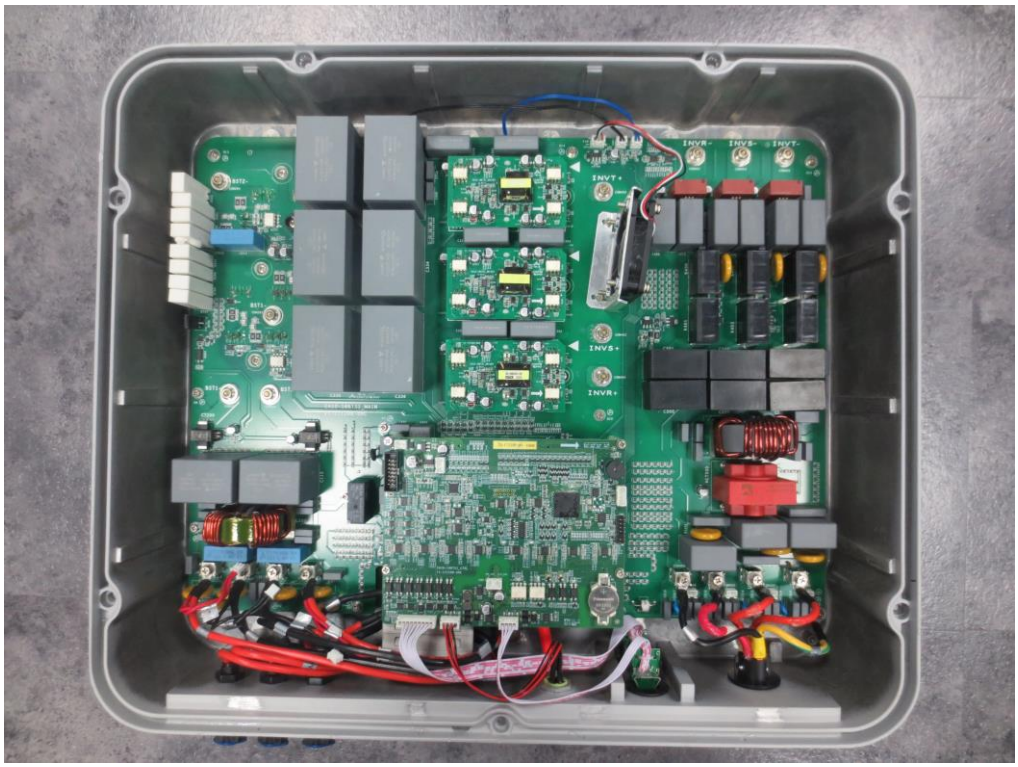
For enclosures without drain-holes, the relevant product standard shall specify the acceptance conditions if water can accumulate to reach live parts.

Pictures during IP6X test: EA16KTSI



Pictures during IPX5 test: EA16KTSI

Pictures after IP65 test:



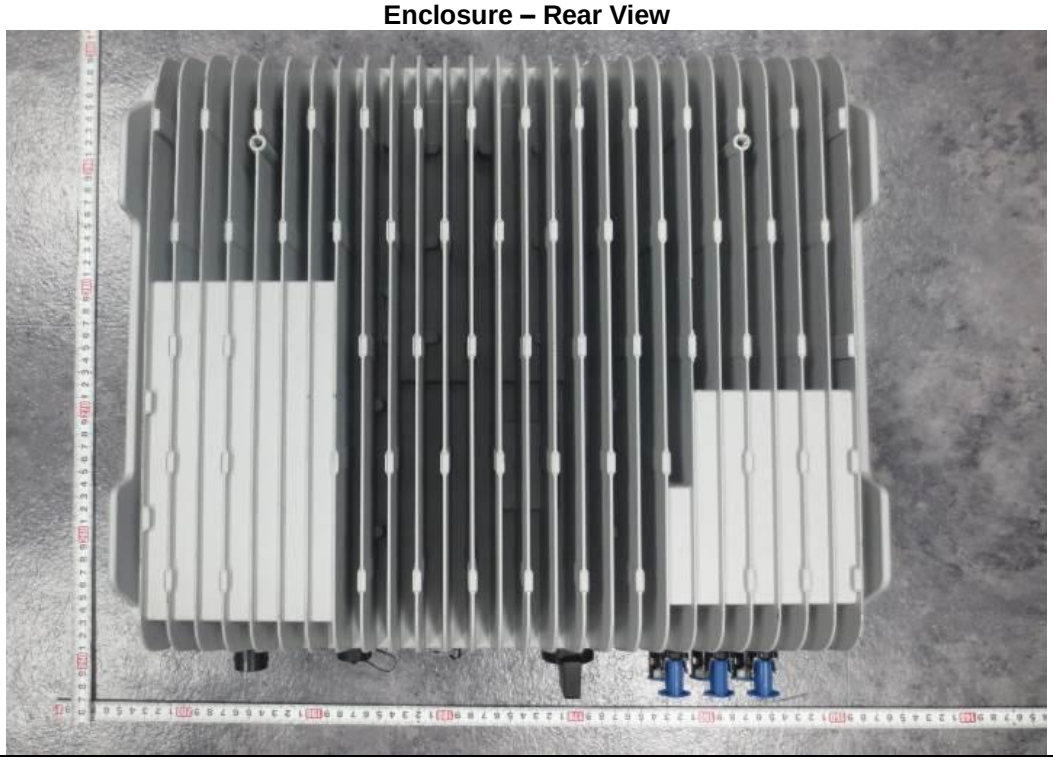
Pictures after IP65 test:

After IP65 test, there was no deposit of dust & no trace of water inside of the enclosure

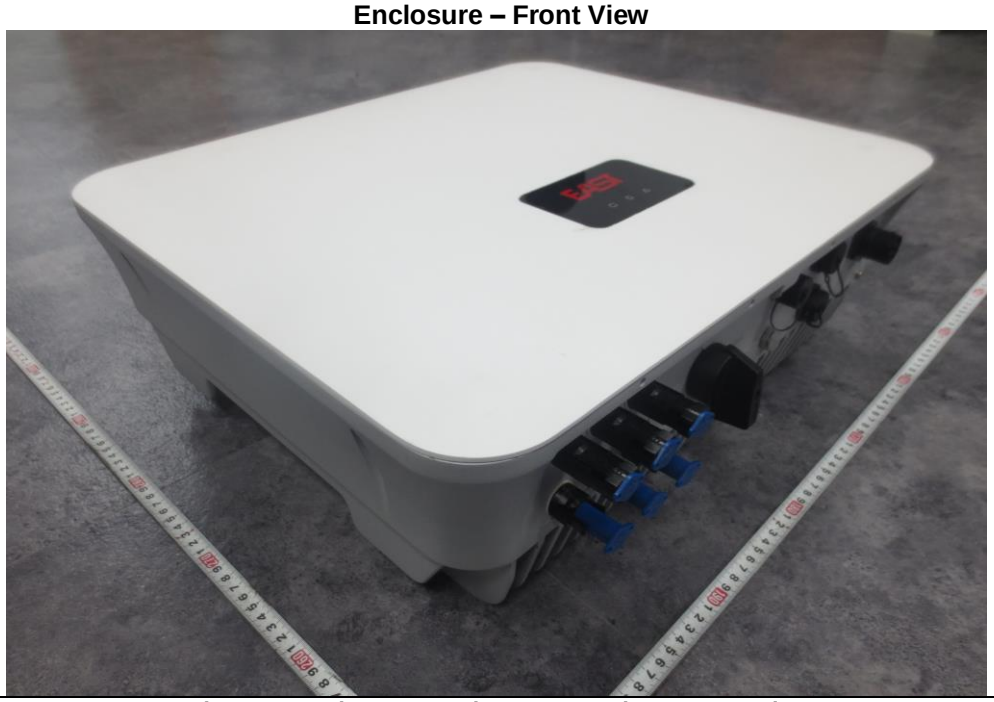
Appendix 2: Pictures

EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Enclosure – Front View

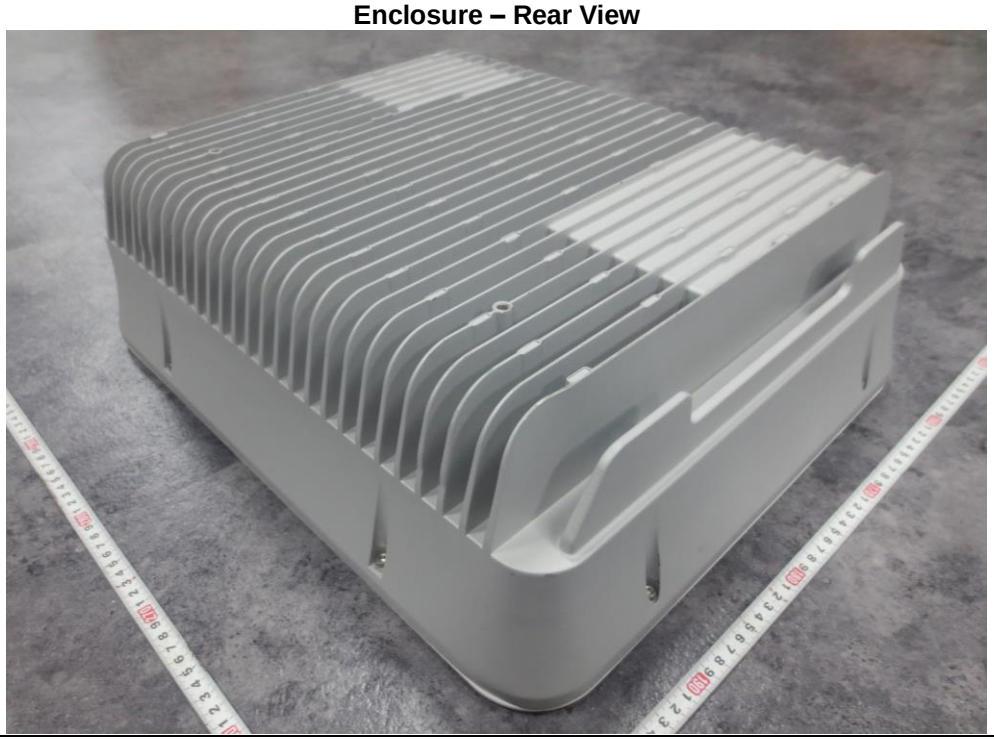
EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Enclosure – Rear View



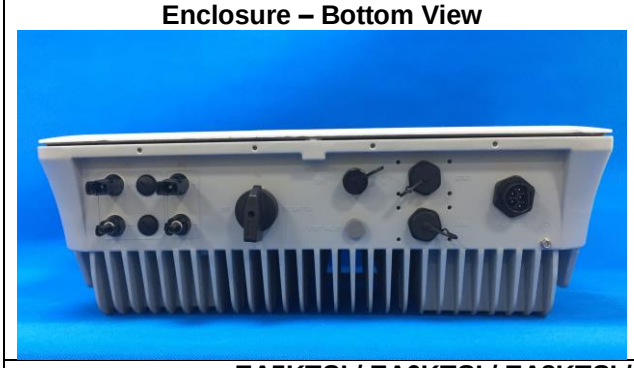
EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Enclosure – Front View



EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Enclosure – Rear View

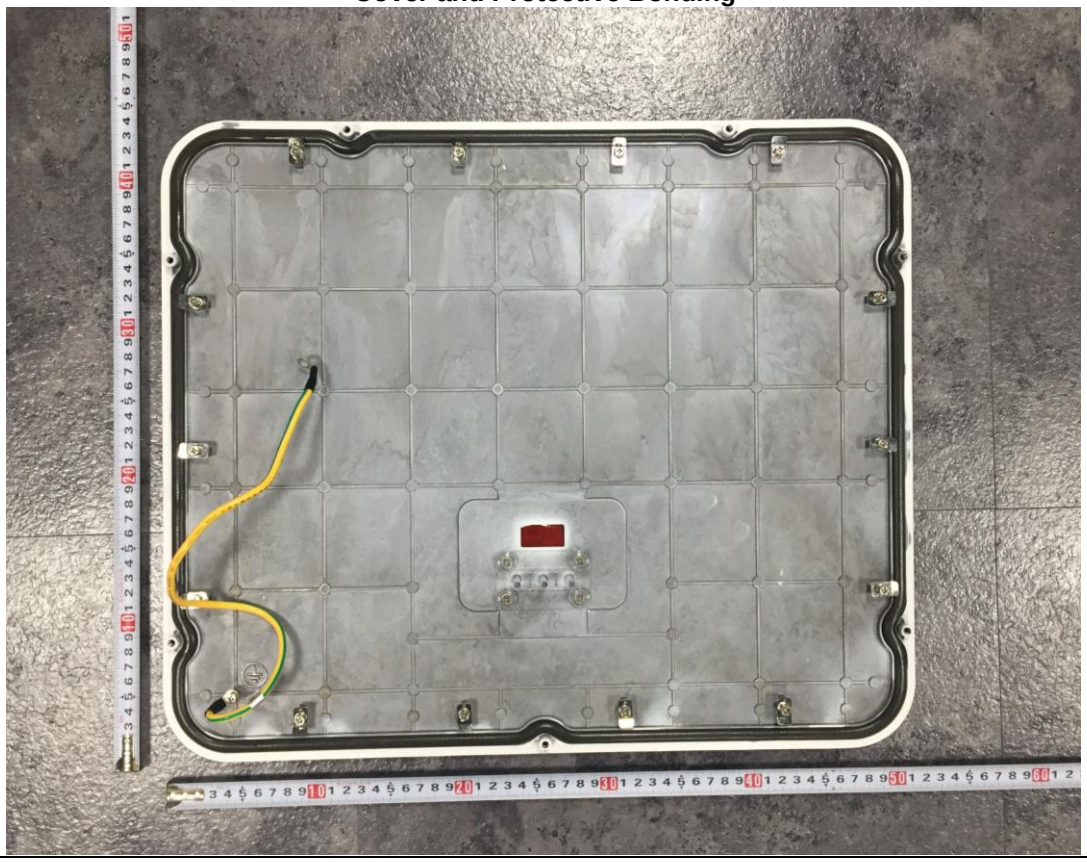


EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI
Enclosure – Bottom View

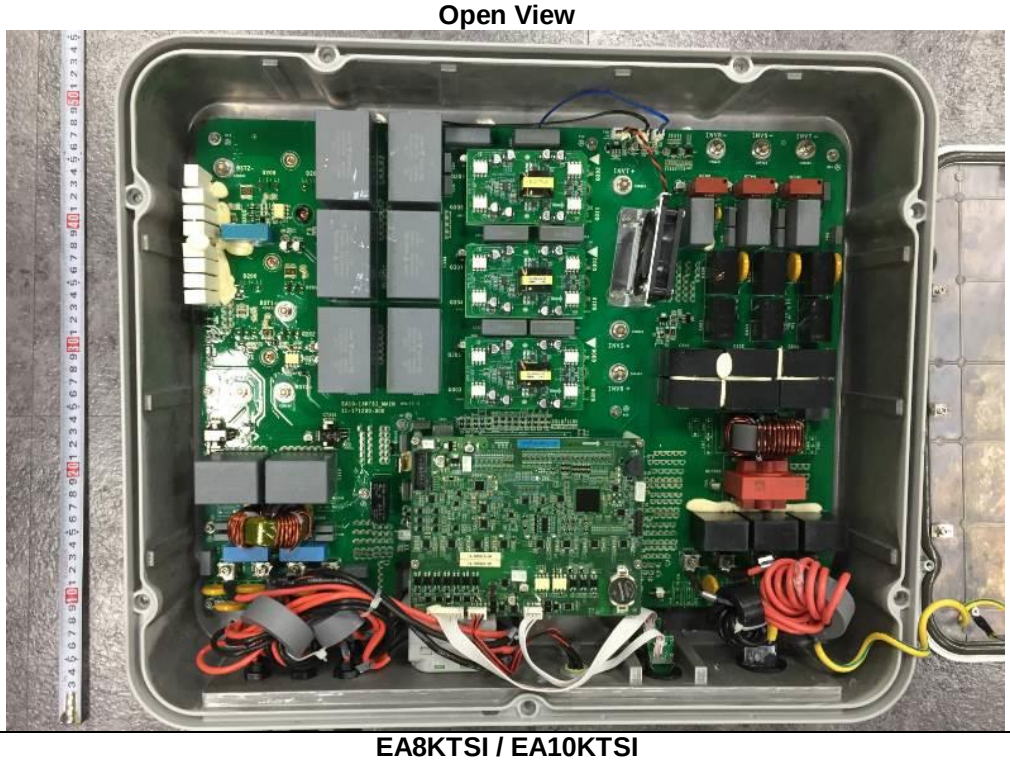


EA13KTSI / EA16KTSI
Enclosure – Bottom View

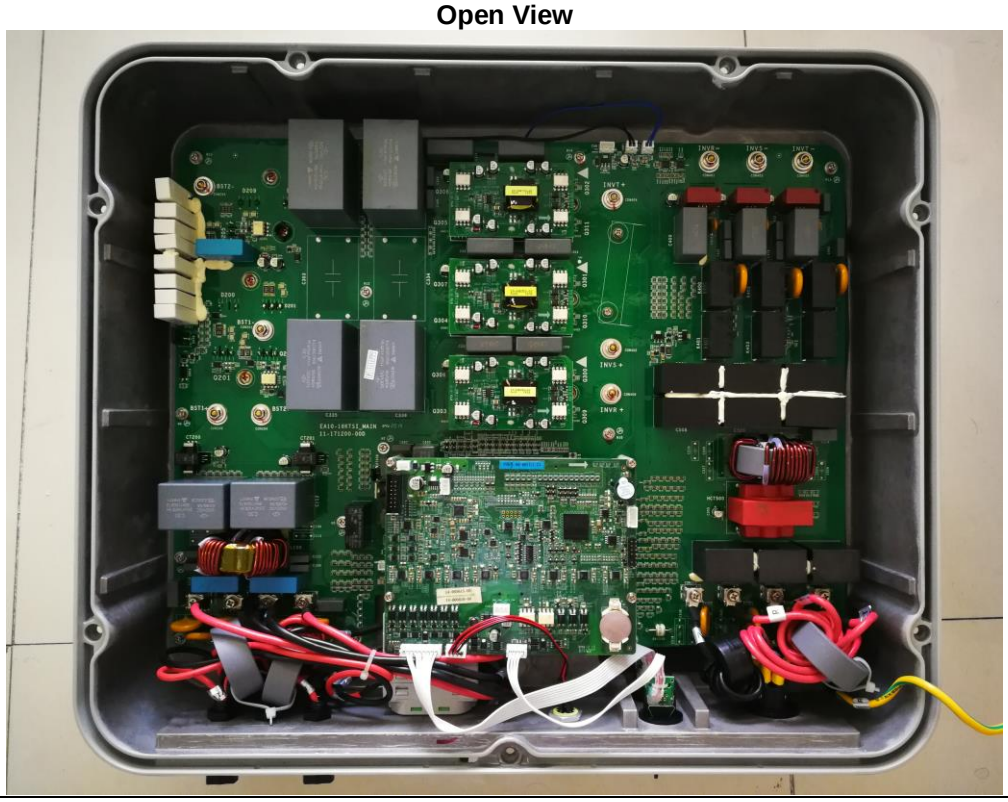
EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Cover and Protective Bonding



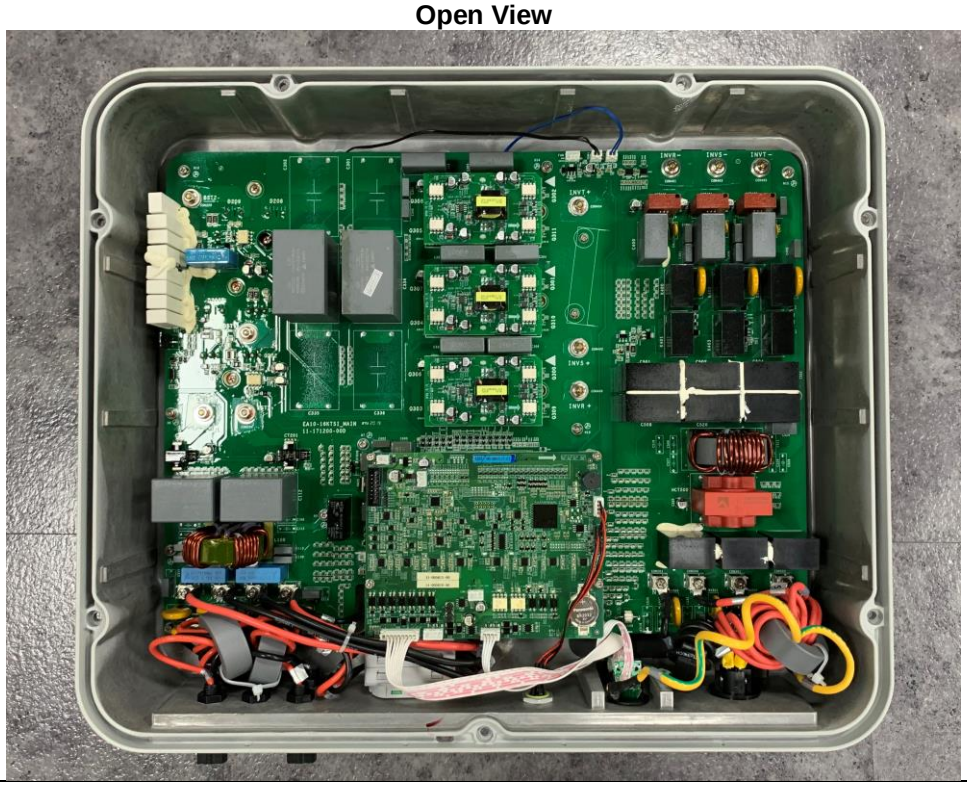
EA13KTSI / EA16KTSI
Open View



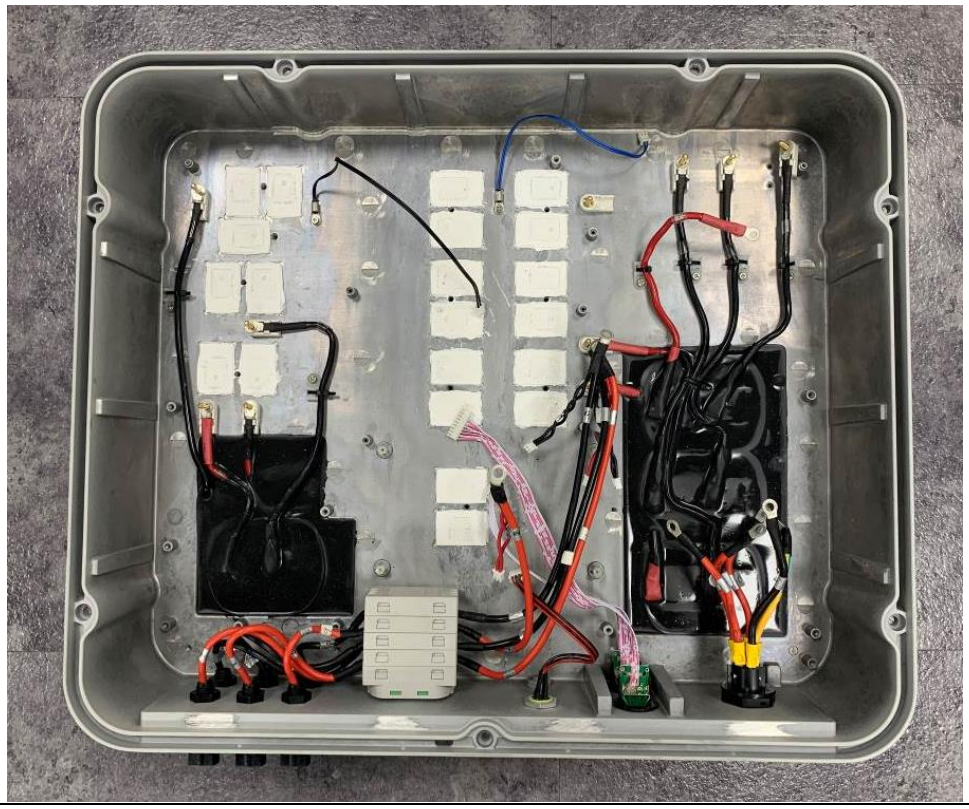
EA8KTSI / EA10KTSI
Open View



EA5KTSI / EA6KTSI
Open View



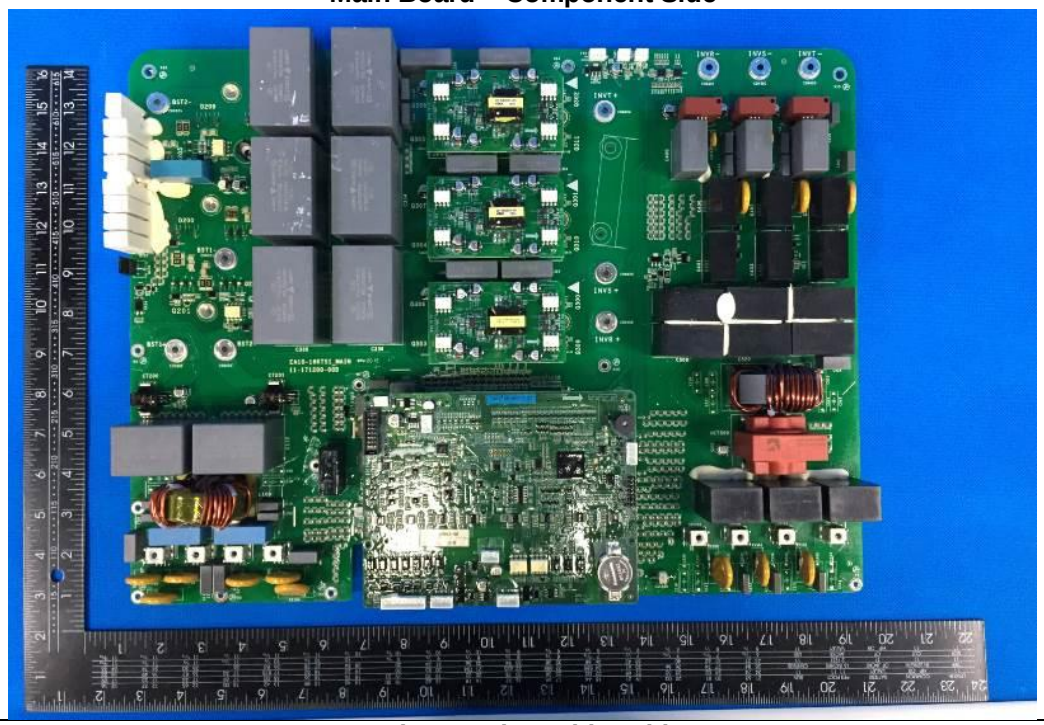
EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Internal Enclosure



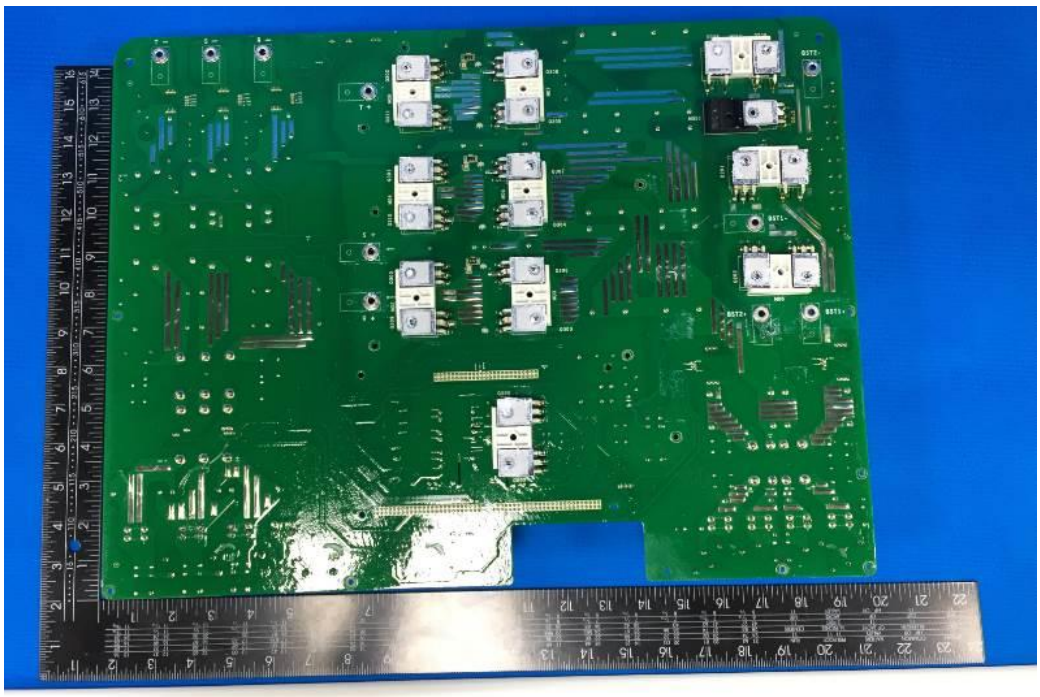
EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
AC Output and Protective Bonding

EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
AC Output and Protective Earthing

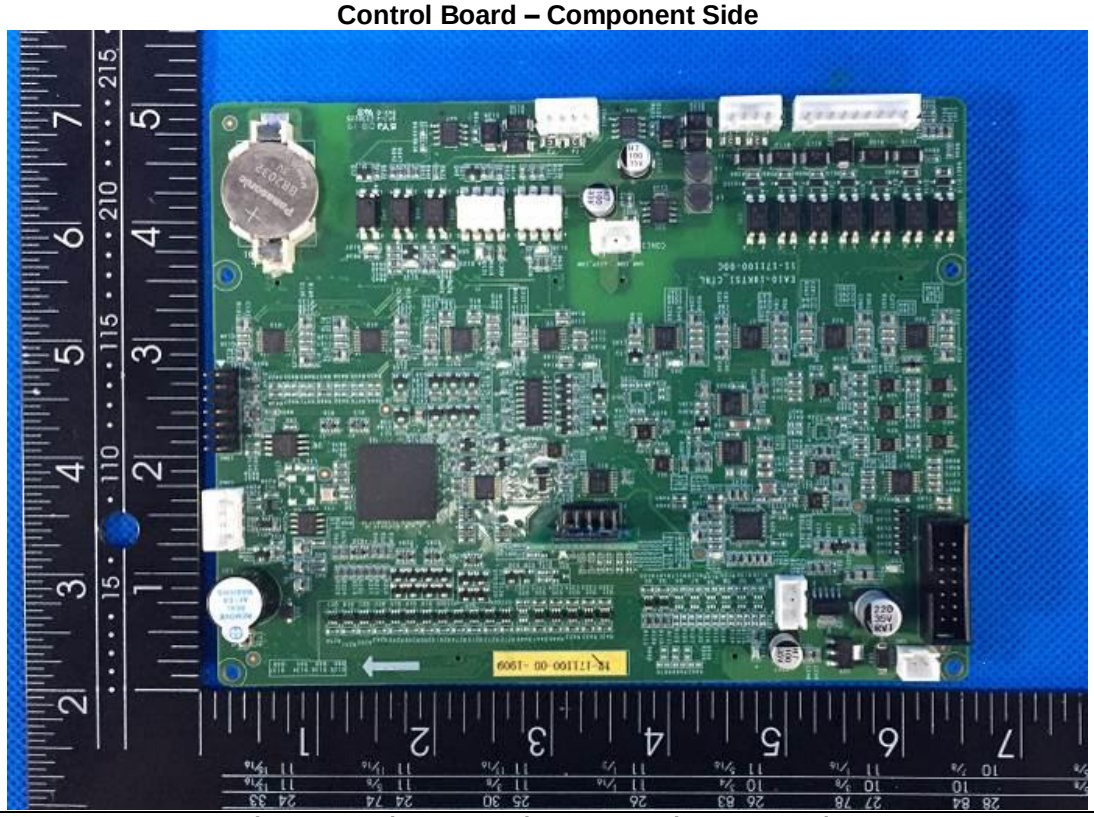
Main Board – Component Side



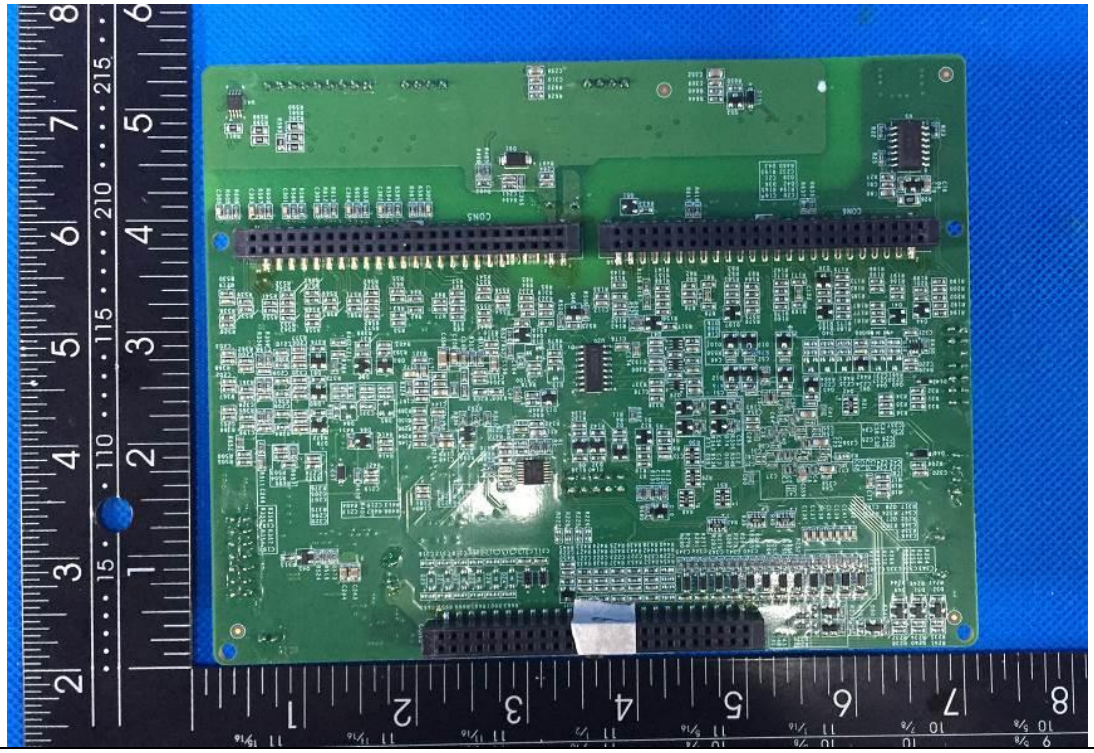
Main Board – Solder Side



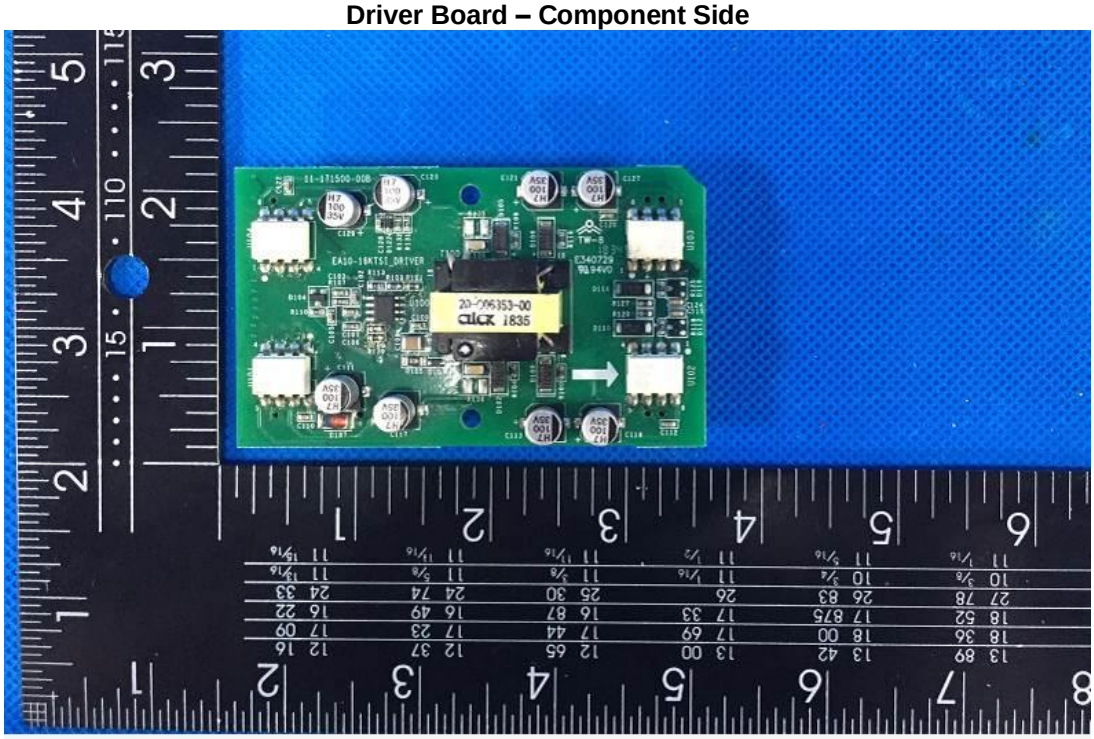
EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Control Board – Component Side



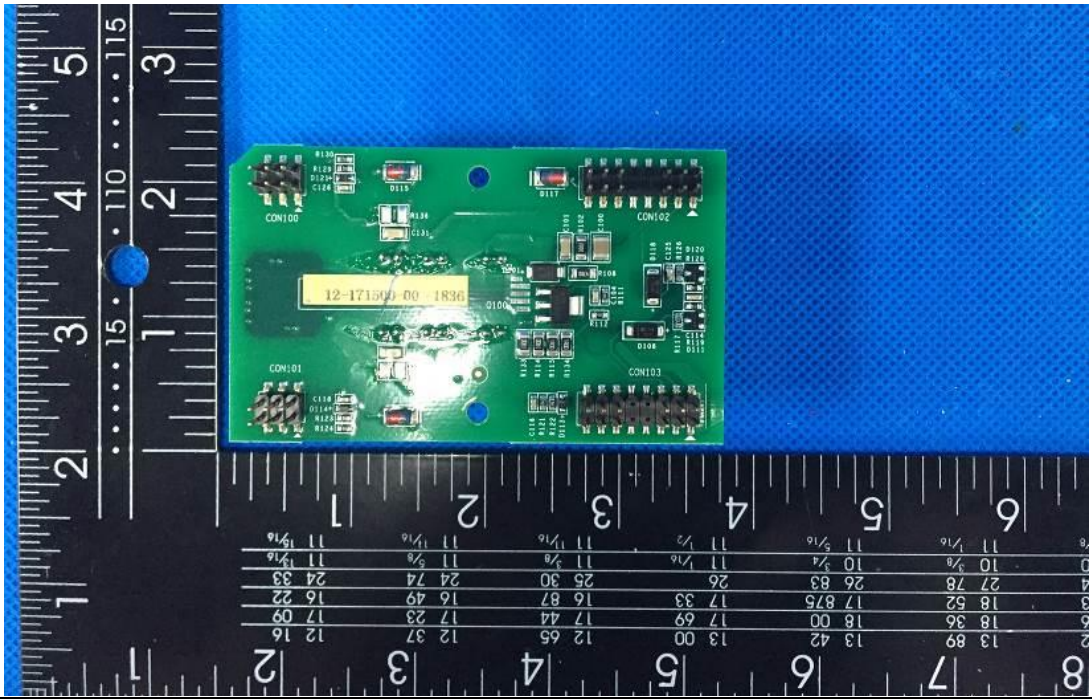
EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Control Board – Solder Side



EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Driver Board – Component Side



EA5KTSI / EA6KTSI / EA8KTSI / EA10KTSI / EA13KTSI / EA16KTSI
Driver Board – Solder Side



--- End of test report---