Prüfbericht - Nr.: *Test Report No.:*	CN20IZ4Z 001	**Auftrags-Nr.:** *Order No.:*	168282208	**Seite 1 von 92** *Page 1 of 92*
Kunden-Referenz-Nr.: *Client Reference No.:*	2027024	**Auftragsdatum:** *Order date:*	2020.09.14	
Auftraggeber: *Client:*	Shenzhen Growatt New Energy Co., Ltd			
Prüfgegenstand: *Test item:*	Grid-connected PV inverter			
Bezeichnung / Typ-Nr.: *Identification / Type No.:*	MAX 175KTL3-X HV, MAX 185KTL3-X HV, MAX 196KTL3-X HV, MAX 216KTL3-X HV, MAX 225KTL3-X HV, MAX 230KTL3-X HV, MAX 250KTL3-X HV, MAX 253KTL3-X HV			
Auftrags-Inhalt: *Order content:*	TÜV Mark Approval			
Prüfgrundlage: *Test specification:*	IEC/EN 62109-1: 2010, IEC/EN 62109-2: 2011			
Wareneingangsdatum: *Date of receipt::*	2020.09.14			
Prüfmuster-Nr.: *Test sample No.:*	MAX 253KTL3-X HV: GLH0A45001			
Prüfzeitraum: *Testing period:*	2020.09.14–2020.12.04			
Ort der Prüfung: *Place of testing:*	Shenzhen Chengxin Technology Service Co., Ltd.			
Prüflaboratorium: *Testing Laboratory:*	TÜV Rheinland (Shanghai) Co., Ltd.			
Prüfergebnis*: *Test result*:*	Pass			

geprüft/ *tested by:*			**kontrolliert/** *reviewed by:*		
2020.12.28	Zhiwei Yan / PE	Zhi wei Yan	2020.12.28	Dean Cao / TC	
Datum *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*	**Datum** *Date*	**Name/Stellung** *Name/Position*	**Unterschrift** *Signature*

Sonstiges/

The report consists of this cover page, 92 pages for IEC/EN 62109-1, 15 pages for IEC/EN 62109-1 attachment 1 and 19 pages for photo document attachment 2.

Zustand des Prüfgegenstandes bei Anlieferung:
Condition of test item at delivery:

Prüfmuster vollständig und unbeschädigt
Test item complete and undamaged

* Legende:	1 = sehr gut	2 = gut	3 = befriedigend	4 = ausreichend	5 = mangelhaft
	P(ass) = entspricht o.g. Prüfgrundlage(n)		F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
Legend:	*1 = very good*	*2 = good*	*3 = satisfactory*	*4 = sufficient*	*5 = poor*
	P(ass) = passed a.m. test specification(s)		*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Test Report issued under the responsibility of:

TÜVRheinland®

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

Report Number..... :	CN20IZ4Z 001
Date of issue ..... :	See cover page
Total number of pages..... :	See cover page
Name of Testing Laboratory preparing the Report ..... :	**TÜV Rheinland (Shanghai) Co., Ltd.**
Applicant's name..... :	Shenzhen Growatt New Energy Co., Ltd
Address..... :	2F and 3F, Building 4, Jiayu Company Industrial Park, Xibianling, Shangyu Village, Shiyan Street, Bao'an District,Shenzhen, P.R. China.
Test specification:	
Standard..... :	IEC/EN 62109-1:2010 (First Edition)
Test procedure..... :	TÜV Test Report
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

If this Test Report Form is used by non-IECEE members, the IECEE/IEC logo and the reference to the CB Scheme procedure shall be removed.

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

General disclaimer:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

Test item description..... :	Grid-connected PV inverter
Trade Mark..... :	Growatt
Manufacturer..... :	Same as applicant
Model/Type reference ..... :	MAX 175KTL3-X HV, MAX 185KTL3-X HV, MAX 196KTL3-X HV, MAX 216KTL3-X HV, MAX 225KTL3-X HV, MAX 230KTL3-X HV, MAX 250KTL3-X HV, MAX 253KTL3-X HV
Ratings..... :	See page 5-15 for details.

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):			
☒	**CB Testing Laboratory:**	See cover page	
Testing location/ address ..... :		See cover page	
☐	**Associated CB Testing Laboratory:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Approved by (name, function, signature).. :			
☐	**Testing procedure: CTF Stage 1:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Approved by (name, function, signature).. :			
☐	**Testing procedure: CTF Stage 2:**		
Testing location/ address ..... :			
Tested by (name + signature) ..... :			
Witnessed by (name, function, signature). :			
Approved by (name, function, signature).. :			
☐	**Testing procedure: CTF Stage 3:**		
☐	**Testing procedure: CTF Stage 4:**		
Testing location/ address ..... :			
Tested by (name, function, signature) ..... :			
Witnessed by (name, function, signature). :			
Approved by (name, function, signature).. :			
Supervised by (name, function, signature):			

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

- ATTACHMENT 1 – Test report of IEC/EN 62109-2: 2011 (15 pages)
- ATTACHMENT 2 – Photo Documentation (19 pages)

Summary of testing:

Tests performed (name of test and test clause):	**Testing location:**
The critical tests were performed for this equipment included clauses 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 5.1.2, 6.3, 6.4, 7.3.2.2, 7.3.2.3, 7.3.4.2.3, 7.3.7.4, 7.3.7.5, 7.3.9, 7.5.1, 7.5.2, 7.5.4, 8.2, 8.5, 10.2, 13.6.2.1, 13.7 in scope of this standard, for temperature test the thermocouples method used, regarding fault condition test simulated faults applied.	**Shenzhen Chengxin Technology Service Co., Ltd.** No.13, Aiqun Road, Shiyan Street, Baoan District, Shenzhen, Guangdong, China.

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

N/A

☒ The product fulfils the requirements of IEC/EN 62109-1: 2010 and IEC/EN 62109-2: 2011.

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.

Growatt PV Grid Inverter	
Model name	MAX 175KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A * 9
Max. input current	30 d.c.A * 9
Max. output power	175000 W
Max. apparent power	175000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	139.3 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

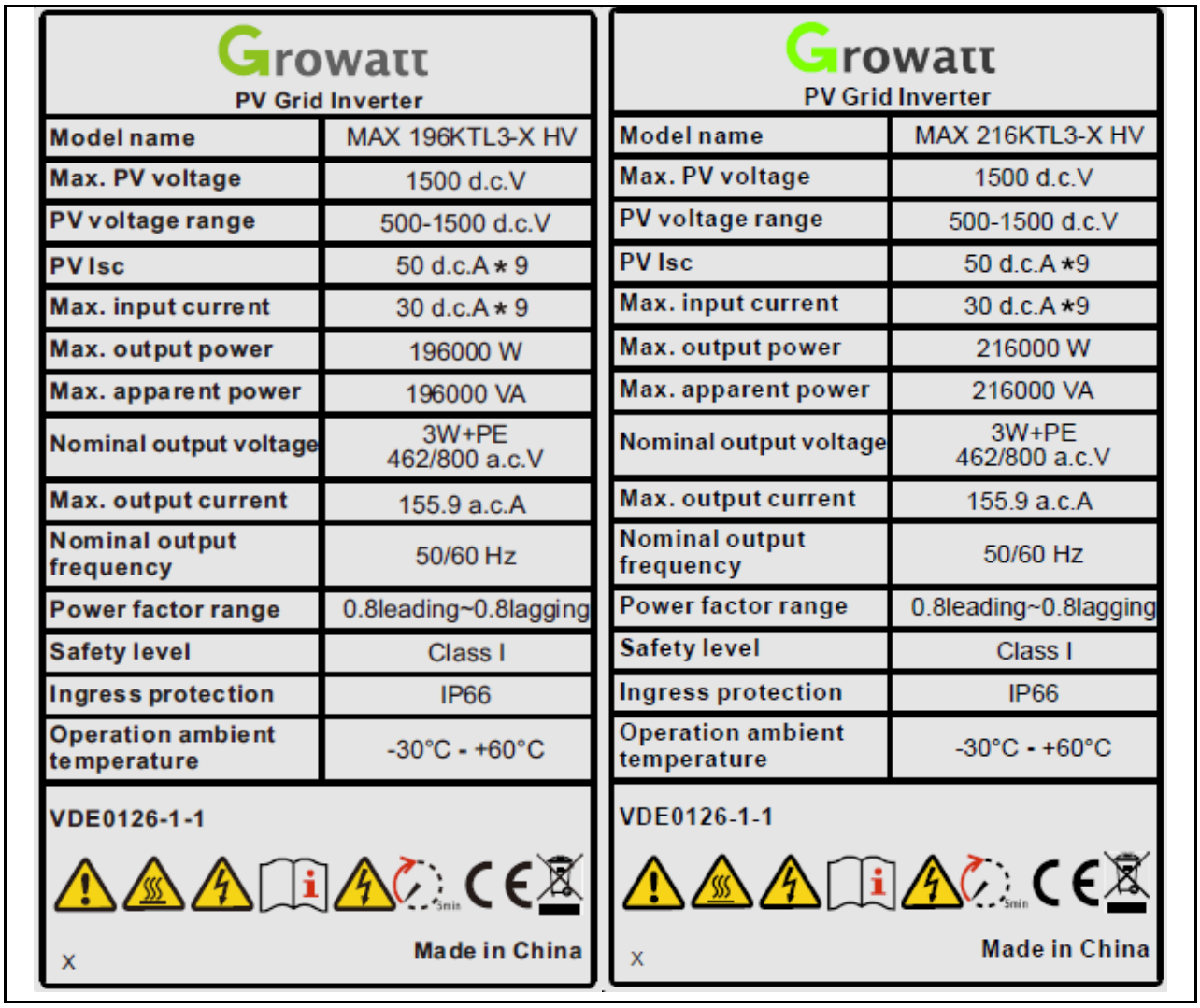
VDE0126-1-1

X Made in China

Growatt PV Grid Inverter	
Model name	MAX 185KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A *9
Max. input current	30 d.c.A *9
Max. output power	185000 W
Max. apparent power	185000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	133.5 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

VDE0126-1-1

X Made in China



Growatt
PV Grid Inverter

Model name	MAX 196KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A * 9
Max. input current	30 d.c.A * 9
Max. output power	196000 W
Max. apparent power	196000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	155.9 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

VDE0126-1-1

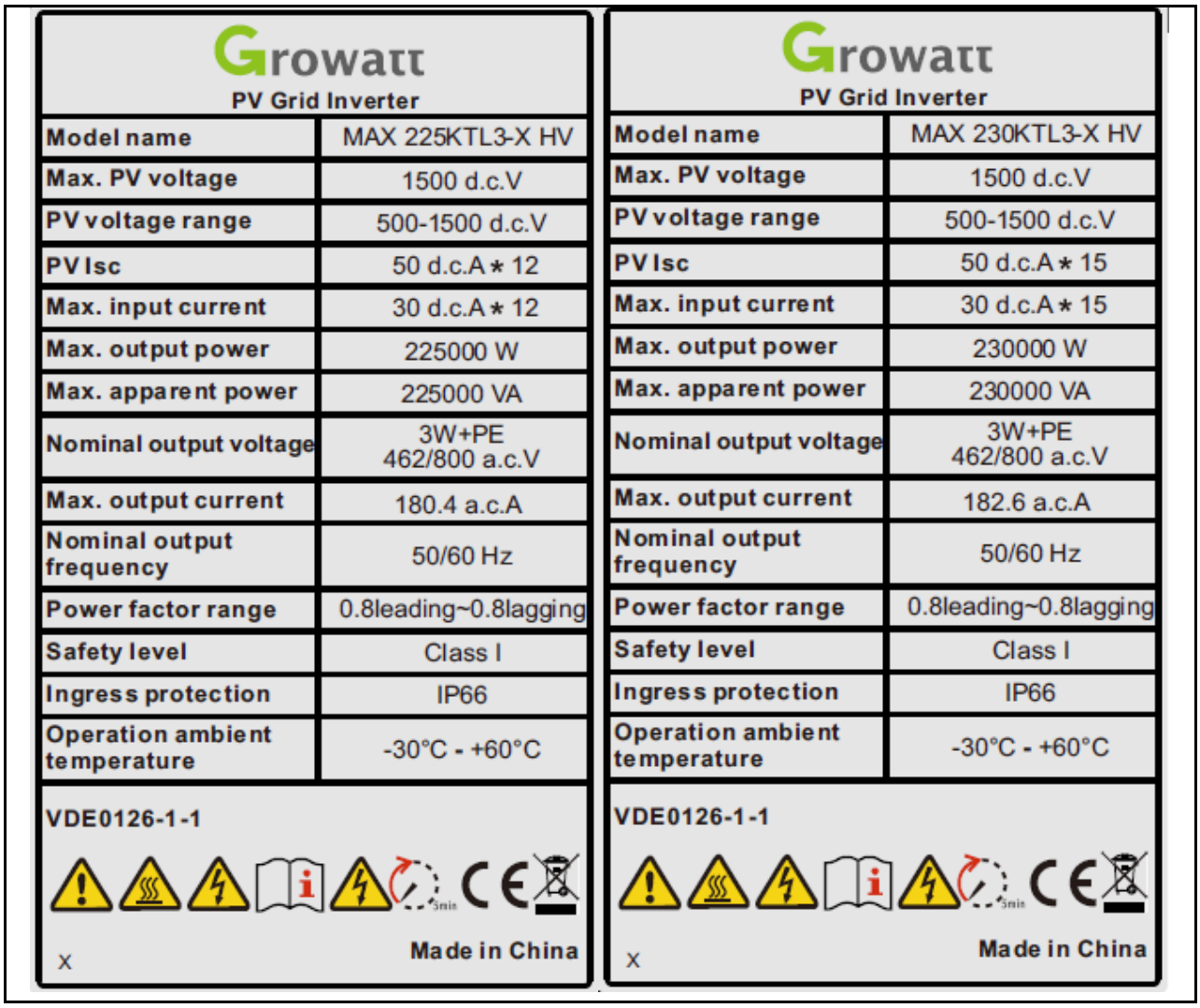
X Made in China

Growatt
PV Grid Inverter

Model name	MAX 216KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A *9
Max. input current	30 d.c.A *9
Max. output power	216000 W
Max. apparent power	216000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	155.9 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

VDE0126-1-1

X Made in China



Growatt
PV Grid Inverter

Model name	MAX 225KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A * 12
Max. input current	30 d.c.A * 12
Max. output power	225000 W
Max. apparent power	225000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	180.4 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

VDE0126-1-1

X Made in China

Growatt
PV Grid Inverter

Model name	MAX 230KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A * 15
Max. input current	30 d.c.A * 15
Max. output power	230000 W
Max. apparent power	230000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	182.6 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

VDE0126-1-1

X Made in China

Growatt PV Grid Inverter	
Model name	MAX 250KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A*12
Max. input current	30 d.c.A*12
Max. output power	250000 W
Max. apparent power	250000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	180.4 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

VDE0126-1-1

X

Made in China

Growatt PV Grid Inverter	
Model name	MAX 253KTL3-X HV
Max. PV voltage	1500 d.c.V
PV voltage range	500-1500 d.c.V
PV Isc	50 d.c.A*15
Max. input current	30 d.c.A*15
Max. output power	253000 W
Max. apparent power	253000 VA
Nominal output voltage	3W+PE 462/800 a.c.V
Max. output current	182.6 a.c.A
Nominal output frequency	50/60 Hz
Power factor range	0.8leading~0.8lagging
Safety level	Class I
Ingress protection	IP66
Operation ambient temperature	-30°C - +60°C

VDE0126-1-1

X

Made in China

Growatt

Growatt New Energy Co.,Ltd

2F and 3F,Building 4,Jiayu Company Industrial Park,Xibianling,Shangyu Village,Shiyan Street, Bao'an District,Shenzhen,China

Authorized representative in EU

Growatt New Energy B.V

Dalkruidbaan 107, 2908KC Capelle aan den ijssel, Netherlands

CE

X

Test item particulars.....:	
Equipment mobility.....:	☐ movable ☐ hand-held ☐ stationary ☒ fixed ☐ transportable ☐ for building-in
Connection to the mains.....:	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Environmental category.....:	☒ outdoor ☐ indoor unconditional ☐ indoor conditional
Over voltage category Mains.....:	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV.....:	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%).....:	According to the specified supply range
Tested for power systems.....:	TN
IT testing, phase-phase voltage (V).....:	- - -
Class of equipment.....:	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg).....:	See model lists.
Pollution degree.....:	☐ PD 1 ☐ PD 2 ☒ PD 3 (internal reduced to PD 2)
IP protection class.....:	IP66
.....:	
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.....:	See cover page
Date (s) of performance of tests.....:	See cover page

General remarks:	
"(See Enclosure #)" refers to additional information appended to the report. "(See appended table)" refers to a table appended to the report. **Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**	
Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:	
The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided……:	☐ **Yes** ☒ **Not applicable**
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) ……:	**Shenzhen Growatt New Energy Technology Co., Ltd** 1st East&3rd Floor of Building A, Building B, Jiayu Industrial Park, #28, GuangHui Road, LongTeng Community, Shiyan Street, Baoan District, shenzhen, P.R. China.

General product information:

The equipment with model names MAX 175KTL3-X HV, MAX 185KTL3-X HV, MAX 196KTL3-X HV, MAX 216KTL3-X HV, MAX 225KTL3-X HV, MAX 230KTL3-X HV, MAX 250KTL3-X HV, MAX 253KTL3-X HV are three phase un-isolated type grid-connected inverters which will be installed and connected to the grid network after installation. In final installation the equipment shall be fixed to suitable manner as specified in the installation instruction.

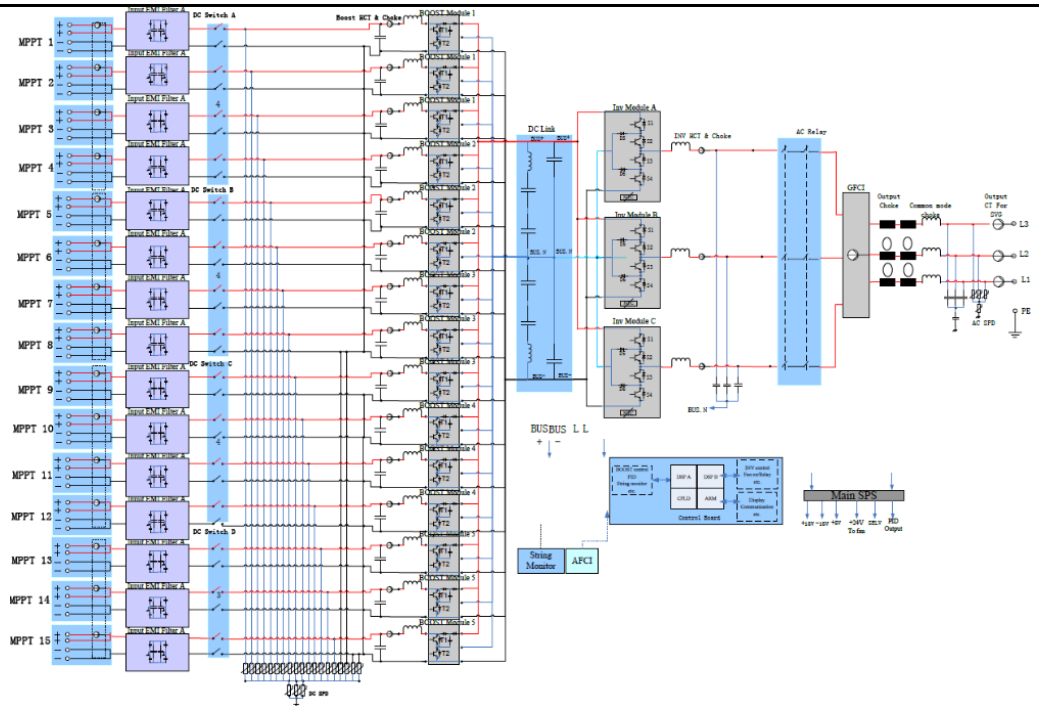
The EUTs contains filters for smoothing the output voltage and for EMC, switching and control circuits. Electronic circuits are mounted on a number of PCBs interconnected by appropriate connectors and wires. Power board including electronics components is mounted on the heat sink to earthing by metal screw and spring washer.

PV input combiner 9 string MPPT tracers for models MAX 175KTL3-X HV, MAX 185KTL3-X HV, MAX 196KTL3-X HV, MAX 216KTL3-X HV, 12 string MPPT tracers for models MAX 225KTL3-X HV, MAX 250KTL3-X HV, 15 string MPPT tracers for models MAX 230KTL3-X HV, MAX 253KTL3-X HV, each MPPT tracer including 2 pair of PV input terminals. AC output direct connected to grid and Protective Earthing are provided by dedicated earthing terminals. Grid is protected combination with a two series of relays as redundant build for ensure the inverter can independent disconnected from gird while a relay was fault.

During fault condition defined in this standard, after the DSP receives the abnormal signal from the relevant protective detection circuit, the relays will operate to disconnect the PV inverter line and neutral from grid automatically.

The master DSP and slaver DSP has capacity independent disconnected from gird, when any grid fault had happened.

The maximum ambient temperature permitted by the manufacturer's specification is 60°C and derate the output power from 30°C.



Block diagram

Models difference:

The models MAX175KTL3-X HV, MAX185KTL3-X HV, MAX196KTL3-X HV, MAX216KTL3-X HV, MAX 225KTL3-X HV, MAX230KTL3-X HV, MAX250KTL3-X HV, MAX253KTL3-X HV are same as the construction, hardware and software, expected the components are desctription as below table and output power are diferent due to be adjusted by software.

Model / Components	MAX175KTL3-X HV,MAX185KTL3-X HV, MAX196KTL3-X HV, MAX216KTL3-X HV	MAX225KTL3-X HV, MAX250KTL3-X HV	MAX230KTL3-X HV, MAX253KTL3-X HV
No. of MPPT	9	12	15
No. of PV Input terminal	36	48	60
No. of PV input switch	3	3	4
No. of Input Boost inductor	3	4	5
No. of BOOST IGBT	3	4	5
Weight [kg]	95kg	99kg	109kg

1) Definition of circuits inside of the PV inverter

I. PV input circuits

PV input circuits are directly connected to the PV array and the voltage can be up to 1500Vdc.
Decisive voltage C considered for the PV voltage side.

II. AC output to the AC mains

AC output will be 800Vac (L-L).
Decisive voltage C considered for the AC voltage side.

III. Communication

The communication terminal (RS485) and WIFI module can be communicated to COM-port (RS485) of a PC for monitoring via the host monitoring software.
Decisive voltage A considered for the communication side.

2) Isolation used in the product

Protective separation applied between decisive voltage A and decisive voltage C with corresponding overvoltage category.

3) Cooling method

Physical cooling by metal heat sink.

4) Isolation between decisive voltage A and decisive voltage C

Reinforced insulation provided in the product to separate those two parts.

Table 1

MODELS LIST		MAX 175KTL3-X HV	MAX 185KTL3-X HV	MAX 196KTL3-X HV	MAX 216KTL3-X HV
PV INPUT	V_{MAX} PV [Vdc]	1500			
	I_{SC} PV [A]	50*9			
	MPPT Voltage Range V_{MPP} [Vdc]	500-1500			
	Max. Input Current I_{MAX} [A] (A/B) (each MPPT if more than 1)	30*9			
	MPPT Full Power Voltage Range [Vdc]	800-1300			
	Number of MPPT	9			
	String per MPPT	2			
	Inrush Current [A]	160			
	Overvoltage Category (OVC)	II			
AC OUTPUT	Rated Output Voltage Ur [Vac]	3W+PE, 800			
	Rated Output Frequency F_{NETZ} [Hz]	50/60			
	Normal Operating Frequency Range Fn [Hz]	45~55/55-65			
	Rated Output Power P_E [kW]	175	185	196	216
	Max. Apparent power S_{Emax} [kVA]	193	185	216	216
	Max. Output Current Imax [A]	139.3	133.5	155.9	155.9
	Power Factor cosφ [λ]	0.8 leading ~0.8lagging			
	Efficiency max. η_{max}	99.0%			
	Night Power Consumption [W]	<15			

	THD [V / I] (100% full power)	<3%
	Overvoltage Category (OVC)	III
CONSTRUCTION	Array Insulation Resistance Detection [Ω]	50K
	Type of inverter	Non-isolated
	Type of NS Protection	Integrated
	Separated by	Transformerless
	Protective Class	Class I
	Software version	TM 1.0
	Hardware version	V1.0
	Enclosure Protection (IP)	IP66
	Operating Temperature Range [°C]	-30 to +60 (30 to 60 with derating)
	Pollution degree (PD)	PD3
	Altitude [m]	4000
	Size [mm]	1070*675*340
	Weight [kg]	95
Note:		

Table 2

MODELS LIST		MAX 225KTL3-X HV	MAX 250KTL3-X HV	MAX 230KTL3-X HV	MAX 253KTL3-X HV
PV INPUT	V_{MAX} PV [Vdc]	1500			
	I_{SC} PV [A]	50*12		50*15	
	MPPT Voltage Range V_{MPP} [Vdc]	500-1500			
	Max. Input Current I_{MAX} [A] (A/B) (each MPPT if more than 1)	30*12		30*15	
	MPPT Full Power Voltage Range [Vdc]	800-1300			
	Number of MPPT	12		15	
	String per MPPT	2			
	Inrush Current [A]	160			
	Overvoltage Category (OVC)	II			
AC OU	Rated Output Voltage Ur [Vac]	3W+PE, 800			

	Rated Output Frequency F_{NETZ} [Hz]	50/60			
	Normal Operating Frequency Range Fn [Hz]	45~55/55-65			
	Rated Output Power P_E [kW]	225	250	230	253
	Max. Apparent power S_{Emax} [kVA]	250	250	253	253
	Max. Output Current Imax [A]	180.4	180.4	182.6	182.6
	Power Factor cosφ [λ]	0.8 leading ~0.8lagging			
	Efficiency max. η_{max}	99.0%			
	Night Power Consumption [W]	<15			
	THD [V / I] (100% full power)	<3%			
	Overvoltage Category (OVC)	III			
CONSTRUCTION	Array Insulation Resistance Detection [Ω]	50K			
	Type of inverter	Non-isolated			
	Type of NS Protection	Integrated			
	Separated by	Transformerless			
	Protective Class	Class I			
	Software version	TM 1.0			
	Hardware version	V1.0			
	Enclosure Protection (IP)	IP66			
	Operating Temperature Range [ºC]	-30 to +60 (30 to 60 with derating)			
	Pollution degree (PD)	PD3			
	Altitude [m]	4000m			
	Size [mm]	1070*675*340			
	Weight [kg]	99		109	
Note:					

General Test Conditions are:

All tests of PV inverter were carried out under the most unfavorable combination within the manufacturer's operating specifications of the following parameters:

-DC input voltage Max. 1500Vd.c.
-operating temperature, Max. Ambient temperature 60°C declared by the client.
-operating mode: continuous.
- AC output:
MAX 185KTL3-X HV, MAX 216KTL3-X HV, MAX 250KTL3-X HV, MAX 253KTL3-X HV: the highest output power is 100% at the rated voltage.
MAX 175KTL3 HV-X, MAX 196KTL3-X HV, MAX 225KTL3-X HV, MAX 230KTL3-X HV: the highest output power is 110% at the rated voltage.
The input voltage range of MPPT with full load is 800Vd.c. to 1300Vd.c for all models.

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	Considered.	P
4.2.2	Reference test conditions	Considered.	P
4.2.2.1	Environmental conditions		P
4.2.2.2	State of equipment		P
4.2.2.3	Position of equipment		P
4.2.2.4	Accessories	Considered.	P
4.2.2.5	Covers and removable parts		P
4.2.2.6	Mains supply a) Voltage: b) Frequency: c) Polarity: d) Earthing: e) Over-current Protection:	(see appended table 4.2.2.6)	P
4.2.2.7	Supply ports other than the mains	Considered.	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	No battery input.	N/A
4.2.2.8	Conditions of loading for output ports		P
4.2.2.9	Earthing terminals		P
4.2.2.10	Controls		P
4.2.2.11	Available short circuit current	Considered.	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	Maximum environment temperature of EUT is 60°C.	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
4.4.2.1	General		P
4.4.2.2	Duration of tests	Considered.	P
4.4.3	Pass/fail criteria for testing under fault conditions	Complied.	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	Complied.	P
4.4.4.1	Component fault tests	Considered.	P
4.4.4.2	Equipment or parts for short-term or intermittent operation		P
4.4.4.3	Motors	No such device.	N/A
4.4.4.4	Transformer short circuit tests		P
4.4.4.5	Output short circuit		P
4.4.4.6	Backfeed current test for equipment with more than one source of supply		P
4.4.4.7	Output overload		P
4.4.4.8	Cooling system failure	Complied.	P
4.4.4.9	Heating devices	No such device.	N/A
4.4.4.10	Safety interlock systems	No such device.	N/A
4.4.4.11	Reverse d.c. connections		P
4.4.4.12	Voltage selector mismatch	No such device.	N/A
4.4.4.13	Mis-wiring with incorrect phase sequence or polarity	Single phase.	N/A
4.4.4.14	Printed wiring board short-circuit test		P
4.5	Humidity preconditioning	(see appended table 7.5)	P
4.5.1	General		P
4.5.2	Conditions		P
4.6	Backfeed voltage protection		P
4.6.1	Backfeed tests under normal conditions		P
4.6.2	Backfeed tests under single-fault conditions		P
4.6.3	Compliance with backfeed tests		P
4.7	Electrical ratings tests	(see appended table 4.2.2.6)	P
4.7.1	Input ratings		P
4.7.1.1	Measurement requirements for DC input ports		P
4.7.2	Output ratings		P

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Clause	Requirement – Test	Result – Remark	Verdict

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		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	The label was subjected to the permanence of marking test. The label was rubbed with cloth soaked with water for 30 sec. And then again for 30 sec. With the cloth soaked with petroleum spirit. After this test there was no damage to the label. The marking on the label did not fade. There was no curling or lifting of the label edge.	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	See copy of marking plate	P
	b) model number, name or other means to identify the equipment	See copy of marking plate	P
	c) a serial number, code or other marking allowing identification of manufacturing location and the manufacturing batch or date within a three month time period.	See copy of marking plate	P
5.1.4	Equipment ratings		P
	Unless otherwise specified in another part of IEC 62109, the following ratings, as applicable shall be marked on the equipment:	See copy of marking plate	P
	– input voltage, type of voltage (a.c. or d.c.), frequency, and max. continuous current for each input	See copy of marking plate	P
	– output voltage, type of voltage (a.c. or d.c.), frequency, max. continuous current, and for a.c. outputs, either the power or power factor for each output	See copy of marking plate	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– the ingress protection (IP) rating as in 6.3 below	IP66	P
5.1.5	Fuse identification		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.	No such device.	N/A
	Where fuses with special fusing characteristics such as time delay or breaking capacity are necessary, the type shall also be indicated		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.	Fuses used and not located in operator access areas. The fuse information contain in the maintenance manual	N/A
5.1.6	Terminals, Connections, and Controls		P
	If necessary for safety, an indication shall be given of the purpose of Terminals, connectors, controls, and indicators, and their various positions, including any connections for coolant fluids such as water and drainage. The symbols in Annex C may be used, and where there is insufficient space, symbol 9 of Annex C may be used.		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.	Emergency stop device will be supplied by the final installation and the requirements are specified in the user manual.	N/A
	A multiple-voltage unit shall be marked to indicate the particular voltage for which it is set when shipped from the factory. The marking is allowed to be in the form of a paper tag or any other non-permanent material.		N/A
	A unit with d.c. terminals shall be plainly marked indicating the polarity of the connections, with:		P
	– the sign “+“ for positive and “-„ for negative; or		P
	– a pictorial representation illustrating the proper polarity where the correct polarity can be unambiguously determined from the representation	See only above.	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	The colour coding green-yellow.	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	– the letters “PE“; or		N/A
	– the colour coding green-yellow.		P
5.1.7	Switches and circuit-breakers		P
	The on and off-positions of switches and circuits breakers shall be clearly marked. If a push-button switch is used as the power switch, symbols 10 and 16 of Annex C may be used to indicate the on-position, or symbols 11 and 17 to indicate the off-position, with the pair of symbols (10 and 16, or 11 and 17) close together.	The DC/AC breaker has marked the “ON” position denote for running mode, “OFF” position denote for stopping mode.	P
5.1.8	Class II Equipment	Class I equipment	N/A
	Equipment using Class II protective means throughout shall be marked with symbol 12 of Annex C. Equipment which is only partially protected by DOUBLE INSULATION or REINFORCED INSULATION shall not bear symbol 12 of Table Annex C.		N/A
	Where such equipment has provision for the connection of an earthing conductor for functional reasons (see 7.3.6.4) it shall be marked with symbol 6 of Annex C		N/A
5.1.9	Terminal boxes for External Connections		P
	Where required by note 1 of Table 2 as a result of high temperatures of terminals or parts in the wiring compartment, there shall be a marking, visible beside the terminal before connection, of either:	No such high temperature of terminals or parts	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
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	Considered.	P
	– Printed text characters shall be at least 1.5 mm high and shall contrast in colour with the background	Considered.	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.	Considered.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	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	Considered.	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		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.	No such heatsink.	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.	Symbol 14 of Annex C used.	P
5.2.2.3	Coolant	No coolant used inside.	N/A
	A unit containing coolant that exceeds 70 °C shall be legibly marked externally where readily visible after installation with symbol 15 of Annex C. The documentation shall provide a warning regarding the risk of burns from hot coolant, and either:		N/A
	a) statement that coolant system servicing is to be done only by SERVICE PERSONNEL, or		N/A
	b) instructions for safe venting, draining, or otherwise working on the cooling system, if these operations can be performed without OPERATOR access to HAZARDS internal to the equipment		N/A
5.2.2.4	Stored energy		P
	Where required by 7.3.9.2 or 7.4.2 the PCE shall be marked with Symbol 21 of Annex C and the time to discharge capacitors to safe voltage and energy levels shall accompany the symbol.	Marked with symbol 21 of Annex C and the time to discharge capacitors to safety voltage and energy levels.	P
5.2.2.5	Motor guarding	No motor used in the appliance.	N/A
	Where required by 8.2 a marking shall be provided where it is visible to service personnel before removal of a guard, warning of the hazard and giving instructions for safe servicing (for example disconnection of the source before removing the guard).		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
5.2.3	Sonic hazard markings and instructions	No sonic hazard	N/A
	If required by 10.2.1 a PCE shall:		N/A
	a) be marked to warn the operator of the sonic pressure hazard; or		N/A
	b) be provided with installation instructions that specify how the installer can ensure that the sound pressure level from equipment at its point of use after installation, will not reach a value, which could cause a hazard. These instructions shall include the measured sound pressure level, and shall identify readily available and practicable protective materials or measures which may be used.		N/A
5.2.4	Equipment with multiple sources of supply		P
	A PCE with connections for multiple energy sources shall be marked with symbol 13 of Annex C and the manual shall contain the information required in 5.3.4.	 used and related information specified.	P
	The symbol shall be located on the outside of the unit or shall be prominently visible behind any cover giving access to hazardous parts.		P
5.2.5	Excessive touch current		P
	Where required by 7.3.6.3.7 the PCE shall be marked with symbol 15 of Annex C. See also 5.3.2 for information to be provided in the installation manual.	Permanently connected wiring, and a cross-section of the protective earthing conductor of at least 35 mm² Cu or 50mm Al (recommendation 50 mm² Cu or 70 mm² Al); In addition, the caution symbol 15 of Annex C is fixed to the product and the installation manual provide details of the protective earthing measures required in the installation.	P
5.3	Documentation		P
5.3.1	General		P
	The documentation provided with the PCE shall provide the information needed for the safe operation, installation, and (where applicable) maintenance of the equipment. The documentation shall include the items required in 5.3.2 through 5.3.4, and the following:		P
	a) explanations of equipment makings, including symbols used		P
	b) location and function of terminals and controls		P
	c) all ratings or specifications that are necessary		P

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Clause	Requirement – Test	Result – Remark	Verdict
	to safely install and operate the PCE, including the following environmental ratings along with an explanation of their meaning and any resulting installation requirements:		
	– ENVIRONMENTAL CATEGORY as per 6.1		P
	– WET LOCATIONS classification fort he intended external environment as per 6.1		P
	– POLLUTION DEGREE classification for the intended external environment as per 6.2		P
	– INGRESS PROTECTION rating as per 6.3		P
	– Ambient temperature and relative humidity ratings		P
	– MAXIMUM altitude rating	4000m	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 III for AC connection. OVC II for DC connection.	P
	d) a warning that when the photovoltaic array is exposed to light, it supplies a d.c. voltage to the PCE	Provided in the instruction manual.	P
5.3.1.1	Language	English version specification and instruction provided	P
	Instructions related to safety shall be in a language that is acceptable in the country where the equipment is to be installed.		P
5.3.1.2	Format		P
	In general, the documentation must be provided in printed form and is to be delivered with the equipment.	Paper version and electronic version will be sent to the customer once sold to end client.	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.		P
5.3.2	Information related to installation	Provided in the instruction manual	P
	The documentation shall include installation and where applicable, specific commissioning instructions and, if necessary for safety, warnings against hazards which could arise during installation or commissioning of the equipment. The information provided shall include:		P
	a) assembly, location, and mounting requirements:		P

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Clause	Requirement – Test	Result – Remark	Verdict
	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)	Standard connector used.	N/A
	e) ventilation requirements;		N/A
	f) requirements for special services, for example cooling liquid;	No such special services.	N/A
	g) instructions and information relating to sound pressure level if required by 10.2.1;		N/A
	h) where required by 14.8.1.3, instructions for the adequate ventilation of the room or location in which PCE containing vented or valve-regulated batteries is located, to prevent the accumulation of hazardous gases;		N/A
	i) tightening torque to be applied to wiring terminals;		P
	j) values of backfeed short-circuit currents available from the PCE on input and output conductors under fault conditions, if those currents exceed the max. rated current of the circuit, as per 4.4.4.6;		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;	Integrated RCMUs.	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:	Second protective earthing conductor not used.	N/A
	n) where required by 7.3.8, the installation instructions shall include the following or equivalent wording:		N/A
	"This product can cause a d.c. current in the external protective earthing conductor. Where a residual current-operated protective (RCD) or monitoring (RCM) device is used for protection in a case of direct or indirect contact, only an RCD or RCM of Type B is allowed on the supply side of this product."		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	o) for PCE intended to charge batteries, the battery nominal voltage rating, size, and type	Not intended to charge batteries.	N/A
	p) PV array configuration information, such as ratings, whether the array is to be grounded or floating, any external protection devices needed, etc.		P
5.3.3	Information related to operation	All below related informations provided in the user's manual.	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	Symbol 14 of Annex C used.	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	All below related informations provided in the service manual.	P
	Maintenance instructions shall include the following:		P
	– Intervals and instructions for any preventive maintenance that is required to maintain safety (for example air filter replacement or periodic re-tightening of terminals);		P
	– Instructions for accessing operator access areas, if any are present, including a warning not to enter other areas of the equipment;		P
	– Part numbers and instructions for obtaining any required operator replaceable parts;		P
	– Instructions for safe cleaning (if recommended)		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.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
5.3.4.1	Battery maintenance	No batteries connections.	N/A
	Where required by 14.8.5, the documentation shall include the applicable items from the following list of instructions regarding maintenance of batteries:		N/A
	– Servicing of batteries should be performed or supervised by personnel knowledgeable about batteries and the required precautions		N/A
	– When replacing batteries, replace with the same type and number of batteries or battery packs		N/A
	– General instructions regarding removal and installation of batteries		N/A
	– CAUTION: Do not dispose of batteries in a fire. The batteries may explode.		N/A
	– CAUTION: Do not open or damage batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.		N/A
	– CAUTION: A battery can present a risk of electrical shock and high short-circuit current. The following precautions should be observed when working on batteries:		N/A
	a) Remove watches, rings, or other metal objects.		N/A
	b) Use tools with insulated handles.		N/A
	c) Wear rubber gloves and boots.		N/A
	d) Do not lay tools or metal parts on top of batteries		N/A
	e) Disconnect charging source prior to connecting or disconnecting battery terminals		N/A
	f) Determine if battery is inadvertently grounded. If inadvertently grounded, remove source from ground. Contact with any part of a grounded battery can result in electrical shock. The likelihood of such shock can be reduced if such grounds are removed during installation and maintenance (applicable to equipment and remote battery supplies not having a grounded supply circuit).		N/A
6	**ENVIRONMENTAL REQUIREMENTS AND CONDITIONS**		P
	The manufacturer shall rate the PCE for the following environmental conditions:		P
	– ENVIRONMENTAL CATEGORY, as in 6.1 below		P
	– Suitability for WET LOCATIONS or not		P
	– POLLUTION DEGREE rating in 6.2 below	See clause 6.2 below	P

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Clause	Requirement – Test	Result – Remark	Verdict
	– INGRESS PROTECTION (IP) rating, as in 6.3 below	See clause 6.3 below	P
	– Ultraviolet (UV) exposure rating, as in 6.4 below	See clause 6.4 below	P
	– Ambient temperature and relative humidity ratings, as in 6.5 below	See clause 6.5 below	
6.1	Environmental categories and minimum environmental conditions		P
6.1.1	Outdoor	Outdoor use.	P
6.1.2	Indoor, unconditioned		N/A
6.1.3	Indoor, conditioned		N/A
6.2	Pollution degree	Pollution degree 2	P
6.3	Ingress Protection	IP66	P
6.4	UV exposure		P
6.5	Temperature and humidity	-30-60°C, 0%-100% humidity	P
7	**PROTECTION AGAINST ELECTRIC SHOCK AND ENERGY HAZARDS**		P
7.1	General		P
7.2	Fault conditions	Suitable protection provided against electric shock under fault conditions.	P
7.3	Protection against electric shock		P
7.3.1	General	See below	P
7.3.2	Decisive voltage classification	Considered.	P
7.3.2.1	Use of decisive voltage class (DVC)		P
7.3.2.2	Limits of DVC (according table 6)	DVC-C for >50Vrms/71Vpeak. DVC-C for >120Vdc. DVC-A for <25Vrms or 35.4Vpeak. DVC-A for <60Vdc.	P
7.3.2.3	Short-terms limits of accessible voltages under fault conditions	No parts were exceed DVC-A level.	P
7.3.2.4	Requirements for protection (according table 7)		P
7.3.2.5	Connection to PELV and SELV circuits	Considered.	P
7.3.2.6	Working voltage and DVC	DVC-A and DVC-C circuits within PCE.	P
7.3.2.6.1	General		P
7.3.2.6.2	AC working voltage (see Figure 2)	Nominal 800V(L-L)	P
7.3.2.6.3	DC working voltage (see Figure 3)	Max. 1500Vd.c.	P
7.3.2.6.4	Pulsating working voltage (see Figure 4)		P
7.3.3	protective separation		P
	Protective separation shall be achieved by:		P
	▪ double or reinforced insulation, or	Protective separation applied	P

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		between decisive voltage C and accessible unearthed parts with corresponding overvoltage category.	
	▪ 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	Protective separation applied between decisive voltage C and accessible earthed metal enclosure with corresponding overvoltage category.	P
	▪ protective impedance comprising limitation of current per 7.3.5.3 and of discharged energy per 7.3.5.4, or	Controlled high impedance resistors used.	P
	▪ limitation of voltage according to 7.3.5.4.		P
	The protective separation shall be fully and effectively maintained under all conditions of intended use of the PCE		
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).	Earthed metal enclosure used.	P
	Open type sub-assemblies and devices do not require protective measures against direct contact but the instruction provided with the equipment must indicate that such measures must be provided in the end equipment or in the installation.		N/A
	Product intended for installation in CLOSED ELECTRICAL OPERATING AREAS, (see 3.9) need not have protective measures against direct contact, except as required by 7.3.4.2.4.		N/A
7.3.4.2	Protection by means of enclosures and barriers		P
	The following requirements apply where protection against contact with live parts is provided by enclosures or barriers, not by insulation in accordance with 7.3.4.3.		P
7.3.4.2.1	General		P
	Parts of enclosures and barriers that provide protection in accordance with these requirements shall not be removable without the use of a tool (see 7.3.4.2.3).	Barrier can't be removed without use of tools	P
	Polymeric materials used to meet these requirements shall also meet the requirements of 13.6	Approved plastic material used as part of the fire enclosure.	P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.4.2.2	Access probe criteria		P
	Protection is considered to be achieved when the separation between the test probes and live parts, when tested as described below, is as follows:		P
	a) decisive voltage classification A, (DVC A) - the probe may touch the live parts	Considered.	P
	b) decisive voltage classification B, (DVC B) - the probe must not touch bare live parts	Considered.	P
	c) decisive voltage classification C, (DVC C) – the probe must have adequate clearance to live parts, based on the clearance for Basic insulation using the recurring peak working voltage involved,	Considered.	P
7.3.4.2.3	Access probe tests	No access with test finger and test pin to any hazardous parts.	P
	Compliance with 7.3.4.2.1 is checked by all of the following:	IP66 appliance.	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	No such openings	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	repeated except that the finger is applied using any necessary force up to 30 N.		
	d) In addition to a) – c) above, top surfaces of enclosure shall be tested with the IP3X probe of IEC 60529. The test probe shall not penetrate the top surface of the enclosure when probed from the vertical direction ±5 ° only.		P
7.3.4.2.4	Service access areas	PCE is not energized since DC input and AC output are disconnected before servicing	P
7.3.4.3	Protection by means of insulation of live parts		P
	Where the requirements of 7.3.4.2 are not met, live parts shall be provided with insulation if:	Considered.	P
	– their working voltage is greater than the maximum limit of decisive voltage class A, or		P
	– for a DVC A or B circuit, protective separation from adjacent circuit of DVC C is not provided (see note "‡" under Table 7)		P
7.3.5	Protection in case of direct contact		P
7.3.5.1	General		P
	Protection in case of direct contact is required to ensure that contact with live parts does not produce a shock hazard.		P
	The protection against direct contact according to 7.3.4 is not required if the circuit contacted is separated from other circuits according to 7.3.2.3, and:		P
	– is of decisive voltage class A and complies with 7.3.5.2, or		P
	– is provided with protective impedance according to 7.3.5.3, or		P
	– 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.		P
	Conformity is checked by visual inspection and trial insertion.		P
7.3.5.2	Protection using decisive voltage class A	For communication terminal applied.	P
7.3.5.3	Protection by means of protective impedance	Protection used as voltage detecting circuit.	P

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Clause	Requirement – Test	Result – Remark	Verdict
	Circuits and conductive parts do not require protection against direct contact if any connection to circuits of DVC-B or DVC-C is through protective impedance, and the accessible circuit or part is otherwise provided with protective separation from circuits of DVC-B or DVC-C according 7.3.3.		P
7.3.5.3.1	Limitation of current through protective impedance		P
	The current available through protective impedance to earth and between simultaneously accessible parts, measured at the accessible live parts, shall not exceed a value of 3,5 mA a.c. or 10 mA d.c. under normal and single-fault conditions.		P
7.3.5.3.2	Limitation of discharging energy through protective impedance		P
	The discharging energy available between simultaneously accessible parts protected by protective impedance shall not exceed the charging voltage and capacitance limits given in Table 9, which applies to both wet and dry locations, under normal and single fault conditions. Refer to figure 8.		P
7.3.5.4	Protection by means of limited voltages		N/A
	That portion of a circuit that has its voltage reduced to DVC-A by a voltage divider that complies with the following requirements, and that is otherwise provided with protective separation from circuits of DVC-B or DVC-C according to 7.3.3, does not require protection against direct contact.		N/A
	The voltage divider shall be designed so that under normal and single fault conditions, including faults in the voltage division circuit, the voltage across the output of the voltage divider does not exceed the limit for DVC-A.		N/A
	This type of protection shall not be used in case of protective class II or unearthed circuits, because it relies on protective earth being connected.		N/A
7.3.6	Protection against indirect contact		P
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)		P
	That part of a PCE meets the requirements of 7.3.6.2 and 7.3.6.3 is defined as protective class I	See cl. 7.3.6.2 and 7.3.6.3	P
	That part of a PCE meets the requirements of 7.3.6.4 is defined as protective class II.	See cl. 7.3.6.4	P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		N/A
7.3.6.2	Insulation between live parts and accessible conductive parts		P
	Accessible conductive parts of equipment shall be separated from live parts by insulation meeting the requirements of Table 7 or by clearances as specified in 7.3.7.4 and creepages as specified in 7.3.7.5	Basic insulation used to such parts except those covered by 7.3.6.3.	P
7.3.6.3	Protective class I – Protective bonding and earthing	Earthed metal enclosure used.	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.		P
7.3.6.3.2	Requirements for protective bonding		P
	Electrical contact with the means of connection of the external protective earthing conductor shall be achieved by one or more of the following means:		P
	a) through direct metallic contact;		P
	b) through other conductive parts which are not removed when the PCE or sub-units are used as intended ;	Applied for connection of top, front, and back of enclosure	P
	c) through a dedicated protective bonding conductor;	Green/Yellow wire used	P
	d) through other metallic components of the PCE		N/A
	Where direct metallic contact is used and one or both of the parts involved is painted or coated, the paint or coating shall be removed in the area of contact, or reliably penetrated, to ensure metal to metal contact.		P
	For moving or removable parts, hinges or sliding	See cl. 7.3.6.3.3	P

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
	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 parts used	P
7.3.6.3.3	Rating of protective bonding		P
	Protective bonding shall withstand the highest thermal and dynamic stresses that can occur to the PCE item(s) concerned when they are subjected to a fault connecting live parts to accessible conductive parts. The protective bonding shall remain effective for as long as a fault to the accessible conductive parts persists or until an upstream protective device removes power from the part.		P
	Protective bonding shall meet following requirements:		P
	a) For PCE with an overcurrent protective device rating of 16 A or less, the impedance of the protective bonding means shall not exceed 0,1 Ω during or at the end of the test below.		N/A
	b) For PCE with an overcurrent protective device rating of more than 16 A, the voltage drop in the protective bonding test shall not exceed 2,5 V during or at the end of the test below.		P
	As alternative to a) and b) the protective bonding may designed according to the requirements for the external protective earthing conductor in 7.3.6.3.5, in which case no testing is required.		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 overcurrent protective device is that provided external to the equipment (for example, in the building wiring, in the mains plug or in an equipment rack);		N/A
	b) For pluggable equipment type B and fixed equipment, the maximum rating of the overcurrent protective device specified in the equipment installation instructions to be provided external to the equipment;		N/A
	c) For a circuit or part of the equipment for which		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	an overcurrent protective device is provided as part of the equipment, the rating of the provided overcurrent device.		
	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		P
	The test current, duration of the test and acceptance criteria are as follows:	(see appended table 7.3.6.3.3)	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 200% of the overcurrent protective device rating and the duration of the test is as shown in Table 10 below. The voltage drop in the protective bonding means, during and at the end of the test, shall not exceed 2,5 V.	(see appended table 7.3.6.3.3)	P
	c) During and after the test, there shall be no melting, loosening, or other damage that would impair the effectiveness of the protective bonding means.		N/A
	The test current is derived from an a.c or d.c supply		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	source, the output of which is not earthed.		
	As an alternative to Table 10, where the time-current characteristic of the overcurrent protective device that limits the fault current in the protective bonding means is known because the device is either provided in the equipment or fully specified in the installation instructions, the test duration may be based on that specific device's time-current characteristic,. The tests are conducted for a duration corresponding to the 200% current value on the time-current characteristic.		N/A
7.3.6.3.4	Protective bonding impedance (routine test)		P
	If the continuity of the protective bonding is achieved at any point by a single means only (for example a single conductor or single fastener), or if the PCE is assembled at the installation location, then the impedance of the protective bonding shall also be tested as a routine test. The test shall be as in 7.3.6.3.3, except for the following:	Considered.	P
	▪ the test current may be reduced to any convenient value greater than 10 A sufficient to allow measurement or calculation of the impedance of the protective bonding means:	Considered.	P
	▪ the test duration may be reduced to no less than 2 s	Considered.	P
	For equipment subject to the type test in 7.3.6.3.3.1a), the impedance during the routine test shall not exceed 0,1Ω.		N/A
	For equipment subject to the type test in 7.3.6.3.3.1b) the impedance during the routine test shall not exceed 2,5 V divided by the test current required by 7.3.6.3.3.1b).		P
7.3.6.3.5	External protective earthing conductor	External protective earthing terminal with symbol 7 of Annex C.	P
	A protective earthing conductor shall be connected at all times when power is supplied to PCE of protective class I. Unless local wiring regulations state otherwise, the protective earthing conductor cross-sectional area shall be determined from Table 11 or by calculation according to IEC 60364-5-54.		P
	If the external protective earthing conductor is routed through a plug and socket or similar means of disconnection, it shall not be possible to disconnect it unless power is simultaneously removed from the part to be protected.		N/A
	The cross-sectional area of every external		P

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Clause	Requirement – Test	Result – Remark	Verdict
	protective earthing conductor which does not form part of the supply cable or cable enclosure shall, in any case, be not less than:		
	▪ 2,5 mm² if mechanical protection is provided;		P
	▪ 4 mm² if mechanical protection is not provided.		N/A
	For cord-connected equipment, provisions shall be made so that the external protective earthing conductor in the cord shall, in the case of failure of the strain-relief mechanism, be the last conductor to be interrupted.		N/A
7.3.6.3.6	Means of connection for the external protective earthing conductor		P
7.3.6.3.6.1	General		P
	The means of connection for the external protective earthing conductor shall be located near the terminals for the respective live conductors. The means of connections shall be corrosion-resistant and shall be suitable for the connection of cables according to 7.3.6.3.5. The means of connection for the protective earthing conductor shall not be used as a part of the mechanical assembly of the equipment or for other connections. A separate means of connection shall be provided for each external protective earthing conductor. Connection and bonding points shall be so designed that their current-carrying capacity is not impaired by mechanical, chemical, or electrochemical influences. Where enclosures and/or conductors of aluminium or aluminium alloys are used, particular attention should be given to the problems of electrolytic corrosion.		P
	The means of connection for the protective earthing conductor shall be permanently marked with:		P
	• symbol 7 of Annex C; or		P
	• the colour coding green-yellow		P
	Marking shall not be done on easily changeable parts such as screws.	Not marked on changeable parts.	P
7.3.6.3.7	Touch current in case of failure of the protective earthing conductor	See below	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.	See below	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.	Permanently connected equipment.	N/A
	For all other PCE, one or more of the following		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
	a) Permanently connected wiring, and:		N/A
	• a cross-section of the protective earthing conductor of at least 10 mm² Cu or 16 mm² Al; or	A cross-section of the protective earthing conductor of at least 35 mm² Cu or 50mm Al (recommendation 50 mm² Cu or 70 mm² Al). The caution symbol 15 of Annex C is fixed to the product and the installation manual provide details of the protective earthing measures required in the installation.	P
	• 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
7.3.6.4	Protective Class II – Double or Reinforced Insulation	Class I equipment.	N/A
	Equipment or parts of equipment designed for protective class II shall have insulation between live parts and accessible surfaces in accordance with		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	7.3.4.3. The following requirements also apply:		
	• equipment designed to protective class II shall not have means of connection for the external protective earthing conductor. However this does not apply if the external protective earthing conductor is passed through the equipment to equipment series-connected beyond it. In the latter event, the external protective earthing conductor and its means for connection shall be insulated with basic insulation from the accessible surface of the equipment and from circuits that employ protective separation, extra-low voltage, protective impedance and limited discharging energy, according to 7.3.5. This basic insulation shall correspond to the rated voltage of the series-connected equipment;		N/A
	• metal-encased equipment of protective class II may have provision on its enclosure for the connection of an equipotential bonding conductor;		N/A
	• equipment of protective class II may have provision for the connection of an earthing conductor for functional reasons or for damping of overvoltages; it shall, however, be insulated as though it is a live part;		N/A
	• equipment employing protective class II shall be marked according to 5.1.8.		N/A
7.3.7	Insulation Including Clearance and Creepage Distance		P
7.3.7.1	General		P
	This subclause gives minimum requirements for insulation, based on the principles of IEC 60664.		P
	Manufacturing tolerances shall be taken into account during measurement of creepage, clearance, and insulation distance in the PCE.		P
	Insulation shall be selected after consideration of the following influences:		P
	• pollution degree	Pollution degree 2 internally	P
	• overvoltage category	For DC input circuits: Overvoltage Category II - For AC output circuits: Overvoltage Category III	P
	• supply earthing system	TN system considered.	P
	• insulation voltage	Considered	P
	• location of insulation	Considered	P

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Clause	Requirement – Test	Result – Remark	Verdict
	• type of insulation	Considered	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:		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	Considered	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	Considered	P
7.3.7.2.3	Circuits other than mains circuits	Considered	P
7.3.7.2.4	Insulation between circuits	Considered	P
7.3.7.3	Functional insulating	Considered	P
7.3.7.4	Clearance distances	(see appended table 7.3.7)	P
7.3.7.4.1	Determination		P
7.3.7.4.2	Electric field homogeneity		P
7.3.7.4.3	Clearance to conductive enclosures		P
7.3.7.5	Creepage distances	(see appended table 7.3.7)	P
7.3.7.5.1	General		P
7.3.7.5.2	Voltage		P

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Clause	Requirement – Test	Result – Remark	Verdict
7.3.7.5.3	Materials	Considered	P
7.3.7.6	Coating	No such coating used.	N/A
7.3.7.7	PWB spacings for functional insulating		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	Approved plastic material used as basic.	P
7.3.7.8.2.2	Functional insulation		N/A
7.3.7.8.3	Thin sheet or tape material		N/A
7.3.7.8.3.1	General		N/A
7.3.7.8.3.2	Material thickness not less than 0,2 mm		N/A
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		N/A
7.3.7.8.4.1	General		N/A
7.3.7.8.4.2	Use of coating materials		N/A
7.3.7.8.5	Wound components		N/A
7.3.7.8.6	Potting materials	No such material.	N/A
7.3.7.9	Insulation requirements above 30 kHz	Considered.	P
7.3.8	Residual Current-operated protective (RCD) or monitoring (RCM) device compatibility		P
	RCD and RCM are used to provide protection against insulation faults in some domestic and industrial installations, additional to that provided by the installed equipment.	RCM used for detection.	P
7.3.9	Capacitor discharge		P
7.3.9.1	Operator access area		P
	Equipment shall be so designed that there is no risk of electric shock in operator access areas from charge stored on capacitors after disconnection of the PCE.		P
7.3.9.2	Service access areas		P
	Capacitors located behind panels that are removable for servicing, installation, or disconnection shall present no risk of electric shock or energy hazard from charge stored on capacitors after disconnection of the PCE.	Symbol 21 of Annex C and an indication of the discharge time used in a clearly visible position.	P
7.4	Protection against energy hazards	No such kind of hazard.	N/A

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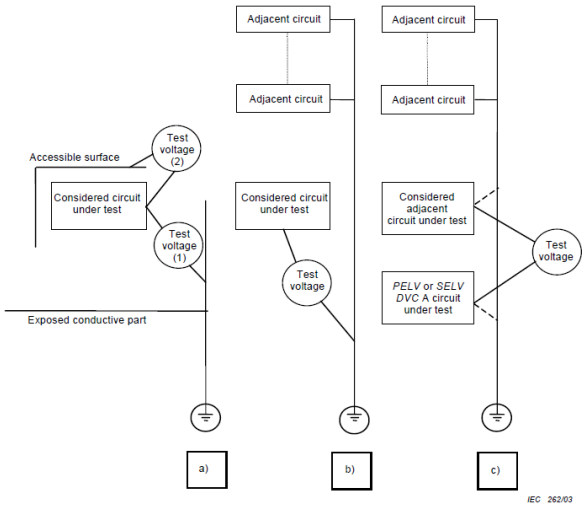
Clause	Requirement – Test	Result – Remark	Verdict
7.4.1	Determination of hazardous energy level		P
	A hazardous energy level is considered to exist if		P
	a) The voltage is 2 V or more, and power available after 60 s exceeds 240 VA.		P
	b) The stored energy in a capacitor is at a voltage. U of 2 V or more, and the stored energy. E, calculated from the following equation, exceeds 20J: $E = 0,5\ CU^2$		P
7.4.2	Operator Access Areas	No risk of energy hazard in operator access areas from accessible circuits	N/A
	Equipment shall be so designed that there is no risk of energy hazard in operator access areas from accessible circuits.		
7.4.3	Services Access Areas	Symbol 21 of Annex C and an indication of the discharge time used in a clearly visible position.	P
7.5	Electrical tests related to shock hazard	(see appended table 7.5)	P
7.5.1	Impulse voltage test (type test)		P
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 The test shall be applied as follows, according to Figure 13:  Figure 13 – Voltage test procedures		P
7.5.2.5	Duration of the a.c. or d.c. voltage test		P

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Clause	Requirement – Test	Result – Remark	Verdict
	The duration of the test shall be at least 60 s for the type test and 1 s for the routine test. The test voltage may be applied with increasing and/or decreasing ramp voltage, and the ramp times are not specified, but regardless of the ramp time, the dwell time at full voltage shall be 60 s and 1 s respectively for type and routine tests.		
7.5.2.6	Verification of the a.c. or d.c. voltage test		P
7.5.3	Partial discharge test	(see appended table 7.5)	P
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	Considered.	P
8	**PROTECTION AGAINST MECHANICAL HAZARDS**		P
8.1	General		P
	Operation shall not lead to a mechanical HAZARD in NORMAL CONDITION or SINGLE FAULT CONDITION. Edges, projections, corners, openings, guards, handles and the like, that are accessible to the operator shall be smooth and rounded so as not to cause injury during normal use of the equipment.		P
	Conformity is checked as specified in 8.2 to 8.6.		P
8.2	Moving parts		P
	Moving parts shall not be able to crush, cut or pierce parts of the body of an OPERATOR likely to contact them, nor severely pinch the OPERATOR's skin. Hazardous moving parts of equipment, that is moving parts which have the potential to cause injury, shall be so arranged, enclosed or guarded as to provide adequate protection against the risk of personal injury.	No moving part.	P
8.2.1	Protection of service persons		P
	Protection shall be provided such that unintentional contact with hazardous moving parts is unlikely during servicing operations. If a guard over a hazardous moving part may need to be removed for servicing, the marking of symbol 15 of Table D-1 shall be applied on or near the guard.		P
8.3	Stability		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	Equipment and assemblies of equipment not secured to the building structure before operation shall be physically stable in NORMAL USE.	Fixed appliance.	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.	Fixed appliance.	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.	Fixed appliance.	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.		P
9.1.1	Reducing the risk of ignition and spread of flame	Considered.	P
	For equipment or a portion of equipment, there are two alternative methods of providing protection against ignition and spread of flame that could affect materials, wiring, wound components and electronic components such as integrated circuits, transistors, thyristors, diodes, resistors and capacitors.		P
9.1.2	Conditions for a fire enclosure	Fire enclosure is required	P
	A FIRE ENCLOSURE is required for equipment or parts of equipment for which Method 2 is not fully applied and complied with.		P
9.1.2.1	Parts requiring a fire enclosure		P
	Except where Method 2 is used, or as permitted in 9.1.2.2, the following are considered to have a risk of ignition and, therefore, require a FIRE ENCLOSURE:		P
	– components in PRIMARY CIRCUITS		P

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Clause	Requirement – Test	Result – Remark	Verdict
	– 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;		P
	– components within a power supply unit or assembly having a limited power output complying with the criteria for a LIMITED POWER SOURCE as specified in 9.2, including overcurrent protective devices, limiting impedances, regulating networks and wiring, up to the point where the LIMITED POWER SOURCE output criteria are met;		P
	– components having unenclosed arcing parts, such as open switch and relay contacts and commutators, in a circuit at HAZARDOUS VOLTAGE or at a HAZARDOUS ENERGY LEVEL; and		P
	– insulated wiring, except as permitted in 9.1.2.2.		P
9.1.2.2	Parts not requiring a fire enclosure		N/A
9.1.3	Materials requirements for protection against fire hazard		P
9.1.3.1	General		P
	ENCLOSURES, components and other parts shall be so constructed, or shall make use of such materials, that the propagation of fire is limited.		P
9.1.3.2	Materials for fire enclosures	Metal enclosure used.	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.		N/A
9.1.3.3	Materials for components and other parts outside fire enclosures		N/A
	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.		N/A
9.1.3.4	Materials for components and other parts inside fire enclosures	Internal components except small parts are V-2, HF-2 or better.	P
9.1.3.5	Materials for air filter assemblies	No such materials used	N/A

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Clause	Requirement – Test	Result – Remark	Verdict
9.1.4	Openings in fire enclosures	IP66 appliance, 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	(see appended table 9.2)	N/A
9.3	Short-circuit and overcurrent protection		N/A
9.3.1	General		N/A
	The PCE shall not present a hazard, under short-circuit or overcurrent conditions at any port, including phase-to-phase, phase-to-earth and phase-to-neutral, and adequate information shall be provided to allow proper selection of external wiring and external protective devices.		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
9.3.2	Protection against short-circuits and overcurrents shall be provided for all input circuits, and for output circuits that do not comply with the requirements for limited power sources in 9.2, except for circuits in which no overcurrent hazard is presented by short-circuits and overloads.		N/A
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.		N/A
10	**PROTECTION AGAINST SONIC PRESSURE HAZARDS**		P
10.1	General		P
	The equipment shall provide protection against the effect of sonic pressure. Conformity tests are carried out if the equipment is likely to cause such HAZARDS.	Sound pressure less than 80dBA, no hazards	P
10.2	Sonic pressure and Sound level	See above.	P
10.2.1	Hazardous Noise Levels		P
11	**PROTECTION AGAINST LIQUID HAZARDS**	No liquid used.	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
11.3	Oil and grease		N/A
12	**CHEMICAL HAZARDS**		N/A
12.1	General		N/A
13	**PHYSICAL REQUIREMENTS**		P
13.1	Handles and manual controls		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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.	No such device.	N/A
13.1.1	Adjustable controls		N/A
13.2	Securing of parts		P
13.3	Provisions for external connections		P
13.3.1	General		P
13.3.2	Connection to an a.c. Mains supply		P
13.3.2.1	General		P
	For safe and reliable connection to a MAINS supply, equipment shall be provided with one of the following:		P
	– terminals or leads or a non-detachable power supply cord for permanent connection to the supply; or		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	No such device.	N/A
13.3.2.5	Cord anchorages and strain relief		N/A
	For equipment with a non-detachable power supply cord, a cord anchorage shall be supplied such that:		N/A
	– the connecting points of the cord conductors are relieved from strain; and		N/A
	– the outer covering of the cord is protected from abrasion.		N/A
13.3.2.6	Protection against mechanical damage		P
13.3.3	Wiring terminals for connection of external conductors	Sizes specified in instruction manual	P
13.3.3.1	Wiring terminals		P
13.3.3.2	Screw terminals		P

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Clause	Requirement – Test	Result – Remark	Verdict
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		N/A
13.3.6	Disconnection from supply sources	Approved DC switch supplied.	P
13.3.7	Connectors, plugs and sockets	Approved standard connectors used.	P
13.3.8	Direct plug-in equipment		N/A
13.4	Internal wiring and connections		P
13.4.1	General	Internal wiring is PVC insulated, rated VW-1. Internal wiring gauge is suitable for current intended to be carried.	P
13.4.2	Routing		P
13.4.3	Colour coding		P
13.4.4	Splices and connections		P
13.4.5	Interconnections between parts of the PCE		P
13.5	Openings in enclosures		N/A
13.5.1	Top and side openings	No openings.	N/A
	Openings in the top and sides of ENCLOSURES shall be so located or constructed that it is unlikely that objects will enter the openings and create hazards by contacting bare conductive parts.		N/A
13.6	Polymeric Materials		P
13.6.1	General		P
13.6.1.1	Thermal index or capability		P
13.6.2	Polymers serving as enclosures or barriers preventing access to hazards		N/A
13.6.2.1	Stress relief test		P
13.6.3	Polymers serving as solid insulation		N/A
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	Considered and approved material used.	P
13.7	Mechanical resistance to deflection, impact, or drop		P

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Clause	Requirement – Test	Result – Remark	Verdict
13.7.1	General	Metal and approved plastic used enclosure used.	P
13.7.2	250-N deflection test for metal enclosures	Applied for external of metal enclosure	P
13.7.3	7-J impact test for polymeric enclosures	Complied.	P
13.7.4	Drop test		N/A
13.8	Thickness requirements for metal enclosures		N/A
13.8.1	General	PCE compliance with re-quirements of 13.7	N/A
13.8.2	Cast metal		N/A
13.8.3	Sheet metal		N/A
14	**COMPONENTS**		P
14.1	General	(see appended table 14)	P
	Where safety is involved, components shall be used in accordance with their specified RATINGS unless a specific exception is made. They shall conform to one of the following:		P
	a) applicable safety requirements of a relevant IEC standard. Conformity with other requirements of the component standard is not required. If necessary for the application, components shall be subjected to the test of this standard, except that it is not necessary to carry out identical or equivalent tests already performed to check conformity with the component standard;		P
	b) the requirements of this standard and, where necessary for the application, any additional applicable safety requirements of the relevant IEC component standard;		P
	c) if there is no relevant IEC standard, the requirements of this standard;		P
	d) applicable safety requirements of a non-IEC standard which are at least as high as those of the applicable IEC standard, provided that the component has been approved to the non-IEC standard by a recognized testing authority.		P
	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

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Clause	Requirement – Test	Result – Remark	Verdict
14.2	Motor Over temperature Protection	No motor used.	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.		
14.3	Over temperature protection devices		P
14.4	Fuse holders	No fuse holder used.	N/A
14.5	MAINS voltage selecting devices	No such device.	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.		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.		N/A
	Conformity of the flammability RATING is checked by inspection of data on the materials. Alternatively, conformity is checked by performing the V-1 tests specified in IEC 60707 on three samples of the relevant parts.	V-0 min. PCB used	P
14.7	Circuits or components used as transient overvoltage limiting devices		P
	If control of transient overvoltage is employed in the equipment, any overvoltage limiting component or circuit shall be tested with the applicable impulse withstand voltage of Table 7-10 using the test method from 7.5.1 except 10 positive and 10 negative impulses are to be applied and may be spaced up to 1 min apart.	Certified components used	P
14.8	Batteries	No batteries.	N/A
	Equipment containing batteries shall be designed to reduce the risk of fire, explosion and chemical leaks under normal conditions and after a single fault in the equipment including a fault in circuitry within the equipment battery pack.		N/A
14.8.1	Battery Enclosure Ventilation		N/A
14.8.1.1	Ventilation requirements		N/A
14.8.1.2	Ventilation testing		N/A
14.8.1.3	Ventilation instructions		N/A
14.8.2	Battery Mounting		N/A
	Compliance is verified by the application of the force to the battery's mounting surface. The test force is to be increased gradually so as to reach the		N/A

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Clause	Requirement – Test	Result – Remark	Verdict
	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.		
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	No batteries.	N/A
	Reverse battery connection of the terminals shall be prevented if reverse connection could result in a hazard within the meaning of this Standard		N/A
14.8.5	Battery maintenance instructions		N/A
	The information and instructions listed in 5.3.4.1 shall be included in the operator manual for equipment in which battery maintenance is performed by the operator, or in the service manual if battery maintenance is to be performed by service personnel only.		N/A
14.8.6	Battery accessibility and maintainability		N/A
	Battery terminals and connectors shall be accessible for maintenance with the correct TOOLS. Batteries with liquid electrolyte, requiring maintained shall be so located that the battery cell caps are accessible for electrolyte tests and readjusting of electrolyte levels.		N/A
15	Software and firmware performing safety functions	Single fault tests simulated for equipment, no critical hazard listed in this standard occur.	P

4.2.2.6/4.2.2.7	TABLE: electrical data					P
Input			Output			
U (V)	I (A)	P (W)	U (V)	I (A)	P (W)	PF
MAX 175KTL3-X HV						
Tested at 50Hz						
496.40	125.19	62087	801.34	43.61	60637	0.997
			802.35	43.51		
			803.14	43.53		
800.83	224.60	179990	803.45	126.10	175520	0.998
			801.00	126.01		
			800.40	126.38		
1000.00	180.00	179010	803.05	127.00	175893	0.998
			801.00	126.95		
			800.50	127.00		
1300.00	137.87	178000	803.59	126.14	175003	0.998
			801.00	126.01		
			800.30	126.33		
1500.37	23.90	35856	801.99	25.87	35210	0.981
			802.04	25.83		
			802.76	25.82		
Tested at 60Hz						
496.37	124.87	61982	802.22	43.53	60294	0.997
			802.30	43.49		
			803.23	43.50		
800.75	224.61	180000	803.46	126.12	175000	0.998
			801.00	126.00		
			800.55	126.39		
1000.00	180.00	179013	803.05	127.00	175790	0.998
			801.00	126.90		
			800.56	127.00		
1300.00	137.88	178003	803.64	126.10	175007	0.998
			801.00	126.01		
			800.24	126.31		
1500.59	23.91	35713	801.89	25.94	35304	0.980
			802.06	25.90		
			802.84	25.89		
MAX 185KTL3-X HV						
Tested at 50Hz						

496.31	132.03	65525	802.19	45.84	63571	0.997
			802.46	45.84		
			803.87	45.87		
800.67	237.91	189127	803.44	134.00	185060	0.998
			801.00	133.87		
			800.47	134.00		
1000.00	190.0	189000	803.05	134.00	185893	0.998
			801.00	134.00		
			800.59	134.00		
1300.00	146.00	189000	803.77	133.95	185003	0.998
			801.00	133.60		
			800.19	134.00		
1500.28	25.37	38070	802.08	27.32	37279	0.983
			802.13	27.26		
			802.96	27.26		
Tested at 60Hz						
496.25	131.54	65228	802.36	45.79	63451	0.997
			802.26	45.78		
			803.22	45.76		
800.79	237.88	190050	803.40	134.00	185043	0.998
			801.00	133.89		
			800.40	134.00		
1000.00	190.00	189000	803.08	134.00	189950	0.998
			801.00	134.00		
			800.59	134.00		
1300.00	146.00	189000	803.75	133.96	185010	0.998
			801.00	133.59		
			800.21	134.00		
1500.28	25.25	37739	802.02	27.26	37180	0.984
			802.14	27.16		
			802.97	27.18		
MAX 196KTL3-X HV						
Tested at 50Hz						
496.15	138.99	68912	802.26	48.48	67181	0.997
			802.44	48.44		
			803.24	48.42		
797.00	252.92	200771	803.00	141.48	195926	0.996
			800.68	141.11		
			801.00	141.64		
997.23	202.42	200617	803.18	144.69	195994	0.996

			800.70	141.59		
			800.78	141.75		
1307.02	154.43	200946	803.09	142.28	196658	0.996
			800.65	142.08		
			801.31	142.21		
1500.00	30.99	40104.67	803.86	28.37	39204	0.954
			801.00	28.26		
			800.19	28.40		
Tested at 60Hz						
496.13	139.15	68986	802.27	48.52	67251	0.997
			802.38	48.49		
			803.20	48.48		
800.88	252.00	201763	803.37	141.98	19604	0.998
			801.00	141.59		
			800.40	142.00		
1000.00	201.0	200013	803.11	142.00	196973	0.998
			801.00	142.00		
			800.58	142.00		
1300.00	154.97	200017	803.86	141.86	196023	0.998
			801.00	141.28		
			800.19	141.99		
1500.38	26.17	39121	802.04	28.33	38779	0.985
			802.16	28.32		
			802.84	28.34		
MAX 216KTL3-X HV						
Tested at 50Hz						
495.95	154.35	76504	802.38	53.72	74516.	0.998
			802.34	53.71		
			803.22	53.75		
797.00	278.63	221007	803.00	156.00	215933	1.00
			800.83	156.00		
			801.00	156.00		
997.00	223.00	221002	803.00	156.00	215976	0.996
			800.98	156.00		
			801.00	156.00		
1306.34	170.34	221777	803.29	156.99	217037	0.996
			800.83	156.76		
			801.27	156.92		
1500.14	28.84	43138	802.18	30.99	42562	0.989
			802.07	30.95		

			802.92	31.20		
Tested at 60Hz						
495.80	153.61	76112	802.38	53.48	74200	0.998
			802.42	53.49		
			803.32	53.49		
800.65	277.56	221007	803.37	156.00	216137	0.998
			801.00	156.00		
			800.43	156.00		
1000.00	221.02	220047	803.89	156.00	216073	0.998
			801.00	156.00		
			800.14	156.00		
1300.00	170.11	220500	803.82	156.00	216070	0.998
			801.00	156.00		
			800.22	156.00		
1499.71	28.76	42994	802.11	30.88	42393	0.990
			802.18	30.85		
			803.03	30.83		
MAX 225KTL3-X HV						
Tested at 50Hz						
495.73	160.44	79494	802.48	55.85	77446	1.000
			802.38	55.80		
			803.28	55.87		
800.81	289.01	230077	803.30	162.84	225130	0.998
			801.00	162.32		
			800.48	162.99		
1000.00	231.0	230000	803.09	163.00	226000	0.998
			801.00	163.00		
			800.68	163.00		
1300.00	177.06	229523	803.84	162.57	225070	0.998
			801.00	162.15		
			800.23	162.93		
1500.15	30.02	44900	802.15	32.25	44335	0.991
			802.23	32.15		
			802.96	32.16		
Tested at 60Hz						
495.72	160.34	79442	802.52	55.80	77393	0.998
			802.42	55.77		
			803.29	55.82		
800.82	289.02	230093	803.28	162.93	225153	0.998
			801.00	162.36		

			800.50	162.99		
1000.00	231.00	229997	803.10	163.00	225993	0.998
			801.00	163.00		
			800.61	163.00		
1300.00	177.10	229583	803.92	162.62	225100	0.998
			801.00	162.19		
			800.17	162.94		
1499.85	30.07	44969	802.07	32.20	44333	0.990
			802.25	32.19		
			802.96	32.19		
MAX 230KTL3-X HV						
Tested at 50Hz						
495.78	164.69	81604	802.48	57.47	79666	0.998
			802.38	57.40		
			803.34	57.43		
800.83	295.51	235260	803.35	166.00	230160	0.998
			801.00	166.00		
			800.41	166.04		
1000.00	236.0	235000	803.14	166.00	235000	0.998
			801.00	166.00		
			800.55	166.04		
1300.00	181.01	234854	803.93	166.00	230057	0.998
			801.00	166.00		
			800.27	166.01		
1500.31	31.24	46751	802.14	33.48	46161	0.992
			802.26	33.44		
			803.02	33.47		
Tested at 60Hz						
495.80	164.90	81716	802.37	57.47	79755	0.998
			802.51	57.46		
			803.32	57.52		
800.82	295.56	235327	803.40	166.00	230213	0.998
			801.00	166.00		
			800.44	166.03		
1000.00	236.00	235000	803.07	166.00	230997	0.998
			801.00	166.00		
			800.58	166.04		
1300.00	181.02	234847	803.92	166.00	230057	0.998
			801.00	166.00		
			800.14	166.01		

1500.05	31.27	46781	802.10	33.47	46136	0.992
			802.26	33.44		
			802.99	33.46		
MAX 250KTL3-X HV						
Tested at 50Hz						
495.67	178.03	88201	802.48	62.17	86248	0.997
			802.47	62.20		
			803.41	62.18		
800.69	321.11	255997	803.32	180.97	250203	0.998
			801.00	180.51		
			800.40	181.00		
1000.00	256.5	255180	803.10	180.98	250300	0.998
			801.00	180.60		
			800.57	181.00		
1300.00	197.00	255003	803.87	180.85	250167	0.998
			801.00	180.31		
			800.28	180.98		
1499.54	33.64	50319	802.19	35.86	49535	0.994
			802.15	35.83		
			803.01	35.85		
Tested at 60Hz						
495.46	178.32	88308	802.47	62.19	86239	0.997
			802.53	62.13		
			803.48	62.18		
800.72	321.09	256000	803.37	180.97	250247	0.998
			801.00	180.60		
			800.45	181.00		
1000.00	256.56	255173	803.17	180.98	250337	0.998
			801.00	180.60		
			800.55	181.00		
1300.00	197.00	255000	803.92	180.84	250120	0.998
			801.00	180.31		
			800.19	180.98		
1499.45	33.66	50355	802.17	36.03	49751	0.994
			802.30	35.98		
			802.97	36.00		
MAX 253KTL3-X HV						
Tested at 50Hz						
495.55	182.27	90285	802.46	63.59	88186	0.997
			802.54	63.57		

			803.31	63.61		
800.62	325.03	259003	803.17	183.00	253317	0.998
			801.00	182.99		
			800.54	183.00		
1000.00	259.75	258210	803.20	183.00	253213	0.998
			801.00	182.98		
			800.53	183.00		
1300.00	199.24	258027	803.92	183.00	253110	0.998
			182.88	182.88		
			800.20	183.00		
1499.24	35.02	52376	802.17	37.15	51368	0.995
			802.33	37.15		
			802.93	37.14		
Tested at 60Hz						
495.47	182.57	90426	802.34	63.72	88356	0.998
			802.58	63.64		
			803.39	63.72		
800.77	325.05	259000	803.16	183.00	253280	0.998
			801.00	182.97		
			800.54	183.00		
1000.00	259.63	258230	803.13	183.00	253253	0.998
			801.00	182.99		
			800.59	183.00		
1300.00	199.19	158017	803.94	183.00	253133	0.998
			801.00	182.91		
			800.21	183.00		
1499.60	34.58	51741	802.17	36.90	51024	0.995
			802.22	36.89		
			803.03	36.93		
Supplementary information:						

4.3	**TABLE: heating temperature rise measurements (MAX 253KTL3-X HV)**		P
	test voltage (V) .....:	See below	—
	t1 (°C).....:	See below	—
	t2 (°C) .....:	See below	—

Thermocouple Locations	Max. temperature measured (°C)				Max. temperature limit, (°C)
	1	2	3	4	
Switch	35.4	35.5	65.6	65.8	75
AC terminal	70.0	70.0	83.2	83.3	120

PV terminal	44.2	44.3	65.1	65.4	75
Handle	35.5	35.6	64.1	64.1	75
Heat sinks	67.7	67.7	78.6	76.9	100
Chassis suspension surface	40.4	40.5	65.5	71.0	75
On the surface of the shell	55.4	55.4	74.5	73.8	75
The surface of the LCD	43.4	43.4	70.2	70.1	75
Internal environment temperature	66.5	66.6	80.4	81.0	--
Internal wire: AC filter board-output terminal	68.4	68.5	83.8	83.7	105
Internal wire: Power board-Electrolyte Capacitor	67.9	67.9	86.9	85.0	105
Internal wire: INV board-IO board	71.6	71.7	91.1	90.6	105
Internal wire: IO board-AC filter board	67.4	67.5	82.3	82.8	105
Boost Inductance	71.3	63.3	92.9	84.0	130
Input Boost Inductor wire	62.9	63.0	84.5	83.6	105
Internal wire: Switch-Input	66.5	66.6	84.2	84.8	105
Internal wire: Switch-Terminal	66.8	66.8	87.7	87.7	105
PV input filter capacitor	71.3	67.8	87.8	88.6	105
PV_CT	72.2	72.3	90.8	90.2	150
PV lightning protection device	66.7	68.3	79.4	82.7	85
Flying across the capacitor	71.3	71.3	87.1	87.1	105
Flying across the clamping diodes	72.9	73.0	90.5	90.0	175
Bus film capacitor	75.6	75.7	92.8	91.2	105
Bus electrolytic capacitor	70.2	70.3	86.3	85.4	105
INV_IGBT	81.3	78.7	103.0	103.4	150
INV_Inductor	106.7	106.4	129.8	129.9	150
Boost_IGBT	69.7	60.3	97.2	81.8	150
Output relay	75.7	75.7	83.3	83.8	85
Output filter capacitor	73.5	73.6	84.2	93.9	105
AC_SPS transformer (TX1)	78.4	78.5	97.0	95.9	110
PV_SPS_ transformer (TX7)	76.3	76.7	96.4	102.3	110
Communication optical coupling U20	69.0	69.1	90.8	90.1	105
INV_CT	69.5	69.6	81.7	82.8	85
IO board _C425 Y capacitor	72.3	72.3	91.3	89.3	110
CPLD	72.5	72.6	87.6	86.1	135
CPU_TMS320F28075	74.3	74.4	89.2	88.2	105
Common-mode inductor	88.5	88.6	105.6	106.6	130
LCL filter inductance	98.3	98.4	115.9	115.7	130

AC SPD_X capacitance	69.9	69.9	88.1	90.4	110
AC lightning protection device	68.0	68.0	82.0	82.8	85
Ambient	30	30	60	60	--

Note:
Condition 1: The ambient temperature 30°C, input voltage 800Vdc, output voltage 800V(L-L), 50Hz the PCE output power with full power still the parts temperature steady.
Condition 2: The ambient temperature 30°C, input voltage 1300Vdc, output voltage 800V(L-L), 50Hz the PCE output power with full power still the parts temperature steady.
Condition 3: The ambient temperature 60°C, , input voltage 800Vdc, output voltage 800V(L-L), 50Hz the PCE output power derating still the parts temperature steady.
Condition 4: The ambient temperature 60°C, input voltage 1300Vdc, output voltage 800V(L-L), 50Hz the PCE output power derating still the parts temperature steady.
Tests are conducted on model **MAX 253KTL3-X HV** to represent all models.

4.4	**TABLE: fault condition tests**						P
	ambient temperature (°C) ..... :		25				—
No.	component No.	fault	test voltage (V)	test time	fuse No.	fuse current (A)	result
PCE							
1.	PV input	reverse	1080	5min	--	--	Error message: “Warning110”. EUT is operating normally. No damaged, no hazard.
2.	AC Output	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. No damage, no hazard.
3.	PV input	DC overload	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
4.	AC Output	lack of phase	1080	3min	--	--	Error message: “Error 129”. EUT disconnected from grid immediately. No damage, no hazard.
5.	Cooling failure	block vents	1080	10min	--	--	Error message: “Warning100”. EUT is alarmed but can operate normally. No damage, no hazard.
6.	Cooling failure	Block wind	1080	2h	--	--	No Error message. EUT is operating normally(Enter over temperature and load reduction mode). No damaged, no hazard.

7.	Cooling failure	wrap quilt	1080	2h	--	--	No Error message. EUT is operating normally(Enter over temperature and load reduction mode). No damaged, no hazard.
PV input board							
8.	PV current detection failure (R11)	o-c	1080	5min	--	--	Error message: “Error 116”. EUT disconnected from grid immediately. No damage, no hazard.
9.	PV current detection failure (U17B)	s-c	1080	5min	--	--	Error message: “Error 116”. EUT disconnected from grid immediately. No damage, no hazard.
10.	PV voltage detection failure (R107)	s-c	1080	5min	--	--	Error message: “Error128”. EUT disconnected from grid immediately. No damage, no hazard.
11.	PV voltage detection failure (R120)	s-c	1080	5min	--	--	Error message: “Error 128”. EUT disconnected from grid immediately. No damage, no hazard.
12.	PV voltage detection failure (R134)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
13.	PV voltage detection failure (R118)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
Power board							
14.	Inverter IGBT M7 (2-4PIN)	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. M7 damage, no hazard.
15.	Inverter IGBT M7 (2-3PIN)	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. M7 damage, no hazard.
16.	Inverter IGBT M7 (1-6PIN)	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. M7 damage, no hazard.
17.	Inverter IGBT M7 Drive failure (R562)	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. M7 damage, no hazard.
18.	Inverter IGBT M7 Drive failure (R565)	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. M7 damage, no hazard.

19.	Inverter NTC detection failure(R562)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
20.	Inverter NTC detection failure(R565)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
21.	Inverter NTC detection failure(R957)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
22.	Inverter NTC detection failure(C311)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
23.	Boost IGBT M1 Drive failure (R937)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
24.	Boost IGBT M1 Drive failure (C295)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
25.	Boost IGBT M1 Drive failure (R490)	s-c	1080	5min			Error message: “Error 116”. EUT disconnected from grid immediately. M1 damage, no hazard.
26.	Boost IGBT M1 Drive failure (R495)	s-c	1080	5min			Error message: “Error 116”. EUT disconnected from grid immediately. M1 damage, no hazard.
27.	Boost IGBT M1 Drive failure (R490)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
28.	Boost IGBT M1 Drive failure (R495)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
29.	Boost IGBT M1 (2-4PIN)	s-c	1080	5min	--	--	Error message: “Error 116”. EUT disconnected from grid immediately. M1 damage, no hazard.
30.	Boost IGBT M1 (1-4PIN)	s-c	1080	5min	--	--	Error message: “Error 116”. EUT disconnected from grid immediately. M1 damage, no hazard.
IO Board							
31.	BOOST1 current detection failure (R126)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.

32.	BOOST1 current detection failure (C69)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
33.	AC voltage detection failure(R854)	s-c	1080	5min	--	--	Error message: “Error 129”. EUT disconnected from grid immediately. No damage, no hazard.
34.	AC voltage detection failure(C146)	s-c	1080	5min	--	--	Error message: “Error 129”. EUT disconnected from grid immediately. No damage, no hazard.
35.	AC voltage detection failure(R206)	o-c	1080	5min	--	--	Error message: “Error 129”. EUT disconnected from grid immediately. No damage, no hazard.
36.	INV voltage detection failure(R1282)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
37.	INV voltage detection failure(C132)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
38.	INV voltage detection failure(R191)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
39.	ISO insulation detection detects failure(R1049)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
40.	ISO insulation detection detects failure(C527)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
41.	ISO insulation detection detects failure(R1174)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
42.	ISO insulation detection detects failure(R1106)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
43.	BUS voltage detection failure (R1095)	o-c	1080	5min	--	--	Error message: “Error 122”. EUT disconnected from grid immediately. No damage, no hazard.

44.	BUS voltage detection failure (C194)	o-c	1080	5min	--	--	Error message: “Error 122”. EUT disconnected from grid immediately. No damage, no hazard.
45.	BUS voltage detection failure (R278)	o-c	1080	5min	--	--	Error message: “Error 122”. EUT disconnected from grid immediately. No damage, no hazard.
46.	BOOST Overcurrent protection detection failure (R1167)	s-c	1080	5min	--	--	Error message: “Error 116”. EUT disconnected from grid immediately. No damage, no hazard.
47.	BOOST Overcurrent protection detection failure (R1037)	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
48.	DC auxiliary source failure Q43(2-3PIN)	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
49.	DC auxiliary source failure Q43(1-3PIN)	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
50.	DC auxiliary source +15V failure	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
51.	DC auxiliary source -15V failure	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
52.	DC auxiliary source +8V failure	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
53.	AC auxiliary source failure Q39(1-3PIN)	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
54.	AC auxiliary source failure Q43(2-3PIN)	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
55.	AC auxiliary source +24V.S failure	s-c	1080	5min	--	--	No Error message. EUT is shut down No damaged, no hazard.
56.	GFCI failure(C590)	s-c	1080	5min	--	--	Error message: “Error 119”. EUT disconnected from grid immediately. No damage, no hazard.

57.	GFCI failure(R249)	o-c	1080	5min	--	--	Error message: “Error 119”. EUT disconnected from grid immediately. No damage, no hazard.
58.	AC current detection failure(C239)	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. No damage, no hazard.
59.	AC current detection failure(R344)	o-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. No damage, no hazard.
60.	DC component detection failure(R382)	s-c	1080	5min	--	--	Error message: “Error 127”. EUT disconnected from grid immediately. No damage, no hazard.
61.	AC relay RY3-RY8 failure	s-c	1080	5min	--	--	Error message: “Error 117”. EUT disconnected from grid immediately. No damage, no hazard.
62.	AC current overcurrent protection failure(C274)	s-c	1080	5min	--	--	Error message: “Error 115”. EUT disconnected from grid immediately. No damage, no hazard.
63.	Optocoupler failure(C386)	s-c	1080	5min	--	--	Error message: “Error 101”. EUT disconnected from grid immediately. No damage, no hazard.
64.	Internal environment NTC detection failure(C534)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
65.	Internal environment NTC detection failure(C534)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
66.	Internal environment NTC detection failure(C534)	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damaged, no hazard.
BUS-CAP-1 Board							
67.	Electrolytic capacitor board 1 failure(C1)	s-c	1080	5min	--	--	Error message: “Error 122”. EUT disconnected from grid immediately. No damage, no hazard.
BUS-CAP-2 Board							

68.	Electrolytic capacitor board 1 failure(C19)	s-c	1080	5min	--	--	Error message: “Error 122”. EUT disconnected from grid immediately. No damage, no hazard.
Control board							
69.	Main chip +3.3V failure	s-c	1080	5min	--	--	Error message: “Error 101”. EUT disconnected from grid immediately. No damage, no hazard.
70.	Main chip XL2 failure	s-c	1080	5min	--	--	No Error message. EUT disconnected from grid immediately. No damage, no hazard.
71.	Main chip XL2 failure	o-c	1080	5min	--	--	No Error message. EUT disconnected from grid immediately. No damage, no hazard.
72.	Main and sub CPU communicati on failure	o-c	1080	5min	--	--	Error message: “Error 101”. EUT disconnected from grid immediately. No damage, no hazard.
73.	Sub chip +3.3V failure	s-c	1080	5min	--	--	Error message: “Error 101”. EUT disconnected from grid immediately. No damage, no hazard.
74.	Sub chip XL failure	s-c	1080	5min	--	--	No Error message. EUT disconnected from grid immediately. No damage, no hazard.
75.	Sub chip XL1 failure	o-c	1080	5min	--	--	No Error message. EUT disconnected from grid immediately. No damage, no hazard.
M3 board							
76.	Main chip +3.3V.S failure	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damage, no hazard.
77.	Main chip COXL1 failure	s-c	1080	5min	--	--	No Error message. EUT is operating normally. No damage, no hazard.
78.	Main chip COXL1 failure	o-c	1080	5min	--	--	No Error message. EUT is operating normally. No damage, no hazard.
supplementary information: s-c: short-circuited, o-c: open-circuited, o-l: overload. The unit passed electric strength test after single fault test above.							
See technical documentation.							

7.3.6.3.3	TABLE: protective equipotential bonding ;			P
Measured between:	Test current (A)	Voltage drop (V)	Resistance (mΩ)	result
PE terminal to metal enclosure	32	--	40	--
supplementary information:				

7.3.6.3.7	TABLE: touch current measurement		P
Measured between:	Measured (mA)	Limit (mA)	Comments/conditions
Ground to Metal Enclosure	AC 7.02 / DC 0.01	AC 3.5 / DC 10	--
Ground to communication terminal	AC 6.86 / DC 0.01		--
supplementary information: Permanently connected wiring, and a cross-section of the protective earthing conductor of at least 35 mm² Cu or 50 mm² Al (Recommendation 50 mm² or 50 mm² Al); In addition, the caution symbol 15 of Annex C is fixed to the product and the installation manual provide details of the protective earthing measures required in the installation.			

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)
On I/O board						
Opto-coupler U20 form Pri. to Sec. (R)**	1500Vdc	1500Vdc	10.4	43.9	15.0	16.3
Primary resistor R676 to secondary of isolated transformer TX1 (R)*	1500Vdc	1500Vdc	10.4	10.7	15.0	15.5
Secondary Trace of D201 to Primary trace (R)*	1500Vdc	1500Vdc	10.4	15.3	15.0	15.3
Secondary Trace of U55 to Primary trace (R)*	1500Vdc	1500Vdc	10.4	11.7	15.0	> 18.0
Secondary Trace of T512 to Primary trace (R)*	1500Vdc	1500Vdc	10.4	16.3	15.0	16.3
Secondary Trace below HS2 to Primary trace of D178 (R)*	1500Vdc	1500Vdc	10.4	11.1	15.0	16.3
Secondary pin of T296 to Primary pin of T274 (R)*	1500Vdc	1500Vdc	10.4	18.3	15.0	18.3
Primary to secondary of Y-cap C425 (B)*	1500Vdc	1500Vdc	7.1	7.8	7.5	7.8
Primary of Y-cap C425 to Secondary Trace of U55 (B)*	1500Vdc	1500Vdc	7.1	7.8	7.5	7.8
Earthing terminal SC1 to primary trace (B)*	1500Vdc	1500Vdc	7.1	7.8	7.5	7.8
Earthing terminal SC21 to primary trace (B)*	1500Vdc	1500Vdc	7.1	9.6	7.5	9.6
Earthing terminal SC18 to primary trace (B)*	1500Vdc	1500Vdc	7.1	9.5	7.5	9.5
Secondary Trace below U24 to earthed trace below R613 in the inner layer of PCB (B)*	1500Vdc	1500Vdc	7.1	10.7	5.6	11.4
On input SPD board						
Earthing terminal SC6 to primary trace (B)*	1500Vdc	1500Vdc	7.1	9.0	7.5	9.0
Earthing terminal SC2 to primary trace (B)*	1500Vdc	1500Vdc	7.1	8.4	7.5	8.4
On DC Input filter board						
Earthing terminal SC22 to primary trace (B)*	1500Vdc	1500Vdc	7.1	8.0	7.5	8.0
Earthing terminal SC4 to primary trace (B)*	1500Vdc	1500Vdc	7.1	8.1	7.5	8.1
On DC Input EMI board						
Earthing Trace to primary trace (B)*	1500Vdc	1500Vdc	7.1	8.0	7.5	8.0
On AC Output filter board						

Earthing terminal SC4 to primary trace (B)*	1500Vdc	1500Vdc	7.1	7.6	7.5	7.6
Earthing terminal SC8 to primary trace (B)*	1500Vdc	1500Vdc	7.1	7.2	7.5	7.2
On AC Output SPD board						
PE terminal to primary S (B)*	1500Vdc	1500Vdc	7.1	7.6	7.5	7.6
Earthing terminal SC1 to primary trace in the inner layer of PCB (B)*	1500Vdc	1500Vdc	7.1	9.6	5.6	9.6

Note(s): * F=functional insulation, B=basic insulation, S=supplementary insulation, R=reinforced insulation.

When determine the clearance:

For DC input circuits: Overvoltage Category II applied(impulse withstand voltage 6000V)

For AC output circuits (connected to AC mains): Overvoltage Category III applied (impulse withstand voltage 6000V, temporary overvoltage 2550Vpeak considered.)

Interpolation is used.

Due to the max. altitude is 4000m, limit of clearance by the correction factor 1.29 considered.

Requirement about creepage distances for transformer and for the distance to the metal enclosure come from columns 7 and 8 of Table 14. Requirement about creepage distances for part on PWB come from column 3 of table 14.

PCB with min. CTI 175 used.

7.3.7	TABLE: distance through insulation measurement			N/A
distance through insulation di at/of:	U r.m.s. (V)	test voltage (V)	required di (mm)	di (mm)
supplementary information: The component was certified.				

7.5	TABLE: electric strength measurements, impulse voltage test and partial discharge test			P
test voltage applied between:	test voltage (V)	impulse withstand voltage (V)	partial discharge extinction voltage (V)	result
PV supply circuits to enclosure	2434Vdc	6000	--	P
AC mains circuits to enclosure	2350Vdc	6000	--	P
PV supply circuits to LCD Panel	4868Vdc	8000	--	P
AC mains circuits to LCD Panel	4700Vdc	8000	--	P
PV supply circuits to COM port	4868Vdc	8000	--	P
AC mains circuits to COM port	4700Vdc	8000	--	P
Note(s): Based on the system voltage 1500V for PV input and 800V L to L for AC mains.				

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						

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Whole product					
Metal Enclosure	Shenzhen Growatt New Energy Technology Co., Ltd	AL-5052	Min. thickness 2.0mm	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Heat sink	Fei Rong Da	AL-1060	Metal, overall measured: L:500mm W:400mm H:95mm	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt	Feng Rui De	AL-1060	Metal, overall measured: L:500mm W:400mm H:95mm	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt	Zheng Kai	AL-1060	Metal,overall measured: L:500mm，W:400mm，H:95mm	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Thermal casing	WOER	RSFR	600V 125℃	ANSI/UL 224	UL E203950
Alt	TYCO	VERSAFIT V2	600V 125℃	ANSI/UL 224	UL E35586
Alt	KAIHENG	K-2	600V 125℃	ANSI/UL 224	UL E214175
Alt	DONGGUAN SALIPT CO LTD	SALIPT S-901-600	600V 125℃	ANSI/UL 224	UL E209436
Insulation gasket	HENKEL	K-10#	WTM-0 MIN 0.13mm 150℃	ANSI/UL 94, UL 746A	UL E59150
LCD screen cover	SABIC	PC-FR60	Min.0.75mm,V-2, UV:F1	ANSI/UL 94, UL 746A/B	UL E207780
Alt.	SABIC	PMMA	Min.0.75mm,V-2, UV:F1	ANSI/UL 94, UL 746A/B	UL E207780
PV Input terminal	Vaconn	VP-D4XA-PHDF4 VP-D4XA-PHDM4	30A/1500V,85℃, IP68,6mm2	IEC 62852:2014+A1 EN 62852:2015	TUV R 50482263
Alt	Vaconn	VP-D4XB-CHSF4 VP-D4XB-CHSM4	30A/1500V,85℃, IP68,6mm2	IEC 62852:2014+A1 EN 62852:2015	TUV R 50482263
Alt	Vaconn	VP-D4XB-PHSF4 VP-D4XB-PHSM4	30A/1500V,85℃, IP68,6mm2	IEC 62852:2014+A1 EN 62852:2015	TUV R 50482263
Alt	Staubli Electrical Connectors AG	PV-ADB4-EVO 2/6-UR PV-ADS4-EVO 2/6-UR	42A/1500V,85℃, IP68,6mm2	IEC 62852:2014	TUV R 60127171

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Alt.	Amphenol	Helios H4 4mm2 Bulkhead	40A/1500V,85℃, IP68,6mm2	EC62852(d.1); am1	SUD B 107201 0002
Alt.	Cixi Longteng Technology Co., Ltd	PV-LTN01	50A/1500V,85℃, IP68,6mm2	EN 62852:2015 IEC 62852:2014+A1	TUV R 50479939
Output terminal	Shenzhen connection Technology Co., Ltd	DSTB300-03	800V/200A/300 mm2	ANSI/UL 1059, ANSI/UL 60947-1	UL E304128
Alt.	Shenzhen connection Technology Co., Ltd	DSTB300-04-R2	1000V/200A/300 mm2	ANSI/UL 1059, ANSI/UL 60947-1	UL E304128
Communication terminal	DEVALAN	VPDS07EP-8S	5A/300Vac/-40℃-90℃/IP67	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	DEVALAN	VPDS06EP-16P(SC)T TYPE	5A/300Vdc/-40℃—90℃/IP67	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	DEVALAN	VPDS06EP-16P	5A/300Vdc/-40℃—90℃/IP67	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
PV input switch （switch1,2,3）	Santon International bv	XBCH+3810-2-D	1500V,20A 1000V, 50A, 800V, 60A, 8Pole IP65	EN 60947-3:2009+A1+A2	TUV R 50436324
Alt.	PROJOY	PEDS150H-HM50-8	1500V,30A 1200V, 40A, 1000V, 50A, 800V, 50A, 8Pole IP66	EN 60947-3:2009+A1+A2	TUV R 50435011
Alt.	Zhejiang Benyi Electrical Co., Ltd	BYSS.1-50-T-8P	1500V,16A 1200V, 40A, 1000V, 50A, 800V, 50A, 8Pole IP66	EN 60947-3:2009+A1+A2	TUV R 50425301
Alt.	BEIJING EPEOPLE'S ELECTRIC PLANT CO., LTD	GHX5-32P/8P-1500-32	1500V,32A 1100V, 50A,8Pole IP66	EN 60947-3:2009+A1+A2	TUV R 50439884

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Alt.	Shanghai Liangxin ELECTRIC PLANT CO., LTD	NDG3V-50H/8/1/02/M	1500V,20A 1000V, 50A, 800V, 50A, 8Pole IP66	EN 60947-3:2009/A2: 2015	SUD N8A0835740315
PV input switch （switch4）	Santon International bv	XBCH+3610-2-D	1500V,20A 1000V, 50A, 800V, 60A, 6Pole IP65	EN 60947-3:2009+A1+A2	TUV R 50436324
Alt.	PROJOY	PEDS150H-HM50-6	1500V,30A 1200V, 40A, 1000V, 50A, 800V, 50A, 6Pole IP66	EN 60947-3:2009+A1+A2	TUV R 50435011
Alt.	Zhejiang Benyi Electrical Co., Ltd	BYSS.1-50-T-6P	1500V,16A 1200V, 40A, 1000V, 50A, 800V, 50A, 6Pole IP66	EN 60947-3:2009+A1+A2	TUV R 50425301
Alt.	BEIJING EPEOPLE'S ELECTRIC PLANT CO., LTD	GHX5-32P/6P-1500-32	1500V,32A 1100V, 50A,8Pole IP66	EN 60947-3:2009+A1+A2	TUVR 50439884
Alt.	Shanghai Liangxin ELECTRIC PLANT CO., LTD	NDG3V-50H/6/1/02/M	1500V,20A 1000V, 50A, 800V, 50A, 6Pole IP66	EN 60947-3:2009/A2: 2015	SUD N8A0835740315
PV input internal wire	3Q WIRE & CABLE CO LTD	AWG10#	UL11627/ 105℃/2000V	UL 758	UL E341104
Alt.	Zhuhai Jingdeshun Technology Co Ltd	AWG10#	UL10183/ 105℃/2000V	UL 758	UL E511656
AC output internal wire	3Q WIRE & CABLE CO LTD	AWG2#	UL11627/ 105℃/2000V	UL 758	UL E341104
Alt.	Zhuhai Jingdeshun Technology Co Ltd	AWG2#	UL10183/ 105℃/2000V	UL 758	UL E511656
Input Boost inductor	Shenzhen Growatt New Energy Technology Co., Ltd	NPH-75/615uH +15%/-10%	615uH +15%/-10%/64Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Alt.	HUIZHOU INDUCTANCE ELECTRONIC TECHNOLOGY CO.,LTD	NPH-75/615uH +15%/-11%	615uH +15%/-10%/65Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Eagle Electric Co., Ltd.	NPH-75/615uH +15%/-12%	615uH +15%/-10%/66Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Jingquanhua Technology Co., Ltd.	NPH-75/615uH +15%/-13%	615uH +15%/-10%/67Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Shenzhen Click Technology Co., Ltd.	NPH-75/615uH +15%/-14%	615uH +15%/-10%/68Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Qingdao Yunlu New Energy Technology Co., Ltd.	NPH-75/615uH +15%/-15%	615uH +15%/-10%/69Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Shenzhen Haiguang Electronics Co., Ltd.	NPH-75/615uH +15%/-16%	615uH +15%/-10%/70Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-CORE	POCO Holding Co., Ltd	NPH-75	800℃	--	--
-WIRE	WUXI YOUFAUN ELECTRIC CO LTD	EIW/MW 35-CS	200℃	ANSI/UL 1446	UL E343483
-MARGIN TAPE	DUPONT SPECIALTY PRODUCTS USA, LLC	Nomex 410	220℃	ANSI/UL 94, UL 746A/B	UL E34739
-VARNISH	WU JIANG TAIHU INSULATING MATERIAL CO LTD	ET-90	180℃	ANSI/UL 1446	UL E228349
-UL TUBE	SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO.,LTD	RSFR-H	200℃	ANSI/UL 224	UL E203950
-EPOXY	SHEN ZHEN SISUN SILICON TECHNOLOGY CO.,LTD	XS-1199-A/B	-60~200℃	UL94, UL746	UL E248811

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
output inductor	Shenzhen Growatt New Energy Technology Co., Ltd	PHD40/125uH +15%/-10%	125uH +15%/-10%/16+16Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	HUIZHOU INDUCTANCE ELECTRONIC TECHNOLOGY CO.,LTD	PHD40/125uH +15%/-10%	125uH +15%/-10%/16+16Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Eagle Electric Co., Ltd.	PHD40/125uH +15%/-10%	125uH +15%/-10%/16+16Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Jingquanhua Technology Co., Ltd.	PHD40/125uH +15%/-10%	125uH +15%/-10%/16+16Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Shenzhen Click Technology Co., Ltd.	PHD40/125uH +15%/-10%	125uH +15%/-10%/16+16Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Qingdao Yunlu New Energy Technology Co., Ltd.	PHD40/125uH +15%/-10%	125uH +15%/-10%/16+16Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Alt.	Shenzhen Haiguang Electronics Co., Ltd.	PHD40/125uH +15%/-10%	125uH +15%/-10%/16+16Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-CORE	POCO Holding Co., Ltd	PHD65-40	800℃	--	--
-WIRE	WUXI YOUFAUN ELECTRIC CO LTD SHANGHAI YOUTUO MAGNET WIRE CO	EIW	200℃	ANSI/UL 1446	UL E343483
-MARGIN TAPE	DUPONT SPECIALTY PRODUCTS USA, LLC	Nomex 410	220℃	ANSI/UL 94, UL 746A/B	UL E34739
-VARNISH	WU JIANG TAIHU INSULATING MATERIAL CO LTD	ET-90	180℃	ANSI/UL 1446	UL E228349

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
-UL TUBE	SHENZHEN WOER HEAT-SHRINKABLE MATERIAL CO.,LTD	RSFR-H	200℃	ANSI/UL 224	UL E203950
-EPOXY	SHEN ZHEN SISUN SILICON TECHNOLOGY CO.,LTD	XS-1199-A/B	-60~200℃	UL94, UL746	UL E248811
Internal fan	NMB	12038VA24QFUE1	24Vdc/1.1A	EN 60950-1	VDE116206
Atl.	Asia Vital Components Co., Ltd	DBTA1225B4S-051	24Vdc/0.62A	EN 60950-1	SUD B180125730821
Atl.	Delta Electronics Industry Co., Ltd.	THB1224B	24Vdc/0.6A/4500rpm	EN 60950-1	TUV R 50156481
External fan	NMB	09238DE24PCUE1	24Vdc/1.1A	IEC 60950-1	VDE118587
Atl.	Delta Electronics Industry Co., Ltd.	THD0924HEGDA	24Vdc/1.15A/10700rpm	IEC 60950-1	TUV R 50156481
Atl.	Delta Electronics Industry Co., Ltd.	PFB0924DHEGT7	24Vdc/1.1A/7200rpm	IEC 60950-1	VDE 40012706
PCB	YA XIN DA INT'L ELECTRONIC TECHNOLOGY CO	YXD-ML	V-0,130℃，CTI≥600	UL796	UL E466113
Alt.	JU XIN ELECTRIC TECH (MEIZHOU) CO LTD	JX-1	V-0,130℃，CTI≥600	UL796	UL E255943
BOOST IGBT（M1、M2、M3、M4、M5）	ON Semiconductor	NXH300B100H4Q2F2SG	1000V/73A/175℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	ON Semiconductor	NXH300B100H4Q2F2PG	1000V/73A/175℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	ON Semiconductor	NXH450B100H4Q2F2SG	1000V/101A/175℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	ON Semiconductor	NXH450B100H4Q2F2PG	1000V/101A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vincotech Electronic Modules(Shenzhen)Co.Ltd	B0-SP103BA100S704-LS69L98T-/7/	950V/100A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
INV IGBT（M6、M7、M8）	ON Semiconductor	NXH350N100H4Q2F2S1G	1000V/350A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	ON Semiconductor	NXH350N100H4Q2F2P1G	1000V/350A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	ON Semiconductor	NXH400N100H4Q2F2SG	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	ON Semiconductor	NXH400N100H4Q2F2PG	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vincotech Electronic Modules(Shenzhen)Co.Ltd	30-FT10NIA400S7-LP59F08	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vincotech Electronic Modules(Shenzhen)Co.Ltd	30-PT10NIA400S7-LP59F08Y	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vincotech Electronic Modules(Shenzhen)Co.Ltd	30-FT10NIA400S701-LP59F06	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vincotech Electronic Modules(Shenzhen)Co.Ltd	30-PT10NIA400S701-LP59F06Y	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vincotech Electronic Modules(Shenzhen)Co.Ltd	30-FT10NIA400S702-LP59F04	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vincotech Electronic Modules(Shenzhen)Co.Ltd	0-PT10NIA400S702-LP59F04Y	1000V/400A/175℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Power Board					

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
BUS capacitor (C131, C132, C133, C135, C136, C137, C139, C141, C142, C144, C145, C330, C331, C332)	Faratronic	C3D1X506KF0AC00	50uF/900V/-40℃~110℃	EN 61071:2007 IEC 61071:2007 IEC 61881-1:2010 EN 61881-1:2011	TUV R 50266108
Atl.	TDK	B32776S9506K5XX	50uF/900V/-40℃~110℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Guangdong Fengming Electronic Technology Co., Ltd.	1GLBH650D900-20 (2020200168)	50uF/900V/-40℃~110℃	EN 61071:2007	TUV R 50321877
Atl.	Panasonic	EZPV80506MTB	50uF/800V/-40℃~110℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Panasonic	EZPV80506MTC	50uF/800V/-40℃~110℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Huarong Electronics Co., Ltd.	EPBS506K0900DB137B-FF	50uF/900V/-40℃~105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
capacitor (C4, C64, C65, C67, C68, C70, C71, C72, C85, C87, C90, C93, C151, C156, C159, C194)	Faratronic	C3D3L105KB00C00	1uF/1200V/-40℃~110℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	KEMET	C4AEQBU4100A1WJ	1u/1100V /-40℃~110℃	EN 61071:2007 IEC 61071:2007 IEC 61881-1:2010 EN 61881-1:2011	TUV R 50266108
Atl.	Guangdong Fengming Electronic Technology Co., Ltd.	1GSBH510D1000-101	1u/1000V /-40℃~110℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	FARAD	PAN1K1W10K0	1u/1000V /-40℃~105℃	ANSI/UL 810	UL E215893

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	HJC	EPB-105K1100DB127B	1u/1000V /-40℃~105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Panasonic	ECWFG1B105J	1u/1000V /-40℃~110℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Relay(RY1,RY2,RY3,RY4,RY5)	HongFa	HFD42/4.5-3	2A /30VDC , -40℃ to 85℃	EN/IEC 61810	TUV R50317623
Atl.	HongFa	HFD42/5-3	2A /30VDC , -40℃ to 85℃	EN/IEC 61810	TUV R50317623
Y2 capacitor （C3, C73, C84, C88, C292, C338）	Faratronic	MKP63 C43Q1472K40 C000	Y2/4.7nF/1500V dc	EN60384-14	ENEC SE0366-2D
Atl.	KEMET	R413F1470M1	Y2/4.7nF/1000V dc	EN60384-14	ENCN V4160
Atl.	HUA JUNG COMPONENTS CO LTD	KY2X1472K0300AB1101	Y2/4.7nF/1000V dc/110℃	EN60384-14	SE-ENEC-2001313
Atl.	KEMET	R413F1470(1)M1(2)	Y2/4.7nF/300Vac/110℃	EN60384-14	ENCN V4160
Transformer(TX1, TX2)	Shenzhen Click Technology Co., Ltd.	T10*6*4C 5K	90μH/4+4PIN	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Chuangshi Fuer Electronics Co., Ltd.	T10*6*4C 5K	90μH/4+4PIN	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Huizhou Baohui Electronic Technology Co., Ltd.	T10*6*4C 5K	90μH/4+4PIN	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Shenzhen Haiguang Electronics Co., Ltd.	T10*6*4C 5K	90μH/4+4PIN	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Daxin Electronics Co., Ltd.	T10*6*4C 5K	90μH/4+4PIN	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-CORE	DMEGC GUANDA OR EQUAL	T10*6*4C 5K	AL=2040nH/N2	--	--
-WIRE	Chang Chun Plastics Co., Ltd	UTW(F)	155℃	ANSI/UL 2353	UL E211989
-BASE&COVER	SUMITOMO BAKELITE CO LTD	PM9630	150℃	UL94, UL746	UL E41429

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
-EPOXY	DONGGUAN EATTO ELECTRONIC MATERIAL CO.LTD	3300A-1/B-1	130℃	UL94, UL746	UL E218090
Alt.	DONGGUAN SHIPAI HUACHUANG MATERIAL FACTORY	H907-HF-Z	130℃	UL94, UL746	UL E304477
Flying-CAP&Diode Board					
BUS capacitor (C1, C2, C3, C4 , C5, C6)	Faratronic	C3D1X106JB0 0352	10uF/900V/- 40℃~110℃	EN 61071:2007 IEC 61071:2007 IEC 61881-1:2010 EN 61881-1:2011	TUV R 50266108
Atl.	TDK	B32774S9106 K5XX	10uF/900V/- 40℃~110℃/	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Guangdong Fengming Electronic Technology Co., Ltd.	1GLBH610D80 0-303	10uF/900V/- 40℃~110℃/	EN 61071:2007	TUVR 50321877
Atl.	FARAD	EPB– 1061100DB137 B–F	10uF,1100V, 105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	HJC	PAN900A10K4	10uF,900V,105 ℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Panasonic	EZPV1B106MT B	10uF,1100Vdc, 105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Panasonic	EZPV80106LT A	10uF,800Vdc, 105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Vishay	MKP1848C570 12JP4	10uF,1100Vdc, 105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
AC Filter Board					
AC common mode inductance(L1)	HUIZHOU INDUCTANCE ELECTRONIC TECHNOLOGY CO.,LTD	T210-13546A	712uH/6TS/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Eagle Electric Co., Ltd.	T210-13546A	712uH/6TS/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Jingquanhua Technology Co., Ltd.	T210-13546A	712uH/6TS/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Shenzhen Click Technology Co., Ltd.	T210-13546A	712uH/6TS/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Qingdao Yunlu New Energy Technology Co., Ltd.	T210-13546A	712uH/6TS/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Shenzhen Haiguang Electronics Co., Ltd.	T210-13546A	712uH/6TS/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-CORE	NANJIN NEW CONDA MAGNETIC INDUSTRIAL CO.,LTD	HP2,T85.7*55.6 *25.4C	130℃	--	--
-WIRE	JUNG SHING WIRE CO LTD	EIW-H	200℃	ANSI/UL 1446	UL E174837
-EPOXY	DONGGUAN EATTO ELECTRONIC MATERIAL CO.LTD	E500(XX)	130℃	UL94, UL746	UL E218090
-UL TUBE	SHENZHEN WAHCHANGWEI INDUSTRIAL CO LTD	SRS-4.0	200℃	ANSI/UL 1441	UL E233803
LCL inductance(L2)	HUIZHOU INDUCTANCE ELECTRONIC TECHNOLOGY CO.,LTD	D210-13545A	5uH/4Ts/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Eagle Electric Co., Ltd.	D210-13545A	5uH/4Ts/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	Jingquanhua Technology Co., Ltd.	D210-13545A	5uH/4Ts/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Shenzhen Click Technology Co., Ltd.	D210-13545A	5uH/4Ts/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Qingdao Yunlu New Energy Technology Co., Ltd.	D210-13545A	5uH/4Ts/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Shenzhen Haiguang Electronics Co., Ltd.	D210-13545A	5uH/4Ts/CLASS F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-CORE	BAOSHAN IRON & STEEL CO.,LTD	23P100	800℃	--	--
-WIRE	JUNG SHING WIRE CO LTD	EIW	6*7mm/200℃	ANSI/UL 1446	UL E174837
-VARNISH	WU JIANG TAIHU INSULATING MATERIAL CO LTD	ET-90	180℃	ANSI/UL 1446	UL E228349
-EPOXY	DONGGUAN SHIPAI HUACHUANG MATERIAL FACTORY	808AB-H	155℃	UL94, UL746	UL E304477
-INSULATIONS	ISOVOLTA	Voltaflex DMD3 0180	180℃	ANSI/UL 1446	UL E208136
Y2 capacitor （C1, C2, C3, C4, C5, C6）	FARATRONIC	MKP63 C43Q1683K40 C000	Y2/68nF/300Vac /110℃	EN60384-14	ENEC SE0366-2D
Atl.	KEME	R413I2680(1)M 1(2）	Y2/68nF/300Vac /110℃	EN60384-14	ENCN V4160
Atl.	TDK	B32022A3683 M289	Y2/68nF/300Vac /110℃	IEC60384-14	VDE40018909
Control Board					
CPU(U4)	Lattice	X02-1200UHC-4FTG256I	256PIN /100℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
CPU(U5)	TEXAS	TMS320F2807 5PTPT	176PIN/105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
CPU(U11, U38)	TEXAS	TMS320F28069PZT	100PIN/105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
M3 Board					
Y2 capacitor （C3, C73, C84, C88, C292, C338）	Faratronic	MKP63 C43Q1472K40 C000	Y2/4.7nF/1500Vdc	EN60384-14	ENEC SE0366-2D
Atl.	KEMET	R413F1470M1	Y2/4.7nF/1000Vdc	EN60384-14	ENCN V4160
Atl.	HUA JUNG COMPONENTS CO., LTD.	Y2X1472K0300AB1101	Y2/4.7nF/1000Vdc/110℃	EN60384-14	SE-ENEC-2001313
Atl.	KEMET	R413F1470(1)M1(2)	Y2/4.7nF/300Vac/110℃	EN60384-14	ENCN V4160
CPU(U9)	ST	STM32F107VCT7	3.3V/-40℃～105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	ST	STM32F107VCT6	3.3V/-40℃～85℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
IO Board					
Y2 capacitor （C50）	KEMET	R413D1100- -00-	Y2 1nF/1000Vdc	EN60384-14	ENCN V4160
Atl.	FARATRONIC	MKP63 C43Q1102-30A	Y2 1nF/300Vac	EN60384-14	ENEC-SE0366-2D
Y2 capacitor （C424, C425, C461, C464, C595, C596, C656, C657, C658, C659, C660, C661）	FARATRONIC	MKP63 C43Q1103-40A	Y2/10nF/300V/110℃	EN60384-14	ENEC-SE0366-2D
Atl.	FARATRONIC	MKP63 C42P2103-40A	Y2/10nF/275V/110℃	EN60384-14	ENEC-SE0366-2D
Atl.	TDK	B32022B3103M289	Y2/10nF/300Vac/110℃	IEC60384-14	VDE40018909
Atl.	KEMET	R413F2100(1)M1(3)	Y2/10nF/300Vac/110°C	EN60384-14	ENCN V4160
Atl.	FARATRONIC	MKP63 C43Q1103K40 C000	Y2/10nF/1000Vdc	IEC60384-14	ENEC-SE0366-2D
GFCI(GFCI1)	LEM	CTSR 3-TP/SP19	-5A~5A/ -40℃~105℃	--	CE
Atl.	Sinomag	SFG-3.0P/P1	-5A~5A/ -40℃~105℃	EN 61010-1	TUV R 50428205

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Output relay(RY3, RY4, RY5, RY6, RY7, RY8)	Song chuan	511ZP-1AD-F-C12	800Vac/200A/ -40℃~85℃	EN/IEC 61810	TUV R 50267102
Atl.	Churod	CHAR-112A200	830Vac/200A/ -40℃~85℃	EN 61810	TUV R 50316974
Atl.	Xiamen Hongfa Electroacoustic Co Ltd	HF167F-200/12-H3F	800Vac/200A/ -40℃~85℃	EN 61810-1:2015	TUV R 50374273
Output current sensor(HCT1, HCT2, HCT3)	LEM	LZSR 200-TP/SP1	-450A~+450A/ -40℃~85℃	--	CE
Atl.	LEM	LZSR 200-P/SP1	-450A~+450A/(3.125mV/A)/-40℃~85℃	--	CE
Atl.	Sinomag	STB-200LA/Z	-450A~+450A/(3.125mV/A)/-40℃~85℃	--	VIC171222-CZX-2243
Atl.	Sinomag	STB-200LA/ZN	-450A~+450A/ -40℃~85℃	--	VIC171222-CZX-2243
Transformer(TX1)	SHENZHEN CLICK Technology Co., Ltd.	EER42	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	SHENZHEN TRANSFORMER ELECTRONICS CO.,LTD.	EER42	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Huizhou Baohui Electronic Technology Co., Ltd.	EER42	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Shenzhen Haiguang Electronics Co., Ltd.	EER42	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Daxin Electronics Co., Ltd.	EER42	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-Bobbin	SUMITOMO BAKELITE CO LTD	PM-9823	150℃	UL94	UL E41429
Alt.	Chang Chun Plastics Co., Ltd	T375HF/T200HF	150℃	UL94	UL E59481

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
-Tube	Changyuan Electronics(shenzhen) Co., Ltd Or Equal	CB-TT-L	155℃	UL224	UL E180908
-Magnet wire	Shenzhen Dayang Industry Co Ltd or Eqyal	xUEW@, QA TYPE:MW 79-C	155℃	UL1446	UL E176101
Alt.	Dong Guan Yida Industrial Co., Ltd Or Equal	xUEW/155,QA-x/155 Type:MW 79-C	155℃	UL1446	UL E344055
-Tape	Jingjiang Yahua Pressure Sensitive Glue Co., Ltd Or Equal	PF*	180℃	UL510	UL E165111
-Varnish	Elantans Zhuhai Co. Ltd	B-277-@	155℃	UL1446	UL E314793
Alt.	Yueyang Green Technology Co., Ltd Or Equal	JX-1150	155℃	UL1446	UL E328930
-EPOXY	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500(XX)	130℃	UL94/UL746	UL E218090
Transformer(TX 7)	SHENZHEN CLICK Technology Co., Ltd.	EER49	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	SHENZHEN TRANSFORMER ELECTRONICS CO.,LTD.	EER49	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Huizhou Baohui Electronic Technology Co., Ltd.	EER49	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Shenzhen Haiguang Electronics Co., Ltd.	EER49	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Daxin Electronics Co., Ltd.	EER49	Class F	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-Bobbin	SUMITOMO BAKELITE CO LTD	PM-9823	150℃	UL94	UL E41429

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Alt.	Chang Chun Plastics Co., Ltd	T375HF/T200HF	150℃	UL94	UL E59481
-Tube	Changyuan Electronics(shenzhen) Co., Ltd Or Equal	CB-TT-L	155℃	UL224	UL E180908
-Magnet wire	Shenzhen Dayang Industry Co Ltd or Eqyal	xUEW@, QA TYPE:MW 79-C	155℃	UL1446	UL E176101
Alt.	Dong Guan Yida Industrial Co., Ltd Or Equal	xUEW/155,QA-x/155 Type:MW 79-C	155℃	UL1446	UL E344055
-Tape	Jingjiang Yahua Pressure Sensitive Glue Co., Ltd Or Equal	PF*	180℃	UL510	UL E165111
-Varnish	Elantans Zhuhai Co. Ltd	B-277-@	155℃	UL1446	UL E314793
Alt.	Yueyang Green Technology Co., Ltd Or Equal	JX-1150	155℃	UL1446	UL E328930
-EPOXY	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	E-500(XX)	130℃	UL94/UL746	UL E218090
Relay(RY1,RY2)	Faratronic	HF140FF	8A/240Vac/-40℃ to 85℃	EN/IEC 61810	TUV R50149131
Alt.	Song chuan	894H-2AH2-F-C	12A/12V/-40℃ to 85℃	EN/IEC 61810	TUV R50008226
Capacitor(C415, C427, C449, C473)	Faratronic	C3D3L105KB00C00	1uF/1200V/-40℃~110℃	EN 61071	TUV R 50266108
Atl.	KEMET	C4AEQBU4100A1WJ	1u/1100V /-40℃~110℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Guangdong Fengming Electronic Technology Co., Ltd.	1GSBH510D1000-101	1u/1000V /-40℃~110℃	UL810	E215893
Atl.	FARAD	PAN1K1W10K0	1u/1000V /-40℃~105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	HJC	EPB-105K1100DB127B	1u/1000V /-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	Panasonic	ECWFG1B105J	1u/1000V /-40℃~110℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
AC filter capacitor(C552, C553, C554, C555, C556, C557, C558, C559, C560, C561, C562, C563)	Faratronic	C6AU1705KM1A382	7uF/600V/-40℃~105℃	EN 61071:2007 IEC 61071:2007 IEC 61881-1:2010 EN 61881-1:2011	TUV R 50266136
Atl.	Faratronic	C3D4M655KF1B382	6.5uF/1500V/-40℃~105℃	EN 61071:2007 IEC 61071:2007 IEC 61881-1:2010 EN 61881-1:2011	TUV R 50266108
Atl.	TDK	B32776S7655K508	6.5uF/1500V/-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	Guangdong Fengming Electronic Technology Co., Ltd.	1GLBH565D1500-08（2020200165）	6.5uF/1500V/-40℃~105℃	EN 61071:2007	TUV R 50321877
Atl.	Panasonic	EZPQ60685LT	6.8uF/600Vac/-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	Panasonic	EZPQ607056LT	7uF/600Vac/-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	Panasonic	EZPV1B605LTB	6uF/1100V/-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	Panasonic	EZPV1B705MTB	7uF/1100V/-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Optocoupler(U16, U17)	SILICON LABS	Si8261BCD-C-IS	6P/–40 to +125 °C/5000V/4A	DIN VDE V 0884-10 (V 0884-10):2006-12	VDE40037519

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	TEXAS	UCC23513	SO-6/–40°C to +150°C/5.7kVRMS	DIN VDE V 0884-11:2017-01	VDE 40040142
Optocoupler(U20, U23, U25, U26, U27, U28)	Avago Technologies Pte Ltd.	ACNT-H61L	15-mm stretched SO-8/–40-105℃/7500 Vrms	IEC 60747-5-5:2007 EN 60747-5-5:2011	TUV R 50261786
PV INPUT Board					
current sensor(HCT1, HCT2, HCT3, HCT4, HCT5, HCT6, HCT7, HCT8, HCT9, HCT10, HCT11, HCT12, HCT13, HCT14, HCT15)	ALLEGRO	ACS724KMATR-50AB-T	-50A~+50A/-40℃~150℃	UL/EN 60950-1	SUD U8V160354214040
Atl.	ALLEGRO	ACS724LMCTR-65AB-T	-65A~+65A/-40℃~150℃	UL/EN 60950-1	SUD U8V160354214040
Atl.	LEM	HMSR 20-SMS	-50A~+50A (40mV/A), 125℃	--	CE
Atl.	LEM	HMSR 30-SMS	-70A~+70A (40mV/A), 125℃	--	CE
Atl.	Sinomag	STK-20PL	-50A~+50A(40mV/A), 125℃/-40℃~150℃	EN 61010-2-030:2010 EN 61010-1:2010	TUV R 50428205
DC filter capacitor(C57, C58, C59, C60, C69, C70, C71, C72, C81, C82, C83, C84, C91, C92, C93)	Faratronic	C6AU1705KM1A382	7uF/600V/-40℃~105℃	EN61071	TUV R 50266136
Atl.	Faratronic	C3D4M655KF1B382	6.5uF/1500V/-40℃~105℃	EN61071	TUV R 50266108
Atl.	TDK	B32776S7655K508	6.5uF/1500V/-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance
Atl.	Guangdong Fengming Electronic Technology Co., Ltd.	1GLBH565D1500-08（2020200165）	6.5uF/1500V/-40℃~105℃	EN61071	TUVR 50321877
Atl.	Panasonic	EZPQ60685LT	6.8uF/600Vac/-40℃~105℃	IEC 62109-1:2010 IEC 62109-2:2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	Panasonic	EZPQ607056LT	7uF/600Vac/-40℃~105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Panasonic	EZPV1B605LTB	6uF/1100V/-40℃~105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Panasonic	EZPV1B705MTB	7uF/1100V/-40℃~105℃	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
PV SPD Board					
Lightning protector(MOV1A, MOV2A, MOV3A, MOV4A, MOV5A, MOV6A, MOV7A, MOV8A, MOV9A, MOV10A, MOV11A, MOV12A, MOV13A, MOV14A, MOV15A, MOV16A, MOV17A, MOV18A, MOV19A, MOV20A)	PTG	PV 670-20M2	670Vac/10kA	EN 50539	SUD B088817 0022
Atl.	Haipengxin	PV20K-890	680 Vac /10kA	EN 50539	TUV R 50456594
Atl.	Xiamen Set Electronics Co.,Ltd	TFMOV10M680	680 Vac /10kA	EN 50539	TUV R 50438698
Atl.	Thinking Electronic Industrial Co.,Ltd	TVR20821KSY	670Vdc/10KA	IEC 61051-2:1991+A1 EN 61051-1:2008 IEC 61051-1:2007 IEC 61051-2-2:1991	TUV J 50411784
AC SPD Board					

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Lightning protector(MOV1A, MOV2A, MOV3A, MOV4A)	PTG	PV 670-20M2	670Vac/10kA	EN 50539	SUD B088817 0022
Atl.	Haipengxin	PV20K-890	680 Vac /10kA	EN 50539	TUV R 50456594
Atl.	Xiamen Set Electronics Co.,Ltd	TFMOV10M680	680 Vac /10kA	EN 50539	TUV R 50438698
Atl.	Thinking Electronic Industrial Co.,Ltd	TVR20821KSY	670Vdc/10KA	IEC 61051-2:1991+A1 EN 61051-1:2008 IEC 61051-1:2007 IEC 61051-2-2:1991	TUV J 50411784
X1 apacitor (C1, C2, C3)	Faratronic	MKP63 C46V2225MF WC450	X1/2.2uF/760Vac&1500Vdc	EN 60384-14:2013+A1	ENEC-SE0366-2D
Atl.	TDK	B32916A6225 M5xx	X1/2.2uF/600Vac/-40℃~110℃	EN 60384-14:2013+A1	ENEC-01641-M3
Atl.	Faratronic	MKP66 C46U3105MF1 C400	X1/1uF/660Vac	EN 60384-14:2013+A1	ENEC-SE0366-3C
Atl.	KEMET	F871FI105(1)330(2)	X1/1U/330Vac	EN 60384-14:2013	ENEC CA08.00186
Atl.	TDK	B32924C3105	X1/1U/305VAC	EN 60384-14:2013+A1	VDE 40010694
Atl.	CT	1uF/310VAC/30*21*11.5mm/27.5mm/K	X1/1uF/310VAC	EN 60384-14:2013+A1	ENEC-02671
Atl.	TDK	B32923H3105	X1/305VAC/1U	EN 60384-14:2013+A1	VDE 40010694
BUS-CAP-1 Board					
Electrolytic capacitor(C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19, C20)	Nichicon	LGX2W5941M ELFNH	940uF/410Vdc/3.75A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	NAN TONG JIANGHAI	ECSS5BB941 MLB350060E	940uF/410Vdc/3.75A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	TDK	B43255S0947 M001	940uF/410Vdc/3.75A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	Fengbin Electronics (Shenzhen) Co., Ltd.	UL941M410P600A	940uF/410Vdc/3.14A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
BUS-CAP-2 Board					
Electrolytic capacitor(C1, C2, C3, C4, C6, C7, C8, C9, C11, C12, C13, C14, C16, C17, C18, C19)	Nichicon	LGX2W5941MELFNH	940uF/410Vdc/3.75A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	NAN TONG JIANGHAI	ECSS5BB941MLB350060E	940uF/410Vdc/3.75A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	TDK	B43255S0947M001	940uF/410Vdc/3.75A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Fengbin Electronics (Shenzhen) Co., Ltd.	UL941M410P600A	940uF/410Vdc/3.14A	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Inductance （L1,L2）	Growatt	AF R14.3	5.5uH/13Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	HUIZHOU INDUCTANCE ELECTRONIC TECHNOLOGY CO.,LTD	AF R14.3	5.5uH/13Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Eagle Electric Co., Ltd.	AF R14.3	5.5uH/13Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Jingquanhua Technology Co., Ltd.	AF R14.3	5.5uH/13Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	CLICK	AF R14.3	5.5uH/13Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
Atl.	Qingdao Yunlu New Energy Technology Co., Ltd.	AF R14.3	5.5uH/13Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance

14	TABLE: list of critical components				P
Component	Manufacturer/ trademark	Type/model	Value / rating	Standard	Approval/ Reference
Atl.	Shenzhen Haiguang Electronics Co., Ltd.	AF R14.3	5.5uH/13Ts	IEC 62109-1: 2010 IEC 62109-2: 2011	Tested with appliance
-CORE	ACYC(huizhou) Magnetic Component Co.,LTD.	AF R10-60	800℃	--	--
-WIRE	XINGNING JINYAN ELECTRICAL CO LTD	xEIW	180℃	ANSI/UL 1446	UL E238500
Atl.	DONGGUAN YIDA ENDUSTRIAL CO LTD	*EIW	180℃	ANSI/UL 1446	UL E344055
Atl.	GUANGDONG JINGDA REA SPECIAL ENAMELED WIRE CO LTD	QZY-2/180	180℃	ANSI/UL 1446	UL E223994
-EPOXY	DONG GUAN SHI PAI HUA CHUANG MATERIAL FTY	808A/B	130℃	UL94, UL746	UL E304477
Atl.	DONGGUAN EATTO ELECTRONIC MATERIAL CO LTD	3300A/B	130℃	UL94, UL746	UL E218090
BUS-CAP-2 Board					
Y2 capacitor (C1, C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16)	Faratronic	MKP63 C43Q1472K40 C000	Y2/4.7nF/1500Vdc	EN60384-14	ENEC SE0366-2D
Atl.	KEMET	R413F1470M1	Y2/4.7nF/1000Vdc	EN60384-14	ENCN V4160
Atl.	HUA JUNG COMPONENTS CO LTD	Y2X1472K030 0AB1101	Y2/4.7nF/1000Vdc/110℃	EN60384-14	SE-ENEC-2001313
Atl.	KEMET	R413F1470(1) M1(2)	Y2/4.7nF/300Vac/110℃	EN60384-14	ENCN V4160
[1]) an asterisk indicates a mark which assures the agreed level of surveillance					

--End of the report--

Test Report issued under the responsibility of:

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TEST REPORT
IEC 62109-2
Safety of power converters for use in photovoltaic power systems – Part2: Particular requirements for inverters

Report Reference No.	CN20IZ4Z 001 attachment 1.	
Tested by (name + signature).....	See cover page	.....
Witnessed by (name + signature)	N/A	.....
Supervised by (name + signature)	N/A	.....
Approved by (name + signature) ..	See cover page	.....
Date of issue	See cover page	

Testing Laboratory.....	See cover page
Address	See cover page
Testing location/ procedure	CBTL☐ TMP☐ WMT☒ SMT☐ RMT☐ CCATL☐
Testing location/ address	See cover page

Applicant's name	See cover page
Address	See cover page

Test specification:	
Standard	IEC 62109-2: 2011
Test procedure.....	TÜV Mark Approval
Non-standard test method.....:	N/A

Test Report Form No.	IEC 62109-2: 2011
Test Report Form(s) Originator	TÜV Rheinland Group
Master TRF	2011-08

Test item description	See report CN20IZ4Z 001.
Trade Mark	See report CN20IZ4Z 001.
Manufacturer.....	See report CN20IZ4Z 001.
Model/Type reference	See report CN20IZ4Z 001.
Ratings	See report CN20IZ4Z 001.

Testing procedure and testing location:	
☒ **CB Testing Laboratory:**	
Testing location/ address.....:	
☐ **Associated CB Test Laboratory:**	
Testing location/ address.....:	
Tested by (name + signature) ..:	See cover page .....
Approved by (+ signature).....:	See cover page .....
☐ Testing procedure: TMP	
Tested by (name + signature) ..:	
Approved by (+ signature).....:	
Testing location/ address.....:	
☐ Testing procedure: WMT	
Tested by (name + signature) ..:	
Witnessed by (+ signature).....:	
Approved by (+ signature).....:	
Testing location/ address.....:	
☐ Testing procedure: SMT	
Tested by (name + signature) ..:	
Approved by (+ signature).....:	
Supervised by (+ signature) .....:	
Testing location/ address.....:	
☐ Testing procedure: RMT	
Tested by (name + signature) ..:	
Approved by (+ signature).....:	
Supervised by (+ signature) .....:	
Testing location/ address.....:	

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

See report CN20IZ4Z 001.

Summary of testing

Tests performed (name of test and test clause):	**Testing location:**
See report CN20IZ4Z 001. All the tests are conducted on models MAX 253KTL3-X HV to represent all the models.	The laboratory described on the cover page.

Summary of compliance with National Differences

List of countries addressed: See report CN20IZ4Z 001.

Copy of marking plate:

See report CN20IZ4Z 001.

Equipment mobility ..... :	☐ movable ☐ hand-held ☐ stationary ☒ fixed (Wall mounted)
Connection to the mains ..... :	☐ pluggable equipment ☐ direct plug-in ☒ permanent connection ☐ for building-in
Enviromental category ..... :	☒ outdoor ☐ indoor conditional ☐ indoor unconditional
Operating condition ..... :	☒ continuous ☐ short-time ☐ intermittent
Over voltage category mains..... :	☐ OVC I ☐ OVC II ☒ OVC III ☐ OVC IV
Over voltage category PV..... :	☐ OVC I ☒ OVC II ☐ OVC III ☐ OVC IV
Mains supply tolerance (%)..... :	According to specified supply range
Tested for IT power systems ..... :	☐ Yes ☒ No
IT testing, phase-phase voltage (V) ..... :	N/A
Class of equipment ..... :	☒ Class I ☐ Class II ☐ Class III ☐ Not classified
Mass of equipment (kg) ..... :	See report CN20IZ4Z 001.
Pollution degree ..... :	☐ PD 1 ☐ PD 2 ☒ PD 3
IP protection class ..... :	IP66

Possible test case verdicts:

- test case does not apply to the test object ..... :	N/A
- test object does meet the requirement ..... :	Pass (P)
- test object does not meet the requirement..... :	Fail (F)

Testing:

Date of receipt of test items ..... :	See report CN20IZ4Z 001.
Date(s) of performance of tests..... :	See report CN20IZ4Z 001.

General remarks:

"(see Attachment #)" refers to additional information appended to the report.

"(see appended table)" refers to a table appended to the report.

The tests results presented in this report relate only to the object tested.

This report shall not be reproduced except in full without the written approval of the testing laboratory.

List of test equipment must be kept on file and available for review.

Additional test data and/or information provided in the attachments to this report.

Throughout this report a ☐ comma / ☒ **point** is used as the decimal separator.

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

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

☐ Yes

☒ Not applicable

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

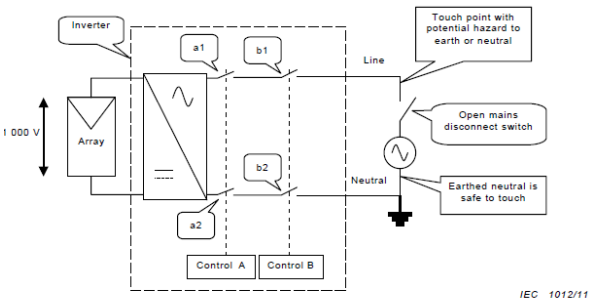
Name and address of factory (ies) : See report CN20IZ4Z 001.

General product information:

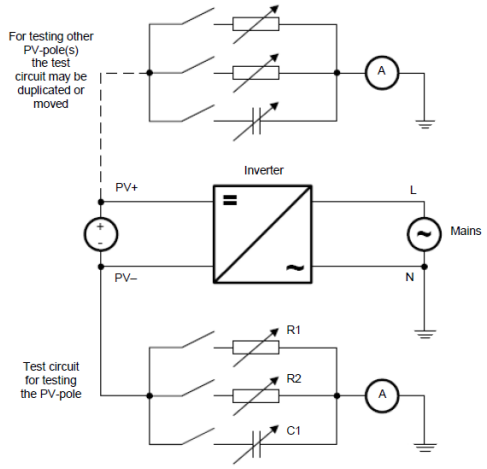
See report CN20IZ4Z 001.

Throughout the test report following abbreviations may be used:

• cl	clearance	• int	internal distance
• dcr	creepage distance	• o-c	open-circuit
• dti	distance through insulation	• o-l	overload
• PCE	Power Conversion Equipment	• s-c	short-circuit
• BI	basic insulation	• SI	supplementary insulation
• DI	double insulation	• RI	reinforced insulation

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
4	General testing requirements *This clause of Part 1 is applicable with the following exceptions:*		P
4.4	Testing in SINGLE FAULT CONDITIONS		P
4.4.4	SINGLE FAULT CONDITIONS to be applied: *Additional subclauses:*	The PCE could detect and indicate the fault condition and disconnect from or not connect to the grid in case of single fault condition. Refer to the appended table 4.4 of IEC/EN 62109-1 test report CN20IZ4Z 001.	P
4.4.4.15	Fault-tolerance of protection for GRID-INTERACTIVE INVERTERS		P
4.4.4.15.1	Fault-tolerance of residual current monitoring		P
4.4.4.15.2	Fault-tolerance of automatic disconnecting means		P
4.4.4.15.2.1	General		P
4.4.4.15.2.2	Design of insulation or separation  **Figure 20 – Example system discussed in Note 2 above**		P
4.4.4.15.2.3	Automatic checking of the disconnect means		P
4.4.4.16	Stand-alone inverters-load transfer test	Grid-interactive inverter.	P
4.4.4.17	Cooling system failure – Blanketing test	See following table 4.4.4.17.	P
4.7	Electrical Ratings Tests *Additional subclauses:*	Refer to the appended table 4.7 of IEC/EN 62109-1 test report CN20IZ4Z 001.	P
4.7.3	Measurement requirements for AC output ports for stand-alone inverters	Grid-interactive inverter.	N/A
4.7.4	Stand-alone Inverter AC output voltage and frequency		N/A

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
4.7.4.1	General		N/A
4.7.4.2	Steady state output voltage at nominal DC input		N/A
4.7.4.3	Steady state output voltage across the DC input range		N/A
4.7.4.4	Load step response of the output voltage at nominal DC input		N/A
4.7.4.5	Steady state output frequency		N/A
4.7.5	Stand-alone inverter output voltage waveform		N/A
4.7.5.1	General		N/A
4.7.5.2	Sinusoidal output voltage waveform requirements	See following table 4.7.5.2.	N/A
4.7.5.3	Non-sinusoidal output waveform requirements	Sinusoidal output.	N/A
4.7.5.3.1	General		N/A
4.7.5.3.2	Total harmonic distortion		N/A
4.7.5.3.3	Waveform slope		N/A
4.7.5.3.4	Peak voltage		N/A
4.7.5.4	Information requirements for non-sinusoidal waveforms		N/A
4.7.5.5	Output voltage waveform requirements for inverters for dedicated loads	Not for dedicated loads.	N/A
4.8	Additional tests for grid-interactive inverters	See below.	P
4.8.1	General requirements regarding inverter isolation and array grounding		N/A
4.8.2	Array insulation resistance detection for inverters for ungrounded and functionally grounded arrays	Only for ungrounded arrays.	N/A
4.8.2.1	Array insulation resistance detection for inverters for ungrounded arrays	See following table 4.8.2.Complied.	P
4.8.2.2	Array insulation resistance detection for inverters for functionally grounded arrays		N/A
4.8.3	Array residual current detection	Complied.	P
4.8.3.1	General		P
4.8.3.2	30mA touch current type test for isolated inverters	Non-isolated inverters.	N/A
4.8.3.3	Fire hazard residual current type test for isolated inverters		N/A
4.8.3.4	Protection by application of RCD's	Complied.	P
4.8.3.5	Protection by residual current monitoring	See following table 4.8.3.5.	P
4.8.3.5.1	General		P

<table>
<tr><td colspan="4">IEC 62109-2: 2011</td></tr>
<tr><td>Clause</td><td>Requirement – Test</td><td>Result - Remark</td><td>Verdict</td></tr>
<tr><td></td><td>Table 31 – Response time limits for sudden changes in residual current
<table>
<tr><th>Residual current sudden change</th><th>Max time to inverter disconnection from the mains</th></tr>
<tr><td>30 mA</td><td>0,3 s</td></tr>
<tr><td>60 mA</td><td>0,15 s</td></tr>
<tr><td>150 mA</td><td>0,04 s</td></tr>
</table>
NOTE These values of residual current and time are based on the RCD standard IEC61008-1.


For the continuous residual current test, R1 establishes a baseline current just below the trip point, and R2 is switched in to cause the current to exceed the trip point. Capacitor C1 is not used.
For the sudden change residual current test, C1 establishes a baseline current and R1 or R2 is switched in to cause the desired value of sudden change. The other resistor is not used.
IEC 1013/11
Figure 21 – Example test circuit for residual current detection testing</td><td>See following table 4.8.3.5.</td><td>P</td></tr>
<tr><td>4.8.3.5.2</td><td>Test for detection of excessive continuous residual current</td><td>See appended table.</td><td>P</td></tr>
<tr><td>4.8.3.5.3</td><td>Test for detection of sudden changes in residual current</td><td>See appended table.</td><td>P</td></tr>
<tr><td>4.8.3.6</td><td>Systems located in closed electrical operating areas</td><td></td><td>N/A</td></tr>
<tr><td>5</td><td>Marking and documentation
This clause of Part 1 is applicable with the following exceptions:</td><td>See report CN20IZ4Z 001.</td><td>P</td></tr>
<tr><td>5.1</td><td>Marking</td><td></td><td>P</td></tr>
<tr><td>5.1.4</td><td>Equipment ratings
Replacement:</td><td>See report CN20IZ4Z 001.</td><td>P</td></tr>
<tr><td>5.2</td><td>Warning markings</td><td>See report CN20IZ4Z 001.</td><td>P</td></tr>
</table>

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
5.2.2	Content for warning markings		P
5.2.2.6	Inverters for closed electrical operating areas		N/A
5.3	Documentation		P
5.3.2	Information related to installation Additional subclauses:		P
5.3.2.1	Ratings		P
5.3.2.2	Grid-interactive inverter setpoints		P
5.3.2.3	Transformers and isolation		P
5.3.2.4	Transformers required but not provided	See above.	N/A
5.3.2.5	PV modules for non-isolated inverters		P
5.3.2.6	Non-sinusoidal output waveform information		N/A
5.3.2.7	Systems located in closed electrical operating areas		N/A
5.3.2.8	Stand- alone inverter output circuit bonding		N/A
5.3.2.9	Protection by application of RCD's	Not used.	N/A
5.3.2.10	Remote indication of faults		P
5.3.2.11	External array insulation resistance measurement and response		P
5.3.2.12	Array functional grounding information		N/A
5.3.2.13	Stand-alone inverters for dedicated loads		N/A
5.3.2.14	Identification of firmware version(s)		P
6	Environmental requirements and conditions *This clause of Part 1 is applicable.*		P
7	Protection against electric shock and energy hazards *This clause of Part 1 is applicable except for the following additions:*	See report CN20IZ4Z 001.	P
7.3	Protection against electric shock *Additional subclauses:*		P
7.3.10	Additional requirements for stand-alone inverters		N/A
	Stand-alone inverter output circuit bonding		N/A
	Stand-alone inverter isolation and protection of DVC-A circuits		N/A
7.3.11	Functionally grounded arrays		N/A
8	Protection against mechanical hazards *This clause of Part 1 is applicable.*	See report CN20IZ4Z 001	P

IEC 62109-2: 2011			
Clause	Requirement – Test	Result - Remark	Verdict
9	Protection against fire hazards *This clause of Part 1 is applicable with the following exceptions:*		P
9.3	Short-circuit and overcurrent protection *Additional subclause:*		P
9.3.4	Inverter backfeed current onto the array		P
10	Protection against sonic pressure hazards *This clause of Part 1 is applicable*	See report CN20IZ4Z 001	P
11	Protection against liquid hazards *This clause of Part 1 is applicable*	See report CN20IZ4Z 001	P
12	Protection against chemical hazards *This clause of Part 1 is applicable*	See report CN20IZ4Z 001	P
13	Physical requirements *This clause of Part 1 is applicable with the following exception:* *Additional subclause:*	See report CN20IZ4Z 001	P
13.9	Fault indication		P
	a) a visible or audible indication, integral to the inverter, and detectable from outside the inverter, and	LCD panel is available for fault indication.	P
	b) an electrical or electronic indication that can be remotely accessed and used.	RS485/232 port as communication connection.	P
14	Components *This clause of Part 1 is applicable*	See report CN20IZ4Z 001	P

4.4.4.17	Cooling system fainlure – Blanketing test		P
	Test voltage(V)	See below	--
	t1(°C)	See below	--
	t2(°C)	See below	--
Maximum temperature T of part/at:		Measured T (°C)	allowed T_{max} (°C)
Test Voltage		800Vdc	--
Display		65.4	90
Enclosure		70.3	90
Ambient		25	--
Note(s):			

4.7.5.2	Stand-alone inverter output voltage waveform	N/A

Harmonics at continuous operation

P/Pn[%]	5%	50%	100%	Limites Limit
Ordinal number	Measurement [Harmonic/Fundamental]			
	[%]	[%]	[%]	[%]
2				6.0
3				6.0
4				6.0
5				6.0
6				6.0
7				6.0
8				6.0
9				6.0
10				6.0
11				6.0
12				6.0
13				6.0
14				6.0
15				6.0
16				6.0
17				6.0
18				6.0

19				6.0
20				6.0
21				6.0
22				6.0
23				6.0
24				6.0
25				6.0
26				6.0
27				6.0
28				6.0
29				6.0
30				6.0
31				6.0
32				6.0
33				6.0
34				6.0
35				6.0
36				6.0
37				6.0
38				6.0
39				6.0
40				6.0
THD				10.0
Note: The PCE is grid-interactive inverter and without stand-alone functions.				

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

Conditions	Measurement [I.F. / N.O.]				Identification
	PV / DC Supply Voltage [Vdc]				
	550	800	1000	1300	
PV1+ to PE: 49 [kΩ]	I.F.	I.F.	I.F.	I.F.	I.F.: Isolation Fault N.O.: Normal
PV1- to PE: 49 [kΩ]	I.F.	I.F.	I.F.	I.F.	
PV1+ to PE: 51 [kΩ]	N.O.	N.O.	N.O.	N.O.	

PV1- to PE: 51 [kΩ]	N.O.	N.O.	N.O.	N.O.	Operation

Note:

For isolated inverters, shall indicate a fault in accordance with 13.9 (operation is allowed); the fault indication shall be maintained until the array insulation resistance has recovered to a value higher than the limit above

For non-isolated inverters, or inverters with isolation not complying with the leakage current limits in the minimum inverter isolation requirements in Table 30, shall indicate a fault in accordance with 13.9, and shall not connect to the mains; the inverter may continue to make the measurement, may stop indicating a fault and may connect to the mains if the array insulation resistance has recovered to a value higher than the limit above.

It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Supplementary information:

Array Insulation Resistance Threshold Value should be larger than R = $V_{MAX\,PV}$ / 30mA

4.8.3.2, 4.8.3.3	TABLE: Touch current and fire hazard residual current measurement			N/A
Condition	PV power supply " + " → earthing [mA]	PV power supply " - " → earthing [mA]	Limit [mA]	Comments
Touch current	--	--	--	Pass
Condition	PV power supply " + " → earthing [mA]	PV power supply " - " → earthing [mA]	Limit [mA]	Comments
fire hazard residual current	--	--	--	Inverter ≤ 30kVA
fire hazard residual current	--	--	10mA / kW	Inverter > 30kVA

Note:

Using measurement circuit of IEC 60990 figure 4 for testing touch current.

Using ammeter for testing fire hazard residual current.

4.8.3.5	TABLE: Protection by residual current monitoring	P
Test conditions:	Output power (kVA) : 15 Input voltage (V_{DC}): 1000 Frequency (Hz): 50 Output AC Voltage (V_{AC}): 230	
4.8.3.5.2	Test for detection of excessive continuous residual current	P

Fault Current (mA)		Disconnection time (ms)	
Measured Fault Current	Limit 300mA for output power ≤ 30 kVA 10mA per kVA for output power > 30 kVA	Measured Disconnection time	Limit
+ PV to N:			
1688.0	1750		300
1679.9	1750		300
1685.1	1750		300
1690.3	1750		300
1690.2	1750		300
-PV to N			
1687.5	1750		300
1686.5	1750		300
1687.1	1750		300
1682.9	1750		300
1687.2	1750		300

Note:
– maximum 300mA for inverters with continuous output power rating ≤30 kVA;
– maximum 10mA per kVA of rated continuous output power for inverters with continuous output power rating > 30 kVA.
This test shall be repeated 5 times, and for all 5 tests the time to disconnect shall not exceed 0,3s. The test is repeated for each PV input terminal. It is not required to test all PV input terminals if analysis of the design indicates that one or more terminals can be expected to have the same result, for example where multiple PV string inputs are in parallel.

Supplementary information:

4.8.3.5.3	TABLE: Test for detection of sudden changes in residual current	P
+PV to N		
Limit (mA)	U_N Disconnection time (ms)	Limit (ms)
30	215.0	300
30	207.5	300
30	210.5	300
30	214.5	300
30	211.0	300

60	57.0	150
60	57.0	150
60	60.0	150
60	63.6	150
60	64.2	150
150	3.4	40
150	2.8	40
150	3.8	40
150	4.0	40
150	7.4	40
-PV to N		
Limit (mA)	U_N Disconnection time (ms)	Limit (ms)
30	205.0	300
30	203.5	300
30	218.0	300
30	220.0	300
30	208.0	300
60	69.4	150
60	63.6	150
60	63.2	150
60	72.6	150
60	65.2	150
150	6.8	40
150	3.8	40
150	3.4	40
150	5.6	40
150	5.0	40

Note:
The capacitive current is risen until disconnection.
Test condition: I_c + 30/60/150mA <= I_{cmax}. R_1 is set that 30/60/150mA Flow and switch S is closed.

Supplementary information:

The PCE has be mounted shall need an external isolated transformer before connected to grid, such the residual current detection will not applicable according to cl 4.8 requirements.

- End of test report -

TÜVRheinland®

PHOTO DOCUMENTATION

CN20IZ4Z 001 attachment 2

for

Grid-connected PV inverter

MAX 175KTL3-X HV, MAX 185KTL3-X HV, MAX 196KTL3-X HV,
MAX 216KTL3-X HV, MAX 225KTL3-X HV, MAX 230KTL3-X HV,
MAX 250KTL3-X HV, MAX 253KTL3-X HV

Shenzhen Growatt New Energy Co., Ltd.

This documentation consists of 19 pages (excluding this cover page)

Model: as cover

Figure 1. Front view

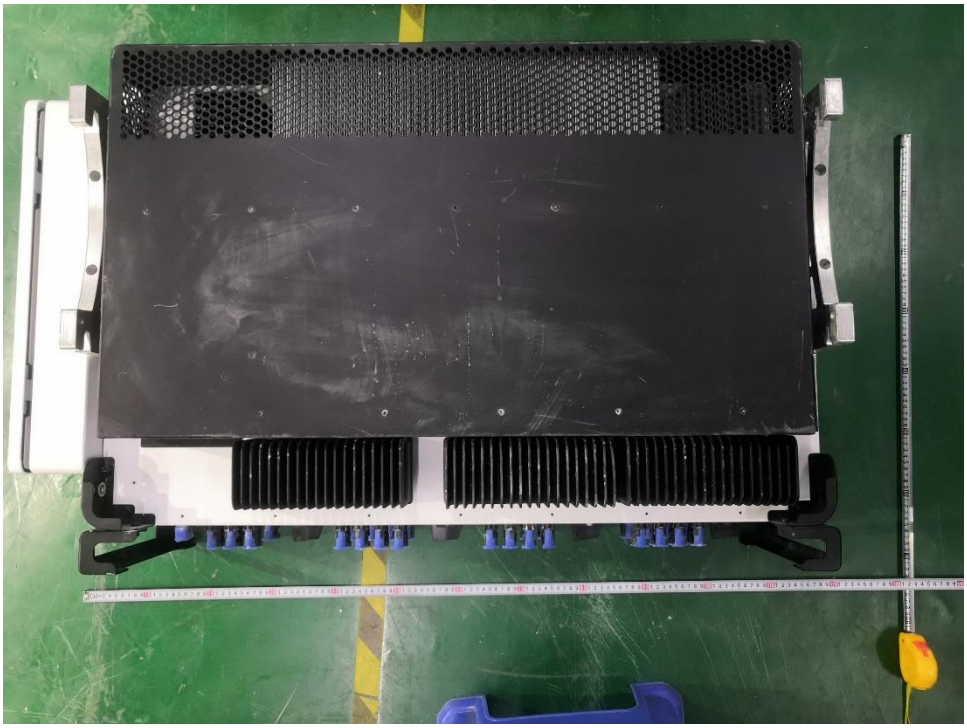


Figure 2. Back view

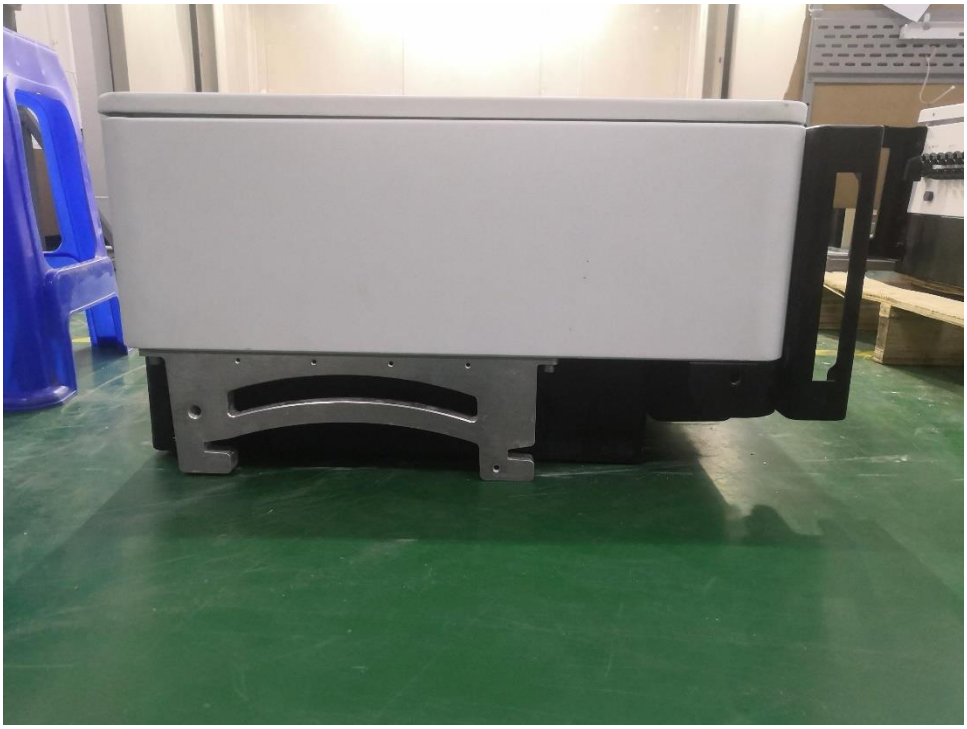


Figure 3. Side view

Figure 4. Connection view for MAX 230KTL3-X HV, MAX 253KTL3-X HV

Model: as cover

Figure 5. Connection view for MAX 225KTL3-X HV, MAX 250KTL3-X HV

Figure 6. Connection view for MAX 175KTL3-X HV,MAX 185KTL3-X HV, MAX 196KTL3-X HV, MAX 216KTL3-X HV

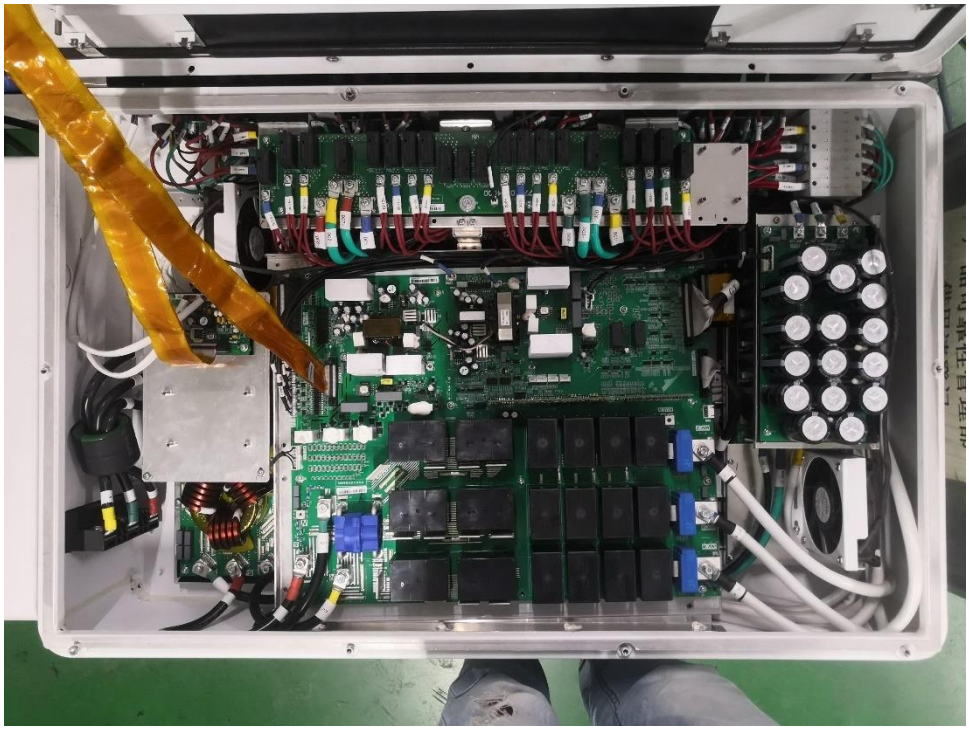


Figure 7. Internal view-1

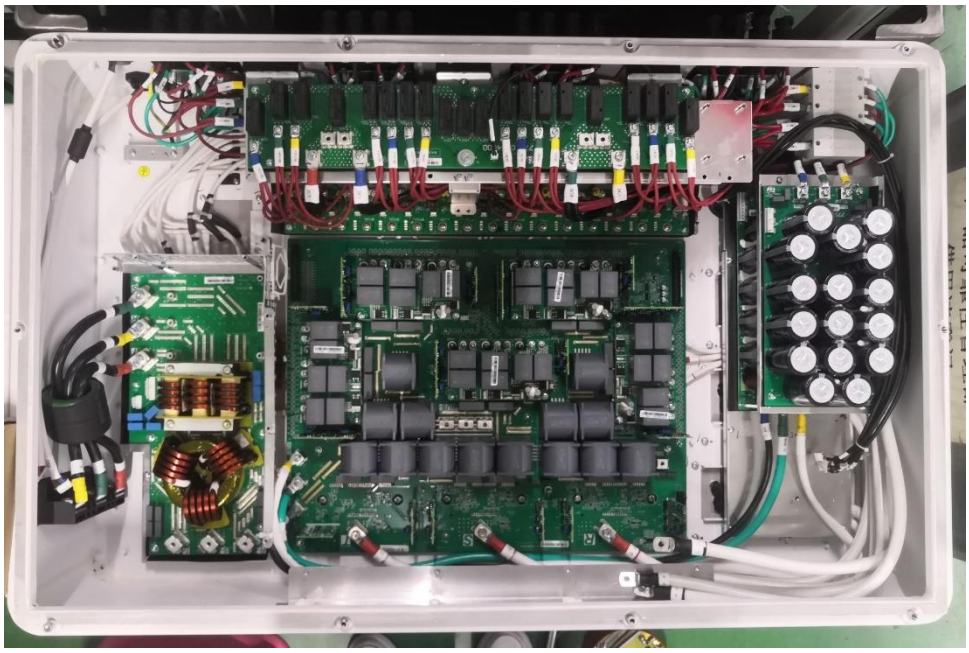


Figure 8. Internal view-2

Model: as cover

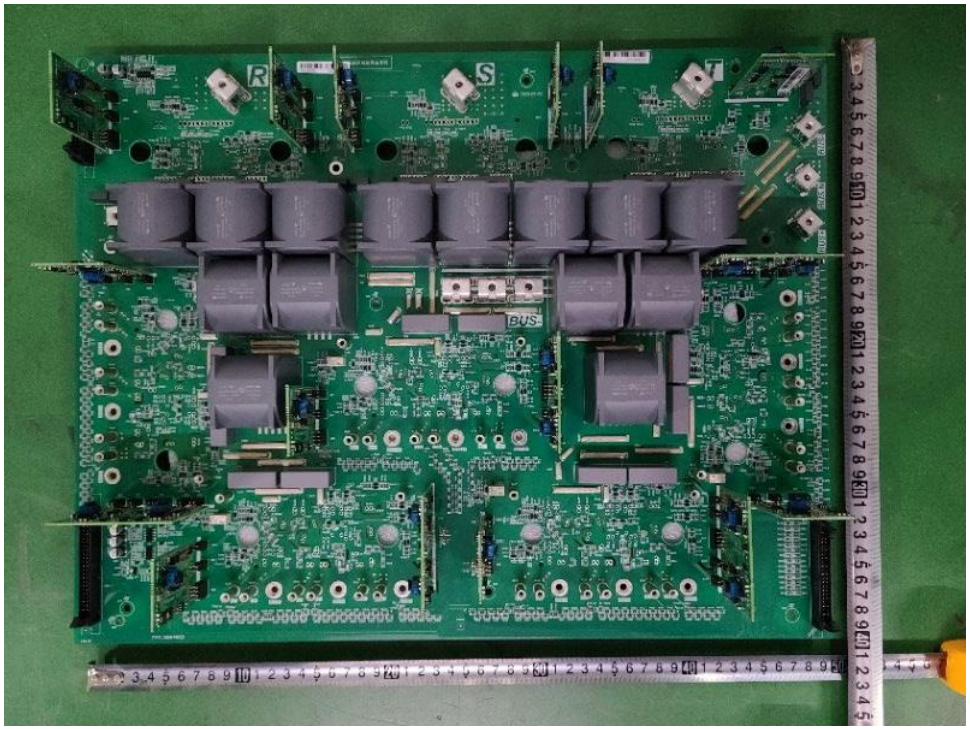


Figure 9. Front view of Power board

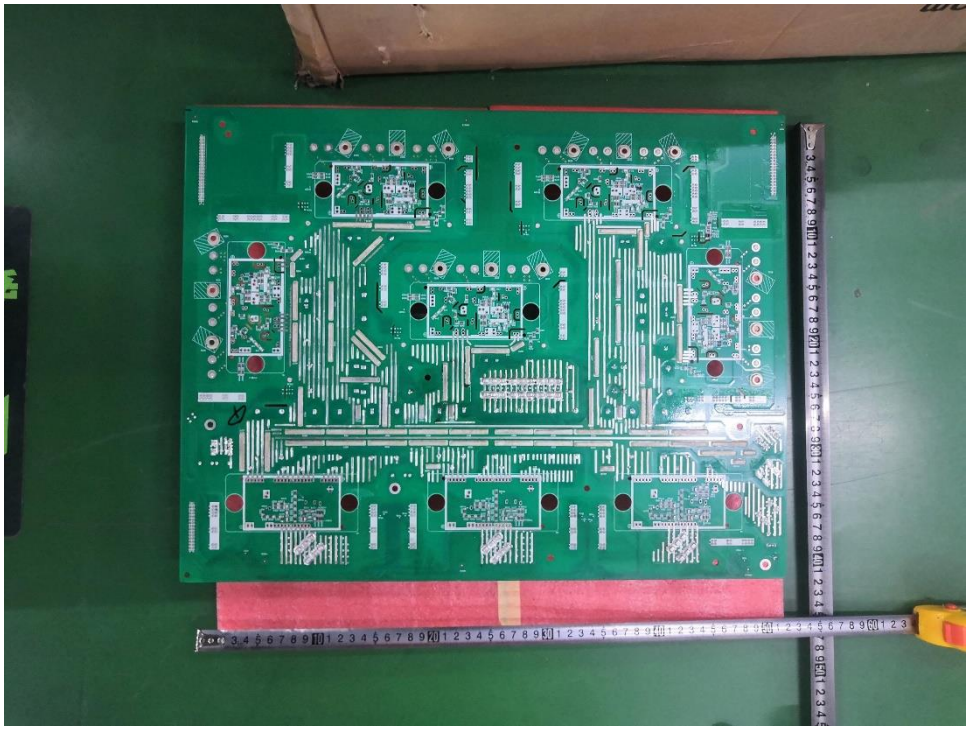


Figure 10. Back view of Power board

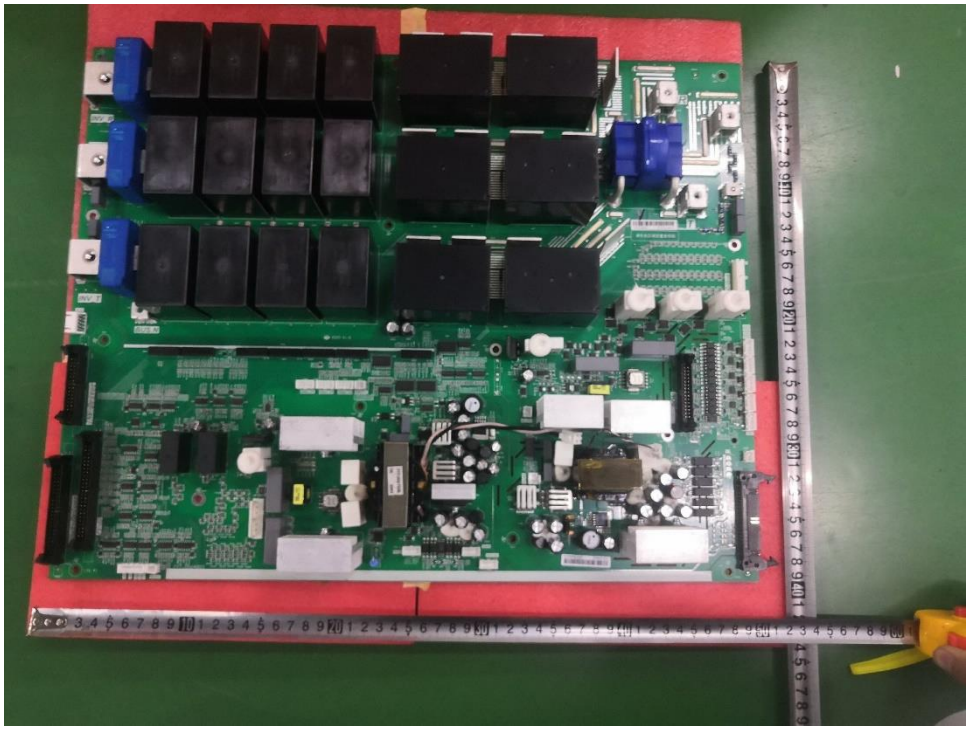


Figure 11. Front view of IO board

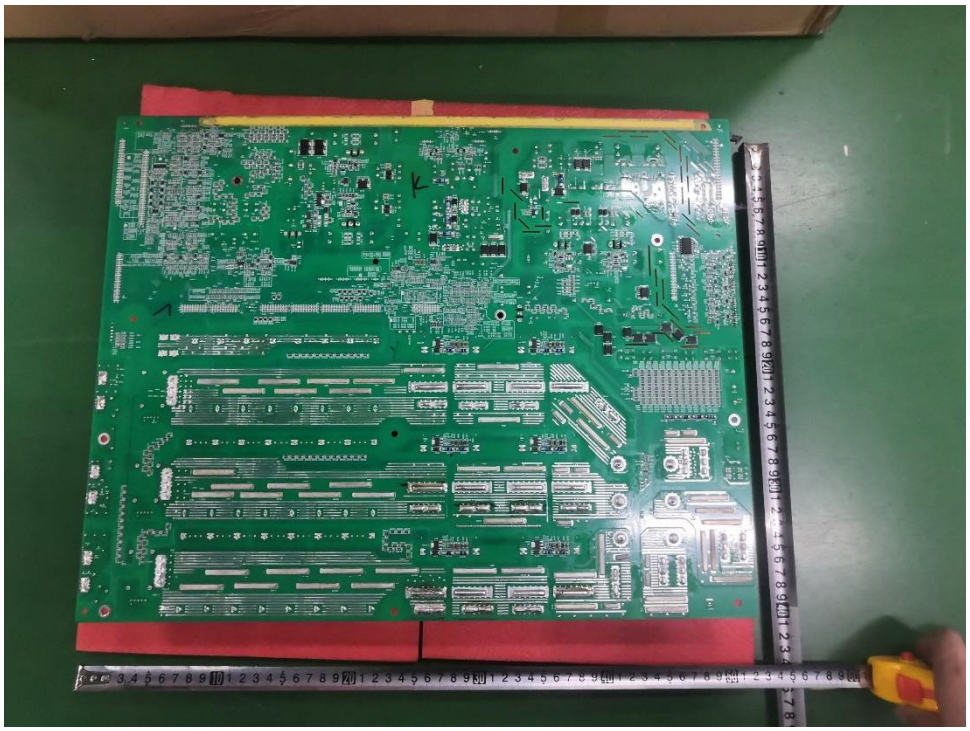


Figure 12. Back view of IO board

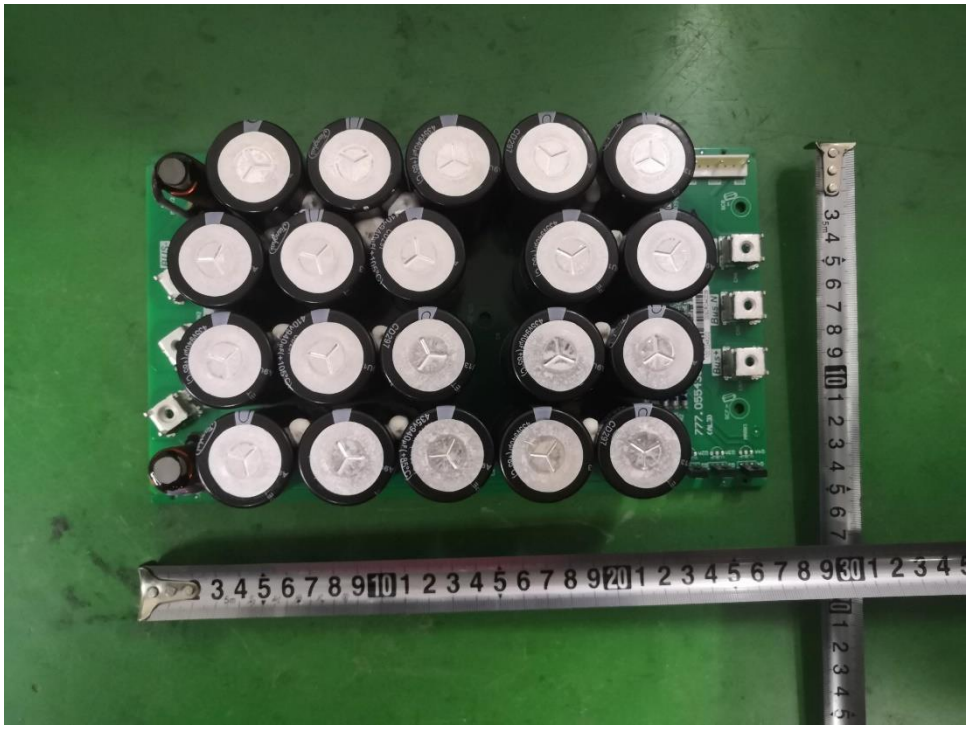


Figure 13. Front view of Electrolyte capacitor board 1

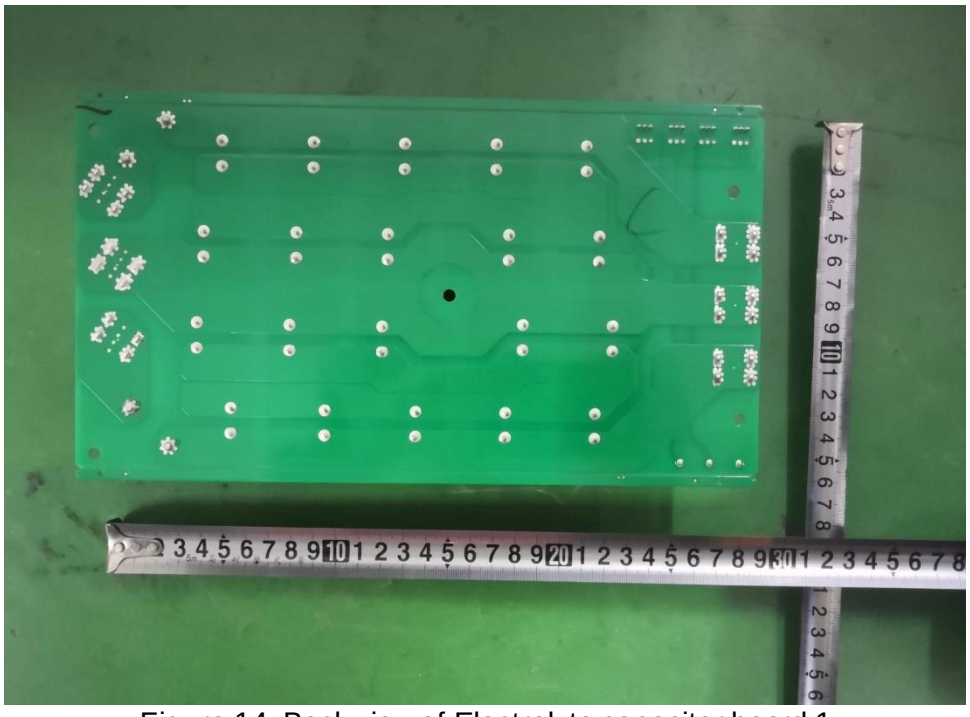


Figure 14. Back view of Electrolyte capacitor board 1

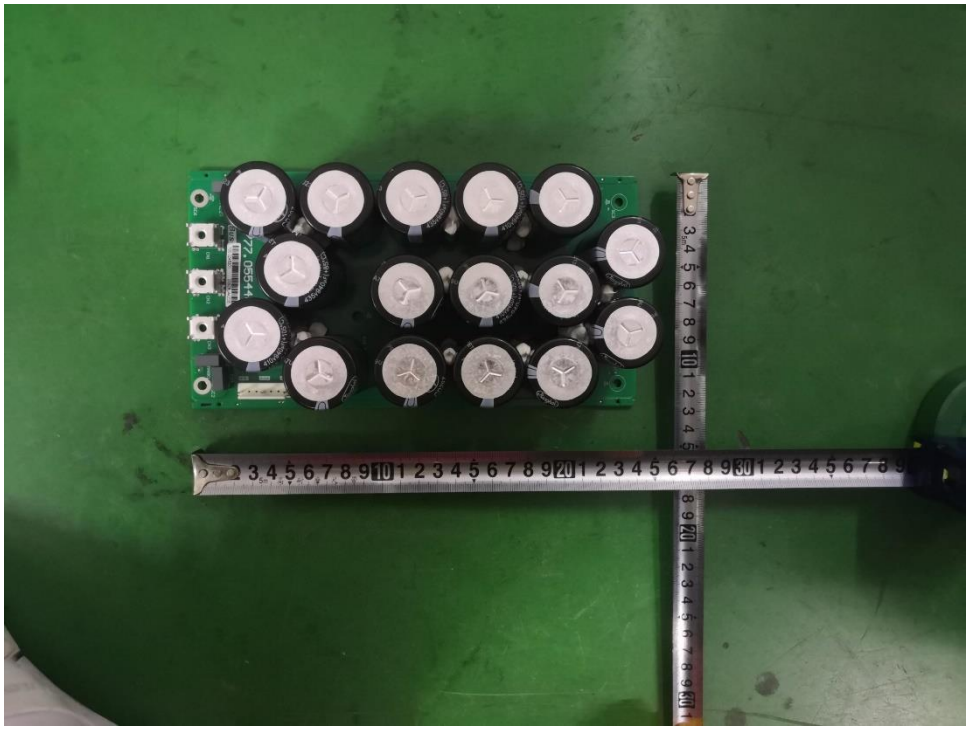


Figure 15. Front view of Electrolyte capacitor board 2

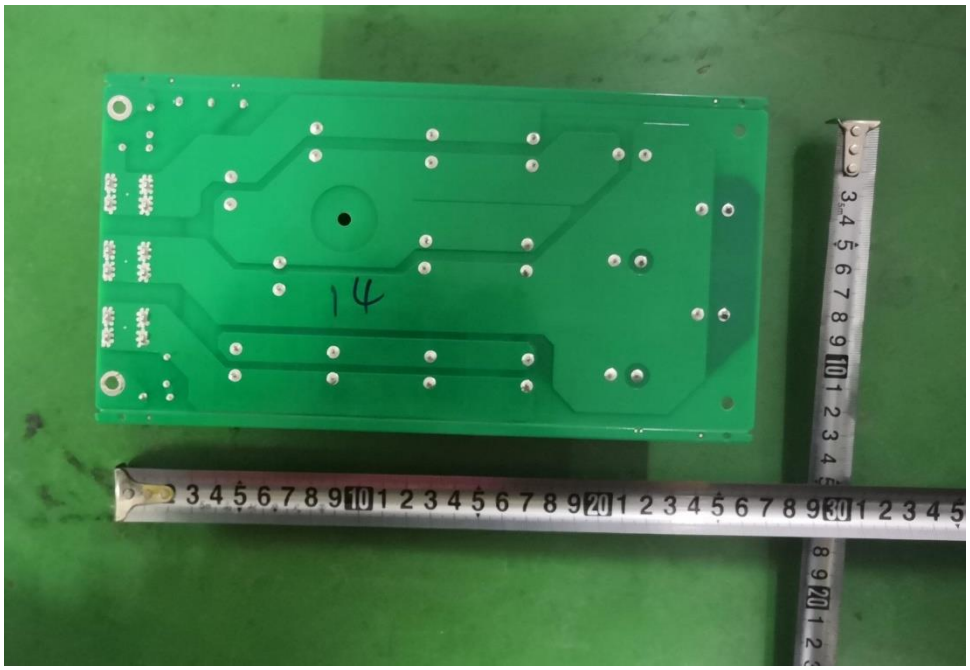


Figure 16. Back view of Electrolyte capacitor board 2

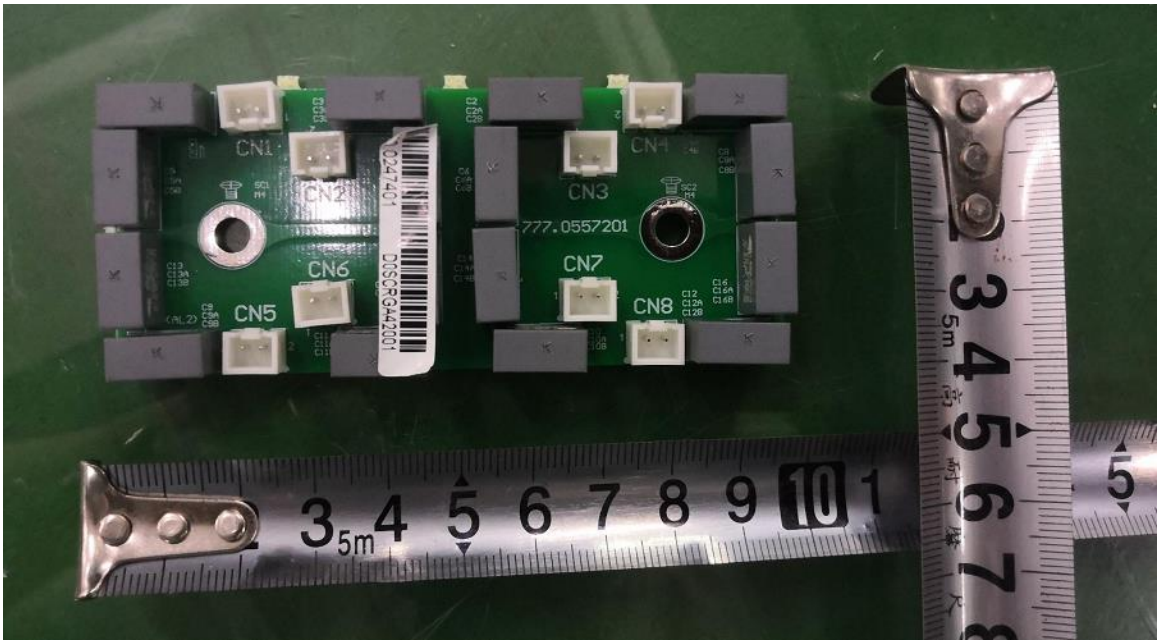


Figure 17. Front view of DC EMI board

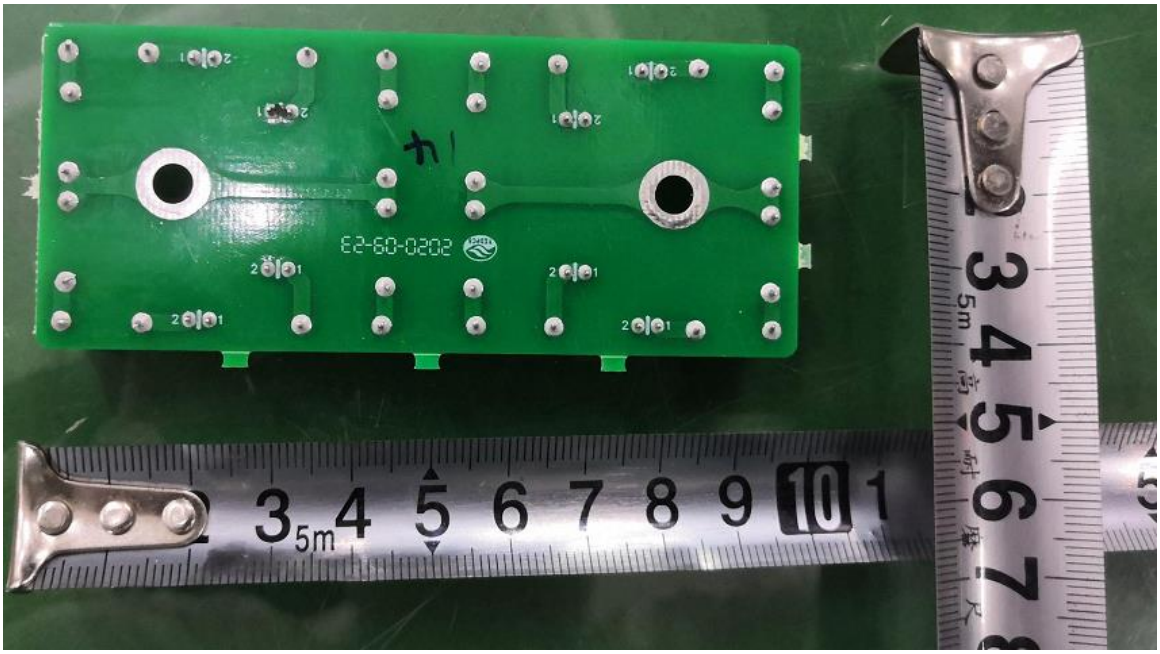


Figure 18. Back view of DC EMI board

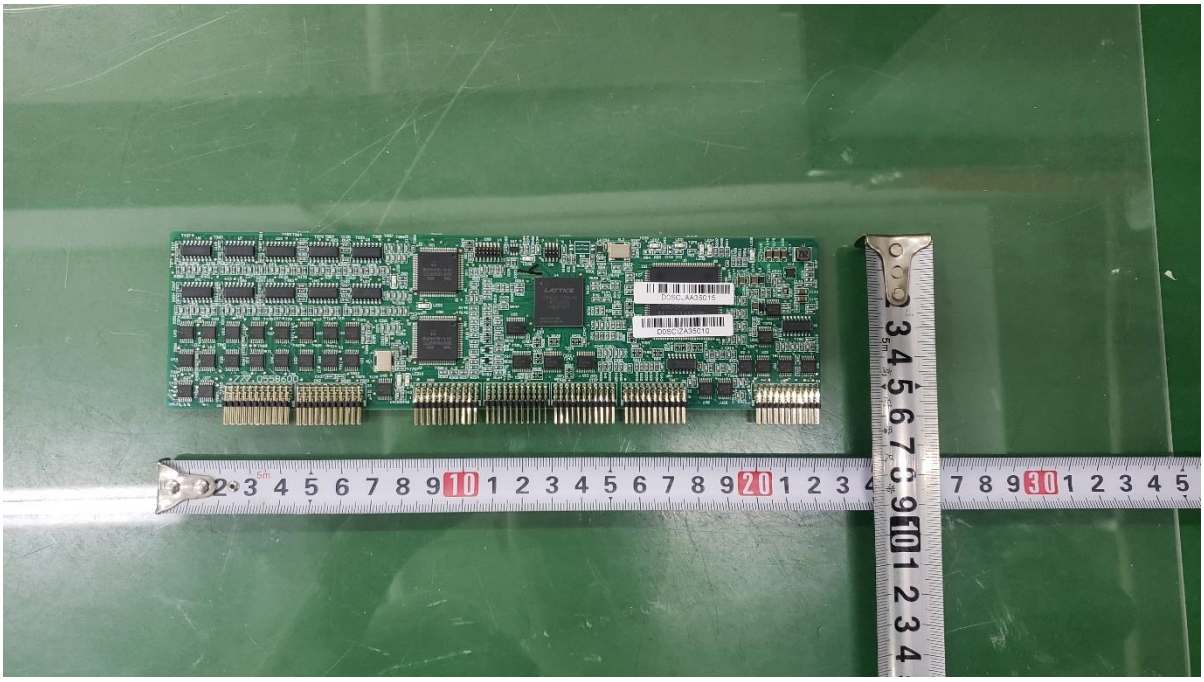


Figure 19. Front view of Control board

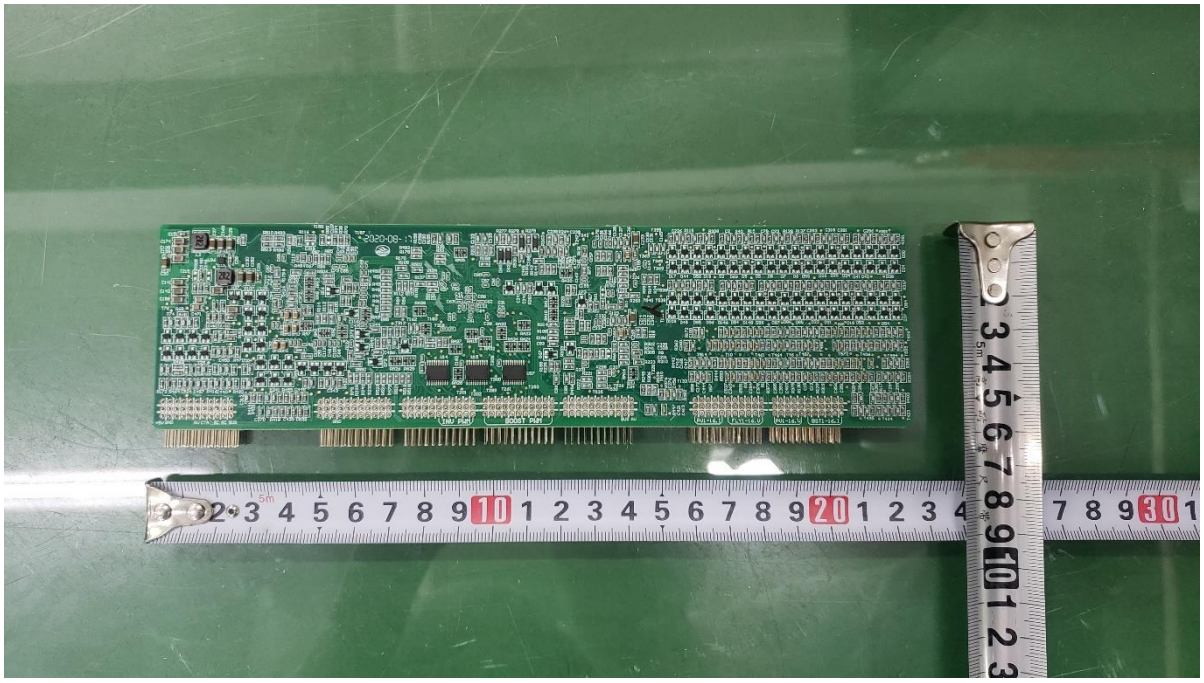


Figure 20. Back view of Control board

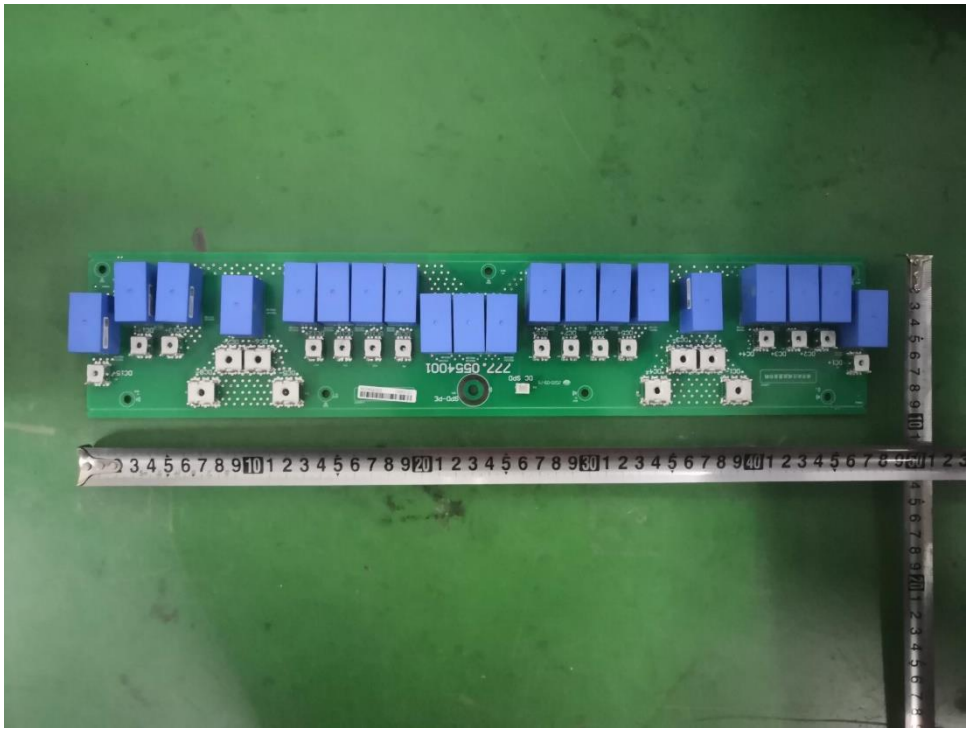


Figure 21. Front view of PV SPD board 1

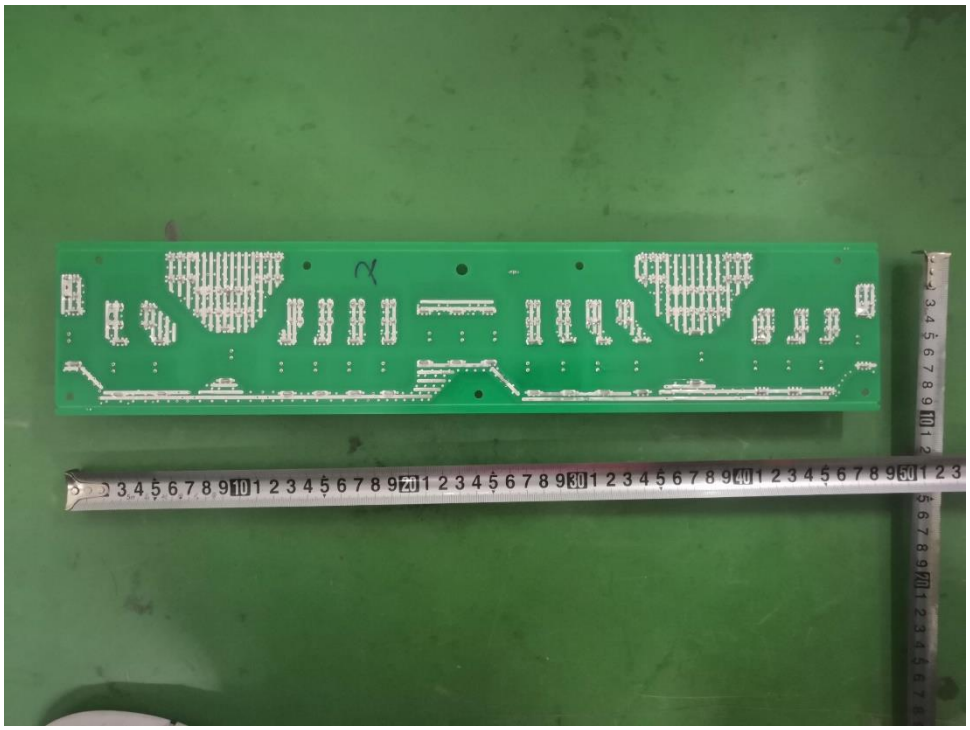


Figure 22. Back view of PV SPD board 1

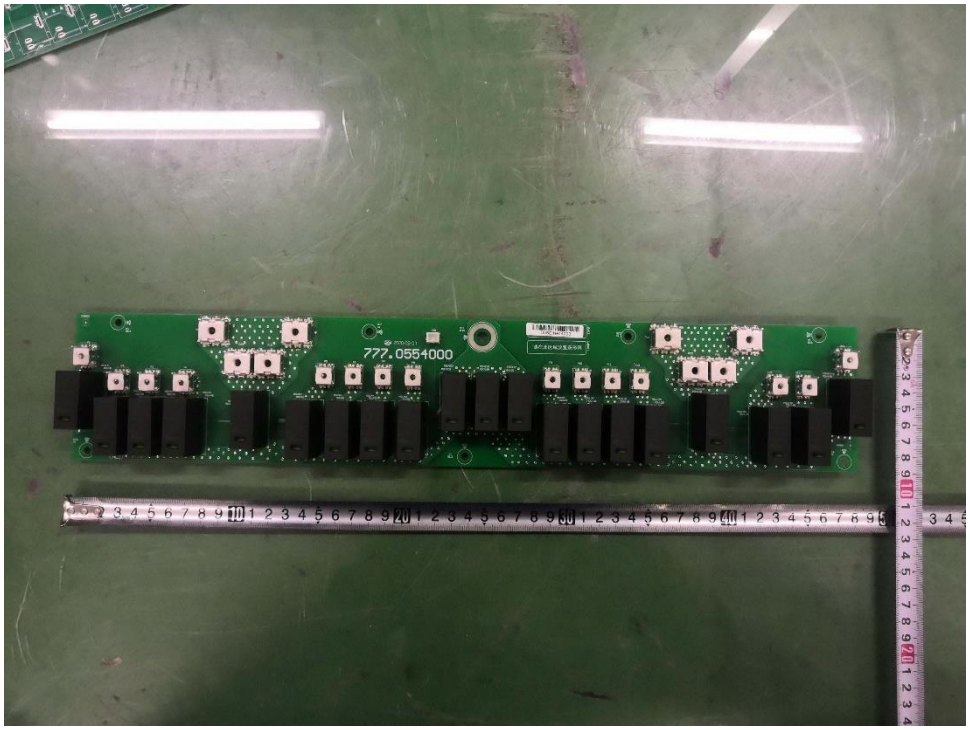


Figure 23. Front view of PV SPD board 2

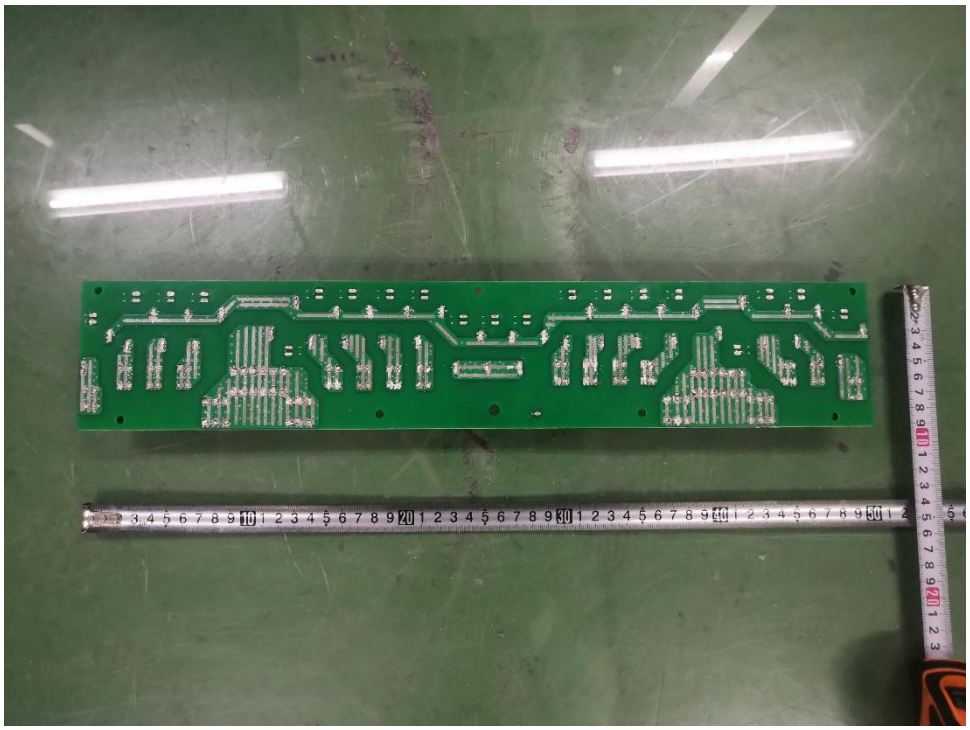


Figure 24. Back view of PV SPD board 2

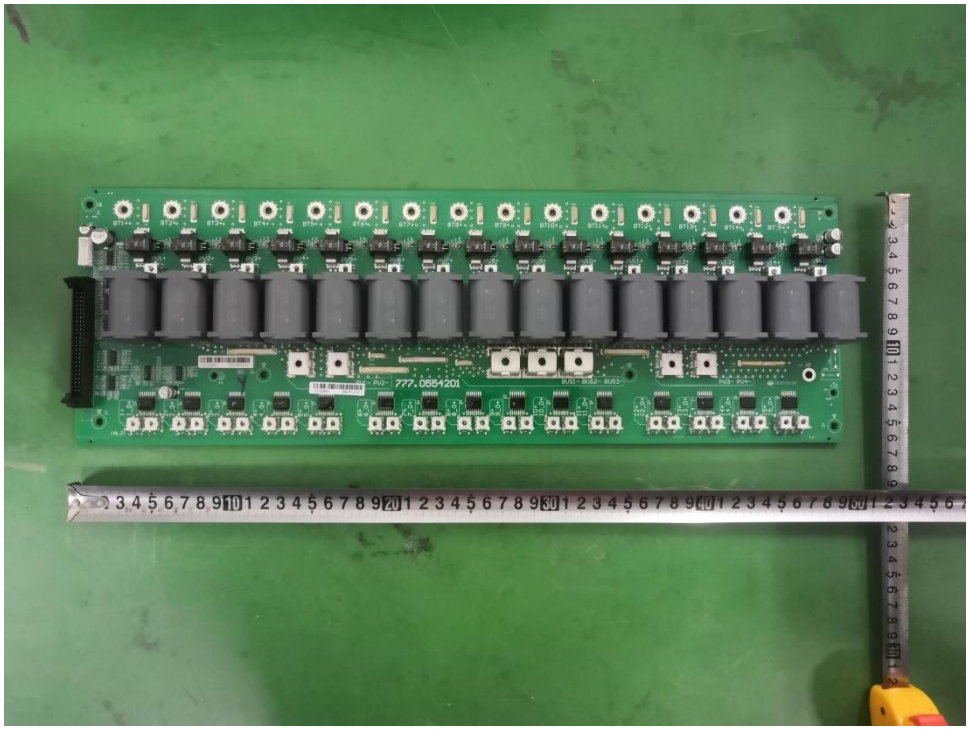


Figure 25. Front view of PV INPUT board

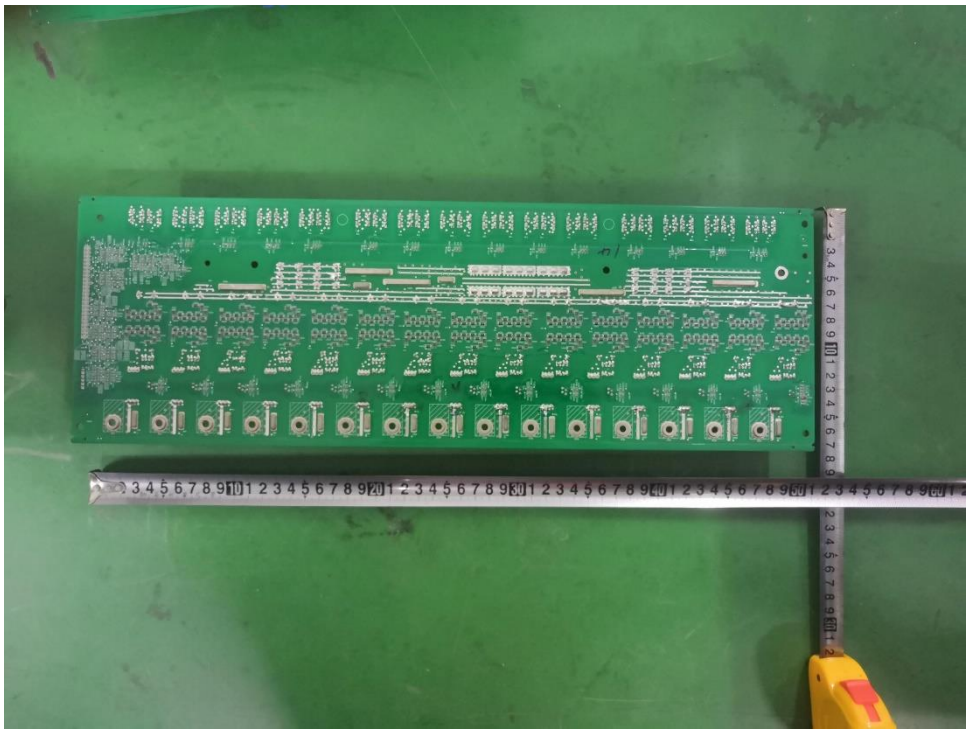


Figure 26. Back view of PV INPUT board

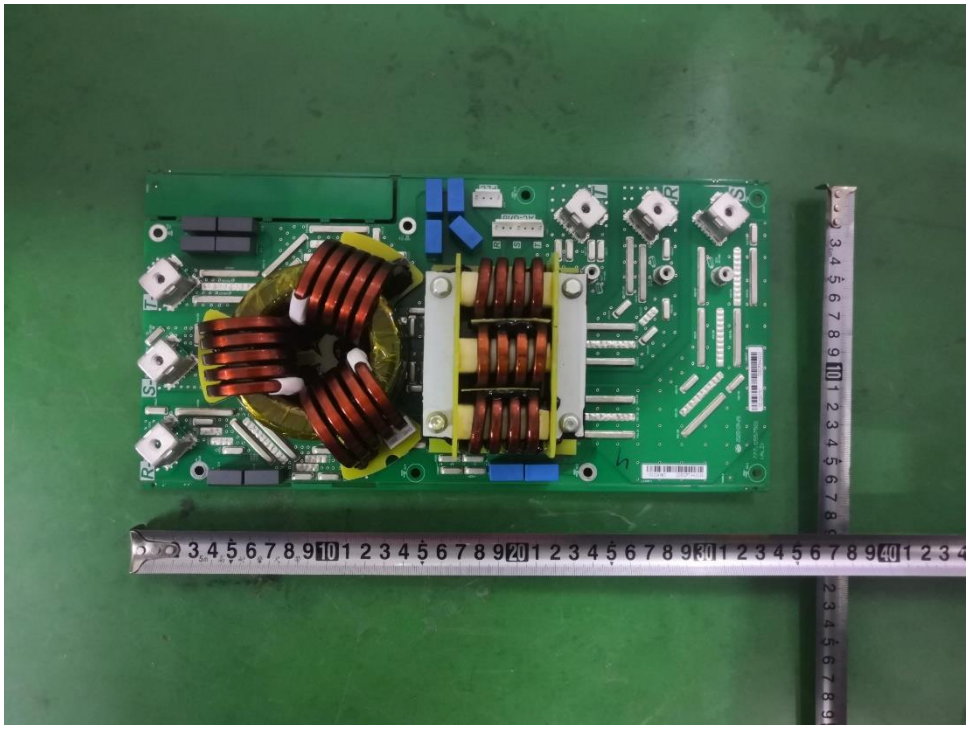


Figure 27. Front view of AC filter board

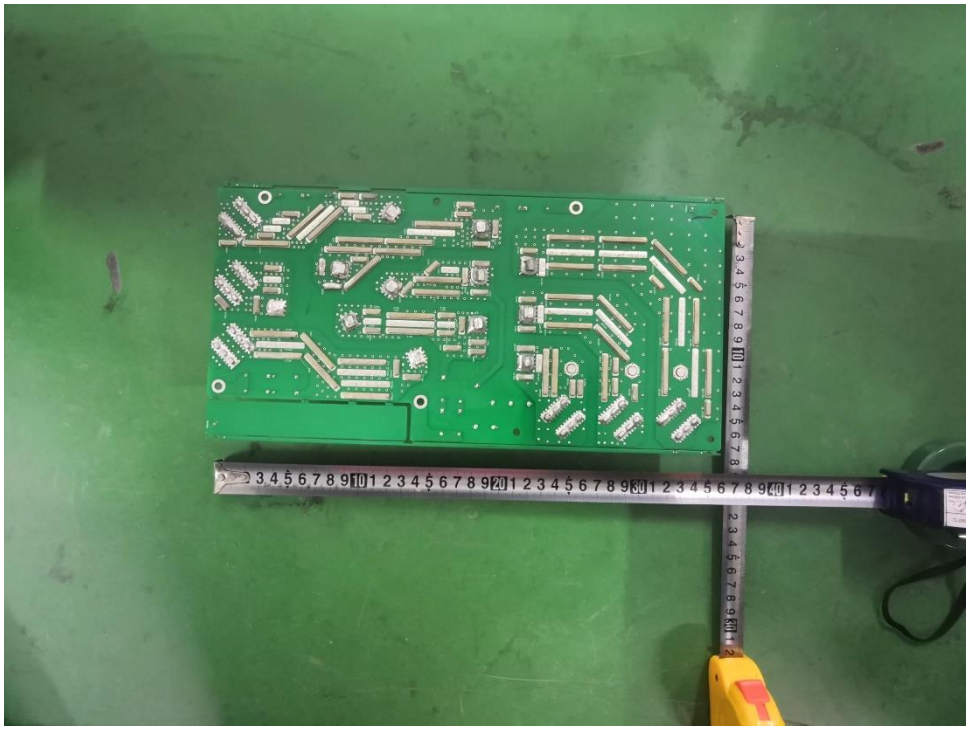


Figure 28. Back view of AC filter board

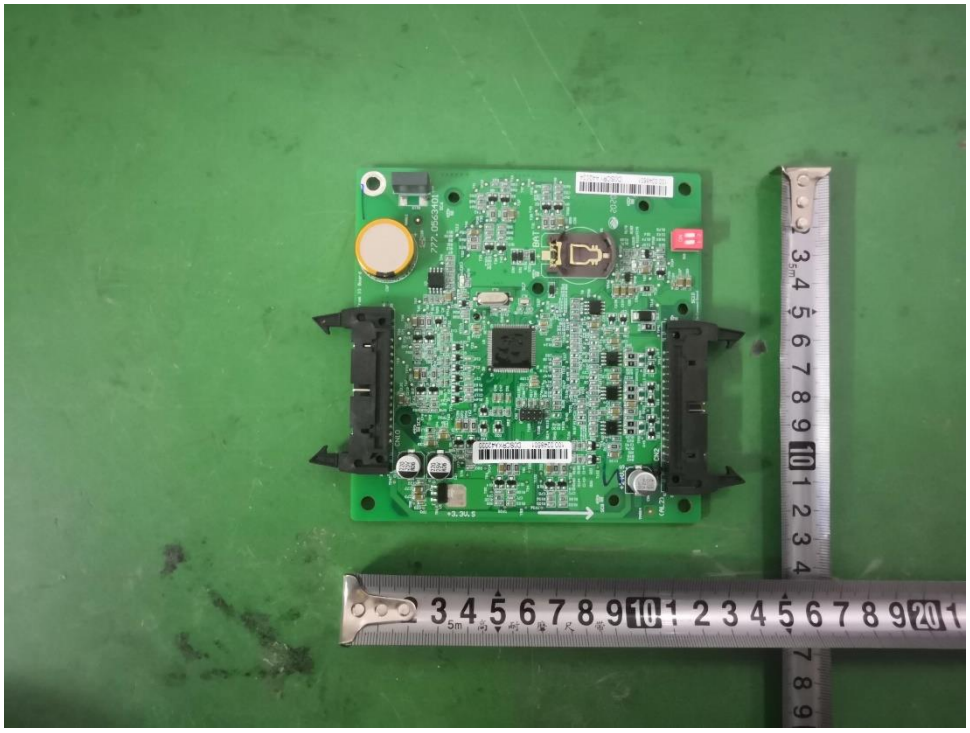


Figure 29. Front view of M3 board

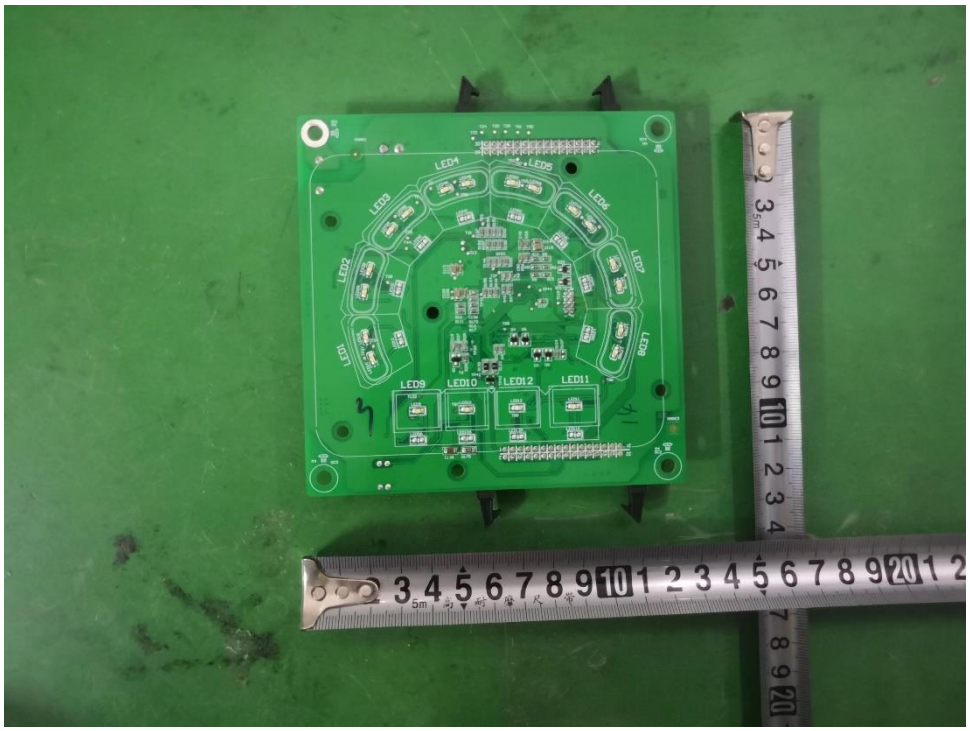


Figure 30. Back view of M3 board

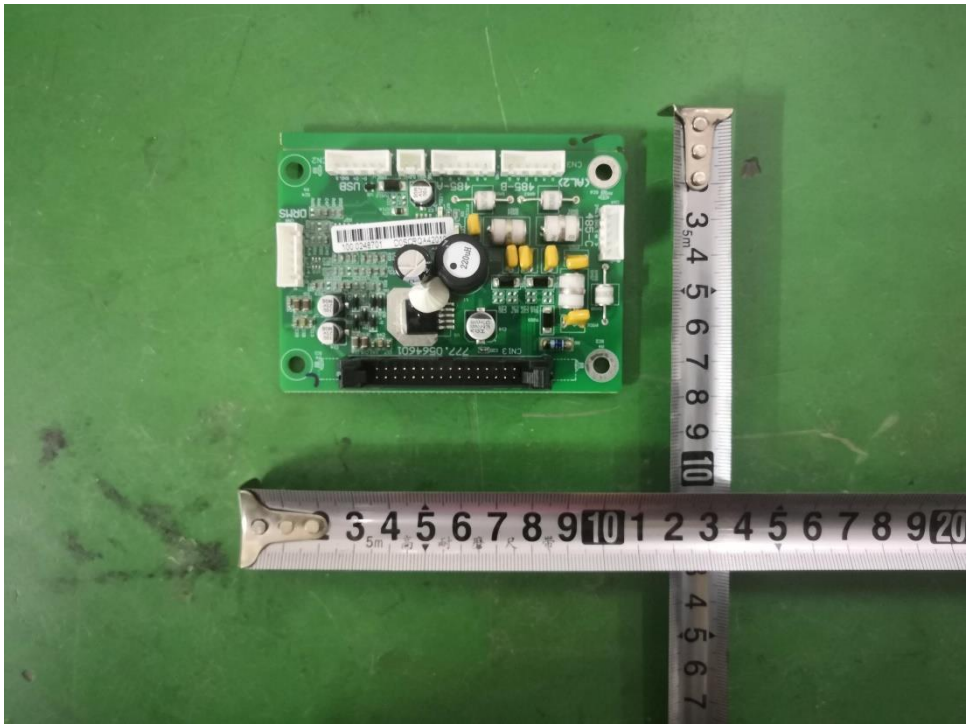


Figure 31. Front view of Transfer board

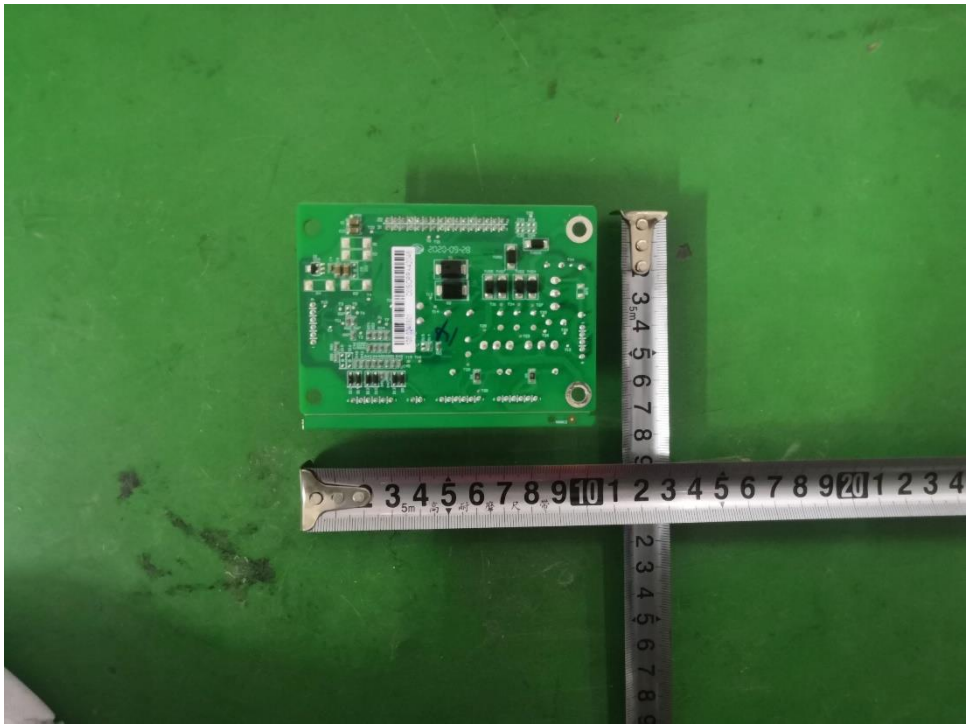


Figure 32. Back view of Transfer board

Figure 33. Front view of Flying across the capacitor board

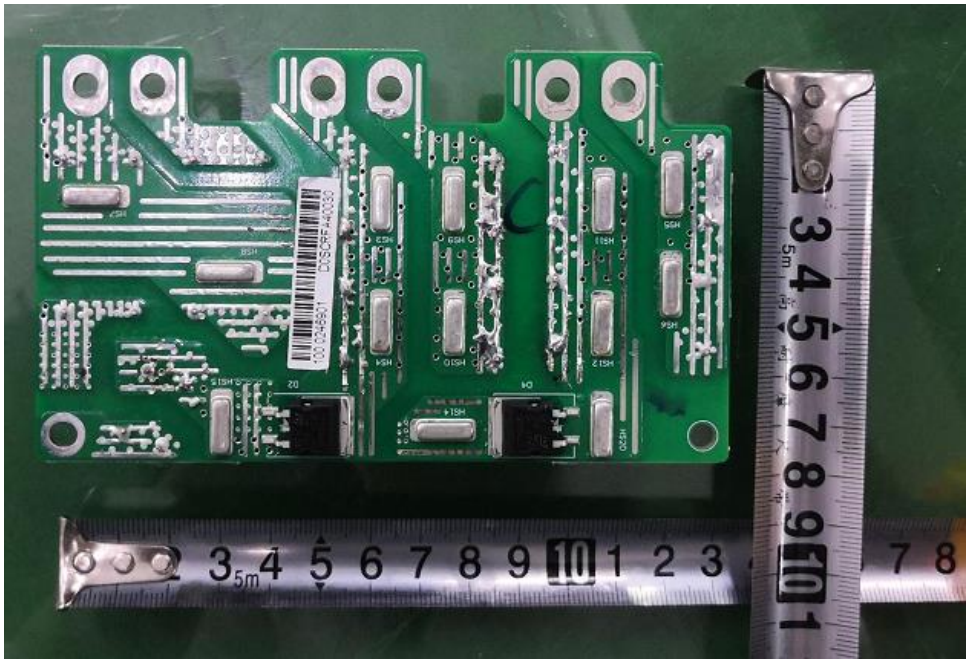


Figure 34. Back view of Flying across the capacitor board

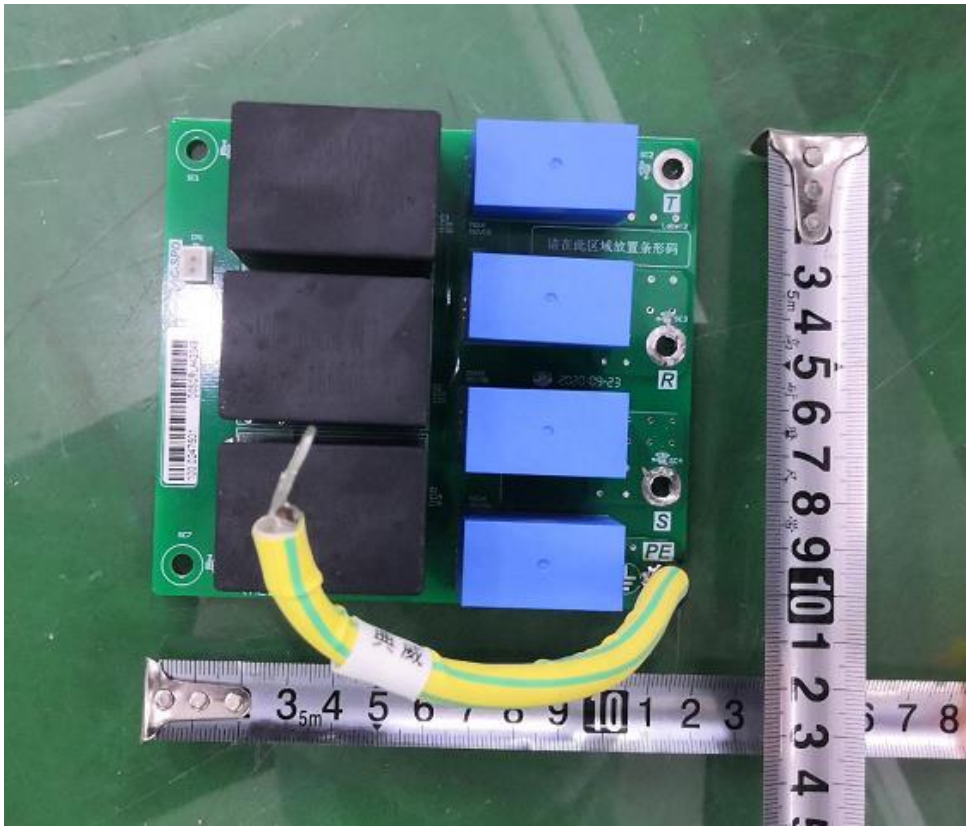


Figure 35. Front view of AC SPD board

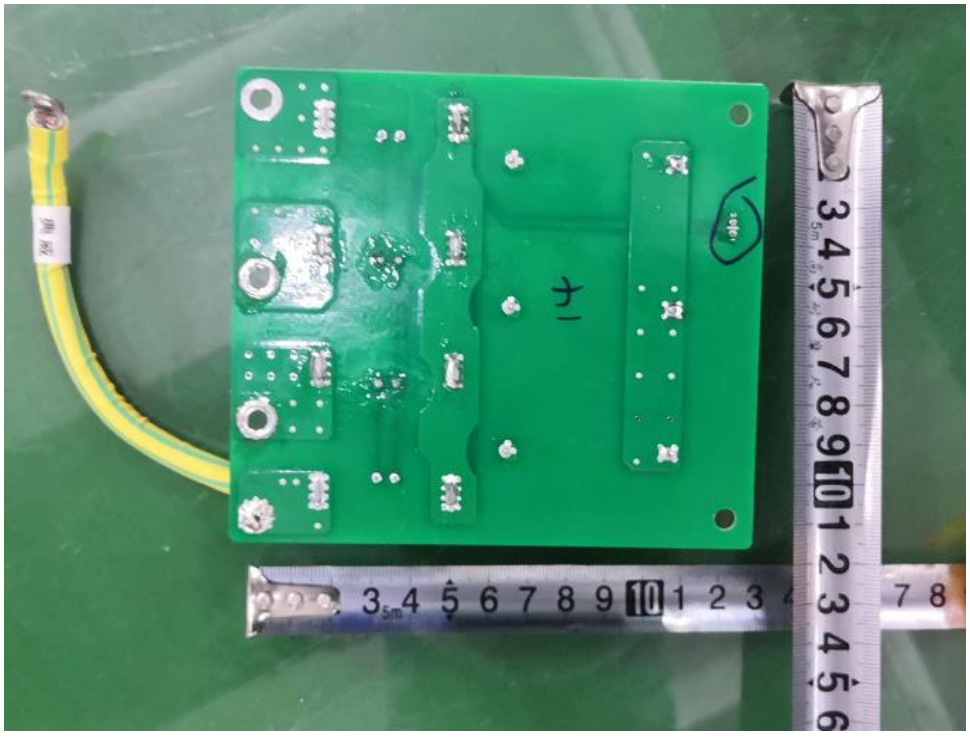


Figure 36. Back view of AC SPD board

Figure 37. AC terminals view

Figure 38. PE terminals view