TEST REPORT

IS 16221 (PART 2):2015/ IEC 62109-2 : 2011

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

Report Number..... :	2NL202320023
Date of issue ..... :	24/07/2023
Total number of pages ..... :	65
Testing laboratory and its address:..... :	Conformity Testing Labs Pvt. Ltd., Unit 2, A-33, Mayapuri Industrial Area, Phase-I, New Delhi-110064,India
Manufacturer's name..... :	**ENERTECH UPS PVT. LTD.**
Address..... :	S.Ho. 399/1-2, Plot No:-5, Bhare P.O, Ghotawade (Near Pirangut), Tal-Mulshi, Dist-Pune-412 115
Applicant's name ..... :	**ENERTECH UPS PVT. LTD.**
Address..... :	S.Ho. 399/1-2, Plot No:-5, Bhare P.O, Ghotawade (Near Pirangut), Tal-Mulshi, Dist-Pune-412 115
Test specification:	
Standard ..... :	IS 16221 (PART 2):2015/ IEC 62109-2 : 2011
Test procedure..... :	As per standard
Non-standard test method ..... :	N/A
Test Report Form No. ..... :	CTL_IS 16221-2_TRF_V1.0
Test Report Form(s) Originator .... :	Conformity Testing Labs Pvt. Ltd., Unit 2, New Delhi
Master TRF ..... :	18/05/2020
Test item description..... :	Solar PCU
Trade Mark..... :	EnerTech Answering All Power Needs
Model/Type reference..... :	Sunmagic-REeFi
Ratings..... :	See Copy of marking plate (Page no. 3)
Serial No. ..... :	3202303126

Tested by:	Approved by / Authorized Signatory:	Issued by:
Vikas Verma Digitally signed by Vikas Verma	Sandeep Kumar Patel Digitally signed by Sandeep Kumar Patel	Madhuri Khanna Digitally signed by Madhuri Khanna
Vikas Verma (Sr. Test Engineer)	**Sandeep Kumar Patel (Sr. Test Engineer)**	**Madhuri Khanna (CSC Executive)**
Date: 24/07/2023	**Date: 24/07/2023**	**Date: 24/07/2023**

Discipline: Electrical **Group:** Power Supplies & Stabilizers

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

Appendix A: List of Critical Component, 4 pages (Page no.60-62)

Appendix B: Block diagram/ Schematic three line diagram,1 page (Page no.63)

Appendix C: Photographs, 2 pages (Page no.64-65)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
Cl.4. General testing requirements Cl.5. Marking and documentation Cl.6. Environmental requirements and conditions Cl.7. Protection against electric shock and energy hazards Cl.8. Protection against mechanical hazards Cl.9. Protection against fire hazards Cl.10. Protection against sonic pressure hazards Cl.13. Physical requirements Cl.14. Components	Conformity Testing Labs Pvt. Ltd., Unit 2, A-33, Mayapuri Industrial Area, Phase-I, New Delhi-110064,India

Copy of marking plate:

Marking Label of Main Model

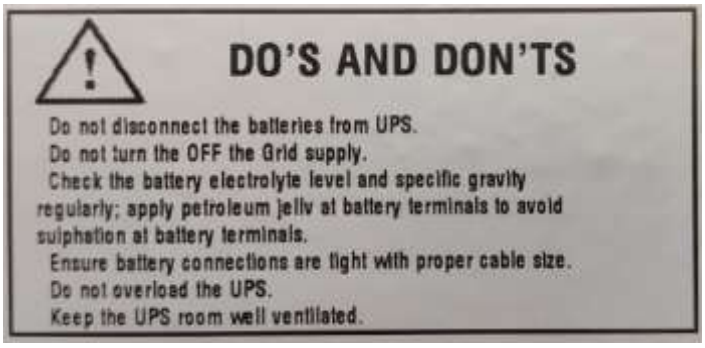
EnerTech
Answering All Power Needs

Serial No. 3202303126

PRODUCT: SOLAR PCU	MODEL: Sunmagic-REeFi
Max. DC Input Voltage	300V DC
DC Input Voltage Range	165-250VDC
DC Input Current	60A
Max. DC Input Current	83A
Rated Input Voltage	3/N/PE AC 230/400V
Rate Input Current	18A per ph
Rated Input Frequency	50Hz
Rated Output Voltage	3/N/PE AC 230/400V
Rated Output Current	15A per ph
Rated Output Frequency	50Hz
Rated Apparent Power	10kW
Power Factor	0.8i - 0.8c
Operating Temperature Range	0 to 40°C
Battery Normal Voltage	120VDC
Battery Current rating	83Adc
Environmental Protection Rating	IP20
Protection Class	Class I
Overvoltage Category	DC (II) , AC (III)
Topology	Isolated
Communication Protocol	RS485 Connectivity
Disp. Date	02-03-2023

ENERTECH UPS PVT. LTD.
S. Ho. 399/1-2, Plot No. :-5, Bhare P.O, Ghotawade
(Near Pirangut), Tal-Mulshi, Dist-Pune-412 115
Made In India

Warning Label on Solar PCU



Test item particulars …..:	Solar PCU
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[ ] indoor~~ ~~Unconditional conditional~~
Over voltage category Mains….:	~~[ ] OVCI~~ ~~[ ] OVCII~~ [√] OVCIII ~~[ ] OVCIV~~
Over voltage category PV ….:	~~[ ] OVCI~~ [√] OVCII ~~[] OVCIII~~ ~~[ ] OVCIV~~
Mains supply tolerance (%) ….:	-90 / +110 %
Tested for power systems ….:	TN system
IT testing, phase-phase voltage (V) ….. :	N/A
Class of equipment ….. :	[√] Class I ~~[ ] Class II[ ] Class III[ ] Not classified~~
Mass of equipment (kg) ….. :	150kg Approx.
Pollution degree ….. :	PD2
IP protection class….. :	IP20

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….:	20/05/2023
Date (s) of performance of tests….:	01/06/2023 to 17/07/2023

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced,except in full, without the written approval of the Issuing testing laboratory.
"(see Enclosure #)" refers to additional information appended to the report. "(see appended table)" refers to a table appended to the report.
“RD”(Refer document) refers “ IS 16221 (Part 1) : 2016 / IEC 62109-1 : 2010”

This report is digitally signed and does not require signature on subsequent pages.

Manufacturer's Declaration per Standard:

General product information:

Solar PCU model: Sunmagic-REeFi is a three phase Invertor.
It has connection of AC output supply terminal & PV terminal. LCD screen provides information on the operational status of the inverter &all these details are described in user manual.

All the applicable test has been carried out on main model: Sunmagic-REeFi and meeting the requirement of IS 16221 (Part 2): 2015/ IEC 62109-2: 2011 in conjunction with IS 16221 (Part 1): 2016 / IEC 62109-1: 2010.

Similarities & Differences: N/A

Discipline: Electrical

Group: Power supplies & stabilizers

IS 16221 (PART 2):2015/ IEC 62109-2 : 2011			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
4	General testing requirements	In compliance	P
4.1 /RD	General	Considered	P
4.2/RD	General conditions for testing	See below	P
4.2.1/RD	Sequence of tests	Considered	P
4.2.2/RD	Reference test conditions	See below	P
4.2.2.1/RD	Environmental conditions a)Temp. of 15 °C to 40 °C b) humidity of 5% to 75 % c) air pressure of 75 kPa to 106 kPa. d) no frost. dew. Percolating water. rain. solar radiation. etc.	Tested at lab ambient environmental	P
4.2.2..2/RD	State of equipment	Tests were carried out on a complete EUT	P
4.2.2.3/RD	Position of equipment	The equipment was installed in accordance with the manufacturer's instructions	P
4.2.2.4/RD	Accessories	No such accessories	N/A
4.2.2.5/RD	Covers and removable parts	No covers & removable parts	N/A
4.2.2.6/RD	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:	a) Voltage: 3/N/PE AC 230/400 b) Frequency: 50Hz c) Polarity: Terminal block provided d) Earthing: Terminal block provided e) Over-current Protection: building installation is considered for such protection	P
4.2.2.7/RD	Supply ports other than the mains	See below	P
4.2.2.7.1/RD	Photovoltaic supply sources a) Open circuit voltage: b) Short-circuit current:	DC power supply source used with sufficient capability	P
4.2.2.7.2/RD	Battery inputs	Appropriate DC input sources provide used	P
4.2.2.8/RD	Conditions of loading for output ports	Linear load for continuous operation applied as per EUT rating	P
4.2.2.9 /RD	Earthing terminals	Earthing terminal provided	P
4.2.2.10/RD	Controls	No mains selection is provided for operator	N/A
4.2.2.11/RD	Available short circuit current	In compliance	P
4.3/RD	Thermal testing	See below	P
4.3.1/RD	General	No parts attained excessive temperature (Refer appended table 4.3)	P
4.3.2/RD	Maximum temperatures	(Refer appended table 4.3)	P
4.3.2.1/RD	General	(Refer appended table 4.3)	P
4.3.2.2/RD	Touch temperatures	(Refer appended table 4.3)	P
4.3.2.3/RD	Temperatures limits for mounting surfaces	Floor standing PCE	N/A
4.4/RD	Testing in single fault condition	In compliance (Refer appended table 4.4)	P
4.4.1/RD	General	(Refer appended table 4.4)	P
4.4.2/RD	Test conditions and duration for testing under fault conditions	(Refer appended table 4.4)	P

IS 16221 (PART 2):2015/ IEC 62109-2 : 2011			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
4.4.2.1/RD	General	(Refer appended table 4.4)	P
4.4.2.2/RD	Duration of tests	(Refer appended table 4.4)	P
4.4.3/RD	Pass/fail criteria for testing under fault conditions	See below	P
4.4.3.1/RD	Protection against shock hazard	No shock hazard occurred, Incompliance with dielectric strength test	P
4.4.3.2/RD	Protection against the spread of fire	No fire hazards occurred	P
4.4.3.3/RD	Protection against other hazards	No other hazards after application of faults	P
4.4.3.4/RD	Protection against parts expulsion hazards	No such hazards after application of faults	P
4.4.4	Single fault conditions to be applied	See below	P
4.4.4.1/RD	Component fault tests	Considered	P
4.4.4.2 /RD	Equipment or parts for short-term or intermittent operation	PCE operated continuously	N/A
4.4.4.3 /RD	Motors	In compliance (Refer appended table 4.4)	P
4.4.4.4/RD	Transformer short circuit tests	In compliance (Refer appended table 4.4)	P
4.4.4.5/RD	Output short circuit	In compliance (Refer appended table 4.4)	P
4.4.4.6/RD	Backfeed current test for equipment with more than one source of supply	Only single source of supply used	N/A
4.4.4.7/RD	Output overload	In compliance (Refer appended table 4.4)	P
4.4.4.8/RD	Cooling system failure	In compliance (Refer appended table 4.4)	P
4.4.4.9/RD	Heating devices	No such device used	N/A
4.4.4.10/RD	Safety interlock systems	No such components used	N/A
4.4.4.11/RD	Reverse d.c. connections	In compliance (Refer appended table 4.4)	P
4.4.4.12/RD	Voltage selector mismatch	No such device used	N/A
4.4.4.13/RD	Mis-wiring with incorrect phase sequence or polarity	In compliance (Refer appended table 4.4)	P
4.4.4.14/RD	Printed wiring board short-circuit test	Adequate spacing provided for Functional insulation	N/A
4.4.4.15	Fault-tolerance of protection for grid-interactive inverters	In compliance	P
4.4.4.15.1	Fault-tolerance of residual current monitoring according to 4.8.3.5: the residual current monitoring system operates properly	No such construction	N/A
	a) - The inverter ceases to operate	As above	N/A
	-Indicates a fault in accordance with13.9	As above	N/A
	-Disconnect from the mains	As above	N/A
	-not re-connect after any sequence of removing and reconnecting PV power	As above	N/A
	-not re-connect after any sequence of removing and reconnecting AC power	As above	N/A
	-not re-connect after any sequence of removing and reconnecting both PV and	As above	N/A

IS 16221 (PART 2):2015/ IEC 62109-2 : 2011			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	AC power		
	b) - The inverter continues to operate	As above	N/A
	-the residual current monitoring system operates properly under single fault condition	As above	N/A
	-Indicates a fault in accordance with13.9	As above	N/A
	c) - The inverter continues to operate regardless of loss of residual current monitoring functionality	As above	N/A
	-not re-connect after any sequence of removing and reconnecting PV power	As above	N/A
	-not re-connect after any sequence of removing and reconnecting AC power	As above	N/A
	-not re-connect after any sequence of removing and reconnecting both PV and AC power	As above	N/A
	-Indicates a fault in accordance with13.9	As above	N/A
4.4.4.15.2	Fault-tolerance of automatic disconnecting means	Considered	P
4.4.4.15.2.1	The means provided for automatic disconnection of a grid-interactive inverter from the mains shall:	See below	P
	disconnect all grounded current-carrying conductors from the mains	In compliance	P
	disconnect all ungrounded current-carrying conductors from the mains	In compliance	P
	be such that with a single fault applied to the disconnection means or to any other location in the inverter, at least basic insulation or simple separation is maintained between the PV array and the mains when the disconnecting means is intended to be in the open state.	Basic insulation is maintained between PV array to mains	P
4.4.4.15.2.2	Design of insulation or separation complies with requirements of 7.3.7 of Part 1: report here Part 1 comment and verdict.	In compliance	P
4.4.4.15.2.3	For non-isolated inverter, automatic checking of the isolation provided by a disconnect means after fault.	Isolated Transformer used	N/A
	If the check fail: any still-functional disconnection means shall be left in the open position	As above	N/A
	-at least basic or simple separation shall be maintained between the PV input and the mains	As above	N/A
	-the inverter shall not start operation	As above	N/A
	-the inverter shall indicate a fault in accordance with 13.9	As above	N/A

IS 16221 (PART 2):2015/ IEC 62109-2 : 2011			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
4.4.4.16	A stand-alone inverter with a transfer switch to transfer AC loads from the mains or other AC bypass source to the inverter output:	In Compliance	P
	-shall continue to operate normally	Continues operated	P
	-shall not present a risk of fire as the result of an out-of-phase transfer	No risk of fire out-of-phase transformer	P
	-shall not present a risk of shock as the result of an out-of-phase transfer	As above	P
	-for an inverter employing a bypass switch having a control preventing switching, the test is to be conducted under the condition of a component Malfunction	Switch is used	P
4.4.4.17	Cooling system failure – Blanketing test No hazards according to the criteria of sub-clause 4.4.3 of Part 1 shall result from blanketing the inverter. This test is not required for inverters restricted to use only in closed electrical operating areas.	No External heat sink	N/A
	Test stop condition: time duration value or stabilized temperature……..:	As above	N/A
4.5/RD	Humidity preconditioning	In compliance	P
4.5.1/RD	General	See below	P
4.5.2/RD	Conditions	92.5% RH ±2.5% RH, 40°C ± 2°C for 48Hrs.	P
4.6/RD	Backfeed voltage protection	In compliance	P
4.6.1/RD	Backfeed tests under normal conditions	Complied	P
4.6.2/RD	Backfeed tests under single-fault conditions	Complied	P
4.6.3/RD	Compliance with backfeed tests	After 3.79 sec voltage become zero	P
4.7	Electrical ratings tests	See below	P
4.7.1/RD	Input ratings	Refer appended table 4.2.2.6 / 4.7	P
4.7.1.1/RD	Measurement requirements for DC input ports	Refer appended table 4.2.2.6 / 4.7	P
4.7.2/ RD	Output ratings	Refer appended table 4.2.2.6 / 4.7	P
4.7.3	Measurement requirements for AC output ports for standalone inverters	Refer to table 4.2.2.6 / 4.7	P
4.7.4	Stand-alone Inverter AC output voltage and frequency	In compliance	P
4.7.4.1	General	See below	P
4.7.4.2	Steady state output voltage at nominal DC input The steady-state AC output voltage shall not be less than 90 % or more than 110 % of the rated nominal voltage with the inverter supplied with its nominal value of DC input voltage.	Refer to table 4.2.2.6 / 4.7	P
4.7.4.3	Steady state output voltage across the DC input range The steady-state AC output voltage shall not be less than 85 % or more than 110 % of the rated nominal voltage with the inverter supplied with any value within the rated range of DC input voltage.	As above	P

IS 16221 (PART 2):2015/ IEC 62109-2 : 2011			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
4.7.4.4	Load step response of the output voltage at nominal DC input .The AC output voltage shall not be less than 85 % or morethan110% of the rated nominal voltage for more than1, 5s after application or removal of a resistive load.	As above	P
4.7.4.5	Steady state output frequency The steady-state AC output frequency shall not vary from the nominal value by more than +4 % or –6 %.	As above	P
4.7.5	Stand-alone inverter output voltage waveform	Sinusoidal wave	P
4.7.5.1	General	As above	P
4.7.5.2	The AC output voltage wave form of a sinusoidal output stand-alone inverter shall have a total harmonic distortion (THD) not exceeding of 10 % and no individual harmonic a to level exceeding 6%.	THD level within limit	P
4.7.5.3	Non-sinusoidal output waveform requirements	As above	N/A
4.7.5.3.1	General	As above	N/A
4.7.5.3.2	The total harmonic distortion (THD) of the voltage waveform shall not exceed 40 %.	As above	N/A
4.7.5.3.3	The slope of the rising and falling edges of the positive and negative half-cycles of the voltage wave form shall not exceed 10 V/µs measured between the points at whichthewaveformhasavoltageof10%and90 %ofthe peak voltage for that half-cycle.	As above	N/A
4.7.5.3.4	The absolute value of the peak voltage of the positive and negative half-cycles of the waveform shall not exceed1,414 times 110% of the RMS value of the rated nominal AC output voltage.	As above	N/A
4.7.5.4	Information requirements for non-sinusoidal waveforms The instructions provided with a stand-alone inverter not complying with 4.7.5.2 shall include the information in 5.3.2.6.	As above	N/A
4.7.5.5	Output voltage waveform requirements for inverters for dedicated loads. For an inverter that is intended only for use with a known dedicated load, the following requirements may be used as an alternative to the waveform requirements in 4.7.5.2 to4.7.5.3.	Output voltage waveform does not of requirements for dedicated loads	N/A
	The combination of the inverter and dedicated load shall be evaluated to ensure that the output waveform does not cause any hazards in the load equipment and inverter, or cause the load equipment to fail to comply with the applicable product safety standards.	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	The inverter shall be marked with symbols 9 and 15 of Table C.1 of Part 1.	As above	N/A
	The installation instructions provided with the inverter	As above	N/A
	shall include the information in 5.3.2.13.	As above	N/A
4.8	Additional tests for grid-interactive inverters	See below	P
4.8.1	General requirements regarding inverter isolation and array grounding	Isolated	P
	-Type of Array grounding supported……:	Ungrounded	N/A
	-Inverter isolation……..:	isolated	P
4.8.2	Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	Complies	P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays	Refer appended table 4.8.2	P
	Inverter shall have means to measure DC insulation resistance from PV input (array) to ground before starting operation	Complies	P
	Or Inverter shall be provided with instruction in accordance with 5.3.2.11.	As above	N/A
	Measured DC insulation resistance: ……:	Refer appended table 4.8.2	P
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value R= Vmax/30mA under normal conditions	Complies	P
	Inverter measurement circuit shall be capable of detecting insulation resistance below the limit value R=Vmax/30mA with ground fault in the PV array	Complies	P
	Isolated inverters shall indicate a fault if the insulation resistance is less than the limit value	PCE is isolated inverter	P
	Isolated inverter fault indication maintained until insulation resistance has recovered to a value higher than the limit value	As above	P
	Non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30:	As above	N/A
	-shall indicate a fault in accordance with13.9	Screen on PCE shows , adequately defined in manual	P
	-shall not connect to the mains	Complies	P
4.8.2.2	Array insulation resistance detection for inverters for functionally grounded arrays	PCE does not have functionally grounded array connection	N/A
	a-1) The value of the total resistance, including the intentional resistance for array functional grounding, the expected insulation resistance of the array to ground, and the resistance of any other networks connected to ground (for example measurement networks) must not be lower than R = (VMAX PV/30 mA) ohms.	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	a-2) The installation instructions shall include the information required in 5.3.2.12.	As above	N/A
	b-1) As an alternative to a), or if a resistor value lower than in a) is used, the inverter shall incorporate means to detect, during operation, if the total current through the resistor and any networks (for example measurement networks) in parallel with it, exceeds the residual current values and times in Table 31	As above	N/A
	b-2) Inverter shall either disconnect the resistor or limit the current by other means :	As above	N/A
	b-3) If the inverter is a non-isolated inverter, or has isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, it shall also disconnect from the mains.	As above	N/A
	c) The inverter shall have means to measure the DC insulation resistance from the PV input to ground before starting operation, in accordance with 4.8.2.1.	As above	N/A
4.8.3	Array residual current detection	See below	P
4.8.3.1	General	In compliance	P
4.8.3.2	30 mA touch current type test for isolated inverters	Refer to table 4.8.3.2	P
4.8.3.3	Fire hazard residual current type test for isolated inverters	Refer to table 4.8.3.3	P
4.8.3.4	Protection by application of RCD's	PCE provide an integral RCD	N/A
	-The requirement for additional protection in4.8.3.1 can be met by provision of an RCD with a residual current setting of 30mA, located between the inverter and the mains.	Refer appended table 4.8.3.4	N/A
	-The selection of the RCD type to ensure compatibility with the inverter must be made according to rules for RCD selection in Part 1.	As above	N/A
	-The RCD provided integral to the inverter, or	As above	N/A
	-The RDC provided by the installer if details of the rating, type, and location for the RCD are given in the installation instructions per5.3.2.9.	As above	N/A
4.8.3.5	Protection by residual current monitoring	See below	P
4.8.3.5.1	General	PCE provide an integral RCD	P
	Where required by Table 30, the inverter shall provide residual current monitoring that functions whenever the inverter is connected to the mains with the automatic disconnection means closed.	The residual current measured before PCE start up	P
	The residual current monitoring means shall measure the total (both a.c. and d.c. components) RMS current.	Complies	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	As indicated in Table 30 for different inverter types, array types, and inverter isolation levels, detection may be required for excessive continuous residual current, excessive sudden changes in residual current, or both, according to the following limits:	Considered	P
	a) Continuous residual current: The inverter shall disconnect within 0,3 s and indicate a fault in accordance with 13.9 if the continuous residual current exceeds:	Refer appended table 4.8.3.5	P
	-maximum300mAforinverterswithcontinuous output power rating≤30kV;	Complies	P
	-maximum 10 mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.	<30kVA	N/A
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.	Complies	P
	b) Sudden changes in residual current: The inverter shall disconnect from the mains within the time	Refer appended table 4.8.3.5	P
	specified in Table 31	Refer appended table 4.8.3.5	P
	The inverter indicates a fault in accordance with 13.9, if a sudden increase in the RMS residual current is detected exceeding the value in the table.	Refer appended table 4.8.3.5	P
	The inverter may attempt to re-connect if the array insulation resistance meets the limit in 4.8.2.	Complies	P
4.8.3.5.2	Test for detection of excessive continuous residual current: test repeated 5 times and time to disconnect shall not exceed 0,3 s.	Refer appended table 4.8.3.5.2	P
4.8.3.5.3	Test for detection of sudden changes in residual current repeated 5 times and each of the 5 results shall not exceed the time limit indicated in for each row (30mA, 60mA and150mA) of Table 31.	Refer appended table 4.8.3.5.3	P
4.8.3.6	Systems located in closed electrical operating areas	No such construction	N/A
	The protection against shock hazard is not required if the installation information provided with the inverter indicates the restriction for use in a closed electrical operating area, and	Refer appended table 4.8.3.6	N/A
	Installation information indicates what forms of shock hazard protection are and are not provided integral to the inverter, in accordance with 5.3.2.7.	As above	N/A
	The inverter shall be marked as in 5.2.2.6.	As above	N/A
5	MARKING AND DOCUMENTATION	In compliance	P

IS 16221 (PART 2):2015/ IEC 62109-2 : 2011			
Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
5.1	Marking	See below	P
5.1.1/RD	General	See below	P
	Equipment shall bear markings as specified in 5.1 and 5.2	Marking label marked on outer surface of enclosure, and is visible from the exterior	P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable	In compliance	P
	Graphic symbols shall be explained in the documentation provided with the PCE	Graphical symbol explained in manual.	P
5.1.2/RD	Durability of markings	See below	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 test marking is durable and clearly legible and no curling occurred	P
5.1.3/RD	Identification	In compliance	P
	The equipment shall, as a minimum, be permanently marked with:	See below	P
	a) the name or trade mark of the manufacturer or supplier	Trade mark: 	P
	b) model number, name or other means to identify the equipment	Model No.: Sunmagic-REeFi	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.	SN: 3202303126	P
5.1.4	Equipment ratings	See below	P
	PV input ratings:	See below	P
	-Vmax PV (absolute maximum) (d.c.V)	300Vdc	P
	-Isc PV (absolute maximum) (d.c.A)	83Adc	P
	a.c. output ratings:	See below	P
	- Voltage (nominal or range) (a.c.V)	3/N/PE AC 230/400	P
	- Current (maximum continuous) (a.c.A)	15A AC/ Phase	P
	- Frequency (nominal or range)(Hz)	50Hz	P
	- Power (maximum continuous) (W or VA)	10000W	P
	- Power factor range	0.8i - 0.8c	P
	a.c input ratings:	See below	P
	- Voltage (nominal or range) (a.c.V)	3/N/PE AC 230/400	P
	- Current (maximum continuous) (a.c.A)	18A AC Per ph	P
	- Frequency (nominal or range)(Hz)	50 Hz	P
	d.c. output ratings:	No DC output used	N/A
	- Voltage (nominal or range) (d.c.V)	As above	N/A
	- Current (maximum continuous) (d.c.A)	As above	N/A
	Protective class (I or II or III)	Protective class I	P
	Ingress protection (IP) rating per part 1	IP20	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	An inverter that is adjustable for more than one nominal output voltage shall be marked to indicate the particular voltage for which it is set when shipped from the factory.	No such construction	N/A
5.1.5/RD	Fuse identification	See below	P
	Marking shall be located adjacent to each fuse or fuse holder, or on the fuse holder, 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.	In compliance	P
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated	No such fuse used	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.	In compliance	P
5.1.6/RD	Terminals, Connections, and Controls	See below	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.	In compliance	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.	Indicated warning in coloured red	P
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other nonpermanent material.	No such construction	N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:	See below	P
	– the sign “+“ for positive and “-„ for negative; or	Marked on PCE	P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from there presentation	No pictorial representation	P
5.1.6.1/RD	Protective Conductor Terminals	Earthing terminal provided	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	The means of connection for the protective earthing conductor shall be marked with:	In compliance	P
	– symbol 7 of Annex C; or	In compliance	P
	– the letters “PE“;or	Letter “PE” not used to indicate	N/A
	– the colour coding green-yellow	Colour coding green-yellow not used for earthing terminal	N/A
5.1.7/RD	Switches and circuit-breakers	See below	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.	“ON” indicated the on-position of DC switch and “OFF” indicated the off-position of DC switch	P
5.1.8/RD	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.	As above	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	As above	N/A
5.1.9/RD	Terminal boxes for External Connections	See below	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:	In compliance	P
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or	See below b)	N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking	Symbol 9 marked on label	P
5.2	Warning markings	See below	P
5.2.1/RD	Visibility and legibility requirements for warning markings	In compliance	P
	Warning markings shall be legible, and shall have minimum dimensions as follows:	See below	P
	-Printed symbols shall be at least 2,75 mm high	Printed symbols greater 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	Printed text characters greater than1.5 mm high	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	-Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in colour from the background, shall have a depth or raised height of at least 0,5 mm.	No such marking	N/A
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C	The manual provide necessary information for the warning marking	P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual	All symbols that are explained in the manual	P
5.2.2	Content for warning markings	See below	N/A
5.2.2.1/RD	Ungrounded heat sinks and similar parts	Grounded heat sinks and similar parts	N/A
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking maybe 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.	As above	N/A
5.2.2.2/RD	Hot Surfaces	See below	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.	Symbol 14 of Annex C marked on marking label	P
5.2.2.3/RD	Coolant	No coolant contained within the equipment	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:	As above	N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or	As above	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	As above	N/A
5.2.2.4/RD	Stored energy	See below	P
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.	Symbol 21 of Annex C and the time provided on marking label	P
5.2.2.5/RD	Motor guarding	See below	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).	No such motor used	N/A
5.2.2.6	Inverters for closed electrical operating areas	Inverter is for operator access area	N/A
	Where required by 4.8.3.6, an inverter not provided with full protection against shock hazard on the PV array shall be marked with a warning that the inverter is only for use in a closed electrical operating area, and referring to the installation instructions.	As above	N/A
5.2.3/RD	Sonic hazard markings and instructions	Sound pressure not exceeded 80dBA	N/A
	If required by 10.2.1 a PCE shall:	As above	N/A
	a) be marked to warn the operator of the sonic pressure hazard; or	As above	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.	As above	N/A
5.2.4/RD	Equipment with multiple sources of supply	No multiple sources of supply	N/A
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.	As above	N/A
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.	As above	N/A
5.2.5/RD	Excessive touch current	No excessive touch current	N/A
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.	As above	N/A
5.3	Documentation	In compliance	P
5.3.1/RD	General	See below	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 in5.3.2 through 5.3.4, and the following:	User manual provided	P
	a) explanations of equipment makings, including symbols used	As above	P
	b) location and function of terminals and	As above	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	controls		
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:	As above	P
	– ENVIRONMENTAL CATEGORY as per 6.1	Outdoor use	P
	– WET LOCATIONS classification for the intended external environment as per 6.1	Complies	P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2	PD2	P
	– INGRESS PROTECTION rating as per 6.3	IP20	P
	– Ambient temperature and relative humidity ratings	0°C -40°C, upto95% RH	P
	– Maximum altitude rating	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;	AC supply: OVC II PV Supply: OVC II	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE	In compliance	P
5.3.1.1/RD	Language	See below	P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.	Instructions are provided in English language	P
5.3.1.2/RD	Format	See below	P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	Provided in printed form with PCE	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.	As above	N/A
5.3.2/RD	Information related to installation	In compliance	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:	Provided in user manual	P
	a) assembly, location, and mounting requirements:	As above	P
	b) ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including	As above	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	instructions that the installation position shall not prevent access to the disconnection means;		
	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;	As above	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)	In compliance	P
	e) ventilation requirements;	Provided in user manual	P
	f) requirements for special services, for example cooling liquid;	No such construction	N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;	Not required	N/A
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve regulated batteries is located, to prevent the accumulation of hazardous gases;	External battery used	N/A
	i) tightening torque to be applied to wiring terminals;	No such construction	N/A
	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;	No back-feed short circuit current	N/A
	k) for each input to the PCE, the max value of short-circuit current available from the source, for which the PCE is designed; and	Considered	P
	l) compatibility with RCD and RCM;	Provided	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:	Provided	P
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:	RCD is built in the PCE	N/A
	“This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product.	As above	N/A
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	Provided in user manual	P
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices	Adequate information provided in user manual	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	needed, etc.		
5.3.2.1	Ratings: Sub clause 5.3.2 of Part 1 requires the documentation to include ratings information for each input and output. For inverters this information shall be as in Table 33 below. Only those ratings that are applicable based on the type of inverter are required.	Refer instruction user manual	P
	PV input quantities :	Provided in user manual	P
	-Vmax PV (absolute maximum) (d.c.V)	300Vdc	P
	-PV input operating voltage range (d.c.V)	165-250Vdc	P
	-Maximum operating PV input current (d.c.A)	60Adc	P
	-Isc PV (absolute maximum) (d.c.A)	83Adc	P
	-Max. inverter back feed current to the array (a.c. or d.c. A)	No backfeed current	N/A
	a.c. output quantities:	See below	P
	-Voltage (nominal or range) (a.c.V)	3/N/PE AC 230/400V	P
	-Current (maximum continuous) (a.c.A)	15A/ Phase	P
	-Current (inrush) (a.c. A, peak and duration)	20A, 10ms	P
	-Frequency (nominal or range)(Hz)	50Hz	P
	-Power (maximum continuous) (W or VA)	10000W	P
	-Power factor range	0.8i - 0.8c	P
	-Maximum output fault current (a.c. A, peak and duration or RMS)	18A, 10ms	P
	-Maximum output overcurrent protection (a.c.A)	18A	P
	a.c. input quantities:	See below	P
	-Voltage (nominal or range) (a.c.V)	3/N/PE AC 230/400	P
	-Current (maximum continuous) (a.c.A)	18A/Phase	P
	-Current (inrush) (a.c. A, peak and duration)	22A, 10ms	P
	-Frequency (nominal or range)(Hz)	50Hz	P
	d.c input (other than PV) quantities:	See below	P
	-Voltage (nominal or range) (d.c.V)	120V DC	P
	-Nominal battery voltage (d.c.V)	120V DC	P
	-Current (maximum continuous) (d.c.A)	83A	P
	d.c. output quantities:	No DC output	N/A
	-Voltage (nominal or range) (d.c.V)	As above	N/A
	-Nominal battery voltage (d.c.V)	As above	N/A
	-Current (maximum continuous) (d.c.A)	As above	N/A
	Protective class (I or II or III)	Class I	P
	Ingress protection (IP) rating per part 1	IP20	P
5.3.2.2	Grid-interactive inverter set points	See below	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	For a grid-interactive unit with field adjustable trip points, trip times, or reconnect times, the presence of such controls, the means for adjustment, the factory default values, and the limits of the ranges of adjustability shall be provided in the documentation for the PCE or in other format such as on a website. Provided solution: ……..	No adjustable setting available	N/A
	The setting of field adjustable set points shall be accessible from the PCE	As above	N/A
5.3.2.3	Transformers and isolation	See below	P
	whether an internal isolation transformer is provided, and if so, what level of insulation (functional, basic, reinforced, or double) is provided by that transformer. The instructions shall also indicate what the resulting installation requirements are regarding such things as earthing or not earthing the array, providing external residual current detection devices, etc.	Reinforced/double insulated	P
	An inverter shall be provided with information to the installer regarding:	See below	P
	-providing of internal isolation transformer	In compliance	P
	-the level of insulation (functional, basic, reinforced, or double)	Reinforced/double insulated	P
	The instructions shall also indicate what the resulting installation requirements are regarding:	See below	P
	-earthing or not earthing the array	Earthing provided with EUT	P
	-providing external residual current detection devices	No such device	N/A
	-requiring an external isolation transformer,	Isolation transformer installed within EUT	N/A
5.3.2.4	Transformers required but not provided	As above	N/A
	An inverter that requires an external isolation transformer not provided with the unit, shall be provided with instructions that specify, and for the external isolation transformer with which it is intended to be used:	As above	N/A
	- the configuration type	As above	N/A
	- electrical ratings	As above	N/A
	- environmental ratings	As above	N/A
5.3.2.5	PV modules for non-isolated inverters	Isolated Inverter	N/A
	Non-isolated inverters shall be provided with installation instructions that require PV modules that have an IEC 61730 Class A rating	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	If the maximum AC mains operating voltage is higher than the PV array maximum system voltage then the instructions shall require PV modules that have a maximum system voltage rating based upon the AC mains voltage.	As above	N/A
5.3.2.6	Non-sinusoidal output waveform information	PCE is for sinusoidal output waveform	N/A
	The instruction manual for a stand-alone inverter not complying with 4.7.5.2 shall include a warning that:	PCE complying with Cl. 4.7.5.2	N/A
	-the waveform is not sinusoidal,	As above	N/A
	-some loads may experience increased heating,	As above	N/A
	-the user should consult the manufacturers of the intended load equipment before operating that load with the inverter	As above	N/A
	The inverter manufacturer shall provide information regarding:	As above	N/A
	-what types of loads may experience increased heating	As above	N/A
	-recommendations for maximum operating times with such loads	As above	N/A
	The inverter manufacturer shall specify for the waveforms as determined by the testing in 4.7.5.3.2 through 4.7.5.3.4.:	As above	N/A
	- THD	As above	N/A
	- slope	As above	N/A
	- peak voltage	As above	N/A
5.3.2.7	Systems located in closed electrical operating areas	No such PCE	N/A
	Where required by 4.8.3.6, an inverter not provided with full protection against shock hazard on the PV array shall be provided with installation instructions:	As above	N/A
	-requiring that the inverter and the array must be installed in closed electrical operating areas	As above	N/A
	- indicating which forms of shock hazard protection are and are not provided integral to the inverter (for example the RCD, isolation transformer complying with the 30 mA touch current limit, or residual current monitoring for sudden changes)	As above	N/A
5.3.2.8	Stand-alone inverter output circuit bonding	Output circuit is bonded	N/A
	Where required by 7.3.10, the documentation for an inverter shall include the following:	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	-if output circuit bonding is required but is not provided integral to the inverter, the required means shall be described in the installation instructions, including which conductor is to be bonded and the required current carrying capability or cross-section of the bonding means;	As above	N/A
	- if the output circuit is intended to be floating, the documentation for the inverter shall indicate that the output is floating.	As above	N/A
5.3.2.9	Protection by application of RCD's	See below	N/A
	Where the requirement for additional protection in4.8.3.1 is met by requiring an RCD that is not provided integral to the inverter, as allowed by 4.8.3.4, the installation instructions shall state the need for the RCD,.	The RCD protected is integrated with inverter	N/A
	and shall specify its rating, type, and required circuit location	As above	N/A
5.3.2.10	Remote indication of faults	No such construction	N/A
	The installation instructions shall include an explanation of how to properly make connections to (where applicable), and use, the electrical or electronic fault indication required by 13.9.	As above	N/A
5.3.2.11	External array insulation resistance measurement and response	PCE having built-in resistance measurement and response	N/A
	The installation instructions for an inverter for use with ungrounded arrays that does not incorporate all the aspects of the insulation resistance measurement and response requirements in 4.8.2.1, must include:	As above	N/A
	-for isolated inverters: an explanation of what aspects of array insulation resistance measurement and response are not provided, and	As above	N/A
	- an instruction to consult local regulations to determine if any additional functions are required or not;	As above	N/A
	- for non-isolated inverters: an explanation of what external equipment must be provided in the system, and	As above	N/A
	-what the set points and response implemented by that equipment must be, and:	As above	N/A
	-how that equipment is to be interfaced with the rest of the system.	As above	N/A
5.3.2.12	Array functional grounding information	PCE does not have functional grounding	N/A
	Where approach a) of 4.8.2.2 is used, the installation instructions for the inverter shall include all of the following:	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	a) the value of the total resistance between the PV circuit and ground integral to the invert.	As above	N/A
	b) the minimum array insulation resistance to ground that system designer or installer must meet when selecting the PV panel and system design, based on the minimum value that the design of the PV functional grounding in the inverter was based on.....	As above	N/A
	c) the minimum value of the total resistance R = VMAX PV/30 mA that the system must meet, with an explanation of how to calculate the total…;	As above	N/A
	d) a warning that there is a risk of shock hazard if the total minimum resistance requirement is not met.	As above	N/A
5.3.2.13	Stand-alone inverters for dedicated loads	In compliance	P
	Where the approach of 4.7.5.5 is used, the installation instructions for the inverter shall include a warning that the inverter is only to be used with the dedicated load for which it was evaluated, and	Installation instructions & dedicated load information provided in user manual	P
	shall specify the dedicated load.	As above	P
5.3.2.14	Identification of firmware version(s)	Firmware version is displayed on display screen	P
	An inverter utilizing firmware for any protective functions shall provide means to identify the firmware version.	In compliance	P
	This can be a marking, but the information can also be provided by a display panel, communications port or any other type of user interface……	In compliance	P
5.3.3	Information related to operation	Adequate information provided in manual	P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:	As above	P
	Instructions for adjustment of controls including the effects of adjustment;	No such adjustment provided	N/A
	Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;	Adequate information provided in manual	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	Temp. not exceeded the limit however symbol 14 of Annex C marked on marking label	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	Instructions, that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.	Adequate information provided in user manual	P
5.3.4	Information related to maintenance	Adequate information provided in user manual	P
	Maintenance instructions shall include the following:	As above	P
	Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic retightening of terminals);	As above	P
	Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;	As above	P
	Part numbers and instructions for obtaining any required operator replaceable parts;	No any operator replaceable parts	N/A
	Instructions for safe cleaning (if recommended)	As above	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.	Only one source of supply	N/A
5.3.4.1	Battery maintenance	External battery used	N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:	As above	N/A
	Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions	As above	N/A
	When replacing batteries, replace with the same type and number of batteries or battery packs	As above	N/A
	General instructions regarding removal and installation of batteries	As above	N/A
	CAUTION: Do not dispose of batteries in a fire. The batteries may explode.	As above	N/A
	CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.	As above	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:	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	a) Remove watches, rings, or other metal objects.	As above	N/A
	b) Use tools with insulated handles.	As above	N/A
	c) Wear rubber gloves and boots.	As above	N/A
	d) Do not lay tools or metal parts on top of batteries	As above	N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals	As above	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).	As above	N/A
6	Environmental requirements and conditions	In compliance	P
6.1/RD	Environmental categories and minimum environmental conditions	See below	P
6.1.1/RD	Outdoor	In compliance	P
6.1.2/RD	Indoor, unconditioned	As above	N/A
6.1.3/RD	Indoor, conditioned	As above	N/A
6.2/RD	Pollution degree	PD2	P
6.3/RD	Ingress Protection	IP20	P
6.4/RD	UV exposure	Metal enclosure used	P
6.5/RD	Temperature and humidity	0 - 40°C; up to 95%RH	P
7	Protection against electric shock and energy hazards	See below	P
7.1/RD	General	In compliance	P
7.2/RD	Fault conditions	In compliance	P
7.3	Protection against electric shock	See below	P
7.3.1/RD	General	Considered	P
7.3.2/RD	Decisive voltage classification	See below	P
7.3.2.1/RD	Use of decisive voltage class (DVC)	In compliance	P
7.3.2.2/RD	Limits of DVC (according table 6)	DVC-C is classified for input &output circuit & PV supply	P
7.3.2.3/RD	Short-terms limits of accessible voltages under fault conditions	No voltage exceeded under fault condition	N/A
7.3.2.4/RD	Requirements for protection (according table 7)	Considered	P
7.3.2.5/RD	Connection to PELV and SELV circuits	In compliance	P
7.3.2.6/RD	Working voltage and DVC	Considered	P
7.3.2.6.1/RD	General	See below	
7.3.2.6.2/RD	AC working voltage (see Figure 2)	Considered	P
7.3.2.6.3/RD	DC working voltage (see Figure 3)	Considered	P
7.3.2.6.4/RD	Pulsating working voltage (see Figure 4)	No such voltage	N/A
7.3.3/RD	Protective separation	In compliance	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	Protective separation shall be achieved by:	See below	P
	- double or reinforced insulation, or	Double or reinforced insulation between mains and accessible panel	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, where by the screen is separated from live parts by at least basic insulation, or	All accessible metal parts are connected to earth and separated from live part 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	No such construction	N/A
	- limitation of voltage according to7.3.5.4.	As above	N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE	In compliance	P
7.3.4/RD	Protection against direct contact	In compliance	P
7.3.4.1/RD	General	See below	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).	In compliance (Refer Cl.7.3.4.2 and 7.3.4.3)	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.	No such construction	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.	As above	N/A
7.3.4.2/RD	Protection by means of enclosures and barriers	See below	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.	In compliance	P
7.3.4.2.1/RD	General	See below	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).	In compliance	P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6	In compliance	P
7.3.4.2.2 / RD	Access probe criteria	In compliance	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:	See below	P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Probe not touched live part	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	Probe not touched live part	P
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	In compliance	P
7.3.4.2.3/RD	Access probe tests	In compliance	P
	Compliance with 7.3.4.2.1 is checked by all of the following:	See below	P
	a) Inspection; and	In compliance	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 fuse holders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavorable position.	Test finger and test pin not touched live part	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	In compliance	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.	No such equipment	N/A
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to	No such openings	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	30 N.		
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±5 ° only.	No any opening on top surface of PCE	N/A
7.3.4.2.4/RD	Service access areas	PCE is not allowed to remove cover during installation and maintenance when PCE is energized	P
7.3.4.3/RD	Protection by means of insulation of live parts	See below	N/A
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:	Requirement of Cl.7.3.4.2 are met	N/A
	– their working voltage is greater than the maximum limit of decisive voltage class A, or	As above	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)	As above	N/A
7.3.5/RD	Protection in case of direct contact	In compliance	P
7.3.5.1/RD	General	See below	P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.	In compliance	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:	In compliance	P
	– is of decisive voltage class A and complies with 7.3.5.2, or	DVC - A classified circuits can be only touch directly	P
	– is provided with protective impedance according to7.3.5.3, or	No such construction	N/A
	– is limited in voltage according to 7.3.5.4	As above	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.	In compliance	P
	Compliance is checked by visual inspection and trial insertion.	In compliance	P
7.3.5.2/RD	Protection using decisive voltage class A	In compliance	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
7.3.5.3/RD	Protection by means of protective impedance	No such construction	N/A
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC- B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.	As above	N/A
7.3.5.3.1/RD	Limitation of current through protective impedance	As above	N/A
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.	As above	N/A
7.3.5.3.2 /RD	Limitation of discharging energy through protective impedance	No such construction	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.	As above	N/A
7.3.5.4/RD	Protection by means of limited voltages	No such construction	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.	As above	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.	As above	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.	As above	N/A
7.3.6/ RD	Protection against indirect contact	In compliance	P
7.3.6.1/ RD	General	See below	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)	All accessible metal parts are adequately connected with protective earth, and complying the requirement for protective class I	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	That part of a PCE meets the requirements of 7.3.6.2 and7.3.6.3 is defined as protective class I	In compliance	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	Protective class I	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	Accessible panel is designated for protective class I	N/A
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.	In compliance	P
7.3.6.2/ RD	Insulation between live parts and accessible conductive parts	See below	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 in7.3.7.4 and creepages as specified in 7.3.7.5	Adequate clearance and creepage distance	P
7.3.6.3 / RD	Protective class I – Protective bonding and earthing	In compliance	P
7.3.6.3.1/ RD	General	See below	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:	In compliance	P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or	DVC-A circuit considered	P
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.	Accessible panel is separated from live part by double or reinforced insulation	P
7.3.6.3.2/RD	Requirements for protective bonding	In compliance	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:	See below	P
	a) through direct metallic contact;	All accessible metal parts are adequately connected with protective earth, and complying the requirement for protective class I	P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;	No such construction	N/A
	c) through a dedicated protective bonding conductor;	In compliance	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	d) through other metallic components of the PCE	No such construction	N/A
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.	In compliance	P
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.	No such construction	N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.	As above	N/A
7.3.6.3.3/ RD	Rating of protective bonding	In compliance	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.	In compliance	P
	Protective bonding shall meet following requirements:	See below	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	Overcurrent protective device rating more than 16A	N/A
	b) For PCE with an overcurrent protective device rating of more than16A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.	In compliance Refer appended table 7.3.6.3.3/RD	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.	Above test b) is carried out	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:	In compliance	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	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);	Not a pluggable equipment type A	N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;	Not a pluggable equipment type B	N/A
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.	In compliance	P
7.3.6.3.3.1/ RD	Test current, duration, and acceptance criteria	In compliance	P
	The test current, duration of the test and acceptance criteria are as follows:	See below	P
	a) For PCE with an overcurrent protective device rating of 16A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1Ω.	Overcurrent protective device rating more than 16A	N/A
	b) For PCE with an overcurrent protective device rating of more than 16A, 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 2,5V.	In compliance Refer appended table 7.3.6.3.3/RD	P
	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.	In compliance	P
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.	In compliance	P
	As an alternative to Table 10, where the time current characteristic of the over current 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.	Alternate method not used	N/A
7.3.6.3.4/RD	Protective bonding impedance (routine test)	Above test b) is carried out	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	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:	As above	N/A
	- the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:	As above	N/A
	-the test duration may be reduced to no less than 2s	As above	N/A
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.	As above	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).	As above	N/A
7.3.6.3.5/ RD	External protective earthing conductor	See below	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.	Earthing connection is provided with PCE and information provided in manual	P
	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.	As above	N/A
	-2,5 mm² if mechanical protection is provided;	Refer below	N/A
	-4 mm² if mechanical protection is not provided.	External earth conductor should be greater than 4mm^2, information provided in manual	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.	As above	N/A
7.3.6.3.6/ RD	Means of connection for the external protective earthing conductor	See below	P
7.3.6.3.6.1 / RD	General	In compliance	P
	The means of connection for the protective earthing conductor shall be permanently marked with:	Earthing symbol marked	P
	-symbol 7 of Annex C; or	As above	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	-the colour coding green-yellow	As above	N/A
	Marking shall not be done on easily changeable parts such as screws.	In compliance	P
7.3.6.3.7/ RD	Touch current in case of failure of the protective earthing conductor	In compliance	P
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5mA a.c. or mA d.c.	Refer below	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 mAd.c.	Touch current not exceeded (Refer appended table 7.3.6.3.7 /RD)	P
	a) Permanently connected wiring, and:	Refer b)	N/A
	-a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al;or	As above	N/A
	-automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or	As above	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	As above	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.	As above	N/A
7.3.6.4/ RD	Protective Class II – Double or Reinforced Insulation	Consider as 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:	As above	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 -connected equipment;	As above	N/A
	-metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;	No such construction	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;	As above	N/A
	-equipment employing protective class II shall be marked according to5.1.8.	As above	N/A
7.3.7/RD	Insulation Including Clearance and Creepage Distance	In compliance	P
7.3.7.1/RD	General	See below	P
	Insulation shall be selected after consideration of the following influences:	See below	P
	pollution degree	PD2	P
	overvoltage category	AC supply: OVCII PV Supply: OVC II	P
	supply earthing system	TN system	P
	insulation voltage	Refer appended table 7.3.7/RD	P
	location of insulation	As above	P
	type of insulation	As above	P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.	As above	P
7.3.7.1.3/RD	Supply earthing systems	In compliance	P
	Three basic types of earthing system are described in IEC 60364-1. They are:	See below	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	TN system	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	neural and protective conductor.		
	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;	As above	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.	As above	N/A
7.3.7.1.4 /RD	Insulation voltages	AC supply: OVCII- 2500V PV Supply: OVC II- 2500V	P
7.3.7.2/RD	Insulation between a circuit and its surroundings	Considered	P
7.3.7.2.1 / RD	General	TN system	P
7.3.7.2.2 / RD	Circuits connected directly to the mains	Considered	P
7.3.7.2.3/ RD	Circuits other than mains circuits	In compliance	P
7.3.7.2.4/RD	Insulation between circuits	Considered	P
7.3.7.3/ RD	Functional insulating	No such construction	N/A
7.3.7.4/RD	Clearance distances	Refer appended table 7.3.7/RD	P
7.3.7.4.1/RD	Determination	As above	P
7.3.7.4.2 /RD	Electric field homogeneity	No such construction	N/A
7.3.7.4.3/RD	Clearance to conductive enclosures	In compliance	P
7.3.7.5/RD	Creepage distances	Refer appended table 7.3.7/RD	P
7.3.7.5.1 /RD	General	In compliance	P
7.3.7.5.2 / RD	Voltage	Considered	P
7.3.7.5.3/ RD	Materials	In compliance	P
7.3.7.6/ RD	Coating	No coating used	N/A
7.3.7.7/ RD	PWB spacing's for functional insulating	No such construction	N/A
7.3.7.8/ RD	Solid insulating	See below	P
7.3.7.8.1/ RD	General	As above	P
7.3.7.8.2/ RD	Requirements for electrical withstand capability of solid insulation	In compliance	P
7.3.7.8.2.1/ RD	Basic, supplemental, reinforced, and double insulation	Double or reinforced material used	P
7.3.7.8.2.2/ RD	Functional insulation	No such construction	N/A
7.3.7.8.3/ RD	Thin sheet or tape material	See below	P
7.3.7.8.3.1/RD	General	Thin sheet material used inside the transformer to meet the dielectric requirement	P
7.3.7.8.3.2/ RD	Material thickness not less than 0,2 mm	Thickness less than 0.2mm used	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
7.3.7.8.3.3/ RD	Material thickness less than 0,2 mm	In compliance	P
7.3.7.8.3.4/ RD	Compliance	In compliance	P
7.3.7.8.4/ RD	Printed wiring boards	As above	P
7.3.7.8.4.1/ RD	General	As above	P
7.3.7.8.4.2/ RD	Use of coating materials	No coated PCB used	N/A
7.3.7.8.5/ RD	Wound components	In compliance	P
7.3.7.8.6/ RD	Potting materials	No potting materials used	N/A
7.3.7.9/ RD	Insulation requirements above 30 kHz	Frequency less than 30kHz	N/A
7.3.8/ RD	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility	Information provided regarding RCD in user manual	P
7.3.9/ RD	Protection against shock hazard due to stored energy	See below	P
7.3.9.1/ RD	Operator access area	No such construction	N/A
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.	As above	N/A
7.3.9.2/RD	Service access areas	In compliance	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 present on the user manual	P
7.3.10	Additional requirements for stand-alone inverters	In compliance	P
	One circuit conductor bonded to earth to create a grounded conductor and an earthed system.	No output circuit is required to be bonded , e.g. earthed neutral	N/A
	The means used to bond the grounded conductor to protective earth provided within the inverter or	As above	N/A
	as part of the installation	As above	N/A
	If not provided integral to the inverter, the required means shall be described in the installation instructions as per 5.3.2.8.	As above	N/A
	The means used to bond the grounded conductor to protective earth shall comply with the requirements for protective bonding in Part 1,	As above	N/A
	If the bond can only ever carry fault currents in stand- alone mode, the maximum current for the bond is determined by the inverter maximum output fault current.	As above	N/A
	Output circuit bonding arrangements shall ensure that in any mode of operation, the system only has the grounded circuit conductor bonded to earth in one place at a	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	time.		
	Switching arrangements may be used, in which case the switching device used is to be subjected to the bond impedance test along with the rest of the bonding path	As above	N/A
	Inverters intended to have a circuit conductor bonded to earth shall not impose any normal current on the bond except for leakage current.	As above	N/A
	Outputs that are intentionally floating with no circuit conductor bonded to ground, must not have any voltages with respect to ground that are a shock hazard in accordance with Clause 7 of Parts 1 and 2.	As above	N/A
	The documentation for the inverter shall indicate that the output is floating as per 5.3.2.8.	As above	N/A
7.3.11	Functionally grounded arrays	No such construction	N/A
	All PV conductors in a functionally grounded array shall be treated as being live parts with respect to protection against electric shock.	As above	N/A
7.4/RD	Protection against energy hazards	See below	P
7.4.1/RD	Determination of hazardous energy level	No such construction	N/A
	A hazardous energy level is considered to exist if	As above	N/A
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.	As above	N/A
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5\ CU^2$	As above	N/A
7.4.2/ RD	Operator Access Areas	See below	P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.	No energy hazard in operator access area. Compliance checked with standard test finger	P
7.4.3/ RD	Services Access Areas	The warning symbol 21 present on the user manual	P
7.5/ RD	Electrical tests related to shock hazard	In compliance	P
7.5.1/ RD	Impulse voltage test (type test)	Refer appended table 7.5/RD	N/A
7.5.2/ RD	Voltage test (dielectric strength test)	Refer appended table 7.5/RD	P
7.5.2.1 / RD	Purpose of test	In compliance	P
7.5.2.2/ RD	Value and type of test voltage	Refer appended table 7.5/RD	P
7.5.2.3/ RD	Humidity pre-conditioning	Not specified for wet location	N/A
7.5.2.4 / RD	Performing the voltage test	Refer appended table 7.5/RD	P
7.5.2.5/ RD	Duration of the a.c. or d.c. voltage test	Refer appended table 7.5/RD	P
7.5.2.6/ RD	Verification of the a.c. or d.c. voltage test	In compliance	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
7.5.3/ RD	Partial discharge test	Refer appended table 7.5/RD	N/A
7.5.4/ RD	Touch current measurement (type test)	See below	P
	The touch current shall be measured if required by7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in7.3.6.3.7 are required.	Refer appended table 7.3.6.3.7/RD	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.	Not specified for wet location	N/A
7.5.5/RD	Equipment with multiple sources of supply	Backfeed current and voltage not produced	N/A
8	Protection against mechanical hazards	In compliance	P
8.1/ RD	General	See below	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.	No mechanical hazards under the normal and single fault condition	P
	Conformity is checked as specified in 8.2 to 8.6.	In compliance	P
8.2/ RD	Moving parts	See below	N/A
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.	No such part used	N/A
8.2.1/ RD	Protection of service persons	No such part used	N/A
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table C-1 shall be applied on or near the guard.	As above	N/A
8.3/ RD	Stability	See below	P
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	PCE is stable	P
8.4/ RD	Provisions for lifting and carrying	No such construction	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	If carrying handles or grips are fitted to, or supplied with, the equipment, they shall be capable of withstanding a force of four times the weight of the equipment.	As above	N/A
	Equipment or parts having a mass of 18 kg or more shall be provided with a means for lifting and carrying or directions shall be given in the manufacturer's documentation.	As above	N/A
8.5/ RD	Wall mounting	Not a wall mounted	N/A
	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.	As above	N/A
8.6/RD	Expelled parts	See below	N/A
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.	No such part expelled during fault	N/A
9	Protection against fire hazards	In compliance	P
9.1/ RD	Resistance to fire	See below	P
	This sub clause 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.	Materials & components are safety certified and have adequate flammability classification, other material which are not certified tested accordingly with this standard (Refer Table 9.1)	P
9.1.1/RD	Reducing the risk of ignition and spread of flame	See below	P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.	Method 1 used	P
9.1.2/RD	Conditions for a fire enclosure	See below	P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.	Fire enclosure is used	P
9.1.2.1/ RD	Parts requiring a fire enclosure	In compliance	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 FIREENCLOSURE:	See below	P
	-components in PRIMARYCIRCUITS	In compliance	P
	- components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;	No such construction	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	- components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITYCLASSV-1;	As above	N/A
	- components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;	As above	N/A
	- 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	As above	N/A
	-insulated wiring, except as permitted in9.1.2.2	As above	N/A
9.1.2.2/ RD	Parts not requiring a fire enclosure	In compliance	P
9.1.3/RD	Materials requirements for protection against fire hazard	In compliance	P
9.1.3.1/RD	General	See below	P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.	Components and materials have adequate flammability classification, PCB material complies with flammability test (Refer Table 9.1)	P
9.1.3.2/ RD	Materials for fire enclosures	Metallic enclosure used	N/A
	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.	As above	N/A
9.1.3.3/ RD	Materials for components and other parts outside fire enclosures	Sees below	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.	In compliance	P
9.1.3.4/ RD	Materials for components and other parts inside fire enclosures	Components and materials have adequate flammability classification, PCB material complies with flammability test (Refer Table 9.1)	P
9.1.3.5/ RD	Materials for air filter assemblies	No such construction	N/A
9.1.4/ RD	Openings in fire enclosures	No opening in fire enclosure	N/A
9.1.4.1/ RD	General	PCE not installed in more than one orientation	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	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.	As above	N/A
	These requirements are in addition to those in the following sections:	As above	N/A
	-7.3.4, Protection against direct contact;	As above	N/A
	-7.4, Protection against energy hazards;	As above	N/A
	-13.5, Openings in enclosures	As above	N/A
9.1.4.2 / RD	Side openings treated as bottom openings	Refer Cl.13.5.1	P
9.1.4.3/ RD	Openings in the bottom of a fire enclosure	In compliance Bottom side opening: 8.24 mm	P
	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.	No such materials used	N/A
9.1.4.4/ RD	Equipment for use in a closed electrical operating area	No such PCE	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 noncombustible surface. Such equipment shall be marked as follows:	As above	N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NONCOMBUSTIBLE SURFACE ONLY	As above	N/A
9.1.4.5/ RD	Doors or covers in fire enclosures	No doors or covers	N/A
9.1.4.6/ RD	Additional requirements for openings in transportable equipment	PCE is consider for stationary	N/A
9.2/ RD	Limited power sources	See below	P
9.2.1/ RD	General	In compliance	P
9.2.2/ RD	Limited power source tests	See appended table 9.2/RD	P
9.3	Short-circuit and overcurrent protection	In compliance	P
9.3.1/ RD	General	See below	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.	Short-circuit protection provided with PCE and during short-circuit, PCE is shutdown immediately and no output observed	P
9.3.2/ RD	Protection against short-circuits and over currents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited	As above	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	power sources in 9.2, except for circuits in which no over current hazard is presented by short circuits and overloads.		
9.3.3/ RD	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.	In compliance	P
9.3.4	Inverter backfeed current onto the array	No backfeed current	P
	The backfeed current testing and documentation requirements in Part 1 apply, including but not limited to the following.	In compliance	P
	Inverter backfeed current onto the PV array Maximum value……	0A	P
	This inverter backfeed current value shall be provided in the installation instructions regardless of the value of the current, in accordance with Table 33.	Information provided in manual	P
10	Protection against sonic pressure hazards	In compliance	P
10.1/RD	General	See below	P
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.	No sonic pressure hazard	P
10.2/ RD	Sonic pressure and Sound level	As above	P
10.2.1/ RD	Hazardous noise levels	Sound pressure not exceeded 80dBA	P
11	Protection against liquid hazards	No liquid containment	N/A
11.1/RD	Liquid Containment, Pressure and Leakage	As above	N/A
	The liquid containment system components shall be compatible with the liquid to be used.	As above	N/A
	There shall be no leakage of liquid onto live parts as a result of:	As above	N/A
	a) Normal operation, including condensation;	As above	N/A
	b) Servicing of the equipment; or	As above	N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.	As above	N/A
11.2/RD	Fluid pressure and leakage	As above	N/A
11.2.1/RD	Maximum pressure	As above	N/A
11.2.2/RD	Leakage from parts	As above	N/A
11.2.3/RD	Overpressure safety device	As above	N/A
11.3/ RD	Oil and grease	As above	N/A
12	Protection against Chemical Hazards	No chemical hazards	N/A
12.1/ RD	General	As above	N/A
13	Physical requirements	See below	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
13.1/RD	Handles and manual controls	In compliance	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.	In compliance	P
13.1.1/ RD	Adjustable controls	No such construction	N/A
13.2/RD	Securing of parts	In compliance	P
13.3/RD	Provisions for external connections	In compliance	P
13.3.1/ RD	General	In compliance	P
13.3.2/RD	Connection to an a.c. Mains supply	Terminal block used for AC cable connection	P
13.3.2.1/RD	General	Adequate information provided in manual	P
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:	Terminal block used for connection to a mains supply	P
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or	As above	P
	– a non-detachable power supply cord for connection tithe supply by means of a plug	Terminal block used for connection to a mains supply	N/A
	– an appliance inlet for connection of a detachable power supply cord; or	As above	N/A
	– a mains plug that is part of direct plug-in equipment as in13.3.8	As above	N/A
13.3.2.2/ RD	Permanently connected equipment	Terminal block used for connection to a mains supply	P
13.3.2.3/ RD	Appliance inlets	As above	N/A
13.3.2.4/ RD	Power supply cord	No power cord used	N/A
13.3.2.5/RD	Cord anchorages and strain relief	As above	N/A
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:	As above	N/A
	– the connecting points of the cord conductors are relieved from strain; and	As above	N/A
	– the outer covering of the cord is protected from abrasion.	As above	N/A
13.3.2.6/ RD	Protection against mechanical damage	In compliance	P
13.3.3/RD	Wiring terminals for connection of external conductors	Specific connector used for PV supply, terminal block used for mains supply and earth	P
13.3.3.1/ RD	Wiring terminals	As above	P
13.3.3.2/ RD	Screw terminals	In compliance	P
13.3.3.3/ RD	Wiring terminal sizes	In compliance with temperature measurement	P

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
13.3.3.4/ RD	Wiring terminal design	In compliance	P
13.3.3.5/ RD	Grouping of wiring terminals	In compliance	P
13.3.3.6/ RD	Stranded wire	In compliance	P
13.3.4/ RD	Supply wiring space	In compliance	P
13.3.5/RD	Wire bending space for wires 10 mm² and greater	In compliance	P
13.3.6/RD	Disconnection from supply sources	Adequate information provided in manual	P
13.3.7/RD	Connectors, plugs and sockets	Terminal block used for PV &mains supply connection	N/A
13.3.8/RD	Direct plug-in equipment	No such equipment	N/A
13.4/RD	Internal wiring and connections	See below	P
13.4.1/RD	General	All connections are used with adequate current rating, no mechanical damage during installation	P
13.4.2/RD	Routing	In compliance	P
13.4.3/RD	Colour coding	In compliance	P
13.4.4/RD	Splices and connections	In compliance	P
13.4.5/RD	Interconnections between parts of the PCE	No such connection	N/A
13.5/RD	Openings in enclosures	See below	N/A
13.5.1/RD	Top and side openings	No top opening, Side opening: 6.9mm (for exhaust fan), Rear opening:7.8mm (for exhaust fan), Front opening:2.1mm	P
	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	Front and back opening present for exhaust fan	P
13.6/RD	Polymeric Materials	Metallic enclosure used, certified MCB & DC switch used	P
13.6.1/RD	General	As above	P
13.6.1.1/RD	Thermal index or capability	As above	P
13.6.2/RD	Polymers serving as enclosures or barriers preventing access to hazards	Metallic enclosure used	N/A
13.6.2.1/RD	Stress relief test	As above	N/A
13.6.3/RD	Polymers serving as solid insulation	No solid insulation used	N/A
13.6.3.1/RD	Resistance to arcing	In compliance	P
13.6.4/RD	UV resistance	See below	P
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation	In compliance	P
13.7/RD	Mechanical resistance to deflection, impact, or drop	See below	P
13.7.1/RD	General	No hazards	P
13.7.2/RD	250-N deflection test for metal enclosures	In compliance	P
13.7.3/RD	7-J impact test for polymeric enclosures	Metallic enclosure used	N/A
13.7.4/RD	Drop test	Not a hand-held, direct plug-in or transportable equipment	N/A
13.8/RD	Thickness requirements for metal enclosures	Metal enclosure comply with Cl.13.7	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
13.8.1/RD	General	As above	N/A
13.8.2/RD	Cast metal	As above	N/A
13.8.3/RD	Sheet metal	As above	N/A
13.9	Fault indication	In compliance	P
	Where this Part 2 requires the inverter to indicate a fault, both of the following shall be provided:	See below	P
	a) a visible or audible indication, integral to the inverter, and detectable from outside the inverter, and	LCD screen indicate fault	P
	b) An electrical or electronic indication that can be remotely accessed and used.	No such construction	N/A
	The installation instructions shall include information regarding how to properly make connections (where applicable) and use the electrical or electronic means in b) above, in accordance with 5.3.2.10.	Adequate information provided in user manual.	P
14	Components	Verification of approvals with due correlation between the components used and the approval certificates submitted (Refer appended table 14)	P
14.1/RD	General	In compliance	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:	Parts and components are safety certified in accordance with their relevant standards. Component which has no relevant IEC/National standard, tested under the conditions occurring in the equipment using applicable parts of this standard (Refer appended table 14)	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;	As above	P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;	As above	P
	c) if there is no relevant IEC standard, the requirements of this standard;	As above	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.	No such component used	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
	Components such as Optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.	In compliance	P
14.2/ RD	Motor Over temperature Protection	See below	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.	Power limited by temperature control in single fault condition or high temperature environment condition	P
14.3/RD	Over temperature protection devices	Impedance protection motor	P
14.4/RD	Fuse holders	In compliance	P
14.5/RD	MAINS voltage selecting devices	No such device used	N/A
14.6/RD	Printed circuit boards	PCB material complies with flammability test (Refer Table 9.1)	P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better	As above	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 of9.2.	No such construction	N/A
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.	As above	N/A
14.7/RD	Circuits or components used as transient overvoltage limiting devices	Certified component used (Refer appended table 14)	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 7.5.1except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.	As above	P
14.8/RD	Batteries	No batteries used within PCE	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.	As above	N/A

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Clause	**Requirement + Test**	**Result - Remark**	**Verdict**
14.8.1/RD	Battery Enclosure Ventilation	As above	N/A
14.8.1.1/RD	Ventilation requirements	As above	N/A
14.8.1.2/RD	Ventilation testing	As above	N/A
14.8.1.3/RD	Ventilation instructions	As above	N/A
14.8.2/ RD	Battery Mounting	As above	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	As above	N/A
14.8.3/RD	Electrolyte spillage	As above	N/A
	Battery trays and cabinets shall have an electrolyte resistant coating.	As above	N/A
14.8.4/RD	Battery Connections	As above	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	As above	N/A
14.8.5/RD	Battery maintenance instructions	As above	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.	As above	N/A
14.8.6/RD	Battery accessibility and maintainability	As above	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.	As above	N/A

4.2.2.6/4.7RD	TABLE: mains supply electrical data in normal condition/ Electrical ratings tests					P
Type	U (V) DC	I (A) DC	P (kW) DC	U (V) AC	I (A) AC	P (kW) AC
Sunmagic-REeFi	165	16.33	2.695	L1: 207 L2: 207 L3: 207	L1:5.36 L2: 5.33 L3:5.39	2.678
		16.29	2.688	L1: 230 L2: 230 L3: 230	L1: 4.84 L2: 4.86 L3: 4.80	2.672
		16.31	2.691	L1: 253 L2: 253 L3: 253	L1: 4.41 L2: 4.44 L3: 4.39	2.681
	207	26.96	5.582	L1: 207 L2: 207 L3: 207	L1: 10.89 L2: 10.92 L3:10.86	5.412
		26.76	5.539	L1: 230 L2: 230 L3: 230	L1: 9.82 L2: 9.86 L3:9.80	5.421
		26.80	5.548	L1: 253 L2: 253 L3: 253	L1: 8.91 L2: 8.95 L3:8.88	5.411
	250	37.30	9.325	L1: 207 L2: 207 L3: 207	L1: 14.91 L2: 14.93 L3: 14.49	8.993
		42.26	10.566	L1: 230 L2: 230 L3: 230	L1: 14.98 L2: 14.95 L3: 14.92	9.989
		41.51	10.377	L1: 253 L2: 253 L3: 253	L1: 13.80 L2: 13.83 L3: 13.77	10.055
Supplementary information: Appliance not exceeds the rated current and rated power by more than 10% under normal load.						

4.3/RD	TABLE: Thermal Testing				P
Type/Model:	Sunmagic-REeFi				Permitted T (°C)
Test voltage(V):	DC input: 165Vdc		DC input: 250Vdc		
Ambient temp. during test(°C) :	A : 26.5	B: 26.7	--	--	
Temperature t of part/at:	Temperature rise at(T_{amb})		Calculated temperature at (T_{ma})		
	A dT (°C)	B dT (°C)	A T(°C)	B T(°C)	
Battery Terminal (+)	05.2	06.6	45.2	46.6	60
Battery Terminal (-)	06.6	06.5	46.6	46.5	60
Solar Terminal (+)	08.6	11.2	48.6	51.2	60
Solar Terminal (-)	10.4	12.2	50.4	52.2	60
Input Terminal Block	08.3	10.3	48.3	50.3	60
Output Terminal Block	10.5	12.4	50.5	52.4	60
Power Transformer coil	27.5	35.9	67.5	75.9	150
ETH Chock coil	21.6	27.5	61.6	67.5	130
Auxiliary Transformer coil	22.2	25.5	62.2	65.5	130
Enclosure (Metallic)	5.7	6.4	45.7	46.4	70
PCB Card (EUPL-2003-01)	11.4	13.7	51.4	53.7	105
Transformer coil (T1) (EUPL-2003-01)	19.5	22.3	59.5	62.3	130
Transformer coil (T1) (EUPL-2112)	16.8	19.2	56.8	59.2	110
Internal Wire	05.2	07.1	45.2	47.1	80
Supplementary information: T_{ma}: Maximum ambient temp. permitted by manufacturer=40°C					

4.4.4	TABLE: Single fault condition to be applied						P
	Ambient temperature (°C) :			26.5			--
	Power source for PCE: Manufacturer, model/type, output rating :			ENERTECH UPS PVT. LTD. Sunmagic-REeFi, 10kW			--
4.4.4.15.1	Fault-tolerance of residual current monitoring						
Component No.	Fault	Supply voltage (V)	Test time	Fuse #	Fuse current (A)	Observation	
Output	Overload	250Vdc	10 min	--	--	The unit works in overload, Error message display on the screen, no damage, no hazards, no fire occurred, temp. rise is insignificant	

Output	Short- circuited	250Vdc	5 min	--	--	The unit cut off immediately after short circuit, Error message display on the screen, no damage, no hazards, no fire occurred
Power Transformer	Short- circuited	250Vdc	5 min	--	--	The unit is protected immediately & grid disconnected & inverter shut down, Error message display on the screen, no damage, no hazards, no fire occurred
PV connection	Reverse	250Vdc	5 min	--	--	The unit is protected immediately & grid disconnected, Error message display on the screen, no damage, no hazards, no fire occurred
Input terminal block	Mis-wiring of Phase sequence	250Vdc	10 min	--	--	The unit is protected immediately, Phase Sequence error message display on the screen, no damage, no hazards, no fire occurred
Check that the residual current monitoring operates properly						--
Supplementary information: Nil.						

4.4.4.17	Cooling system failure – Blanketing test			N-A
	Test voltage (Vdc) .....:	--	--	--
	Test current (Idc)	--	--	--
	Test voltage (Vac) .....:	--	--	--
	Test current (Iac)	--	--	--
	t_{amb1} (°C) .....:	--	--	--
	t_{amb2} (°C) .....:	--	--	--
maximum temperature T of part/at::		T (°C)		T_{max} (°C)
Top enclosure		--	--	--
Side enclosure		--	--	--
Mounting surface		--	--	--
Supplementary information: No External heat sink				

4.7.4	TABLE: Steady state Inverter AC output voltage and frequency		P
	Nominal DC input (V) : Nominal output AC voltage (V) :		--
AC output U (V)	Frequency (Hz)	Condition/status	Comments
228.4	50.1	Without load	Pass
230.3	50.2	Resistive load application	Pass
232.2	50.1	Resistive load removal	Pass
Supplementary information:			

4.7.5	TABLE: Harmonics distortion		P
	Output ……..:	230V AC, 50Hz	
Harmonics order (N)		Maximum permissible (%)	Measured (%)
2		6	0.18
3		6	0.81
4		6	0.11
5		6	0.63
6		6	0.46
7		6	0.65
8		6	0.38
9		6	0.28
10		6	0.09
11		6	0.29
12		6	0.3
13		6	0.21
14		6	0.18
15		6	0.29
16		6	0.04
17		6	0.08
18		6	0.03
19		6	0.04
20		6	0.05
21		6	0.13
22		6	0.09
23		6	0.01
24		6	0.08
25		6	0.25
26		6	0.04
27		6	0.1
28		6	0.07
29		6	0.1
30		6	0.04
31		6	0.17
32		6	0.02
33		6	0.08
34		6	0.02
35		6	0.12
36		6	0.01
37		6	0.11
38		6	0.03
39		6	0.02
40		6	0.02
Total harmonics distortion		10	1.16
Supplementary information:			

4.8.2	TABLE: Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	P
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays	P

DC Voltage below minimum operating voltage (V)	DC Voltage for inverter begin operation (V)	Resistance between ground and PV input terminal (kΩ)	Required Insulation resistance R = (V_{MAX} PV/ 30mA) (kΩ)	Result
DC+				
100	165	8.99	10	Unit can't start up, Error message on display isolation fault
100	250	8.99	10	Unit can't start up, Error message on display isolation fault
100	300	8.99	10	Unit can't start up, Error message on display isolation fault
DC-				
100	165	8.99	10	Unit can't start up, Error message on display isolation fault
100	250	8.99	10	Unit can't start up, Error message on display isolation fault
100	300	8.99	10	Unit can't start up, Error message on display isolation fault

Note:
For isolated inverters, shall indicate a fault in accordance with 13.9 (operation is allowed); the fault indication shall be maintained until the array insulation resistance has recovered to a value higher than the limit above
For non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, shall indicate a fault in accordance with 13.9, and shall not connect to the mains; the inverter may continue to make the measurement, may stop indicating a fault and may connect to the mains if the array insulation resistance has recovered to a value higher than the limit above.
It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Supplementary information:

4.8.3.2	TABLE: 30mA touch current type test for isolated inverters	P

Condition	Current (mA)	Limit (mA)
DC+ to PE	16.46	30mA
DC- to PE	14.56	30mA

Supplementary information:

- The touch current measurement circuit of IEC 60990, Figure 4 is connected from each terminal of the array to ground, one at a time.

4.8.3.3	TABLE: Fire hazard residual current type test for isolated inverters	P

Condition	Current (mA)	Limit (300mA or 10mA per kVA)
DC+ to PE	152	300mA
DC- to PE	141	300mA

Supplementary information:

4.8.3.5	TABLE: Protection by residual current monitoring	P
Test conditions:	Output power (W) : 10000 Input voltage (V_{DC}): 250 Frequency (Hz): 50 Output AC Voltage (V_{AC}): L1: 230, L2: 230, L3: 230	
4.8.3.5.2	Test for detection of excessive continuous residual current	P

Fault Current (mA)		Disconnection time (ms)	
Measured Fault Current	Limit 300mA for output power ≤30 kVA 10mA per kVA for output power > 30 kVA	Measured Disconnection time	Limit
+ PV to N:			
112	300	160	300
89	300	155	300
88	300	156	300
85	300	148	300
93	300	151	300
- PV to N:			
113	300	173	300
89	300	168	300
85	300	175	300
83	300	165	300
91	300	160	300

Note: This test is not deemed applicable.

– maximum 300mA for inverters with continuous output power rating ≤30kVA;

– maximum 10mA perk VA of rated continuous output power for inverters with continuous output power rating > 30kVA.

This test shall be repeated 5 times, and for all 5 tests the time to disconnect shall not exceed 0,3s.
The test is repeated for each PV input terminal. It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Supplementary information:

4.8.3.5.3	TABLE: Test for detection of sudden changes in residual current	P
	+PV to N	
Limit (mA)	U_N Disconnection time (ms)	Limit(ms)
30	214	300
30	241	300
30	230	300
30	252	300
30	243	300
60	142	150
60	135	150
60	135	150
60	128	150
60	125	150
150	33	40
150	32	40
150	27	40
150	28	40
150	27	40
	-PV to N	
Limit (mA)	U_N Disconnection time (ms)	Limit(ms)
30	215	300
30	248	300
30	234	300
30	262	300
30	245	300
60	128	150
60	124	150
60	112	150
60	122	150
60	137	150
150	33	40
150	27	40
150	24	40
150	21	40
150	25	40
Note: This test is not deemed applicable. The capacitive current is risen until disconnection. Test condition: I_c + 30/60/150mA <= I_{cmax}. R_1 is set that 30/60/150mA Flow and switch S is closed.		
Supplementary information:		

7.3.6.3.3/RD	TABLE: Protective equipotential bonding			P
Measured between	Test Current (A)	Voltage drop (V)	Resistance (mΩ)	Result
Earth pin to metal enclosure	64	0.42	6.56	No melting, no loosening, no damage
Supplementary information:				

7.3.6.3.7/RD	TABLE: Touch current measurement		P
Measured between	Measured (mA)	Limit (mA)	Comments/Conditions
L1 to metal enclosure	1.18	3.5	Pass
L2 to metal enclosure	1.14	3.5	Pass
L3 to metal enclosure	1.16	3.5	Pass
Supplementary information:			

7.3.7/RD	TABLE: Clearance and creepage measurements					P
Measured between	Up (V)	U r.m.s (V)	Required cl (mm)	cl (mm)	Required cr (mm)	Cr (mm)
Between PV2+ to PV- (FI)	250	250	3.0	8.8	3.0	8.8
Across Line to Neutral (FI) Input side	325	230	3.0	8.6	3.0	8.6
Across Line to Neutral (FI)Output side	325	230	3.0	8.3	3.0	8.3
PV input to ground (BI)	250	250	3.0	30.7	3.0	30.7
AC output to ground (BI)	325	230	3.0	21.5	3.0	21.5
AC Input to ground (BI)	325	230	3.0	21.8	3.0	21.8
Transformer (T1) primary to secondary (RI)	325	230	5.5	20.4	5.5	20.4
Supplementary information:						

7.3.7/RD	TABLE: Distance through insulation measurement			N/A
Distance through insulation	U r.m.s (V)	Test voltage (V)	Required di (mm)	Di (mm)
--	--	--	--	--
Supplementary information:				

7.5/RD	TABLE: electric strength measurements, impulse voltage test and partial discharge test	P

Test voltage applied between	Test voltage (V)	Impulse withstand voltage (V)	Partial discharge voltage (V)	Results
Across PV terminal to ground	1500	--	--	Pass
PCB card: EUPL-2112AC output to ground	1500	--	--	Pass
AC Input to ground	1500	--	--	Pass
AC output to accessible part	3000	--	--	Pass
Supplementary information:				

9.1	Table: Resistance to fire				P
Location	Manufacturer of material	Type of material	Thickness (mm)	Flammability class	Evidence
Surge PCB (Grid)	ENERTECH UPS PVT LTD	--	1.62	V-2	In compliance
Surge PCB (Solar)		--	1.63	V-2	In compliance
PCB (EUPL-2003-01)		--	1.65	V-2	In compliance
PCB (EUPL-2112)		--	1.62	V-2	In compliance
PCB (EUPL-2003)		--	1.62	V-2	In compliance
PCB (EUPL-2005)		--	1.64	V-2	In compliance
PCB (EUPL-2113)		--	1.62	V-2	In compliance
PCB (EUPL-2008)		--	1.63	V-2	In compliance
Supplementary information:					

9.2/RD	TABLE: Limited power sources			P
Circuit output tested				
Components	Uoc (V)	Isc (A)		VA
		Meas.	Limit	
RS485	2.73	0.0	≤8.0	0.0
Supplementary information:				

Appendix A

14/RD	TABLE: List of critical components				P
Object/ part No.	Manufacturer/ trademark	Type/model	Technical data	Standard (Edition / year)	Mark(s) of conformity)
Emergency switch	Teknic Electric (I) Pvt Ltd	3PSM	500V, 10A	UL 508 (Equivalent to IEC 60947-5-1)	UL E322123
Grid MCB	Schneider Electric India Private Limited	BB30320C	32A, 3 Pole, C32,	IS/IEC 60898 : PART 1 : 2015	ISI CM/L-7128970
Control MCB (2 Qty.)	EATON POWER QUALITY PRIVATE LIMITED	PLS6-C16/2 DC	16A, 220V/440V DC, 1 Pole	IS/IEC 60898 : PART 1 : 2015	ISI CM/L-9592504
Battery MCCB	MITSUBISHI ELECTRIC CORP	3 Pole MCCB	100A, 600V	UL 489 (Equivalent to IEC 60947-2)	UL E167691
Solar MCCB	MITSUBISHI ELECTRIC CORP	3 Pole MCCB	100A, 3 Pole, 600V	UL 489 (Equivalent to IEC 60947-2)	UL E167691
Rotary Switch	TELERGON S A	T12	3 terminal, 2 Way, 16A, 440V	UL 60947-4-1/ IEC 60947-4-1	UL E123623
Battery Terminal (2 Qty.)	SURAJ	1 terminal	150A, 1000V	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Solar Terminal (2 Qty.)	SURAJ	1 terminal	150A, 1000V	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Input Terminal Block	SURAJ	4 terminal	4 terminal, 500V, 60A	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Output Terminal Block	SURAJ	4 terminal	4 terminal, 500V, 60A	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Power Transformer	Enertech UPS Pvt. Ltd.	A/464/03	Class H	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
ETH Chock	Enertech UPS Pvt. Ltd.	1PH DC CHOCK (AI)	Class F	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
DC Contactor	Altran Magnetics Inc	ALEV100-CN	100A, Coil: 24VDC	UL 60947-1/IEC 60947-1	UL E501749

Axillary Transformer	Enertech UPS Pvt. Ltd.	Axillary	Class F	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
AC fan	HICOOL ELECTRONIC INDUSTRIES	17A	230V, 38W	UL 507 (No equivalent IEC standard)	UL E235304
Enclosure	Enertech UPS Pvt. Ltd.	Metallic	Mild Steel	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Solar IGBT Module	SEMIKRON International GmbH	SKM195GB066D	200A/600V	UL 1557 (Equivalent to IEC 60747-1)	UL E63532
INV IGBT Module	SEMIKRON International GmbH	SKM195GB066D	200A/600V	UL 1557 (Equivalent to IEC 60747-1)	UL E63532
SCR Module	SEMIKRON International GmbH	SKKT57/16E	57A/1600V	UL 1557 (Equivalent to IEC 60747-1)	UL E63532
Diode Module	SEMIKRON International GmbH	SKKD101/16E	100A/1600V	UL 1557 (Equivalent to IEC 60747-1)	UL E63532
Diode Bridge	SEMIKRON International GmbH	SKD 110/16	100A/1600V	UL 1557 (Equivalent to IEC 60747-1)	UL E63532
Surge PCB (Grid)					
PCB	ENERTECH UPS PVT LTD	EN-MOV-00	V-0	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
MOV (MOV1, MOV3, MOV4, MOV5)	TDK Electronics GmbH & Co OG	S20	6 kV/ 3 kA, 680V RMS	IEC 61051-2	VDE 40027582
Fuse (FUSE 2, FUSE 4, FUSE 5, FUSE 6)	PROTECTRON ELECTROMECH (P) LTD	PSF	2A, 250V	UL 248-1 (No Equivalent IC standard)	UL E228912
Surge PCB (Solar)					
PCB	ENERTECH UPS PVT LTD	EN-MOV-00	V-0	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
MOV (MOV1, MOV3, MOV5)	TDK Electronics GmbH & Co OG	S20	6 kV/ 3 kA, 680V RMS	IEC 61051-2	VDE 40027582
Fuse (FUSE 2, FUSE 3, FUSE 5, FUSE 6)	PROTECTRON ELECTROMECH (P) LTD	PSF	2A, 250V	UL 248-1 (No Equivalent IC standard)	UL E228912

PCB Card (EUPL-2003-01) (4 Qty.)					
PCB	ENERTECH UPS PVT LTD	EUPL-E003-01	V-2	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Fuse (F1)	PROTECTRON ELECTROMECH (P) LTD	PSF	4A, 250V	UL 248-1 (No Equivalent IC standard)	UL E228912
X2 Capacitor (C1)	TENTA ELECTRIC INDUSTRIAL CO LTD	MEX	250V, 1µF	UL 60384-14 (Equivalent to IEC 60384-14)	UL E222911
Transformer (T1)	Enertech UPS Pvt. Ltd.	855-22	Class F	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Y1 Capacitor (C2, C3)	HONGZHI ENTERPRISES LTD	Y	400V, 4.7 nF	UL 60384-14 (Equivalent to IEC 60384-14)	UL E192572
NTC	HONGZHI ENTERPRISES LTD	5D-15	240V, 6A	UL 1434 (Equivalent to IEC 60730-1)	UL E319959
PCB card: EUPL-2112 (2 Qty.)					
PCB	ENERTECH UPS PVT LTD	EUPL-2112-00	V-2	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Fuse	PROTECTRON ELECTROMECH (P) LTD	PSF	4A, 250V	UL 248-1 (No Equivalent IC standard)	UL E228912
Transformer (T1)	Enertech UPS Pvt. Ltd.	1032-22	Class B	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
PCB card: EUPL-2003(1 Qty.)					
PCB	ENERTECH UPS PVT LTD	EUPL-2003	V-2	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
PCB card: EUPL-2005(1 Qty.)					
PCB	ENERTECH UPS PVT LTD	EUPL-2005	V-2	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
PCB card: EUPL-2113 (1 Qty.)					
PCB	ENERTECH UPS PVT LTD	EUPL-2113	V-2	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
PCB card: EUPL-2008 (2 Qty.)					
PCB	ENERTECH UPS PVT LTD	EUPL-2008	V-2	IS 16221 (Part 2) : 2015/ IEC 62109-2: 2011	Tested within equipment
Supplementary Information:					

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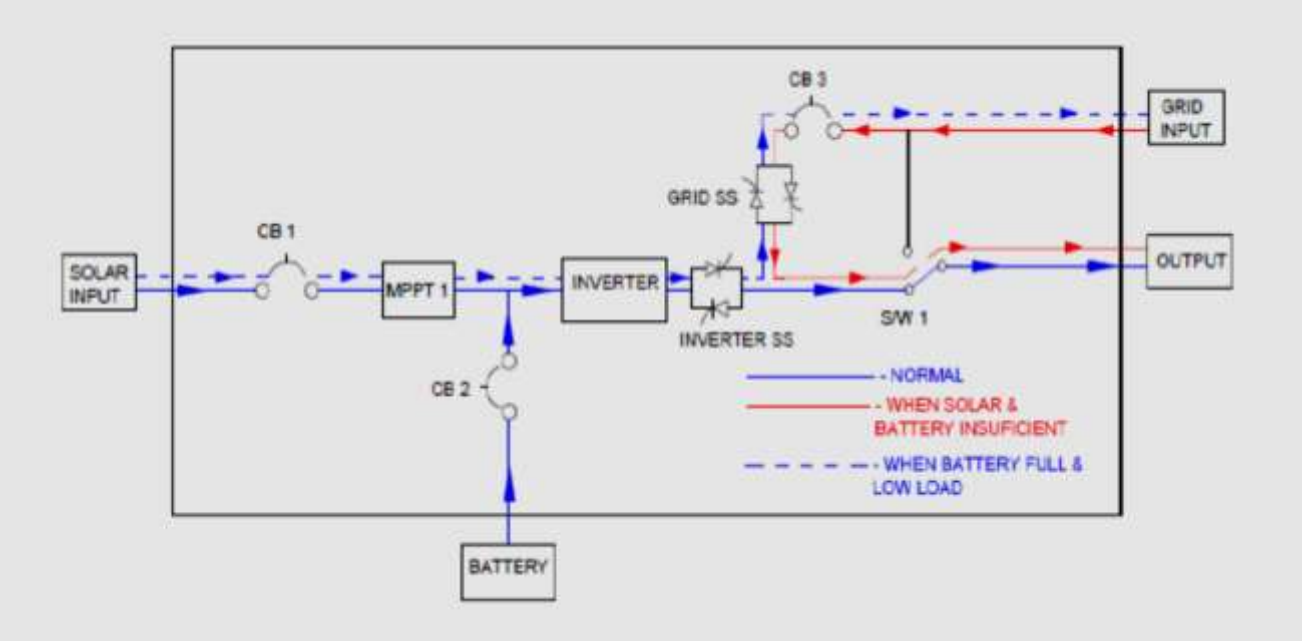
Appendix B

Block diagram/ Schematic three line diagram:



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Appendix C

Photographs of Sample:

Front View

Back View

Top View

Internal View

Side View

Internal View

***** End of Test Report *****