

Test Report issued under the responsibility of:



TEST REPORT IEC 61683

Photovoltaic systems – Power conditioners – Procedure for measuring efficiency

Report Number..... : GZES221001907802
Date of issue : 2022-10-14
Total number of pages..... 55

Name of Testing Laboratory preparing the Report : SGS-CSTC Standards Technical Services Co., Ltd. - E&E Lab
Guangzhou

Address : 198 Kezhu Road, Science City, Economic & Technology
Development Area, Guangzhou, Guangdong, China

Applicant's name : AISWEI Technology (Shanghai) Co., Ltd.

Address : Room 905B, 757 Mengzi Road, Huangpu District, 200023
Shanghai, China

Test specification:

Standard..... : IEC 61683:1999 (First Edition)

Test procedure..... : SGS-CSTC

Non-standard test method..... : N/A

Test Report Form No. : IEC 61683B

Test Report Form(s) Originator.... : TÜV SÜD Product Service GmbH

Master TRF..... : Dated 2017-11

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General disclaimer:

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Test item description..... :	Grid-connected PV Inverter
Trade Mark..... :	
Manufacturer..... :	AISWEI Technology (Shanghai) Co., Ltd.
Address..... :	Room 905B, 757 Mengzi Road, Huangpu District, 200023 Shanghai, China
Model/Type reference..... :	ASW3000-S-G2, ASW3680-S-G2, ASW4000-S-G2, ASW5000-S-G2, ASW6000-S-G2.
Ratings..... :	Refer to the rating on page 6 of the report
	Serial Number: SA60000522260024 (The Equipment parameters were changed by software)
	Master Firmware version: V610-01055-01 Slave Firmware version: V610-01056-01 Safety Firmware version: V610-10010-01

Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):		
Testing Laboratory:	SGS-CSTC Standards Technical Services Co., Ltd. Guangzhou Branch	
Location/ address.....:	198 Kezhu Road, Science City, Economic & Technology Development Area, Guangzhou, Guangdong, China	
Tested by (name, function, signature).....:	Hugo Zhang (Project Engineer)	
Approved by (name, function, signature.....):	Roger Hu (Technical Reviewer)	

List of Attachments (including a total number of pages in each attachment):		
50/60 Hz		
Attachment #	Description	Pages
Attachment I	Pictures of the EUT and Electrical Schemes	6 pages
Attachment II	Testing Information	5 pages
Summary of testing:		
<p>Tests performed (name of test and test clause):</p> <p>The equipment has been tested according to the standard: IEC 61683:1999. Testing has been carried out at 50/60 Hz.</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>Note: Output voltage is 230Va.c..</p>	<p>Testing location: See page 2</p>	
Summary of compliance with National Differences		
No National Differences are addressed to this test report		

Copy of marking plate(representative):



Model: ASW6000-S-G2

Max. input voltage	d.c. 600V
MPP voltage range	d.c. 60-560V
Max. input current	d.c. 2x16A
Isc PV(absolute maximum)	d.c. 2x22.5A
Rated grid voltage	220/ 230/240 V
Rated grid frequency	50/60Hz
Rated AC output active power	6000W
Rated AC output apparent power	6000VA
Max. AC output apparent power	6600VA ^{*1}
Max. continuous output current	a.c. 30.0A
Adjustable cos(φ)	0.8ind...0.8cap
Operating temperature range	-25...+60°C
Topology	Non-isolated
Ingress protection	IP 66
Protective class	I
Over voltage category	II(PV) III(MAINS)

^{*1}For European market and AS/NZS4772 S_{max}=6000VA

Supported DRMO



AISWEI Technology (Shanghai) Co., Ltd.
 Hotline: +86 400 801 9996
 Web: www.solplanet.net
 Add.: Room 905B, 757 Mengzi Road, Huangpu District,
 Shanghai, 200023, China



XXXXXXXXXXXXXXXXXXXX

532-100008-00 Made in China

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 **ASW6000-S-G2**'s except the parameters of rating.
4. As declared by the applicant, the importer (and manufacturer, if it is different)'s name, registered trade name or registered trademark and the postal address will be marked on the products before being place on the market. The contact details shall be in a language easily understood by end-users and market surveillance authorities.

Test item particulars : Single Phase Grid-connected PV 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 :	
Date of receipt of test item : N/A	
Date (s) of performance of tests : From 2022-07-08 to 2022-07-20	
General remarks:	
<p>"(See Enclosure #)" refers to additional information appended to the report. "(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) : AISWEI New Energy Technology (Yangzhong) Co., Ltd. No.588 Gangxing Road, Yangzhong, Jiangsu, China	

General product information:

Solplanet inverter is a transformerless solar inverter with two independent MPP trackers. It converts the direct current (DC) from a photovoltaic (PV) array to grid-compliant alternating current (AC) and feeds it into the grid.

Equipment Under Testing:

- ASW3000-S-G2
- ASW3680-S-G2
- ASW4000-S-G2
- ASW5000-S-G2
- ASW6000-S-G2

Product Model	ASW3000 -S-G2	ASW3680 -S-G2	ASW4000 -S-G2	ASW5000 -S-G2	ASW6000 -S-G2
Input (DC)					
Max. PV array power	4500 Wp STC	5520 Wp STC	6000 Wp STC	7500 Wp STC	9000 Wp STC
Max. input voltage	600 V				
MPP voltage range / rated input voltage	60 V-560 V/360 V				
Full load MPPT Voltage Range	200 V-500 V				
Initial. feed in voltage	100 V				
Max. operating input current	16 A/16 A				
Max. short circuit current	24 A/24 A				
Output (AC)					
Rated active power	3000 W	3680 W	4000 W	5000 W	6000 W
Rated apparent Power	3000 VA	3680 VA	4000 VA	5000 VA	6000 VA
Max. apparent AC power	3000 VA	3680 VA	4000 VA	5000 VA	6000 VA
AC nominal voltage	230 V				
AC grid frequency	50 / 60 Hz				
Rated active current	13 A	16 A	17.4 A	21.7 A	26.1 A
Max. output current	15 A	16 A	20 A	21.7 A	30 A
Adjustable power factor range	0.8 leading ... 0.8 lagging				
Operating temperature range	-25°C ... +60°C				
Cooling concept	Natural convection				
Degree of protection	IP66				

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 °C ± 2 °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 50/60 Hz have been carried out at 25°C±5°C	P
4.3	Output voltage and frequency		P
	The output voltage and frequency are maintained at the manufacturer's stated nominal values.	230 V, 50/60 Hz	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

IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
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
	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

IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
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
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>		N/A
	Figure 1b is applied to utility-interactive power conditioners		P
	<p>Figure 1b – Utility-interactive type</p> <p> PS 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

IEC 61683: 1999			
Clause	Requirement – Test	Measuring result – Remark	Verdict
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 for 50 Hz							
power conditioner type	Grid-connected								
Model:	ASW3000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 3000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 200 V (± 3 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	200.1	199.4	199.5	200.3	200.4	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.3	0.2	0.3	/	/	/
Input current (A)	/	1.6	4.0	7.8	11.7	15.6	/	/	/
Input current ripple (A)	/	0.4	0.4	0.3	0.6	0.8	/	/	/
Input power (Pi) (kW)	/	0.329	0.789	1.557	2.341	3.135	/	/	/
Output power (Po) (kW)	/	0.309	0.755	1.495	2.251	3.006	/	/	/
Output efficiency (%)	/	93.9	95.7	96.0	96.2	95.9	/	/	/
Input energy (Wi) (Wh)	/	10.9	26.2	51.8	77.9	104.3	/	/	/
Output energy (Wo) (Wh)	/	10.3	25.2	49.8	75.1	100.2	/	/	/
Energy efficiency(%)	/	94.5	96.2	96.1	96.4	96.1	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	b) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	359.4	359.8	359.7	360.8	358.9	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.3	0.2	0.3	/	/	/
Input current (A)	/	0.9	2.2	4.3	6.6	8.5	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.6	0.7	/	/	/
Input power (Pi) (kW)	/	0.317	0.776	1.535	2.368	3.056	/	/	/
Output power (Po) (kW)	/	0.305	0.755	1.500	2.307	2.974	/	/	/
Output efficiency (%)	/	96.2	97.3	97.7	97.4	97.3	/	/	/
Input energy (Wi) (Wh)	/	10.5	25.8	51.1	78.8	101.7	/	/	/
Output energy (Wo) (Wh)	/	10.2	25.2	50.0	76.9	99.1	/	/	/
Energy efficiency(%)	/	97.1	97.7	97.8	97.6	97.4	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	c) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	502.1	498.7	498.7	498.9	500.5	/	/	/
Input voltage ripple (V)		0.3	0.3	0.3	0.2	0.3	/	/	/
Input current (A)	/	0.6	1.5	3.1	4.6	6.2	/	/	/
Input current ripple (A)		0.4	0.3	0.4	0.5	0.7	/	/	/
Input power (Pi) (kW)	/	0.318	0.772	1.544	2.285	3.079	/	/	/
Output power (Po) (kW)	/	0.303	0.747	1.501	2.216	2.981	/	/	/
Output efficiency (%)	/	95.3	96.8	97.2	97.0	96.8	/	/	/
Input energy (Wi) (Wh)	/	10.6	25.7	51.4	76.0	102.5	/	/	/
Output energy (Wo) (Wh)	/	10.1	24.9	50.1	73.9	99.4	/	/	/
Energy efficiency(%)	/	95.3	96.9	97.5	97.2	97.0	/	/	/
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 for 50 Hz							
power conditioner type	Grid-connected								
Model:	ASW3680-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 3680 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 200 V (± 3 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	198.9	200.3	200.6	200.0	200.2	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.2	0.2	0.3	/	/	/
Input current (A)	/	2.0	4.8	9.5	14.2	18.6	/	/	/
Input current ripple (A)	/	0.4	0.4	0.4	0.5	0.7	/	/	/
Input power (Pi) (kW)	/	0.390	0.962	1.906	2.840	3.728	/	/	/
Output power (Po) (kW)	/	0.367	0.922	1.831	2.725	3.570	/	/	/
Output efficiency (%)	/	94.1	95.8	96.1	96.0	95.8	/	/	/
Input energy (Wi) (Wh)	/	13.0	32.0	63.4	94.5	124.1	/	/	/
Output energy (Wo) (Wh)	/	12.2	30.7	61.0	90.9	119.1	/	/	/
Energy efficiency(%)	/	93.8	95.9	96.2	96.2	96.0	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	b) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	361.1	360.6	359.1	360.2	361.1	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.2	0.3	0.3	/	/	/
Input current (A)	/	1.1	2.7	5.1	7.7	10.3	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.383	0.956	1.848	2.758	3.736	/	/	/
Output power (Po) (kW)	/	0.368	0.930	1.802	2.685	3.633	/	/	/
Output efficiency (%)	/	96.1	97.3	97.5	97.4	97.2	/	/	/
Input energy (Wi) (Wh)	/	12.8	31.8	61.5	91.8	124.3	/	/	/
Output energy (Wo) (Wh)	/	12.3	31.0	60.1	89.5	121.2	/	/	/
Energy efficiency(%)	/	96.1	97.5	97.7	97.5	97.5	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	c) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	501.8	497.1	501.4	499.9	500.9	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.2	0.3	0.3	/	/	/
Input current (A)	/	0.8	1.9	3.8	5.6	7.5	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.386	0.935	1.905	2.777	3.765	/	/	/
Output power (Po) (kW)	/	0.370	0.908	1.853	2.696	3.645	/	/	/
Output efficiency (%)	/	95.9	97.1	97.3	97.1	96.8	/	/	/
Input energy (Wi) (Wh)	/	12.9	31.1	63.4	92.4	125.3	/	/	/
Output energy (Wo) (Wh)	/	12.3	30.3	61.8	89.9	121.5	/	/	/
Energy efficiency(%)	/	95.3	97.4	97.5	97.3	97.0	/	/	/
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 for 50 Hz							
power conditioner type	Grid-connected								
Model:	ASW4000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 4000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 200 V (± 3 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	199.5	201.0	199.2	199.5	200.6	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.2	0.3	0.3	/	/	/
Input current (A)	/	2.2	4.8	10.7	15.7	21.0	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.432	0.960	2.141	3.127	4.206	/	/	/
Output power (Po) (kW)	/	0.406	0.922	2.058	2.999	4.024	/	/	/
Output efficiency (%)	/	94.0	96.0	96.1	95.9	95.7	/	/	/
Input energy (Wi) (Wh)	/	14.4	32.0	71.2	104.1	140.0	/	/	/
Output energy (Wo) (Wh)	/	13.5	30.7	68.6	100.0	134.2	/	/	/
Energy efficiency(%)	/	93.8	95.9	96.3	96.1	95.9	/	/	/
Remark: (*)If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	b) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	360.7	360.4	359.4	358.8	361.1	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.2	0.3	0.3	/	/	/
Input current (A)	/	1.2	3.0	5.7	8.5	11.4	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.419	1.083	2.065	3.050	4.125	/	/	/
Output power (Po) (kW)	/	0.403	1.058	2.015	2.968	4.007	/	/	/
Output efficiency (%)	/	96.2	97.7	97.6	97.3	97.1	/	/	/
Input energy (Wi) (Wh)	/	14.0	36.1	68.7	101.5	137.3	/	/	/
Output energy (Wo) (Wh)	/	13.4	35.3	67.2	98.9	133.6	/	/	/
Energy efficiency(%)	/	95.7	97.8	97.8	97.4	97.3	/	/	/
Remark: (*)If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	c) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Input voltage (V)	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage ripple (V)	/	500.1	486.5	500.3	498.3	499.6	/	/	/
Input current (A)	/	0.3	0.2	0.2	0.3	0.3	/	/	/
Input current ripple (A)	/	0.8	2.3	4.1	6.1	8.3	/	/	/
Input power (Pi) (kW)	/	0.4	0.4	0.4	0.5	0.7	/	/	/
Output power (Po) (kW)	/	0.415	1.112	2.070	3.058	4.164	/	/	/
Output efficiency (%)	/	0.398	1.084	2.010	2.967	4.029	/	/	/
Input energy (Wi) (Wh)	/	95.9	97.5	97.1	97.0	96.8	/	/	/
Output energy (Wo) (Wh)	/	13.8	37.0	68.9	101.8	138.6	/	/	/
Energy efficiency(%)	/	13.3	36.1	67.0	98.9	134.3	/	/	/
Input voltage (V)	/	96.4	97.6	97.2	97.2	96.9	/	/	/
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 for 50 Hz							
power conditioner type	Grid-connected								
Model:	ASW5000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 5000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 200 V (± 3 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	198.0	200.5	199.5	199.3	200.9	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.2	0.3	0.3	/	/	/
Input current (A)	/	2.7	6.7	13.2	19.6	26.2	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.7	/	/	/
Input power (Pi) (kW)	/	0.533	1.349	2.626	3.905	5.274	/	/	/
Output power (Po) (kW)	/	0.503	1.297	2.525	3.740	5.035	/	/	/
Output efficiency (%)	/	94.4	96.1	96.2	95.8	95.5	/	/	/
Input energy (Wi) (Wh)	/	17.7	44.9	87.4	129.9	175.5	/	/	/
Output energy (Wo) (Wh)	/	16.8	43.2	84.1	124.7	167.8	/	/	/
Energy efficiency(%)	/	94.9	96.2	96.2	96.0	95.6	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	b) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	361.3	359.4	360.8	360.2	360.2	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.2	0.3	0.3	/	/	/
Input current (A)	/	1.4	3.5	7.1	10.6	14.4	/	/	/
Input current ripple (A)	/	0.4	0.4	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.516	1.275	2.554	3.833	5.202	/	/	/
Output power (Po) (kW)	/	0.498	1.245	2.490	3.726	5.043	/	/	/
Output efficiency (%)	/	96.5	97.6	97.5	97.2	96.9	/	/	/
Input energy (Wi) (Wh)	/	17.2	42.4	85.0	127.6	173.1	/	/	/
Output energy (Wo) (Wh)	/	16.6	41.5	83.0	124.2	168.1	/	/	/
Energy efficiency(%)	/	96.5	97.9	97.6	97.3	97.1	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	c) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	499.2	497.7	501.6	500.2	500.2	/	/	/
Input voltage ripple (V)	/	0.2	0.2	0.3	0.3	0.3	/	/	/
Input current (A)	/	1.0	2.6	5.1	7.7	10.5	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.5	0.7	/	/	/
Input power (Pi) (kW)	/	0.517	1.293	2.571	3.857	5.239	/	/	/
Output power (Po) (kW)	/	0.498	1.260	2.499	3.745	5.062	/	/	/
Output efficiency (%)	/	96.3	97.4	97.2	97.1	96.6	/	/	/
Input energy (Wi) (Wh)	/	17.2	43.0	85.6	128.4	174.4	/	/	/
Output energy (Wo) (Wh)	/	16.6	42.0	83.3	124.9	168.8	/	/	/
Energy efficiency(%)	/	96.5	97.7	97.3	97.3	96.8	/	/	/
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 for 50 Hz							
power conditioner type	Grid-connected								
Model:	ASW6000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 6000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 200 V (± 3 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	201.0	201.0	199.1	199.8	201.6	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.3	0.3	0.3	/	/	/
Input current (A)	/	3.2	8.2	15.7	23.4	30.7	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.5	0.7	/	/	/
Input power (Pi) (kW)	/	0.635	1.646	3.122	4.685	6.190	/	/	/
Output power (Po) (kW)	/	0.600	1.581	2.995	4.483	5.897	/	/	/
Output efficiency (%)	/	94.5	96.1	95.9	95.7	95.3	/	/	/
Input energy (Wi) (Wh)	/	21.1	54.8	103.9	155.9	206.0	/	/	/
Output energy (Wo) (Wh)	/	20.0	52.7	99.8	149.5	196.6	/	/	/
Energy efficiency(%)	/	94.8	96.2	96.1	95.9	95.4	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	b) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	361.0	360.3	360.0	360.8	358.4	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.3	0.2	0.3	/	/	/
Input current (A)	/	1.7	4.3	8.7	13.6	17.3	/	/	/
Input current ripple (A)	/	0.4	0.4	0.3	0.6	0.7	/	/	/
Input power (Pi) (kW)	/	0.618	1.562	3.140	4.900	6.188	/	/	/
Output power (Po) (kW)	/	0.597	1.526	3.057	4.756	5.975	/	/	/
Output efficiency (%)	/	96.6	97.7	97.4	97.1	96.6	/	/	/
Input energy (Wi) (Wh)	/	20.6	52.0	104.5	163.1	205.9	/	/	/
Output energy (Wo) (Wh)	/	19.9	50.9	101.8	158.7	199.1	/	/	/
Energy efficiency(%)	/	96.6	97.9	97.4	97.3	96.7	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	c) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.3	501.6	500.3	494.9	499.9	/	/	/
Input voltage ripple (V)	/	0.2	0.3	0.3	0.2	0.3	/	/	/
Input current (A)	/	1.2	3.2	6.1	9.4	12.4	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.624	1.583	3.058	4.651	6.213	/	/	/
Output power (Po) (kW)	/	0.600	1.545	2.971	4.504	5.987	/	/	/
Output efficiency (%)	/	96.2	97.6	97.2	96.8	96.4	/	/	/
Input energy (Wi) (Wh)	/	20.7	52.7	101.7	154.8	217.5	/	/	/
Output energy (Wo) (Wh)	/	20.0	51.5	99.0	150.3	209.8	/	/	/
Energy efficiency(%)	/	96.6	97.7	97.3	97.1	96.5	/	/	/
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 for 60 Hz							
power conditioner type	Grid-connected								
Model:	ASW3000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 60 Hz Rated output power: 3000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	d) Manufacturer's minimum rated input voltage 200 V (±3 V)								
Temperature (°C)	25 °C ± 5 °C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	200.3	201.0	199.5	200.8	201.3	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.2	0.2	0.3	/	/	/
Input current (A)	/	1.6	3.9	7.9	11.8	15.6	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.323	0.790	1.569	2.379	3.148	/	/	/
Output power (Po) (kW)	/	0.304	0.755	1.506	2.288	3.010	/	/	/
Output efficiency (%)	/	94.1	95.6	96.0	96.2	95.6	/	/	/
Input energy (Wi) (Wh)	/	10.7	26.3	52.2	79.2	104.5	/	/	/
Output energy (Wo) (Wh)	/	10.1	25.2	50.2	76.2	100.1	/	/	/
Energy efficiency(%)	/	94.4	95.8	96.2	96.2	95.8	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	e) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	360.2	359.7	360.2	360.7	360.2	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.7	0.2	0.5	/	/	/
Input current (A)	/	4.3	2.2	4.3	6.4	8.8	/	/	/
Input current ripple (A)	/	0.5	0.6	0.7	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.317	0.774	1.541	2.313	3.168	/	/	/
Output power (Po) (kW)	/	0.305	0.753	1.506	2.254	3.078	/	/	/
Output efficiency (%)	/	96.2	97.3	97.7	97.4	97.2	/	/	/
Input energy (Wi) (Wh)	/	10.6	25.8	51.3	77.0	106.7	/	/	/
Output energy (Wo) (Wh)	/	10.2	25.2	50.2	75.2	103.8	/	/	/
Energy efficiency(%)	/	96.2	97.7	97.9	97.7	97.3	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	f) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	502.2	498.8	499.4	498.4	498.9	/	/	/
Input voltage ripple (V)		0.3	0.4	0.7	0.4	0.5	/	/	/
Input current (A)	/	0.6	1.6	3.1	4.7	6.4	/	/	/
Input current ripple (A)		0.5	0.5	0.7	0.9	0.9	/	/	/
Input power (Pi) (kW)	/	0.313	0.774	1.535	2.337	3.202	/	/	/
Output power (Po) (kW)	/	0.299	0.752	1.492	2.267	3.105	/	/	/
Output efficiency (%)	/	95.5	97.2	97.2	97.0	97.0	/	/	/
Input energy (Wi) (Wh)	/	10.4	25.8	51.1	77.8	114.0	/	/	/
Output energy (Wo) (Wh)	/	10.0	25.1	49.7	75.6	110.6	/	/	/
Energy efficiency(%)	/	96.2	97.3	97.3	97.2	97.0	/	/	/
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 for 60 Hz							
power conditioner type	Grid-connected								
Model:	ASW3680-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 3680 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	d) Manufacturer's minimum rated input voltage 200 V (±3 V)								
Temperature (°C)	25 °C ± 5 °C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	199.0	200.1	198.4	201.6	200.1	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.3	0.3	0.2	/	/	/
Input current (A)	/	2.0	4.8	9.6	14.1	19.0	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.8	0.7	/	/	/
Input power (Pi) (kW)	/	0.391	0.961	1.898	2.833	3.808	/	/	/
Output power (Po) (kW)	/	0.365	0.921	1.824	2.715	3.648	/	/	/
Output efficiency (%)	/	93.4	95.8	96.1	95.8	95.8	/	/	/
Input energy (Wi) (Wh)	/	13.0	32.0	63.1	94.3	126.9	/	/	/
Output energy (Wo) (Wh)	/	12.2	30.7	60.8	90.5	121.7	/	/	/
Energy efficiency(%)	/	93.8	95.9	96.4	96.0	95.9	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	e) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	358.4	359.6	357.9	361.0	361.7	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.3	0.3	0.3	/	/	/
Input current (A)	/	1.1	2.6	13.3	7.9	10.4	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.382	0.948	1.896	2.867	3.756	/	/	/
Output power (Po) (kW)	/	0.367	0.923	1.811	2.791	3.644	/	/	/
Output efficiency (%)	/	96.1	97.4	95.5	97.3	97.0	/	/	/
Input energy (Wi) (Wh)	/	12.7	31.5	158.6	96.8	126.6	/	/	/
Output energy (Wo) (Wh)	/	12.2	30.8	60.4	94.3	123.0	/	/	/
Energy efficiency(%)	/	96.1	97.8	38.1	97.4	97.2	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	f) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	501.2	497.0	500.1	495.6	500.0	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.3	0.3	0.2	/	/	/
Input current (A)	/	0.8	1.9	3.8	5.8	7.6	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.5	/	/	/
Input power (Pi) (kW)	/	0.381	0.943	1.902	2.885	3.779	/	/	/
Output power (Po) (kW)	/	0.365	0.917	1.850	2.803	3.668	/	/	/
Output efficiency (%)	/	95.8	97.2	97.3	97.2	97.1	/	/	/
Input energy (Wi) (Wh)	/	12.7	31.4	63.3	97.4	126.7	/	/	/
Output energy (Wo) (Wh)	/	12.1	30.5	61.7	94.8	123.1	/	/	/
Energy efficiency(%)	/	95.3	97.1	97.5	97.3	97.2	/	/	/
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 for 60 Hz							
power conditioner type	Grid-connected								
Model:	ASW4000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 4000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	d) Manufacturer's minimum rated input voltage 200 V (± 3 V)								
Temperature ($^{\circ}\text{C}$)	25 $^{\circ}\text{C} \pm 5$ $^{\circ}\text{C}$								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	200.0	200.0	199.0	199.1	200.3	/	/	/
Input voltage ripple (V)	/	0.3	0.6	0.8	0.4	0.5	/	/	/
Input current (A)	/	2.1	4.8	10.7	15.7	21.0	/	/	/
Input current ripple (A)	/	0.6	0.6	0.6	0.9	0.9	/	/	/
Input power (Pi) (kW)	/	0.426	0.964	2.127	3.135	4.213	/	/	/
Output power (Po) (kW)	/	0.401	0.922	2.044	3.009	4.040	/	/	/
Output efficiency (%)	/	94.1	95.6	96.1	96.0	95.9	/	/	/
Input energy (Wi) (Wh)	/	14.3	32.1	70.8	104.3	140.2	/	/	/
Output energy (Wo) (Wh)	/	13.4	30.7	68.1	100.3	134.8	/	/	/
Energy efficiency(%)	/	93.7	95.6	96.2	96.2	96.1	/	/	/
Remark: (*)If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	e) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	360.2	360.9	357.6	359.9	358.4	/	/	/
Input voltage ripple (V)	/	0.4	0.4	0.7	0.5	0.5	/	/	/
Input current (A)	/	1.2	3.0	5.8	8.8	11.6	/	/	/
Input current ripple (A)	/	0.5	0.5	0.7	0.8	0.8	/	/	/
Input power (Pi) (kW)	/	0.420	1.083	2.080	3.158	4.146	/	/	/
Output power (Po) (kW)	/	0.404	1.058	2.029	3.075	4.022	/	/	/
Output efficiency (%)	/	96.2	97.7	97.5	97.4	97.0	/	/	/
Input energy (Wi) (Wh)	/	14.0	36.1	98.6	115.3	143.0	/	/	/
Output energy (Wo) (Wh)	/	13.5	35.3	96.3	112.4	139.0	/	/	/
Energy efficiency(%)	/	96.4	97.8	97.7	97.5	97.2	/	/	/
Remark: (*)If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	f) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	498.4	486.1	498.7	503.5	495.3	/	/	/
Input voltage ripple (V)	/	0.4	0.4	0.6	0.5	0.5	/	/	/
Input current (A)	/	0.8	2.3	4.2	6.3	8.4	/	/	/
Input current ripple (A)	/	0.4	0.5	0.8	0.9	0.8	/	/	/
Input power (Pi) (kW)	/	0.414	1.112	2.092	3.186	4.174	/	/	/
Output power (Po) (kW)	/	0.398	1.084	2.036	3.093	4.040	/	/	/
Output efficiency (%)	/	96.1	97.5	97.3	97.1	96.8	/	/	/
Input energy (Wi) (Wh)	/	13.8	37.0	74.1	113.3	140.3	/	/	/
Output energy (Wo) (Wh)	/	13.3	36.1	72.2	110.0	136.2	/	/	/
Energy efficiency(%)	/	96.4	97.6	97.4	97.1	97.1	/	/	/
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 for 60 Hz							
power conditioner type	Grid-connected								
Model:	ASW5000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 50 Hz Rated output power: 5000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	d) Manufacturer's minimum rated input voltage 200 V (± 3 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	199.5	198.9	200.1	200.5	202.8	/	/	/
Input voltage ripple (V)	/	0.3	0.4	0.6	0.5	0.5	/	/	/
Input current (A)	/	2.7	6.5	13.2	19.5	26.0	/	/	/
Input current ripple (A)	/	0.4	0.5	0.8	0.8	0.9	/	/	/
Input power (Pi) (kW)	/	0.533	1.284	2.637	3.902	5.272	/	/	/
Output power (Po) (kW)	/	0.503	1.231	2.531	3.733	5.041	/	/	/
Output efficiency (%)	/	94.4	95.9	96.0	95.7	95.6	/	/	/
Input energy (Wi) (Wh)	/	17.7	42.8	87.8	130.0	175.7	/	/	/
Output energy (Wo) (Wh)	/	16.8	41.1	84.4	124.6	168.2	/	/	/
Energy efficiency(%)	/	94.9	96.0	96.1	95.8	95.7	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	e) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	360.2	360.4	358.3	356.2	359.1	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.2	0.2	0.2	/	/	/
Input current (A)	/	1.4	3.5	7.2	10.7	14.1	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.516	1.262	2.567	3.820	5.070	/	/	/
Output power (Po) (kW)	/	0.498	1.233	2.503	3.695	4.910	/	/	/
Output efficiency (%)	/	96.5	97.7	97.5	96.7	96.8	/	/	/
Input energy (Wi) (Wh)	/	17.2	42.0	85.4	127.1	169.0	/	/	/
Output energy (Wo) (Wh)	/	16.6	41.1	83.5	123.3	163.8	/	/	/
Energy efficiency(%)	/	96.5	97.9	97.8	97.0	96.9	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	f) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	498.1	501.8	498.0	507.8	499.6	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.3	0.2	0.3	/	/	/
Input current (A)	/	1.0	2.6	5.2	7.6	10.4	/	/	/
Input current ripple (A)	/	0.4	0.3	0.4	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.516	1.300	2.589	3.870	5.212	/	/	/
Output power (Po) (kW)	/	0.498	1.267	2.518	3.760	5.043	/	/	/
Output efficiency (%)	/	96.5	97.5	97.3	97.2	96.8	/	/	/
Input energy (Wi) (Wh)	/	17.2	43.3	86.2	129.0	173.6	/	/	/
Output energy (Wo) (Wh)	/	16.6	42.3	84.0	125.6	168.2	/	/	/
Energy efficiency(%)	/	96.5	97.7	97.4	97.4	96.9	/	/	/
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 for 60 Hz							
power conditioner type	Grid-connected								
Model:	ASW6000-S-G2								
Parameters of power conditioner	Minimum rated input voltage:60 V Nominal voltage: 360 V Maximum input voltage: 600 V MPPT voltage range: 60 ~ 560 V MPPT voltage range with full power: 200 ~ 500 V Rated output voltage: 230 V Rated output frequency: 60 Hz Rated output power: 6000 W Note: According to the user manual, the minimum rated input voltage is 60 V, and 90% of the inverter's maximum input voltage is 90%*600 V=540 V. However, in this range, the inverter can't output full power. So, for this test, 200 V were used instead of 60 V, and 500 V were used instead of 540 V.								
PV input voltage	d) Manufacturer's minimum rated input voltage 200 V (±3 V)								
Temperature (°C)	25 °C ± 5 °C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	199.5	200.1	202.4	200.6	201.2	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.3	0.3	0.2	/	/	/
Input current (A)	/	3.2	7.7	15.4	23.3	31.0	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.635	1.548	3.125	4.684	6.240	/	/	/
Output power (Po) (kW)	/	0.600	1.488	2.998	4.486	5.952	/	/	/
Output efficiency (%)	/	94.5	96.1	95.9	95.8	95.4	/	/	/
Input energy (Wi) (Wh)	/	21.1	51.5	104.0	155.9	207.6	/	/	/
Output energy (Wo) (Wh)	/	20.0	49.6	100.0	149.6	198.4	/	/	/
Energy efficiency(%)	/	94.8	96.3	96.2	96.0	95.6	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	e) The inverter's nominal voltage 360 V (± 5.4 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	359.4	357.9	359.1	360.7	353.4	/	/	/
Input voltage ripple (V)	/	0.3	0.3	0.3	0.2	0.2	/	/	/
Input current (A)	/	1.6	4.4	8.8	12.8	17.3	/	/	/
Input current ripple (A)	/	0.4	0.3	0.3	0.5	0.8	/	/	/
Input power (Pi) (kW)	/	0.596	1.571	3.143	4.610	6.114	/	/	/
Output power (Po) (kW)	/	0.589	1.534	3.062	4.476	5.905	/	/	/
Output efficiency (%)	/	98.8	97.6	97.4	97.1	96.6	/	/	/
Input energy (Wi) (Wh)	/	19.9	52.3	104.6	153.4	203.5	/	/	/
Output energy (Wo) (Wh)	/	19.6	51.1	102.1	149.2	196.8	/	/	/
Energy efficiency(%)	/	98.5	97.7	97.6	97.3	96.7	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

PV input voltage	f) 90% of the inverter's maximum input voltage 500 V (± 7.5 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	2								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	501.4	499.8	498.3	494.6	501.5	/	/	/
Input voltage ripple (V)	/	0.3	0.2	0.3	0.2	0.2	/	/	/
Input current (A)	/	1.3	3.2	6.1	9.3	12.4	/	/	/
Input current ripple (A)	/	0.3	0.3	0.5	0.8	0.8	/	/	/
Input power (Pi) (kW)	/	0.632	1.603	3.057	4.584	6.206	/	/	/
Output power (Po) (kW)	/	0.609	1.564	2.970	4.434	5.985	/	/	/
Output efficiency (%)	/	96.4	97.6	97.2	96.7	96.4	/	/	/
Input energy (Wi) (Wh)	/	21.0	53.3	101.7	152.5	208.9	/	/	/
Output energy (Wo) (Wh)	/	20.3	52.1	99.0	147.8	201.9	/	/	/
Energy efficiency(%)	/	96.7	97.7	97.3	96.9	96.6	/	/	/
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 for 50 Hz	P
power conditioner type	Utility-interactive	
ASW3000-S-G2		
Measure input voltage (V)	360.8	
Measured input power (W)	13.7	
ASW3680-S-G2		
Measure input voltage (V)	360.8	
Measured input power (W)	13.7	
ASW4000-S-G2		
Measure input voltage (V)	360.4	
Measured input power (W)	7.8	
ASW5000-S-G2		
Measure input voltage (V)	360.8	
Measured input power (W)	14.1	
ASW6000-S-G2		
Measure input voltage (V)	360.8	
Measured input power (W)	13.9	
Remark: No load loss is measured when the power conditioner works at rated input voltage and its load is disconnected.		

TABLE	No load loss for 60 Hz	P
power conditioner type	Utility-interactive	
ASW3000-S-G2		
Measure input voltage (V)	360.4	
Measured input power (W)	7.8	
ASW3680-S-G2		
Measure input voltage (V)	364.4	
Measured input power (W)	7.9	
ASW4000-S-G2		
Measure input voltage (V)	362.4	
Measured input power (W)	7.9	
ASW5000-S-G2		
Measure input voltage (V)	360.4	
Measured input power (W)	8.1	
ASW6000-S-G2		
Measure input voltage (V)	360.4	
Measured input power (W)	7.9	
Remark: No load loss is measured when the power conditioner works at rated input voltage and its load is disconnected.		

TABLE	Standby loss for 50 Hz	P
power conditioner type	Utility-interactive	
ASW3000-S-G2		
Measure input voltage (V)	230.6	
Measured input power (W)	-0.3	
ASW3680-S-G2		
Measure input voltage (V)	230.6	
Measured input power (W)	-0.3	
ASW4000-S-G2		
Measure input voltage (V)	230.6	
Measured input power (W)	-0.3	
ASW5000-S-G2		
Measure input voltage (V)	230.6	
Measured input power (W)	-0.3	
ASW6000-S-G2		
Measure input voltage (V)	230.6	
Measured input power (W)	-0.3	
Remark: Standby loss is measured when the power conditioner works at rated input voltage and in standby mode.		

TABLE	Standby loss for 60 Hz	P
power conditioner type	Utility-interactive	
ASW3000-S-G2		
Measure input voltage (V)	230.7	
Measured input power (W)	-1.3	
ASW3680-S-G2		
Measure input voltage (V)	230.6	
Measured input power (W)	-0.3	
ASW4000-S-G2		
Measure input voltage (V)	230.7	
Measured input power (W)	-1.3	
ASW5000-S-G2		
Measure input voltage (V)	230.7	
Measured input power (W)	-1.3	
ASW6000-S-G2		
Measure input voltage (V)	230.7	
Measured input power (W)	-1.3	
Remark: Standby loss is measured when the power conditioner works at rated input voltage and in standby mode.		

--- End of test report---

ATTACHMENT I

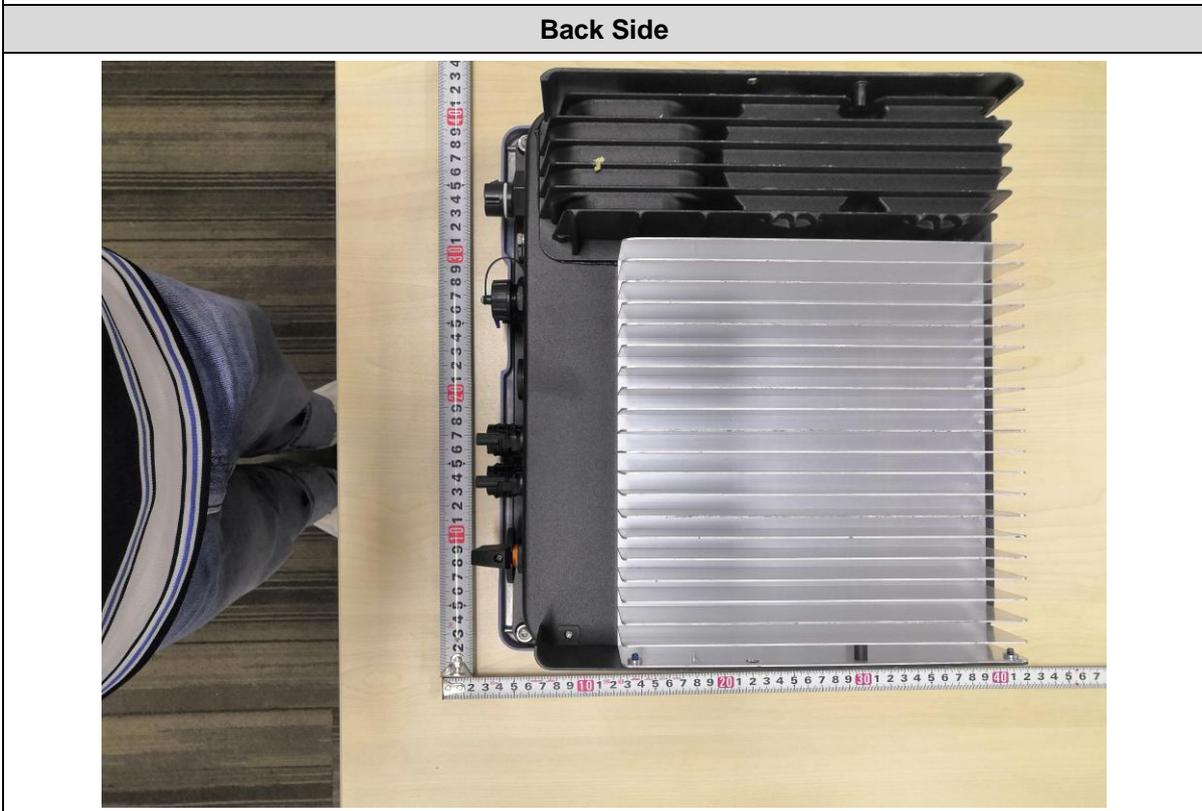
(Pictures of the EUT and Electrical Schemes)

1 PICTURES

Front view



Back Side



Connection interface



Top Side



Left Side

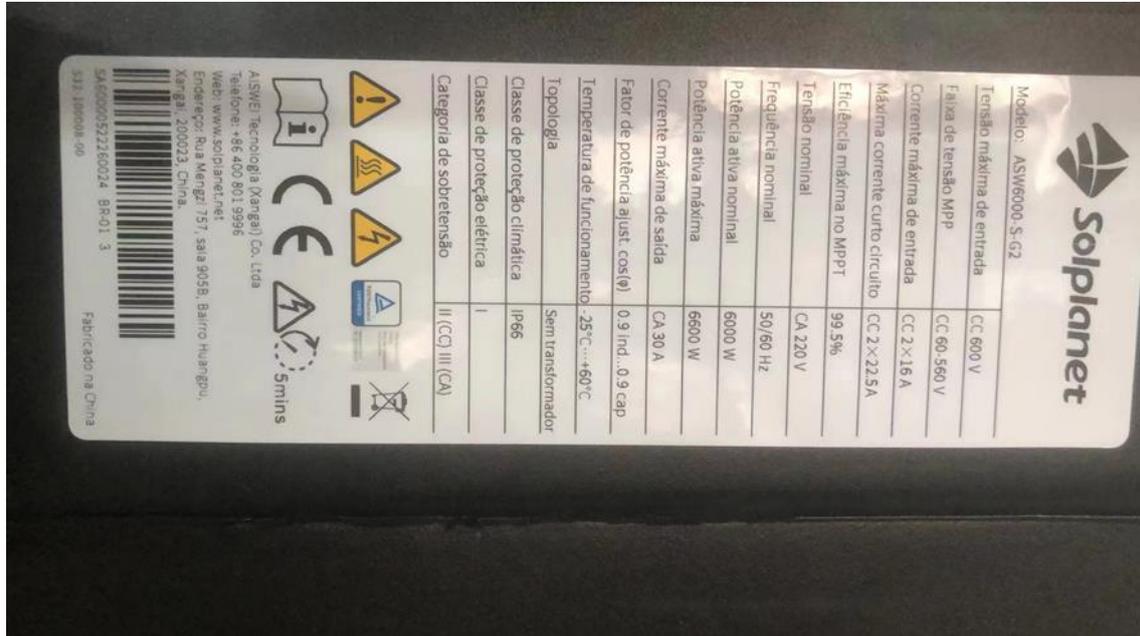


Right side



IEC 61683: 1999

Serial number



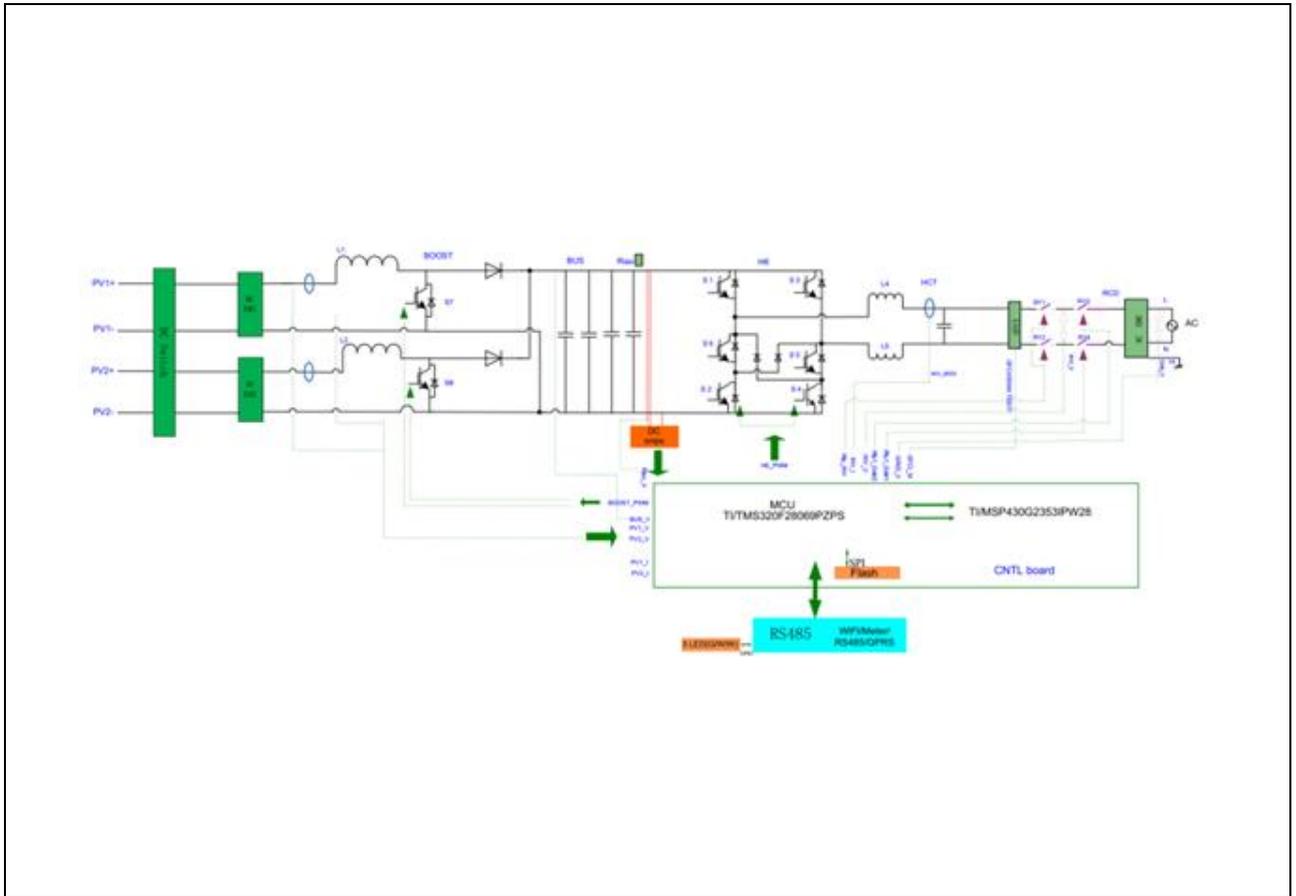
Software version

Master软件号 V610-01055-01

Slave软件号 V610-01056-01

Safety软件号 V610-10010-01

2 ELECTRICAL SCHEMES



ATTACHMENT II

(Testing information)

1 TESTING CIRCUIT

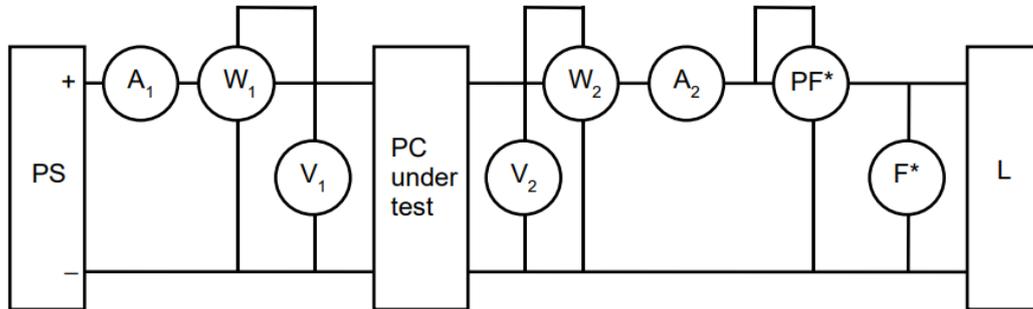


Figure 1a – Stand-alone type

IEC 1566/99

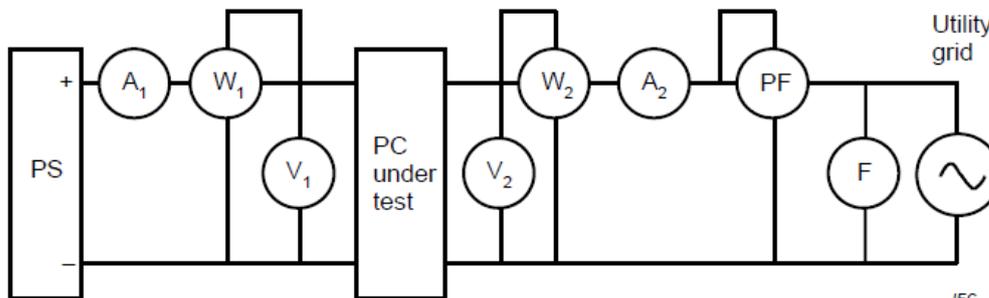


Figure 1b – Utility-interactive type

IEC 1567/99

- | | |
|---|-------------------------------------|
| 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

From	No.	Equipment Name	Trademark / Model	Equipment No.	Calibration Period
SGS	1	Digital Oscilloscope	Tektronix/ MDO3022	GZE007-41	2021/10/20 to 2022/10/19
	2	Differential probe	Tektronix/ P5210A	GZE007-25	2022/01/20 to 2023/01/19
	3	Current probe	CA/PAC 12	GZE007-31	2021/10/28 to 2022/10/27
	4	Power Analyzer	Yokogawa/ WT3000	GZE006-72	2022/06/23 to 2023/06/22
	5	Temperature & Humidity meter	HUATO/ S520-EX	GZE020-68	2021/08/18 to 2022/08/17

Items	Specifications
1) PV array simulator	
a) Voltage range	0 – 1500 Vdc
b) Current range	0 – 100 A
2) AC Source	
a) Output wiring	Three phase
b) Output capacity	100 kVA
c) Output voltage	0 - 300 Vrms
d) Output frequency	30 - 100 Hz
e) Voltage stability	/
f) Output voltage distortion	/
3) Power Analyzer	
a) Voltage range	0 – 1000 Vdc, 0 – 1000 Va.c.
b) Current range	0 – 50 A
c) Frequency range (accuracy)	0 – 999.99 kHz (0.005%)
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) Digital Oscilloscope	
a) Sampling speed	2.5GS/s
b) Recording device	Memory record and USB reading
c) Time accuracy	± 10 ppm
5) AC load	
a) Resistive load	Capacity: 68.33 kW
b) Inductive load	Capacity: 68.33 kVAr
c) Capacitive load	Capacity: 68.33 kVAr

3 MEASUREMENT UNCERTAINTY

Magnitude	Uncertainty
Voltage measurement uncertainty	$\pm 1.5\%$
Current measurement uncertainty	$\pm 2.0\%$
Frequency measurement uncertainty	$\pm 0.2\%$
Time measurement uncertainty	$\pm 0.2\%$
Power measurement uncertainty	$\pm 2.5\%$
Phase Angle	$\pm 1^\circ$
Temperature	$\pm 3^\circ\text{C}$

Note: Measurement 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.