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

Report Number.	180903076GZU-002
Date of issue	14 Nov., 2018
Total number of pages	81 pages
Name of Testing Laboratory preparing the Report	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
Applicant's name	Shenzhen SOFAR SOLAR Co., Ltd.
Address	5/F,Building 4, Antongda Industrial Park, No.1 Liuxian Avenue,Xin'an Street,Bao'an District, Shenzhen City, Guangdong Province,P.R. China.
Test specification:	
Standard	IEC/EN 62109-1:2010 (First Edition)
Test procedure	Australia registration
Non-standard test method	N/A
Test Report Form No.	IEC62109_1B
Test Report Form(s) Originator	VDE Testing and Certification Institute
Master TRF	Dated 2016-04

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General disclaimer:

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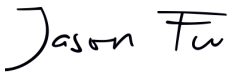
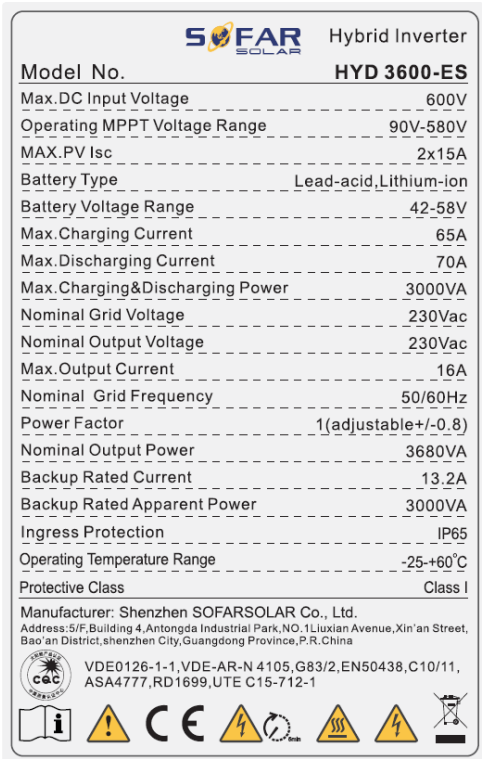
Test item description ..... :	Hybrid inverter
Trade Mark ..... :	SOFAR SOLAR
Manufacturer ..... :	Same as applicant
Model/Type reference ..... :	HYD 6000-ES, HYD 5000-ES, HYD 4000-ES, HYD 3600-ES, HYD 3000-ES
Ratings ..... :	See ratings in page 10 for details

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**Testing Laboratory:**	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch	
Testing location/ address .....:		Block E, No.7-2 Guang Dong Software Science Park, Caipin Road, Guangzhou Science City, GETDD, Guangzhou, China	
☐	**Associated CB Testing Laboratory:**	N/A	
Testing location/ address .....:		N/A	
Tested by (name, function, signature).....:		Jason Fu Senior Project Engineer	
Approved by (name, function, signature)...:		Tommy Zhong Assistant Technical Manager	
☐	**Testing procedure: CTF Stage 1:**	N/A	
Testing location/ address .....:		N/A	
Tested by (name, function, signature).....:		N/A	
Approved by (name, function, signature)...:		N/A	
☐	**Testing procedure: CTF Stage 2:**	N/A	
Testing location/ address .....:		N/A	
Tested by (name + signature).....:		N/A	
Witnessed by (name, function, signature) .:		N/A	
Approved by (name, function, signature)...:		N/A	
☐	**Testing procedure: CTF Stage 3:**	N/A	
☐	**Testing procedure: CTF Stage 4:**	N/A	
Testing location/ address .....:		N/A	
Tested by (name, function, signature).....:		N/A	
Witnessed by (name, function, signature) .:		N/A	
Approved by (name, function, signature)...:		N/A	
Supervised by (name, function, signature) :		N/A	

List of Attachments (including a total number of pages in each attachment): **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 (List of countries addressed): N/A ☒ **The product fulfils the requirements of** IEC/EN 62109-1:2010 (First Edition)	

Copy of marking plate:

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

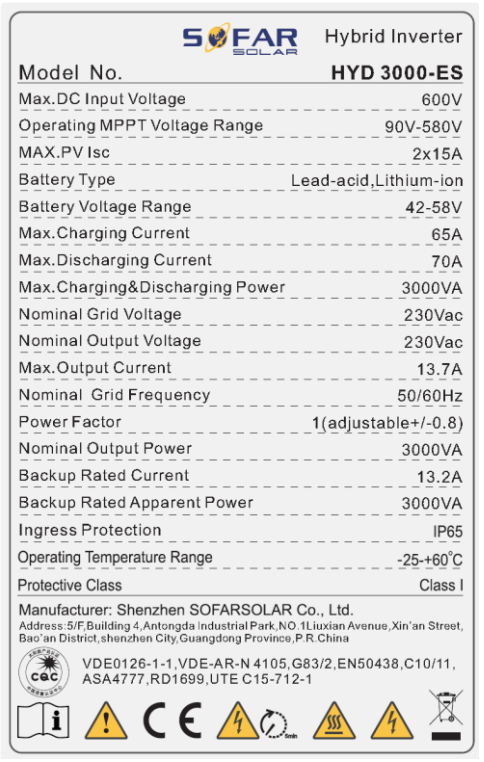


SOFAR SOLAR Hybrid Inverter

Model No.	HYD 3600-ES
Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V-580V
MAX.PV Isc	2x15A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	65A
Max.Discharging Current	70A
Max.Charging&Discharging Power	3000VA
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	16A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	3680VA
Backup Rated Current	13.2A
Backup Rated Apparent Power	3000VA
Ingress Protection	IP65
Operating Temperature Range	-25-+60°C
Protective Class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial Park,NO.1Liuxian Avenue,Xin'an Street, Bao'an District,shenzhen City,Guangdong Province,P.R.China

VDE0126-1-1,VDE-AR-N 4105,G83/2,EN50438,C10/11, ASA4777,RD1699,UTE C15-712-1



SOFAR SOLAR Hybrid Inverter

Model No.	HYD 3000-ES
Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V-580V
MAX.PV Isc	2x15A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	65A
Max.Discharging Current	70A
Max.Charging&Discharging Power	3000VA
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	13.7A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	3000VA
Backup Rated Current	13.2A
Backup Rated Apparent Power	3000VA
Ingress Protection	IP65
Operating Temperature Range	-25-+60°C
Protective Class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial Park,NO.1Liuxian Avenue,Xin'an Street, Bao'an District,shenzhen City,Guangdong Province,P.R.China

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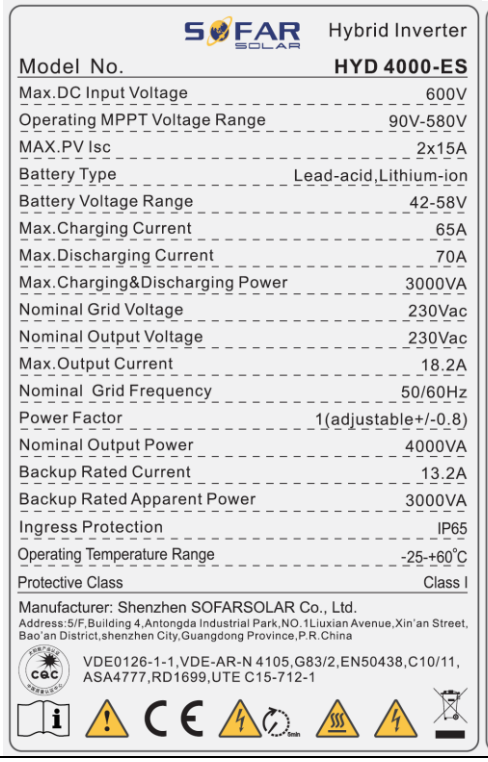

SOFAR SOLAR Hybrid Inverter

Model No.	HYD 4000-ES
Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V-580V
MAX.PV Isc	2x15A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	65A
Max.Discharging Current	70A
Max.Charging&Discharging Power	3000VA
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	18.2A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	4000VA
Backup Rated Current	13.2A
Backup Rated Apparent Power	3000VA
Ingress Protection	IP65
Operating Temperature Range	-25-+60°C
Protective Class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial Park,NO.1Liuxian Avenue,Xin'an Street, Bao'an District,shenzhen City,Guangdong Province,P.R.China

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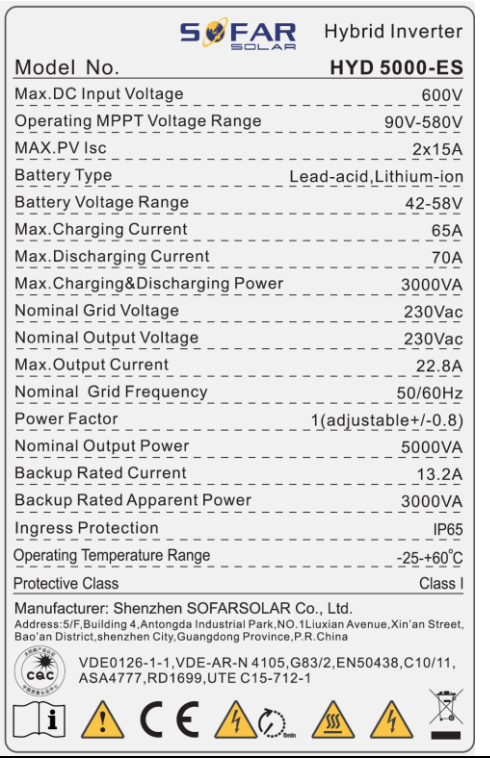
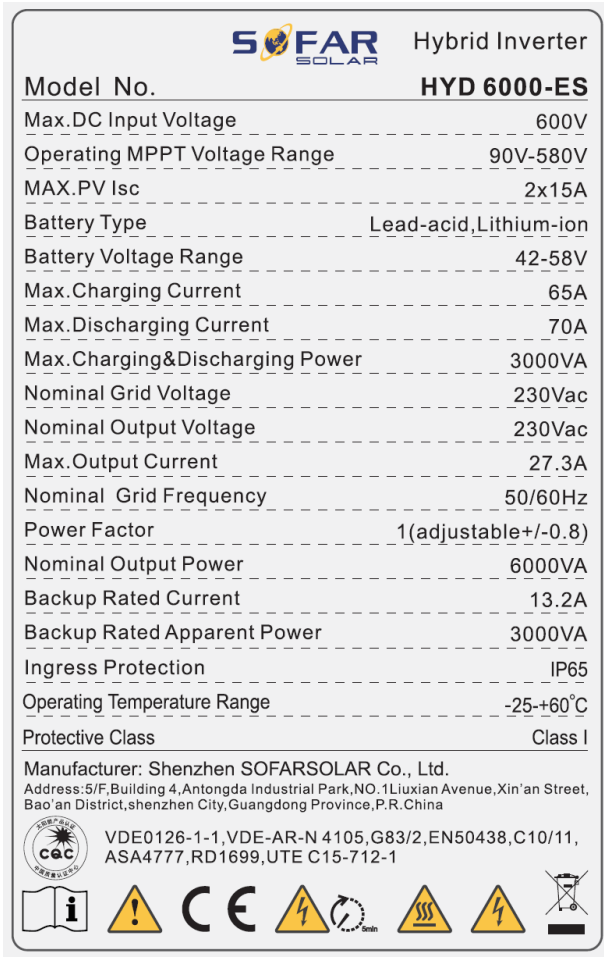


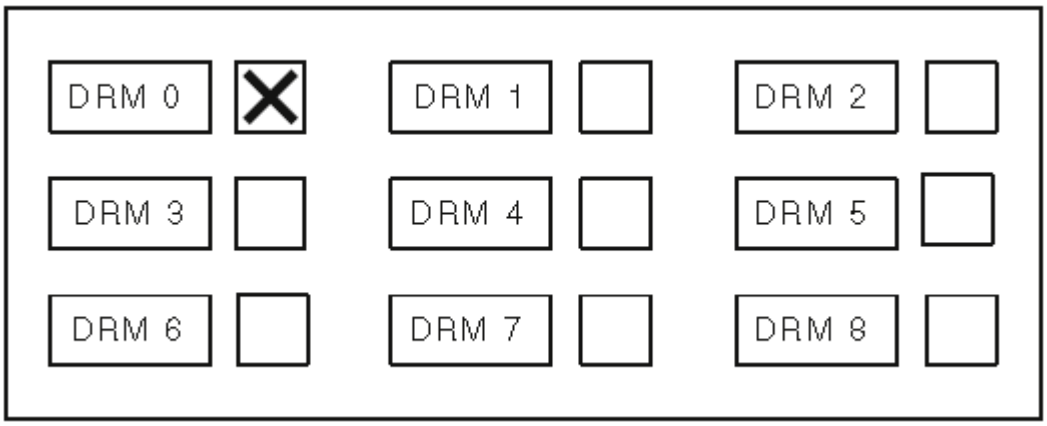
SOFAR SOLAR Hybrid Inverter

Model No.	HYD 5000-ES
Max.DC Input Voltage	600V
Operating MPPT Voltage Range	90V-580V
MAX.PV Isc	2x15A
Battery Type	Lead-acid,Lithium-ion
Battery Voltage Range	42-58V
Max.Charging Current	65A
Max.Discharging Current	70A
Max.Charging&Discharging Power	3000VA
Nominal Grid Voltage	230Vac
Nominal Output Voltage	230Vac
Max.Output Current	22.8A
Nominal Grid Frequency	50/60Hz
Power Factor	1(adjustable+/-0.8)
Nominal Output Power	5000VA
Backup Rated Current	13.2A
Backup Rated Apparent Power	3000VA
Ingress Protection	IP65
Operating Temperature Range	-25-+60°C
Protective Class	Class I

Manufacturer: Shenzhen SOFARSOLAR Co., Ltd.
Address:5/F,Building 4,Antongda Industrial Park,NO.1Liuxian Avenue,Xin'an Street, Bao'an District,shenzhen City,Guangdong Province,P.R.China

VDE0126-1-1,VDE-AR-N 4105,G83/2,EN50438,C10/11, ASA4777,RD1699,UTE C15-712-1





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
Environmental category :	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category DC :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%) :	-90 / +110 %
Tested for power systems :	TN systems
IT testing, phase-phase voltage (V) :	- - -
Class of equipment :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) :	Approx. 20.5Kg
Pollution degree :	Outside PD3; Inside PD2
IP protection class :	IP 65
... :	
Possible test case verdicts:	
- test case does not apply to the test object :	N/A
- test object does meet the requirement :	P (Pass)
- test object was not evaluated for the requirement :	N/E
- test object does not meet the requirement :	F (Fail)
Testing :	
Date of receipt of test item :	03 Sep., 2018
Date (s) of performance of tests :	03 Sep., 2018 – 20 Oct., 2018

General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.** **This report shall be used together with report No.180903076GZU-003**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided..... :	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) ..... :	Dongguan SOFAR SOLAR Co., Ltd 1F-6F, Building E, No.1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City

General product information:

The unit is a single-phase hybrid inverter, it can converts the high PV voltage and Grid voltage to low DC for charge battery, also converts PV voltage and battery voltage to AC output .

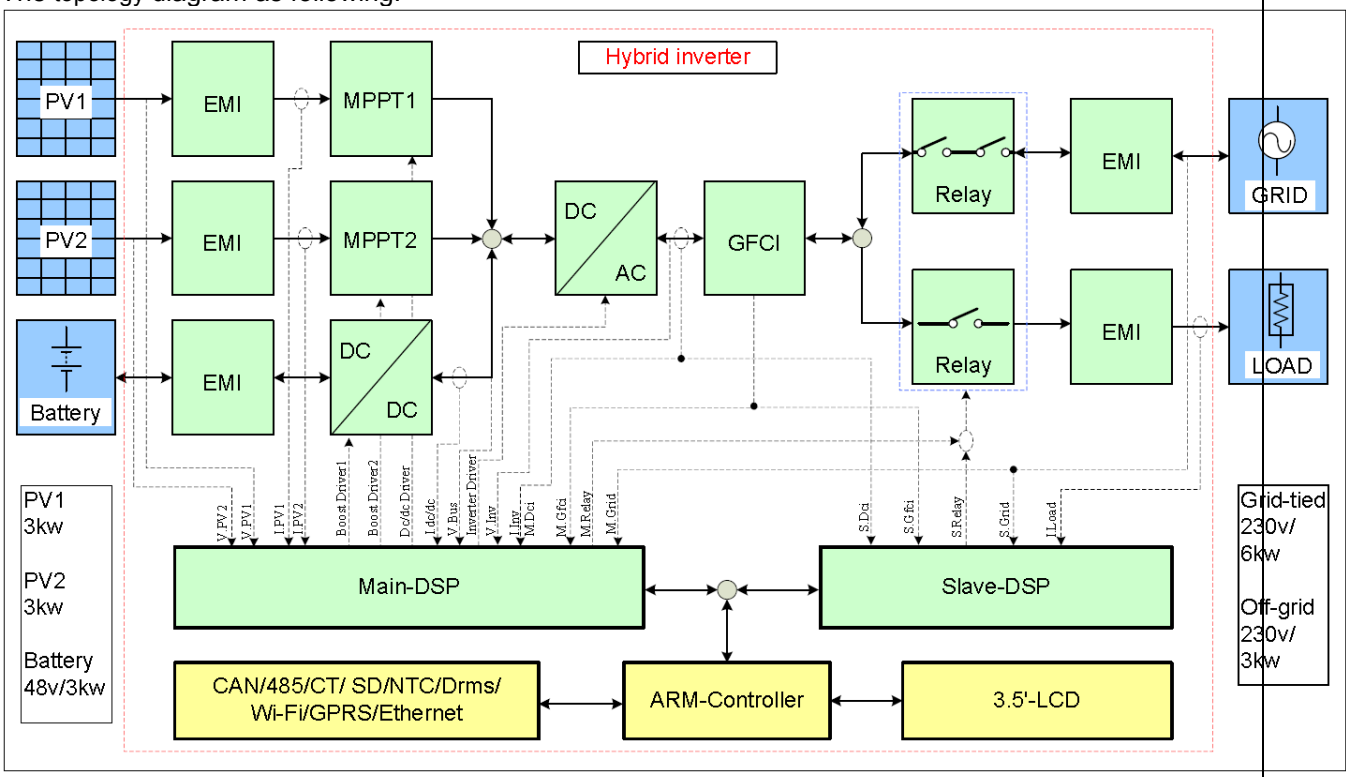
The unit is providing EMC filtering at the PV and battery side. It does provide galvanic separation from PV side to Grid. The battery circuit does provide high frequency isolation to PV side and AC mains.

The unit has two controllers. the master DSP controller monitor the charge or discharge statue; measure the PV voltage and current, battery voltage, bus voltage, buck voltage and current, AC voltage, current, GFCI and frequency.

The slave DSP controller monitor AC voltage , current ,frequency , GFCI and communicate with the master controller

The master DSP and slave DSP are used together to control relay open or close, if the single fault on one DSP, the other one DSP can be capable to open the relay, so that still providing safety means

The topology diagram as following:



Model differences:

The models HYD 3000-ES, HYD 3600-ES, HYD 4000-ES , HYD 5000-ES and HYD 6000-ES are completely identical and output power derated by software, except for the following table.

Model	HYD 6000-ES	HYD 5000-ES	HYD 4000-ES	HYD 3600-ES	HYD 3000-ES
R332, R334,R336	0Ω, NC, 0Ω		NC, 0Ω, NC		
Bus capacitance	8pcs		6pcs		
INV inductor	0.75mH		1.035mH		
R123,R132	1.5KΩ, 1.5KΩ		499Ω, 499Ω		

The product was tested on:

The Software version: V1.00

The Hardware version: V1.00

Other than special notes, typical model HYD 6000-ES used as representative for testing in this report.

Rating:

Model	HYD 3000-ES	HYD 3600-ES	HYD 4000-ES	HYD 5000-ES	HYD 6000-ES
Max. DC Input Voltage	600 d.c.V				
Max. PV Isc	2 X 15 d.c.A				
Battery Type	Lead-acid, Lithium-ion				
Battery Voltage Range	42-58 d.c.V				
Max. Charging Current	65 d.c.A				
Max. Discharging Current	70 d.c.A				
Max. Charging & Discharging Power	3000VA				
Nominal Grid voltage	230 a.c.V				
Nominal Output Voltage (backup)	230 a.c.V				
Max. output current	13.7 a.c.A	16 a.c.A	18.2 a.c.A	22.8 a.c.A	27.3 a.c.A
Nominal Grid Frequency	50Hz				
Power Factor	1 (adjustable +/-0.8)				
Nominal output power	3000VA	3680VA	4000VA	5000VA	6000VA
Backup Rated current	13.2 a.c.A				
Backup Rated Apparent Power	3000VA				
Ingress Protection	IP 65				
Protective Class	Class I				
Operating temperature range	-25 ~ +60℃				

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	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	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:	(see appended table 4.2.2.6)	P
4.2.2.7	Supply ports other than the mains		P
4.2.2.7.1	Photovoltaic supply sources a) Open circuit voltage: b) Short-circuit current:	(see appended table 4.2.2.7)	P
4.2.2.7.2	Battery inputs		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
4.2.2.11	Available short circuit current		P
4.3	Thermal testing	(see appended table 4.3)	P
4.3.1	General		P
4.3.2	Maximum temperatures		P
4.3.2.1	General		P
4.3.2.2	Touch temperatures		P
4.3.2.3	Temperature limits for mounting surfaces		P
4.4	Testing in single fault condition	(see appended table 4.4)	P
4.4.1	General		P
4.4.2	Test conditions and duration for testing under fault conditions		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
4.4.2.1	General		P
4.4.2.2	Duration of tests		P
4.4.3	Pass/fail criteria for testing under fault conditions		P
4.4.3.1	Protection against shock hazard		P
4.4.3.2	Protection against the spread of fire		P
4.4.3.3	Protection against other hazards		P
4.4.3.4	Protection against parts expulsion hazards		P
4.4.4	Single fault conditions to be applied	(See appended tables)	P
4.4.4.1	Component fault tests		P
4.4.4.2	Equipment or parts for short-term or intermittent operation	Not for short-term or intermittent operation	N/A
4.4.4.3	Motors	Fan inside	P
4.4.4.4	Transformer short circuit tests		P
4.4.4.5	Output short circuit		P
4.4.4.6	Backfeed current test for equipment with more than one source of supply	Considered	P
4.4.4.7	Output overload		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
4.4.4.10	Safety interlock systems	No safety interlock	N/A
4.4.4.11	Reverse d.c. connections	Reverse DC+ and DC-, the PCE cannot start-up. No damaged.	P
4.4.4.12	Voltage selector mismatch	No voltage selector	N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity	Mis-wiring: L to L,normal operation	P
4.4.4.14	Printed wiring board short-circuit test		P
4.5	Humidity preconditioning	(see appended table 7.5)	P
4.5.1	General		P
4.5.2	Conditions	95% R.H. 40℃. 48H	P
4.6	Backfeed voltage protection		P
4.6.1	Backfeed tests under normal conditions	The max. DC input and output are less than 60V, disconnected DC inputs and main	P
4.6.2	Backfeed tests under single-fault conditions	PV input is separated from Main with basic insulation under normal and single-fault	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
		conditions with disconnection method evaluated to IEC 62109-2 Also,  is presented on the marking label means that “After disconnect must wait for 5 mins can touch with PCE terminal ”	
4.6.3	Compliance with backfeed tests		P
4.7	Electrical ratings tests	(see appended table 4.2.2.6)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P

5	**MARKING AND DOCUMENTATION**		P
5.1	Marking		P
5.1.1	General		P
	Equipment shall bear markings as specified in 5.1 and 5.2	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	After this test, the markings are clearly legible. There was neither loose nor curling on the edge of label.	P
5.1.3	Identification		P
	The equipment shall, as a minimum, be permanently marked with:		P
	a) the name or trade mark of the manufacturer or supplier	Trade mark: SOFAR	P
	b) model number, name or other means to identify the equipment		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:		P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	Refer to the marking label	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	Refer to the marking label	P
	– the ingress protection (IP) rating as in 6.3 below	IP 65	P
5.1.5	Fuse identification	See below	P
	Marking shall be located adjacent to each fuse or fuseholder, or on the fuseholder, or in another location provided that it is obvious to which fuse the marking applies, giving the fuse current rating and where fuses of different voltage rating value could be fitted, the fuse voltage rating.		N/A
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated		N/A
	For fuses not located in operator access areas and for soldered-in fuses located in operator access areas, it is permitted to provide an unambiguous cross-reference (for example, F1, F2, etc.) to the servicing instructions which shall contain the relevant information.	The fuse rating marked on The circuit diagram and Maintance manual.	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.	The indications were provided adjacent to Battery terminals , AC and DC quick Connector.	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.		P
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other non-permanent material.	The PCE is not intended to connect to multiple-voltage and there is no voltage setting device.	N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:	The “+” and “-” marking were provided adjacent to the DC input terminals and battery	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
		terminals.	
	– the sign “+“ for positive and “-„ for negative; or		
	– 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:		P
	– symbol 7 of Annex C; or		P
	– the letters “PE“; or		N/A
	– the colour coding green-yellow.		P
5.1.7	Switches and circuit-breakers	Approved switch was used for all models.	P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.	“ON” indicated the on-position of DC switch. “OFF” indicated the off-position of DC switch	P
5.1.8	Class II Equipment	Class I	N/A
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections	No such parts	N/A
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:		N/A
	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 background		P
	– Symbols or text that are moulded, stamped or engraved in a material shall have a character height of at least 2,0 mm, and if not contrasting in colour from the background, shall have a depth or raised height of at least 0,5 mm.		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 necessary information for warning marking	P
	Symbol 9 of Annex C is not required to be used adjacent to symbols that are explained in the manual		P
5.2.2	Content for warning markings		P
5.2.2.1	Ungrounded heat sinks 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 heat sink and shall be clearly visible when the PCE is disassembled to the extent that a risk of contact with the heat sink exists.		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.	The symbol 14 of Annex C provided on the warning label which located on the surface of enclosure	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
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		
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		P
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).		P
5.2.3	Sonic hazard markings and instructions	Hazardous noise is 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 ensure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply		P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.	Marked with symbol 13 of Annex C and explain in user manual.	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
	The documentation provided with the PCE shall provide the information needed for the safe		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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:		
	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	Outside: PD3, Inside: PD2	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(PV and battery side), 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
	The documentation shall include installation and where applicable, specific commissioning		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		
	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;		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;	Sealed lead acid battery, Vented battery, Gel battery and lithium battery of external battery pack (EBP) used. The detail installation and maintenance explanations are provided in the manufacturer's EBP of manual	P
	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 exceed the max. rated current of the circuit, as per 4.4.4.6;	The backfeed current Was prevented.	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;	Internal RCM is used	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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		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."	Internal RCM is used	N/A
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	The explanations are provided in themanual.	P
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.	PV array should be floating configuration to be connected to PCE, relevant information h ad shown on the installation manual.	P
5.3.3	Information related to operation		P
	Instructions for use shall include any operating instructions necessary to ensure safe operation, including the following, as applicable:		P
	– Instructions for adjustment of controls including the effects of adjustment;		P
	– Instructions for interconnection to accessories and other equipment, including indication of suitable accessories, detachable parts and any special materials;		P
	– Warnings regarding the risk of burns from surfaces permitted to exceed the temperature limits of 4.3.2 and required operator actions to reduce the risk; and		P
	– Instructions, that if the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.		P
5.3.4	Information related to maintenance		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;	No such part	P
	– Part numbers and instructions for obtaining any required operator replaceable parts;		N/A

IEC 62109-1			
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	External battery module used, and should evaluate in the final product.	P
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		P
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		P
	– When replacing batteries, replace with the same type and number of batteries or battery packs	The detail installation and maintenance explanations are provided in the manufacturer's EBP of manual.	N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A

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

6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		P
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below	Outdoor used	P
	– Suitability for WET LOCATIONS or not	Yes	P
	– POLLUTION DEGREE rating in 6.2 below	Outside PD3, Inside PD2	P
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	IP 65	P
	– Ultraviolet (UV) exposure rating, as in 6.4 below		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	P
6.3	Ingress Protection	IP65	P
6.4	UV exposure		P
6.5	Temperature and humidity	-25°C~+60°C, 0%~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 PV, battery input and the Main output DVC A circuit: The signal communication output port.	P
7.3.2	Decisive voltage classification		P
7.3.2.1	Use of decisive voltage class (DVC)	Working voltage and protective measure and considered	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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 PV 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	The double or reinforced insulation was provided between: 1) DC input circuits and communication circuits; 2) Battery circuits and communication circuits; 3) AC output circuits and communication circuits.	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		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	per 7.3.5.4, or		
	▪ limitation of voltage according to 7.3.5.4.		N/A
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		P
7.3.4	Protection against direct contact		P
7.3.4.1	General		P
	Protection against direct contact is employed to prevent persons from touching live parts that do not meet the requirements of 7.3.5 and shall be provided by one or more of the measure given in 7.3.4.2 (enclosures and barriers) and 7.3.4.3 (insulation).	Metal 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.		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 material used on display screen is evaluated via 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	The DVC C circuit is not accessible by probe	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,		
7.3.4.2.3	Access probe tests		P
	Compliance with 7.3.4.2.1 is checked by all of the following:		P
	a) Inspection; and		P
	b) Tests with the test finger (Figure D.1) and test pin (Figure D.2) of 0E, the results of which shall comply with the requirements of 7.3.4.2.1 a), b), and c) as applicable. Probe tests are performed on openings in the enclosures after removal of parts that can be detached or opened by an operator without the use of a tool, including fuseholders, and with operator access doors and covers open. It is permitted to leave lamps in place for this test. Connectors that can be separated by an operator without use of a tool, shall also be tested during and after disconnection. Any movable parts are to be put in the most unfavourable position.		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.	No openings	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.	Metal enclosure	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	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
		marked on PCE and explained in user manual	
7.3.4.3	Protection by means of insulation of live parts	The earthed enclosure is with basic insulation form the live parts inside	N/A
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:		N/A
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		N/A
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		N/A
7.3.5	Protection in case of direct contact	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 single communication port is DVC A and reinforced insulation from the live part by means of isolation transformer and optocoupler	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
7.3.5.2	Protection using decisive voltage class A	The communication port is DVC A and reinforced insulation from the live part by means of isolation transformer	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
		and optocoupler	
7.3.5.3	Protection by means of protective impedance	Protective impedance not used as protective separation in the PCE	N/A
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		N/A
7.3.5.3.1	Limitation of current through protective impedance		N/A
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		N/A
7.3.5.3.2	Limitation of discharging energy through protective impedance		N/A
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		N/A
7.3.5.4	Protection by means of limited voltages	No such design	N/A
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		N/A
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		N/A
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact		P
7.3.6.1	General		P
	Protection against indirect contact is required to prevent shock- hazardous current being accessible from conductive parts during an insulation failure. This protection shall comply with the requirements for protective class I (basic insulation plus protective earthing), class II (double or reinforced insulation) or class III (limitation of voltages)	The earthing metal enclosure is complied with protective class I and the circuit of communication is complied with protective class II for accessible communication	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
		ports.	
	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.		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		P
	b) accessible conductive parts are separated from live parts of DVC-B or -C using double or reinforced insulation.	Communication circuits are separated from live parts used double or reinforced insulation	P
7.3.6.3.2	Requirements for protective bonding		P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:		P
	a) through direct metallic contact;	The connection of external protective earthing conductor is direct metal contact via a terminal with screw.	P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;		N/A
	c) through a dedicated protective bonding		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	conductor;		
	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 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	The alternative of 7.3.6.3.5 is considered.	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.		N/A
	Protective bonding shall meet following requirements:		N/A
	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.		N/A
	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.	The alternative of 7.3.6.3.5 is considered.	N/A
	The impedance of protective bonding means shall be checked by passing a test current through the bond for a period of time as specified below. The test current is based on the rating of the overcurrent protection for the equipment or part of the equipment under consideration, as follows:		N/A
	a) For pluggable equipment type A, the		N/A

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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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.		
	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.		N/A
	The test current is derived from an a.c or d.c supply source, the output of which is not earthed.		N/A
	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	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
	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	The protective earthing conductor is fixed permanently and the minimum cross-sectional area is 4mm^2	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.	cable of phase and protective earthing. Only qualified personnel can install the protective earthing.	
	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.		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	External protective earthing conductors connect to the enclosure body.	P
7.3.6.3.6.1	General		P
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.	Considered	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		P
	Marking shall not be done on easily changeable		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	parts such as screws.		
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.		N/A
	For all other PCE, one or more of the following measure shall be applied, unless the touch current measured in accordance with 7.5.4 using the test network of IEC 60990 test figure 4 shall not exceed 3,5 mA a.c. or 10 mA d.c.	Living part and com. Port: 0.16 mA Live part and metal enclosure: 2.05mA	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
	• provision of an additional terminal for a second protective earthing conductor of the same cross-sectional area as the original protective earthing conductor and installation instruction requiring a second protective earthing conductor to be installed or		N/A
	b) Connection with an industrial connector according to IEC 60309 and a minimum protective earthing conductor cross-section of 2,5 mm² as part of a multi-conductor power cable. Adequate strain relief shall be provided.		N/A
	In addition, the caution symbol 15 of Annex C shall be fixed to the product and the installation manual shall provide details of the protective earthing measures required in the installation as required in 5.3.2.		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

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.3.6.4	Protective Class II – Double or Reinforced Insulation		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:	Signal communication port are evaluated with reinforced insulation form live parts inside	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
	• 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.	Considered	P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.	Considered	P
	Insulation shall be selected after consideration of the following influences:	Considered	P
	• pollution degree	PD3 outside, PD2 inside	P
	• overvoltage category	The mains circuits: OVC III The PV Array and battery circuits: OVC II	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	• supply earthing system	TN	P
	• insulation voltage	PV input: max. 1100Vdc and Main:277Vac (480Vac)	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
	• TT system: has one point directly earthed, the accessible conductive parts of the installation being connected to earth electrodes electrically independent of the earth electrodes of the power system;		N/A
	• IT system: has all live parts isolated from earth or one point connected to earth through an impedance, the accessible conductive parts of the installation being earthed independently or collectively to the earthing system.		N/A
7.3.7.1.4	Insulation voltages	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 withstands voltage and the temporary overvoltage.		P
7.3.7.2	Insulation between a circuit and its surroundings		P
7.3.7.2.1	General		P
7.3.7.2.2	Circuits connected directly to the mains	System voltage for mains is 300Vrms according to table 1	P
7.3.7.2.3	Circuits other than mains circuits		P
7.3.7.2.4	Insulation between circuits		P
7.3.7.3	Functional insulating		P
7.3.7.4	Clearance distances	(see appended table 7.3.7)	P
7.3.7.4.1	Determination	Designed for use in altitudes	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
		2000m and below.	
7.3.7.4.2	Electric field homogeneity	Inhomogeneous electric field is considered for PCE	N/A
7.3.7.4.3	Clearance to conductive enclosures		P
7.3.7.5	Creepage distances	(see appended table 7.3.7)	P
7.3.7.5.1	General		P
7.3.7.5.2	Voltage	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 insulating	V-0 and short circuit test are considered	P
7.3.7.8	Solid insulating	(see appended table 7.3.7)	P
7.3.7.8.1	General		P
7.3.7.8.2	Requirements for electrical withstand capability of solid insulation		P
7.3.7.8.2.1	Basic, supplemental, reinforced, and double insulation		P
7.3.7.8.2.2	Functional insulation		P
7.3.7.8.3	Thin sheet or tape material		P
7.3.7.8.3.1	General		P
7.3.7.8.3.2	Material thickness not less than 0,2 mm	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		N/A
7.3.7.8.3.4	Compliance		N/A
7.3.7.8.4	Printed wiring boards		P
7.3.7.8.4.1	General		P
7.3.7.8.4.2	Use of coating materials		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	Internal RCM is used. An external built RCD is not	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	monitoring (RCM) device compatibility	necessary	
	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.	Considered	P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5\ CU^2$	Considered	P
7.4.2	Operator Access Areas	No energized parts accessible to 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	The capacitor inside the equipment stored hazardous energy. A symbol 21 of Annex C is provided.	P
7.5	Electrical tests related to shock hazard	(see appended table 7.5)	P
7.5.1	Impulse voltage test (type test)		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
7.5.2	Voltage test (dielectric strength test)		P
7.5.2.1	Purpose of test		P
7.5.2.2	Value and type of test voltage		P
7.5.2.3	Humidity pre-conditioning		P
7.5.2.4	Performing the voltage test		P
7.5.2.5	Duration of the a.c. or d.c. voltage test		P
7.5.2.6	Verification of the a.c. or d.c. voltage test		P
7.5.3	Partial discharge test		N/A
7.5.4	Touch current measurement (type test)		P
	The touch current shall be measured if required by 7.3.6.3.7 and shall not be greater than 3.5 mA a.c. or 10 mA d.c. or special measures of protection as given in 7.3.6.3.7 are required.	(see appended table 7.3.6.3.7)	P
	For type tests on PCE for which wet locations requirements apply according to 6.1, the humidity pre-conditioning of 4.5 shall be performed immediately prior to the touch current test.		P
7.5.5	Equipment with multiple sources of supply		P
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.	No mechanical hazards under the normal or single fault condition.	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		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	shall be applied on or near the guard.		
8.3	Stability		N/A
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	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.		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.	PCE employed with metal enclosure reduce the risk of ignition and the spread of flame.	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		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	ENCLOSURE:		
	– 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;		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;		N/A
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and	Enclosed relay	N/A
	– insulated wiring, except as permitted in 9.1.2.2.	PVC wire	N/A
9.1.2.2	Parts not requiring a fire enclosure	Metal enclosure	N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures		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.		P
9.1.3.4	Materials for components and other parts inside fire		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	enclosures		
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		N/A
	The requirements of 9.1.4.3 do not apply to FIXED EQUIPMENT intended only for use in a CLOSED ELECTRICAL OPERATING AREA and to be mounted on a concrete floor or other non-combustible surface. Such equipment shall be marked as follows:		N/A
	WARNING: FIRE HAZARD SUITABLE FOR MOUNTING ON CONCRETE OR OTHER NON-COMBUSTIBLE SURFACE ONLY		N/A
9.1.4.5	Doors or covers in fire enclosures		N/A
9.1.4.6	Additional requirements for openings in transportable equipment		N/A
9.2	LIMITED POWER SOURCES		N/A
9.2.1	General		N/A
9.2.2	Limited power source tests		N/A
9.3	Short-circuit and overcurrent protection		P
9.3.1	General		P
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and	The circumstances of short-circuitand overcurrent are protected by the circuits	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.	design. When short-circuit orovercurrent of components occurred,the PCE will shutdown and disconnect from the grid immediately.	
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.	DC wire are designed for the short circuit rating of the array Short-circuit was occurred at Battery input, battery would alarm and open, no hazards.	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 sonic pressure hazards.	N/A
10.2	Sonic pressure and Sound level		N/A
10.2.1	Hazardous Noise Levels		N/A
11	**PROTECTION AGAINST LIQUID HAZARDS**		N/A
11.1	Liquid Containment, Pressure and Leakage		N/A
	The liquid containment system components shall be compatible with the liquid to be used.		N/A
	There shall be no leakage of liquid onto live parts as a result of:		N/A
	a) Normal operation, including condensation;		N/A
	b) Servicing of the equipment; or		N/A
	c) Inadvertent loosening or detachment of hoses or other cooling system parts over time.		N/A
11.2	Fluid pressure and leakage		N/A
11.2.1	Maximum pressure		N/A
11.2.2	Leakage from parts		N/A
11.2.3	Overpressure safety device		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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		P
	Handles, knobs, grips, levers and the like shall be reliably fixed so that they will not work loose in normal use, if this might result in a hazard. Sealing compounds and the like, other than self-hardening resins, shall not be used to prevent loosening. If handles, knobs and the like are used to indicate the position of switches or similar components, it shall not be possible to fix them in a wrong position if this might result in hazard.	DC breaker holder for manual controls.	P
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 PV 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
13.3.2.2	Permanently connected equipment		P
13.3.2.3	Appliance inlets		N/A
13.3.2.4	Power supply cord	Battery supply cord used.	P
13.3.2.5	Cord anchorages and strain relief	Cable gland used	P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	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	DC, AC and battery 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		P
13.3.5	Wire bending space for wires 10 mm² and greater		P
13.3.6	Disconnection from supply sources	The explanations are provided in theinstallation manual.	P
13.3.7	Connectors, plugs and sockets	The misconnection is unlikely for PVDC connectors and AC output connector.	P
13.3.8	Direct plug-in equipment	Permanently equipment.	N/A
13.4	Internal wiring and connections		P
13.4.1	General	All wires were used suitably and are fixed well to prevent mechanical damage during installation.	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		N/A
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
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		P
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		N/A
13.8.1	General	The metal enclosure complied with13.7.	P
13.8.2	Cast metal		N/A
13.8.3	Sheet metal		N/A
14	**COMPONENTS**		P
14.1	General	(see appended table 14)	P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional		P

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	applicable safety requirements of the relevant IEC component standard;		
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P
	Components such as optocouplers, capacitors, transformers, and relays connected across basic, supplemental, reinforced, or double insulation shall comply with the requirements applicable for the grade of insulation being bridged, and if not previously certified to the applicable component safety standard shall be subjected to the voltage test of 7.5.2 as routine test.		P
14.2	Motor Over temperature Protection		N/A
	Motors which, when stopped or prevented from starting (see 4.4.4.3), would present an electric shock HAZARD, a temperature HAZARD, or a fire HAZARD, shall be protected by an over temperature or thermal protection device meeting the requirements of 14.3.		N/A
14.3	Over temperature protection devices		N/A
14.4	Fuse holders		N/A
14.5	MAINS voltage selecting devices		N/A
14.6	Printed circuit boards		P
	Printed circuit boards shall be made of material with a flammability classification of V-1 of IEC 60707 or better.	V-0	P
	This requirement does not apply to thin-film flexible printed circuit boards that contain only circuits powered from limited power sources meeting the requirements of 9.2.		P
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.		P
14.7	Circuits or components used as transient overvoltage limiting devices		N/A
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be		N/A

IEC 62109-1			
Clause	Requirement – Test	Result – Remark	Verdict
	spaced up to 1 min apart.		
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.	Sealed lead acid battery, Vented battery, Gel battery and lithium battery of external battery pack (EBP) used. The detail installation and maintenance explanations are provided in the manufacturer's EBP of manual.	N/A
14.8.1	Battery Enclosure Ventilation	The detail installation andmaintenance explanations areprovided in the manufacturer's EBPof manual	N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the required value in 5 to 10 s, and is to be maintained at that value for 1 min. A non-metallic rack or tray shall be tested at the highest normal condition operating temperature.		N/A
14.8.3	Electrolyte spillage		N/A
	Battery trays and cabinets shall have an electrolyte-resistant coating.		N/A
	The ENCLOSURE or compartment housing a VENTED BATTERY shall be constructed so that spillage or leakage of the electrolyte from one battery will be contained within the ENCLOSURE and be prevented from:		N/A
	a) reaching the PCE outer surfaces that can be contacted by the USER		N/A
	b) contaminating adjacent electrical components or materials; and		N/A
	c) bridging required electrical distances		N/A
14.8.4	Battery Connections		N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for		N/A

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

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

4.2.2.6/4.7	TABLE: mains supply electrical data in normal condition/ Electrical ratings test					P
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) AC	P (W) AC
PV Input mode						
HYD 6000-ES	90Vdc	7.223	646	230V	2.936	590
HYD 6000-ES	300Vdc	20.739	6225	230V	25.789	5954
HYD 6000-ES	360Vdc	17.274	6169	230V	25.824	5961
HYD 6000-ES	520Vdc	12.096	6234	230V	26.208	6014
HYD 6000-ES	580Vdc	0.528	299	230V	1.721	265
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) DC	P (W) DC
PV charging mode						
HYD 6000-ES	90Vdc	7.225	647	46Vdc	11.804	543
HYD 6000-ES	300Vdc	10.646	3208	46Vdc	64.989	2985
HYD 6000-ES	360Vdc	8.858	3174	46Vdc	64.981	2990
HYD 6000-ES	520Vdc	6.155	3197	46Vdc	64.964	2987
HYD 6000-ES	580Vdc	0.519	299	46Vdc	5.132	236
HYD 6000-ES	90Vdc	7.165	646	48Vdc	11.409	548
HYD 6000-ES	300Vdc	10.740	3212	48Vdc	62.780	3011
HYD 6000-ES	360Vdc	8.936	3214	48Vdc	63.000	3023
HYD 6000-ES	520Vdc	6.179	3215	48Vdc	62.799	3011
HYD 6000-ES	580Vdc	0.519	297	48Vdc	4.904	235
HYD 6000-ES	90Vdc	7.223	647	58Vdc	9.256	539
HYD 6000-ES	300Vdc	10.619	3191	58Vdc	51.439	2993
HYD 6000-ES	360Vdc	8.907	3214	58Vdc	51.856	3017
HYD 6000-ES	520Vdc	6.201	3217	58Vdc	52.320	3042
HYD 6000-ES	580Vdc	0.515	297	58Vdc	4.029	234
Type	U (V)	I (A) AC	P (W) AC	U (V)	I (A) DC	P (W) DC
AC charging mode						
HYD 6000-ES	207Vac	15.712	3241	46Vdc	64.924	2976
HYD 6000-ES	230Vac	14.110	3234	46Vdc	64.904	2978
HYD 6000-ES	253Vac	12.847	3230	46Vdc	64.921	2979
HYD 6000-ES	207Vac	16.001	3296	48Vdc	63.006	3033
HYD 6000-ES	230Vac	14.348	3285	48Vdc	63.014	3034
HYD 6000-ES	253Vac	13.053	3279	48Vdc	63.031	3035
HYD 6000-ES	207Vac	15.948	3277	58Vdc	52.073	3032
HYD 6000-ES	230Vac	14.280	3261	58Vdc	52.064	3032
HYD 6000-ES	253Vac	12.931	3248	58Vdc	52.044	3030
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) AC	P (W) AC
Battery discharging mode						
HYD 6000-ES	46Vdc	69.977	3221	207Vac	14.851	2989
HYD 6000-ES	46Vdc	69.945	3219	230Vac	13.459	2992
HYD 6000-ES	46Vdc	69.948	3220	253Vac	12.279	2990
HYD 6000-ES	48Vdc	66.861	3224	207Vac	14.851	2995
HYD 6000-ES	48Vdc	66.998	3222	230Vac	13.447	2998
HYD 6000-ES	48Vdc	66.974	3222	253Vac	12.305	2996
HYD 6000-ES	58Vdc	56.462	3245	207Vac	15.013	3011
HYD 6000-ES	58Vdc	56.415	3245	230Vac	13.990	3019
HYD 6000-ES	58Vdc	56.426	3244	253Vac	12.403	3024
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) AC	P (W) AC
PV input for battery charging and AC output mode						
HYD 6000-ES	90Vdc	7.208	646	230Vac	0.010	2
HYD 6000-ES				46Vdc	11.891	548

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

HYD 6000-ES	300Vdc	20.66	6212	230Vac	12.615	2880
HYD 6000-ES				46Vdc	64.941	2989
HYD 6000-ES	360Vdc	17.376	6216	230Vac	12.911	2954
HYD 6000-ES				46Vdc	64.970	2990
HYD 6000-ES	520Vdc	12.029	6231	230Vac	13.014	2956
HYD 6000-ES				46Vdc	64.986	2988
HYD 6000-ES	580Vdc	0.519	298	230Vac	0.015	2
HYD 6000-ES				46Vdc	5.133	236
HYD 6000-ES	90Vdc	7.199	646	230Vac	0.010	2
HYD 6000-ES				48Vdc	11.496	549
HYD 6000-ES	300Vdc	20.738	6214	230Vac	12.676	2895
HYD 6000-ES				48Vdc	62.402	2995
HYD 6000-ES	360Vdc	17.291	6225	230Vac	12.749	2911
HYD 6000-ES				48Vdc	62.464	2997
HYD 6000-ES	520Vdc	12.024	6232	230Vac	12.83	2909
HYD 6000-ES				48Vdc	63.358	3037
HYD 6000-ES	580Vdc	0.520	299	230Vac	0.010	2
HYD 6000-ES				48Vdc	4.924	236
HYD 6000-ES	90Vdc	7.151	646	230Vac	0.010	2
HYD 6000-ES				58Vdc	9.396	548
HYD 6000-ES	300Vdc	20.776	6216	230Vac	12.708	2899
HYD 6000-ES				58Vdc	51.45	2999
HYD 6000-ES	360Vdc	17.318	6226	230Vac	12.883	2936
HYD 6000-ES				58Vdc	51.388	2995
HYD 6000-ES	520Vdc	12.035	6230	230Vac	13.158	2990
HYD 6000-ES				58Vdc	51.379	2992
HYD 6000-ES	580Vdc	0.515	297	230Vac	0.010	2
HYD 6000-ES				58Vdc	3.950	230
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) AC	P (W) AC
PV Input mode						
HYD 3000-ES	90Vdc	13.136	1185	230V	4.984	1094
HYD 3000-ES	160Vdc	19.706	3164	230V	13.099	2990
HYD 3000-ES	360Vdc	8.701	3134	230V	13.182	3011
HYD 3000-ES	520Vdc	6.074	3102	230V	13.217	2999
HYD 3000-ES	580Vdc	0.317	177	230V	1.274	149
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) DC	P (W) DC
PV charging mode						
HYD 3000-ES	90Vdc	13.286	1186	46Vdc	23.001	1059
HYD 3000-ES	160Vdc	19.638	3159	46Vdc	62.903	2892
HYD 3000-ES	360Vdc	8.652	3124	46Vdc	63.301	2908
HYD 3000-ES	520Vdc	6.089	3156	46Vdc	64.303	2951
HYD 3000-ES	580Vdc	0.308	177	46Vdc	2.562	118
HYD 3000-ES	90Vdc	13.131	1184	48Vdc	22.018	1060
HYD 3000-ES	160Vdc	19.813	3166	48Vdc	60.312	2901
HYD 3000-ES	360Vdc	8.670	3125	48Vdc	60.603	2913
HYD 3000-ES	520Vdc	6.033	3127	48Vdc	61.010	2930
HYD 3000-ES	580Vdc	0.313	176	48Vdc	2.549	123
HYD 3000-ES	90Vdc	13.068	1182	58Vdc	18.144	1056
HYD 3000-ES	160Vdc	19.769	3165	58Vdc	50.304	2923
HYD 3000-ES	360Vdc	8.844	3194	58Vdc	51.682	3002
HYD 3000-ES	520Vdc	6.089	3157	58Vdc	51.488	2988
HYD 3000-ES	580Vdc	0.316	178	58Vdc	2.059	120

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

Type	U (V)	I (A) AC	P (W) AC	U (V)	I (A) DC	P (W) DC
AC charging mode						
HYD 3000-ES	207Vac	15.887	3265	46Vdc	64.89	2995
HYD 3000-ES	230Vac	14.359	3276	46Vdc	64.818	2991
HYD 3000-ES	253Vac	13.033	3262	46Vdc	64.919	2993
HYD 3000-ES	207Vac	15.858	3263	48Vdc	62.454	3000
HYD 3000-ES	230Vac	14.339	3273	48Vdc	62.561	3004
HYD 3000-ES	253Vac	13.017	3257	48Vdc	62.648	3010
HYD 3000-ES	207Vac	15.921	3269	58Vdc	51.543	2993
HYD 3000-ES	230Vac	14.316	3258	58Vdc	51.64	2999
HYD 3000-ES	253Vac	13.079	3271	58Vdc	51.539	2993
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) AC	P (W) AC
Battery discharging mode						
HYD 3000-ES	46Vdc	69.983	3222	207Vac	14.840	2991
HYD 3000-ES	46Vdc	69.942	3220	230Vac	13.451	2990
HYD 3000-ES	46Vdc	69.913	3220	253Vac	12.285	2990
HYD 3000-ES	48Vdc	66.811	3222	207Vac	14.840	2995
HYD 3000-ES	48Vdc	67.011	3223	230Vac	13.444	2998
HYD 3000-ES	48Vdc	67.001	3222	253Vac	12.316	2997
HYD 3000-ES	58Vdc	56.432	3245	207Vac	15.025	3012
HYD 3000-ES	58Vdc	56.422	3244	230Vac	13.65	3019
HYD 3000-ES	58Vdc	56.395	3243	253Vac	12.425	3023
Type	U (V)	I (A) DC	P (W) DC	U (V)	I (A) AC	P (W) AC
PV input for battery charging and AC output mode						
HYD 3000-ES	90Vdc	13.289	1185	230Vac	0.012	1
HYD 3000-ES				46Vdc	23.011	1060
HYD 3000-ES	160Vdc	19.641	3160	230Vac	0.013	2
HYD 3000-ES				46Vdc	62.913	2893
HYD 3000-ES	360Vdc	8.649	3123	230Vac	0.012	2
HYD 3000-ES				46Vdc	63.307	2909
HYD 3000-ES	520Vdc	6.089	3157	230Vac	0.01	1
HYD 3000-ES				46Vdc	64.282	2950
HYD 3000-ES	580Vdc	0.315	177	230Vac	0	0
HYD 3000-ES				46Vdc	2.667	123
HYD 3000-ES	90Vdc	13.238	1186	230Vac	0	0
HYD 3000-ES				48Vdc	22.014	1060
HYD 3000-ES	160Vdc	19.374	3144	230Vac	0	0
HYD 3000-ES				48Vdc	60.303	2900
HYD 3000-ES	360Vdc	8.670	3125	230Vac/50Hz	0	0
HYD 3000-ES				48Vdc	60.598	2912
HYD 3000-ES	520Vdc	6.001	3125	230Vac	0	0
HYD 3000-ES				48Vdc	60.996	2930
HYD 3000-ES	580Vdc	0.312	178	230Vac	0.015	3
HYD 3000-ES				48Vdc	2.533	123
HYD 3000-ES	90Vdc	13.255	1186	230Vacz	0	0
HYD 3000-ES				58Vdc	18.145	1056
HYD 3000-ES	160Vdc	19.768	3165	230Vac	0	0
HYD 3000-ES				58Vdc	50.289	2922
HYD 3000-ES	360Vdc	8.843	3193	230Vac	0	0
HYD 3000-ES				58Vdc	51.667	3000
HYD 3000-ES	520Vdc	6.088	3157	230Vac	0	0
HYD 3000-ES				58Vdc	51.47	2987

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

HYD 3000-ES	580Vdc	0.32	178	230Vac	0	0
HYD 3000-ES				58Vdc	2.061	120

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

4.3 TABLE: Thermal testing (PV input for all AC output mode)					P
Model :	HYD 6000-ES				—
temperature t of part/at:	t (°C)				permitted t (°C)
test Condition :	300Vdc,20.7A; 230Vac,25.8A	300Vdc,10.7A; 230Vac,13.0A	520Vdc,12.1A; 230Vac, 26.2A	520Vdc, 6.15A; 230Vac,13.0A	—
Ambient	45.86	60.61	46.90	60.54	—
Battery input connector	55.28	62.77	55.20	61.48	120
PV input line	56.99	62.68	55.90	61.29	105
Battery input line	55.17	63.31	55.70	62.07	105
DC switch body	58.39	63.61	58.60	62.45	70
T2 winding	63.97	67.99	65.30	66.50	110
R534 for PCB	66.13	69.19	67.60	67.79	130
D134 for PCB	66.06	69.20	67.50	67.79	130
Q18 for PCB	86.10	76.50	79.70	72.95	130
Q17 for PCB	76.81	73.77	78.30	72.07	130
Q22 for PCB	76.77	73.88	78.60	72.27	130
Capacitor EC2	66.44	69.43	67.90	67.97	105
D13 for PCB	91.62	80.04	89.80	76.51	130
Q26 for PCB	105.26	86.89	103.90	84.09	130
Optocoupler U2	88.83	79.46	87.90	77.10	100
R30 for PCB	85.02	76.45	86.30	76.74	130
Q25 for PCB	108.09	87.72	106.00	85.28	130
Q12 for PCB	87.43	77.35	88.30	75.88	130
Q7 for PCB	86.10	76.83	87.80	75.37	130
Q6 for PCB	104.90	84.41	108.10	81.94	130
Q5 for PCB	105.10	84.29	108.50	81.27	130
Film capacitor C13	75.30	72.95	77.60	71.25	105
L8 winding	78.60	73.97	78.10	72.31	110
L8 core	75.68	73.95	78.30	72.10	110
Q8	74.10	73.72	76.40	72.01	130
Q14	76.12	73.55	79.00	71.93	130
Capacitor C8	73.06	73.61	75.00	71.98	130
Relay RY3 enclosure	75.20	74.17	77.30	72.72	85
T3 body	78.04	75.66	82.40	76.17	130

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

Power PCB	62.37	66.65	63.40	65.23	130
T1 winding	77.05	78.74	80.50	78.68	110
T1 core	78.15	79.84	81.90	80.05	110
Master DSP	72.42	76.18	73.60	74.59	105
AC connector	58.14	63.54	58.60	62.13	105
AC_L line	62.61	64.98	63.10	63.56	105
Power PCB	64.24	67.10	65.90	65.94	130
PV connector	45.98	60.70	45.50	61.32	90
CF375	64.04	67.00	65.70	65.69	105
DC swtich knob	47.65	61.81	48.00	61.11	70
C4	85.10	77.09	85.60	74.48	105
PF18 line	71.07	70.43	72.40	68.77	120
INV L Line	90.75	76.45	95.40	75.59	105
C107	75.54	71.76	76.80	70.01	100
L9 winding	82.01	73.54	83.70	72.01	110
L10 winding	78.60	74.06	79.60	72.39	110
C94	77.17	73.76	78.70	71.93	110
RL3	75.29	72.66	73.40	70.89	85
R297	72.21	71.72	76.30	70.01	155
L8 winding	75.73	69.98	73.50	68.09	110
L15 winding	67.04	66.96	77.50	64.72	110
C142	66.09	67.45	63.60	65.67	105
UC32	69.90	69.73	65.20	68.20	125
Output PCB	97.11	79.76	69.10	77.06	130
INV inductor L	103.10	81.57	106.10	81.34	110
INV inductor N	104.06	82.94	106.50	82.18	110
BOOST inductor 1	99.74	83.17	95.90	77.95	110
BOOST inductor 1	98.10	82.43	92.70	77.00	110
Displayer	62.17	65.32	62.50	63.78	75
Mounting bracket	66.04	67.68	67.60	65.77	90

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

4.3 TABLE: Thermal testing (PV input for battery charging and AC output mode)					P
Model :	HYD 6000-ES				—
temperature t of part/at:	t (°C)				permitted t (°C)
test Condition :	300Vdc,20.6A; 230Vac,12.6A	300Vdc,11.0A; 230Vac,13.4A	520Vdc,12.0A; 230Vac, 13.0A	520Vdc, 6.2A; 230Vac,13.4A	—
Ambient	45.73	60.42	45.59	60.29	—
Battery input connector	51.22	64.93	54.17	61.11	120
PV input line	59.89	64.14	55.05	61.54	105
Battery input line	50.30	65.22	53.68	61.14	105
DC switch body	61.78	65.24	57.62	62.81	70
T2 winding	71.61	75.83	58.82	73.80	110
R534 for PCB	68.98	76.94	58.49	72.83	130
D134 for PCB	66.00	73.75	57.72	71.73	130
Q18 for PCB	69.14	78.26	56.73	73.19	130
Q17 for PCB	73.88	80.39	58.50	74.67	130
Q22 for PCB	73.94	79.68	59.22	75.14	130
Capacitor EC2	65.85	75.03	58.27	73.11	105
D13 for PCB	88.84	83.98	62.91	75.77	130
Q26 for PCB	102.35	91.11	60.97	75.31	130
Optocoupler U2	86.09	83.72	62.56	76.24	100
R30 for PCB	82.62	91.75	64.23	84.59	130
Q25 for PCB	111.17	92.14	62.43	75.93	130
Q12 for PCB	84.50	83.31	63.02	77.62	130
Q7 for PCB	83.48	89.80	64.61	80.48	130
Q6 for PCB	108.40	83.87	78.37	82.92	130
Q5 for PCB	108.10	82.27	78.54	82.47	130
Film capacitor C13	79.40	74.63	63.30	74.20	105
L8 winding	73.54	77.39	63.95	76.73	110
L8 core	73.81	77.12	64.43	77.04	110
Q8	71.30	79.60	59.79	76.93	130
Q14	73.25	79.36	60.82	77.02	130
Capacitor C8	76.60	76.98	61.12	76.05	130
Relay RY3 enclosure	82.60	76.44	62.64	75.85	85
T3 body	81.48	76.84	67.95	80.16	130

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

Power PCB	60.04	71.85	53.20	68.75	130
T1 winding	80.81	80.45	69.04	81.87	110
T1 core	81.95	81.60	70.61	83.54	110
Master DSP	75.93	78.36	70.66	76.70	105
AC connector	62.05	63.69	57.13	63.00	105
AC_L line	66.58	65.13	59.88	64.16	105
Power PCB	61.83	72.98	54.16	68.20	130
PV connector	46.26	60.72	47.30	60.51	90
CF375	61.54	69.99	62.14	68.88	105
DC swtich knob	46.67	62.09	48.00	60.57	70
C4	88.86	77.30	75.25	75.85	105
PF18 line	68.56	76.02	57.62	72.82	120
INV L Line	93.73	74.91	77.52	76.69	105
C107	79.15	71.89	68.84	71.94	100
L9 winding	85.35	73.36	72.44	73.91	110
L10 winding	81.26	73.72	70.66	74.00	110
C94	79.93	73.27	70.49	74.00	110
RL3	79.19	73.47	68.32	72.01	85
R297	75.36	71.79	67.27	71.40	155
L8 winding	79.14	69.08	66.82	69.95	110
L15 winding	77.28	68.30	60.08	65.69	110
C142	69.78	68.51	62.16	66.93	105
UC32	73.43	71.56	63.87	70.19	125
Output PCB	99.37	77.44	80.13	78.82	130
INV inductor L	105.59	78.74	85.88	81.95	110
INV inductor N	106.86	80.48	86.80	84.23	110
BOOST inductor 1	104.15	83.98	78.64	82.90	110
BOOST inductor 1	102.51	84.73	77.26	81.27	110
Displayer	65.28	66.03	59.32	65.46	75
Mounting bracket	68.74	69.23	56.36	69.58	90

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

4.3 TABLE: Thermal testing (AC charging mode)					P
Model :	HYD 6000-ES				—
temperature t of part/at:	t (°C)				permitted t (°C)
test Condition :	207Vac,15.7A; 48Vdc, 63A	207Vac,9.5A; 48Vdc,45A	253Vac,13.1A; 48Vdc,63A	253Vac,8.0A; 48Vdc,45A	—
Ambient	45.02	60.85	45.04	60.14	—
Battery input connector	54.55	61.86	52.59	61.71	120
PV input line	52.23	62.39	52.62	61.89	105
Battery input line	59.11	62.77	52.00	62.49	105
DC switch body	55.68	63.47	55.88	63.25	70
T2 winding	70.48	77.52	67.06	73.84	110
R534 for PCB	77.65	80.31	65.95	73.67	130
D134 for PCB	72.17	73.81	65.03	72.03	130
Q18 for PCB	79.50	73.92	62.48	73.65	130
Q17 for PCB	81.60	74.39	63.34	74.39	130
Q22 for PCB	81.39	74.24	63.64	74.14	130
Capacitor EC2	70.82	74.76	66.37	73.01	105
D13 for PCB	72.99	72.13	63.25	72.03	130
Q26 for PCB	74.14	72.58	64.00	72.62	130
Optocoupler U2	77.74	73.61	67.19	73.92	100
R30 for PCB	89.52	82.05	70.67	83.20	130
Q25 for PCB	73.59	72.24	63.96	72.11	130
Q12 for PCB	77.30	74.53	64.82	74.59	130
Q7 for PCB	95.60	82.23	66.31	82.26	130
Q6 for PCB	81.14	75.50	65.94	75.10	130
Q5 for PCB	78.92	74.92	64.80	74.42	130
Film capacitor C13	71.05	71.75	69.21	72.08	105
L8 winding	78.27	74.36	71.75	74.65	110
L8 core	77.58	73.91	72.85	74.57	110
Q8	75.77	76.35	66.17	76.19	130
Q14	76.52	75.84	65.45	75.62	130
Capacitor C8	72.66	74.91	67.77	75.07	130
Relay RY3 enclosure	71.96	74.42	67.41	74.63	85
T3 body	72.56	76.35	70.16	77.06	130

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

Power PCB	73.63	69.38	61.10	69.58	130
T1 winding	73.76	79.28	73.47	80.11	110
T1 core	75.11	80.32	74.96	81.39	110
Master DSP	70.09	76.96	67.91	77.22	105
AC connector	52.78	64.02	51.75	63.32	105
AC_L line	55.18	64.82	53.42	64.19	105
Power PCB	90.01	69.03	60.87	69.76	130
PV connector	45.43	61.23	45.92	60.51	90
CF375	83.15	68.09	64.27	68.23	105
DC swtich knob	45.64	61.06	45.66	61.57	70
C4	72.52	71.10	70.24	71.51	105
PF18 line	105.34	71.81	64.57	72.04	120
INV L Line	72.86	71.23	65.98	71.13	105
C107	67.00	69.22	65.67	69.70	100
L9 winding	69.37	70.62	66.65	71.18	110
L10 winding	68.80	72.10	66.75	72.63	110
C94	68.19	72.30	66.46	72.98	110
RL3	67.69	71.13	64.06	71.58	85
R297	65.51	70.66	64.31	70.99	155
L8 winding	63.22	67.87	59.94	68.05	110
L15 winding	58.31	65.91	58.54	66.02	110
C142	60.46	66.89	60.92	67.11	105
UC32	64.76	69.09	62.72	69.27	125
Output PCB	74.70	75.19	68.98	75.53	130
INV inductor L	78.35	73.64	70.02	73.47	110
INV inductor N	79.44	73.89	71.79	74.02	110
BOOST inductor 1	77.11	73.30	73.58	73.93	110
BOOST inductor 1	77.15	73.54	73.70	74.07	110
Displayer	58.77	65.64	58.45	65.84	75
Mounting bracket	62.44	69.26	57.68	68.71	90

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

4.3 TABLE: Thermal testing (Battery discharging mode)					P
Model :	HYD 6000-ES				—
temperature t of part/at:	t (°C)				permitted t (°C)
test Condition :	46Vdc,70A; 230Vac, 13.5A	46Vdc,45.0A; 230Vac, 9.5A	58Vdc,56A; 230Vac, 14.0A	58Vdc,37A; 230Vac, 9.0A	—
Ambient	45.51	60.12	45.07	60.03	—
Battery input connector	47.55	63.78	59.30	62.00	120
PV input line	47.29	62.15	54.93	62.24	105
Battery input line	47.34	65.43	64.97	63.21	105
DC switch body	48.54	63.60	57.89	63.19	70
T2 winding	62.28	77.09	74.19	74.52	110
R534 for PCB	63.11	79.94	84.66	76.30	130
D134 for PCB	61.83	78.40	76.60	73.63	130
Q18 for PCB	50.83	77.99	84.92	76.78	130
Q17 for PCB	50.71	78.89	86.96	77.93	130
Q22 for PCB	50.98	79.63	87.07	78.62	130
Capacitor EC2	59.27	74.50	74.39	73.49	105
D13 for PCB	50.43	73.51	74.56	72.88	130
Q26 for PCB	50.77	74.14	75.95	73.59	130
Optocoupler U2	52.35	76.81	83.01	76.49	100
R30 for PCB	52.29	86.64	89.36	84.08	130
Q25 for PCB	50.58	74.94	75.88	74.26	130
Q12 for PCB	50.80	87.15	96.72	85.43	130
Q7 for PCB	51.25	81.06	87.55	79.84	130
Q6 for PCB	51.65	77.15	81.30	77.02	130
Q5 for PCB	51.10	76.17	80.09	75.88	130
Film capacitor C13	55.57	71.17	73.03	71.87	105
L8 winding	55.96	75.61	81.92	75.91	110
L8 core	56.49	75.29	81.33	75.80	110
Q8	52.67	74.58	74.03	73.53	130
Q14	51.27	74.01	73.99	73.14	130
Capacitor C8	54.84	73.33	73.68	73.28	130
Relay RY3 enclosure	54.52	72.82	72.34	73.06	85
T3 body	53.46	73.14	71.65	74.92	130

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

Power PCB	51.65	73.30	81.74	72.65	130
T1 winding	59.43	77.27	74.58	78.86	110
T1 core	60.25	78.44	76.15	80.14	110
Master DSP	59.50	75.62	71.51	76.34	105
AC connector	47.46	62.63	54.36	63.28	105
AC_L line	48.20	63.71	56.92	64.05	105
Power PCB	50.71	76.36	89.99	75.06	130
PV connector	46.27	60.97	45.90	60.97	90
CF375	50.47	73.61	82.89	72.51	105
DC swtich knob	45.78	61.95	45.96	61.05	70
C4	56.79	70.79	73.98	72.30	105
PF18 line	51.30	83.20	106.95	81.33	120
INV L Line	51.79	70.32	72.62	70.99	105
C107	53.80	68.55	68.82	68.98	100
L9 winding	54.59	69.85	70.86	70.43	110
L10 winding	54.46	70.48	69.91	71.72	110
C94	53.19	70.93	69.68	72.26	110
RL3	51.23	71.46	70.08	71.60	85
R297	54.05	69.75	66.94	70.35	155
L8 winding	50.91	66.51	64.60	67.44	110
L15 winding	50.52	65.00	59.93	65.29	110
C142	51.94	65.78	62.02	66.30	105
UC32	52.45	68.58	66.66	68.56	125
Output PCB	53.46	73.58	75.23	74.49	130
INV inductor L	52.59	73.97	76.10	74.01	110
INV inductor N	53.39	75.28	78.27	75.17	110
BOOST inductor 1	54.41	75.82	78.01	75.25	110
BOOST inductor 1	54.20	76.24	78.35	75.68	110
Displayer	49.73	64.21	60.42	65.19	75
Mounting bracket	48.54	66.86	61.46	67.63	90
Supplementary information:					

	TABLE: Heating test, resistance method	N/A

Temperature rise of winding	**R_1 (Ω)**	**R_2 (Ω)**	**ΔT (K)**	**Max. dT (K)**	**Insulation class**
Supplementary information:					

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

.4	TABLE: fault condition tests		P
	ambient temperature (°C) .....:	24.6	—

No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
1	Relay RY1 defect	Short circuit before energize d	Input:520V dc Output:230 Vac	10min	--	--	Indicate Relay fault, error code “ID55” (RecoverRelayFail). Do not connect to AC mainsn. No damage, no hazards.
2	Relay RY2 defect	Short circuit before energize d	Input:520V dc Output:230 Vac	10min	--	--	Indicate Relay fault, error code “ID55” (RecoverRelayFail). Do not connect to AC mainsn. No damage, no hazards.
3	Relay RY3 defect	Short circuit before energize d	Input:520V dc Output:230 Vac	10min	--	--	Indicate Relay fault, error code “ID55” (RecoverRelayFail). Do not connect to AC mainsn. No damage, no hazards.
4	Relay RY4 defect	Short circuit before energize d	Input:520V dc Output:230 Vac	10min	--	--	Indicate Relay fault, error code “ID55” (RecoverRelayFail). Do not connect to AC mainsn. No damage, no hazards.
5	Relay RY5 defect	Short circuit before energize d	Input:520V dc Output:230 Vac	10min	--	--	Indicate Relay fault, error code “ID55” (RecoverRelayFail). Do not connect to AC mainsn. No damage, no hazards.
6	Relay RY6 defect	Short circuit before energize d	Input:520V dc Output:230 Vac	10min	--	--	Indicate Relay fault, error code “ID55” (RecoverRelayFail). Do not connect to AC mainsn. No damage, no hazards.
7	Monitoring voltage defect R508	short	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid. Q59 damage. No hazards.

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

8	Monitoring voltage defect Q59 pin 1-2	short	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid , error code “ID55” (RecoverRelayFail). No damage, no hazards.
9	Monitoring voltage defect U46 pin 1-2	short	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid , error code “ID55” (RecoverRelayFail). U46 damage, no hazards.
10	Monitoring voltage defect R511	short	Input:520V dc Output:230 Vac	23mins	--	--	Output a.c. relays operated, disconnected with grid , error code “ID55” (RecoverRelayFail). U46 damage, no hazards.
11	Monitoring voltage defect R509	open	Input:520V dc Output:230 Vac	10min	--	--	The unit was in check state. No damage. No hazards.
12	Monitoring voltage defect U46 pin 3-4	short	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid , error code “ID55” (RecoverRelayFail). U46 damage, no hazards.
13	Voltage measurement disabled R204	Open	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid , error code “ID01” (The grid voltage is too high). No damage. No hazards.
14	L to N (grid)	Short circuit	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid. No damage. No hazards.
15	PV+ to PV-	Short circuit	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid. No damage. No hazards.
16	L to N (off-grid)	Short circuit	Input:58Vdc Output:230 Vac	10min	--	--	No damage. No hazards.

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

17	L to N (off-grid)	Over load	Input:58Vdc Output:230 Vac	10min	--	--	The EUT shut down immediately, indicate over current, error code “over load”. No damage, no hazards.
18	PV+ to PV-	Reverse d	Input:520V dc Output:230 Vac	10min	--	--	Do not connect to AC mains ,can reset by remove fault condition. No damage, no hazards.
19	BAT+ to BAT-	Reverse d	Input:520V dc Output:230 Vac	10min	--	--	Battery did not join to the system. No damage, no hazards.
20	L to N(grid)	Reverse d	Input:520V dc Output:230 Vac	10min	--	--	EUT operationed normally. No damage, no hazards.
21	Loss of control XL1	Short	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid , error code “ID53, ID54” (SPI communication is fault, SCI communication is fault). No damage. No hazards.
22	Loss of control C738(3.3VDD)	Short	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid , error code “ID53, ID54” (SPI communication is fault, SCI communication is fault). No damage. No hazards.
23	Communication microcontroller defect U4 pin1 to pin2	Short	Input:520V dc Output:230 Vac	10min	--	--	Output a.c. relays operated, disconnected with grid , error code “ID53, ID54, ID75” (SPI communication is fault, SCI communication is fault, Unrecoverable EEPROM write). No damage. No hazards.
24	ISO defect R531	Short circuit before energized	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.

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

25	ISO defect R598	Open circuit before energized	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.
26	ISO defect R602	Short circuit before energized	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.
27	ISO defect R605	Open circuit before energized	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.
28	ISO defect R355	Short circuit before energized	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.
29	ISO defect R303	Open circuit before energized	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.
30	ISO defect R307	Short circuit before energized	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.
31	ISO defect U23 pin 13-14	ISO defect U23 pin 13-14	Input:520V dc Output:230 Vac	10min	--	--	Indicate ISO fault, error code “ID56” (The insulation resistance is too low). Do not connect to AC mainsn. No damage, no hazards.

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

32	GFCI defect R292	GFCI defect R292	Input:520V dc Output:230 Vac	10min	--	--	Indicate GFCI fault, error code “ID48” (The GFCI sampling value between the master DSP and slave DSP is not consistent). Do not connect to AC mainsn. No damage, no hazards.
33	GFCI defect R297	GFCI defect R297	Input:520V dc Output:230 Vac	10min	--	--	Indicate GFCI fault, error code “ID48” (The GFCI sampling value between the master DSP and slave DSP is not consistent). Do not connect to AC mainsn. No damage, no hazards.
34	T2 pin 1-3	T2 pin 1-3	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately.The displayer was not wark. No damage, no hazards.
35	T2 pin 5-6	T2 pin 5-6	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately.The displayer was not wark. No damage, no hazards.
36	T2 pin8-7	T2 pin8-7	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately.The displayer was not wark. D84 damaged, no hazards.
37	T2 pin12-10	T2 pin12-10	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately.The displayer was not wark. D86, D134 Ddamaged, no hazards.
38	Q12 pin D-S	Q12 pin D-S	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q12 damaged. No hazards.
39	Q23 pin D-S	Q23 pin D-S	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q23 damaged. No hazards.

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

40	Q16 pin D-S	Short	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q16 damaged. No hazards.
41	Q21 pin D-S	Short	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q21 damaged. No hazards.
42	Q7 pin D-S	Short	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q7 damaged. No hazards.
43	Q9 pin D-S	Short	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q9,Q13 damaged. No hazards.
44	Q13 pin D-S	Short	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q9,Q13 damaged. No hazards.
45	Q4 pin D-S	Short	Input:520V dc Output:230 Vac	10min	--	--	The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q1,Q2,Q3,Q6 damaged. No hazards.
46	Q6 pin D-S	Short	Input:520V dc Output:230 Vac	10min			The EUT shut down immediately, output a.c. relays operated, disconnected with grid. Q1,Q2,Q3,Q6 damaged. No hazards.

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

supplementary information

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

During the test:
Fire do not propagates beyond the PCE;
Equipment do not emitt molten metal;
Enclosures do not deform to cause non-compliance with the standard.

Pass the dielectric test.

Tested on model HYD 6000-ES

7.3.6.3.3	TABLE: protective equipotential bonding ;				N/A
Measured between:	Test current (A)	Voltage drop (V)	Resistance (mΩ)	result	

supplementary information

The alternative of 7.3.6.3.5 was considered.

7.3.6.3.7	TABLE: touch current measurement			P
Measured between:	Measured (mA)	Limit (mA)	Comments/conditions	
Live parts and enclosure	0.16	3.5	N/A	
Live parts and communication ports	2.05	3.5	N/A	

supplementary information

7.3.7	TABLE: clearance and creepage distance measurements						P
clearance cl and creepage distance dcr at / of:	Up (V)	U r.m.s. (V)	required cl (mm)	cl (mm)	required dcr (mm)	dcr (mm)	
Primary circuits to secondary circuits on PCB board (RI)	600Vdc	600V 230	5.5	6.20	5.5	6.20	
Optocoupler pin 1 to pin 3 on PCB board (RI) (U15,U14, U20, U16, U17, U18, U19, U30)	600Vdc	600V 230	5.5	7.70	5.5	7.70	
Primary circuits to secondary circuits on PCB board (RI)	600Vdc	600V 230	6.4	7.60	6.4	7.60	
Primary circuits to earthing on PCB board (BI)	600Vdc	600V 230	3.2	5.50	3.2	5.50	
Y capacitor (C132, C137, C141, C141) to earthing on PCB board (BI)	600Vdc	600V 230	3.2	5.50	3.2	5.50	
Relay (RY3- RY6) two polarity on	600Vdc	600V	3.2	3.30	3.2	3.30	

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

7.3.7	TABLE: clearance and creepage distance measurements						P
PCB board (BI)			230				
Y capacitor (C104,C114, C105, C113) to earthing on PCB board (BI)	600Vdc		600V 230	3.2	5.50	3.2	5.50
Y capacitor (C105,C113,C97,C92) to earthing on PCB board (BI)	600Vdc		600V 230	3.2	5.50	3.2	5.50
Y capacitor (C30, C31) to earthing on PCB board (BI) (Main board)	600Vdc		600V 230	3.2	5.50	4.5	5.50
Primary circuits to earthing on PCB board (BI) (Main board)	600Vdc		600V 230	3.2	5.50	3.2	5.50
Remarks: 1) FI: function insulation BI: Basic insulation SI: Supplementary insulation RI: Reinforced insulation The double side PCB layout is considered and evaluated.							

7.3.7	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)
Optocoupler		230Vac 600Vdc	4594Vdc	--	certified
Insulation sheet		230Vac 600Vdc	4594Vdc	--	0.13

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
DC input terminal to earthed enclosure		2545Vdc	4000	N/A	No breakdown
AC Output terminal to communication port		4240Vdc	6000	N/A	No breakdown
DC input terminal to communication port		4594Vdc	6000	N/A	No breakdown
Battery terminal to earthed enclosure		2545Vdc	4000	N/A	No breakdown
Battery terminal to communication port		4594Vdc	6000	N/A	No breakdown
Insulation sheet		2545Vdc	4000	N/A	No breakdown
One layer of insulation tape		4594Vdc	6000	N/A	No breakdown
Relay pin 3 to pin 4		2545Vdc	4000	N/A	No breakdown

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

9.2	**TABLE: Limited power sources**	N/A

Circuit output tested:

Note: Measured Uoc (V) with all load circuits disconnected:

Components	Sample No.	Uoc (V)	I_{sc} (A)		VA	
			Meas.	Limit	Meas.	Limit

supplementary information:

Sc=Short circuit, Oc=Open circuit

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
Metal Enclosure	Various	Various	Min. thickness : 1.2mm	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Heat-sink (the rear side of enclosure)	Various	Various	Metal, overall measured: L: 445mm, W: 340mm, H: 57.5mm	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
DC breaker	Santon	XBE3310-2-D	650V dc, 25A dc, Max.70℃	EN 60947-3/A1/C1	DEKRA: 2199573.01
(Alternative)	ProJoy Electric SRL.	PEDS150R-HM25-3	25A, 600VDC, Max.75℃	EN 60947-3:2009+A1	TUV R50389807
PV connector	Amphenol Industrial operations	Helios H4 series	1000Vdc, 40A, Max. 90 C, IP 68	DIN V VDE V 0126-3/12.2006	TUV R50157783
(Alternative)	PV-FT-CF-C; PV-FT-CM-C	Phoenix Contact Gmbh & Co.kg	1000Vdc, 40A, Max.85℃, IP65	EN 50521:2008	TUV R60029159
(Alternative)	MC4 Series	Stäubli Electrical Connectors Ltd.	1000Vdc, 39A, Max. 90℃, IP68	EN 50521:2008	TUV R60028286
(Alternative)	H4-RH Bulkhead	Amphenol Technology Co., Ltd	1000Vdc, 39A, Max. 90 C, IP 68	EN 50521	TUV 17011847012
Battery terminal	SHENZHEN SUCCEED ELECTRONICS TECHNOLOGY CO.,LTD	TR100-01-2P	AC600V, 100A, Max. 120 C	UL 1059, UL 486E	UL E332956
Internal wiring (DC-in)	Various	1015	Min.8AWG,600 V,105°C,VW-1	UL 758	UL
Internal wiring (AC-out)	Various	1015	Min.12AWG,60 0V,105°C,VW-1	UL 758	UL
Earthing wire	Various	1015	Min. 12AWG, 600V, 105°C, VW-1	UL 1015	UL
Battery wire	Various	1015	Min.8AWG, 600V, 105°C, VW-1	UL 1015	UL
AC Grid terminal	SHENZHEN SUCCEED	TR-6N-01-NP - XX-T(f)	600V, 50A, Max. 105°C	UL 1059, UL 486E	UL E332956

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
	ELECTRONICS TECHNOLOGY CO.,LTD				
Plastic sheet for Transistors	BERGQUIST CO	K-10#	150°C, VTM-0, min. 0.13mm thickness	UL 94	UL E59150
PCB	Various	Various	Min.130°C, min. V-0, CTI≥175	UL 796	UL
LCD panel	MACDERMID AUTOTYPE LTD	Autotex XE(f2)	105°C, V-0, min. 0.2mm thickness	UL 94 UL 746C	UL E165805
Boost inductor (L1, L2)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L1,2,3	0.84mH, Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Lead wire	Various	Various	10AWG, 600V, 105°C, VW-1	UL 758	UL
Inductor (L4, L5, TX1)	Huizhou Baohui Electronics Technology Co., Ltd	SH-T016	840μH, ClassB	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
- Lead wire	Various	Various	10AWG, 600V, 105°C, VW-1	UL 758	UL
Inductor (L8, L9, L14, L15)	Huizhou Baohui Electronics Technology Co., Ltd	SH-L040	0.5mH, ClassB	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
-Winding	All	All accepted	155°C	UL 1446	UL
-Expoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/B-1	V-0, 130°C	UL 746 UL94	UL E218090
SPS transformer (T1)	Huizhou Baohui Electronics Technology Co., Ltd	SH-T008	Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
-Winding	Various	Various	130°C	UL 1446	UL
--Tape	JINGJIANG YAHUA PRESSURE SENSITIVE GLUE CO LTD	CT-	130°C	UL 510	UL E165111

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
- Margin Tape	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	WF-	130°C	UL 510	UL E165111
-Expoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/B-1	V-0, 130 C	UL 746 UL94	UL E218090
Transformer (TX2,T3)	Huizhou Baohui Electronics Technology Co., Ltd	SH-T010	Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
-Winding	All	All accepted	130 C	UL 1446	UL
- Bobbin	CHANG CHUN PLASTICS CO LTD	PM-9820 PM-9830	V-0, min. thickness: 0.75mm, 150 C	UL 94	UL E41429
- Margin Tape	Jingjiang Yahua Pressure Sensitive Glue Co Ltd	CT-	130°C	UL 510	UL E165111
BUS Capacitor (C1, C2, C3, C4, C7, C8, C9, C10)	Unielecs Co.,LTD	LLN2F102M3550	1000μf, 315V, Max.105℃	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Nichicon Co., Ltd.	LGX2F102MELEZS	1000μf, 315V, Max.105℃	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Nantong jianghai Capacitor Co., Ltd.	ECS2FBB102MVN350050V	1000μf, 315V, Max.105℃	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	LELON ELECTRONICS CORP.	LSK102M2F--A3550	1000μf, 315V, Max.105℃	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
DC-LINK Capacitor (C13)	Xiamen FARA Electronic Co.,Ltd	C3D2H606KF0AC00	60μF, 500V, 105°C	EN61071:2007; EN61881-1:2011	TUV R50266108
Y capacitor (C30,C31,C337)	Shantou High-New Technology Dev. Zone Songtian	CE	10nF, 250Vac, Max.125°C	EN 60384-14:2013; IEC 60384-14(ed.4)	VDE 40025748

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
	Enterprise Co., Ltd				
Y capacitor (C20,C92,C97, C104,C105,C106,C113,C114,C115,C132,C134, C137,C138,C141,C142,C147,C148)	Shantou High-New Technology Dev. Zone Songtian Enterprise Co., Ltd	CD	Y1, 4.7nF, 400Vac, Max.125°C	EN 60384-14:2013; IEC 60384-14(ed.4)	VDE 40025754
X2 capacitor (C103,C112)	Shantou High-New Technology Dev. Zone Songtian Enterprise Co., Ltd	MPX	1μF, 275V, Max.110°C	EN 60384-14:2013; IEC 60384-14(ed.4)	VDE 40034679
Current transducer (HL1)	LEM	CASR 25-NP	IPN: ±25A; Vout: ±5V Max.: 85°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
IGBT (Q1, Q2, Q3, Q4, Q5, Q6, Q7, Q12, Q25, Q26)	Fairchild Semiconductor Corporation	FGA40N65SMD	650V, 40A, 155°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	Fairchild Semiconductor Corporation	FGA60N65SMD	650V, 60A, 155°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	ST Microelectronics	STGWT40H65DFB	650V, 40A, 155°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	IXYS CORPORATION	IXXH40N65B4H1	650V, 40A, 155°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	ST Semiconductor Corporation	STGWT60H65DFB	650V, 60A, Max.150°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
IGBT	Infineon	IKW40N65H5	650V, 46A,	IEC/EN 62109-1	Tested with

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

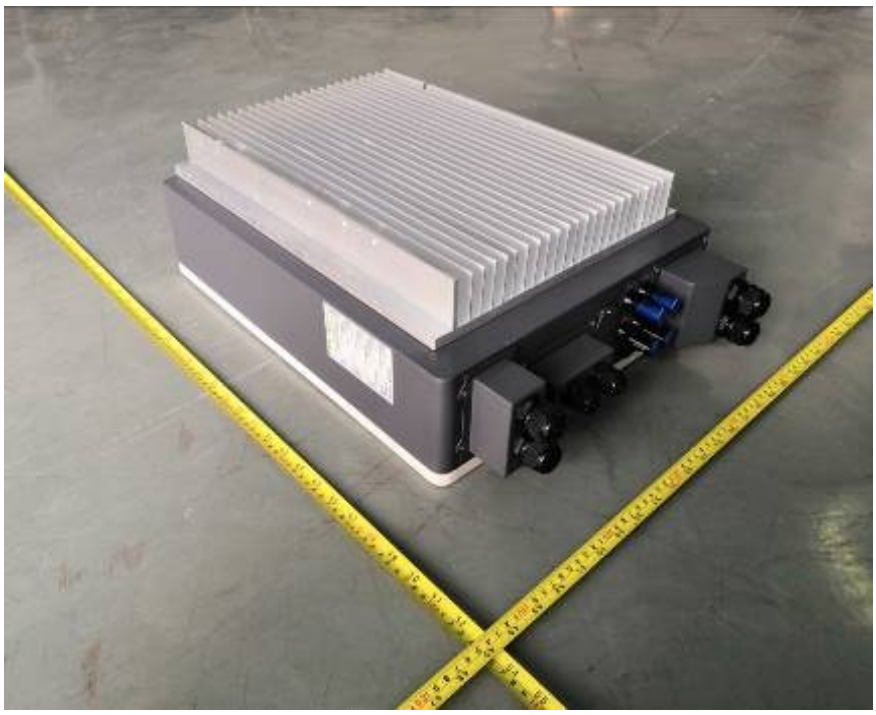
14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
(QD1, QD2, QD3, QD4)	Semiconductor Corporation		155°C	IEC/EN 62109-2	appliance
MOSFET (Q16, Q17, Q18, Q19, Q21, Q22, Q23, Q24)	Fairchild Semiconductor Corporation	FDP027N08B	80V, 120A, 175°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	ST Microelectronics	STP270N8F7	80V, 180A, 155°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Doide (D13、D12)	IXYS CORPORATIO N	DSEI30-06A	37A, 600V, , 155°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
(Alternative)	MICROSEMI CORPORATIO N	APT30DQ60BG	30A, 600V, , 155°C	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
Relay (RL1，RL2，RL3，RL4，RL5，RL6	Xiamen Hongfa Electroacoustics Co., Ltd.	HF161F-W/12-HT	31A, 250Vac, 12Vdc, 85°C	IEC/EN 61810-1	VDE 40031410
(Alternative)	ALFG2PF121	33A,277VAC,12 VDC, Max.85 C	Panasonic Corporation	VDE 0435	VDE 40023067
Optocoupler (U14,U15,U16, U 17,U19,U20)	Liteon optoelectronics	LTV816	Di≧0.4mm, Internall di≧ 7.0mm, External di≧ 7.62mm, AC 8000V, 115°C	IEC 60747-5-5	VDE 40015248
Optocoupler U2,U3,U13,U14, U17,U18,U26,U 27,U31,U32	TOSHIBA Semiconductor Corporation	TLP350（D4-TP1.F）	Di≧0.4mm Internal di≧ 7.0mm External di≧ 7.0mm, AC 5000V,	DIN EN 60747-5-2	VDE 40009302

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

14	TABLE: list of critical components				P
object/part No.	manufacturer/ trademark	type/model	technical data	standard	mark(s) of conformity[1])
			reinforced Insulation 100°C		
(Alternative)	TOSHIBA	TLP352(TP1,F)	Di≧0.4mm Internall di≧ 7.0mm External di≧ 7.0mm, 125°C	DIN EN 60747-5-2	VDE 40009302
GFCI（L10）	Huizhou Baohui Electronics Technology Co., Ltd	W539	Class B	IEC/EN 62109-1 IEC/EN 62109-2	Tested with appliance
-Expoxy	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A-1/B-1	V-0, 130°C	UL 746 UL94	UL E218090
(Alternative)	HUI ZHOU QIANG DA ELECTRONICS INDUSTRY CO LTD	QDJ600(#)	V-0, 130°C	UL 746 UL94	UL E351561
-Tape	SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO LTD	WF	200°C	UL224	UL 203950
[1]) an asterisk indicates a mark which assures the agreed level of surveillance					

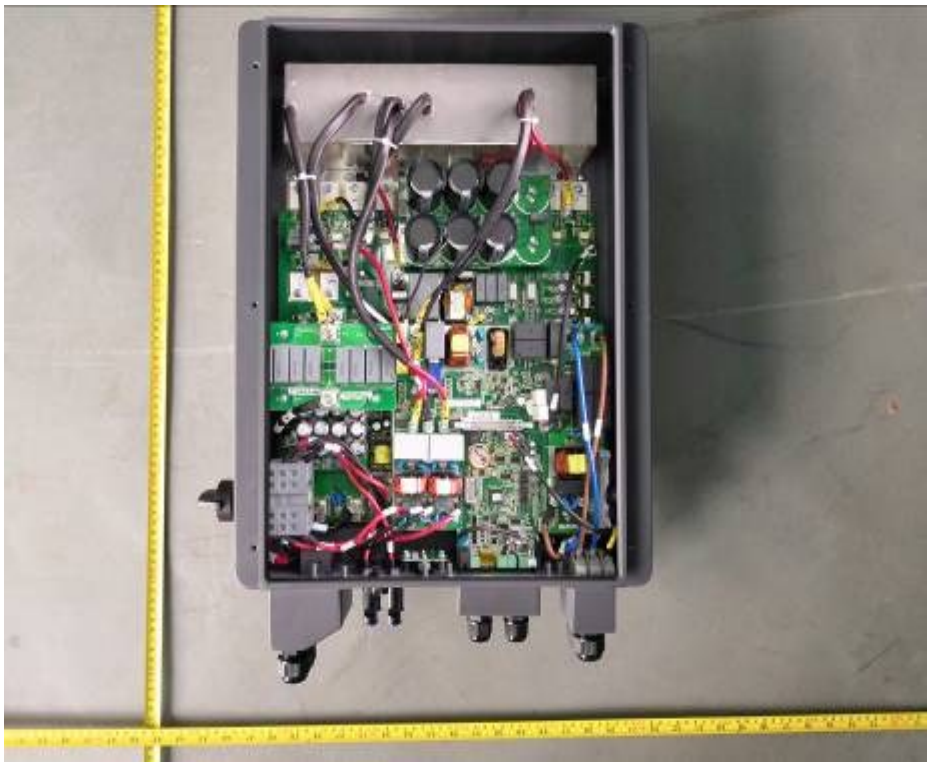
Appendix 1: Photos

Overview

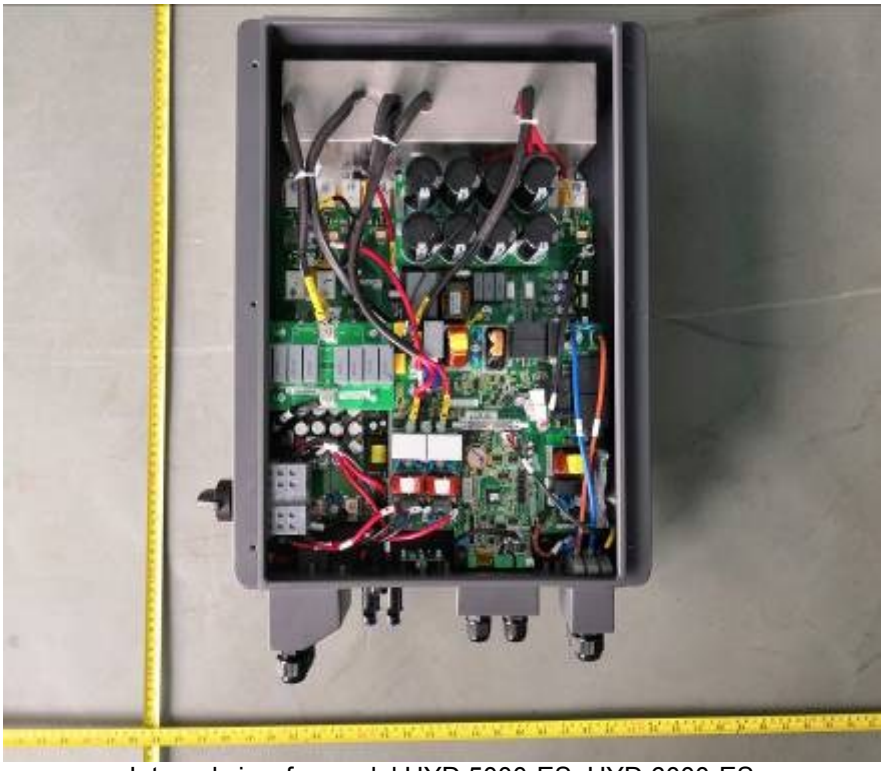


Bottom view

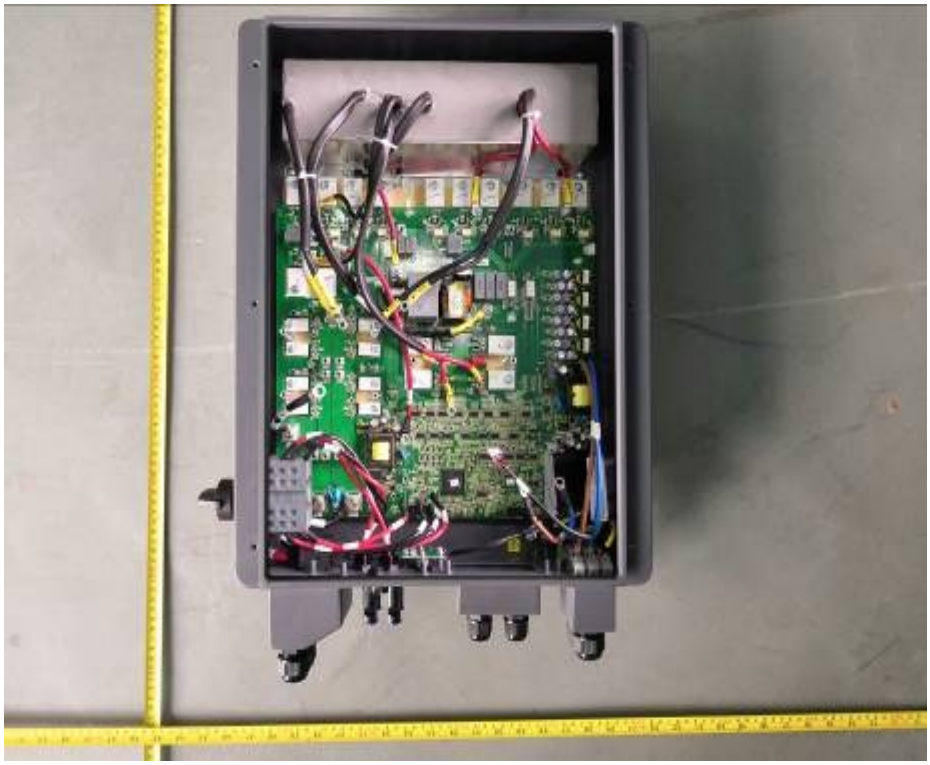
Connection view



Internal view for model HYD 4000-ES, HYD 3600-ES, HYD 3000-ES

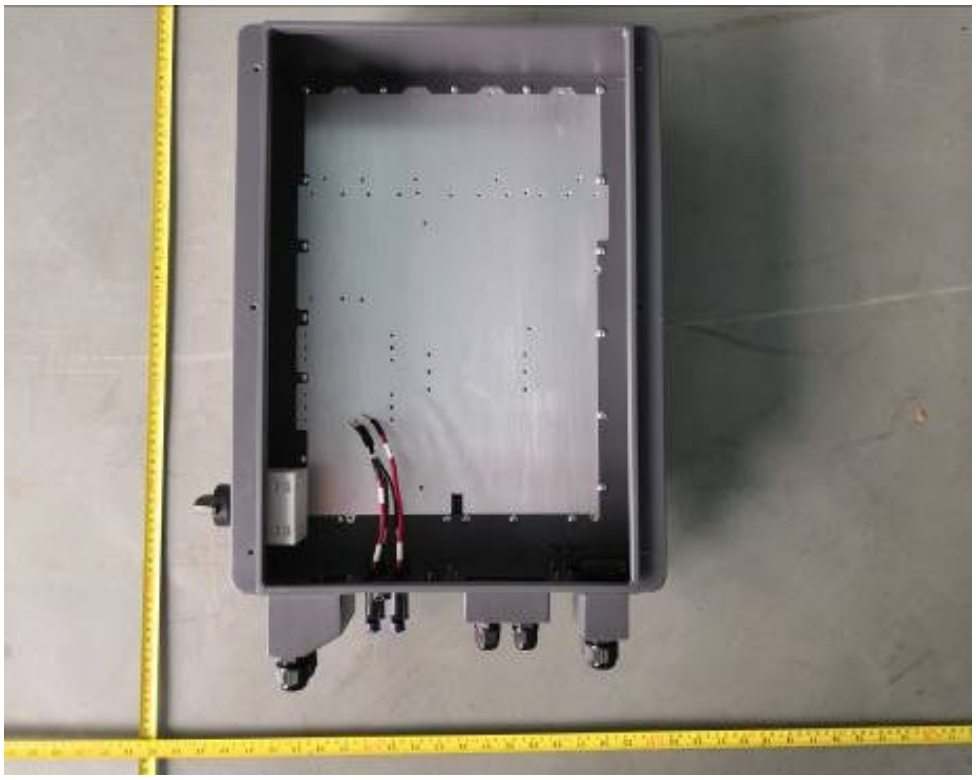


Internal view for model HYD 5000-ES, HYD 6000-ES

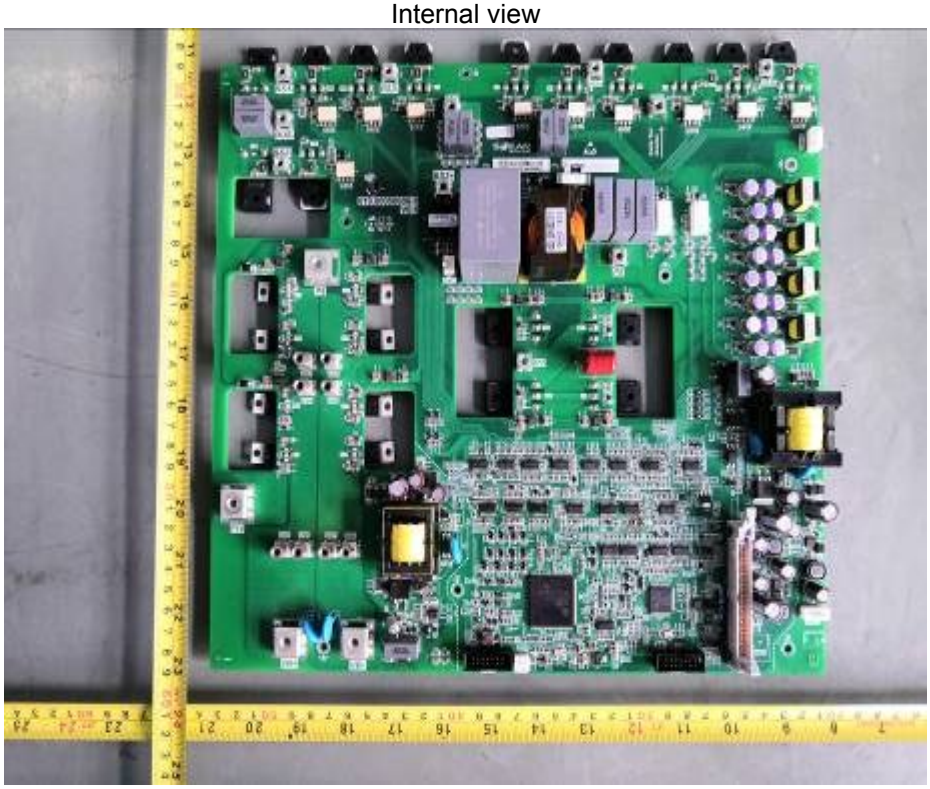


Internal view

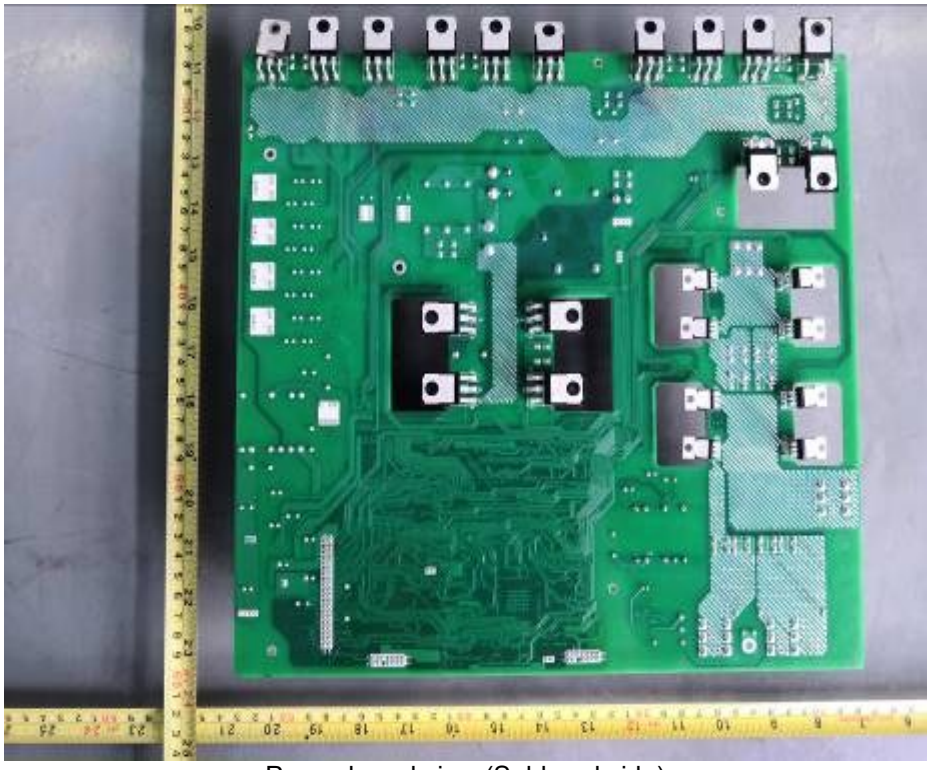
Earthing view



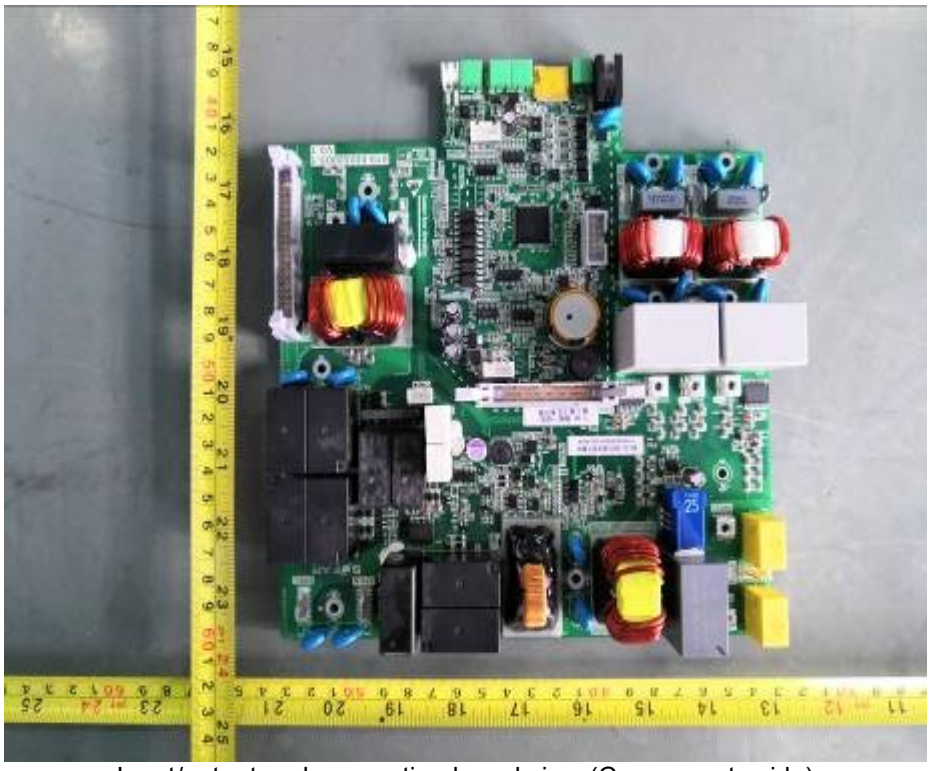
Internal view



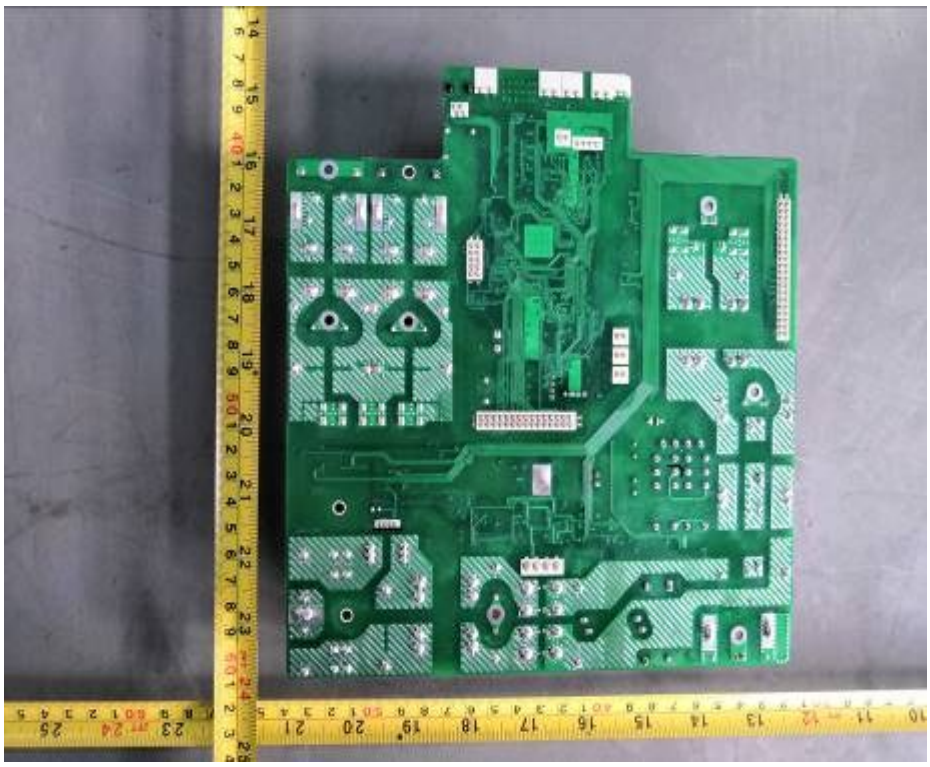
Power board view (Components side)



Power board view (Soldered side)



Input/output and connection board view (Components side)



Input/output and connection board view (Soldered side)
(End of Report)