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

Report	
Report Reference No. ..... :	161008062GZU-002
Date of issue ..... :	18 Nov., 2016
Total number of pages ..... :	83
Testing Laboratory..... :	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch
Address ..... :	Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China
Applicant's name ..... :	Shenzhen SOFARSOLAR Co., Ltd.
Address ..... :	5L,Fourth Building,Antongda Industrial Park,Liuxian Avenue No.1,Xinan Street,Baoan District,Shenzhen,China.
Test specification:	
Standard..... :	IEC/EN 62109-1:2010 (First Edition)
Test procedure ..... :	SAA,CE
Non-standard test method……..:	N/A
Test Report Form No. ..... :	TTRF_IEC62109_1A
TRF Originator ..... :	Intertek Guangzhou
Master TRF ..... :	Dated 2011-03

Test item description..... :	AC-coupled Storage Converter
Trade Mark..... :	
Manufacturer ..... :	Same as applicant
Model/Type reference ..... :	ME 3000SP

Rating……:	Battery Type: Lead-acid, Lithium-ion Battery Voltage Range: 42-58Vdc Max. Charging Current: 60A Max. Discharging Current: 60A Max. Charging & Discharging Power: 3000VA Nominal Grid Voltage: 230Vac Nominal output Voltage (stand-alone): 230Vac Max. output Current: 13A Nominal Grid frequency: 50Hz Power factor: 1 (adjustable +/-0.8) Ingress protection: IP65 Operating Temperature Range: -25℃ - 60℃ Protective Class: Class I

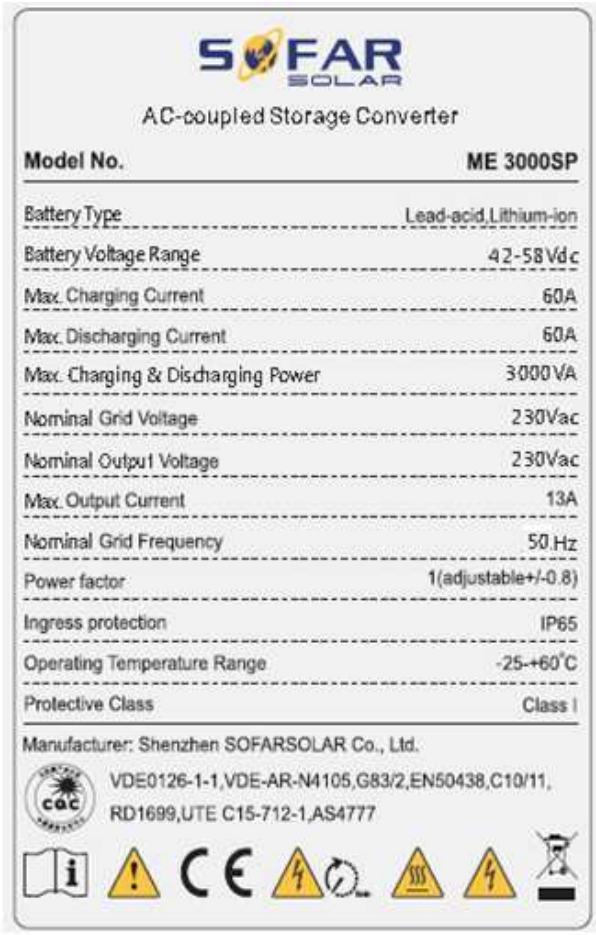
Testing procedure and testing location:	
☒ **Testing Laboratory**:	
Testing location/ address.....:	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China
☐ **Associated Laboratory:**	
Testing location/ address.....:	N/A
Tested by (name + signature) .....:	Jason Fu
Approved by (+ signature) .....:	Tommy Zhong
☐ Testing procedure: TMP	
Testing location/ address.....:	N/A
Tested by (name + signature) .....:	N/A
Approved by (+ signature) .....:	N/A
☐ Testing procedure: WMT	
Testing location/ address.....:	N/A
Tested by (name + signature) .....:	N/A
Witnessed by (+ signature).....:	N/A
Approved by (+ signature) .....:	N/A
☐ Testing procedure: SMT	
Testing location/ address.....:	N/A
Tested by (name + signature) .....:	N/A
Approved by (+ signature) .....:	N/A
Supervised by (+ signature) .....:	N/A
☐ Testing procedure: RMT	
Testing location/ address.....:	N/A
Tested by (name + signature) .....:	N/A
Approved by (+ signature) .....:	N/A
Supervised by (+ signature) .....:	N/A

Summary of testing:	
Tests performed (name of test and test clause): All applicable tests	**Testing location:** Intertek Testing Services Shenzhen Ltd. Guangzhou Branch Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China

Summary of compliance with National Differences:

N/A

Copy of marking plate(representative):



S/N 9990123456789

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation

Test item particulars:	
Equipment mobility:	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains:	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category:	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains:	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV:	☐ OVC I ☒ OVC II (battery circuits) ☐ OVC III ☐ OVC IV
Mains supply tolerance (%):	-90 / +110 %
Tested for power systems:	TN systems
IT testing, phase-phase voltage (V):	N/A
Class of equipment:	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg):	Approx. 16kg
Pollution degree:	Outside PD3; Inside PD2
IP protection class:	IP 65
Testing	
Date of receipt of test item(s):	08 Oct 2016
Dates tests performed:	08 Oct 2016 to 17 Nov 2016
Possible test case verdicts:	
– test case does not apply to the test object:	N/A
– test object does meet the requirement:	Pass (P)
– test object was not evaluated for the requirement:	N/E
– test object does not meet the requirement:	Fail (F)

General remarks:

"(see Attachment #)" refers to additional information appended to the report.
"(see appended table)" refers to a table appended to the report.
The tests 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 testing laboratory.
List of test equipment must be kept on file and available for review.
Additional test data and/or information provided in the attachments to this report.
Throughout this report a ☐ comma / ☒ point is used as the decimal separator.

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

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This report shall be used together with the report 161008062GZU-003

Manufacturer's Declaration per sub-clause 6.2.5 of IECEE 02:

The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided.....:

☐ Yes
☒ Not applicable

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

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

Shenzhen SOFARSOLAR Co., Ltd.

5L,Fourth Building,Antongda Industrial Park,Liuxian Avenue No.1,Xinan Street,Baoan District,Shenzhen,China.

General product information:

The equipment under test is single phase energy storage inverter. They are responsible for converting the direct current generated by battery into single-phase 230V, 50 Hz. It is basic insulation between grid and battery. Two mechanical disconnection device (relay) and high frequency isolated transformer are provided between grid and battery on line and neutral conductor

The inverters intended to operate at ambient temperature -25℃ - +60℃, which will be specified in the user manual, however, the inverters will output full power when operated at 45℃, if operated at higher than 45℃ temperature, the output power would be derate.

The equipment have three working mode. Charge mode, Discharge mode, Stand-alone mode :

Charge mode: The AC voltage from mains charges the battery provided in the final system.

Discharge mode: The inverter converters the energy from the battery to 230Va.c.,50 Hz voltage and connected to AC mains. In this mode the inverter works as grid connected inverter.

Stand-alone mode: The inverter converter the energy from the battery to 230Va.c.,50 Hz voltage and feed the general load. In this mode the inverter worked as stand-alone inverter.

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4	General testing requirements		P
4.1	General		P
4.2	General conditions for testing		P
4.2.1	Sequence of tests		P
4.2.2	Reference test conditions		P
4.2.2.1	Environmental conditions		P
	Unless otherwise specified, the following ambient environmental conditions shall exist in the test location: a) temperature of 15 °C to 40 °C b) a relative humidity of not more than 75 % and not less than 5% c) an air pressure of 75 kPa to 106 kPa. d) no frost, dew, percolating water, rain, solar radiation, etc.	Max. 60°C rated ambient temperature tested.	P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment	Be fixed in accordance with the manufacturer's instruction.	P
4.2.2.4	Accessories		N/A
4.2.2.5	Covers and removable parts		N/A
4.2.2.6	Main supply	230Vac (90 to 110% tolerance), 50Hz, single phase, TN system	P
4.2.2.7	Supply ports other than the mains		P
4.2.2.7.1	Photovoltaic supply sources		P
4.2.2.7.2	Battery inputs		P
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		N/A
	Controls which the operator can adjust shall be set to any position except that		N/A
	a) mains selection devices shall be set to the correct value unless otherwise noted in this standard;		N/A
	b) Combinations of settings shall not be made if they are prohibited by the manufacturer's instructions provided with the equipment.		N/A
4.2.2.11	Available short circuit current		P
4.3	Thermal testing		P
4.3.1	General		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.3.2	Maximum temperature		P
4.3.2.1	General		P
	Materials and components shall be selected so that under the most severe rated operating conditions, the temperatures do not exceed the temperature limits below.		P
	Conformity is verified by measuring temperatures under the conditions given in 4.2 for each rated operating condition or mode of the PCE that could affect the resulting temperatures.		P
	The temperature limits specified below are total temperature limits (not temperature rise limits).		P
	Tests of equipment rated for use in ambient temperatures up to 50°C may be conducted at any ambient temperature in the range given in 4.2.2.1, in which case the difference between the maximum rated ambient temperature and the test ambient is to be subtracted from or added to (as appropriate) the measured temperatures for comparison to the limits specified below.		N/A
	PCE rated for use in ambient temperatures more than 50°C shall be tested at the maximum rated ambient temperature +/- 5°C. the difference between the maximum rated ambient temperature and the test ambient is to be subtracted from or added to the measured temperatures for comparison to the limits specified.	Maximum rated ambient temperature of the unit: 60°C. Tested at an ambient temperature to simulate the worst condition. See appended tables.	P
	PCE with different output ratings or with automatic derating for different ambient temperatures shall be tested under as many conditions as are necessary to record worst-case temperatures, including at least the maximum ambient before derating, and the maximum ambient with derating.	Tested at two conditions: maximum ambient before derating and maximum ambient with deration	P
	During thermal testing within NORMAL CONDITIONS protective devices shall not operate.		P
	Temperatures are to be measured by thermocouples, except that for coils the change of resistance method may be used.	Method of thermocouples is used, including coils.	P
	Limits: - for coils and their insulation systems, the temperature limits in Table 1 apply.		P
	- for other components the measured temperatures shall not exceed the lower of:	See appended tables.	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	- the applicable IEC component standards		P
	- the component or material's rated manufacturer's operating temperature		P
	- if neither of the above exists, temperature limits are given in Table 2.		P
4.3.2.2	Touch temperatures		P
	The maximum temperature for accessible parts of the PCE shall be in compliance with table 3	See appended tables.	P
	It is permitted that accessible parts that are required to get hot as part of their intended function (for example heatsinks) may have temperatures up to 100 °C, if the parts are marked with the hot surface marking of symbol 14 of Annex C. For products only for use in a closed electrical operating area the 100 °C limit does not apply.		P
4.3.2.3	Temperature limits for mounting surfaces		P
	In order to protect against long-term degradation of building materials, surfaces of the PCE that will be in contact with the mounting surface shall not exceed a maximum total temperature of 90 °C.		P
4.4	Testing in single fault condition		P
4.4.1	General		P
	Testing in single fault conditions is done to determine that no hazards result from reasonably expected fault conditions that may arise in normal service or from reasonably expected misuse.		P
	Fault testing shall be done unless it can be conclusively demonstrated that no hazards could arise from a particular fault condition, or unless alternative methods of checking conformity are specified in this standard in place of fault testing.		P
4.4.2	Test conditions and duration for testing under fault conditions		P
4.4.2.1	General		P
	The equipment shall be operated under the combination of conditions in 4.2, which is least favourable for the particular fault test being performed.		P

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

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

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

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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	For equipment in which the output voltage is designed to collapse when a specified overload current is reached, the overload is slowly increased to the point of maximum output power before the point which causes the output voltage to collapse.	The PCE is overload to the max. output power before the point voltage collapse	P
	In all other cases, the loading is the maximum power output obtainable from the output.		P
4.4.4.8	Cooling system failure	Blanketing test for the heatsink according to IEC 62109-2 Clause 4.4.4.17	P
4.4.4.9	Heating devices	No heating devices	N/A
	In equipment incorporating heating devices, the following faults shall be applied one at a time: a) timers which limit the heating period shall be overridden to energize the heating circuit continuously; b) temperature control devices or circuits shall have single fault conditions applied such that control over the heater is lost. Over-temperature protection devices meeting the requirements of 14.3 are left operational during the test.		N/A
4.4.4.10	Safety interlock	No safety interlock	N/A
4.4.4.11	Reverse d.c. connections	Reverse DC+ and DC-, the unit cannot start-up. Fuse open. No damage.	P
4.4.4.12	Voltage selector mismatch	No voltage selector	P
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity	Mis-wiring: L to N, normal operation	P
4.4.4.14	PWB short-circuit test	No insulation distance less than the required spacing.	P
4.5	Humidity preconditioning		P
4.5.1	General		P
4.5.2	Conditions		P
	Relative humidity (%), temperature (°C)	95% R.H. 40℃. 48H	P
4.6	Voltage Backfeed protection	Only battery input	N/A
4.6.1	Backfeed tests under normal conditions		N/A
4.6.2	Backfeed tests under single-fault condtions		N/A
4.6.3	Compliance with backfeed tests		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	The PCE is compliant with the requirements if during the tests in 4.6.1 and 4.6.2 no hazardous voltage or energy is present on the PCE terminals for the source under test. Measurements are taken 15 s or 1 s after the source is de-energized or disconnected, as follows:		N/A
	- 15 s for sources that are connected by fixed wiring		N/A
	- 1 s for sources that are cord-connected or use connectors that can be opened without the use of a tool		N/A
4.7	Electrical ratings tests	See appended table	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P
5	**MARKING AND DOCUMENTATION**		P
5.1	Marking		–
5.1.1	General		P
	Equipment shall bear markings as specified in 5.1 and 5.2	Label are marked on PCE and graphic symbol is explained in user manual	P
	Graphic symbols may be used and shall be in accordance with Annex C or IEC 60417 as applicable.		P
	Graphic symbols shall be explained in the documentation provided with the PCE.		P
5.1.2	Durability of markings		P
	Markings required by this clause to be located on the PCE shall remain clear and legible under conditions of NORMAL USE and resist the effects of cleaning agents specified by the manufacturer		P
5.1.3	Identification		P
	The equipment shall, as a minimum, be permanently marked with:		P
	a) the name or trade mark of the manufacturer or supplier	Trade mark: 	P
	b) model number, name or other means to identify the equipment	ME 3000SP	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.	Within three month	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
5.1.4	Equipment ratings	See below	P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	Special requirement as EN 62109-2	P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	Refer to the marking label on page 4	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	Refer to the marking label on page 4	P
	– the ingress protection (IP) rating as in 6.3 below	IP 65	P
5.1.5	Fuse identification	The fuse is secured on the PCB. It cannot access by operator.	P
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.		P
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated		N/A
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.		P
5.1.6	Terminals, Connections, and Controls		P
	If necessary for safety, an indication shall be given of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.	"+" and "-" marked close to input connect. "L" "N" and "GND" marked close to AC output terminal block.	P
	Push-buttons and actuators of emergency stop devices, and indicator lamps used only to indicate a warning of danger or the need for urgent action shall be coloured red.	No such device.	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other nonpermanent material.	The PCE is not intended to connect to multiple-voltage and there is no voltage setting device.	N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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		P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation	Not provided	N/A
5.1.6.1	Protective Conductor Terminals		P
	The means of connection for the protective earthing conductor shall be marked with:	The protective earthing terminal is connected via AC connector.	P
	– symbol 7 of Annex C; or		P
	– the letters "PE"; or		N/A
	– the colour coding green-yellow.		N/A
5.1.7	Switches and circuit-breakers		N/A
	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.		N/A
5.1.8	Class II Equipment	Class I	N/A
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections	No such terminal box	N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:		N/A
	a) the minimum temperature Rating and size of the cable to be connected to the TERMINALS; or		N/A
	b) a marking to warn the installer to consult the installation instruction. Symbol 9 of Table D-1 is an acceptable marking		N/A
5.2	Warning markings		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
5.2.1	Visibility and legibility requirements for warning markings		P
	Warning markings shall be legible, and shall have minimum dimensions as follows:		P
	– Printed symbols shall be at least 2,75 mm high		P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the back-ground		P
	– Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in colour from the background, shall have a depht or raised height of at least 0,5 mm.		P
	If it is necessary to refer to the instruction manual to preserve the protection afforded by the equipment, the equipment shall be marked with symbol 9 of Annex C	The manual provide neces-sary information for warning marking	P
	Symbol 9 of Annex C is not required to be used ad-jacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heatsinks and similar parts	Grounded heatsink and metal enclosure	N/A
	An ungrounded heat sink or other part that may be mistaken for a grounded part and involves a risk of electric shock in accordance with 7.3 shall be marked with symbol 13 of Annex C, or equivalent. The marking may be on or adjacent to the heatsink and shall be clearly visible when the PCE is disas-sembled to the extent that a risk of contact with the heatsink exists.		N/A
5.2.2.2	Hot Surfaces		P
	A part of the PCE that exceeds the temperature limits specified in 4.3.2 shall be marked with symbol 14 of Annex C or equivalent.		P
5.2.2.3	Coolant	Coolant is not used	N/A
	A unit containing coolant that exceeds 70 °C shall be legibly marked externally where readily visible after installation with symbol 15 of Annex C. The documentation shall provide a warning regarding the risk of burns from hot coolant, and either:		N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		N/A
5.2.2.4	Stored energy		P
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.		P
5.2.2.5	Motor guarding		N/A
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before 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 motor inside enclosure	N/A
5.2.3	Sonic hazard markings and instructions	Hazardous noise level not produced	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can enxure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply		P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.		P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.		P
5.2.5	Excessive touch current		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.	The touch current does not exceed limited	N/A
5.3	Documentation		P
5.3.1	General		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:		P
	a) explanations of equipment makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		P
	– ENVIRONMENTAL CATEGORY as per 6.1	Outdoor	P
	– WET LOCATIONS classification fort he intended external environment as per 6.1	Suitable for wet location	P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2	PD 3 outside. PD2 inside	P
	– INGRESS PROTECTION rating as per 6.3	IP 65	P
	– Ambient temperature and relative humidity ratings	Max. +60℃ and 100% R.H.	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;	OVC II(battery circuits), OVC III(Mains)	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE		P
5.3.1.1	Language	English provide	P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.	For other country language further evaluated is needed	N/A
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	Printed form provided	P
	For equipment which requires the use of a computer for both installation and operation, documentation may be provided in electronic format without accompanying printed format.		N/A
5.3.2	Information related to installation		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		P
	a) assembly, location, and mounting requirements:		P
	b) ratings and means of connection to each source of supply and any requirements related to wiring and external controls, colour coding of leads, disconnection means, or overcurrent protection needed, including instructions that the installation position shall not prevent access to the disconnection means;		P
	c) ratings and means of connection of any outputs from the PCE, and any requirements related to wiring and externals controls, colour coding of leads, or overcurrent protection needed;		P
	d) explanation of the pin-out of connectors for external connections, unless the connector is used for a standard purpose (e.g. RS 232)		P
	e) ventilation requirements;		P
	f) requirements for special services, for example cooling liquid;	No special services	N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;		N/A
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;	No such battery	N/A
	i) tightening torque to be applied to wiring terminals;		N/A
	j) values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceeds the max. rated current of the circuit, as per 4.4.4.6;	Not exceeds the max. rated 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		P
	l) compatibility with RCD and RCM;		N/A
	m) instructions for protective earthing, including the information required by 7.3.6.3.7 if a second protective earthing conductor is to be installed:	Touch current is not exceed limit	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		N/A
	"This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product."		N/A
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	Grid interactive	N/A
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		N/A
5.3.3	Information related to operation		P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:		P
	– Instructions for adjustment of controls including the effects of adjustment;		P
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and		P
	– Instructions, that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.		P
5.3.4	Information related to maintenance		P
	Maintenance instructions shall include the following:		P
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		N/A
	– Part numbers and instructions for obtaining any required operator replaceable parts;	No such part	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	– Instructions for safe cleaning (if recommended)		N/A
	– Where there is more than one source of supply energizing the PCE, information shall be provided in the manual to indicate which disconnect device or devices are required to be operated in order to completely isolate the equipment.		P
5.3.4.1	Battery maintenance	No battery inside	N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		N/A
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below	Outdoor use	P
	– Suitability for WET LOCATIONS or not	Yes	P
	– POLLUTION DEGREE rating in 6.2 below	PD3 outside. PD2 inside	P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	IP 65	P
	– Ultraviolet (UV) exposure rating, as in 6.4 below	Yes	P
	– Ambient temperature and relative humidity ratings, as in 6.5 below	Max. 60℃， 100%R.H.	P
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor		P
6.1.2	Indoor, unconditioned		N/A
6.1.3	Indoor, conditioned		N/A
6.2	Pollution degree	PD3 outside. PD2 inside	P
6.3	Ingress Protection	IP 65	P
6.4	UV exposure	Yes	P
6.5	Temperature and humidity	Max. 60℃， 100%R.H.	P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		P
7.1	General		P
7.2	Fault conditions	Normal and single fault condition are considered	P
7.3	Protection against electric shock		P
7.3.1	General	In the PCE the earthed metal enclosure is evaluated by means of basic insulation from DVC C circuit DVC A circuit and unearthed accessible parts are evaluated by means of reinforced insulation from DVC C or protective impedance DVC C circuit: The battery input and the Main output DVC A circuit: The signal communication output port.	P
7.3.2	Decisive voltage classification		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.2.1	Use of decisive voltage class (DVC)	Working voltage and protective measure and considered	P
7.3.2.2	Limits of DVC (according table 6)	Wet location is considered for PCE outside only	P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions		P
7.3.2.4	Requirements for protection (according table 7)	Single fault condition is considered	P
7.3.2.5	Connection to PELV and SELV circuits	The external signal communication port are considered as SELV	P
7.3.2.6	Working voltage and DVC		P
7.3.2.6.1	General	Transients and voltage fluctuation are disregarded. And worst case normal operation condition is considered	P
7.3.2.6.2	AC working voltage (see Figure 2)		P
7.3.2.6.3	DC working voltage (see Figure 3)		P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		P
7.3.3	protective separation	In the PCE the earthed metal enclosure is evaluated by means of basic insulation from DVC C circuit DVC A circuit and unearthed accessible parts are evaluated by means of reinforced insulation from DVC C or protective impedance DVC C circuit: The battery input and the Main output DVC A circuit: The signal communication output port	P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or		P
	▪ protective screening, i.e. by a conductive screen connected to earth by protective bonding in the PCE, or connected to the protective earth conductor itself, whereby the screen is separated from live parts by at least basic insulation, or		P
	▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or		P
	▪ limitation of voltage according to 7.3.5.4.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact		P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).	Enclosure provided	P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.	End use product	N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.	Not use under this condition	N/A
7.3.4.2	Protection by means of enclosures and barriers		P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.	Enclosure provided to prevent access to inside live parts	P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).	Secured by screws	P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6	The plastic board as part of enclosure is evaluated as clause 13.6	P
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	The signal is considered as DVC A	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	The DVC B circuit is not accessible by probe	P
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	The DVC C circuit is not accessible by probe	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.4.2.3	Access probe tests		P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and		P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuseholders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavorable position.		P
	The test finger and the test pin are applied as above, without appreciable force, in every possible position, except that floor-standing equipment having a mass exceeding 40 kg is not tilted.		P
	Equipment intended for building-in or rack mounting, or for incorporation in larger equipment, is tested with access to the equipment limited according to the method of mounting detailed in the installation instructions.		N/A
	c) Openings preventing the entry of the jointed test finger (Figure E-1 of 0E) during test b) above, are further tested by means of straight unjointed test finger (Figure E-3 of 0E), applied with a force of 30 N. If the unjointed finger enters, the test with the jointed finger is repeated except that the finger is applied using any necessary force up to 30 N.		N/A
	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.		N/A
7.3.4.2.4	Service access areas	Inside PCE are not intentionally touched with energized part when installation and maintenance. Symbol 21 of Annex C are marked on PCE and explained in user manual	P
7.3.4.3	Protection by means of insulation of live parts	The earthed enclosure is with basic insulation form the live parts inside	P

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Clause	Requirement – Test	Result – Remark	Verdict
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		P
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		P
7.3.5	Protection in case of direct contact	The single communication port are direct contact and evaluated with reinforced insulation from live part	P
7.3.5.1	General		P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:	Considered	P
	– is of decisive voltage class A and complies with 7.3.5.2, or	The signal communication port (RS 485,CAN,SD card, DRM0) is DVC A and reinforced insulation from the live part by means of isolation transformer and optocoupler The signal (CTa,CTb, CTc,NTC) is DVC A and reinforced insulation from the live part by means of resistance isolation	P
	– is provided with protective impedance according to 7.3.5.3, or		N/A
	– is limited in voltage according to 7.3.5.4		N/A
	In addition to the measures as given in 7.3.5.2 to 7.3.5.4, it shall be ensured that in the event of error or polarity reversal of connectors no voltages that exceed DVC A can be connected into a circuit with protective separation. This applies for example to plug-in-sub-assemblies or other plug-in devices which can be plugged-in without the use of a tool (key) or which are accessible without the use of a tool.	Considered	P
	Conformity is checked by visual inspection and trial insertion.		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.5.2	Protection using decisive voltage class A	The signal communication port (RS 485,CAN,SD card, DRM0) is DVC A and reinforced insulation from the live part by means of isolation transformer and optocoupler The signal (CTa,CTb, CTc,NTC) is DVC A and reinforced insulation from the live part by means of resistance isolation	P
7.3.5.3	Protection by means of protective impedance		P
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		P
7.3.5.3.1	Limitation of current through protective impedance		P
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		P
7.3.5.3.2	Limitation of discharging energy through protective impedance		P
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		P
7.3.5.4	Protection by means of limited voltages		N/A
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		N/A
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		N/A
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)	Class I also with reinforced insulation design inside PCE	P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	The earthed metal enclosure meet this requirement	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	The signal communication port is reinforced insulation from live parts inside	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.		N/A
	Where protection against indirect contact is dependent on means provided during installation, the installation instructions shall provide details of the required means and shall indicate the associated hazards.	The manual require the PCE must be securely earthed	P
7.3.6.2	Insulation between live parts and accessible conductive parts		P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5	See Cl. 7.3.7.4 and Cl. 7.3.7.5	P
7.3.6.3	Protective class I – Protective bonding and earthing		P
7.3.6.3.1	General		P
	Equipment of protective class I shall be provided with protective earthing, and with protective bonding to ensure electrical contact between accessible conductive parts and the means of connection for the external protective earthing conductor, except bonding is not required for:		P
	a) accessible conductive parts that are protected by one of the measures in 7.3.5.2 to 7.3.5.4, or		N/A
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.		N/A
7.3.6.3.2	Requirements for protective bonding		P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:	The earthing wire is reliable secured to internal metal enclosure	P
	a) through direct metallic contact;		P

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Clause	Requirement – Test	Result – Remark	Verdict
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		N/A
	c) through a dedicated protective bonding conductor;		P
	d) through other metallic components of the PCE		N/A
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.	The metal enclosure is reliably penetrated and earthed	P
	For moving or removable parts, hinges or sliding contacts designed and maintained to have a low resistance are examples of acceptable means if they comply with the requirements of 7.3.6.3.3.	No such design	N/A
	Metal ducts of flexible or rigid construction and metallic sheaths shall not be used as protective bonding conductors, unless the device or material has been investigated as suitable for protective bonding purposes.	No such design	N/A
7.3.6.3.3	Rating of protective bonding		P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		P
	Protective bonding shall meet following requirements:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.		P
	As alternative to a) and b) the protective bonding may designed according to the requirements for the external protective earthing conductor in 7.3.6.3.5, in which case no testing is required.	Test done	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		P
	a) For pluggable equipment type A, the overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		P
	c) For a circuit or part of the equipment for which an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		P
	Voltages are measured from the protective earthing terminal to all parts whose protective bonding means are being considered. The impedance of the protective earthing conductor is not included in the measurement. However, if the protective earthing conductor is supplied with the equipment, it is permitted to include the conductor in the test circuit but the measurement of the voltage drop is made only from the main protective earthing terminal to the accessible part required to be earthed.	Measured form the farthest part of earthed metal enclosure to the input earth terminal	P
	On equipment where the protective earth conncection to a subassembly or to a separate unit is part of a cable that also supplies power to that subassembly or unit, the resistance of the protective bonding conductor in that cable is not included in the protective bond impedance measurements for the subassembly or separate unit, as shown in Figure 11. However, this option is only permitted if the cab le is protected by a suitably rated protective device that takes into account the size of the conductor. Otherwise the impedance of the protective bonding conductor between the separate units is to be included, by measuring to the protective earthing terminal where the power source enters the first unit in the system, as shown in Figure 12.		P
7.3.6.3.3.1	Test current, duration, and acceptance criteria		P
	The test current, duration of the test and acceptance criteria are as follows:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	a) For PCE with an overcurrent protective device rating of 16 A or less, the test current is 200% of the overcurrent protective device rating, but not less than 32 A, applied for 120s. The impedance of the protective bonding means during and at the end of the test shall not exceed 0,1 Ω.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the test current is 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.	0.5V	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.		P
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		P
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic,. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)	Manufacture declaration for this and with FI	N/A
	If the continuity of the protective bonding is achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:		N/A
	▪ the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:		N/A
	▪ the test duration may be reduced to no less than 2 s		N/A
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		N/A
7.3.6.3.5	External protective earthing conductor		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.	Table 11 used. 12AWG and not less than phase conductor	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.	Permanently connected	N/A
	The cross-sectional area of every external protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		P
	▪ 2,5 mm² if mechanical protection is provided;		N/A
	▪ 4 mm² if mechanical protection is not provided.	The installation manual require min 4mm^2 wire	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.	Not cord-connected equipment.	N/A
7.3.6.3.6	Means of connection for the external protective earthing conductor		P
7.3.6.3.6.1	General		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.		P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		P
	• the colour coding green-yellow		N/A
	Marking shall not be done on easily changeable parts such as screws.		P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor		P
	The requirements of this sub-clause shall be satisfied to maintain safety in case of damage to or disconnection of the protective earthing conductor.		P
	For pluggable equipment type A, the touch current measured in accordance with 7.5.4 shall not exceed 3,5 mA a.c. or mA d.c.		P
	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3,5 mA a.c. or 10 mA d.c.	1.392 mA a.c. max.	P
	a) Permanently connected wiring, and:	Not exceed 3.5mA a.c.	N/A
	• a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or		N/A
	• automatic disconnection of the supply in case of discontinuity of the protective earthing conductor; or		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	• provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.	Not exceed 3.5mA a.c.	N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		N/A
	When it is intended and allowed to connect two or more PCEs in parallel using one common PE conductor, the above touch current requirements apply to the maximum number of the PCEs to be connected in parallel, unless one of the measures in a)		N/A
	or b) above is used. The maximum number of parallel PCEs is used in the testing and has to be stated in the installation manual.		N/A
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Signal communication port are evaluated with reinforced insulation form live parts inside	P
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with 7.3.4.3. The following requirements also apply:		P
	• equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low voltage, protective impedance and limited discharging energy, according to 7.3.5. This basic insulation shall correspond to the rated voltage of the series-connected equipment;		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	• metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	• equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	• equipment employing protective class II shall be marked according to 5.1.8.		N/A
7.3.7	Insulation Including Clearance and Creepage Distance		P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	• pollution degree	PD3 outside. PD2 inside	P
	• overvoltage category	battery (OVC II), Main(OVC III)	P
	• supply earthing system	TN	P
	• insulation voltage	Main:230Vac	P
	• location of insulation	See table 7.3.7.4 and 7.3.7.5 for detail	P
	• type of insulation	See table 7.3.7.4 and 7.3.7.5 for detail	P
	Compliance of insulation, creepage distances, and clearance distances, shall be verified by measurement or visual inspection, and the tests of 7.5.		P
7.3.7.1.3	Supply earthing systems		P
	Three basic types of earthing system are described in IEC 60364-1. They are:	Inverter is intended to installed in TN system	P
	• TN system: has one point directly earthed, the accessible conductive parts of the installation being connected to that point by protective conductors. Three types of TN systems, TN-C, TN-S and TN-C-S, are defined according to the arrangement of the neutral and protective conductor.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	• TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system;		N/A
	• IT sytem: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system.		N/A
7.3.7.1.4	Insulation voltages	See table 7.3.7.4 and 7.3.7.5 for detail	P
	Table 12 makes use of the circuit system voltage and overvoltage category to define the impulse withstand voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General Basic, supplementary and reinforced insulation between a circuit and its surroundings shall be designed according to: Impulse voltage; temporary overvoltage; working voltage of the circuit;	300V, OVC III (4000V impulse voltage, 1500Vrms temporary overvoltage) for the AC output terminal. 60V, OVC II (500V impulse voltage, no temporary overvoltage) for PV input terminal.	P
7.3.7.2.2	Circuit connected directly to the mains Clearance and solid insulation between circuit connected directly to the mains and their surroundings shall be designed according to the impulse voltage, temporary overvoltage, or working voltage, whichever gives the most severe requirement	System voltage for mains is 300Vrms according to table 12	P
7.3.7.2.3	Circuit other than mains circuit Clearance and solid insulation between circuit other than the mains and their surroundings shall be designed according to impulse voltage and recurring peak voltage	System voltage for battery is 60Vdc.	P
7.3.7.2.4	Insulation between circuits a) For clearances and insulation, the requirements are determined by the circuit having the higher impulse voltage; b) For creepages, r.m.s. working voltage across the insulation determines the requirements.	4000V impulse voltage, 1500Vrms temporary overvoltage is calculated from table 12 for clearance. 300Vac working voltage across insulation is used for creepage	P
7.3.7.3	Functional insulation For parts or circuit in OVC I, functional insulation shall be designed according to the working voltage across the insulation For parts or circuit in OVC II, functional insulation shall be designed according to the applicable impulse voltage as determined by 7.3.7.1.4		P
7.3.7.4	Clearance distances		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.4.1	Determination Table 13 defines the minimum clearance distances required to provide functional, basic , or supplementary insulation		P
	Clearance for use in altitudes above 2000m shall be calculated with correction factor according to Table A.2 of IEC 60664-1	Not designed for use in altitudes above 2000m.	N/A
	For reinforced insulation, the value corresponding to the next higher impulse voltage, or 1.6 times the temporary overvoltage, or 1.6 times the working voltage shall be used, whichever results in the most severe requirement		N/A
7.3.7.4.2	Electric field homogeneity For homogeneous electric field and impulse voltage is equal to or greater than 6000V for a circuit connected directly to the mains or 4000V within a circuit, the clearance may be reduced to the requirement by Table F.2 Case B of IEC 60664-1. In this case, impulse voltage test shall be performed on the clearance	Inhomogeneous electric field is considered for PCE	N/A
7.3.7.4.3	Clearance to conductive enclosures Clearance shall be measured following the deformation test of 13.7 for conductive enclosures		P
7.3.7.5	Creeage distances		P
7.3.7.5.1	General Creepage distances shall be large enough to prevent long-term degradation of the surface of solid insulators. For reinforced insulation, the value is doubled. If less than clearance, it shall be increased to that clearance	300V system voltage is used for the RMS voltage across insulation	P
7.3.7.5.2	Voltage r.m.s. value of working voltage is used. Interpolation is permitted	If Working voltage less than system voltage, system voltage is used for creepage according to IEC60664-1	P
7.3.7.5.3	Materials	Certified PWB used. Other materials are considered IIIb. The inside part are considered Pollution degree 2	P
7.3.7.6	Coating		N/A
7.3.7.7	PWB spacings for functional insulation	V-0 and short circuit test are considered	P
7.3.7.8	Solid insulation		P
7.3.7.8.1	General Material for solid insulation shall be able to withstand mechanical, electrical, thermal and climatic stresses in normal use and ageing during the expected lifetime. Compliance is evaluated by test and inspection.		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation		P
7.3.7.8.2.1	Basic and supplementary, reinforced, and double insulation Solid insulation shall withstand the impulse voltage test 7.5.1 and voltage test 7.5.2. In addition, if re-curring peak working voltage across the insulation is greater than 700V and voltage stress on insula-tion is greater than 1Kv/mm, double and reinforced insulation shall withstand the partial discharge test according to 7.5.3	4000V Impulse voltage test and 1500V voltage test are considered for solid insulation.	P
7.3.7.8.2.2	Functional insulation		P
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General Insulation of thin sheet or tape less than 0.7mm is subject to this requirement		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm Basic or supplementary insulation at least one layer Double insulation at least two layers Reinforced insulation with single layer is permitted	Impulse test and voltage test are considered for insulation on IGBT as basic insulation	P
7.3.7.8.3.3	Material thickness less than 0,2 mm Basic or supplementary insulation at least one layer Double insulation at least three layers Reinforced insulation with single layer is not permit-ted		N/A
7.3.7.8.3.4	Compliance Component, sub-assembly, or material is checked by applicable tests 7.5.1 to 7.5.3 according to 7.3.7.8.		N/A
7.3.7.8.4	Printed wiring boards (PWBs)		P
7.3.7.8.4.1	General For double-sided single-layer PWBs, multi-layer PWBs and metal core PWBs, insulation between conductors shall meet the requirement for solid in-sulation in 7.3.7.8 For the inner layer of multi-layer PWBs, the insula-tion between adjacent pollution	Four layers PWB	P
7.3.7.8.4.2	Use of coating materials		N/A
7.3.7.8.5	Wound components	Varnish is not considered as insulation and voltage test performed as routine test.	P
7.3.7.8.6	Potting materials		N/A
7.3.7.9	Insulation requirements above 30 kHz		N/A
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.		N/A
7.3.9	Capacitor discharge		P
7.3.9.1	Operator access area	Accessible signal communication port is DVA circuit.	P
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.		P
7.3.9.2	Service access areas	Inside capacitor discharge to DVC A and no energy hazard level within 300s	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.	Warning symbol 21 of annex C is marked on PCE with 5min.	P
7.4	Protection against energy hazards		P
7.4.1	Determination of hazardous energy level	No such high energy level presented in the operator access area.	P
	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		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: $E = 0,5\ CU^2$	Communication port : 5.76V, 1.11mA. No cap.	P
7.4.2	Operator Access Areas	No energized parts accessibel by user	P
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.		P
7.4.3	Services Access Areas		P
	Energy storage devices located behind panels that are removable for servicing, installation or disconnection shall present no risk of electric energy hazard from charge stored after disconnection of the PCE.	The capacitor inside the equipment stored hazardous energy. A symbol 21 of Annex C is provided.	P
	Energy storage devices within a PCE shall be discharged to an energy level less than 20 J, as in 7.4.1, within 10 s after the removal	Warning symbol 21 of Annex C is marked	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.5	Electrical tests related to shock hazard		P
7.5.1	Impulse voltage test (type test)	See appended table	P
7.5.2	Voltage test (dielectric strength test) (type test and routine test)	See appended table	P
7.5.3	Partial discharge test (type test or sample test)		
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	1.392 mA a.c. max.	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.6	Equipment with multiple sources of supply		P’
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.		P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		P
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.		P
8.2.1	Protection of service persons		P
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.		P
8.3	Stability		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	Wall mounted	N/A
8.4	Provisions for lifting and carrying		N/A
	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.		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.		N/A
8.5	Wall mounting		P
	Mounting brackets on equipment intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the equipment.	It is intended to be mounted on concrete wall	P
8.6	Expelled parts		N/A
	Equipment shall contain or limit the energy of parts that could cause a HAZARD if expelled in the event of a fault.		N/A
9	**PROTECTION AGAINST FIRE HAZARDS**		P
9.1	Resistance to fire		P
	This subclause specifies requirements intended to reduce the risk of ignition and the spread of flame, both within the equipment and to the outside, by the appropriate use of materials and components and by suitable construction.	Components are witnessed at normal condition and abnormal test are verified	P
9.1.1	Reducing the risk of ignition and spread of flame		P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.	Method 1 used	P
9.1.2	Conditions for a fire enclosure		P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.		P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– components in PRIMARY CIRCUITS		P
	– components in SECONDARY CIRCUITS supplied by power sources which exceed the limits for a LIMITED POWER SOURCE as specified in 9.2;		P
	– components in SECONDARY CIRCUITS supplied by a LIMITED POWER SOURCE as specified in 9.2, but not mounted on a material of FLAMMABILITY CLASS V-1;	PWB rated V-0	N/A
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and	Certified relay	N/A
	– insulated wiring, except as permitte in 9.1.2.2.	PVC wire	N/A
9.1.2.2	Parts not requiring a fire enclosure	Fire enclosure used	N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures	Metal fire enclosure	P
	If an enclosure material is not classified as specified below, a test may be performed on the final enclosure or part of the enclosure, in which case the material shall additionally be subjected to periodic SAMPLE testing.		P
9.1.3.3	Materials for components and other parts outside fire enclosures		P
	Except as otherwise noted below, materials for components and other parts (including MECHANICAL ENCLOSURES, ELECTRICAL ENCLOSURES and DECORATIVE PARTS); located outside FIRE ENCLOSURES, shall be of FLAMMABILITY CLASS HB.	Internal wire:VW-1 PWB: V-0	P
9.1.3.4	Materials for components and other parts inside fire enclosures		N/A

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

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Clause	Requirement – Test	Result – Remark	Verdict
	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.	Circuit breaker operated	P
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		P
9.3.3	Protective devices provided or specified shall have adequate breaking capacity to interrupt the maximum short circuit current specified for the port to which they are connected. If protection that is provided integral to the PCE for an input port is not rated for the short-circuit current of the circuit in which it is used, the installation instructions shall specify that an upstream protective device, rated for the prospective short-circuit current of that port, shall be used to provide backup protection.		P
10	**PROTECTION AGAINST SONIC PRESSURE HAZARDS**		N/A
10.1	General		N/A
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.	No hazardous noise when operating	N/A
10.2	Sonic pressure and Sound level		N/A
10.2.1	Hazardous Noise Levels		N/A
11	**PROTECTION AGAINST LIQUID HAZARDS**		N/A
11.1	Liquid Containment, Pressure and Leakage	No liquid containment system	N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A
11.3	Oil and grease		N/A
12	**CHEMICAL HAZARDS**		N/A
12.1	General		N/A
13	**PHYSICAL REQUIREMENTS**		P
13.1	Handles and manual controls		N/A
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than selfhardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.		N/A
13.1.1	Adjustable controls	No such setting control	N/A
13.2	Securing of parts		P
13.3	Provisions for external connections		P
13.3.1	General	Certified DC connectors are used. AC terminal provided for grid connection and secured by a cable gland. Installation manual provide information for the disconnection means	P
13.3.2	Connection to an a.c. Mains supply	An industrial AC connector used and it is detachable with tool	P
13.3.2.1	General		P
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:	See above	P
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or		P
	– a non-detachable power supply cord for connection to the supply by means of a plug		N/A
	– an appliance inlet for connection of a detachable power supply cord; or		N/A
	– a mains plug that is part of direct plug-in equipment as in 13.3.8		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
13.3.2.2	Permanently connected equipment		P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord		N/A
13.3.2.5	Cord anchorages and strain relief	Cable gland used	P
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		P
	– the connecting points of the cord conductors are relieved from strain; and		P
	– the outer covering of the cord is protected from abrasion.		P
13.3.2.6	Protection against mechanical damage		P
13.3.3	Wiring terminals for connection of external conductors		P
13.3.3.1	Wiring terminals		P
13.3.3.2	Screw terminals		P
13.3.3.3	Wiring terminal sizes		P
13.3.3.4	Wiring terminal design		P
13.3.3.5	Grouping of wiring terminals		P
13.3.3.6	Stranded wire		P
13.3.4	Supply wiring space		N/A
13.3.5	Wire bending space for wires 10 mm² and greater		N/A
13.3.6	Disconnection from supply sources	Installation manual instruct the disconnect device when connection AC main	P
13.3.7	Connectors, plugs and sockets		P
13.3.8	Direct plug-in equipment		N/A
13.4	Internal wiring and connections		P
13.4.1	General		P
13.4.2	Routing	Internal wire is routed to avoid sharp edge and overheat	P
13.4.3	Colour coding	Green-yellow wire used as protective bonding only	P
13.4.4	Splices and connections		P
13.4.5	Interconnections between parts of the PCE		P
13.5	Openings in enclosures		N/A
13.5.1	Top and side openings	No openings in enclosure	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		N/A
13.6	Polymeric Materials		P
13.6.1	General		P
13.6.1.1	Thermal index or capability		P
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards		P
13.6.2.1	Stress relief test		N/A
13.6.3	Polymers serving as solid insulation		P
13.6.3.1	Resistance to arcing		N/A
13.6.4	UV resistance		P
	Polymeric parts of an OUTDOOR ENCLOSURE required for compliance with this standard shall be sufficiently resistance to degradation by ultra-violet (UV) radiation	The enclosure of the unit is made of metal with painting and the plastic window frame rated UV resistance according to UL 746C	P
13.7	Mechanical resistance to deflection, impact, or drop		P
13.7.1	General		P
13.7.2	250-N deflection test for metal enclosures		P
13.7.3	7-J impact test for polymeric enclosures		P
13.7.4	Drop test		N/A
13.8	Thickness requirements for metal enclosures		P
13.8.1	General		P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal	Metal sheet	P

14	**COMPONENTS**		P
14.1	General		P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Overtemperature Protection		N/A
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperatur HAZARD, or a fire HAZARD, shall be protected by an overtemperature or thermal protection device meeting the requirements of 14.3.	No motor	N/A
14.3	Overtemperature protection devices		N/A
14.4	Fuse holders		N/A
14.5	MAINS voltage selecting devices		N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.	V-0	P
	This requirements does not apply to thin-film flexible printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		P

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Clause	Requirement – Test	Result – Remark	Verdict
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.		P
14.7	Circuits or components used as transient overvoltage limiting devices		N/A
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.		N/A
14.8	Batteries		N/A
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.		N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A nonmetallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions	Refer to annex B for details	P
Annex A	Measurement of clearances and creepage distances (see 7.3.7.4 and 7.3.7.5)		P
Annex B	Programmable Equipment		P
B.1	Software or firmware that perform safety critical functions		P
B.1.1	Firmware or software that performs a critical safety function/s, the failure of which can result in a risk of fire, electric shock or other hazard as specified by this standard, shall be evaluated by one of the following means.		P
	a) All software or firmware limits or controls shall be disabled before the test to evaluate the hardware circuitry during the abnormal test condition related to the safety function.		P
	b) Protective controls employing software or firmware to perform their function(s), shall be so constructed that they comply with IEC 60730-1 Annex H to address the risks identified in B.2.1.		N/A
B.2	Evaluation of controls employing software		P
Annex C	Symbols to be used in equipment markings		P
Annex D	Test Probes for Determining Access		P
Annex E	RCDs		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
Annex F	Altitude correction for clearances		N/A
Annex G	Clearance and creepage distance determination for frequencies greater than 30 kHz	Only clock for IC	P
Annex H	Measuring Instrument for Touch Current Measure-ments		P
H.1	Measuring instrument		P
H.2	Alternative measuring instrument		N/A
Annex I	Examples of Protection, Insulation, and Overvolt-age Category Requirements for PCE		P
Annex J	Ultraviolet light conditioning test		P

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Clause	Requirement – Test	Result – Remark	Verdict

4.2.2.6/4.7	TABLE: mains supply electrical data in normal condition/ Electrical ratings test	P

Input ratings

Input voltage (Vdc)	Input current (Adc)	Input power (W)	Rated input current (Adc)	Measured -Rating / Rating value (%) input current	Rated input Power (W)	Measured - Rating / Rating value (%) input power	Output condition/status		
							Output voltage(Vac)	Output Current(Aac)	Output Power (W)
50	57.71	2885.69	60	-3.82	--	--	207	13.10	2712.55
50	61.86	3093.00	60	3.10	--	--	230	12.64	2907.42
50	61.63	3081.36	60	2.72	--	--	253	11.91	2896.48

Output ratings

Output voltage (Vac)	Output current (Aac)	Output power (W)	Rated Output current (Aac)	Measured -Rating / Rating value (%) output current	Rated output Power (W)	Measured - Rating / Rating value (%) output power	Input condition/status		
							Input voltage(Vdc)	Input Current(Aac)	Input Power (W)
207	13.10	2712.55	13	0.77	3000	-9.58	50	57.71	2885.69
230	12.64	2907.42	13	-2.77	3000	-3.09	50	61.86	3093.00
253	11.91	2896.48	13	-8.38	3000	-3.45	50	61.63	3081.36

Note: Tested with battery supply

4.3 TABLE: Thermal testing				P
temperature t of part/at:		t (°C)		permitted t (°C)
Test condition	Discharging power & charging power	3013.72W	Derating to 1300.45W	--
Ambient		45.8	59.5	--
Input lead wires		75.0	90.7	105
Y capacitor C51		75.7	91.8	125
Filter capacitor CF370		92.3	101.7	110

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Clause	Requirement – Test	Result – Remark	Verdict

PF18 (the lead wire of high frequency isolated trans-former)	109.4	124.1	130
PF19 (the lead wire of high frequency isolated trans-former)	100.1	115.7	130
Filter Chock L4	83.6	98.7	110
Transformer TX2	102.8	106.3	110
Transformer TX1	89.4	103.8	110
Winding of transformer TX1	89.7	104.2	110
Y capacitor C70	93.1	108.7	110
PCB under D15	91.2	106.7	130
Boost inductor	95.9	108.7	130
Bus capacitor ECF32	83.3	95.8	105
DC-Link capacitor CF383	77.4	90.4	105
Chock LF12	85.6	98.6	110
Inv inductor	104.4	112.1	130
PCB under Q9	91.0	104.2	130
The lead wire of Inv induc-tor	80.3	93.2	105
Current sensor HCT2	74.4	82.5	85
Relay RY1	75.4	82.1	85
X capacitor CF397	72.8	86.0	100
AC chock L2	77.2	90.6	110
Y capacitor C12	74.9	88.4	125
Varistor MOV1	67.7	81.9	85
Output L wire	66.9	79.5	105
Output terminal	61.3	71.4	90
Internal ambient	86.6	101.6	Ref
Isolated optocoupler U14	63.7	76.9	100
Press Key	57.1	67.5	85
Mounting surface	69.4	81.9	90
Enclosure, Top	67.9	81.8	100
LCD Display	62.6	74.7	85

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Clause	Requirement – Test	Result – Remark	Verdict

Input terminal	58.7	68.7	90
PCB under Q16	89.1	105.6	130
PCB under Q65	88.8	105.4	130
PCB under Q59	90.7	107.1	130
PCB under Q63	91.9	108.3	130
Note: 1, Test for a discharging and charging cycle to achieve temperature stable. 2, Used of battery supply			

4.4	**Testing in single fault condition**		P
	Ambient temperature (°C)	25	—
	Model	ME 3000SP	—

No.	Component No.	fault	Test voltage	Duration	Result
1	BAT input	Re-verse polarity	Input 50Vdc Output 230Vac	10min	The PCE do not work, DC fuse opened. No hazards
2	AC output	Re-verse polarity	Input 50Vdc Output 230Vac	10min	Inverter work normal.
3	EC2 in commu-nication board	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, and disconnect from the grid. No hazards
4	C196	S/C	Input 50Vdc Output 230Vac	10min	The PCE can operate normally, but the communication fails. No hazards
5	C197	S/C	Input 50Vdc Output 230Vac	10min	The PCE switch off immediately, and disconnect from the grid, error code “ID17, ID18, ID19” display. No hazards
6	RYB1	S/C	Input 50Vdc Output 230Vac	10min	The PCE check relay fail before power on, error code “ID55, ID77” display. No hazards
7	HCT (12-13)	S/C)	Input 50Vdc Output 230Vac	10min	The PCE switch off immediately, and disconnect from the grid, error code “ID10” display. No hazards
8	Q2 (C-G)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, com-ponents Q2,Q8, R26,R27, Q4, Q24 damaged. No hazards

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

4.4	**Testing in single fault condition**		P
	Ambient temperature (°C)	25	—
	Model	ME 3000SP	—

No.	Component No.	fault	Test voltage	Duration	Result
9	Q2 (C-E)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q8, C17, R44, Q3, C10, R25, Q7, R37 damaged. No hazards
10	Q3 (C-G)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q3, R28, R29, Q5, and U23 damaged. No hazards
11	Q3 (C-E)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q7, C16, R39, R37, R38, Q8, C17, and R44 damaged. No hazards
12	Q14	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q14, R80, R73, and Q15 damaged. No hazards
13	QD2 (C-G)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components QD2, R76, R78, Q18, QD3 and U30 damaged. No hazards
14	QD2 (C-E)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components QD3, R96, R94, Q21, QD4 and U33 damaged. No hazards
15	QD1 (C-E)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components QD4, R93, R95, and QD2 damaged. No hazards
16	QD1 (C-G)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components QD1, Q18, R76, and R83 damaged. No hazards
17	EC2 in main board	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q14, Q19, Q2, Q8, QD1 and QD3 damaged. No hazards
18	RD1	O/C	Input 50Vdc Output 230Vac	10min	The PCE switch off immediately, and disconnect from the grid, error code “ID29, ID25” display. No hazards
19	RD5	O/C	Input 50Vdc Output 230Vac	10min	The PCE switch off immediately, and disconnect from the grid, error code “ID29, ID25” display. No hazards

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Clause	Requirement – Test	Result – Remark	Verdict

4.4	**Testing in single fault condition**		P
	Ambient temperature (°C)	25	—
	Model	ME 3000SP	—

No.	Component No.	fault	Test voltage	Duration	Result
20	Q54 (D-S)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q62, Q63, R104, C63, R105 and Q64 damaged. No hazards
21	Q60 (D-S)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q64, Q65, R106, C65, R103 and Q66 damaged. No hazards
22	C39	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components RT618, D5 and D8 damaged. No hazards
23	EC9	S/C	Input 55Vdc Output 230Vac	10min	The PCE shutdown immediately, and disconnect from the grid. No hazards
24	EC11	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, and disconnect from the grid. No hazards
25	EC13	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, and disconnect from the grid. No hazards
27	EC18	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, and disconnect from the grid. No hazards
28	Q24 (G-D)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q24, R127 and U6 damaged. No hazards
29	Q24 (D-S)	S/C	Input 50Vdc Output 230Vac	10min	The PCE shutdown immediately, components Q24, R137, R138, and R135 damaged. No hazards
30	ECF31	S/C	Input 50Vdc Output 230Vac	10min	The PCE switch off immediately, and disconnect from the grid, error “communication fails” display. No hazards
31	AC output	O/L	Input 50Vdc Output 230Vac	2h	The PCE is adjusted by connecting a variable resistor to achieve max current output and the max power output, since the temperature achieve stable. No hazards

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Clause	Requirement – Test	Result – Remark	Verdict

4.4	**Testing in single fault condition**		P
	Ambient temperature (°C)	25	—
	Model	ME 3000SP	—

No.	Component No.	fault	Test voltage	Duration	Result

Supplementary information and remarks:

S/C: Short circuit, O/C: Open circuit, O/L: Overload

During the test:

Fire do not propagates beyond the EUT;

Equipment do not emit molten metal;

Enclosures do not deform to cause non-compliance with the standard.

Pass the dielectric test.

7.3.7	**TABLE: clearance and creepage distance measurements**					P
clearnace cl and creepage distance dcr at / of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
Battery input “+” and “+” on PCB (BI)	60Vdc	60Vdc	0.2	1.15	0.2	1.15
The pin of DC fuse on PCB (BI)	60Vdc	60Vdc	0.2	3.21	0.2	3.21
Between main board and metal enclosure (BI)	326V	60Vdc 230 Vac	3.0	3.75	3.0	3.75
The live parts across Y capacitor C51,C56 on PCB to earthed enclosure (BI)	326V	60Vdc 230 Vac	3.0	6.00	3.0	6.00
The live parts across Y capacitor C11,C211 on PCB to earthed enclosure (BI)	326V	60Vdc 230 Vac	3.0	7.93	3.0	7.93
The live parts across MOV1, MOV3 on PCB to earthed enclosure (BI)	326V	230 Vac	3.0	4.57	3.0	4.57
The live parts across IGBT to earthed screws (BI)	326V	230 Vac	3.0	5.93	3.0	5.93
The live parts across Y capacitor C12,C20,C13,C19 on PCB to earthed enclosure (BI)	326V	230 Vac	3.0	4.83	3.0	4.83
The live parts across isolated opto-coupler U13,U14,U15,U16,U18,U19 to accessible part (RS 485, CAN, DRM0) (RI)	326V	230 Vac	5.5	5.62	5.5	5.62
The accessible parts (CTa,CTb,CTc, NTC) across series resistor to separate AC circuits (RI)	326V	230 Vac	5.5	5.60	5.5	5.60

Remarks:

1) FI: function insulation BI: Basic insulation SI: Supplementary insulation RI: Reinforced insulation

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Clause	Requirement – Test	Result – Remark	Verdict

7.3.7	TABLE: clearance and creepage distance measurements						P
clearnace cl and creepage distance dcr at / of:		Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)
2) A force of 10 N applied to the internal components and 250 N applied to the enclosure for measure 3) For battery circuit, system voltage is 60V and overvoltage Category is OVCII, impulse voltage corresponding to battery circuit is 500V. 4)For AC main circuit, nominal voltage is 230V and overvoltage category is OVC III, impulse voltage is corresponding to main circuit is 4000V. 5) The PCE enclosure is rated IP65 and the pollution degree inside enclosure is reduced from PD3 to PD2. 7) The disconnection devices are two relays, clearance between contacts of each relay rated min.1,5 mm. The isolated transformer and relay used for basic insulation according to IEC 62109-2 Clause 4.4.4.15.2.2.							

7.3.7.8.3.2 to 7.3.7.8.3.3	TABLE: distance through insulation measurement				P
distance through insulation di at/of:		U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)
Communication isolated optocoupler		230V	6000Vpk	--	certified

7.5	TABLE: electric strength measurements, impulse voltage test and partial discharge test				P
test voltage applied between:		test voltage (V)	impulse withstand voltage (V)	partial discharge extinction voltage (V)	result
Battery input and Ground (BI)		800Vac	500V	N/A	No breakdown
Battery input and communication output port(RI)		1500Vac	800V	N/A	No breakdown
AC mains output and Ground (BI)		1500Vac	4000V	N/A	No breakdown
AC mains and communication output port and accessible parts (CTa, CTb, CTc, NTC)(RI)		3000Vac	6000V	N/A	No breakdown

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Clause	Requirement – Test	Result – Remark	Verdict

14	**TABLE: list of critical components**				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
Enclosure	Various	Various	Metal, AL 5052 456*358*14.2mm (W / D / H) IP65	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
Battery input connector	SHENZHEN SUCCEED ELECTRONICS TECHNOLOGY CO.,LTD	TD100-01-2P-C	2pin, 600V ,101A, 35*56*71	EN 60998 UL 486A IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	CE UL* Tested with appliance
Internal wiring (for DC-in)	Various	10269	8AWG, 600 V, 105°C or better	UL 758	UL*
Internal wiring (for AC-out)	Various	1015	12AWG, 600 V, 105°C or better	UL 758	UL*
PCB	SHANTOU LUCKY STAR PCB CO.,LTD.	WS888	130°C, V-0, CTI:min.175	UL94 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
(Alternative)	Various	Various	130°C, V-0, CTI:min.175	UL94	UL*
DC-LINK Capacitor (EC2,EC3,ECF32)	Unielecs Co.,LTD	LLN2W681M3560	680µF, 450V, 105°C	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
DC-LINK Capacitor (CF383)	Xiamen FARA Electronic Co.,Ltd	C3D2H606KF0AC00	60µF, 500V, 105°C	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
Y capacitor (C11, C12, C13, C19, C20, C21, C51, C56, C70, C71)	Shantou High-New Technology Dev. Zone Song-tian Enterprise Co., Ltd	G14F1D103MN0BOSO	Y2, 10nF, 250Vac, 125°C	IEC 60384-14	VDE*
(Alternative)	Shantou High-New Technology Dev. Zone Song-tian Enterprise Co., Ltd	CEY210Y5V1E472MB	Y2, 4.7nF, 250Vac, 125°C	IEC 60384-14	VDE*
(Alternative)	Various	Various	Y2, 10nF/4.7nF, 250Vac, 125°C	IEC 60384-14	VDE or other EU certificate

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Clause	Requirement – Test	Result – Remark	Verdict

X capacitor (C15, CF397)	Xiamen FARA Electronic Co.,Ltd	MKP62	X2, min 275VAC,2.2μF, 100°C	IEC 60384-14	VDE*
(Alternative)	Various	Various	X2, min 275VAC,2.2μ, 100°C	IEC 60384-14	VDE or other EU certificate
Varistor (MOV1， MOV3)	Thinking Electronic Industrial Co.Ltd	TVR20561KSY	560VDC, Imax: 6.5 KA, Max.: 85°C	IEC 61051-1 IEC 61051-2 IEC 61051-2-2	VDE*
Insulation sheet under IGBT	BERGQUIST CO	K-10	150°C, V-0, min. 1.3mm thickness.	UL 94	UL*
Current transducer (HCT2)	LEM	CASR 15-NP	IPN: ±15A; Vout: ±5V Max.: 85°C	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	VAC	T60404-N4646-X662	IPN: ±15A; Vout: ±5V Max.: 85°C	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
Boost chock	Bo Luo Da Xin Electronic Co., Ltd	SH-L028	0.816mH, Class F	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L028	0.816mH, Class F	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
- Lead wire of the boost chock	Various	1015	10AWG, 600V, 105°C or better	UL 758 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
- Winding of the boost chock	Various	Various	155°C or above	UL 1446 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
- Tube	SHENZHEN WAHCHANGWEI INDUSTRIAL CO.,LTD	SGS-25	600V, 200°C	UL 224 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
Varnish	WU JIANG TAIHU INSULATING MATERIAL CO LTD	T-4260(a)	155°C	UL 1446 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance

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

Inv chock	Bo Luo Da Xin Electronic Co., Ltd	SH-L029	0.9mH, Class F	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L029	0.9mH, Class F	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
- Lead wire of the Inv chock	Various	1015	10AWG, 600V, 105°C or better	UL 758 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
- Winding of the Inv chock	Various	Various	155°C or above	UL 1446 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
- Tube	SHENZHEN WAHCHANGWEI INDUSTRIAL CO.,LTD	SGS-25	600V, 200°C	UL 224 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
Varnish	WU JIANG TAIHU INSULATING MATERIAL CO LTD	T-4260(a)	155°C	UL 1446 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
AC Filter	Bo Luo Da Xin Electronic Co., Ltd	NSP080060	12µH, Class B	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	NSP080060	12µH, Class B	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
AC Filter	Bo Luo Da Xin Electronic Co., Ltd	NSP080060	1.8mH, Class B	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	NSP080060	1.8mH, Class B	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
- Wire	Various	Various	130℃ or batter	UL 1446 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance

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

- VARNISH	WUJIANGTAIHUINSULATINGMATERIAL COLTD	T-4260(a)	130℃	UL 1446 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
- Spacer	KINGBOARDLAMINATES(MACAO COMMERCIALOFFSHORE)LTD	FR-4	130℃	UL 746E IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
High frequency isolated transformer	Bo Luo Da Xin Electronic Co., Ltd	SH-T011	EE65, Class F	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	Huizhou Baohui Electronics Technology Co., Ltd	SH-T011	EE65, Class F	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
- Winding	Various	Various	155°C or above	UL 1446	UL*
- Insulation tape	Jingjiang Yahua Pressure Sensi-tive Glue Co Ltd	PF-	180°C	UL 510 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
(Alternative)	Various	Various	180°C	UL 510	UL*
- Tube	SHENZHEN WAHCHANGWEI INDUSTRIAL CO.,LTD	SGS-25	600V, 200°C	UL 224 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
- PRESS BOARDS	E I DUPONT DE NEMOURS & CO INC	NOMEX410	220°C	UL 746D IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
Varnish	WU JIANG TAIHU INSULATING MATERIAL CO LTD	T-4260(a)	155°C	UL 1446 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
IGBT (Q2, Q3, Q7, Q8, Q14, Q19)	Fairchild Semi-conductor Cor-poration	FGA40N65SMD	650V, 40A	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	ST Microelec-tronics	STGWT40H65DFB	650V, 40A	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance

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

(Alternative)	IXYS CORPORATION	IXXH40N65B4H1	650V, 40A	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
IGBT (QD1, QD2, QD3, QD4)	Infineon Semiconductor Corporation	IKW40N65H5	650V, 46A	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
MOSFET (Q54, Q59, Q60, Q61, Q62, Q63, Q64, Q65)	Fairchild Semiconductor Corporation	FDP027N08B	80V, 120A	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	ST Microelectronics	STP270N8F7	80V, 180A	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	IXYS CORPORATION	IXTP230N075T2	75V, 115A	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
Relay (RYB1,RYB2,RYB3)	Panasonic Corporation Ise Factory	ALFG2PF12	31A, 250Vac, 12Vdc, 85°C	IEC/EN 61810-1	VDE*
(Alternative)	Xiamen Hongfa Electroacoustics Co., Ltd.	HF161F-W/12-HT	31A, 250Vac, 12Vdc, 85°C	IEC/EN 61810-1	VDE*
AC output terminal	Shenzhen teng da xing Electron Co.,Ltd	PA12H-3P	3P, 500V, 41A	EN 60998-1	VDE*
Transformer (TX1 in communication board)	Huizhou Baohui Electronics Technology Co., Ltd	SH-T010	Class B	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
(Alternative)	Bo Luo Da Xin Electronic Co., Ltd	SH-T010	Class B	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	Tested with appliance
- Bobbin of the transformer	CHANG CHUN PLASTICS CO LTD	PM-9820 PM-9830	150°C, V-0	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
(Alternative)	Chang Chun Plastics Co Ltd	T375J	V-0, 150°C	IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
- Insulating tape of the transformer	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	CT	130°C	UL 510	UL*
(Alternative)	Various	Various	130°C or above	UL 510	UL*

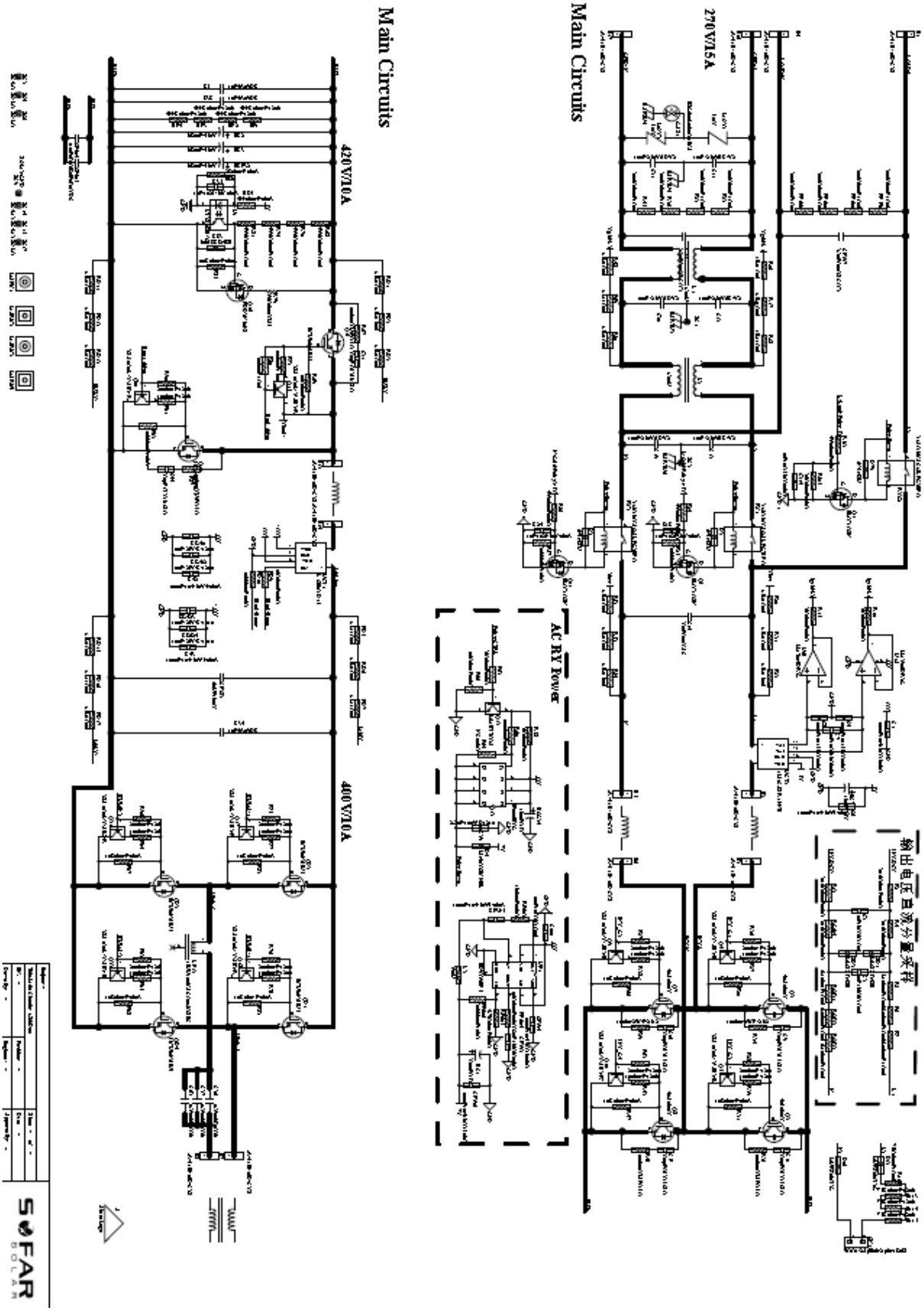
IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

- Margin Tape	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	WF	130°C	UL 510	UL*
(Alternative)	Various	Various	130°C or above	UL 510	UL*
- Magnet wire of the transformer	Tai-I Electric Wire & Cable Co Ltd	UEW	130°C	UL 1446	UL*
(Alternative)	Various	Various	130°C or above	UL 1446	UL*
- Varnishes	Suzhou Taihu Electric Advanced Material Co Ltd	T-4260(a)	130°C	UL 1446	UL*
(Alternative)	Various	Various	130°C or above	UL 1446	UL*
Optocoupler (U3, U4, U5, U6, U8,U9)	Lite-On Technology Corporation	LTV816SB-V	Di ≧ 0.4mm Internall External di≧8.0mm, AC5000V, reinforced Insulation 100°C	EN 60747-5-5	VDE*
(Alternative)	Fairchild Semiconductor Corporation	FOD817	Di ≧ 0.4mm Internal di ≧ 7.0mm External di ≧ 7.0mm, AC 5000V, reinforced Insulation 110°C	EN 60747-5-5	VDE*
(Alternative)	Everlight Electronics	EL817	Di ≧ 0.4mm Internall di ≧ 7.6mm External di ≧ 7.6mm, AC 5000V, reinforced Insulation 110°C	EN 60747-5-5	VDE*
DC fuse	Shenzhen victors industrial CO.,LTD	VBS1727	150Vdc, 100A	UL 248 IEC/EN 62109-1 IEC/EN 62109-2 IEC/EN 62040-1	UL* Tested with appliance
LCD panel	BAYER MATERIALSCIENCE AG	6557 + (z)(f1)	V-0, 3.0mm thickness, Anti-UV	UL 746D IEC/EN 62109-1 IEC/EN 62109-2	UL* Tested with appliance

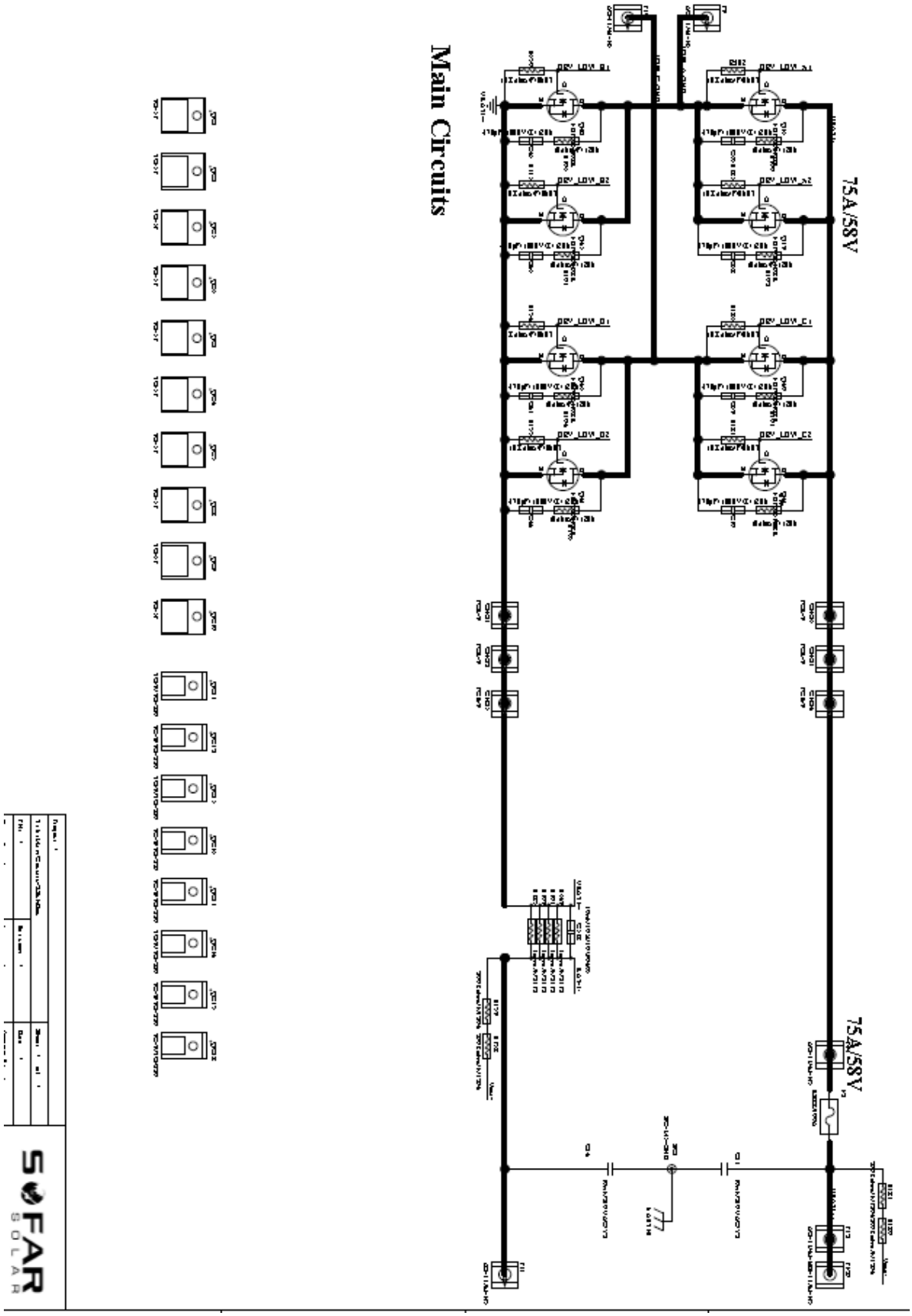
IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict

[1]) an asterisk indicates a mark which assures the agreed level of surveillance

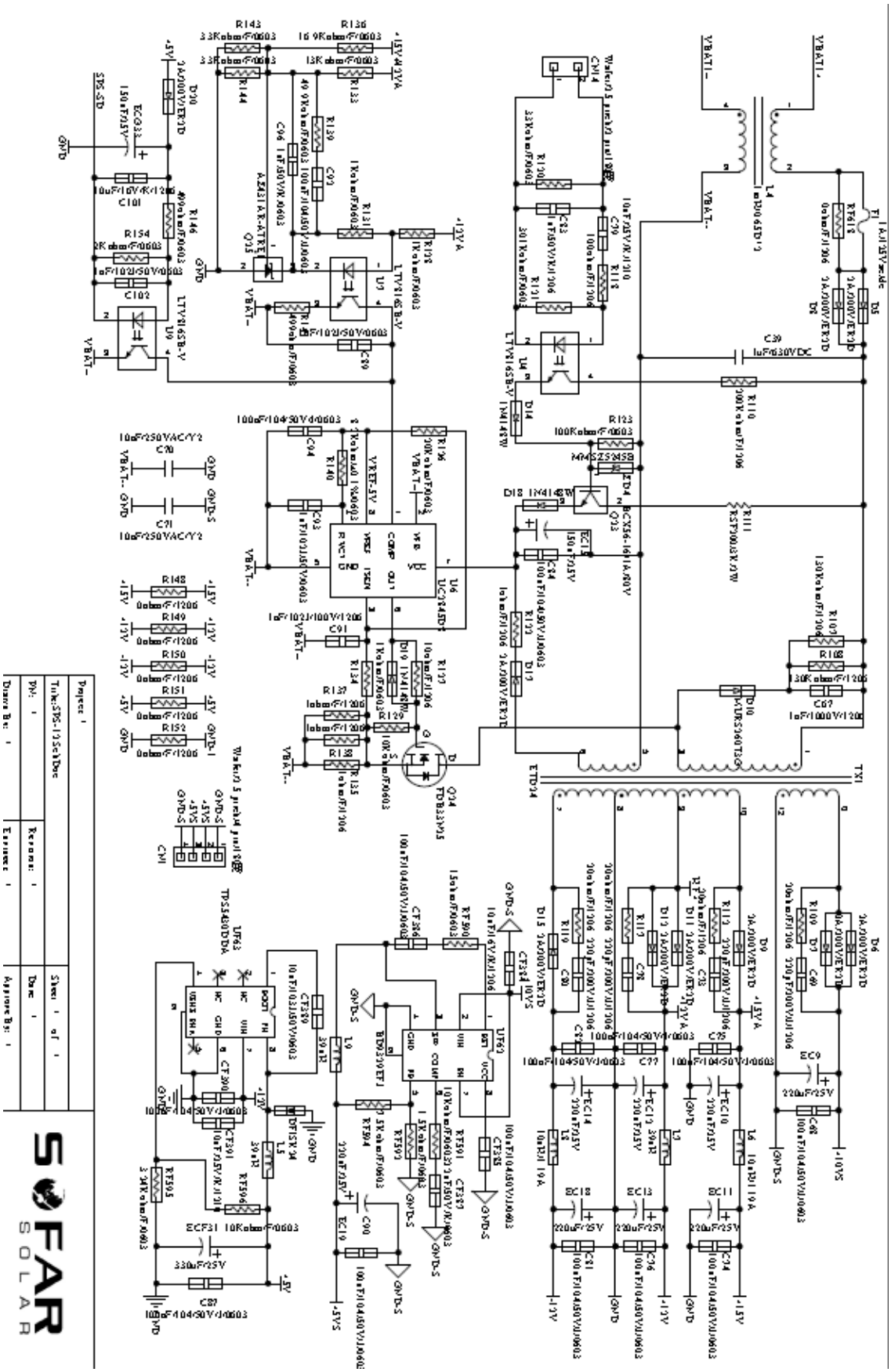
Appendix 1: Circuit Diagram



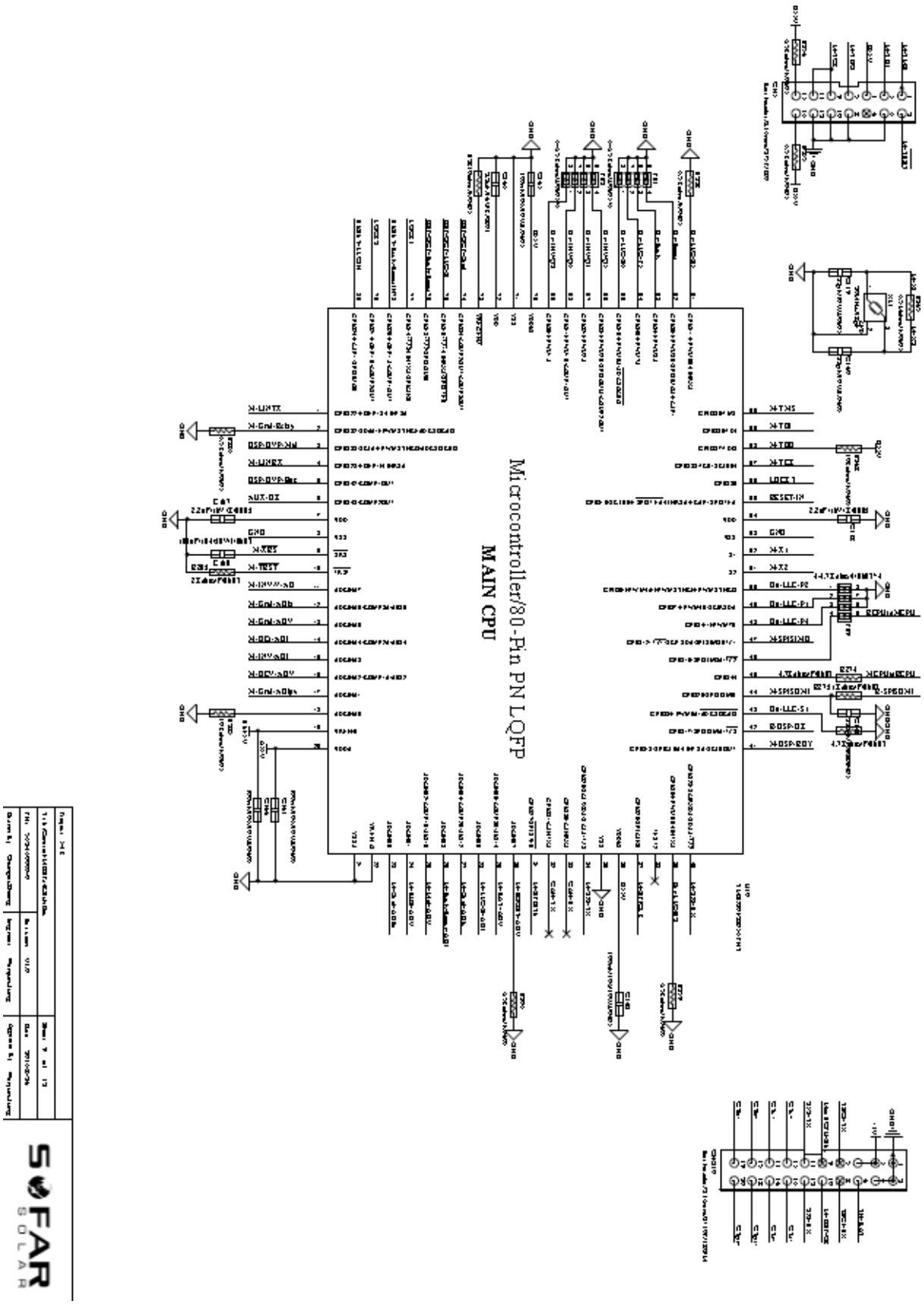
Appendix 1: Circuit Diagram



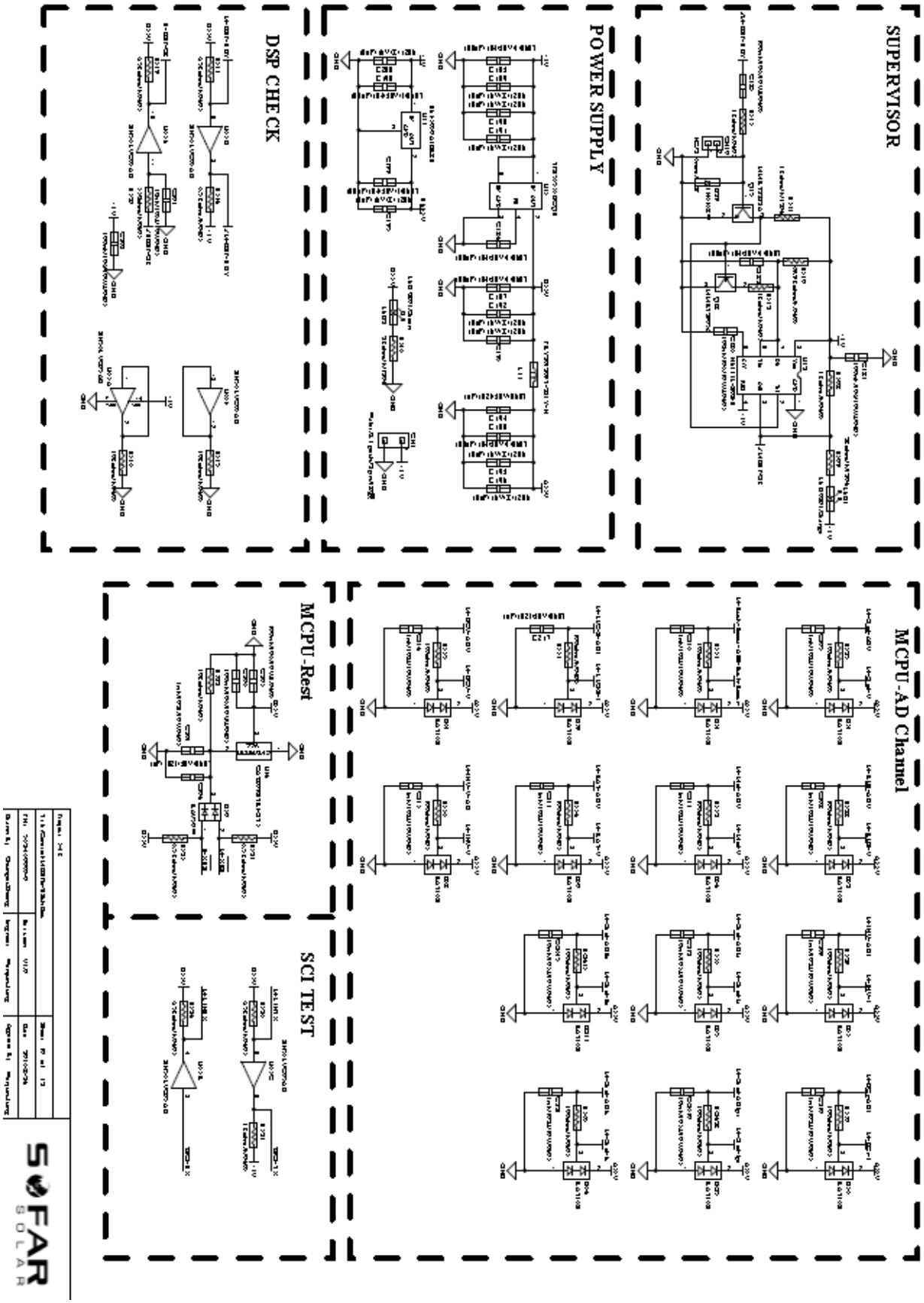
Appendix 1: Circuit Diagram



Appendix 1: Circuit Diagram

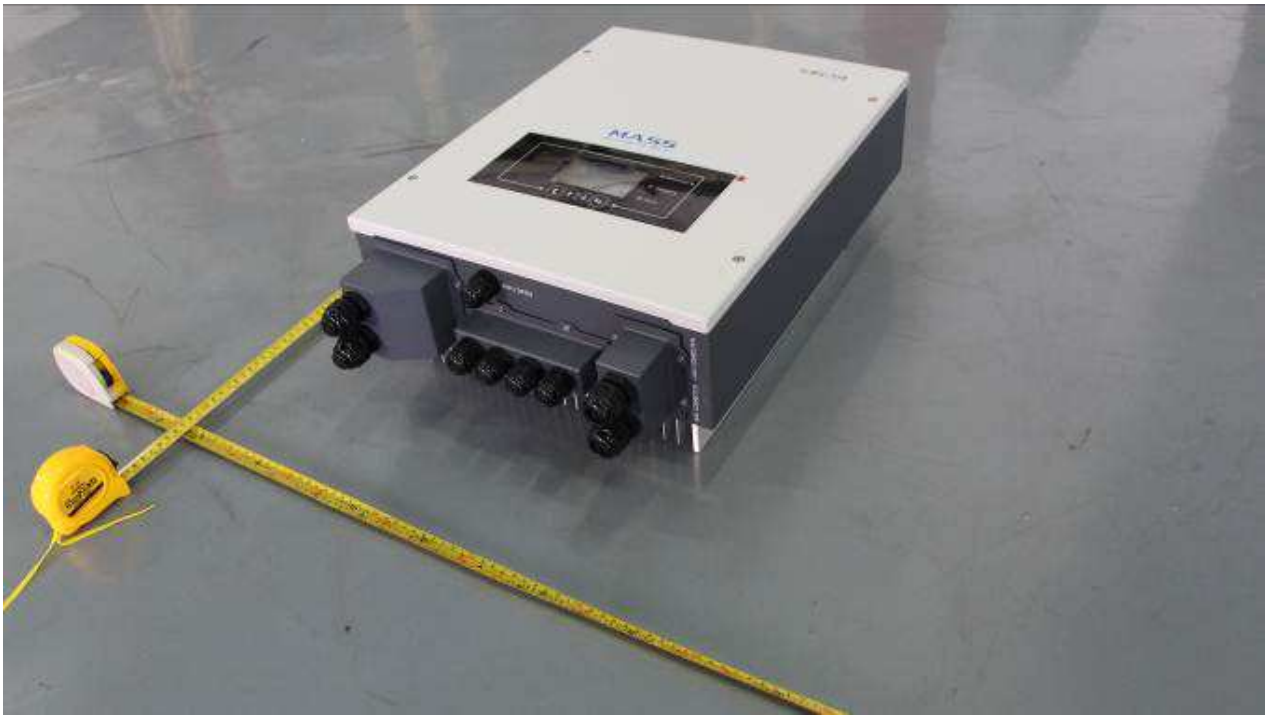


Appendix 1: Circuit Diagram



Appendix 2: Photos

Overview



Overview

Appendix 2: Photos

Top view

Heatsink view

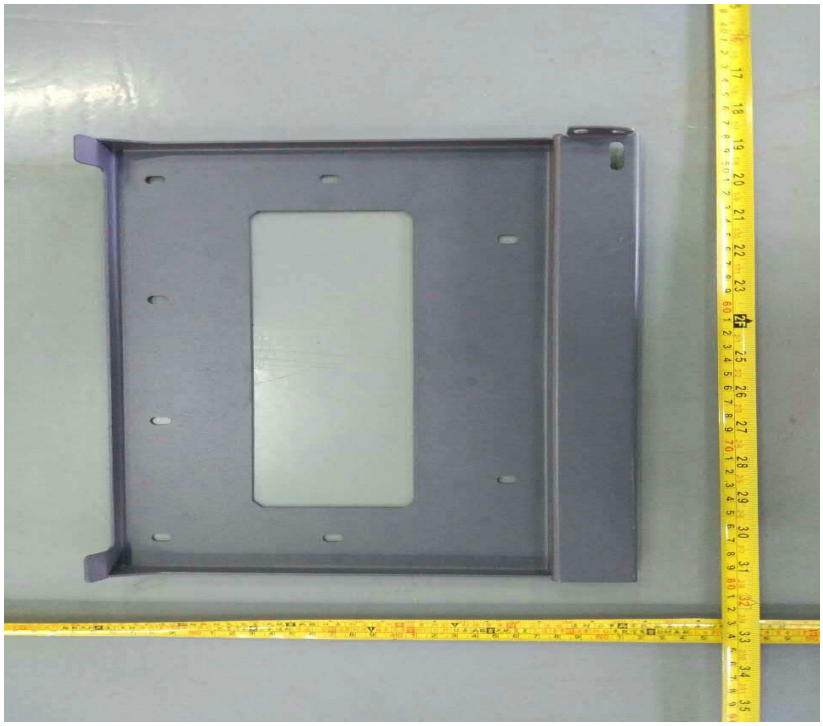
Appendix 2: Photos

Terminal view

Terminal view

Appendix 2: Photos

Bracket view



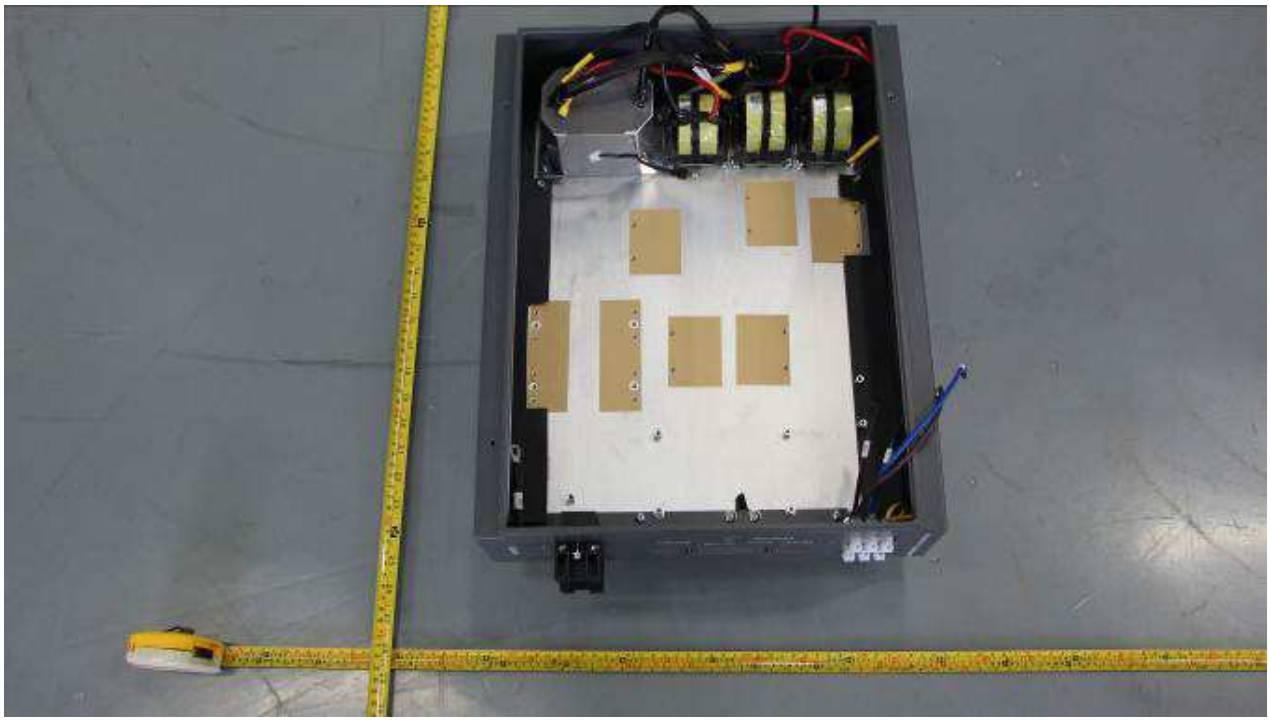
Bracket view

Appendix 2: Photos

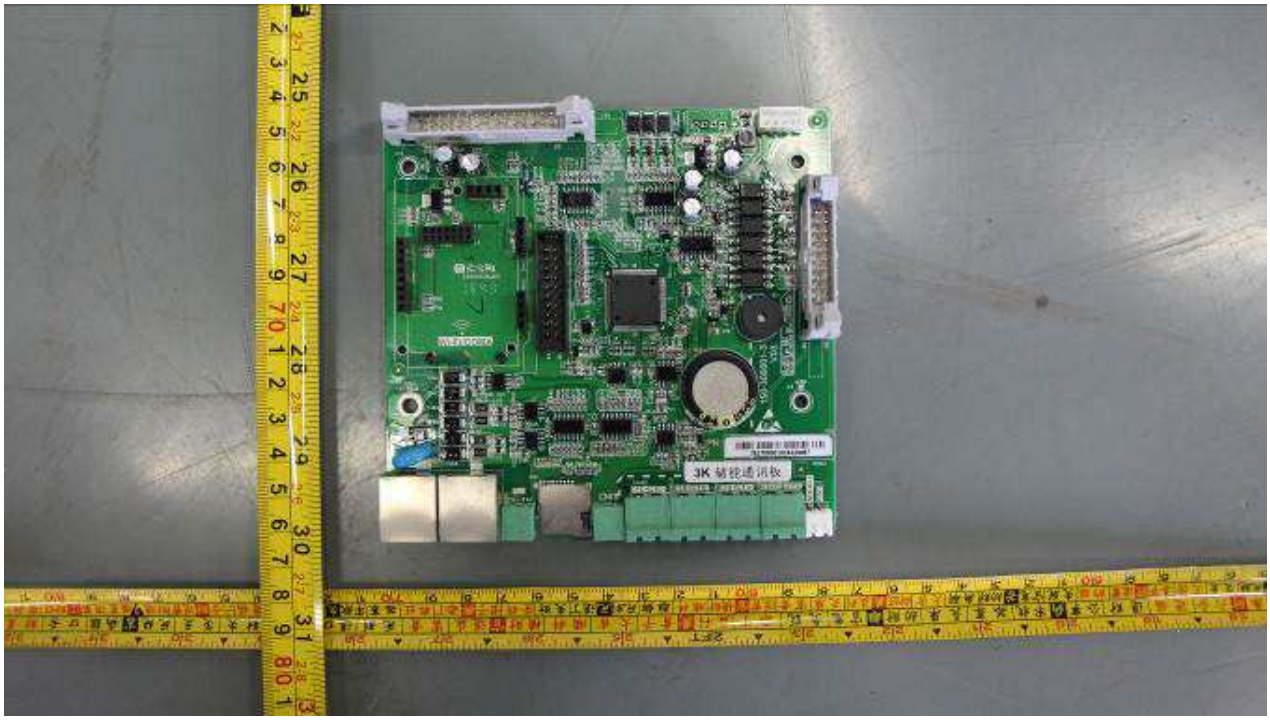
Inside view

Inside view

Appendix 2: Photos

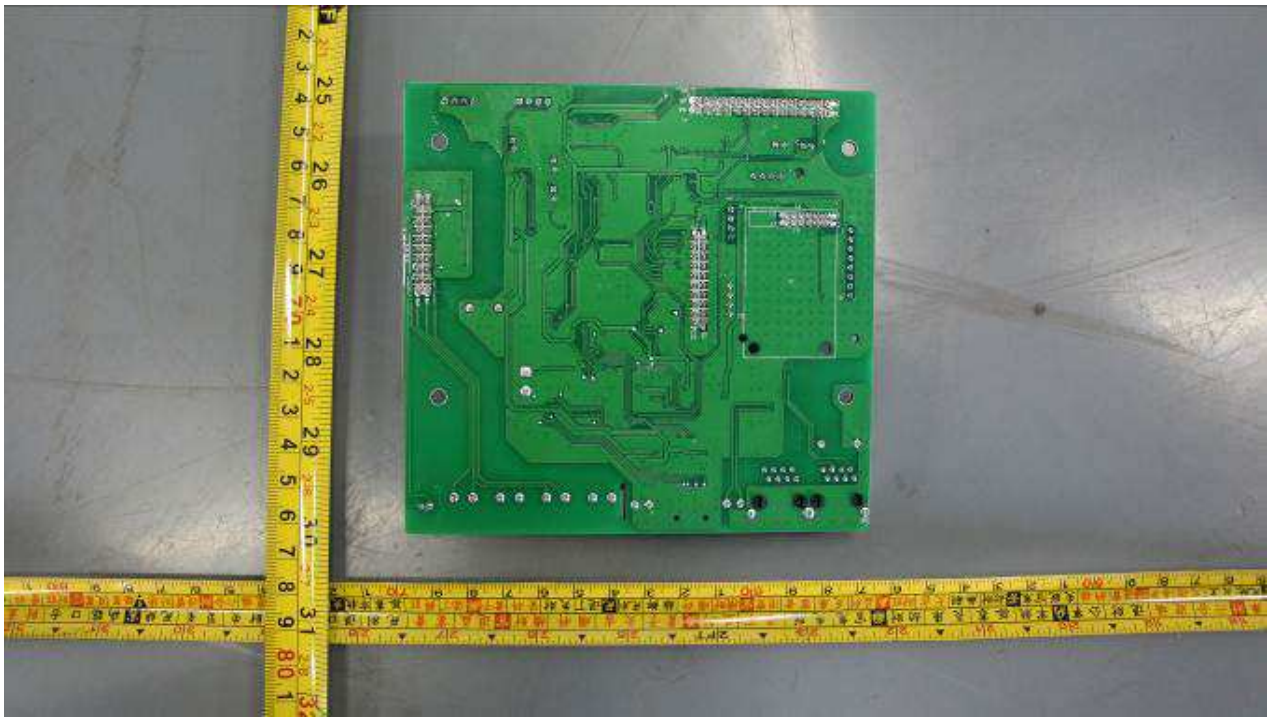


Inside view

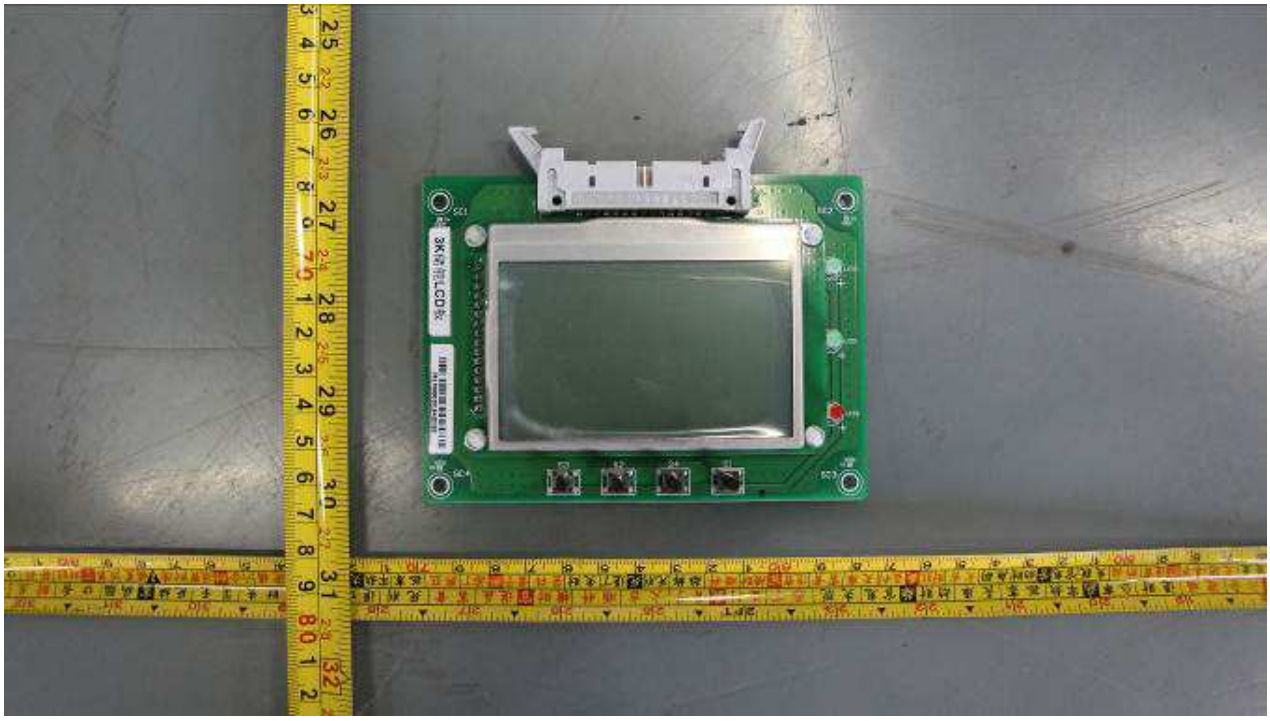


Communication board view

Appendix 2: Photos

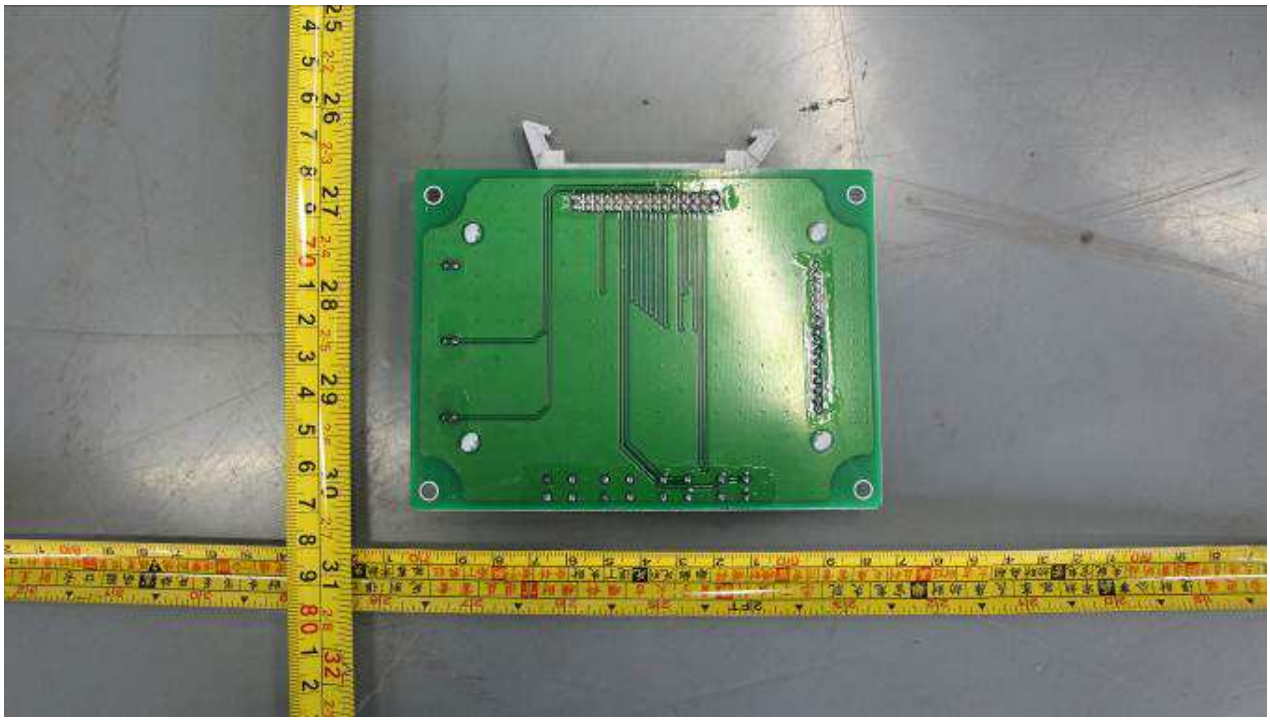


Soldered view

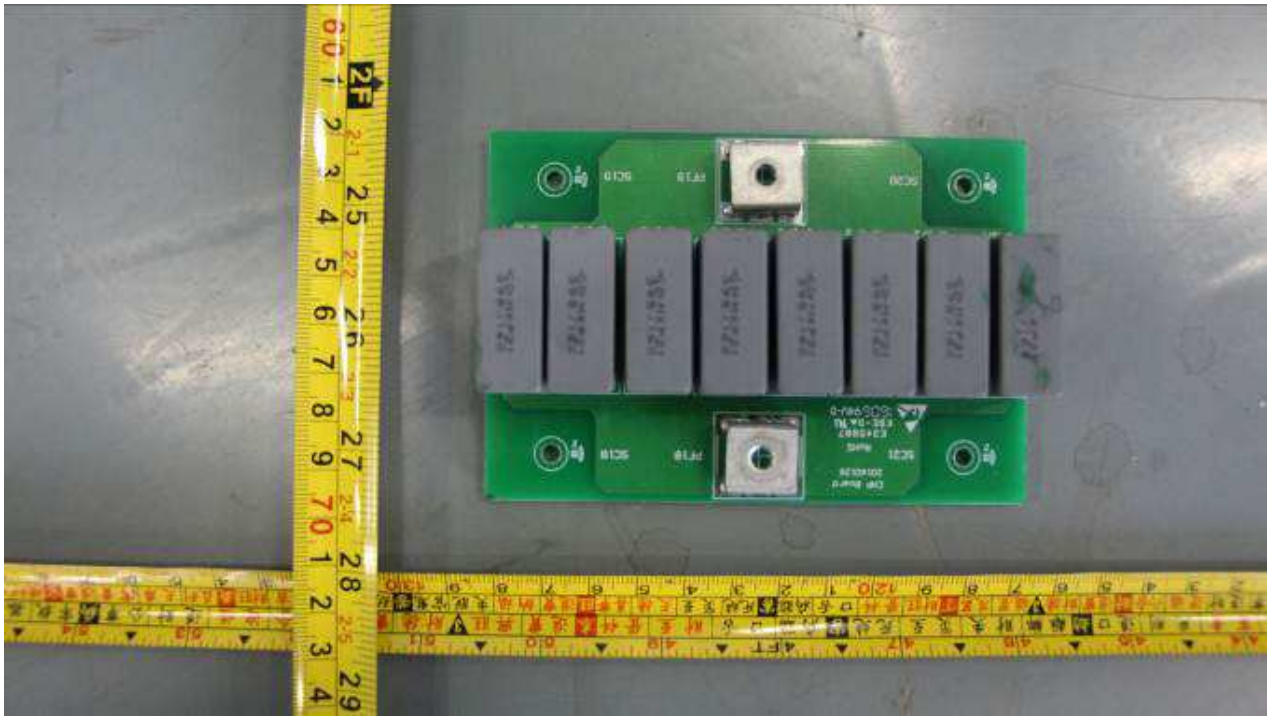


LCD display view

Appendix 2: Photos

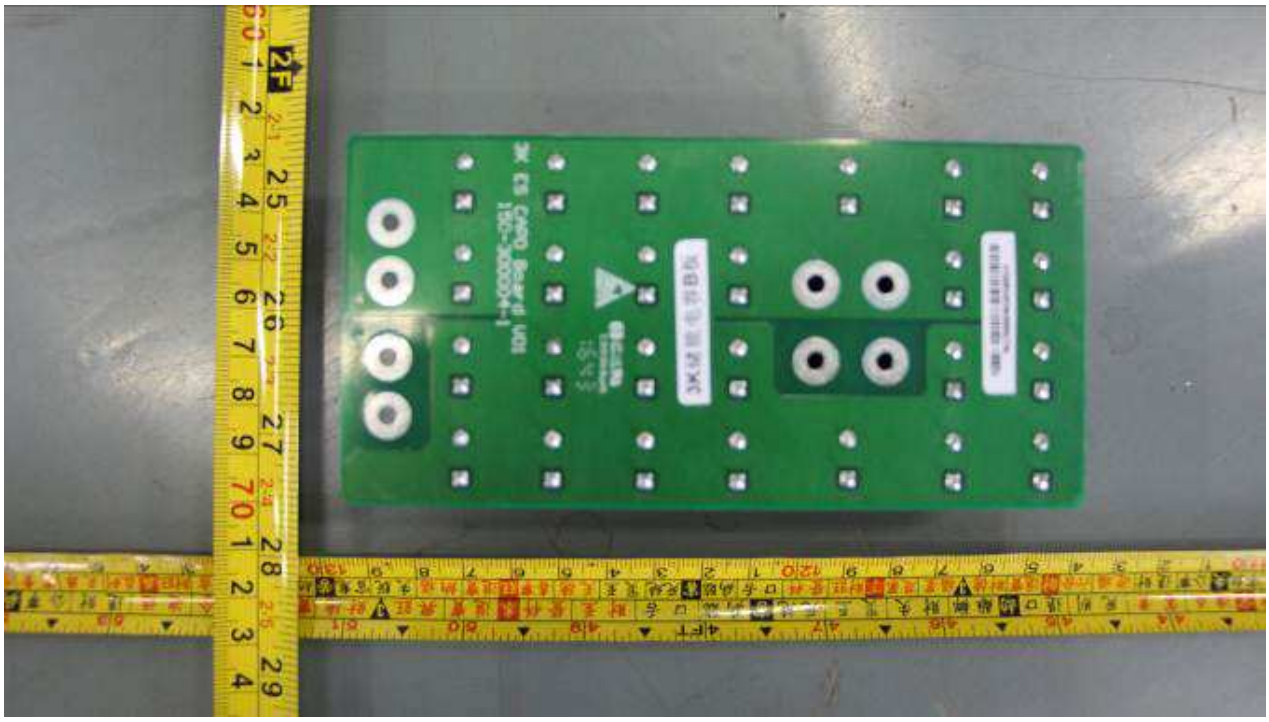


LCD display view



Capacitor A board view

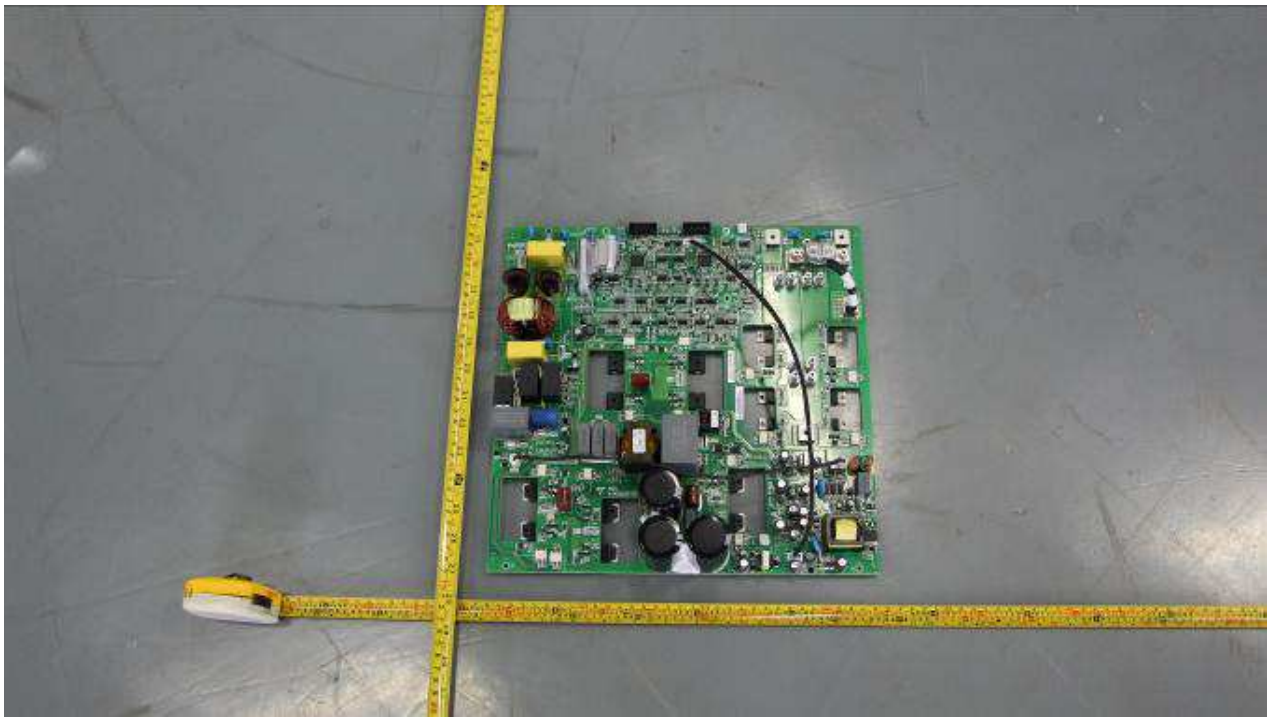
Appendix 2: Photos



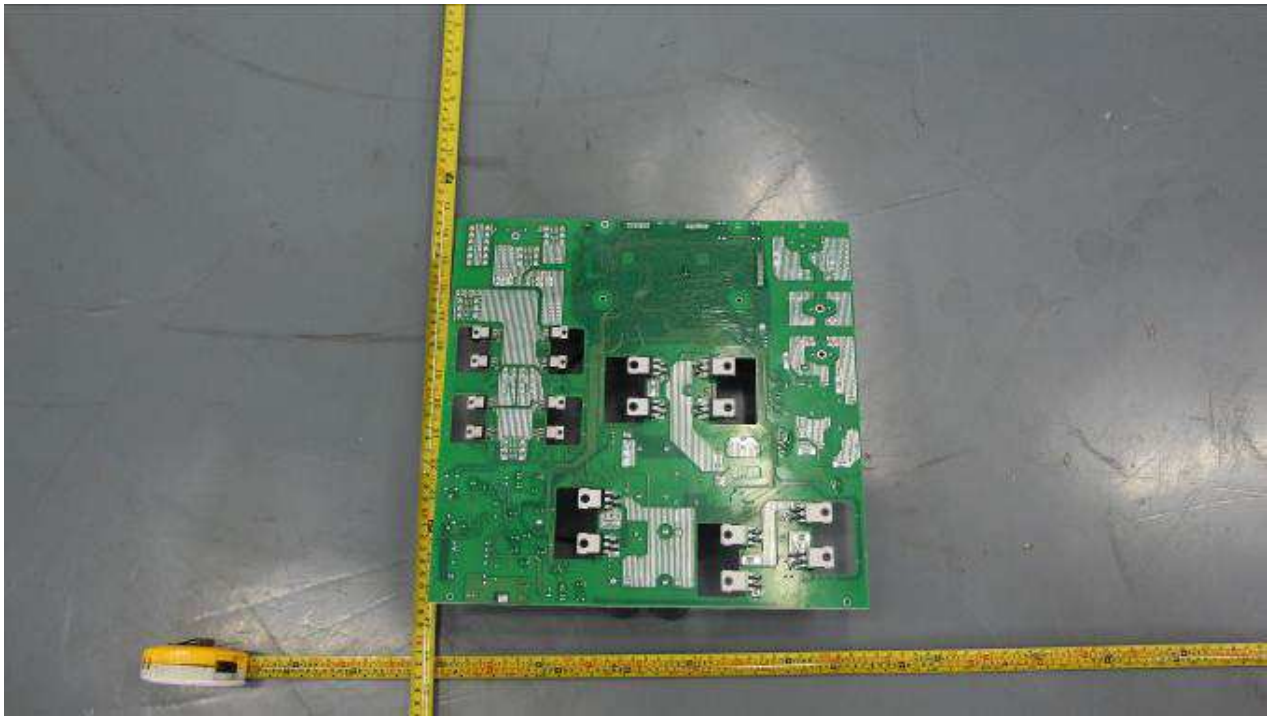
Soldered view

Capacitor B board view

Appendix 2: Photos



Main board view



Soldered view

Appendix 2: Photos

Battery used for test

Battery used for test

----------End of report----------