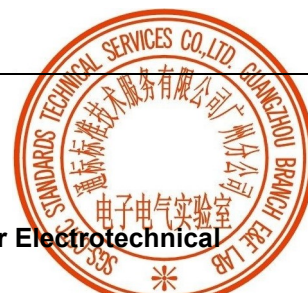





TEST REPORT IEC 61683 Photovoltaic systems – Power conditioners – Procedure for measuring efficiency	
Report Number.	GZES191102649904
Date of issue	12 / 11 / 2019
Total number of pages	26
Applicant's name	Hitachi Hi-Rel Power Electronics Pvt. Ltd.
Address	SM 3 & 4, Sanand – II GIDC, Industrial Estate, Boll Village, Sanand – 382 110, Gujarat, India.
Test specification:	
Standard	IEC 61683:1999 (First Edition)
Test procedure	Characteristic Examination
Non-standard test method	N/A
Test Report Form No	IEC61683A
Test Report Form(s) Originator	TÜV SÜD Product Service GmbH
Master TRF	Dated 2014-10
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General disclaimer:	
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Test item description..... :	Solar Grid-tied Inverter
Trade Mark..... :	
Manufacturer	Hitachi Hi-Rel Power Electronics Pvt. Ltd.
Address	SM 3 & 4, Sanand – II GIDC, Industrial Estate, Boll Village, Sanand – 382 110, Gujarat, India.
Model/Type reference	Hiverter Si-3K-H2, Hiverter Si-3.6K-H2, Hiverter Si-4K-H2, Hiverter Si-4.6K-H2, Hiverter Si-5K-H2, Hiverter Si-6K-H2.
Ratings	<p>Hiverter Si-6K-H2 DC input: 90-580V, 11/11A. AC output: 230V, 50Hz, 27.3A, 6000VA</p> <p>Hiverter Si-5K-H2 DC input: 90-580V, 11/11A. AC output: 230V, 50Hz, 22.8A, 5000VA</p> <p>Hiverter Si-4.6K-H2 DC input: 90-580V, 11/11A. AC output: 230V, 50Hz, 21A, 4600VA</p> <p>Hiverter Si-4K-H2 DC input: 90-580V, 11/11A. AC output: 230V, 50Hz, 18.2A, 4000VA</p> <p>Hiverter Si-3.6K-H2 DC input: 90-580V, 11/11A. AC output: 230V, 50Hz, 16.8A, 3680VA</p> <p>Hiverter Si-3K-H2 DC input: 90-580V, 11/11A. AC output: 230V, 50Hz, 13.7A, 3000VA</p> <p>Serial Number: ZG1ES060H61001 ZH1ES160H9S999 for spot-check test Firmware version: V0.22</p>

Testing procedure and testing location:		
Test date from 30/10/2017 to 11/11/2017		
<input checked="" type="checkbox"/>	Testing procedure: TMP/CTF Stage 1:	Shenzhen SOFAR SOLAR Co., Ltd.
Testing location/ address.....		401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China
Tested by (name + signature)		Hugo zhang (Project Engineer) <i>Hugo zhang</i>
Approved by (name + signature)		Roger Hu (Technical Reviewer) <i>Roger Hu</i>
Test date on 24/04/2019 and 06/05 2019		
<input checked="" type="checkbox"/>	Testing procedure: TMP/CTF Stage 1:	Shenzhen SOFAR SOLAR Co., Ltd.
Testing location/ address.....		401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China
Tested by (name + signature)		Hugo zhang (Project Engineer) <i>Hugo zhang</i>
Approved by (name + signature)		Roger Hu (Technical Reviewer) <i>Roger Hu</i>

List of Attachments (including a total number of pages in each attachment):		
50Hz		
Attachment #	Description	Pages
Attachment I	Pictures of the EUT and Electrical Schemes	12 pages
Attachment II	Testing Information	5 pages
Summary of testing:		
Tests performed (name of test and test clause): <p>The equipment has been tested according to the standard: IEC 61683:1999. Testing has been carried out at 50Hz.</p> <p>All applicable tests according to the above specified standard have been carried out.</p> <p>From the result of inspection and tests on the submitted sample, we conclude that it complies with the requirements of the standard.</p> <p>Remarks: All the test results are from the report below: - IEC 61683:1999 (First Edition) Test Report No: 2217 / 1094 – 4- M1 which issued by SGS Tecnos, S.A. (Electrical Testing Laboratory) on 06/05/2019</p>		Testing location: <p>Test date from 30/10/2017 to 11/11/2017: Shenzhen SOFAR SOLAR Co., Ltd. 5/F, Building 4, Antongda Industrial Park, No. 1 Liuxian Avenue, Xin'an Street, Bao'an District, Shenzhen City, Guangdong Province, P.R. China</p> <p>Test date on 24/04/2019 and 06/05 2019: Shenzhen SOFAR SOLAR Co., Ltd. 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China (All clauses)</p>
Summary of compliance with National Differences List of countries addressed No National Differences are addressed to this test report		

Copy of marking plate(representative):

HITACHI	
Solar Grid Tied Inverter	
Model No.	Hiverter Si-6K-H2
Max. DC Input Voltage	600V
Operating MPPT Voltage Range	90-580V
Max. Input Current	2x11A
Max. PV Isc	2x13.2A
Nominal Grid Voltage	230V
Max. Output Current	27.3A
Nominal Grid Frequency	50Hz/60Hz
Nominal Output Power	6000W
Max. Output Power	6000VA
Power Factor	1(adjustable+/-0.8)
Ingress Protection	IP65
Operating Temperature Range	-25 ~+60°C
Protective Class	Class I
 Hitachi Hi-Rel Power Electronics Pvt. Ltd. SM 3 & 4, Sanand - II GIDC, Industrial Estate, Bol Village, Sanand - 382 110, Gujarat, India., www.hitachi-hirel.com	
      	

Note:

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation
3. Labels of other models are as the same with Hiverter Si-6K-H2's except the parameters of rating.

Test item particulars : Single Phase Inverter	
Classification of installation and use : Fixed(permanent connection)	
Supply Connection : DC; PV	
..... : AC; Grid connection	
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 does not meet the requirement..... : F (Fail)	
Testing : CTF Stage 1 procedure	
Date of receipt of test item : N/A	
Date (s) of performance of tests : From 30/10/2017 to 11/11/2017, 24/04/2019 and 06/05 2019	
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report.</p> <p>"(See appended table)" refers to a table appended to the report.</p> <p>This document is issued by the Company subject to its General Conditions of Service printed overleaf, available on request or accessible at www.sgs.com/terms_and_conditions.htm and, for electronic format documents, subject to Terms and Conditions for Electronic Documents at www.sgs.com/terms_e-document.htm. Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein. Any holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents. This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p>	
Manufacturer's Declaration per sub-clause 4.2.5 of IECCE 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 :	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> Not applicable
When differences exist; they shall be identified in the General product information section.	
Name and address of factory (ies) : Dongguan SOFAR SOLAR Co., Ltd. 1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City, Guangdong Province, P.R. China.	

General product information:

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through connectors. The structure of the unit complied with the IP 65 requirement.

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

The Solar inverter converts DC voltage into AC voltage.

The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit can operate in case of one error.

Equipment Under Testing:

- Hiverter Si-6K-H2
- Hiverter Si-5K-H2
- Hiverter Si-4.6K-H2
- Hiverter Si-4K-H2
- Hiverter Si-3.6K-H2
- Hiverter Si-3K-H2

Product Model	Hiverter Si-3K- H2	Hiverter Si-3.6K- H2	Hiverter Si-4K- H2	Hiverter Si-4.6K- H2	Hiverter Si-5K- H2	Hiverter Si-6K- H2
Input (DC)						
Max.DC Input Power	3500W	4000W	4400W	5000W	5500W	6600W
Max.DC Voltage	600V					
Power Turn on	80V					
Start-up input voltage	120V					
Rated input voltage	360V					
MPPT Voltage Range	90-580V					
Full load DC voltage range	160- 520V	180- 520V	200- 520V	230- 520V	250- 520V	300- 520V
MAX input current per MPPT	11A/11A					
Number of DC inputs	2/2					
Output(AC)						
Max AC Output power	3000VA	3680VA	4000VA	4600VA	5000VA	6000VA
Max AC Output power (PF=1)	3000W	3680W	4000W	4600W	5000W	6000W
Max AC Output Current	13.7A	16.8A	18.2A	21A	22.8A	27.3A
Nominal Grid Voltage	230Vac(Single phase)					
Nominal Frequency	50Hz					
Power factor	1(adjustable+/-0.9)					
Topology	Transformerless					
Operating temperature range	-25 °C -60 °C					
Degree of protection	IP65					

The variants models have been included in this test report without tests because the following features don't change regarding to the tested model:

- Same connection system and hardware topology
- Same control algorithm.
- Output power within 2,5 and 2/3 of the EUT or Modular inverters
- Same Firmware Version

IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
4	Efficiency measurement conditions		P
	Efficiency is measured under the conditions in the following clauses.		P
	Specific conditions may be excluded by mutual agreement when those conditions are outside the manufacturer's allowable operating range.		P
4.1	DC power source for testing		P
	For power conditioners operating with fixed input voltage, the d.c. power source is a storage battery or constant voltage power source to maintain the input voltage.		N/A
	For power conditioners that employ maximum power point tracking (MPPT) and shunt-type power conditioners, either a photovoltaic array or a photovoltaic array simulator is utilized.		P
4.2	Temperature		P
	All measurements are to be made at an ambient temperature of $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$.		N/A
	Other ambient temperatures may be allowed by mutual agreement. However, the temperature used must be clearly stated in all documentation.	By mutual agreement all measurements at 50 Hz have been carried out at $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$	P
4.3	Output voltage and frequency		P
	The output voltage and frequency are maintained at the manufacturer's stated nominal values.	230Vac, 50Hz	P
4.4	Input voltage		P
	Measurements performed in each of the following tests are repeated at three power conditioner input voltages: a) manufacturer's minimum rated input voltage; b) the inverter's nominal voltage or the average of its rated input range; c) 90 % of the inverter's maximum input voltage.		P
	In the case where a power conditioner is to be connected with a battery at its input terminals, only the nominal or rated input voltage may be applied.		N/A
4.5	Ripple and distortion		P
	Record input voltage and current ripple for each measurement. Also record output voltage and current distortion (if a.c.) or ripple (if d.c.). Ensure that these measurements remain within the manufacturer's specified values.		P
4.6	Resistive loads/utility grid		P

IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
	At unity power factor, or at the intrinsic power factor of grid-connected inverters without power factor adjustment, measure the efficiency for power levels of 10 %, 25 %, 50 %, 75 %, 100 % and 120 % of the inverter's rating.		P
	Stand-alone inverters are also measured at a power level of 5 % of rated. The power conditioner test is conducted with a specified resistive and reactive grid impedance.		N/A
4.7	Reactive loads		N/A
	For stand-alone inverters, measure the efficiency with a load which provides a power factor equal to the manufacturer's specified minimum level (or 0,25, whichever is greater) and at power levels of 25 %, 50 % and 100 % of rated VA.		N/A
	Repeat for power factors of 0,5 and 0,75 (do not go below the manufacturer's specified minimum PF) and power levels of 25 %, 50 %, and 100 % of rated VA.		N/A
4.8	Resistive plus non-linear loads		N/A
	For stand-alone inverters, measure the efficiency with a fixed non-linear load (total harmonic distortion (THD) = $(80 \pm 5) \%$) equal to $(25 \pm 5) \%$ of the inverter's rated VA plus sufficient resistive load in parallel to achieve a total load of 25 %, 50 % and 100 % of rated VA.		N/A
	Repeat the measurements with a fixed non-linear load equivalent to $(50 \pm 5) \%$ of the inverter's rated VA plus sufficient resistive load in parallel to achieve a total load of 50% and 100% of rated VA.		N/A
	The type of non-linear load must be clearly stated in all documentation.		N/A
4.9	Complex loads		N/A
	When a non-linear plus a sufficient reactive load condition is specified for stand-alone inverters, measure the efficiency with a fixed non-linear load (THD = $(80 \pm 5) \%$) equal to $(50 \pm 5) \%$ of the inverter's rated VA plus a sufficient reactive load (PF = 0,5) in parallel to achieve a total load of 50 % and 100 % of rated VA.		N/A
	The type of complex load is clearly stated in all documentation.		N/A
5	Efficiency calculations		P
5.1	Rated output efficiency		P

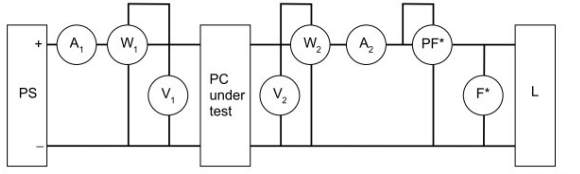
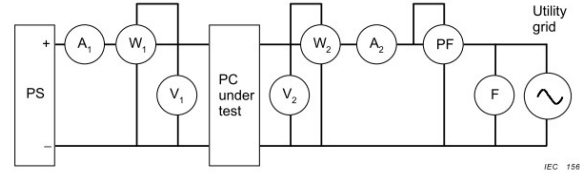
IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
5.2	Partial output efficiency		P
5.3	Energy efficiency		P
5.4	Efficiency tolerances		P
6	Conditions of loading for output ports		P
6.1	Test circuit		P
	Figure 1a is applied to standard-alone power conditioners		N/A
	 <p>Figure 1a – Stand-alone type</p> <p>IEC 1566/99</p>		N/A
	Figure 1b is applied to utility-interactive power conditioners		P
	 <p>Figure 1b – Utility-interactive type</p> <p>IEC 1567/99</p> <p>PC power conditioner PS variable voltage-current d.c. power supply A₁ DC ammeter A₂ AC or d.c. ammeter W₁ DC wattmeter W₂ AC or d.c. wattmeter L load F frequency meter V₁ DC voltmeter V₂ AC or d.c. voltmeter PF power factor meter</p>		P
6.2	Measurement procedure		P
7	Loss measurement		P
7.1	No-load loss		P
7.2	Standby loss		P
Annex A	Power conditioner description		P
Annex B	Power efficiency and conversion factor		P
Annex C	Weighted-average energy efficiency		P
Annex D	Derivation of efficiency tolerance in table 2		P

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	Hiverter Si-6K-H2								
Parameters of power conditioner	Minimum rated input voltage:300V Nominal voltage:360V Maximum input voltage:520V Rated output voltage:230V Rated output frequency:50Hz Rated output power: 6000W								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	301.0	303.5	300.4	300.1	300.4	/	/	/
Input voltage ripple (V)	/	0.9	1.9	3.7	5.5	7.2	/	/	/
Input current (A)	/	2.1	5.1	10.4	15.6	20.1	/	/	/
Input current ripple (A)	/	0.2	0.5	0.8	1.2	1.6	/	/	/
Input power (Pi) (kW)	/	0.629	1.553	3.115	4.657	6.243	/	/	/
Output power (Po) (kW)	/	0.601	1.500	3.016	4.503	6.017	/	/	/
Output efficiency(%)	/	95.55	96.59	96.82	96.69	96.38	/	/	/
Input energy (Wi) (Wh)	/	10.468	25.907	51.886	77.599	104.054	/	/	/
Output energy (Wo) (Wh)	/	9.969	25.044	50.261	75.029	100.306	/	/	/
Energy efficiency(%)	/	95.23	96.67	96.87	96.69	96.40	/	/	/
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	358.1	357.5	357.6	357.0	364.6	/	/	/
Input voltage ripple (V)	/	1.2	2.4	4.8	7.0	8.3	/	/	/
Input current (A)	/	1.7	4.3	8.7	13.0	17.0	/	/	/

Input current ripple (A)	/	0.3	0.6	1.1	1.6	1.9	/	/	/
Input power (Pi) (kW)	/	0.622	1.544	3.090	4.626	6.179	/	/	/
Output power (Po) (kW)	/	0.597	1.507	3.010	4.510	6.006	/	/	/
Output efficiency(%)	/	95.98	97.60	97.41	97.49	97.20	/	/	/
Input energy (Wi) (Wh)	/	10.352	25.719	51.509	77.083	103.035	/	/	/
Output energy (Wo) (Wh)	/	9.959	25.088	50.296	75.131	100.169	/	/	/
Energy efficiency(%)	/	96.20	97.55	97.65	97.47	97.22	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	464.5	466.1	468.2	468.1	464.6	/	/	/
Input voltage ripple (V)		1.0	1.9	4.0	5.4	7.2	/	/	/
Input current (A)	/	1.4	3.3	6.6	9.9	13.4	/	/	/
Input current ripple (A)		0.2	0.5	0.9	1.4	1.8	/	/	/
Input power (Pi) (kW)	/	0.627	1.544	3.090	4.638	6.185	/	/	/
Output power (Po) (kW)	/	0.601	1.498	3.011	4.515	5.995	/	/	/
Output efficiency(%)	/	95.85	97.02	97.44	97.35	96.93	/	/	/
Input energy (Wi) (Wh)	/	10.439	25.739	51.495	77.298	103.107	/	/	/
Output energy (Wo) (Wh)	/	10.009	25.030	50.192	75.232	100.089	/	/	/
Energy efficiency(%)	/	95.88	97.25	97.47	97.33	97.07	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Spot-check test for Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	Hiverter Si-6K-H2								
Parameters of power conditioner	Minimum rated input voltage:300V Nominal voltage:360V Maximum input voltage:520V Rated output voltage:230V Rated output frequency:50Hz Rated output power: 6000W								
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	361.1	358.6	359.6	360.5	359.1	/	/	/
Input voltage ripple (V)	/	1.6	2.1	5.2	7.8	9.8	/	/	/
Input current (A)	/	1.8	4.4	8.7	13.0	17.3	/	/	/
Input current ripple (A)	/	0.3	0.3	0.3	0.4	0.7	/	/	/
Input power (Pi) (kW)	/	0.634	1.571	3.125	4.668	6.199	/	/	/
Output power (Po) (kW)	/	0.616	1.541	3.063	4.567	6.041	/	/	/
Output efficiency(%)	/	97.19	98.02	98.01	97.78	97.49	/	/	/
Input energy (Wi) (Wh)	/	10.384	25.735	51.209	76.501	101.590	/	/	/
Output energy (Wo) (Wh)	/	10.093	25.224	50.187	74.807	99.043	/	/	/
Energy efficiency(%)	/	97.20	98.01	98.00	97.79	97.49	/	/	/

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	Hiverter Si-5K-H2								
Parameters of power conditioner	Minimum rated input voltage:250V Nominal voltage:360V Maximum input voltage:520V Rated output voltage:230V Rated output frequency:50Hz Rated output power: 5000W								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	249.3	248.4	250.5	250.3	247.2	/	/	/
Input voltage ripple (V)	/	0.9	1.5	2.7	3.8	5.2	/	/	/
Input current (A)	/	2.1	5.2	10.4	15.6	21.1	/	/	/
Input current ripple (A)	/	0.2	0.3	0.6	0.9	1.2	/	/	/
Input power (Pi) (kW)	/	0.532	1.302	2.593	3.888	5.207	/	/	/
Output power (Po) (kW)	/	0.501	1.252	2.503	3.753	5.011	/	/	/
Output efficiency(%)	/	94.17	96.16	96.53	96.53	96.24	/	/	/
Input energy (Wi) (Wh)	/	8.851	21.695	43.212	64.816	86.747	/	/	/
Output energy (Wo) (Wh)	/	8.367	20.873	41.734	62.527	83.469	/	/	/
Energy efficiency(%)	/	94.53	96.21	96.58	96.47	96.22	/	/	/
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	362.3	359.1	359.1	358.4	359.0	/	/	/
Input voltage ripple (V)	/	1.4	2.1	3.8	5.8	7.8	/	/	/

Input current (A)	/	1.4	3.6	7.2	10.8	14.4	/	/	/
Input current ripple (A)	/	0.3	0.5	0.9	1.3	1.8	/	/	/
Input power (Pi) (kW)	/	0.519	1.289	2.569	3.850	5.148	/	/	/
Output power (Po) (kW)	/	0.495	1.262	2.508	3.757	5.018	/	/	/
Output efficiency(%)	/	95.38	97.91	97.63	97.58	97.48	/	/	/
Input energy (Wi) (Wh)	/	8.658	21.472	42.810	64.144	85.790	/	/	/
Output energy (Wo) (Wh)	/	8.315	20.920	41.804	62.563	83.498	/	/	/
Energy efficiency(%)	/	96.04	97.43	97.65	97.54	97.33	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	465.7	465.6	465.8	467.2	468.3	/	/	/
Input voltage ripple (V)	/	0.8	1.7	3.0	4.6	5.9	/	/	/
Input current (A)	/	1.1	2.8	5.5	8.3	11.0	/	/	/
Input current ripple (A)	/	0.2	0.4	0.8	1.1	1.5	/	/	/
Input power (Pi) (kW)	/	0.523	1.297	2.571	3.851	5.154	/	/	/
Output power (Po) (kW)	/	0.497	1.262	2.503	3.750	5.016	/	/	/
Output efficiency(%)	/	95.03	97.30	97.36	97.38	97.32	/	/	/
Input energy (Wi) (Wh)	/	8.720	21.614	42.845	64.170	85.887	/	/	/
Output energy (Wo) (Wh)	/	8.318	20.987	41.757	62.506	83.511	/	/	/
Energy efficiency(%)	/	95.39	97.10	97.46	97.41	97.23	/	/	/
Remark: *If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	Hiverter Si-4.6K-H2								
Parameters of power conditioner	Minimum rated input voltage:230V Nominal voltage:360V Maximum input voltage:520V Rated output voltage:230V Rated output frequency:50Hz Rated output power: 4600W								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	228.6	228.9	231.1	229.5	240.0	/	/	/
Input voltage ripple (V)	/	0.7	1.1	2.3	3.3	4.5	/	/	/
Input current (A)	/	2.2	5.3	10.4	15.6	20.8	/	/	/
Input current ripple (A)	/	0.1	0.3	0.5	0.7	1.0	/	/	/
Input power (Pi) (kW)	/	0.491	1.208	2.392	3.581	4.786	/	/	/
Output power (Po) (kW)	/	0.460	1.160	2.309	3.453	4.604	/	/	/
Output efficiency(%)	/	93.69	96.03	96.53	96.43	96.20	/	/	/
Input energy (Wi) (Wh)	/	8.157	20.115	39.867	59.657	79.790	/	/	/
Output energy (Wo) (Wh)	/	7.671	19.309	38.459	57.516	76.77	/	/	/
Energy efficiency(%)	/	94.04	95.99	96.47	96.41	96.22	/	/	/
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	360.0	360.3	360.8	361.9	360.0	/	/	/
Input voltage ripple (V)	/	0.9	1.9	3.5	5.7	7.1	/	/	/

Input current (A)	/	1.3	3.3	6.6	9.8	13.2	/	/	/
Input current ripple (A)	/	0.3	0.5	0.9	1.3	1.6	/	/	/
Input power (Pi) (kW)	/	0.489	1.189	2.363	3.538	4.725	/	/	/
Output power (Po) (kW)	/	0.458	1.157	2.307	3.453	4.603	/	/	/
Output efficiency(%)	/	93.66	97.31	97.63	97.60	97.42	/	/	/
Input energy (Wi) (Wh)	/	7.994	19.806	39.384	59.006	78.713	/	/	/
Output energy (Wo) (Wh)	/	7.658	19.283	38.458	57.573	76.668	/	/	/
Energy efficiency(%)	/	95.80	97.36	97.65	97.57	97.40	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	464.1	469.0	468.0	469.3	466.9	/	/	/
Input voltage ripple (V)	/	0.8	1.5	2.8	4.0	5.5	/	/	/
Input current (A)	/	1.0	2.5	5.1	7.6	10.2	/	/	/
Input current ripple (A)	/	0.2	0.4	0.7	1.1	1.4	/	/	/
Input power (Pi) (kW)	/	0.480	1.191	2.368	3.545	4.739	/	/	/
Output power (Po) (kW)	/	0.457	1.152	2.318	3.456	4.620	/	/	/
Output efficiency(%)	/	95.21	96.73	97.89	97.49	97.49	/	/	/
Input energy (Wi) (Wh)	/	8.010	19.855	39.447	59.081	78.943	/	/	/
Output energy (Wo) (Wh)	/	7.620	19.259	38.438	57.565	76.814	/	/	/
Energy efficiency(%)	/	95.13	97.00	97.44	97.43	97.30	/	/	/
Remark: *If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	Hiverter Si-4K-H2								
Parameters of power conditioner	Minimum rated input voltage:200V Nominal voltage:360V Maximum input voltage:520V Rated output voltage:230V Rated output frequency:50Hz Rated output power: 4000W								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	201.3	201.7	201.2	198.4	199.7	/	/	/
Input voltage ripple (V)	/	0.8	1.2	2.4	3.5	4.6	/	/	/
Input current (A)	/	2.1	5.2	10.4	15.8	21.0	/	/	/
Input current ripple (A)	/	0.2	0.3	0.5	0.7	1.1	/	/	/
Input power (Pi) (kW)	/	0.424	1.046	2.089	3.126	4.180	/	/	/
Output power (Po) (kW)	/	0.400	1.005	2.014	3.006	4.011	/	/	/
Output efficiency(%)	/	94.34	96.08	96.41	96.16	95.96	/	/	/
Input energy (Wi) (Wh)	/	7.054	17.433	34.84	52.065	69.688	/	/	/
Output energy (Wo) (Wh)	/	6.651	16.741	33.561	50.070	66.818	/	/	/
Energy efficiency(%)	/	94.29	96.03	96.33	96.17	95.88	/	/	/
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	360.3	360.5	360.3	359.3	360.5	/	/	/
Input voltage ripple (V)	/	1.1	1.9	3.9	5.8	7.9	/	/	/

Input current (A)	/	1.2	2.9	5.7	8.6	11.5	/	/	/
Input current ripple (A)	/	0.3	0.6	1.0	1.4	1.8	/	/	/
Input power (Pi) (kW)	/	0.416	1.031	2.051	3.077	4.104	/	/	/
Output power (Po) (kW)	/	0.400	1.005	2.006	3.006	4.001	/	/	/
Output efficiency(%)	/	96.15	97.48	97.81	97.69	97.49	/	/	/
Input energy (Wi) (Wh)	/	6.927	17.176	34.177	51.269	68.435	/	/	/
Output energy (Wo) (Wh)	/	6.677	16.767	33.421	50.070	66.706	/	/	/
Energy efficiency(%)	/	96.39	97.62	97.79	97.66	97.47	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	467.6	467.2	468.7	468.8	469.1	/	/	/
Input voltage ripple (V)	/	1.1	1.5	3.0	4.4	6.0	/	/	/
Input current (A)	/	0.9	2.2	4.4	6.6	8.8	/	/	/
Input current ripple (A)	/	0.2	0.5	0.8	1.1	1.5	/	/	/
Input power (Pi) (kW)	/	0.416	1.037	2.055	3.081	4.119	/	/	/
Output power (Po) (kW)	/	0.399	1.010	2.005	3.004	4.011	/	/	/
Output efficiency(%)	/	95.91	97.40	97.57	97.50	97.38	/	/	/
Input energy (Wi) (Wh)	/	6.940	17.276	34.259	51.341	68.651	/	/	/
Output energy (Wo) (Wh)	/	6.647	16.815	33.439	50.083	66.854	/	/	/
Energy efficiency(%)	/	95.78	97.33	97.61	97.55	97.38	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	Hiverter Si-3.6K-H2								
Parameters of power conditioner	Minimum rated input voltage:180V Nominal voltage:360V Maximum input voltage:520V Rated output voltage:230V Rated output frequency:50Hz Rated output power: 3680W								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	181.1	179.2	181.4	180.9	180.4	/	/	/
Input voltage ripple (V)	/	0.8	1.1	2.0	2.9	3.8	/	/	/
Input current (A)	/	2.2	5.4	10.6	15.9	21.4	/	/	/
Input current ripple (A)	/	0.1	0.2	0.2	0.6	0.8	/	/	/
Input power (Pi) (kW)	/	0.393	0.964	1.921	2.877	3.846	/	/	/
Output power (Po) (kW)	/	0.369	0.923	1.848	2.762	3.683	/	/	/
Output efficiency(%)	/	93.89	95.75	96.20	96.00	95.76	/	/	/
Input energy (Wi) (Wh)	/	6.554	16.054	32.052	47.995	64.159	/	/	/
Output energy (Wo) (Wh)	/	6.154	15.379	30.820	46.077	61.397	/	/	/
Energy efficiency(%)	/	93.90	95.80	96.16	96.00	95.70	/	/	/
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	357.6	358.7	362.7	359.9	357.6	/	/	/
Input voltage ripple (V)	/	1.1	1.7	3.5	5.5	7.2	/	/	/

Input current (A)	/	1.1	2.7	5.3	7.9	10.6	/	/	/
Input current ripple (A)	/	0.3	0.5	0.9	1.3	1.7	/	/	/
Input power (Pi) (kW)	/	0.388	0.959	1.901	2.826	3.784	/	/	/
Output power (Po) (kW)	/	0.370	0.929	1.847	2.760	3.692	/	/	/
Output efficiency(%)	/	95.36	96.87	97.16	97.67	97.57	/	/	/
Input energy (Wi) (Wh)	/	6.453	15.958	31.694	47.091	63.054	/	/	/
Output energy (Wo) (Wh)	/	6.127	15.440	30.787	46.009	61.497	/	/	/
Energy efficiency(%)	/	94.95	96.75	97.14	97.70	97.53	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	466.8	468.4	467.9	467.4	469.5	/	/	/
Input voltage ripple (V)	/	0.8	1.6	2.3	4.0	5.5	/	/	/
Input current (A)	/	0.8	2.0	4.1	6.1	8.1	/	/	/
Input current ripple (A)	/	0.2	0.4	0.6	1.1	1.4	/	/	/
Input power (Pi) (kW)	/	0.385	0.955	1.890	2.834	3.781	/	/	/
Output power (Po) (kW)	/	0.365	0.931	1.841	2.765	3.685	/	/	/
Output efficiency(%)	/	94.81	97.49	97.41	97.57	97.46	/	/	/
Input energy (Wi) (Wh)	/	6.412	15.895	31.515	47.229	63.024	/	/	/
Output energy (Wo) (Wh)	/	6.132	15.469	30.769	46.095	61.419	/	/	/
Energy efficiency(%)	/	95.63	97.32	97.63	97.60	97.45	/	/	/
Remark: *If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	Efficiency recording and efficient calculation sheet								
power conditioner type	Grid-connected								
Model:	Hiverter Si-3K-H2								
Parameters of power conditioner	Minimum rated input voltage:160V Nominal voltage:360V Maximum input voltage:520V Rated output voltage:230V Rated output frequency:50Hz Rated output power: 3000W								
PV input voltage	a) Manufacturer's minimum rated input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	160.5	160.3	161.6	161.0	160.5	/	/	/
Input voltage ripple (V)	/	1.0	0.9	1.5	2.1	2.7	/	/	/
Input current (A)	/	2.0	5.0	9.7	14.6	19.6	/	/	/
Input current ripple (A)	/	0.1	0.2	0.4	0.5	0.7	/	/	/
Input power (Pi) (kW)	/	0.327	0.796	1.568	2.354	3.139	/	/	/
Output power (Po) (kW)	/	0.304	0.759	1.506	2.257	3.006	/	/	/
Output efficiency(%)	/	92.97	95.35	96.05	95.88	95.76	/	/	/
Input energy (Wi) (Wh)	/	5.439	13.256	26.158	39.252	52.347	/	/	/
Output energy (Wo) (Wh)	/	5.055	12.639	25.099	37.644	50.089	/	/	/
Energy efficiency(%)	/	92.94	95.35	95.95	95.90	95.69	/	/	/
PV input voltage	b) The inverter's nominal voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	357.2	360.0	359.5	360.1	360.4	/	/	/
Input voltage ripple (V)	/	1.1	1.6	2.9	4.6	5.8	/	/	/

Input current (A)	/	0.9	2.2	4.3	6.4	8.6	/	/	/
Input current ripple (A)	/	0.2	0.4	0.8	1.1	1.4	/	/	/
Input power (Pi) (kW)	/	0.323	0.782	1.540	2.307	3.076	/	/	/
Output power (Po) (kW)	/	0.305	0.753	1.506	2.256	3.005	/	/	/
Output efficiency(%)	/	94.43	96.29	97.79	97.79	97.69	/	/	/
Input energy (Wi) (Wh)	/	5.348	13.019	25.655	38.436	51.265	/	/	/
Output energy (Wo) (Wh)	/	5.041	12.567	25.085	37.586	50.078	/	/	/
Energy efficiency(%)	/	94.26	96.53	97.78	97.79	97.69	/	/	/
PV input voltage	c) 90% of the inverter's maximum input voltage								
Temperature (°C)	25°C ± 5°C								
Operating period for energy measurement (min)	1								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%*	/	/
Input voltage (V)	/	468.0	468.4	467.9	467.9	470.0	/	/	/
Input voltage ripple (V)	/	0.9	1.2	2.1	3.2	4.5	/	/	/
Input current (A)	/	0.7	1.7	3.3	5.0	6.6	/	/	/
Input current ripple (A)	/	0.2	0.3	0.6	0.9	1.2	/	/	/
Input power (Pi) (kW)	/	0.319	0.782	1.542	2.310	3.082	/	/	/
Output power (Po) (kW)	/	0.302	0.758	1.504	2.253	3.006	/	/	/
Output efficiency(%)	/	94.67	96.93	97.54	97.53	97.53	/	/	/
Input energy (Wi) (Wh)	/	5.311	13.023	25.689	38.505	51.384	/	/	/
Output energy (Wo) (Wh)	/	5.044	12.639	25.072	37.597	50.131	/	/	/
Energy efficiency(%)	/	94.97	97.05	97.60	97.64	97.56	/	/	/
Remark:									
*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived;									

TABLE	No load loss	P
power conditioner type	Utility-interactive	
Hiverter Si-6K-H2		
Measure input voltage (V)	360.0	
Measured input power(W)	6.522	
Hiverter Si-5K-H2		
Measure input voltage (V)	360.1	
Measured input power(W)	6.159	
Hiverter Si-4.6K-H2		
Measure input voltage (V)	360.1	
Measured input power(W)	6.125	
Hiverter Si-4K-H2		
Measure input voltage (V)	360.1	
Measured input power(W)	6.098	
Hiverter Si-3.6K-H2		
Measure input voltage (V)	360.1	
Measured input power(W)	5.613	
Hiverter Si-3K-H2		
Measure input voltage (V)	360.1	
Measured input power(W)	5.639	
Remark: No load loss is measured when the power conditioner works at rated input voltage and it's load is disconnected.		

TABLE	Standby loss	P
power conditioner type	Utility-interactive	
Hiverter Si-6K-H2		
Measure input voltage (V)	230.1	
Measured input power(W)	0.151	
Hiverter Si-5K-H2		
Measure input voltage (V)	230.0	
Measured input power(W)	0.149	
Hiverter Si-4.6K-H2		
Measure input voltage (V)	230.0	
Measured input power(W)	0.139	
Hiverter Si-4K-H2		
Measure input voltage (V)	230.0	
Measured input power(W)	0.234	
Hiverter Si-3.6K-H2		
Measure input voltage (V)	230.0	
Measured input power(W)	0.226	
Hiverter Si-3K-H2		
Measure input voltage (V)	230.0	
Measured input power(W)	0.224	
Remark: Standby loss is measured when the power conditioner works at rated input voltage and in standby mode.		

--- End of test report---



ATTACHMENT I

(Pictures of the EUT and Electrical Schemes)

1 PICTURES

Front



Side



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Connection interface

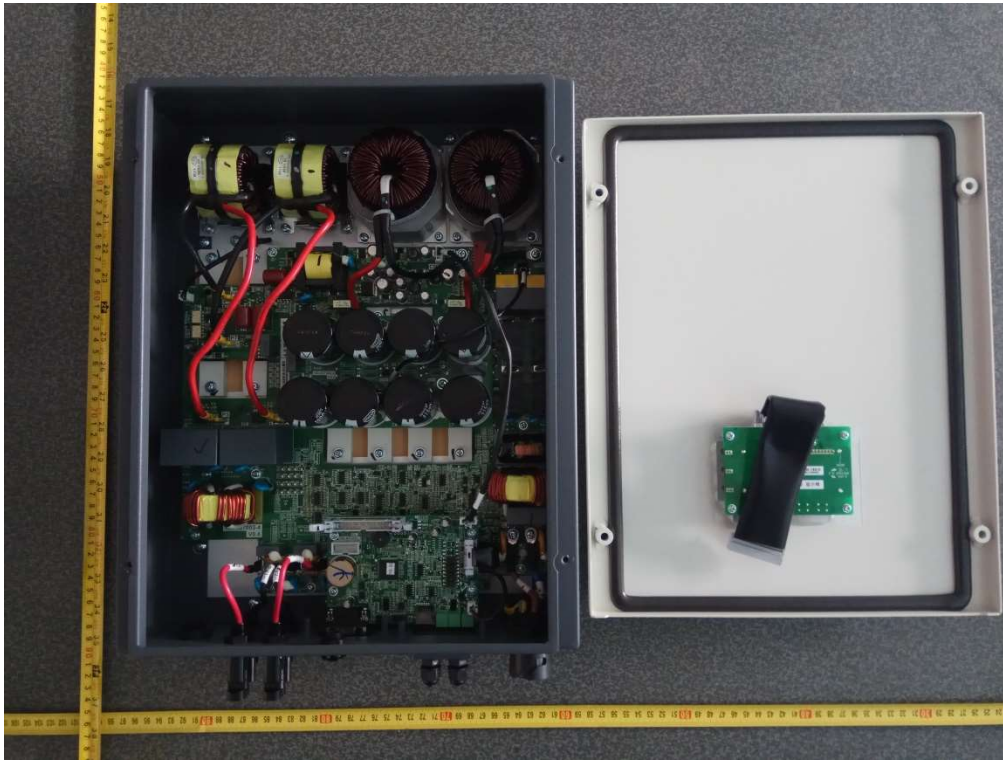


Back Side



IEC 61683: 1999

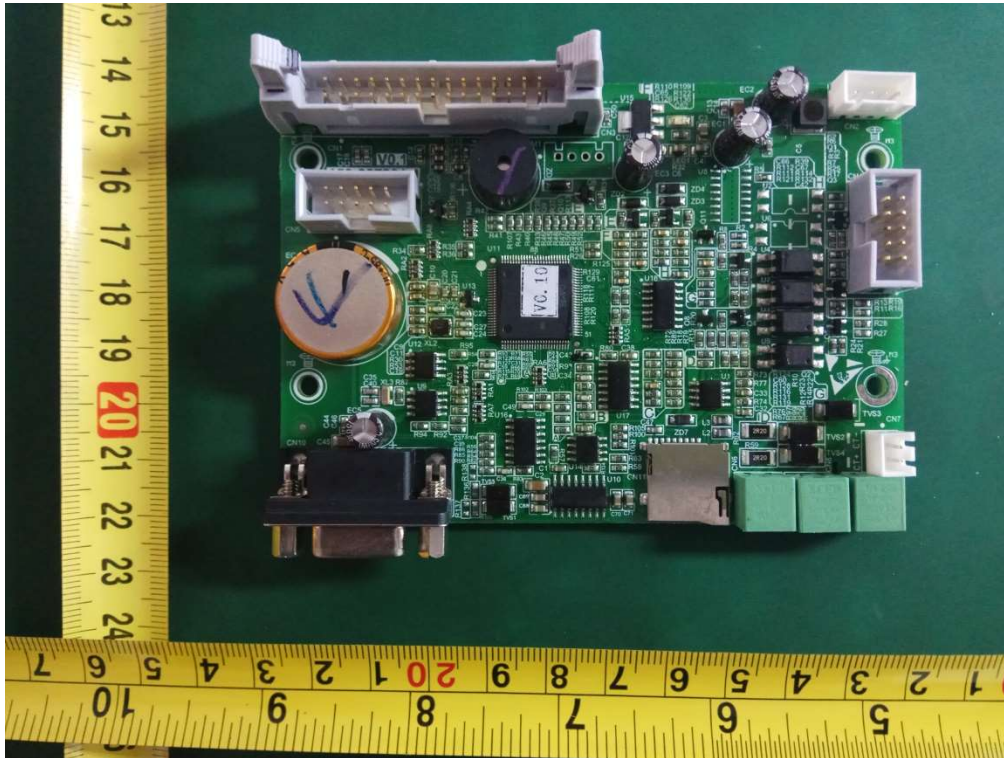
Internal



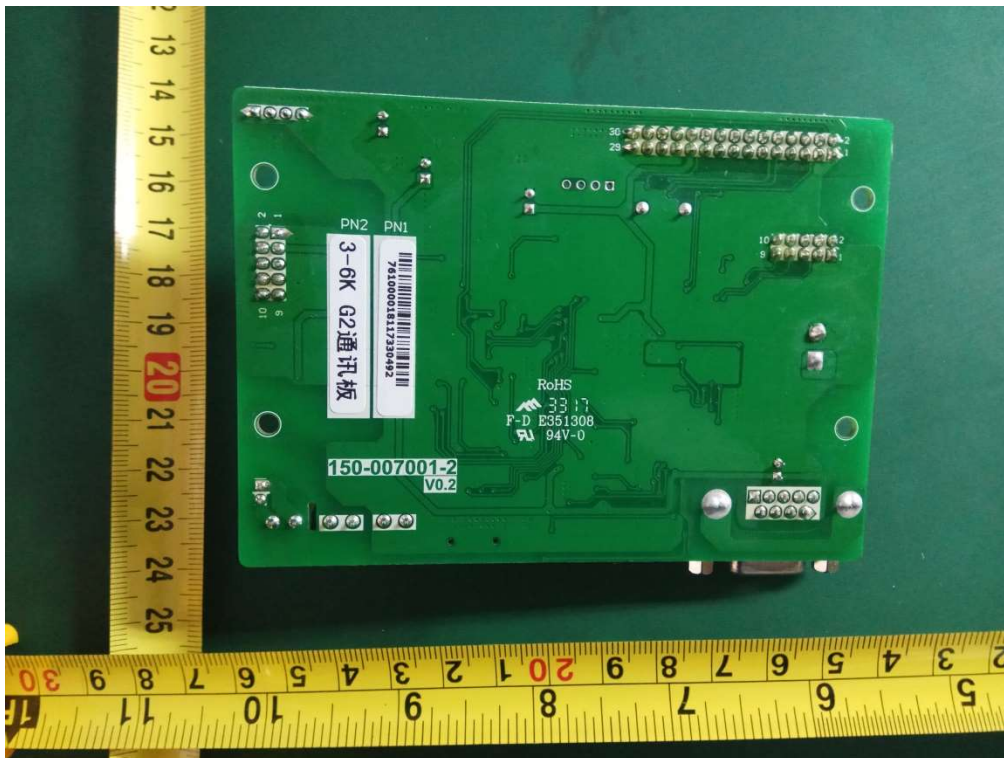
Internal



Front side of communication board

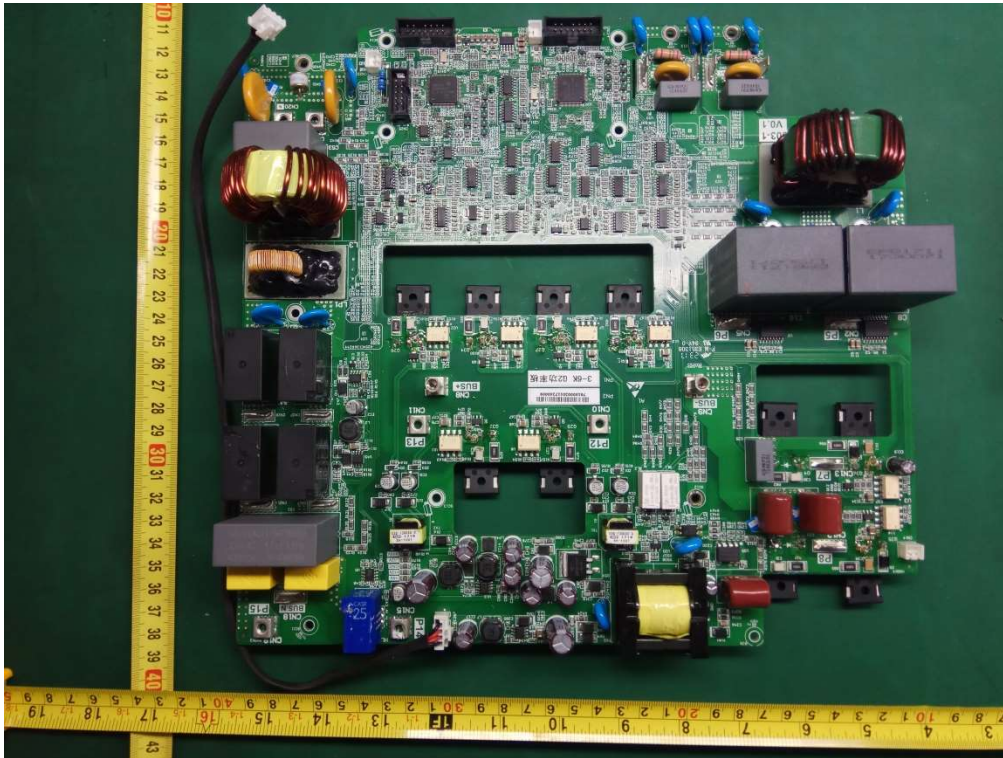


Back side of communication board

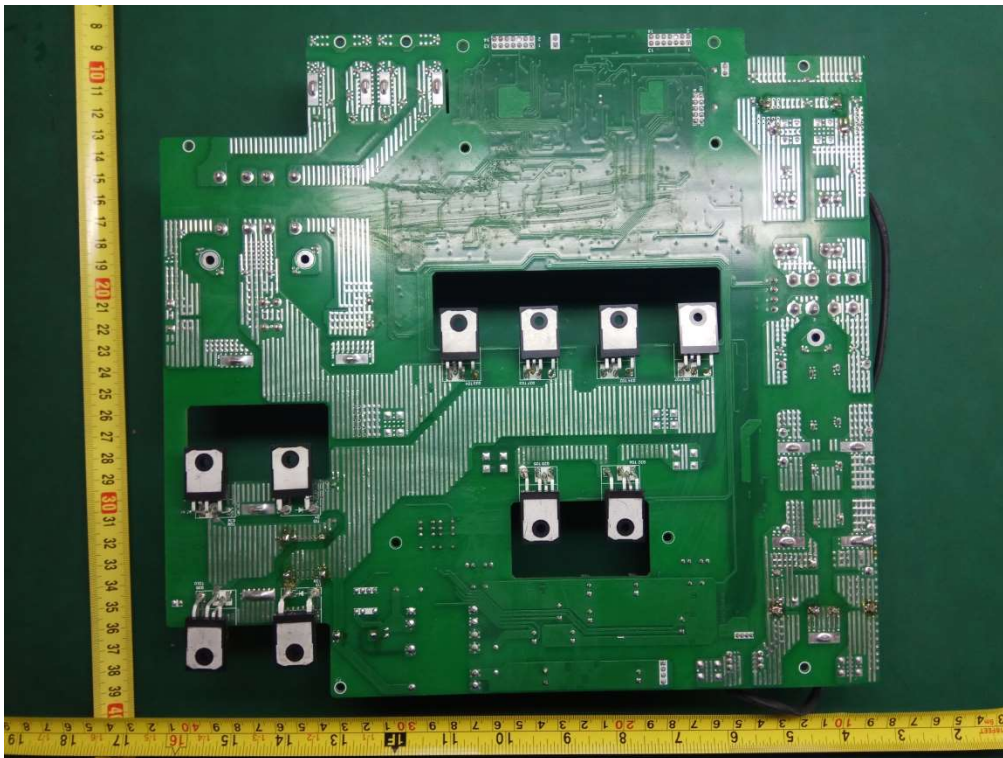


IEC 61683: 1999

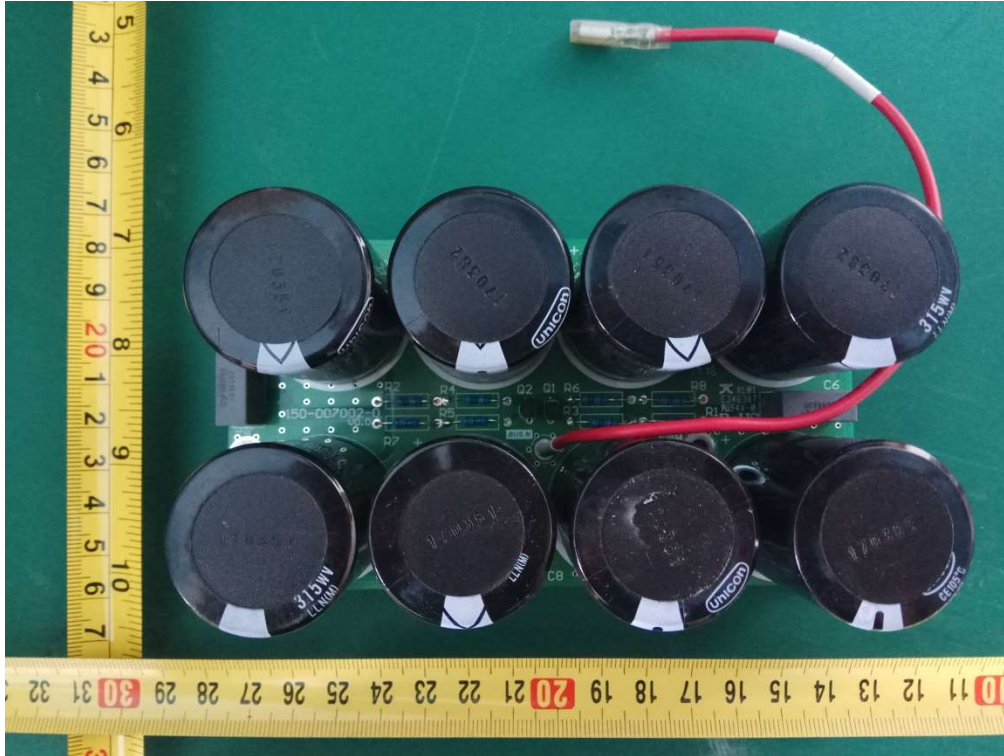
Front side of Main board



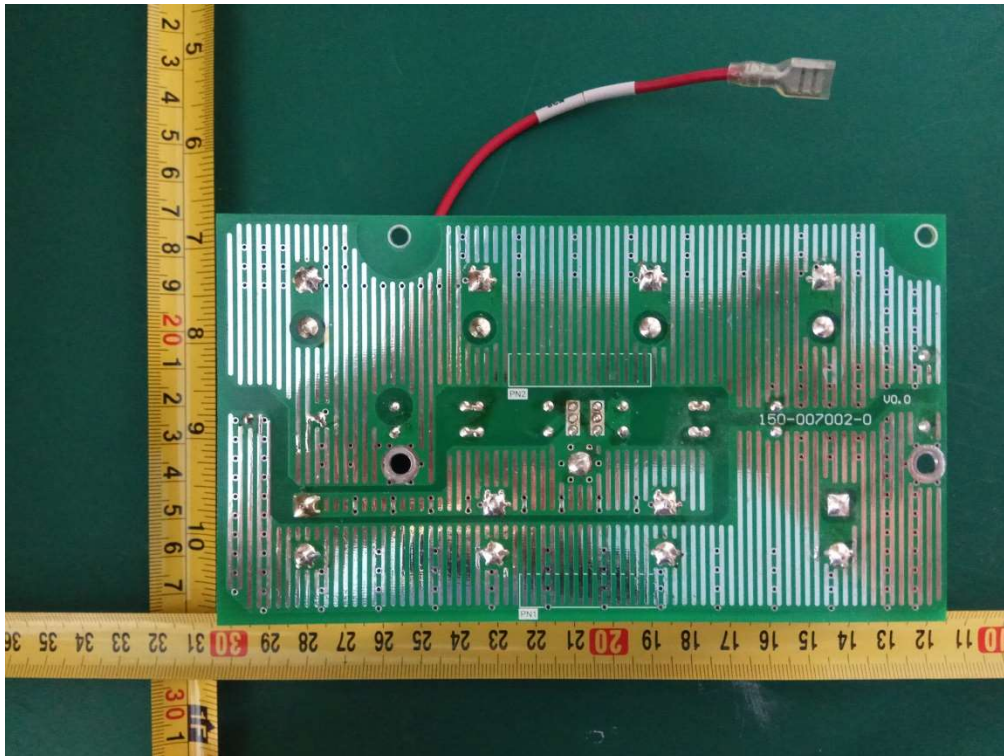
Front side of Main board



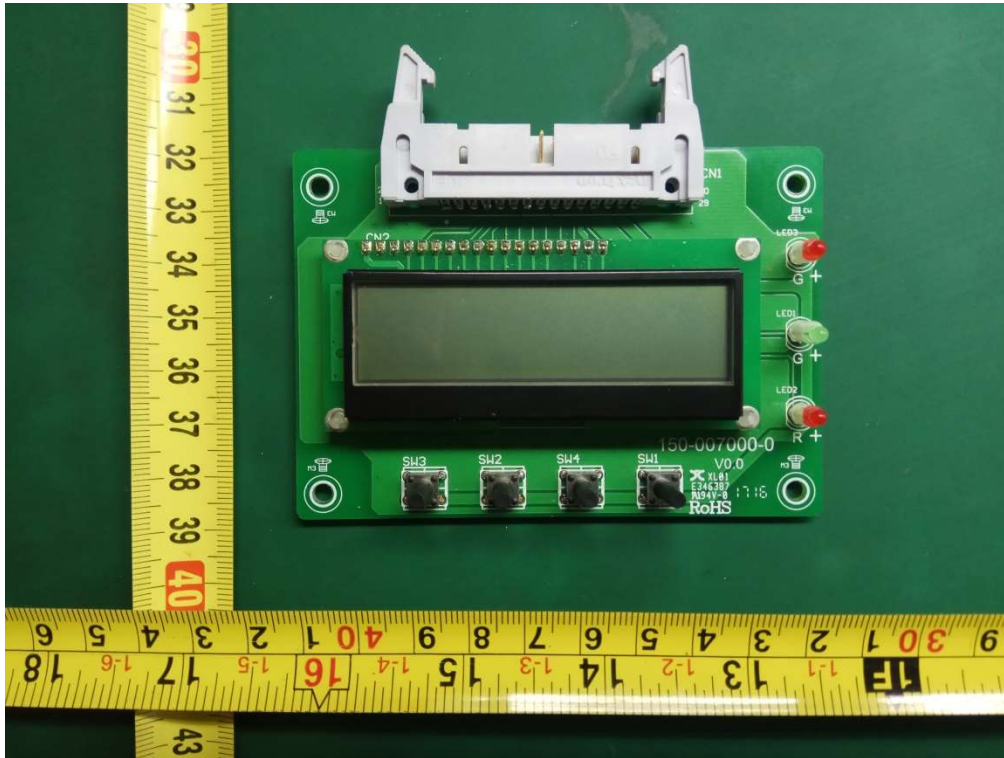
Front side of Bus capacitors board



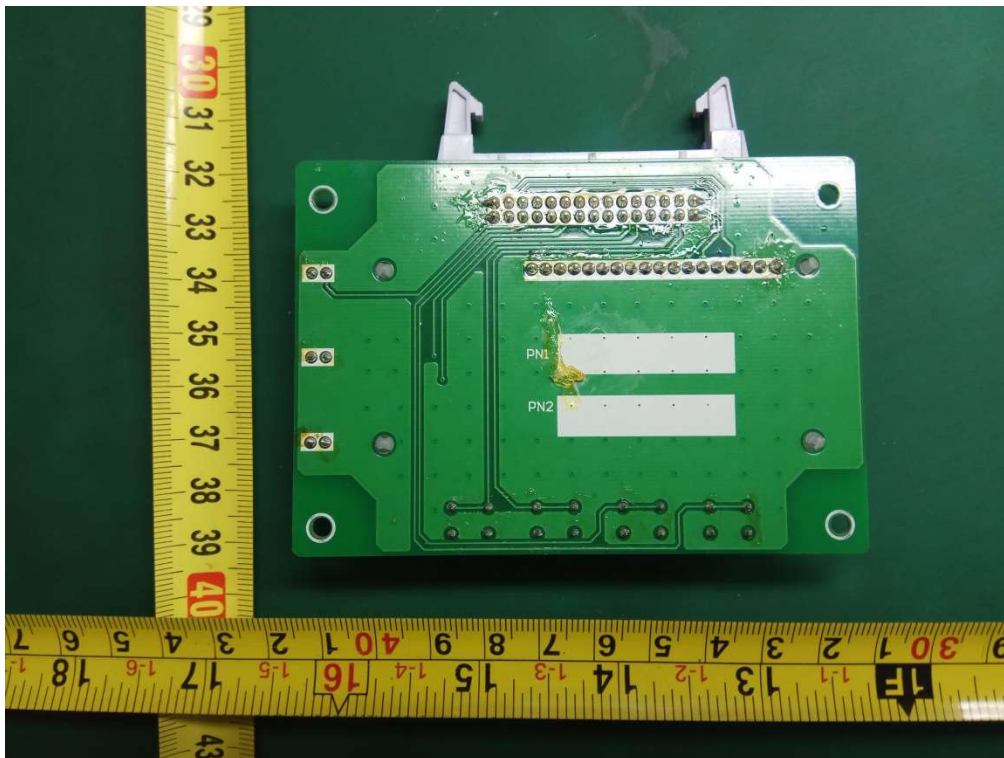
Back side of Bus capacitors board



Front side of display board

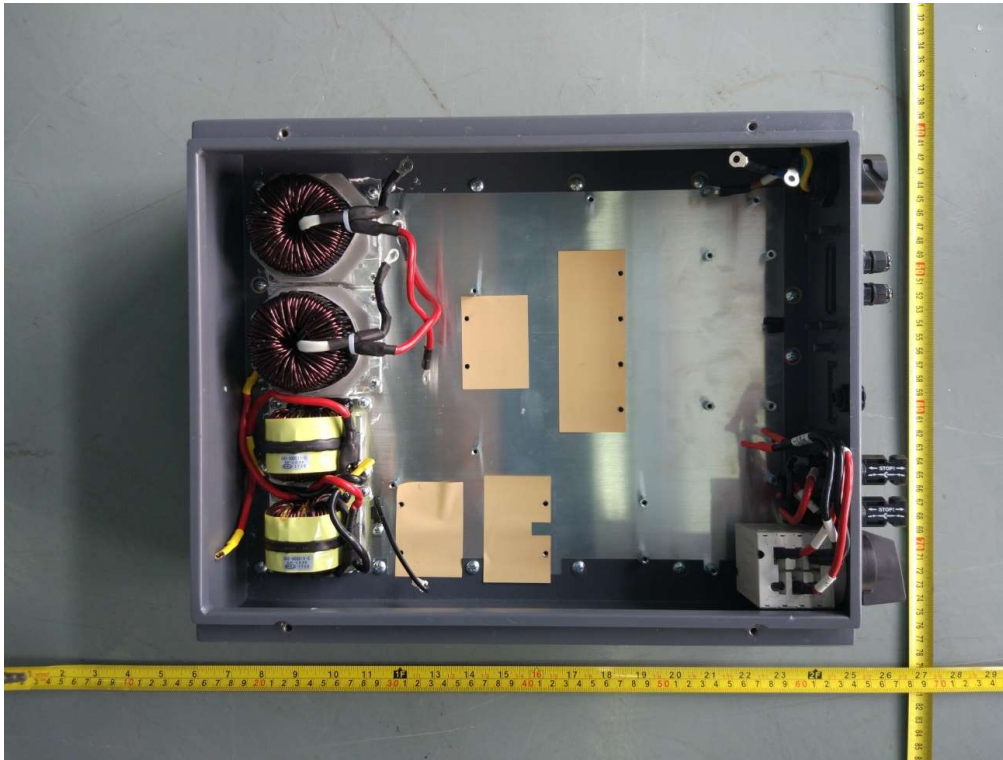


Back side of display board

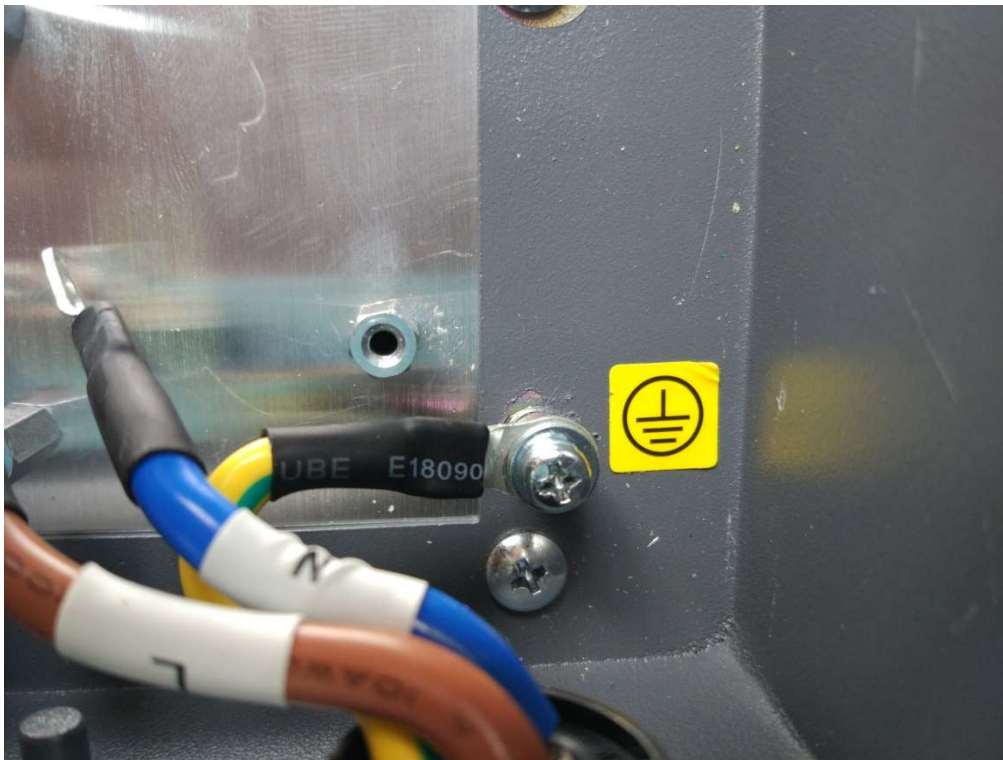


IEC 61683: 1999

Removed all PCBAs



Cover



IEC 61683: 1999

Software Version

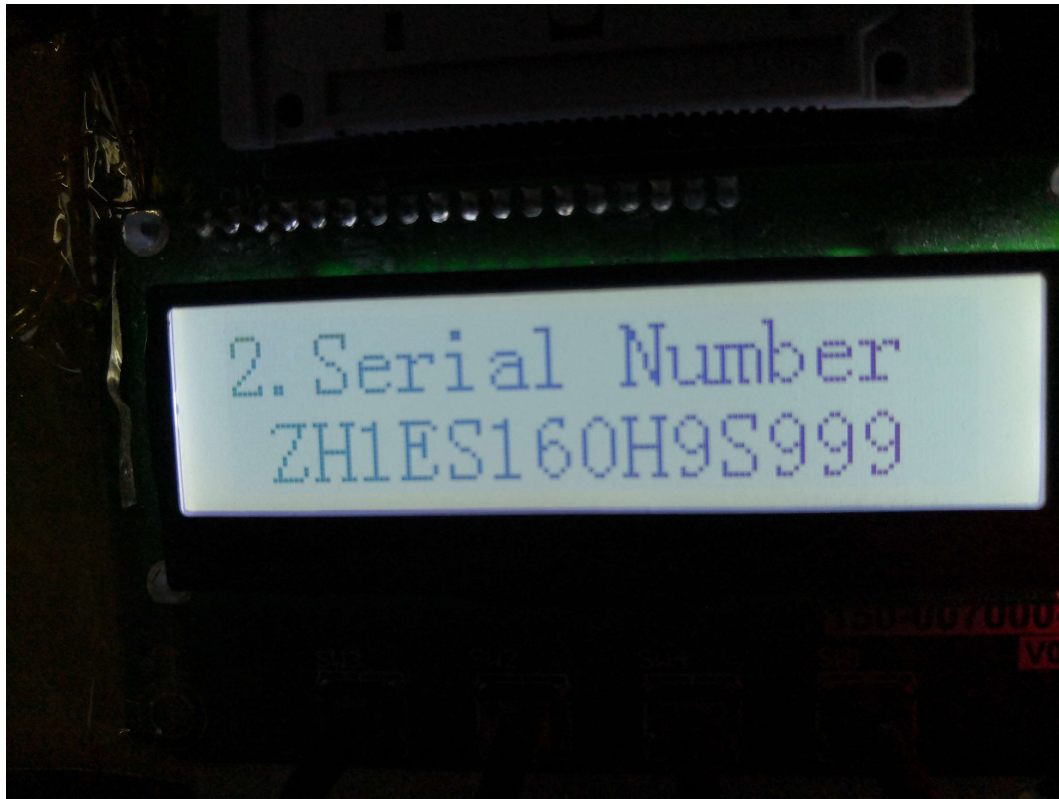


Serial Number of the EUT

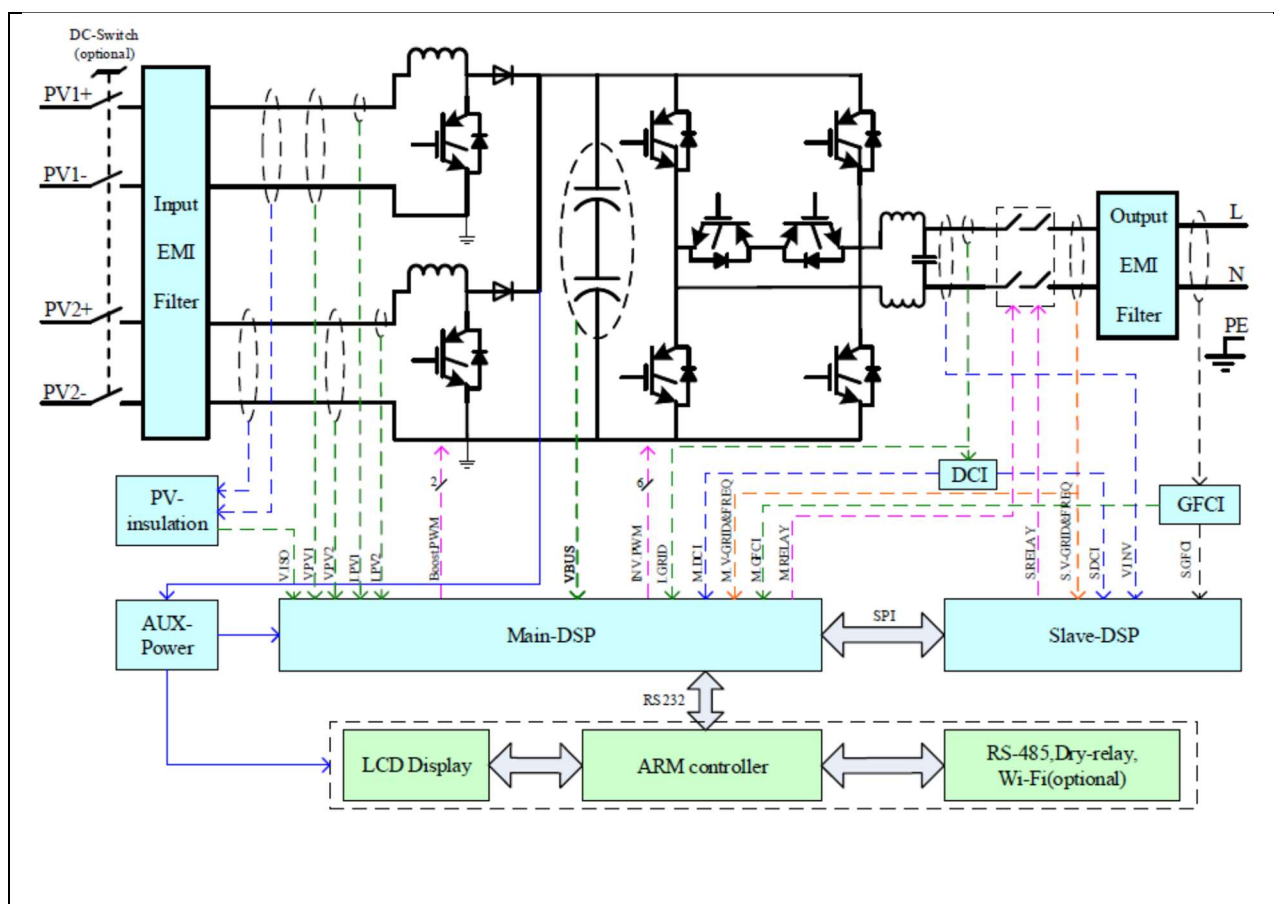


IEC 61683: 1999

Serial Number of the EUT for spot-check test



2 ELECTRICAL SCHEMES





ATTACHMENT II

(Testing information)

1 TESTING CIRCUIT

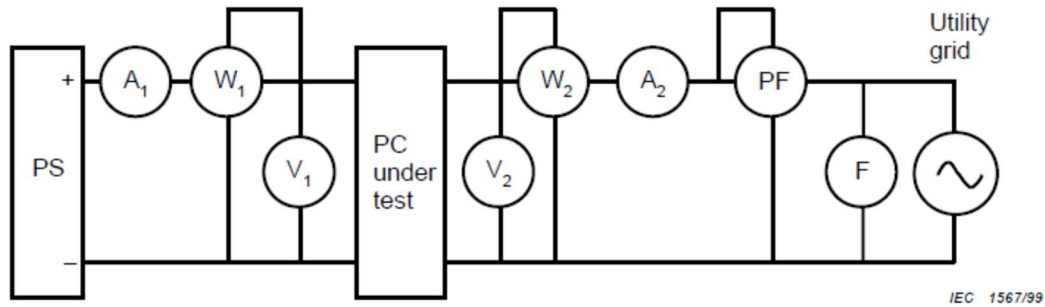


Figure 1b – Utility-interactive type

PC power conditioner	L load
PS variable voltage-current d.c. power supply	F frequency meter
A ₁ DC ammeter	V ₁ DC voltmeter
A ₂ AC or d.c. ammeter	V ₂ AC or d.c. voltmeter
W ₁ DC wattmeter	PF power factor meter
W ₂ AC or d.c. wattmeter	

Current and voltage clamps have been connected to the inverter input/output for all the tests.

All the tests and checks have been performed in accordance with the reference standard under testing.

2 TESTING EQUIPMENT

No.	Equipment Name	MARK/Model No.	Equipment No.	Equipment calibration due date
1	AC source	Chroma / 61860	--	--
2	PV array simulator	Chroma / 62150H-1000S	--	--
3	Current clamp	FLUKE / i1000s	30413441	2018-02-15
4	Differential probe	Sanhua / SI-9110	111134	2018-02-15
5	Temperature & Humidity meter	VICTOR / VC230A	WS01	2018-09-03
6	Power analyzer	YOKOGAWA / WT 3000	EP-011	2018-08-05
7	Digital oscilloscope	YOKOGAWA/DL 850	EP-001	2018-10-22

Equipment for spot-check test

From	No.	Equipment Name	MARK/Model No.	Equipment No.	Equipment calibration due date
Sofar Solar	1	AC source	Chroma / 61860	--	--
	2	PV array simulator	Chroma / 62150H-1000S	--	--
	3	Current clamp	FLUKE / i1000s	29503223	2020-02-12
	4	Differential probe	Sanhua / SI-9110	111541	2020-02-12
	5	Temperature & Humidity meter	Anymeters / TH101B	201030245220	2020-02-12
	6	Power analyzer	YOKOGAWA / WT 3000	91N610888	2020-02-12
	7	Digital oscilloscope	Agilent / DS05014A	MY50070266	2020-02-12
SGS	8	True RMS Multimeter	Fluke / 289C	GZE012-53	2020/01/24

Items	Specifications
1) PV array simulator	
a) Voltage range	0 – 1000Vdc (0.01V step)
b) Current range	0 – 40A (0.01A step)
2) AC power source	
a) Output wiring	Three phase
b) Output capacity	100KVA
c) Output voltage	10-300Vrms
d) Output frequency	45-65Hz
e) Voltage stability	$\pm 100\text{ppm}/^{\circ}\text{C}$
f) Output voltage distortion	0.05% max.
3) Digital meter	
a) Voltage range	0 – 1000Vdc, 0 – 600Vrms
b) Current range	0 – 30A
c) Frequency range (accuracy)	0.2%
d) Measurement items	Voltage (V) Current (A) Active power (W) Reactive power (Var) Volt-ampere (VA) Power factor (PF) Frequency (Hz) Electric energy (Wh)
4) Waveform recorder	
a) Sampling speed	1M/s
b) Recording device	Memory record and USB reading
c) Time accuracy	$\pm 500\text{ppm}$
5) AC load	
a) Resistive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 100KW
b) Inductive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 100KVA
c) Capacitive load	Maximum voltage: 300Vrms Current range: 0 – 100A Capacity: 100KVA

3 MEASUREMENT UNCERTAINTY

Voltage measurement uncertainty	$\pm 0.05 \%$
Current measurement uncertainty	$\pm 0.05 \%$
Frequency measurement uncertainty	$\pm 0.001 \text{ Hz}$
Time measurement uncertainty	$\pm 0.001 \text{ s}$
Power measurement uncertainty	$\pm 0.5 \%$
Phase Angle	$\pm 0.1^\circ$
Cos ϕ	$\pm 0.01\%$

Note1: Measurements uncertainties showed in this table are maximum allowable uncertainties.
The measurement uncertainties associated with other parameters measured during the tests are in the laboratory at disposal of the solicitant.