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

Report Number. ..... :	6067599.50A
Date of issue..... :	2020-01-22
Total number of pages ..... :	100
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

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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 .....:	EA20KTSI, EA25KTSI, EA30KTSI.
Ratings .....:	EA20KTSI: PV input: Max. 1100 Vdc, MPPT voltage range: 200-950 Vdc, max 22 A /22 A, Isc PV: 24 A/24 A, AC output: 230/400 Vac, 50 Hz/60 Hz, 20000 VA, max 29 A. EA25KTSI: PV input: Max. 1100 Vdc, MPPT voltage range: 200-950 Vdc, max 33 A /22 A, Isc PV: 36 A/24 A, AC output: 230/400 Vac, 50 Hz/60 Hz, 25000 VA, max 36.3 A. EA30KTSI: PV input: Max. 1100 Vdc, MPPT voltage range: 200-950 Vdc, max 33 A /33 A, Isc PV: 36 A/36 A, AC output: 230/400 Vac, 50 Hz/60 Hz, 30000 VA, max 43.5 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	Albert Liang
Approved by (name, function, signature) ..:		Jason Guo	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:

- 6067599.50A covering IEC 62109-1:2010 and pictures (100 pages)
- 6067599.50B covering IEC 62109-2:2011 (30 pages)

Summary of testing:

Models EA25KTSI, EA30KTSI are identical with EA20KTSI in topological schematic circuit diagram of hardware except for the bus capacitors quantity (EA20KTSI with 6 bus capacitors, EA25KTSI and EA30KTSI with 8 bus capacitors); inductive reactance of INV inductors and Boost inductors; Boost diode rating; The type designation and the input/output electrical rating.

All tests were performed on Model EA30KTSI except specified otherwise in test results. Tests conducted on Model EA30KTSI or other models specified were considered representative of Models EA20KTSI, EA25KTSI and EA30KTSI.

Tests performed (name of test and test clause):	**Testing location:**
Full applicable clauses test according standards: IEC 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):

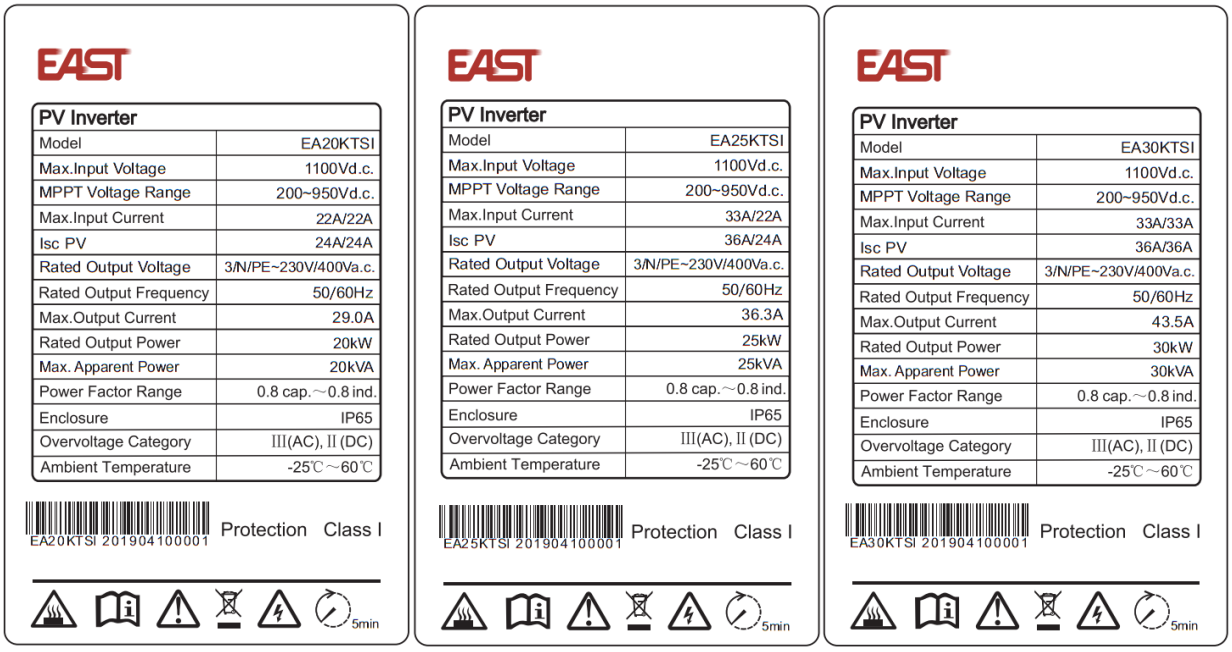
N/A

☒ **The product fulfils the requirements of IEC 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	EA20KTSI
Max.Input Voltage	1100Vd.c.
MPPT Voltage Range	200~950Vd.c.
Max.Input Current	22A/22A
Isc PV	24A/24A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Max.Output Current	29.0A
Rated Output Power	20kW
Max. Apparent Power	20kVA
Power Factor Range	0.8 cap.~0.8 ind.
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA20KTSI 201904100001 Protection Class I

5min

EAST

PV Inverter	
Model	EA25KTSI
Max.Input Voltage	1100Vd.c.
MPPT Voltage Range	200~950Vd.c.
Max.Input Current	33A/22A
Isc PV	36A/24A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Max.Output Current	36.3A
Rated Output Power	25kW
Max. Apparent Power	25kVA
Power Factor Range	0.8 cap.~0.8 ind.
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA25KTSI 201904100001 Protection Class I

5min

EAST

PV Inverter	
Model	EA30KTSI
Max.Input Voltage	1100Vd.c.
MPPT Voltage Range	200~950Vd.c.
Max.Input Current	33A/33A
Isc PV	36A/36A
Rated Output Voltage	3/N/PE~230V/400Va.c.
Rated Output Frequency	50/60Hz
Max.Output Current	43.5A
Rated Output Power	30kW
Max. Apparent Power	30kVA
Power Factor Range	0.8 cap.~0.8 ind.
Enclosure	IP65
Overvoltage Category	III(AC), II (DC)
Ambient Temperature	-25℃~60℃

EA30KTSI 201904100001 Protection Class I

5min

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) ..... :	N/A
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) ..... :	43.5
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 ..... :	2019-12-10 (samples provided by applicant)
Date (s) of performance of tests ..... :	2019-12-10 to 2020-01-10

General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. The product also complies with the following standard: EN 62109-1:2010 **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

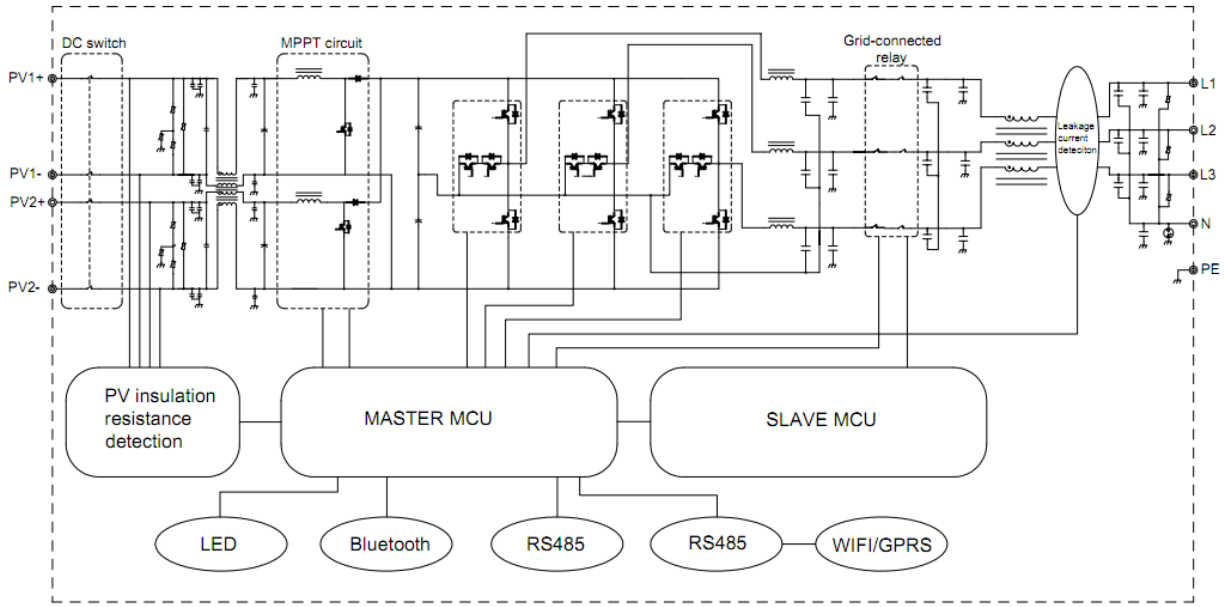
General product information:

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 two relays in series. This designation assures that the disconnection of the output circuit from the grid will also operate in case of one error.

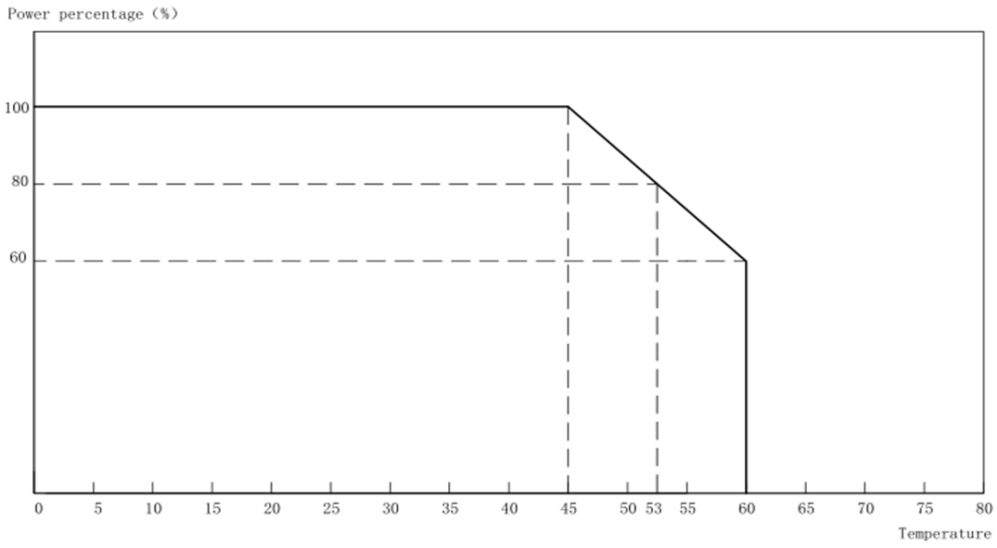
The internal control is redundant built. It consists of two Microcontrollers (master DSP U1, slave DSP U22). The master DSP can control the relays; detect the PV voltage, PV current and BUS voltage, measures grid voltage, frequency, AC current with injected DC, insulation resistance to ground and residual current. The slave CPU (U22) can also detect 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



The ratings of the EA20KTSI, EA25KTSI and EA30KTSI series curve as following derating curve, the output power will derate automatically when ambient temperature exceeds 45°C, and the maximum ambient temperature is 60°C

Derating Curve



Model difference:

1) The models EA25KTSI, EA30KTSI are identical with EA20KTSI in topological schematic circuit diagram of hardware except for the bus capacitors number (EA20KTSI with 6 bus capacitors, EA25KTSI and EA30KTSI with 8 bus capacitors); inductive reactance of INV inductors and Boost inductors; Boost diode rating; The type designation and the input/output electrical rating.

The product was tested on:

Hardware version: 00

Software version: HornetV020

Unless otherwise specified, all the tests were performed on model EA30KTSI 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 decrease 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		P
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	Models EA20KTSI EA25KTSI and EA30KTSI are 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	Maximum available output power equals to rated output power. No overload test is applicable	N/A
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		P
4.5	Humidity preconditioning	(see appended table 7.5)	P
4.5.1	General		P
4.5.2	Conditions		P
4.6	Backfeed voltage protection	Input or output terminals are not accessible	N/A
4.6.1	Backfeed tests under normal conditions		N/A
4.6.2	Backfeed tests under single-fault conditions		N/A
4.6.3	Compliance with backfeed tests		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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. 6067599.50B.	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. outputs, either the power or power factor for each output	Provided on the marking plate	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– 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 conductor shall be marked with:		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– 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		P
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:		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
	– Symbols or text that are moulded, stamped or	The symbols and text were	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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.	printed on the marking plate.	
	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		N/A
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 where it is visible to service personnel before	No such devices which can conduct injury to service	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).	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.	No excessive touch current exceed threshold, Symbol 15 of Annex C was provided by manufacturer's decision	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 resulting installation requirements:	See the user manual.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	– 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	-25 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
	a) assembly, location, and mounting requirements:	See the user manual.	P

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	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	N/A
	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 in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the	See the user manual.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	supply side of this product.“		
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	The PCE 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 equipment.		P
5.3.4.1	Battery maintenance	Without integrated battery	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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
	– POLLUTION DEGREE rating in 6.2 below	See below	P
	– INGRESS PROTECTION (IP) rating, as in 6.3	See below	P

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	below		
	– 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
	Protective separation shall be achieved by:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	▪ 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 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
7.3.4.2.2	Access probe criteria		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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 repeated except that the finger is applied using any necessary force up to 30 N.	There was no opening on the top surfaces.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±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		N/A
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		N/A
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		N/A
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		N/A
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.		P
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
	Circuits and conductive parts do not require protection against direct contact if any connection		P

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	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.		
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 and between simultaneously accessible parts did 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
	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

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Clause	Requirement – Test	Result – Remark	Verdict
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.		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.		P
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 both of the parts involved is painted or coated, the paint or coating shall be removed in the area of		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the		P

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Clause	Requirement – Test	Result – Remark	Verdict
	overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.	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 end of the test, shall not exceed 2.5 V.	See appended table.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		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
	If the external protective earthing conductor is routed through a plug and socket or similar means		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		
	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
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or		P

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Clause	Requirement – Test	Result – Remark	Verdict
	disconnection of the protective earthing conductor.		
	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. See table 7.5.4	N/A
	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.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.	In addition, the caution symbol 15 of Annex C was provided on label and user manual.	N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Class I equipment	N/A
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	• 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 creepage distance measurements.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	• 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;		N/A
	• IT system: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system.		N/A
7.3.7.1.4	Insulation voltages		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
7.3.7.4.1	Determination		P
7.3.7.4.2	Electric field homogeneity		P

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Clause	Requirement – Test	Result – Remark	Verdict
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 are 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
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from	No such operator area can access without the use of a	P

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Clause	Requirement – Test	Result – Remark	Verdict
	charge stored on capacitors after disconnection of the PCE.	tool.	
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 greater than 700 V and the voltage stress on the	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
		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
	If carrying handles or grips are fitted to, or supplied with, the equipment, they shall be capable of		P

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Clause	Requirement – Test	Result – Remark	Verdict
	withstanding a force of four times the weight of the equipment.		
	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.	Method 1	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;		N/A
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as		P

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Clause	Requirement – Test	Result – Remark	Verdict
	specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;		
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and		P
	– insulated wiring, except as permitted in 9.1.2.2.		P
9.1.2.2	Parts not requiring a fire enclosure		N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures	Metal enclosure. LED panel is made of glass.	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 requirements.	P
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

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Clause	Requirement – Test	Result – Remark	Verdict
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		N/A
9.2.1	General		N/A
9.2.2	Limited power source tests		N/A
9.3	Short-circuit and overcurrent protection		P
9.3.1	General		P
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.		P

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

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Clause	Requirement – Test	Result – Remark	Verdict
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 terminal block.	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	P
	– 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	N/A
	– 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		P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord		N/A
13.3.2.5	Cord anchorages and strain relief		N/A
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		N/A
	– the connecting points of the cord conductors are relieved from strain; and		N/A
	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage		N/A
13.3.3	Wiring terminals for connection of external conductors	Certified terminal block is used.	P

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Clause	Requirement – Test	Result – Remark	Verdict
13.3.3.1	Wiring terminals		P
13.3.3.2	Screw terminals		P
13.3.3.3	Wiring terminal sizes		P
13.3.3.4	Wiring terminal design		P
13.3.3.5	Grouping of wiring terminals		P
13.3.3.6	Stranded wire		P
13.3.4	Supply wiring space		P
13.3.5	Wire bending space for wires 10 mm² and greater	Installation wire is less than 10 mm²	N/A
13.3.6	Disconnection from supply sources	Disconnection from supply by manual switch.	P
13.3.7	Connectors, plugs and sockets		P
13.3.8	Direct plug-in equipment		N/A
13.4	Internal wiring and connections		P
13.4.1	General		P
13.4.2	Routing		P
13.4.3	Colour coding	The green-yellow wire was only used for protective bonding conductor.	P
13.4.4	Splices and connections		P
13.4.5	Interconnections between parts of the PCE		N/A
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		P
13.6.3.1	Resistance to arcing		P
13.6.4	UV resistance		N/A
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be	Metal enclosure provided	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	sufficiently resistance to degradation by ultra-violet (UV) radiation		
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

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Clause	Requirement – Test	Result – Remark	Verdict
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
	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	Over temperature is protected by software.	N/A
14.4	Fuse holders		N/A
14.5	MAINS voltage selecting devices		N/A
14.6	Printed circuit boards		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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		P
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.	MOV is used and impulse test was conducted on MOV.	P
14.8	Batteries		N/A
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.	No integrate battery used.	N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A 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

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Clause	Requirement – Test	Result – Remark	Verdict
	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		P

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Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.6	**TABLE: electrical data Output side (Grid connection)**					**P**
Type	U ac(V)	Iac max(A)	Power(W)	Frequency(Hz)	-	-
EA20KTSI	230.2	29.0	20100	50	-	-
EA25KTSI	230.1	36.5	25200	50	-	-
EA30KTSI	230.5	43.2	30100	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(kV)
EA20KTSI	1100	240	203	945	-	-
EA25KTSI	1100	242	205	950	-	-
EA30KTSI	1100	245	210	950	-	-
Supplementary information:						

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 1**		**P**
	test voltage (V) ..... :	490 Vdc, 230 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	67.6	90
Ambient	47.3	-
DC switch	82.1	85
PV connector	53.4	85
PV wire	83.5	105
CON100 (PV terminal metal)	87.3	105
CT200 (Current sensor)	85.0	105
CT1 (Current sensor)	88.9	105
U200 (Optocoupler)	97.1	115
RV100 (MOV)	82.7	85
Input L1 (Inductor)	87.7	130
C103 (Capacitor)	80.7	85
C104 (Capacitor)	83.7	105
C213 (Capacitor)	80.5	85
Q202 (IGBT)	97.1	155
Q208 (IGBT)	96.3	155
D200 (Diode)	86.5	155
D201 (Diode)	102.8	155
U201 (Optocoupler)	92.8	115
Boost inductor (Inductor)	82.0	130
Q314 (IGBT)	98.3	155
Q305 (IGBT)	101.0	155
T100 (Transformer)	83.5	130
U101 (Optocoupler)	87.1	110
HCT400 (Current sensor)	87.3	105
U100(Driver board power IC)	101.3	155
Q300 (IGBT)	101.8	155
Q303 (IGBT)	103.2	155
Q306 (IGBT)	103.3	155
Q309 (IGBT)	109.8	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	99.9	155
Q321 (IGBT)	97.3	155
C400 (Capacitor)	78.3	85
K400 (Relay)	80.3	85
C501 (Capacitor)	77.0	85
L503 (Inductor)	101.5	130
INV Inductor (Inductor)	84.6	130
HCT500 (Current sensor)	76.4	105
C524 (Capacitor)	75.8	110
PCB (Under L503)	100.7	130
PCB (Under CON500)	82.9	130
U1 (Master DSP)	84.5	105
U22 (Slave DSP)	80.3	105
C524 (Near PCB)	75.4	110
AC wire (Near Connector R)	80.4	90
T600 (Transformer)	90.9	130
Q600 (IGBT)	81.3	155
U603 (TL431)	80.5	155
T601 (Transformer)	80.5	130
D625 (Diode)	82.5	155
AC Terminal	75.6	100

Supplementary information:

Note 1: Ran the device EA30KTSI with PV simulator (Pmp:30 KW, Full load MPPT range: 490 Vdc- 950 Vdc) at conditions of 45 °C ambient temperature until steady condition was established; test voltage: 490 Vdc (PV input); 230 Vac (Mains).

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

Note 3: The PCS working at full load.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 2**		**P**
	test voltage (V) ..... :	490 Vdc, 250 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	67.7	90
Ambient	47.6	-
DC switch	82.4	85
PV connector	53.7	85
PV wire	83.9	105
CON100 (PV terminal metal)	87.7	105
CT200 (Current sensor)	85.4	105
CT1 (Current sensor)	89.0	105
U200 (Optocoupler)	97.0	115
RV100 (MOV)	83.2	85
Input L1 (Inductor)	88.1	130
C103 (Capacitor)	80.0	85
C104 (Capacitor)	83.8	105
C213 (Capacitor)	80.1	85
Q202 (IGBT)	97.9	155
Q208 (IGBT)	97.0	155
D200 (Diode)	86.4	155
D201 (Diode)	102.6	155
U201 (Optocoupler)	92.9	115
Boost inductor (Inductor)	81.4	130
Q314 (IGBT)	97.8	155
Q305 (IGBT)	99.9	155
T100 (Transformer)	83.2	130
U101 (Optocoupler)	87.0	110
HCT400 (Current sensor)	87.1	105
U100(Driver board power IC)	100.5	155
Q300 (IGBT)	101.0	155
Q303 (IGBT)	102.0	155
Q306 (IGBT)	102.5	155
Q309 (IGBT)	108.0	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	99.3	155
Q321 (IGBT)	96.9	155
C400 (Capacitor)	78.4	85
K400 (Relay)	80.0	85
C501 (Capacitor)	77.0	85
L503 (Inductor)	101.3	130
INV Inductor (Inductor)	84.6	130
HCT500 (Current sensor)	76.2	105
C524 (Capacitor)	75.6	110
PCB (Under L503)	99.6	130
PCB (Under CON500)	82.1	130
U1 (Master DSP)	84.1	105
U22 (Slave DSP)	80.1	105
C520 (Near PCB)	84.1	110
AC wire (Near Connector R)	80.0	90
T600 (Transformer)	91.2	130
Q600 (IGBT)	81.5	155
U603 (TL431)	80.9	155
T601 (Transformer)	80.7	130
D625 (Diode)	82.6	155
AC Terminal	75.4	100

Supplementary information:

Note 1: Ran the device EA30KTSI with PV simulator (Pmp:30 KW, Full load MPPT range: 490 Vdc- 950 Vdc) at conditions of 45 °C ambient temperature until steady condition established; test voltage: 490 Vdc (PV input); 250 Vac (Mains).

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

Note 3: The PCS working at full load.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 3**		**P**
	test voltage (V) ..... :	850 Vdc, 230 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	63.7	90
Ambient	47.4	-
DC switch	76.4	85
PV connector	52.6	85
PV wire	78.3	105
CON100 (PV terminal metal)	80.4	105
CT200 (Current sensor)	80.7	105
CT1 (Current sensor)	83.2	105
U200 (Optocoupler)	85.1	115
RV100 (MOV)	77.5	85
Input L1 (Inductor)	80.4	130
C103 (Capacitor)	79.2	110
C104 (Capacitor)	78.4	105
C213 (Capacitor)	78.7	110
Q202 (IGBT)	81.5	155
Q208 (IGBT)	80.2	155
D200 (Diode)	82.8	155
D201 (Diode)	81.8	155
U201 (Optocoupler)	86.0	115
Boost inductor (Inductor)	77.9	130
Q314 (IGBT)	98.2	155
Q305 (IGBT)	100.7	155
T100 (Transformer)	82.7	130
U101 (Optocoupler)	86.3	110
HCT400 (Current sensor)	86.2	105
U100(Driver board power IC)	101.2	155
Q300 (IGBT)	101.7	155
Q303 (IGBT)	108.1	155
Q306 (IGBT)	105.1	155
Q309 (IGBT)	112.1	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	99.5	155
Q321 (IGBT)	96.7	155
C400 (Capacitor)	77.5	85
K400 (Relay)	78.7	85
C501 (Capacitor)	76.0	85
L503 (Inductor)	102.8	130
INV Inductor (Inductor)	84.2	130
HCT500 (Current sensor)	75.9	105
C524 (Capacitor)	74.9	110
PCB (Under L503)	102.2	130
PCB (Under CON500)	83.3	130
U1 (Master DSP)	82.1	105
U22 (Slave DSP)	77.8	105
C520 (Near PCB)	85.4	110
AC wire (Near Connector R)	80.4	90
T600 (Transformer)	88.8	130
Q600 (IGBT)	79.5	155
U603 (TL431)	77.6	155
T601 (Transformer)	77.2	130
D625 (Diode)	78.2	155
AC Terminal	76.1	100

Supplementary information:

Note 1: Run the device EA30KTSI with PV simulator (Pmp:30 KW, Full load MPPT range: 490 Vdc- 950 Vdc) at 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 PCS working at full load.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 4**		**P**
	test voltage (V) ..... :	850 Vdc, 250 Vac	—
	t1 (°C)..... :	45	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	59.5	90
Ambient	46.9	-
DC switch	70.9	85
PV connector	51.1	85
PV wire	72.5	105
CON100 (PV terminal metal)	74.3	105
CT200 (Current sensor)	74.1	105
CT1 (Current sensor)	76.4	105
U200 (Optocoupler)	78.2	115
RV100 (MOV)	71.8	85
Input L1 (Inductor)	75.0	130
C103 (Capacitor)	73.4	85
C104 (Capacitor)	72.7	105
C213 (Capacitor)	72.5	85
Q202 (IGBT)	74.1	155
Q208 (IGBT)	73.0	155
D200 (Diode)	75.3	155
D201 (Diode)	73.9	155
U201 (Optocoupler)	75.2	115
Boost inductor (Inductor)	69.6	130
Q314 (IGBT)	89.4	155
Q305 (IGBT)	91.4	155
T100 (Transformer)	76.7	130
U101 (Optocoupler)	79.5	110
HCT400 (Current sensor)	80.1	105
U100(Driver board power IC)	93.0	155
Q300 (IGBT)	93.6	155
Q303 (IGBT)	97.0	155
Q306 (IGBT)	96.1	155
Q309 (IGBT)	100.9	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	91.8	155
Q321 (IGBT)	89.4	155
C400 (Capacitor)	71.8	85
K400 (Relay)	73.2	85
C501 (Capacitor)	70.7	85
L503 (Inductor)	94.8	130
INV Inductor (Inductor)	78.2	130
HCT500 (Current sensor)	70.9	105
C524 (Capacitor)	69.8	110
PCB (Under L503)	93.4	130
PCB (Under CON500)	76.8	130
U1 (Master DSP)	77.6	105
U22 (Slave DSP)	72.8	105
C520 (Near PCB)	78.8	110
AC wire (Near Connector R)	74.7	90
T600 (Transformer)	84.7	130
Q600 (IGBT)	74.5	155
U603 (TL431)	72.7	155
T601 (Transformer)	72.2	130
D625 (Diode)	72.9	155
AC Terminal	71.2	100

Supplementary information:

Note 1: Ran the device EA30KTSI with PV simulator (Pmp: 30 KW, Full load MPPT range: 490 Vdc- 950 Vdc) at conditions of 45 °C ambient temperature until steady condition was established; test voltage: 850 Vdc (PV input); 250 Vac (Mains).

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

Note 3: The PCS working at full load.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 5**		**P**
	test voltage (V) ..... :	490 Vdc, 230 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	72.3	90
Ambient	62.1	-
DC switch	79.6	85
PV connector	65.2	85
PV wire	81.5	105
CON100 (PV terminal metal)	82.7	105
CT200 (Current sensor)	83.7	105
CT1 (Current sensor)	85.4	105
U200 (Optocoupler)	86.9	115
RV100 (MOV)	81.1	85
Input L1 (Inductor)	82.6	130
C103 (Capacitor)	81.7	110
C104 (Capacitor)	80.8	105
C213 (Capacitor)	82.0	110
Q202 (IGBT)	83.8	155
Q208 (IGBT)	82.9	155
D200 (Diode)	83.9	155
D201 (Diode)	83.6	155
U201 (Optocoupler)	85.0	115
Boost inductor (Inductor)	84.3	130
Q314 (IGBT)	100.2	155
Q305 (IGBT)	102.8	155
T100 (Transformer)	85.9	130
U101 (Optocoupler)	89.9	110
HCT400 (Current sensor)	88.4	105
U100(Driver board power IC)	103.2	155
Q300 (IGBT)	103.9	155
Q303 (IGBT)	108.0	155
Q306 (IGBT)	106.0	155
Q309 (IGBT)	112.9	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	102.1	155
Q321 (IGBT)	99.4	155
C400 (Capacitor)	81.2	85
K400 (Relay)	82.4	85
C501 (Capacitor)	80.1	85
L503 (Inductor)	101.5	130
INV Inductor (Inductor)	88.4	130
HCT500 (Current sensor)	80.2	105
C524 (Capacitor)	80.1	110
PCB (Under L503)	103.0	130
PCB (Under CON500)	86.1	130
U1 (Master DSP)	86.9	105
U22 (Slave DSP)	82.0	105
C520 (Near PCB)	87.5	110
AC wire (Near Connector R)	84.0	90
T600 (Transformer)	93.1	130
Q600 (IGBT)	84.4	155
U603 (TL431)	82.4	155
T601 (Transformer)	81.7	130
D625 (Diode)	80.9	155
AC Terminal	81.8	100

Supplementary information:

Note 1: Ran the device EA30KTSI with PV simulator (Pmp:30KW, Full load MPPT range: 490Vdc- 950Vdc) at conditions of 60 °C ambient temperature until steady condition was established; test voltage: 490 Vdc (PV input); 230 Vac (Mains).

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

Note 3: Power output comply with derating curve of general product information.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 6**		**P**
	test voltage (V) ..... :	490 Vdc, 250 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	75.6	90
Ambient	62.6	-
DC switch	82.3	85
PV connector	65.9	85
PV wire	83.4	105
CON100 (PV terminal metal)	85.8	105
CT200 (Current sensor)	85.1	105
CT1 (Current sensor)	86.9	105
U200 (Optocoupler)	95.0	115
RV100 (MOV)	81.7	85
Input L1 (Inductor)	84.7	130
C103 (Capacitor)	80.2	85
C104 (Capacitor)	83.0	105
C213 (Capacitor)	81.1	85
Q202 (IGBT)	96.1	155
Q208 (IGBT)	96.0	155
D200 (Diode)	87.1	155
D201 (Diode)	99.6	155
U201 (Optocoupler)	92.3	115
Boost inductor (Inductor)	81.4	130
Q314 (IGBT)	95.9	155
Q305 (IGBT)	97.9	155
T100 (Transformer)	83.8	130
U101 (Optocoupler)	87.1	110
HCT400 (Current sensor)	87.1	105
U100(Driver board power IC)	98.6	155
Q300 (IGBT)	99.6	155
Q303 (IGBT)	99.8	155
Q306 (IGBT)	100.8	155
Q309 (IGBT)	106.1	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	98.3	155
Q321 (IGBT)	96.6	155
C400 (Capacitor)	79.8	85
K400 (Relay)	81.4	85
C501 (Capacitor)	79.0	85
L503 (Inductor)	94.1	130
INV Inductor (Inductor)	86.5	130
HCT500 (Current sensor)	78.0	105
C524 (Capacitor)	78.9	110
PCB (Under L503)	93.2	130
PCB (Under CON500)	81.3	130
U1 (Master DSP)	86.9	105
U22 (Slave DSP)	82.1	105
C520 (Near PCB)	82.5	110
AC wire (Near Connector R)	80.2	90
T600 (Transformer)	93.5	130
Q600 (IGBT)	85.7	155
U603 (TL431)	85.0	155
T601 (Transformer)	83.8	130
D625 (Diode)	82.4	155
AC Terminal	77.8	100

Supplementary information:

Note 1: Ran the device EA30KTSI with PV simulator (Pmp:30 KW, Full load MPPT range: 490 Vdc- 950 Vdc) at conditions of 60 °C ambient temperature until steady condition was established; test voltage: 490 Vdc (PV input); 250 Vac (Mains).

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

Note 3: Power output comply with derating curve of general product information.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 7**		**P**
	test voltage (V) ..... :	850 Vdc, 230 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	75.5	90
Ambient	62.1	-
DC switch	81.4	85
PV connector	66.0	85
PV wire	83.6	105
CON100 (PV terminal metal)	86.0	105
CT200 (Current sensor)	85.4	105
CT1 (Current sensor)	87.2	105
U200 (Optocoupler)	95.5	115
RV100 (MOV)	81.7	85
Input L1 (Inductor)	84.8	130
C103 (Capacitor)	80.4	85
C104 (Capacitor)	82.8	105
C213 (Capacitor)	81.4	85
Q202 (IGBT)	97.0	155
Q208 (IGBT)	96.3	155
D200 (Diode)	86.8	155
D201 (Diode)	102.6	155
U201 (Optocoupler)	92.1	115
Boost inductor (Inductor)	81.7	130
Q314 (IGBT)	97.3	155
Q305 (IGBT)	99.9	155
T100 (Transformer)	84.1	130
U101 (Optocoupler)	87.7	110
HCT400 (Current sensor)	87.8	105
U100(Driver board power IC)	101.2	155
Q300 (IGBT)	102.1	155
Q303 (IGBT)	102.3	155
Q306 (IGBT)	102.8	155
Q309 (IGBT)	108.5	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	100.6	155
Q321 (IGBT)	98.3	155
C400 (Capacitor)	80.0	85
K400 (Relay)	81.6	85
C501 (Capacitor)	79.2	85
L503 (Inductor)	95.7	130
INV Inductor (Inductor)	86.7	130
HCT500 (Current sensor)	78.2	105
C524 (Capacitor)	79.1	110
PCB (Under L503)	97.4	130
PCB (Under CON500)	82.3	130
U1 (Master DSP)	87.0	105
U22 (Slave DSP)	82.1	105
C520 (Near PCB)	83.6	110
AC wire (Near Connector R)	81.1	90
T600 (Transformer)	92.9	130
Q600 (IGBT)	85.1	155
U603 (TL431)	84.5	155
T601 (Transformer)	83.1	130
D625 (Diode)	82.4	155
AC Terminal	79.0	100

Supplementary information:

Note 1: Ran the device EA30KTSI with PV simulator (Pmp:30 KW, Full load MPPT range: 490 Vdc- 950 Vdc) at conditions of 60 °C ambient temperature until steady condition was established; test voltage: 850 Vdc (PV input); 230 Vac (Mains).

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

Note 3: Power output comply with derating curve of general product information.

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Clause	Requirement – Test	Result – Remark	Verdict

4.3	**TABLE: heating temperature rise measurements - Test 8**		**P**
	test voltage (V) ..... :	850 Vdc, 250 Vac	—
	t1 (°C)..... :	60	—

Thermocouple Locations	Max. temperature measured (°C)	Max. temperature limit, (°C)
Enclosure	72.5	90
Ambient	62.0	-
DC switch	79.4	85
PV connector	65.2	85
PV wire	80.9	105
CON100 (PV terminal metal)	82.1	105
CT200 (Current sensor)	83.0	105
CT1 (Current sensor)	84.5	105
U200 (Optocoupler)	86.4	115
RV100 (MOV)	80.7	85
Input L1 (Inductor)	82.0	130
C103 (Capacitor)	81.1	85
C104 (Capacitor)	80.5	105
C213 (Capacitor)	81.2	85
Q202 (IGBT)	83.5	155
Q208 (IGBT)	82.8	155
D200 (Diode)	83.9	155
D201 (Diode)	83.5	155
U201 (Optocoupler)	84.4	115
Boost inductor (Inductor)	79.6	130
Q314 (IGBT)	98.4	155
Q305 (IGBT)	100.7	155
T100 (Transformer)	84.5	130
U101 (Optocoupler)	87.9	110
HCT400 (Current sensor)	87.5	105
U100(Driver board power IC)	101.8	155
Q300 (IGBT)	102.8	155
Q303 (IGBT)	105.4	155
Q306 (IGBT)	104.8	155
Q309 (IGBT)	110.7	155

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Clause	Requirement – Test	Result – Remark	Verdict

Q312 (IGBT)	101.0	155
Q321 (IGBT)	98.8	155
C400 (Cpacitor)	79.9	85
K400 (Relay)	81.1	85
C501 (Capacitor)	78.9	85
L503 (Inductor)	99.27	130
INV Inductor (Inductor)	87.4	130
HCT500 (Current sensor)	78.7	105
C524 (Capacitor)	79.0	110
PCB (Under L503)	99.0	130
PCB (Under CON500)	83.7	130
U1 (Master DSP)	86.3	105
U22 (Slave DSP)	81.4	105
C520 (Near PCB)	85.2	110
AC wire (Near Connector R)	82.0	90
T600 (Transformer)	93.2	130
Q600 (IGBT)	84.7	155
U603 (TL431)	82.3	155
T601 (Transformer)	81.5	130
D625 (Diode)	80.6	155
AC Terminal	80.3	100

Supplementary information:

Note 1: Ran the device EA30KTSI with PV simulator (Pmp:30KW, Full load MPPT range: 490 Vdc- 950 Vdc) at conditions of 60 °C ambient temperature until steady condition was established; test voltage: 850 Vdc (PV input); 250 Vac (Mains).

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

Note 3: Power output comply with derating curve of general product information.

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Clause	Requirement – Test	Result – Remark	Verdict

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 (R300)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Bus Over Volt Trans Err”. No damage, no hazard
2	BUS Voltage detection (R300)	short circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “Bus Volt Plus-Minus Unbalance Err”. No damage, no hazard
3	Grid voltage detection R (R584)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
4	Grid voltage detection R (R584)	short circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
5	Grid voltage detection N (R678)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
6	Grid voltage detection N (R678)	short circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
7	Grid voltage detection R (R550)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
8	Grid voltage detection R (R550)	Short Circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
9	Inv voltage detection R(R424)	short circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Inv soft Start Fail Err”. No damage, no hazard
10	Inv voltage detection R (R424)	Open Circuit	620Vdc/230 Vac	10min	--	--	Inv soft Start Fail Err PCE shutdown and disconnected from grid immediately. Error message:“Inv soft Start Fail Err”. No damage, no hazard
11	Inv voltage detection N(R407)	short circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
12	Inv voltage detection N(R407)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
13	Inv voltage detection N(R144)	short circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
14	Inv voltage detection N(R144)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard.

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Clause	Requirement – Test	Result – Remark	Verdict

15	Power supply +12V (T612-T616)	Short Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No damage, no hazard
16	Power supply +7V (T616-T619)	Short Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No damage, no hazard
17	Power supply +15V (T609-T610)	Short Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No damage, no hazard
18	Power supply +15V2 (T604-T606)	Short Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Inv soft Start Fail Err”. No damage, no hazard
19	ISO detection relay (RY900)	Short Circuit before start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ ISO Fail Err”. No damage, no hazard
20	BUS Capacitor (C301)	Short Circuit after startup	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ Bus Over Volt Trans Err”. No damage, no hazard
21	PV+ to PV-	Shorted	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage. No damage, no hazard.
22	PV+ to PV-	Reversed	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage. No damage, no hazard.
23	Leakage current detection (R579)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “GFCI Sensor Err”. No damage, no hazard
24	Leakage current detection (R579)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “GFCI Sensor Err”. No damage, no hazard
25	Transformer T600 (Pin 8-pin 9)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: LED off. No power output No damage, no hazard
26	Transformer T600 (Pin10-pin 12)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: LED off. No power output No damage, no hazard
27	Off grid voltage detection (R164)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “ Grid Over Volt Err”. No damage, no hazard
28	Off grid voltage detection (R164)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “ Grid Over Volt Err”. No damage, no hazard

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Clause	Requirement – Test	Result – Remark	Verdict

29	INV Current detection (R75)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Inv Over Curr Trans Err”. No damage, no hazard
30	INV Current detection (R75)	Short circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Inv Over Curr Trans Err”. No damage, no hazard
31	Grid frequency detection (R408)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Grid Under Freq Err”. No damage, no hazard
32	Grid frequency detection (R408)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Grid Under Freq Err”. No damage, no hazard
33	Output Relay (K400)	Short Circuit before start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Output Relay Err”. No damage, no hazard
34	Output Relay (K400)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
35	DSP power supply loss 3.3V (C240)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. No damage, no hazard
36	DSP power supply loss 3.3V (C240)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. No error massage, No damage, no hazard.
37	Communication defect between DSP (R36)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. No damage, no hazard
38	Communication defect between DSP (R36)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SPI Comm Fail Err”. No damage, no hazard
39	Communication defect between DSP (R31)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
40	Communication defect between DSP (R31)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE Normal State. No error message. No damage, no hazard
41	Crystal Oscillator defect (C183)	Short Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message: “SMCU Grid Freq Err”. No damage, no hazard

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Clause	Requirement – Test	Result – Remark	Verdict

42	Crystal Oscillator defect (C183)	Open Circuit after start up	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“SMCU Grid Freq Err”. No damage, no hazard
43	N-PE voltage detection R678	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Ground Connection Err”. No damage, no hazard
44	N-PE voltage detection R678	Short Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“Ground Connection Err”. No damage, no hazard
45	Crystal Oscillator defect (C182)	Short Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“SMCU Grid Freq Err”. No damage, no hazard
46	Crystal Oscillator defect (C182)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“SMCU Grid Freq Err”. No damage, no hazard
47	Crystal Oscillator defect (C182)	Open Circuit	620Vdc/230 Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“SMCU Grid Freq Err”. No damage, no hazard
48	Heat Dissipation Fan	locked-rotor	620Vdc/230 Vac	25min	--	--	PCE output power derated to 60% No Error message, No damage, no hazard
49	L1, N	Mis-wiring with incorrect phase sequence	620Vdc/230 Vac	10min	--	--	PCE cannot start up, Error message: “Grid Over Volt Err”. No damage, no hazard
50	L1, GND	Mis-wiring with incorrect phase sequence	620Vdc/230 Vac	10min	--	--	PCE can not start up, Error message: “Grid Over Volt Err”. No damage, 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

4.4.4.4 Transformer short circuit tests(T600, Input 1100Vdc)							
1	Pin17-18	SC	Pmp:30kw	10min	--	--	EUT normal, with full load output
2	Pin14-15	SC	Pmp:30kw	10min	--	--	EUT normal, with full load output
3	Pin10-12	SC	Pmp:30kw	10min	--	--	EUT output power off, relay switched off.
4	Pin10-11	SC	Pmp:30kw	10min	--	--	EUT output power off, relay switched off.
5	Pin8-9	SC	Pmp:30kw	10min	--	--	EUT normal, with full load output
5	Pin5-6	SC	Pmp:30kw	10min	--	--	EUT normal, with full load output
4.4.4.5 Output short circuit							
1	Output L1-N	SC after start up	620Vdc/230V ac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error massage: " Grid Under Volt Err2". Short current 0A. No damage, no hazard
2	Output L2-N	SC after start up	620Vdc/230V ac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error massage: " Grid Under Volt Err2". Short current 0A. No damage, no hazard
3	Output L3-N	SC after start up	620Vdc/230V ac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error massage: " Grid Under Volt Err2". Short current 0A. No damage, no hazard
4	Output N-PE	SC after start up	620Vdc/230V ac	10min	--	--	PCE shutdown and disconnected from grid immediately. Short current 0A. No damage, no hazard
5	Output L1-L2	SC after start up	620Vdc/230V ac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:" Grid Under Volt Err2". Short current 79.9A. No damage, no hazard
6	Output L1-L3	SC after start up	620Vdc/230V ac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:" Grid Under Volt Err2". Short current 80.9A. No damage, no hazard

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Clause	Requirement – Test	Result – Remark	Verdict

7	Output L2-L3	SC after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ Grid Under Volt Err2”. Short current 79.8A. No damage, no hazard
8	Output L1-L2, L3	SC after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“ Grid Under Volt Err2”. Short current: L1 69.2A. L2 69.4A L3 69.2A No damage, no hazard
9	Output PE not connected	SC after start up	620Vdc/230Vac	10min	--	--	PCE shutdown and disconnected from grid immediately. Error message:“PE Fail Err”. No damage, no hazard
4.4.4.6 Backfeed current test							
1	MPPT1	Backfeed current	1100Vdc/230Vac	10min	--	--	No back feed current in MPPT1, with the DC current
2	MPPT2	Backfeed current	1100Vdc/230Vac	10min	--	--	No back feed current in MPPT2
3	AC output	Backfeed current	1100Vdc/230Vac	10min	--	--	No back feed current in AC output
4.4.4.7 Output overload							
--	--	--	--	--	--	--	--
The PCE can not working on overload mode.							
4.4.4.11 Reverse d.c. connections							
1	PV+ to PV-	RV	Voc:1100V Pmp:30kw	10min	--	--	EUT could not start up.

Supplementary information:
Tests performed under abnormal or fault conditions shall be tested with a source capable of 1,25 to 1,5 times the PCE rated maximum input current (Isc PV) for that input.
SC: short circuit
OC: open circuit
OL: over load
RV: reversed

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.2	**TABLE: DVC and Working Voltage Measurement**		
Location (from pin ... to...)	rms voltage (V)	peak voltage (V)	Classification
Transformer(T600, input 1100Vdc)			
Primary pin1 - Primary pin18	322	550	C
Primary pin1 - Primary pin17	84	550	C
Primary pin1 - Primary pin15	575	1250	C
Primary pin1 - Primary pin14	568	1100	C
Primary pin1 - Primary pin12	99	635	C
Primary pin1 - Primary pin11	94	605	C
Primary pin1 - Primary pin9	96	620	C
Primary pin1 - Primary pin8	131	520	C
Primary pin1 - Primary pin6	232	710	C
Primary pin3 - Secondary pin18	70	450	C
Primary pin3 - Secondary pin17	88	560	C
Primary pin3 - Secondary pin15	570	720	C
Primary pin3 - Secondary pin14	573	750	C
Primary pin3 - Secondary pin12	73	170	C
Primary pin3 - Secondary pin11	79	180	C
Primary pin3 - Secondary pin9	70	140	C
Primary pin3 - Secondary pin8	62	130	C
Primary pin1 - Primary pin3	172	1120	C
Secondary pin17- Secondary pin18	17	114	C
Secondary pin14- Secondary pin15	22	128	C
Secondary pin10- Secondary pin12	78	129	C
Secondary pin10- Secondary pin11	8	62	C
Secondary pin8 - Secondary pin 9	19	138	C
Supplementary information: N/A			

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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	126	0.620	0.005	2
PE-terminal to side enclosure cover	126	0.252	0.002	2
PE-terminal to enclosure heatsink	126	0.504	0.004	2
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 Grid_T to Earth (H2) Through PCB	1100	1100	4.0	6.9	5.52	6.90
BI between Grid_S to Earth Through PCB RV501	1100	1100	4.0	6.9	5.52	6.9
BI between Grid_R to Earth Through PCB RV500	1100	1100	4.0	6.9	5.52	6.9
BI between Grid_N to Earth through PCB GAS500	1100	1100	4.0	5.7	5.52	5.7
BI between INVT to Earth(H4) through PCB	1100	1100	4.0	7.0	5.52	7.0
BI between INVS to Earth(H4) through PCB	1100	1100	4.0	7.4	5.52	7.4
FI between Grid T to Grid S through PCB	1100	1100	4.0	5.7	5.52	5.7
FI between Grid S to Grid R through PCB	1100	1100	4.0	5.7	5.52	5.7
FI between Grid R to Grid N through PCB	1100	1100	4.0	5.7	5.52	5.7
FI between INV T to INV S through PCB	1100	1100	4.0	5.9	5.52	5.9
FI between INV S to INV R through PCB	1100	1100	4.0	5.9	5.52	5.9
Main Board PV circuit:						
BI between PV1+ to Earth through PCB (near C100)	1100	1100	4.0	7.3	5.52	7.3
BI between PV1- to Earth through PCB (near C105)	1100	1100	4.0	7.1	5.52	7.1
BI between PV2+ to Earth through PCB (near C115)	1100	1100	4.0	7.8	5.52	7.8
BI between PV2- to Earth through PCB (near C115)	1100	1100	4.0	6.5	5.52	6.5
BI between BST1+ to Earth(H7) through PCB	1100	1100	4.0	7.4	5.52	7.4
BI between BUS+ to Earth(H12) through PCB	1100	1100	4.0	8.3	5.52	8.3
BI between BUS- to Earth(H10) through PCB	1100	1100	4.0	8.6	5.52	8.6
BI between BUS- to Earth(H8)	1100	1100	4.0	6.3	5.52	6.3

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	TABLE: clearance and creepage distance measurements						P
through PCB(near SPS)							
FI between INVR to INVS	1100	1100	4.0	6.2	5.52	6.2	
FI between INVS to INVT	1100	1100	4.0	6.2	5.52	6.2	
BI between INVR to Earth (H3)	1100	1100	4.0	8.1	5.52	8.1	
BI between INVS to Earth (H3)	1100	1100	4.0	6.5	5.52	6.5	
BI between INVT to Earth (H4)	1100	1100	4.0	6.2	5.52	6.2	
BI between BST1 to Earth(H7)	1100	1100	4.0	7.8	5.52	7.8	
FI between BST1+ to BST1-	1100	1100	4.0	6.2	5.52	6.2	
FI between BST2+ to BST2-	1100	1100	4.0	9.4	5.52	9.4	
FI between C303+ to C303- (BUS capacitor)	1100	1100	4.0	6.3	5.52	6.3	
FI between C5+ to C5- (BUS capacitor)	1100	1100	4.0	6.3	5.52	6.3	
FI between C6+ to C6- (BUS capacitor)	1100	1100	4.0	6..6	5.52	6.6	
FI between C301+ to C301- (BUS capacitor)	1100	1100	4.0	8.0	5.52	8.0	
FI between C303+ to C303- (BUS capacitor)	1100	1100	4.0	6.3	5.52	6.3	
FI between C303+ to C303- (BUS capacitor)	1100	1100	4.0	6.3	5.52	6.3	
FI between C304+ to C304- (BUS capacitor)	1100	1100	4.0	6.5	5.52	6.5	
FI between C334+ to C334- (BUS capacitor)	1100	1100	4.0	6.5	5.52	6.5	
FI between C335+ to C335- (BUS capacitor)	1100	1100	4.0	6.5	5.52	6.5	
FI between C336+ to C336- (BUS capacitor)	1100	1100	4.0	6.5	5.52	6.5	
Communication circuit							
SI between communication circuit and DSP control circuit through opto-coupler (U35, U36, U37, U38, U39, U40, U42)	1100	1100	4.0	7.5	5.52	7.5	
SI between communication circuit and DSP control circuit through opto-coupler(U46,U48,U54).	1100	1100	4.0	7.5	5.52	7.5	

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	**TABLE: clearance and creepage distance measurements**					P
SI between communication circuit and DSP control circuit through opto-coupler(U43, U45).	1100	1100	4.0	7.5	5.52	7.5
BI between primary and secondary circuit pin 1, 2, 3 to pin 17, 18(under T600).	1100	1100	4.0	13.9	5.52	13.9
BI between primary and secondary circuit pin 1, 2, 3 to pin 14, 15(under T600).	1100	1100	4.0	18.7	5.52	18.7
BI between primary and secondary circuit pin 4, 5 to pin 14, 15(under T600).	1100	1100	4.0	6.5	5.52	6.5
BI between primary and secondary circuit pin 4, 5, 6 to pin 10, 11, 12 (under T600).	1100	1100	4.0	6.1	5.52	6.1
DI between Primary circuit Pin 4, 5 and communication circuit Pin 8, 9 through PCB (between C625-C632).	1100	1100	6.5	9.7	11.04	11.6
DI between primary circuit Pin 4, 5 and communication circuit Pin 8, 9 through PCB(between D615-C645 near T600).	1100	1100	6.5	10.3	11.04	11.2
DI between primary and communication circuit through PCB(between Pin5-Pin8 under T600).	1100	1100	6.5	9.5	11.04	11.2
PCE UNIT						
BI between AC output conductor to metal enclosure	1100	1100	4.0	13.0	11.0	13.0
BI between AC output conductor R to enclosure	1100	1100	4.0	14.4	11.0	14.4
BI between AC output conductor S to enclosure	1100	1100	4.0	14.4	11.0	14.4
BI between AC output conductor T to enclosure	1100	1100	4.0	14.4	11.0	14.4
BI between DC input conductor to metal enclosure	1100	1100	4.0	28.2	11.0	31.1
BI between DC input conductor to metal enclosure across DC switch	1100	1100	4.0	25.0	11.0	35.0
BI between IGBT pins to heat sink across insulation material(ceramic)	1100	1100	4.0	5.5	--	--
Transformer (T600)						

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	**TABLE: clearance and creepage distance measurements**					P
BI between Primary pin1,2,3 Secondary pin 10, 11, 13	1100	1100	4.0	7.1	5.52	7.1
BI between Primary pin1,2,3 Secondary pin 15, 16	1100	1100	4.0	7.1	5.52	7.1
BI between Primary pin1,2,3 Secondary pin 17, 18	1100	1100	4.0	7.1	5.52	7.1
SI between communication pin8, 9 Secondary pin 10, 11, 12	1100	1100	4.0	7.1	5.52	7.1
DI between Primary pin5, 6 to communication pin 8, 9	1100	1100	6.5	12.2	11.0	12.2

Supplementary information:

Maximum DC voltage was considered for maximum working voltage of PV and Mains combined.

The PCB comparative tracking index (CTI) ≥ 175.

The compliance of the rest functional insulation of the PCS was evaluated by the short circuit test. 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)
SPS transformer(Insulation Type)	1100 Vdc	4780	<0.2	0.045*3
Insulation sheet between IGBT (Boost) and heatsink mainboard for basic insulation.	230 Vac	1500	>0.2	1.22
Insulation sheet between IGBT (Inverter) and heatsink mainboard for basic insulation.	230 Vac	1500	>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	2120	6000	-	No breakdown
AC output terminal to earthed enclosure	2120	6000	-	No breakdown
DC input terminal to communication port	4240	8000	-	No breakdown
AC output terminal to communication port	4240	8000	-	No breakdown

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Clause	Requirement + Test	Result - Remark	Verdict

7.3.9.2	Protection against shock hazard due to stored energy- service access area		P
Measurement location:	Initial voltage (V)	Discharge time to DVC A (s)	Comments
BUS+ to BUS-	1100	93.0	-
PV1+ to PV1-	1100	50.4	-
PV2+ to PV2-	1100	52.0	-
Supplementary information: DVC A: 60Vdc (35Vdc for wet location); 35,4Vpeak, 25Vrms (22,6Vpeak, 16Vrms for wet location)			

7.4.3	Protection against energy hazards- service access area		P
Measurement location:	Initial voltage (V)	Discharged time to 20J (s)	Comments
BUS+ to BUS-	1100	6.5	-
PV1+ to PV1-	1100	6.9	-
PV2+ to PV2-	1100	7.0	-
Supplementary information: Calculated hazards energy is 300Vdc, by E=0.5CU^2. (7.4.1)			

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Clause	Requirement + Test	Result - Remark	Verdict

7.5.4	**TABLE: Touch current measurement**				**P**
Measurement location	Test voltage (V)	Test frequency (Hz)	Measured current (mA)	Comments	
Metal enclosure → Ground	DC 850 Vdc, AC 253 Vac	50 /60	1.64/1.85	< 3.5 mA	
Supplementary information: After Ingress protection test as specified in clause 6.3, followed by the touch current test of 7.5.4 if required by 7.3.6.3.7.					

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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	1500 V, 35 A, -40 °C ~ +85 °C	EN 62852:2015	TUV R 50157783
DC Switch	Nader	NDG3V-50H	Ue: 1250 Vdc, Ie: 36 A, 4P, -40°C ~ +85 °C,	IEC 60947-1 2011 IEC 60947-3 2005	TUV B 180383574 315
Terminal block	Phoenix	UW 10/S-3073335	500 Vac, 57 A, -40 °C ~ +100 °C	UL 508 UL 1059	UL E60425
AC output cable gland	NBC	PG29	18 mm ~ 25 mm, -40 °C ~ +100 °C	EN60217 6:1994 +A2 2003	SGS SHMR12121 2872
Capacitor (C104, C112)	Faratronic	C3D1M406KM 0A402	40 µF, 1100 Vdc, -40 °C ~ +105 °C	EN 61071:2007 EN 61881-1: 2011	TUV R 50266108
Alternate	Faratronic	C3D1M206KF 0A402	20 µF, 1100 Vdc, -40 °C ~ +105 °C	EN 61071:2007 EN 61881-1: 2011	TUV R 50266108
Capacitor (C103, C111, C213)	Faratronic	C3H3L334JD0 6380	1200 Vdc,0.33 uF, -40 °C ~ +85 °C	UL 810	UL E256238
X-Capacitor (C523, C524, C525)	Faratronic	MKP65	1.5 µF, 440 Vac, X1, -40 °C ~ +110 °C	IEC 60384-14:2005	VDE 40021925
CBB capacitor (C400,C407, C422)	Faratronic	CBB61	3.5 µF, 350 Vac -40 °C ~ +85 °C	IEC 60252-1: 2011	VDE 40023504
Bus capacitor on bus board (C5, C6, C301, C302,C303,C334, C335,C336)	Faratronic	C3D	100 µF, 600 Vdc, 57*35*50, -40 °C ~ +105 °C	EN 61071:2007 EN 61881-1: 2011	TUV R 50266108
Y-Capacitor Output (C101,C102, C106,C107,C108, C109,C113,C115, C300,C340,C600, C602,C607,C608, C645,C646)	Faratronic	MKP63	4.7 nF, 300 Vac, 13*9*4, -40 °C ~ +105 °C	EN 60384-14:2013	Intertek SE/0366-2C
Capacitor (C501,C502,C504)	Faratronic	C6AR2106KF3 0550	10 uF, 350 Vac, 41*41*26 -40 °C ~ +85 °C	UL 810	UL E256238
C605	Faratronic	C3D	2.0 uF, 1200 V	IEC 61071:2007 IEC 61881-1	TUV R AN 50267748
PCB (Main board)	Baoyuejia	BYJ-4	362*400*2, V-0, 130 °C	UL 94	UL E230225
PCB	Baoyuejia	BYJ-4	155*384*2, V-0,	UL 94	UL E230225

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

(Output board)			130 °C		
PCB (Control board)	Baoyuejia	BYJ-4	158*123*2, V-0, 130 °C	UL 94	UL E230225
Boost Inductor	Click	BCK6001-037	649.8 uH, 3 mΩ max (EA20KTSI) 889.0 uH,30.0 mΩ (EA25KTSI,EA30 KTSI)	IEC 62109-1 IEC 62109-2	Test with appliance
-Copper wire	Tianshun	MW36-C	0.7 mm*9.0 mm, 200 °C (EA20KTSI)	UL 1446	UL E210986
--Alternate	Tianshun	MW36-C	1.2mm*10.0 mm, 200 °C (EA25KTSI,EA30 KTSI)	UL 1446	UL E210986
-PCB (Boost1)	Shengyi	BST1	130 °C	UL 94, UL746F UL 746E	UL E109769
-Epoxy	Emerson & Cuming	G500	-40 °C ~ +180 °C	IEC 62109-1 IEC 62109-2	Test with appliance
-Varnish(Boost1)	John C Dolph Co	BC-359	180 °C	UL 1446	UL E317427
-Heat shrink tube	Changyuan	CB-HFT	125 °C	UL 224	UL E180908
-Silicone tube	Shenzhen Wahchangwei	SRS-70* Thermal Rating	200 °C	UL 1441	UL E233803
-Nomex	E I Dupont De Nemours	410	220 °C	UL 94	UL E34739
-Soflex	Sui On	TJ6640NMN	180 °C	UL 1446	UL E355960
-Margin tape	3M Company	44D	130 °C	UL 510A	UL E17385
-Kapton tape	Yahua	PF-301	180 °C	UL 510A	UL E165111
-Silicone molding resin	Shengkangtai Silicone	HC-608AB	150 °C, V-0	UL 94	UL E341043
Inductor (L1,L2)	Spitzer	SPT-40H9824-L	3.0 mH, 100 mΩ Φ=2.0*2P mm	IEC 62109-1 IEC 62109-2	Test with appliance
-Copper wirer(L1,L2)	Ronsen Super	MW30-C	180 °C	UL 94	UL E164502
-- Insulation film (L1,L2)	Dupont Teijin Film	Melinex-238	130 °C	UL 94	UL E93687
-Margin tape (L1,L2)	Jingjiang Yahua	WF-2901	130 °C	UL 94	UL E165111
-Varnish of inductor (L1,L2)	Suzhou Taihu	T-4260(a)	155 °C	UL 94	UL E228349
Inductor (INV1,INV 2, INV3)	Click	BST1	286.6 uH±15%, 25.0 mΩ max	IEC 62109-1 IEC 62109-2	Test with appliance
-PCB	Shengyi Technology Co Ltd	BST1	130 °C	UL 94 UL 746F UL 746E	UL E109769
-Copper Wire	Tianshun	MW36-C	1.2mm*10.0 mm, 200 °C	UL 1446	UL E210986
--Epoxy	Emerson & Cuming	G500	-40 °C ~ +180 °C	IEC 62109-1 IEC 62109-2	Test with appliance

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

-Varnish	John C Dolph Co	BC-359	180 °C	UL 1446	UL E317427
-Heat Shrink Tube	Changyuan	CB-HFT	125 °C	UL224	UL E180908
-Silicone Tube	Shenzhen Wahchangwei	SRS-70*	200 °C	UL 1441	UL E233803
-Electronic Wire	3Q Wire&Cable	UL10269	105 °C 8AWG 1000V	UL758	UL E341104
-Nomex	E I Dupont De Nemours & Co Inc	410	220 °C	UL 94	UL E34739
-Soflex	Sui On	TJ6640NMN	180 °C	UL 1446	UL E355960
-Margin Tape	3M Company	44D	130 °C	UL 510A	UL E17385
-Kapton Tape	Yahua	PF-301	180 °C	UL 510A	UL E165111
-Silicone Molding Resin	Shengkangtai Silicone	HC-608AB	150 °C, V-0	UL 94	UL E341043
Inductor (L503)	Yu Yuan	C.L0.720300	720 uH±30%, Φ=2.4 mm*2P, 1.5 mΩ	IEC 62109-1 IEC 62109-2	Test with appliance
-Copper (L503)	Equivalence	PEWH	180 °C, Φ2.4mm	UL 1446	UL E201757
-Epoxy (L503)	Equivalence	3300A/B-1	130 °C	UL 746C	UL E218090
-Tape (L503)	Yahua	CT280	180 °C	UL 510A	UL E165111
-Varnish (L503)	Equivalence	T4260	130 °C	UL 1446	UL E228349
Transformer (T600)	CLICK	BCK2801-2829	2.037 mH±5%, 4.5 Ω max	IEC 62109-1 IEC 62109-2	Test with appliance
-Copper wire (T600)	Pacific Electric Wire & Cable	MW75-C	130 °C	UL 1446	UL E201757
-Epoxy (T600)	Eatto	E-500(xx)	130 °C	UL 746C	UL E218090
-Teflon tube (T600)	Great Holding	TFL	200 °C	UL 224	UL E156256
-Mylar tape (T600)	Yahua	PF	180 °C	UL 510A	UL E165111
-Bobbin	Changchun	T375HF	150 °C, V-0	UL 746C, UL94	UL E59481
-Varnish (T600)	Kyocera	TVB2180T*(a)	130 °C	UL 1446	UL E83702
-Triple wire	Furukawa	TEX-E	130 °C	UL2353	UL E215961
--Alternate	Cosmolink	TIW-M	130 °C	UL2353	UL E231746
--Alternate	Xiangxiang	TKW-B	130 °C	UL2353	UL E308908
Transformer(T601)	Jiameirui	1.4mH	130 °C, 1.4mH	IEC 62109-1 IEC 62109-2	Test with appliance
Copper wire (T601)	Tai-Electric	UEW Polyester MW 79C	155 °C	UL 1446	UL E85640
-Base of inductor (T601)	Chang Chun Plastics	T375J	150 °C	UL 746C	UL E59481
Transformer (T100)	CLICK	BCK2001-1151	25 µH, 130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
-Copper wire (T100)	Feng Ching Metal Corp	MW75 (UEW/U)	130 °C	UL 1446	UL E172395
-Epoxy (T100)	Dongguan Eatto	E-500(xx)	130 °C	UL 746C	UL E218090
-Teflon tube (T100)	Great Holding Industrial	TFL	200 °C	UL 224	UL E156256
-Mylar tape (T100)	YAHUA	CT	130 °C	UL 510A	UL E165111
-Varnish (T100)	Kyocera	TVB2180T*(a)	130 °C	UL 1446	UL E83702

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

	Chemical				
Thermistor NTC (RT600)	Kemin	NTC 10D-9	10 Ω, 2 A, -40 °C ~ +200 °C	EN 60539-1: 2008	TUV B 151093844001
Gas Dischargetube	Brightking	2RP600L-8	600 VDC, 20 kA 40 °C ~ +85 °C	UL 1449	UL E237997
Relay Output	Hongfa	HF176F/12-H3F	65 A,400 Vac -40 °C ~+85 °C	EN 61810-1：2015	TUV R 50411032
Alternate	Hongfa	HF165FD-G	40 A,277 Vac -40 °C ~+85 °C	IEC60335-1	VDE 40043143
Relay ISO	Songchuan	894-2AH1-F-C	240 Vac, 8 A 85 °C	UL 60947	UL E88991
Current sensor – DC (HCT200,CT1)	LEM	HLSR 32-P	32A -40 °C ~ +105 °C	UL 508	UL 189713
Current sensor AC	LEM	CKSR 50NP	50 A, 650 V	UL 508	UL 189713
MOV (RV100, RV101, RV102, RV103, RV104, RV105, RV400, RV401, RV402, RV500, RV501, RV502)	Thinking	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 (Q602, Q600)	IXYS	IXFH6N120P	1200 V, 6 A	IEC 62109-1 IEC 62109-2	Test with appliance
IGBT (Q1,Q202,Q205, Q208,Q300,Q301, Q302,Q309,Q310, Q311,Q312,Q313, Q314,Q321,Q322, Q323)	ON semiconductor	NGTB40N120FL3WG	1200 V, 40 A, -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Alternate	Infineon	IKW40N120H3	1200 V,40 A, -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
IGBT (Q1,Q202,Q205, Q208,Q300,Q301, Q302,Q309,Q310, Q311)	ON semiconductor	NGTB50N120FL2WG	1200 V, 50 A, -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Diode (D200, D208)	IXYS	DLA60I1200HA	1200 V, 60 A, -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Alternate	Fairchild	RHRG75120	1200 V, 75 A, -65 °C ~ +175 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Diode (D201,D209,D218, D219)	CREE	C4D30120D	1200 V, 30 A, -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Alternate	CREE	C4D20120D	1200 V, 20 A, -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Alternate	IXYS	DSEC60-12A	1200 V, 60 A, -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
IGBT	On	FGH75T65UP	650 V, 75 A,	IEC 62109-1	Test with

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

(Q303,Q304,Q305, Q306,Q307,Q308)	Semiconductor	D	-40 °C ~ +130 °C	IEC 62109-2	appliance
Alternate	Infineon	IKW50N65ES5	650 V,50 A -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Alternate	Infineon	IKW40N65H5	650 V,40 A -40 °C ~ +130 °C	IEC 62109-1 IEC 62109-2	Test with appliance
Optocoupler on control board (U35, U36, U37, U38, U39, U40, U42, U46, U48, U52, U602)	Lite-On	LTV-816	2.5 A, 30 V, -55 °C ~ +115 °C	EN 60647	VDE 40015248
Optocoupler on control board (U43, U45)	Fairchild	6N137	2.5 A, 30 V, -40 °C ~ +110 °C	EN 60647	VDE 40018398
Residual Current Monitor(HCT500)	Magtron	RCMU101SN-3P6A-5S	10 μF,16 V, -40 °C ~ +105 °C	UL 508	UL E492115
Alternate	Sinomags	SFG-1.5P/P2	-40 °C ~ +105 °C	EN 61326-1: 2013	TUV R AE50428896
Current Transducer	LEM	LDSR 0.3-NP	-40 °C ~ +105 °C	UL 508	UL E189713
CPU1	TI	TMS320F2837 7SZWTT	-40 °C ~ +105 °C	IEC 62109-1 IEC 62109-2	Test with appliance
CPU2	TI	MSP430F2252 TRHAR	-40 °C ~ +105 °C	IEC 62109-1 IEC 62109-2	Test with appliance

1) an asterisk indicates a mark which assures the agreed level of surveillance
2) Mechanical size: 57*35*50 means dimension of 57mm*35mm*50mm,

Appendix 1: IP65 Test Result

Summary of IP65 test results:

The test performed on EA30KTSI is valid for EA20KTSI, EA25KTSII 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.

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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;

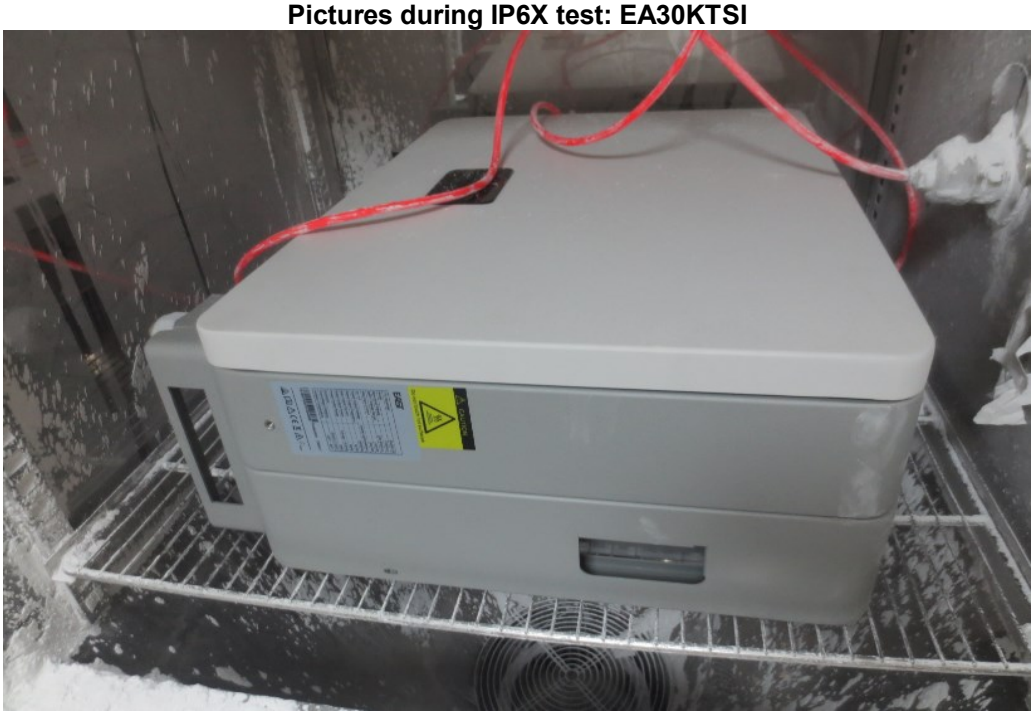
– reach live parts or windings not designed to operate when wet;

– 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.

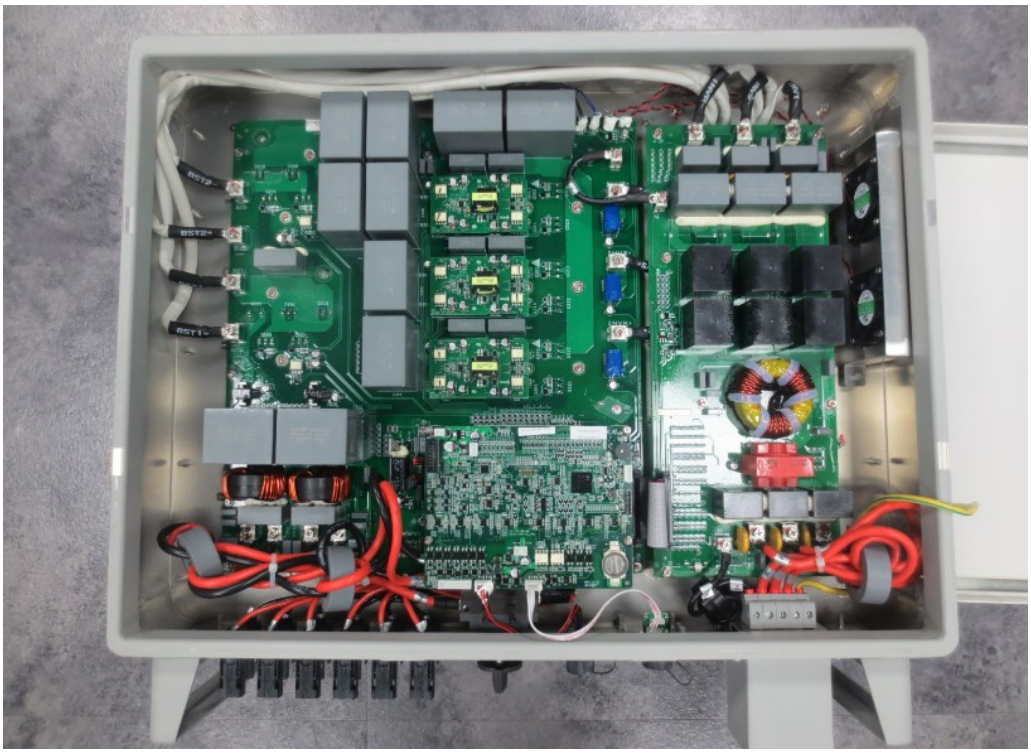
Pictures during IP6X test: EA30KTSI



Pictures during IPX5 test: EA30KTSI

Pictures during IPX5 test: EA30KTSI

Pictures after IP65 test:



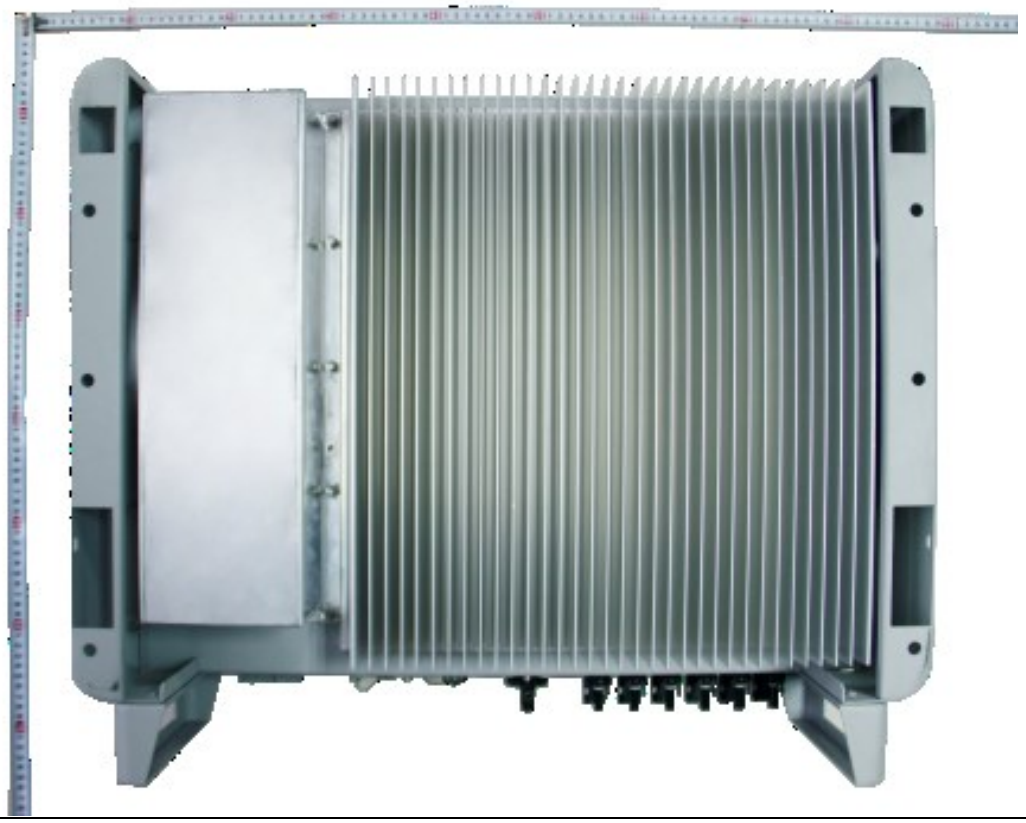
Pictures after IP65 test:

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

Appendix 2: Pictures

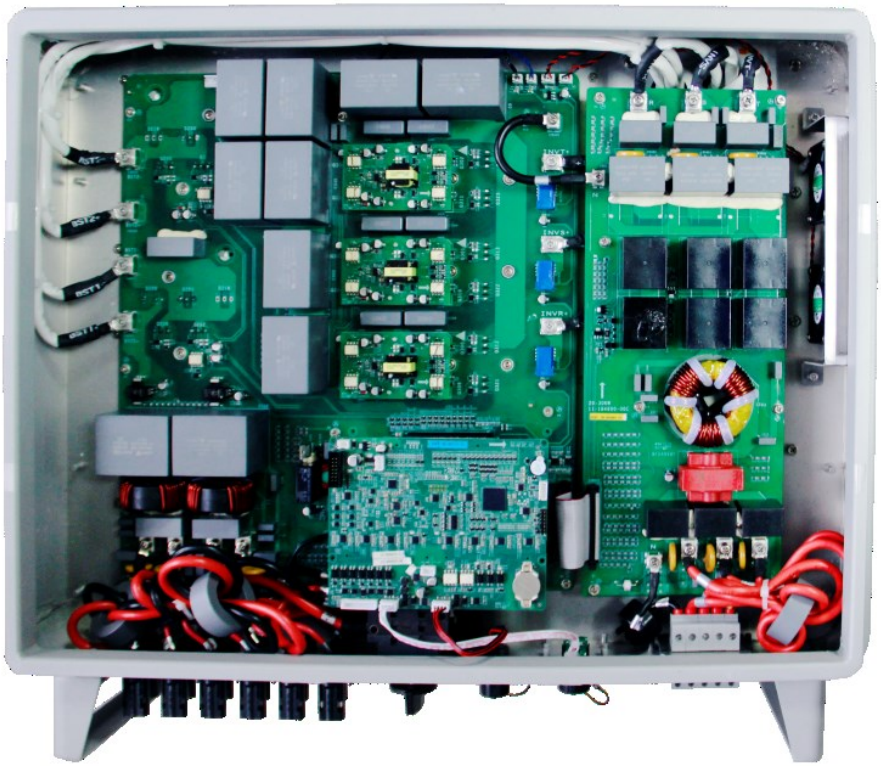
EA20KTSI / EA25KTSI / EA30KTSI
Enclosure – Front View

EA20KTSI / EA25KTSI / EA30KTSI
Enclosure – Rear View

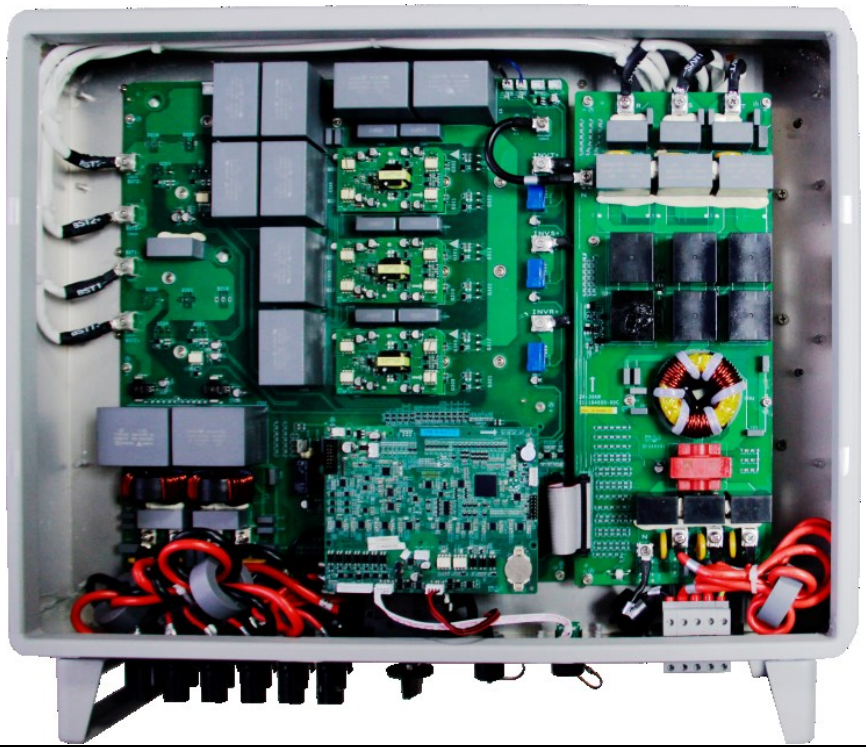


EA20KTSI / EA25KTSI / EA30KTSI
Enclosure – Cover

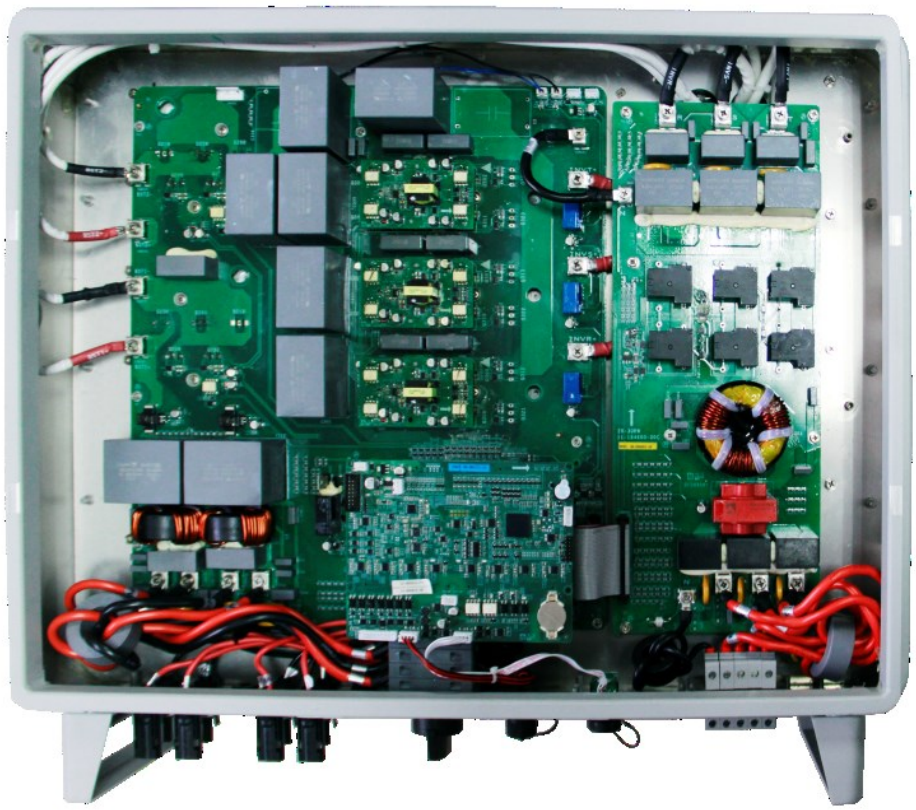
EA30KTSI
Internal View



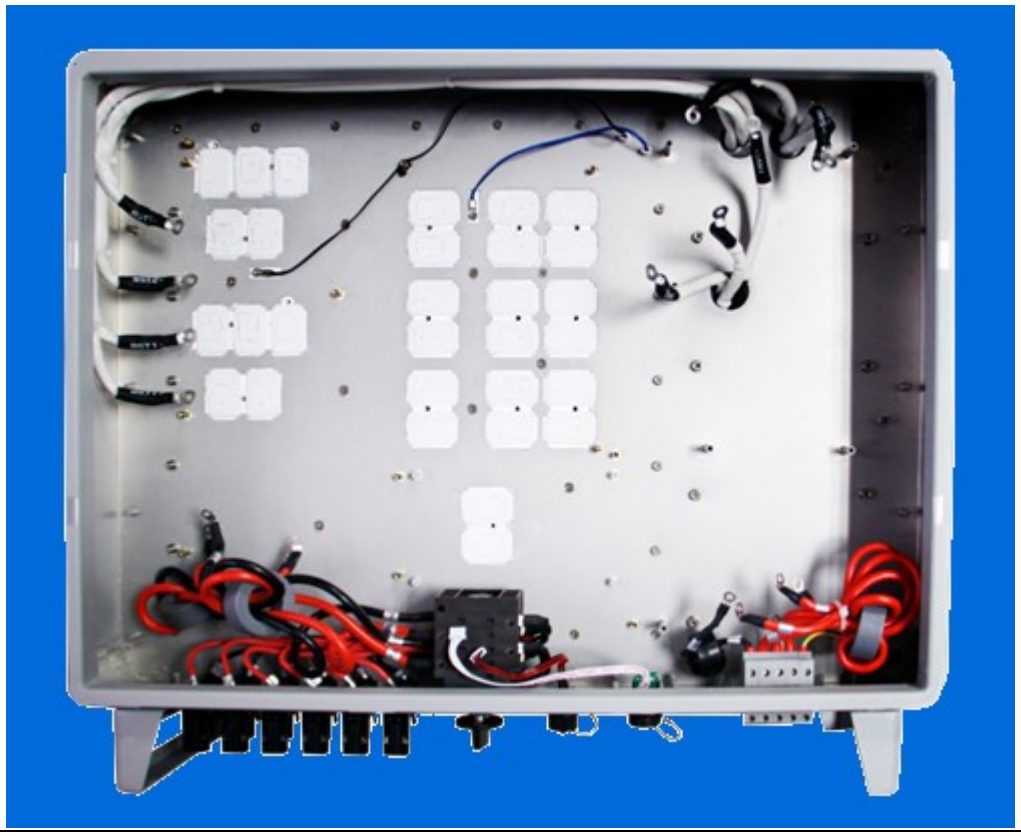
EA25KTSI
Internal View



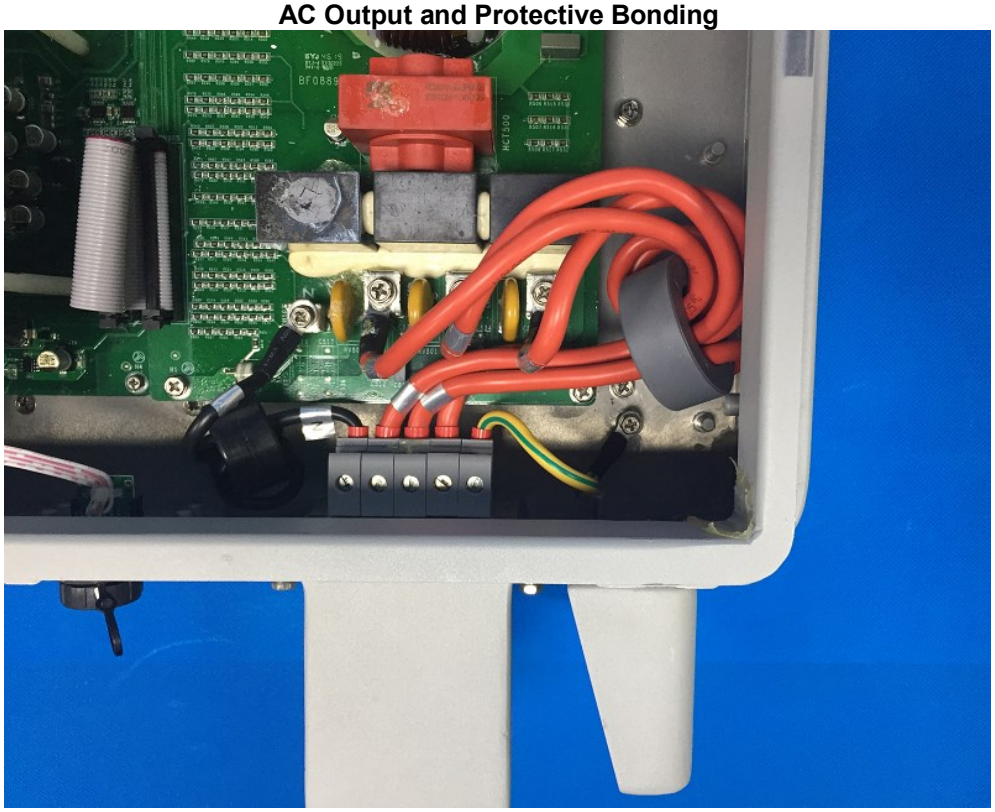
EA20KTSI
Internal View



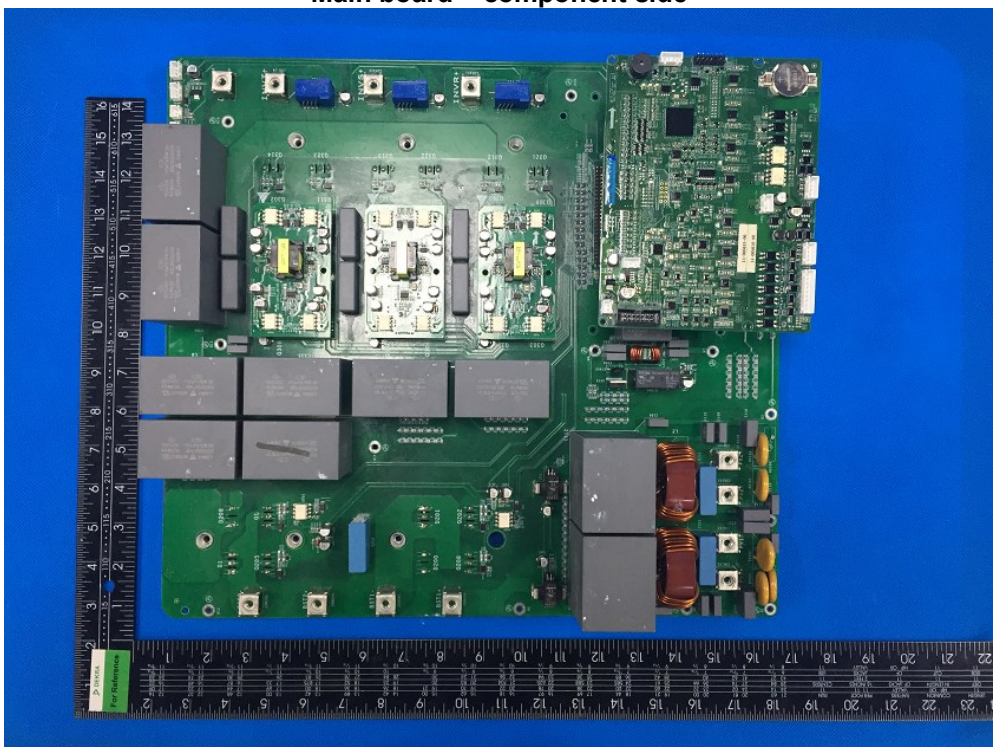
EA20KTSI / EA25KTSI / EA30KTSI
Internal Enclosure



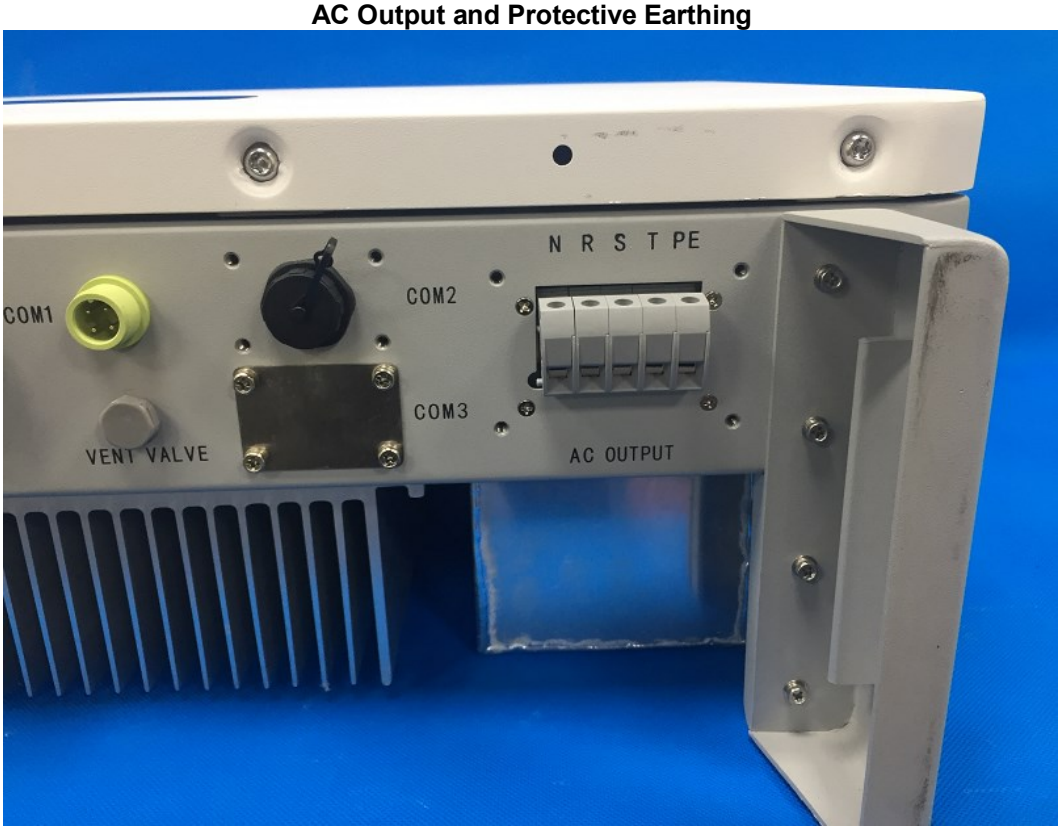
EA20KTSI / EA25KTSI / EA30KTSI
AC Output and Protective Bonding



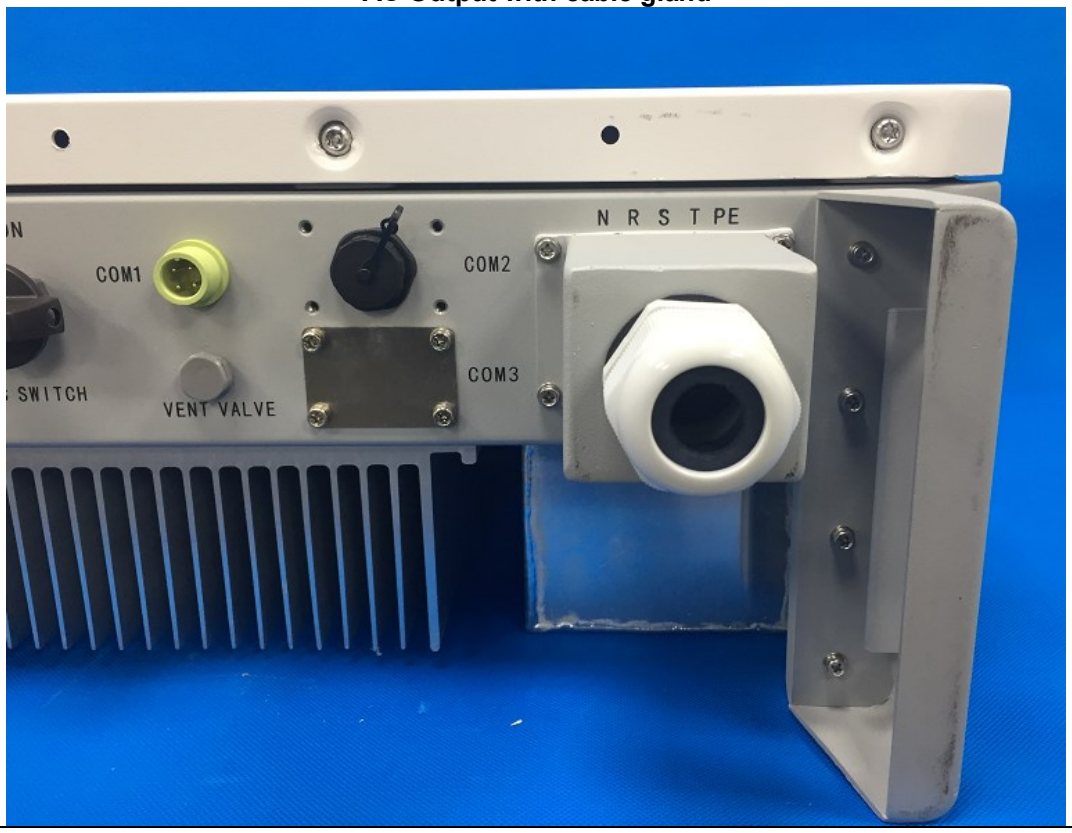
EA25KTSI / EA30KTSI
Main board – component side



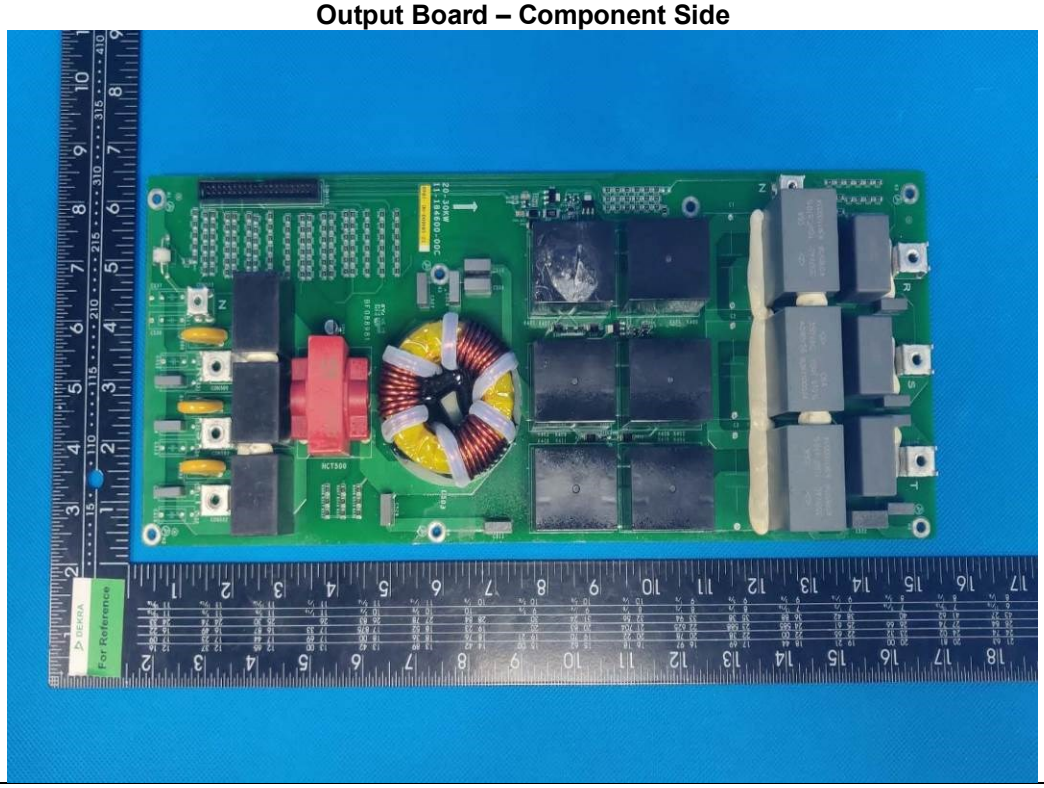
EA20KTSI / EA25KTSI / EA30KTSI
AC Output and Protective Earthing



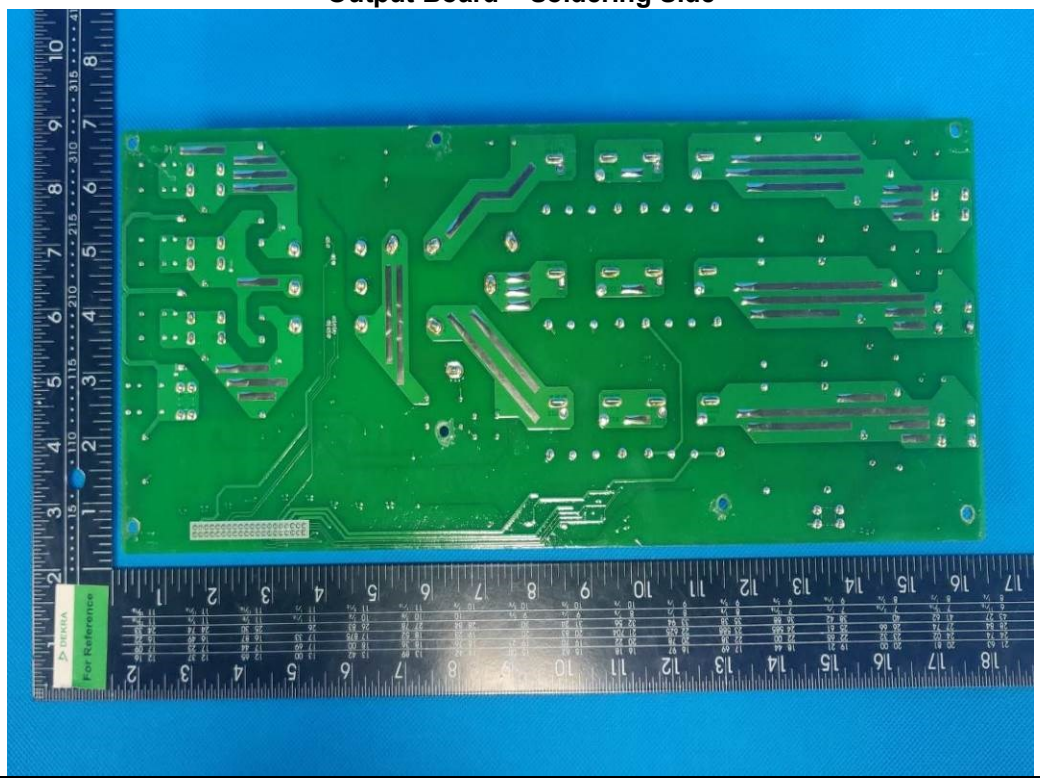
EA20KTSI / EA25KTSI / EA30KTSI
AC Output with cable gland



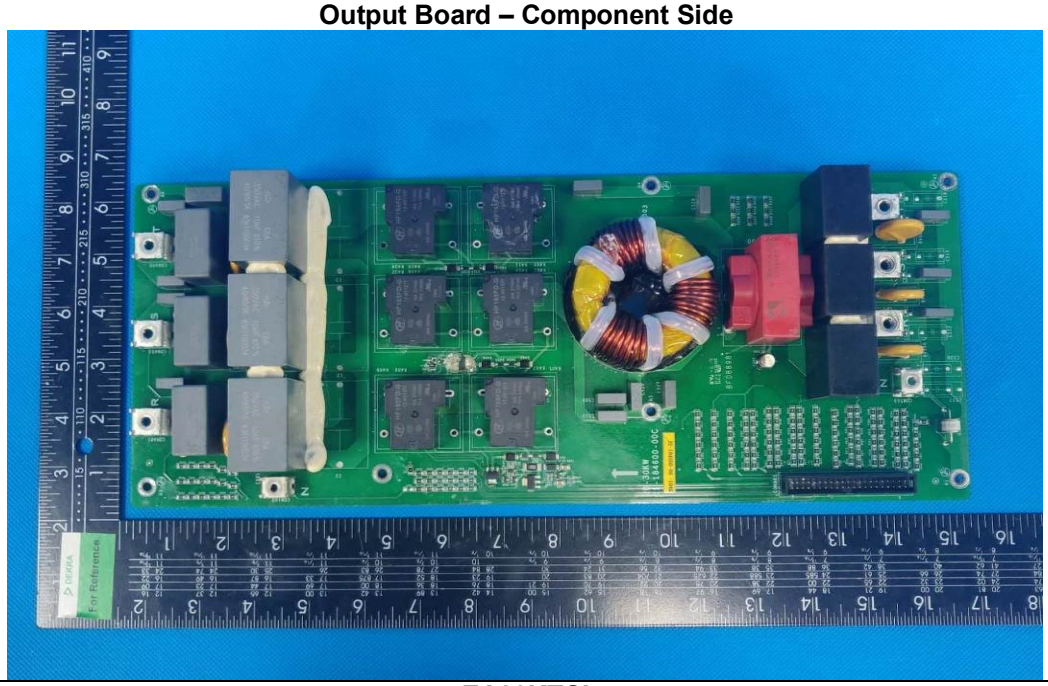
EA25KTSI/EA30KTSI
Output Board – Component Side



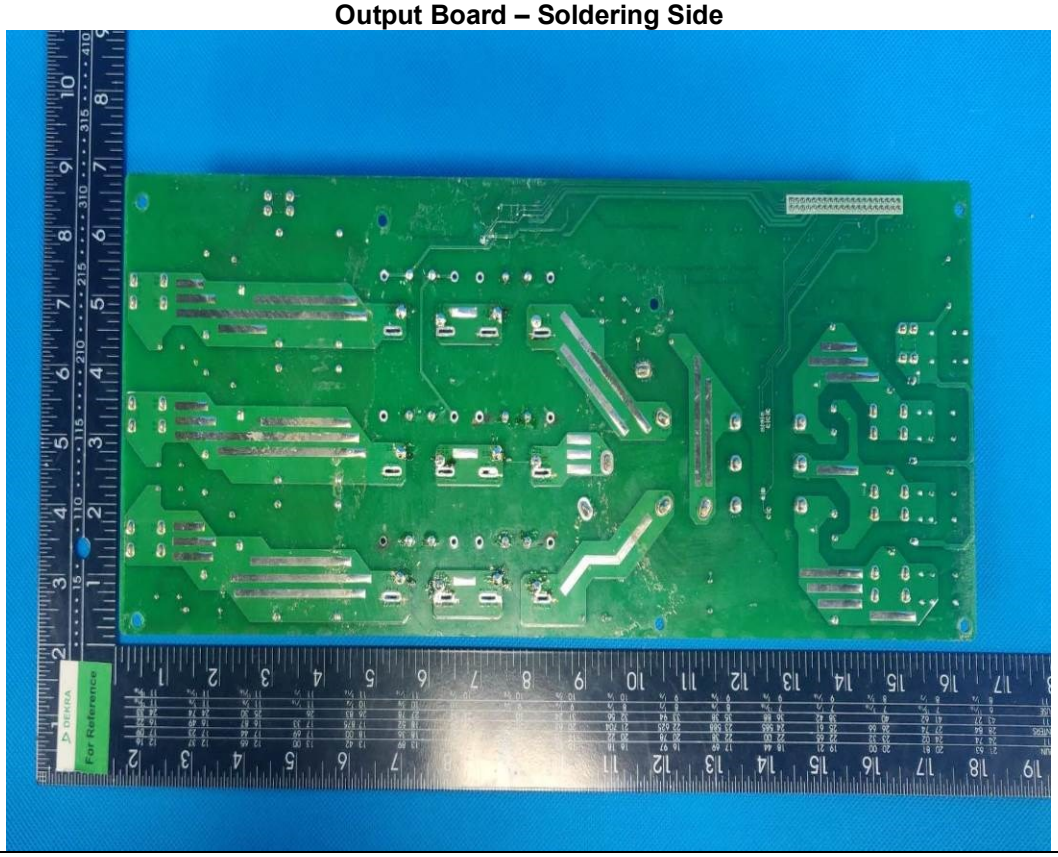
EA25KTSI/EA30KTSI
Output Board – Soldering Side



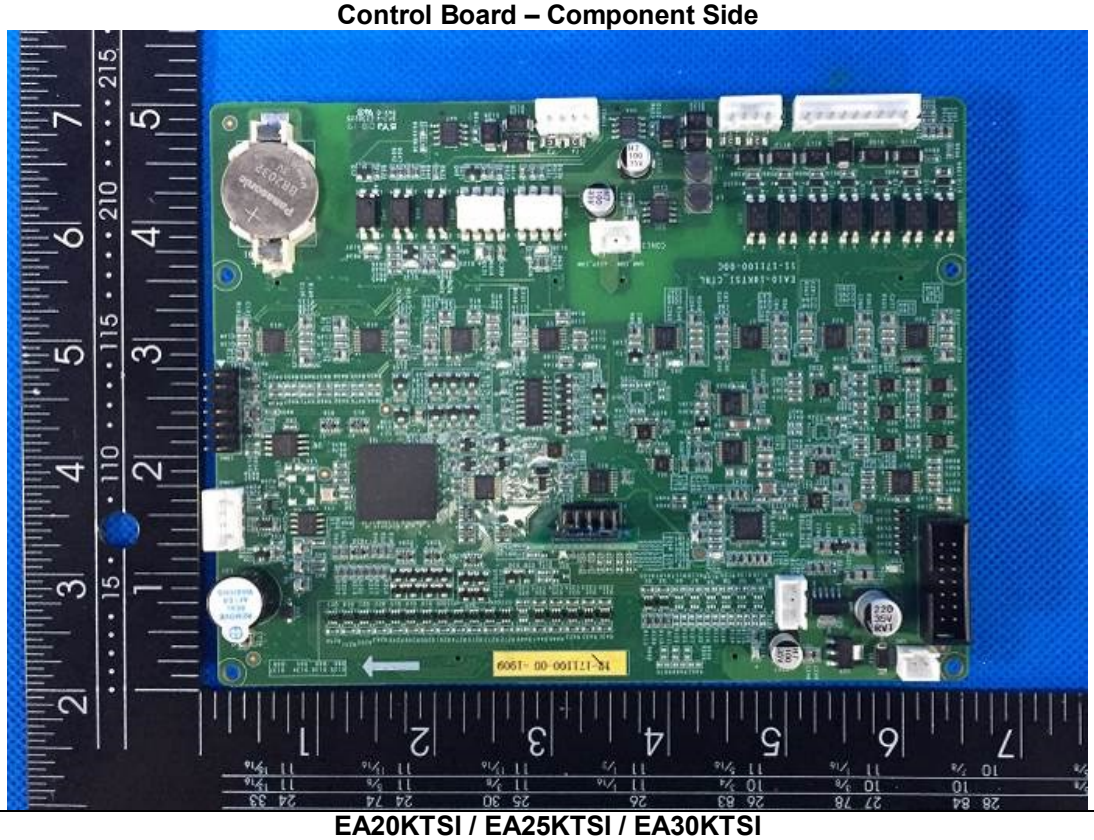
EA20KTSI
Output Board – Component Side



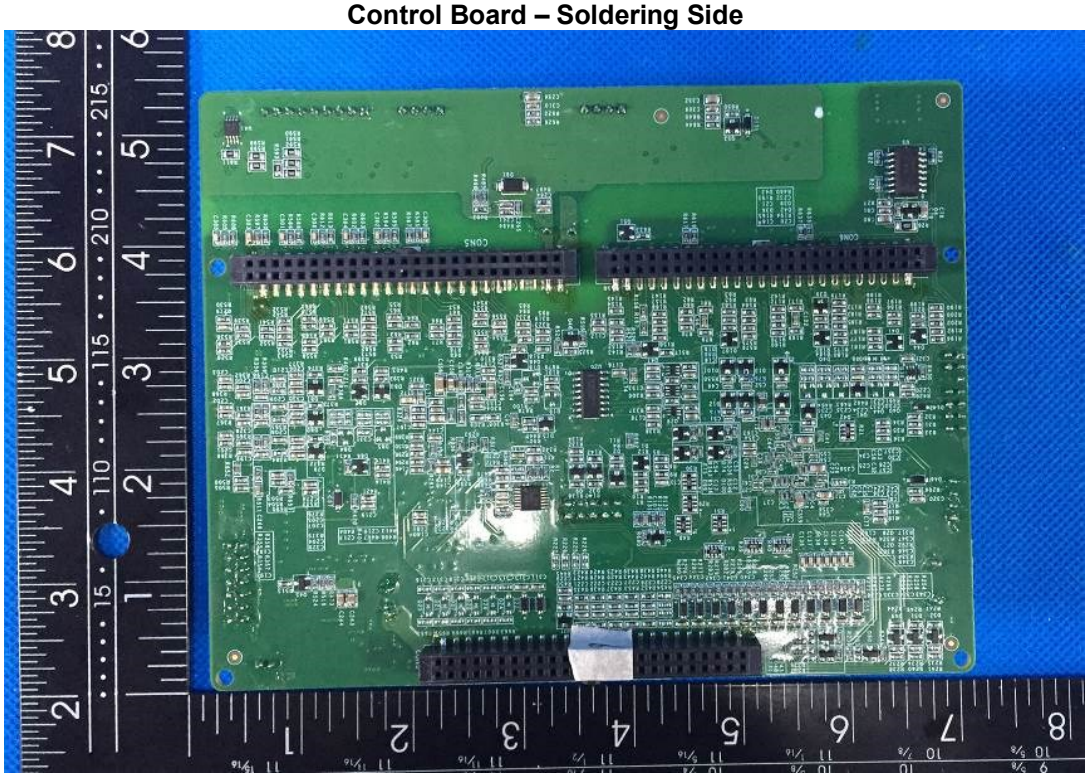
EA20KTSI
Output Board – Soldering Side



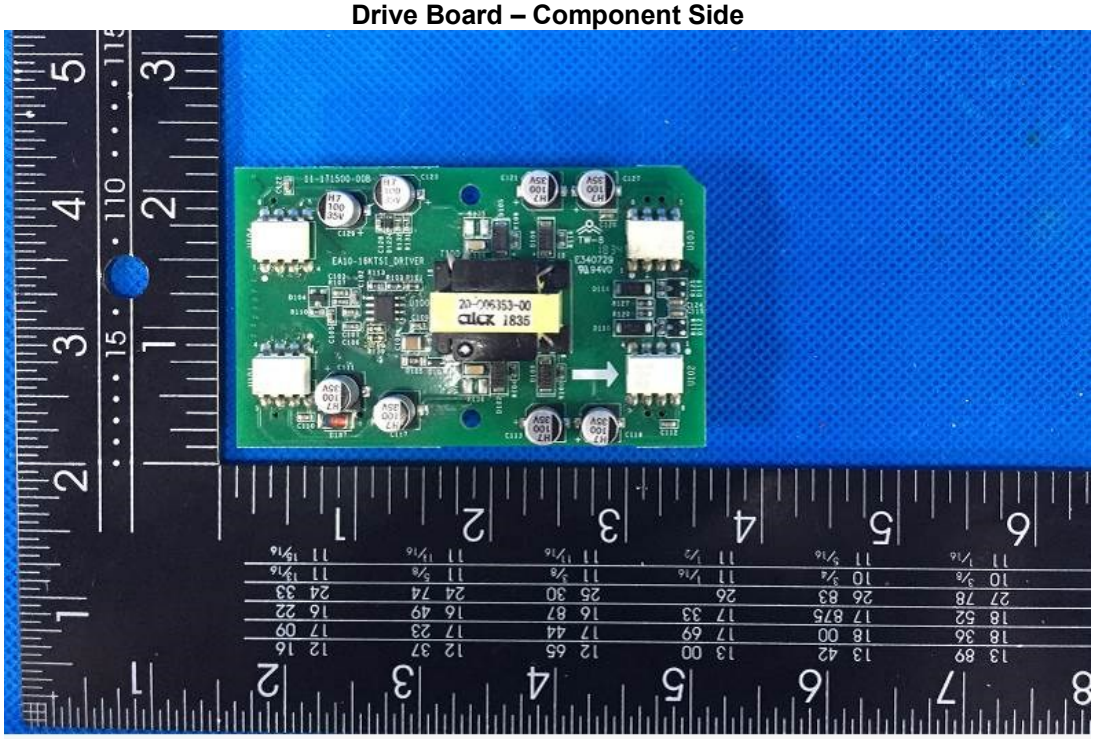
EA20KTSI / EA25KTSI / EA30KTSI
Control Board – Component Side



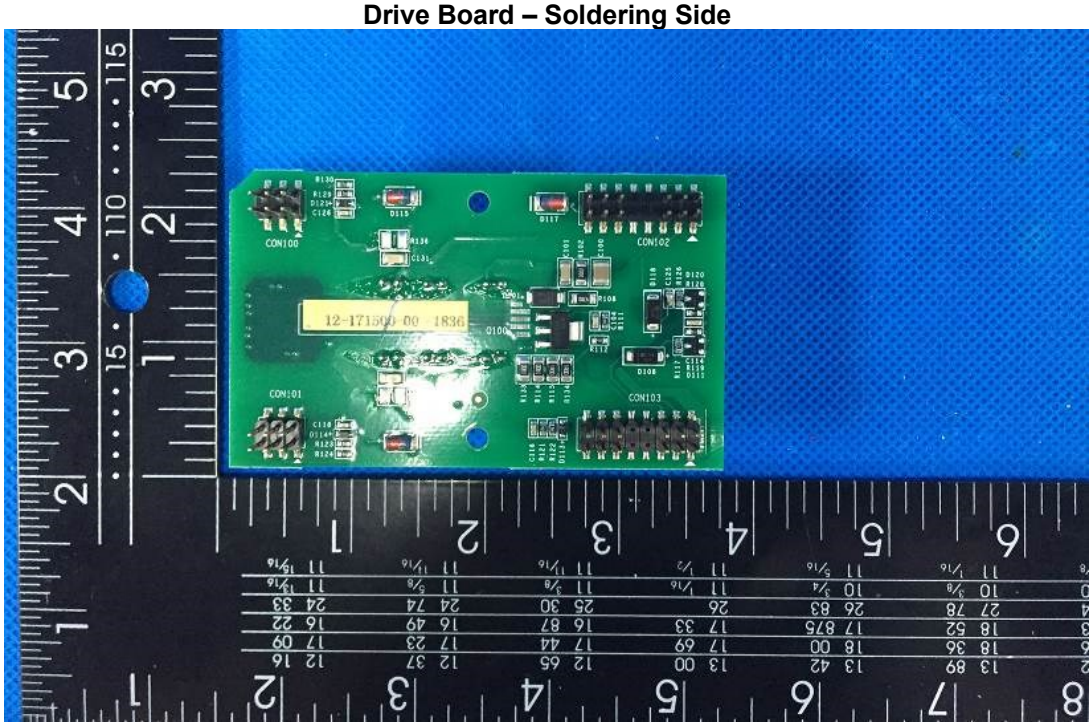
EA20KTSI / EA25KTSI / EA30KTSI
Control Board – Soldering Side



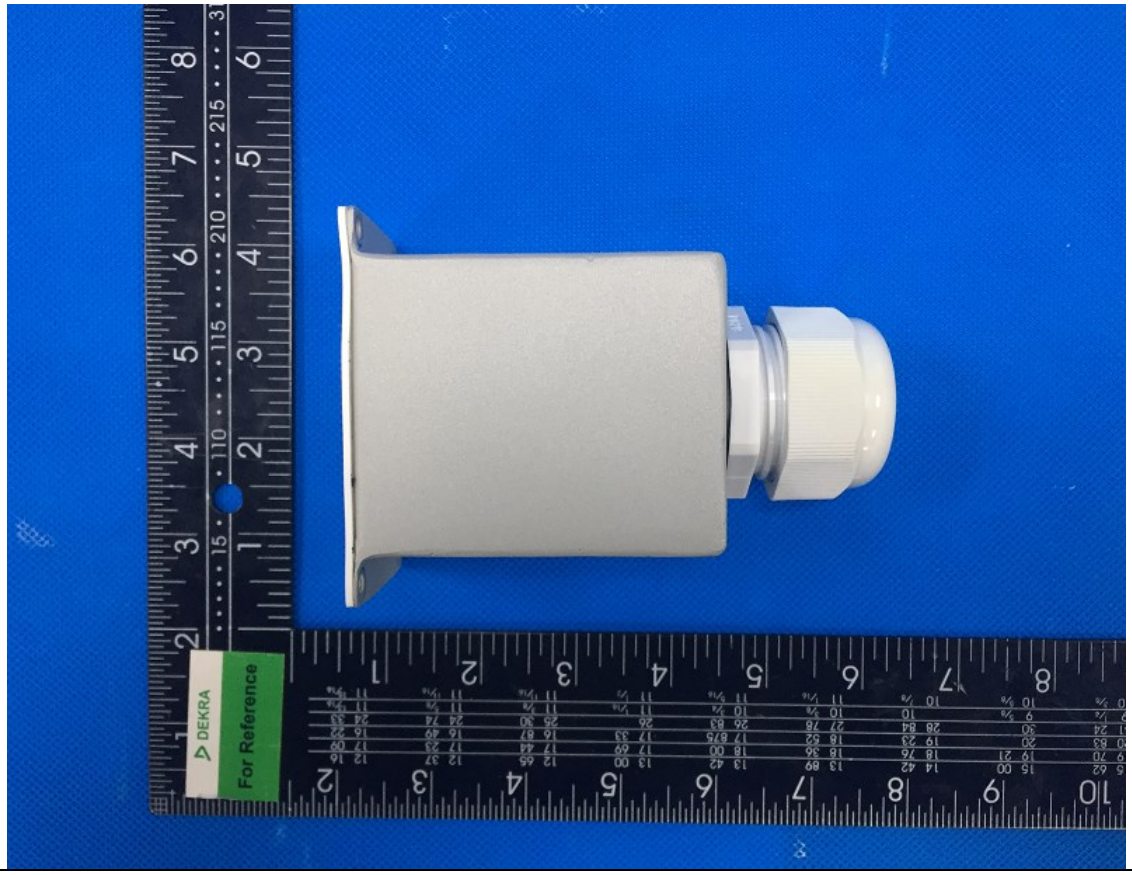
EA20KTSI / EA25KTSI / EA30KTSI
Drive Board – Component Side



EA20KTSI / EA25KTSI / EA30KTSI
Drive Board – Soldering Side



EA20KTSI / EA25KTSI / EA30KTSI



--- End of test report---