

Test Report issued under the responsibility of:



TEST REPORT IEC 61683

Photovoltaic systems – Power conditioners – Procedure for measuring efficiency

Report Number..... : GZES220901844702

Date of issue : 2022-10-20

Total number of pages..... : 56

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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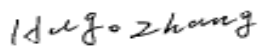

**This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory
and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.**

General disclaimer:

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

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

Test item description :	Hybrid inverter
Trade Mark :	
Manufacturer :	AISWEI Technology (Shanghai) Co., Ltd.
Address :	Room 905B, 757 Mengzi Road, Huangpu District, 200023 Shanghai, China.
Model/Type reference :	ASW3000H-S2, ASW3680H-S2, ASW4000H-S2, ASW5000H-S2, ASW6000H-S2
Ratings :	Refer to the ratings on page 6 of the report.
	Serial Number: PB60000112250003 (The Equipment parameters were changed by software)
	50Hz: Firmware version: Main DSP: V610-02003-01
	Slave DSP: V610-60009-00 Safety package: V610-10008-03
	60Hz: Firmware version: Main DSP: V610-02003-03
	Slave DSP: V610-60009-00 Safety package: V610-10008-05

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 Hz&60 Hz		
Attachment #	Description	Pages
Attachment I	Pictures of the EUT and Electrical Schemes	7 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 50/60Hz.</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: ASW6000H-S2		
PV input	Max. PV input power	9000Wp
	Max. PV input voltage	d.c. 550V
	MPP T voltage range	d.c. 40-530V
	Max. PV input current	d.c. 2×16A
	Isc PV(absolute maximum)	d.c. 2×20A
Battery input	Rated battery voltage	d.c. 48V
	Battery voltage range	d.c. 40-60V
	Max. battery charge/discharge current	d.c. 100/100A
	Battery type	LiFePO4
Grid output	Rated grid voltage	a.c. 230V
	Rated grid frequency	50Hz/60Hz
	Rated grid output active power	6000W
	Rated grid output apparent power	6000VA
	Max. grid output apparent power	6000VA
	Max. grid output current	a.c. 27.3A
Grid input	Rated grid voltage	a.c. 230V
	Rated grid frequency	50Hz/60Hz
	Rated grid input apparent power	6000VA
	Max. grid input apparent power	6000VA
	Max. grid input current	a.c. 27.3A
EPS output	Rated output voltage	a.c. 230V
	Rated output frequency	50Hz/60Hz
	Rated output apparent power	5000VA
	Max. output apparent power	5000VA
	Max. output current	a.c. 21.7A
General information	Adjustable cos(φ)	0.8ind...0.8cap
	Operating temperature range	-25...+60°C
	Inverter topology	Non-Isolated
	Ingress protection	IP66
	Protective class	I
	Overvoltage category	II(PV), III(MAINS)

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

532-100006-00 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 **ASW6000H-S2**'s except for 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.



IEC 61683: 1999					
Clause	Requirement	Test	Measuring result	Remark	Verdict

Test item particulars..... : Single Phase Hybrid Inverter

Classification of installation and use : Fixed (permanent connection)

Supply Connection..... : DC; PV and Batteries
 : 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 2022-07-14 to 2022-07-20

General remarks:
 "(See Enclosure #)" refers to additional information appended to the report.
 "(See appended table)" refers to a table appended to the report.
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 Throughout this report a comma / point is used as the decimal separator.

Manufacturer's Declaration per sub-clause 4.2.5 of IEC 61683-02:
 The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided :
 Yes
 Not applicable

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

Name and address of factory (ies) : AISWEI New Energy Technology (Yangzhong) Co., Ltd.
 No.588 Gangxing Road, Yangzhong, Jiangsu, China

IEC 61683: 1999					
Clause	Requirement	Test	Measuring result	Remark	Verdict

General product information:

Solplanet hybrid inverter is a high-quality inverter which can convert solar energy to AC energy and store energy into battery. The energy produced from the inverter shall be used to optimize self-consumption, then charge battery, exceed power could export to grid. Loads will be supported in priority by the system, then battery power, exceed consumption power will be drained from grid inverter. It can provide power for emergency use during the grid lost by using the energy from battery and inverter(generated from PV).

Equipment Under Testing:

- ASW3000H-S2
- ASW3680H-S2
- ASW4000H-S2
- ASW5000H-S2
- ASW6000H-S2

Model	ASW 3000H-S2	ASW 3680H-S2	ASW 4000H-S2	ASW 5000H-S2	ASW 6000H-S2
PV Input					
Max. PV array power (STC)	5500 Wp	6180 Wp	6500 Wp	7500 Wp	9000 Wp
Max. input voltage	550 V				
MPP voltage range / rated input voltage	40 V to 530 V / 380 V				
MPPT full load voltage	155V- 500V	155V- 500V	195V- 500V	210V- 500V	210V- 500V
Max. input current	2*16 A				
Max. short-circuit current	2*20 A				
Battery Input					
Nominal battery voltage	48 V				
Battery voltage range	40 V to 60 V				
Max. charging / discharging power	5000 W / 5000 W				
Max. charging current / Max. discharging current	100 A / 100 A				
Battery type	LiFePO4				
AC Output					
Rated AC voltage	230 V				
Rated AC grid frequency	50Hz / 60 Hz				
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 power	3000 VA	3680 VA	4000 VA	5000 VA	6000 VA
Rated grid output Current (@230V)	13.1 A	16 A	17.4 A	21.7 A	26.1 A
Max. grid output current	13.6 A	16 A	18.2 A	22.7 A	27.3 A
General data					
Power factor range	0.8 leading to 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 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 stand-alone power conditioners				N/A
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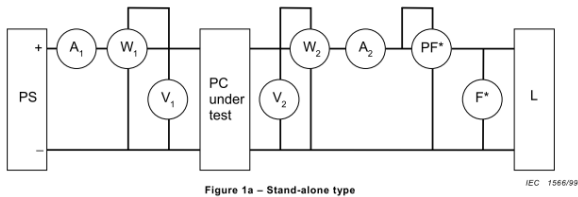
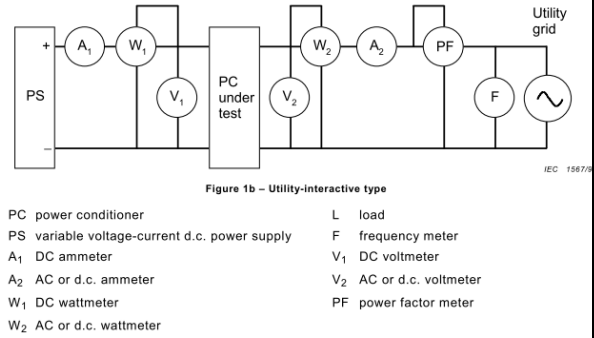


	Figure 1b is applied to utility-interactive power conditioners				P
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IEC 61683: 1999					
Clause	Requirement	Test	Measuring result	Remark	Verdict
6.2	Measurement procedure				P
7	Loss measurement				P
7.1	No-load loss				P
7.2	Standby loss				P
Annex 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							
power conditioner type	Hybrid Inverter								
Model:	ASW3000H-S2								
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 155 ~ 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 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 155 V were used instead of 40 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 155 V (± 2.325 V)								
Temperature (°C)	25 °C \pm 5 °C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	155.0	155.0	156.0	155.0	155.0	/	/	/
Input voltage ripple (V)	/	0.7	0.8	1.2	1.6	2.1	/	/	/
Input current (A)	/	3.5	5.1	10.1	15.1	20.2	/	/	/
Input current ripple (A)	/	0.1	0.1	0.1	0.2	0.3	/	/	/
Input power (Pi) (W)	/	335	791	1580	2340	3130	/	/	/
Output power (Po) (W)	/	315	758	1518	2251	3002	/	/	/
Output efficiency (%)	/	94.0	95.8	96.1	96.2	95.9	/	/	/
Input energy (Wi) (Wh)	/	26.7	39.5	78.9	116.9	157.0	/	/	/
Output energy (Wo) (Wh)	/	25.2	37.9	75.8	112.5	150.7	/	/	/
Energy efficiency(%)	/	94.4	95.9	96.1	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 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.0	380.1	380.0	379.9	380.0	/	/	/
Input voltage ripple (V)	/	1.8	3.5	4.0	2.3	2.3	/	/	/
Input current (A)	/	0.8	2.0	4.0	6.0	8.3	/	/	/
Input current ripple (A)	/	0.1	0.2	0.3	0.4	0.8	/	/	/
Input power (Pi) (W)	/	311	778	1533	2291	3168	/	/	/
Output power (Po) (W)	/	299	757	1497	2233	3079	/	/	/
Output efficiency (%)	/	96.1	97.3	97.7	97.5	97.2	/	/	/
Input energy (Wi) (Wh)	/	15.5	38.8	76.5	114.4	160.9	/	/	/
Output energy (Wo) (Wh)	/	15.0	37.8	74.8	111.6	156.5	/	/	/
Energy efficiency(%)	/	96.8	97.4	97.8	97.6	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 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		1.4	2.7	4.9	4.2	5.0	/	/	/
Input current (A)	/	0.7	1.6	3.1	4.7	6.4	/	/	/
Input current ripple (A)		0.1	0.1	0.2	0.3	0.8	/	/	/
Input power (Pi) (W)	/	326	776	1551	2330	3196	/	/	/
Output power (Po) (W)	/	312	751	1507	2260	3093	/	/	/
Output efficiency(%)	/	95.5	96.8	97.2	97.0	96.8	/	/	/
Input energy (Wi) (Wh)	/	16.3	38.7	77.5	116.3	159.6	/	/	/
Output energy (Wo) (Wh)	/	15.6	37.5	75.3	112.9	154.5	/	/	/
Energy efficiency(%)	/	95.7	96.9	97.2	97.1	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							
power conditioner type	Hybrid Inverter								
Model:	ASW3680H-S2								
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 155 ~ 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 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 155 V were used instead of 40 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 155 V (± 2.325 V)								
Temperature (°C)	25 °C \pm 5 °C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	156.0	156.0	156.0	155.0	155.0	/	/	/
Input voltage ripple (V)	/	0.6	0.9	1.4	1.9	3.2	/	/	/
Input current (A)	/	2.5	6.2	12.3	18.3	25.0	/	/	/
Input current ripple (A)	/	0.1	0.1	0.2	0.2	0.4	/	/	/
Input power (Pi) (W)	/	395	971	1926	2839	3868	/	/	/
Output power (Po) (W)	/	372	930	1850	2722	3701	/	/	/
Output efficiency (%)	/	94.2	95.8	96.1	95.9	95.7	/	/	/
Input energy (Wi) (Wh)	/	19.7	48.5	96.2	142.4	195.7	/	/	/
Output energy (Wo) (Wh)	/	18.6	46.5	92.4	136.7	187.5	/	/	/
Energy efficiency(%)	/	94.4	95.9	96.0	96.0	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	b) The inverter's nominal voltage 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.0	380.1	379.9	380.0	380.0	/	/	/
Input voltage ripple (V)	/	2.1	2.6	2.8	4.3	5.3	/	/	/
Input current (A)	/	1.0	2.5	5.0	7.6	9.9	/	/	/
Input current ripple (A)	/	0.1	0.2	0.3	0.8	0.8	/	/	/
Input power (Pi) (W)	/	380	946	1896	2881	3781	/	/	/
Output power (Po) (W)	/	366	924	1844	2794	3650	/	/	/
Output efficiency (%)	/	96.3	97.7	97.3	97.0	96.5	/	/	/
Input energy (Wi) (Wh)	/	19.0	47.2	94.7	144.5	201.2	/	/	/
Output energy (Wo) (Wh)	/	18.3	46.2	92.1	140.3	194.6	/	/	/
Energy efficiency(%)	/	96.3	97.9	97.3	97.1	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 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.3	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		1.6	3.2	3.9	3.4	4.7	/	/	/
Input current (A)	/	0.7	1.9	3.8	5.8	7.6	/	/	/
Input current ripple (A)		0.1	0.1	0.2	0.7	0.9	/	/	/
Input power (Pi) (W)	/	374	945	1902	2899	3803	/	/	/
Output power (Po) (W)	/	360	922	1847	2806	3662	/	/	/
Output efficiency(%)	/	96.3	97.6	97.1	96.8	96.3	/	/	/
Input energy (Wi) (Wh)	/	18.7	47.2	95.0	144.8	195.2	/	/	/
Output energy (Wo) (Wh)	/	18.0	46.1	92.3	140.2	188.2	/	/	/
Energy efficiency(%)	/	96.3	97.7	97.2	96.8	96.4	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

TABLE		Efficiency recording and efficient calculation sheet									
power conditioner type	Hybrid Inverter										
Model:	ASW4000H-S2										
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 195 ~ 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 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 195 V were used instead of 40 V.										
PV input voltage	a) Manufacturer's minimum rated input voltage 195 V ($\pm 2.925V$)										
Temperature ($^{\circ}C$)	25 $^{\circ}C \pm 5$ $^{\circ}C$										
Operating period for energy measurement (min)	3										
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/	/	
Input voltage (V)	/	195.0	195.0	195.0	195.0	195.0	/	/	/	/	
Input voltage ripple (V)	/	0.8	1.2	1.9	2.6	3.1	/	/	/	/	
Input current (A)	/	2.2	5.4	10.7	16.1	21.9	/	/	/	/	
Input current ripple (A)	/	0.1	0.1	0.2	0.3	0.4	/	/	/	/	
Input power (Pi) (W)	/	426	1055	2081	3134	4264	/	/	/	/	
Output power (Po) (W)	/	401	1012	2000	3002	4077	/	/	/	/	
Output efficiency (%)	/	94.1	95.9	96.1	95.8	95.6	/	/	/	/	
Input energy (Wi) (Wh)	/	21.3	54.3	106.8	158.1	215.1	/	/	/	/	
Output energy (Wo) (Wh)	/	20.1	52.1	102.7	151.6	205.8	/	/	/	/	
Energy efficiency(%)	/	94.4	95.9	96.2	95.9	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	b) The inverter's nominal voltage 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.0	380.0	380.0	379.9	380.0	/	/	/
Input voltage ripple (V)	/	2.1	2.4	2.7	2.7	3.3	/	/	/
Input current (A)	/	1.1	2.7	5.4	8.3	10.9	/	/	/
Input current ripple (A)	/	0.1	0.2	0.4	0.8	0.8	/	/	/
Input power (Pi) (W)	/	420	1026	2053	3168	4150	/	/	/
Output power (Po) (W)	/	404	1001	2002	3080	4030	/	/	/
Output efficiency (%)	/	96.2	97.6	97.5	97.2	97.1	/	/	/
Input energy (Wi) (Wh)	/	21.0	52.9	106.2	159.8	208.3	/	/	/
Output energy (Wo) (Wh)	/	20.2	51.7	103.6	155.5	202.5	/	/	/
Energy efficiency(%)	/	96.2	97.7	97.6	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.									

PV input voltage	c) 90% of the inverter's maximum input voltage 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		1.7	3.4	3.6	3.6	3.7	/	/	/
Input current (A)	/	0.9	2.1	4.1	6.2	8.4	/	/	/
Input current ripple (A)		0.1	0.2	0.3	0.8	0.9	/	/	/
Input power (Pi) (W)	/	426	1030	2072	3088	4177	/	/	/
Output power (Po) (W)	/	409	1002	2013	2996	4039	/	/	/
Output efficiency(%)	/	96.0	97.3	97.2	97.0	96.7	/	/	/
Input energy (Wi) (Wh)	/	21.3	53.1	107.3	156.0	208.6	/	/	/
Output energy (Wo) (Wh)	/	20.4	51.6	104.3	151.5	201.7	/	/	/
Energy efficiency(%)	/	95.8	97.2	97.2	97.1	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.									

TABLE		Efficiency recording and efficient calculation sheet							
power conditioner type	Hybrid Inverter								
Model:	ASW5000H-S2								
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 210 ~ 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 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 210 V were used instead of 40 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 210 V (± 3.15 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	210.0	210.0	209.9	210.0	210.0	/	/	/
Input voltage ripple (V)	/	1.0	1.4	2.4	2.2	2.7	/	/	/
Input current (A)	/	2.5	6.2	12.6	18.9	25.0	/	/	/
Input current ripple (A)	/	0.1	0.1	0.2	0.4	0.4	/	/	/
Input power (Pi) (W)	/	534	1298	2638	3967	5244	/	/	/
Output power (Po) (W)	/	503	1248	2535	3796	5004	/	/	/
Output efficiency (%)	/	94.2	96.1	96.1	95.7	95.4	/	/	/
Input energy (Wi) (Wh)	/	26.7	66.7	132.8	199.2	263.9	/	/	/
Output energy (Wo) (Wh)	/	25.2	64.2	127.6	190.8	252.1	/	/	/
Energy efficiency(%)	/	94.4	96.3	96.1	95.8	95.5	/	/	/
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	b) The inverter's nominal voltage 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.5	380.0	380.0	379.9	380.0	/	/	/
Input voltage ripple (V)	/	2.5	2.6	2.5	1.8	2.6	/	/	/
Input current (A)	/	1.4	3.4	6.8	10.1	13.7	/	/	/
Input current ripple (A)	/	0.1	0.2	0.8	0.9	0.8	/	/	/
Input power (Pi) (W)	/	523	1286	2573	3854	5206	/	/	/
Output power (Po) (W)	/	504	1257	2508	3745	5045	/	/	/
Output efficiency (%)	/	96.4	97.7	97.5	97.2	96.9	/	/	/
Input energy (Wi) (Wh)	/	26.1	66.8	135.9	192.5	261.5	/	/	/
Output energy (Wo) (Wh)	/	25.2	65.4	132.6	187.2	253.6	/	/	/
Energy efficiency(%)	/	96.6	97.9	97.6	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.									

PV input voltage	c) 90% of the inverter's maximum input voltage 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	499.7	500.0	500.0	/	/	/
Input voltage ripple (V)		1.4	1.1	2.1	2.1	3.2	/	/	/
Input current (A)	/	1.0	2.6	5.2	7.7	10.4	/	/	/
Input current ripple (A)		0.1	0.2	0.7	0.9	0.9	/	/	/
Input power (Pi) (W)	/	525	1283	2589	3870	5180	/	/	/
Output power (Po) (W)	/	506	1251	2519	3755	5004	/	/	/
Output efficiency(%)	/	96.4	97.5	97.3	97.0	96.6	/	/	/
Input energy (Wi) (Wh)	/	26.2	66.3	132.4	194.6	261.2	/	/	/
Output energy (Wo) (Wh)	/	25.3	64.7	128.9	189.0	252.5	/	/	/
Energy efficiency(%)	/	96.6	97.6	97.4	97.1	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.									

TABLE		Efficiency recording and efficient calculation sheet							
power conditioner type	Hybrid Inverter								
Model:	ASW6000H-S2								
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 210 ~ 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 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 210 V were used instead of 40 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 210 V (±3.15 V)								
Temperature (°C)	25 °C ± 5 °C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%()	/	/
Input voltage (V)	/	210.0	210.0	209.9	210.0	210.0	/	/	/
Input voltage ripple (V)	/	1.0	1.7	2.8	2.7	2.9	/	/	/
Input current (A)	/	3.0	7.4	14.9	22.6	30.0	/	/	/
Input current ripple (A)	/	0.1	0.1	0.3	0.4	0.4	/	/	/
Input power (Pi) (W)	/	640	1563	3129	4747	6295	/	/	/
Output power (Po) (W)	/	604	1503	3002	4541	5993	/	/	/
Output efficiency (%)	/	94.4	96.2	95.9	95.7	95.2	/	/	/
Input energy (Wi) (Wh)	/	32.0	80.7	157.6	238.8	320.0	/	/	/
Output energy (Wo) (Wh)	/	30.2	77.7	151.2	228.6	305.1	/	/	/
Energy efficiency(%)	/	94.4	96.3	95.9	95.7	95.3	/	/	/
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	b) The inverter's nominal voltage 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.1	380.0	379.8	380.0	380.0	/	/	/
Input voltage ripple (V)	/	2.9	3.3	3.6	3.6	3.7	/	/	/
Input current (A)	/	1.7	4.0	8.2	12.1	16.3	/	/	/
Input current ripple (A)	/	0.2	0.3	0.9	0.8	0.8	/	/	/
Input power (Pi) (W)	/	630	1533	3130	4611	6201	/	/	/
Output power (Po) (W)	/	608	1497	3046	4473	5986	/	/	/
Output efficiency (%)	/	96.5	97.7	97.3	97.0	96.5	/	/	/
Input energy (Wi) (Wh)	/	31.5	79.3	165.1	256.0	313.9	/	/	/
Output energy (Wo) (Wh)	/	30.4	77.5	160.8	248.6	303.4	/	/	/
Energy efficiency(%)	/	96.5	97.7	97.4	97.1	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 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	499.7	500.0	500.0	/	/	/
Input voltage ripple (V)		2.3	4.9	4.2	4.2	2.4	/	/	/
Input current (A)	/	1.3	3.1	6.2	9.4	12.4	/	/	/
Input current ripple (A)		0.1	0.2	0.8	0.9	0.9	/	/	/
Input power (Pi) (W)	/	628	1542	3080	4685	6215	/	/	/
Output power (Po) (W)	/	604	1504	2994	4534	5984	/	/	/
Output efficiency(%)	/	96.2	97.5	97.2	96.8	96.3	/	/	/
Input energy (Wi) (Wh)	/	31.4	79.9	153.9	235.0	313.4	/	/	/
Output energy (Wo) (Wh)	/	30.2	78.0	149.5	227.7	302.1	/	/	/
Energy efficiency(%)	/	96.2	97.6	97.1	96.9	96.4	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

TABLE		Efficiency recording and efficient calculation sheet									
power conditioner type	Hybrid Inverter										
Model:	ASW3000H-S2										
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 155 ~ 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 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 155 V were used instead of 40 V.										
PV input voltage	a) Manufacturer's minimum rated input voltage 155 V (± 2.325 V)										
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C										
Operating period for energy measurement (min)	3										
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/	/	
Input voltage (V)	/	155.0	155.0	155.0	155.0	155.0	/	/	/	/	
Input voltage ripple (V)	/	1.2	1.0	1.5	2.0	1.9	/	/	/	/	
Input current (A)	/	2.1	5.1	10.1	15.2	20.3	/	/	/	/	
Input current ripple (A)	/	0.5	0.1	0.2	0.2	0.3	/	/	/	/	
Input power (Pi) (W)	/	318	786	1564	2351	3142	/	/	/	/	
Output power (Po) (W)	/	299	752	1501	2261	3003	/	/	/	/	
Output efficiency (%)	/	94.0	95.7	96.0	96.2	95.6	/	/	/	/	
Input energy (Wi) (Wh)	/	16.0	40.2	80.7	117.9	159.3	/	/	/	/	
Output energy (Wo) (Wh)	/	15.1	38.5	77.6	113.5	152.4	/	/	/	/	
Energy efficiency(%)	/	94.4	95.8	96.2	96.3	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	b) The inverter's nominal voltage 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.0	380.0	380.0	380.0	380.0	/	/	/
Input voltage ripple (V)	/	1.8	3.0	3.4	3.0	4.3	/	/	/
Input current (A)	/	0.8	2.0	4.0	6.1	8.3	/	/	/
Input current ripple (A)	/	0.1	0.2	0.3	0.2	0.9	/	/	/
Input power (Pi) (W)	/	311	774	1533	2320	3169	/	/	/
Output power (Po) (W)	/	299	753	1498	2261	3077	/	/	/
Output efficiency (%)	/	96.1	97.3	97.7	97.5	97.1	/	/	/
Input energy (Wi) (Wh)	/	16.0	38.8	77.6	116.4	159.4	/	/	/
Output energy (Wo) (Wh)	/	15.4	37.7	75.9	113.5	155.0	/	/	/
Energy efficiency(%)	/	96.3	97.2	97.8	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	c) 90% of the inverter's maximum input voltage 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		1.3	2.4	4.2	4.1	4.1	/	/	/
Input current (A)	/	0.6	1.5	3.1	4.7	6.4	/	/	/
Input current ripple (A)		0.1	0.1	0.2	0.3	0.9	/	/	/
Input power (Pi) (W)	/	320	771	1548	2325	3182	/	/	/
Output power (Po) (W)	/	306	749	1504	2255	3080	/	/	/
Output efficiency(%)	/	95.6	97.1	97.2	97.0	96.8	/	/	/
Input energy (Wi) (Wh)	/	16.1	39.3	77.6	119.1	166.9	/	/	/
Output energy (Wo) (Wh)	/	15.4	38.2	75.5	115.6	161.7	/	/	/
Energy efficiency(%)	/	95.7	97.2	97.3	97.1	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							
power conditioner type	Hybrid Inverter								
Model:	ASW3680H-S2								
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 155 ~ 500 V Rated output voltage: 230 V Rated output frequency: 60 Hz Rated output power: 3680 W Note: According to the user manual, the minimum rated input voltage is 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 155 V were used instead of 40 V.								
PV input voltage	a) Manufacturer's minimum rated input voltage 155 V (±2.325 V)								
Temperature (°C)	25 °C ± 5 °C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	155.0	155.0	155.0	155.0	155.0	/	/	/
Input voltage ripple (V)	/	0.6	0.9	1.4	1.8	2.8	/	/	/
Input current (A)	/	2.6	6.3	12.4	19.0	24.3	/	/	/
Input current ripple (A)	/	0.1	0.1	0.2	0.2	0.3	/	/	/
Input power (Pi) (W)	/	396	970	1924	2940	3769	/	/	/
Output power (Po) (W)	/	372	930	1850	2816	3609	/	/	/
Output efficiency (%)	/	93.9	95.9	96.2	95.8	95.8	/	/	/
Input energy (Wi) (Wh)	/	19.8	48.5	96.1	155.0	188.2	/	/	/
Output energy (Wo)(Wh)	/	18.6	46.5	92.4	148.6	180.3	/	/	/
Energy efficiency(%)	/	93.9	95.9	96.1	95.9	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	b) The inverter's nominal voltage 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.0	380.1	379.9	380.0	380.0	/	/	/
Input voltage ripple (V)	/	2.1	2.1	2.8	3.1	2.8	/	/	/
Input current (A)	/	1.0	2.5	5.0	7.5	9.9	/	/	/
Input current ripple (A)	/	0.1	0.2	0.3	0.6	0.7	/	/	/
Input power (Pi) (W)	/	381	949	1890	2868	3760	/	/	/
Output power (Po) (W)	/	366	924	1844	2792	3647	/	/	/
Output efficiency (%)	/	96.1	97.4	97.6	97.4	97.0	/	/	/
Input energy (Wi) (Wh)	/	19.0	47.4	94.4	144.1	188.8	/	/	/
Output energy (Wo)(Wh)	/	18.3	46.2	92.1	140.4	183.5	/	/	/
Energy efficiency(%)	/	96.3	97.5	97.6	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	c) 90% of the inverter's maximum input voltage 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.3	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		1.6	3.2	1.9	2.8	3.4	/	/	/
Input current (A)	/	0.8	1.9	3.8	5.8	7.5	/	/	/
Input current ripple (A)		0.1	0.1	0.2	0.8	0.8	/	/	/
Input power (Pi) (W)	/	376	948	1899	2875	3764	/	/	/
Output power (Po) (W)	/	360	922	1847	2793	3651	/	/	/
Output efficiency(%)	/	95.7	97.3	97.3	97.1	97.0	/	/	/
Input energy (Wi) (Wh)	/	18.8	47.3	94.8	143.6	188.9	/	/	/
Output energy (Wo)(Wh)	/	18.0	46.1	92.3	139.5	183.4	/	/	/
Energy efficiency(%)	/	95.7	97.5	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									
power conditioner type	Hybrid Inverter										
Model:	ASW4000H-S2										
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 195 ~ 500 V Rated output voltage: 230 V Rated output frequency: 60 Hz Rated output power: 4000 W Note: According to the user manual, the minimum rated input voltage is 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 195 V were used instead of 40 V.										
PV input voltage	a) Manufacturer's minimum rated input voltage 195 V ($\pm 2.925V$)										
Temperature (°C)	25 °C \pm 5 °C										
Operating period for energy measurement (min)	3										
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/	/	
Input voltage (V)	/	195.0	195.0	195.0	195.5	195.0	/	/	/	/	
Input voltage ripple (V)	/	0.9	1.4	2.3	3.5	3.7	/	/	/	/	
Input current (A)	/	2.2	5.4	10.7	16.2	21.3	/	/	/	/	
Input current ripple (A)	/	0.1	0.1	0.2	0.3	0.3	/	/	/	/	
Input power (Pi) (W)	/	426	1050	2078	3173	4154	/	/	/	/	
Output power (Po) (W)	/	401	1008	1999	3045	3982	/	/	/	/	
Output efficiency (%)	/	94.1	96.0	96.2	96.0	95.9	/	/	/	/	
Input energy (Wi) (Wh)	/	21.4	52.6	106.4	159.7	210.5	/	/	/	/	
Output energy (Wo) (Wh)	/	20.1	50.6	102.4	153.4	202.1	/	/	/	/	
Energy efficiency(%)	/	93.9	96.2	96.2	96.1	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 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.0	380.0	380.0	380.0	380.0	/	/	/
Input voltage ripple (V)	/	2.1	2.9	3.2	3.4	3.4	/	/	/
Input current (A)	/	1.1	2.7	5.4	8.3	10.9	/	/	/
Input current ripple (A)	/	0.1	0.2	0.4	0.6	0.7	/	/	/
Input power (Pi) (W)	/	420	1033	2057	3137	4124	/	/	/
Output power (Po) (W)	/	404	1009	2006	3053	4007	/	/	/
Output efficiency (%)	/	96.2	97.7	97.5	97.3	97.2	/	/	/
Input energy (Wi) (Wh)	/	21.0	52.3	103.2	157.6	207.1	/	/	/
Output energy (Wo) (Wh)	/	20.2	51.1	100.7	153.6	201.6	/	/	/
Energy efficiency(%)	/	96.2	97.7	97.6	97.5	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 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		1.5	3.0	2.5	3.2	3.2	/	/	/
Input current (A)	/	0.8	2.1	4.1	6.4	8.3	/	/	/
Input current ripple (A)		0.1	0.2	0.3	0.9	0.9	/	/	/
Input power (Pi) (W)	/	419	1029	2073	3210	4165	/	/	/
Output power (Po) (W)	/	402	1003	2013	3080	4031	/	/	/
Output efficiency(%)	/	95.9	97.5	97.1	96.0	96.8	/	/	/
Input energy (Wi) (Wh)	/	21.3	53.2	107.1	161.0	292.3	/	/	/
Output energy (Wo) (Wh)	/	20.5	51.9	104.1	154.7	283.2	/	/	/
Energy efficiency(%)	/	96.2	97.6	97.2	96.1	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									
power conditioner type	Hybrid Inverter										
Model:	ASW5000H-S2										
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 210 ~ 500 V Rated output voltage: 230 V Rated output frequency: 60 Hz Rated output power: 5000 W Note: According to the user manual, the minimum rated input voltage is 40 V.However, in this minimum voltage, the inverter can't output full power. So, for this test, 210 V were used instead of 40 V.										
PV input voltage	a) Manufacturer's minimum rated input voltage 210 V (± 3.15 V)										
Temperature (°C)	25 °C \pm 5 °C										
Operating period for energy measurement (min)	3										
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/	/	
Input voltage (V)	/	210.0	210.0	209.9	210.0	210.0	/	/	/	/	
Input voltage ripple (V)	/	1.1	1.8	2.3	2.9	2.4	/	/	/	/	
Input current (A)	/	2.5	6.2	12.6	18.4	24.5	/	/	/	/	
Input current ripple (A)	/	0.1	0.1	0.2	0.3	0.4	/	/	/	/	
Input power (Pi) (W)	/	532	1302	2641	3857	5135	/	/	/	/	
Output power (Po) (W)	/	501	1249	2535	3702	4903	/	/	/	/	
Output efficiency (%)	/	94.2	95.9	96.0	96.0	95.5	/	/	/	/	
Input energy (Wi) (Wh)	/	26.6	65.2	156.9	193.9	257.5	/	/	/	/	
Output energy (Wo) (Wh)	/	25.1	62.6	150.7	186.2	246.2	/	/	/	/	
Energy efficiency(%)	/	94.4	96.0	96.0	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 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.5	380.0	380.7	380.0	380.0	/	/	/
Input voltage ripple (V)	/	1.5	1.7	1.8	1.2	1.3	/	/	/
Input current (A)	/	1.4	3.4	7.0	10.1	13.4	/	/	/
Input current ripple (A)	/	0.1	0.2	0.9	0.7	0.4	/	/	/
Input power (Pi) (W)	/	517	1287	2668	3854	5106	/	/	/
Output power (Po) (W)	/	504	1257	2602	3743	4951	/	/	/
Output efficiency (%)	/	97.5	97.7	97.5	97.1	97.0	/	/	/
Input energy (Wi) (Wh)	/	25.8	66.3	126.5	192.5	256.3	/	/	/
Output energy (Wo) (Wh)	/	25.2	64.8	123.0	186.9	248.7	/	/	/
Energy efficiency(%)	/	97.7	97.7	97.2	97.1	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.									

PV input voltage	c) 90% of the inverter's maximum input voltage 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		1.9	3.6	3.0	3.6	2.8	/	/	/
Input current (A)	/	1.0	2.6	5.2	7.7	10.3	/	/	/
Input current ripple (A)		0.1	0.2	0.8	0.9	0.9	/	/	/
Input power (Pi) (W)	/	525	1283	2577	3858	5168	/	/	/
Output power (Po) (W)	/	506	1251	2508	3745	4998	/	/	/
Output efficiency(%)	/	96.4	97.5	97.3	97.1	96.7	/	/	/
Input energy (Wi) (Wh)	/	26.2	66.3	130.6	192.7	263.9	/	/	/
Output energy (Wo) (Wh)	/	25.3	64.7	127.2	187.1	255.5	/	/	/
Energy efficiency(%)	/	96.6	97.6	97.4	97.1	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								
power conditioner type	Hybrid Inverter									
Model:	ASW6000H-S2									
Parameters of power conditioner	Minimum rated input voltage:40 V Nominal voltage: 380 V Maximum input voltage: 550 V MPPT voltage range: 40 ~ 530 V MPPT voltage range with full power: 210 ~ 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 40 V. However, in this minimum voltage, the inverter can't output full power. So, for this test, 210 V were used instead of 40 V.									
PV input voltage	a) Manufacturer's minimum rated input voltage 210 V (± 3.15 V)									
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C									
Operating period for energy measurement (min)	3									
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/	
Input voltage (V)	/	209.9	210.0	210.0	210.0	210.0	/	/	/	
Input voltage ripple (V)	/	1.2	2.0	2.7	3.2	2.3	/	/	/	
Input current (A)	/	3.0	7.5	15.3	22.6	29.9	/	/	/	
Input current ripple (A)	/	0.1	0.2	0.3	0.3	0.4	/	/	/	
Input power (Pi) (W)	/	639	1569	3221	4741	6287	/	/	/	
Output power (Po) (W)	/	604	1509	3043	4537	5990	/	/	/	
Output efficiency (%)	/	94.5	96.2	94.5	95.7	95.3	/	/	/	
Input energy (Wi) (Wh)	/	31.9	78.8	163.5	236.8	315.1	/	/	/	
Output energy (Wo) (Wh)	/	30.2	75.8	154.7	226.6	300.5	/	/	/	
Energy efficiency(%)	/	94.7	96.2	94.6	95.7	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 380 V (± 5.7 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	380.0	380.0	380.0	380.0	380.0	/	/	/
Input voltage ripple (V)	/	1.8	1.5	1.1	2.9	1.4	/	/	/
Input current (A)	/	1.6	4.1	8.3	12.1	16.3	/	/	/
Input current ripple (A)	/	0.2	0.3	0.4	0.6	0.5	/	/	/
Input power (Pi) (W)	/	615	1556	3159	4614	6196	/	/	/
Output power (Po) (W)	/	601	1501	3077	4480	5982	/	/	/
Output efficiency (%)	/	97.7	96.5	97.4	97.1	96.5	/	/	/
Input energy (Wi) (Wh)	/	32.4	78.2	159.3	230.5	309.4	/	/	/
Output energy (Wo) (Wh)	/	31.7	75.6	155.4	223.7	299.2	/	/	/
Energy efficiency(%)	/	97.8	96.7	97.6	97.0	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 495 V (± 7.425 V)								
Temperature ($^{\circ}$ C)	25 $^{\circ}$ C \pm 5 $^{\circ}$ C								
Operating period for energy measurement (min)	3								
Percentage of rated output VA	/	10%	25%	50%	75%	100%	120%(*)	/	/
Input voltage (V)	/	500.0	500.0	500.0	500.0	500.0	/	/	/
Input voltage ripple (V)		2.3	2.2	3.1	2.6	3.1	/	/	/
Input current (A)	/	1.3	3.1	6.3	9.2	12.4	/	/	/
Input current ripple (A)		0.1	0.2	0.9	0.8	0.8	/	/	/
Input power (Pi) (W)	/	627	1541	3167	4620	6207	/	/	/
Output power (Po) (W)	/	604	1504	3080	4471	5984	/	/	/
Output efficiency(%)	/	96.3	97.6	97.3	96.8	96.4	/	/	/
Input energy (Wi) (Wh)	/	31.3	79.1	159.7	234.4	310.0	/	/	/
Output energy (Wo) (Wh)	/	30.2	77.3	155.5	227.2	298.8	/	/	/
Energy efficiency(%)	/	96.5	97.7	97.4	96.9	96.4	/	/	/
Remark: (*) If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived.									

TABLE	No load loss for 50 Hz	P
power conditioner type	Utility-interactive	
ASW3000H-S2		
Measure input voltage (V)	380.1	
Measured input power (W)	-12.7	
ASW3680H-S2		
Measure input voltage (V)	380.1	
Measured input power (W)	-12.7	
ASW4000H-S2		
Measure input voltage (V)	380.1	
Measured input power (W)	-13.0	
ASW5000H-S2		
Measure input voltage (V)	380.2	
Measured input power (W)	-13.1	
ASW6000H-S2		
Measure input voltage (V)	380.1	
Measured input power (W)	-13.7	
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	
ASW3000H-S2		
Measure input voltage (V)	380.2	
Measured input power (W)	-12.7	
ASW36800H-S2		
Measure input voltage (V)	380.1	
Measured input power (W)	-12.7	
ASW4000H-S2		
Measure input voltage (V)	380.1	
Measured input power (W)	-12.5	
ASW5000H-S2		
Measure input voltage (V)	380.2	
Measured input power (W)	-12.6	
ASW6000H-S2		
Measure input voltage (V)	380.1	
Measured input power (W)	-12.6	
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	
ASW3000H-S2		
Measure input voltage (V)	229.6	
Measured input power (W)	-19.9	
ASW3680H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.8	
ASW4000H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.8	
ASW5000H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.7	
ASW6000H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.8	
Remark: Standby loss is measured when the power conditioner works at rated output voltage and in standby mode.		

TABLE	Standby loss for 60 Hz	P
power conditioner type	Utility-interactive	
ASW3000H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.7	
ASW3680H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.8	
ASW4000H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.6	
ASW5000H-S2		
Measure input voltage (V)	229.8	
Measured input power (W)	-19.6	
ASW6000H-S2		
Measure input voltage (V)	229.7	
Measured input power (W)	-19.8	
Remark: Standby loss is measured when the power conditioner works at rated output voltage and in standby mode.		

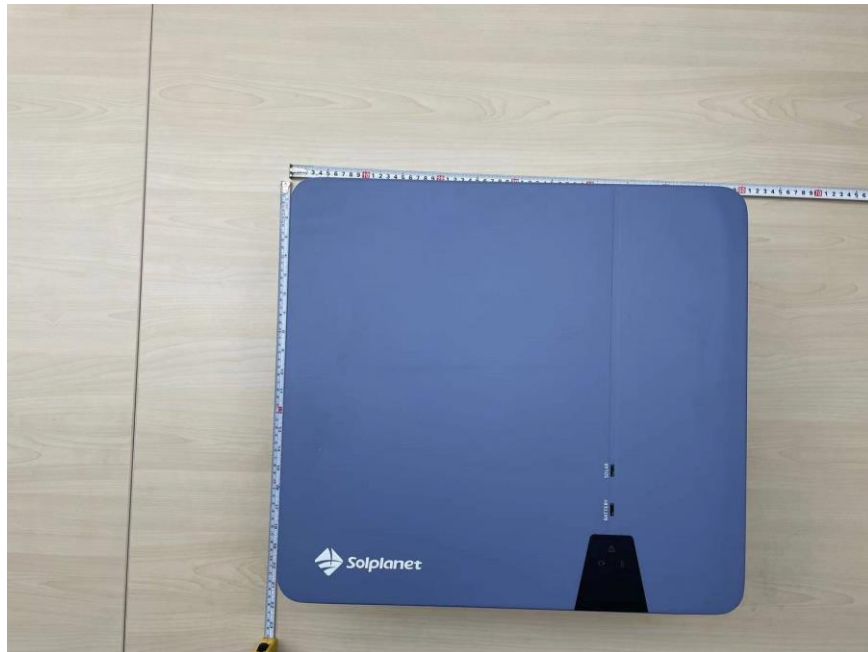
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ATTACHMENT I

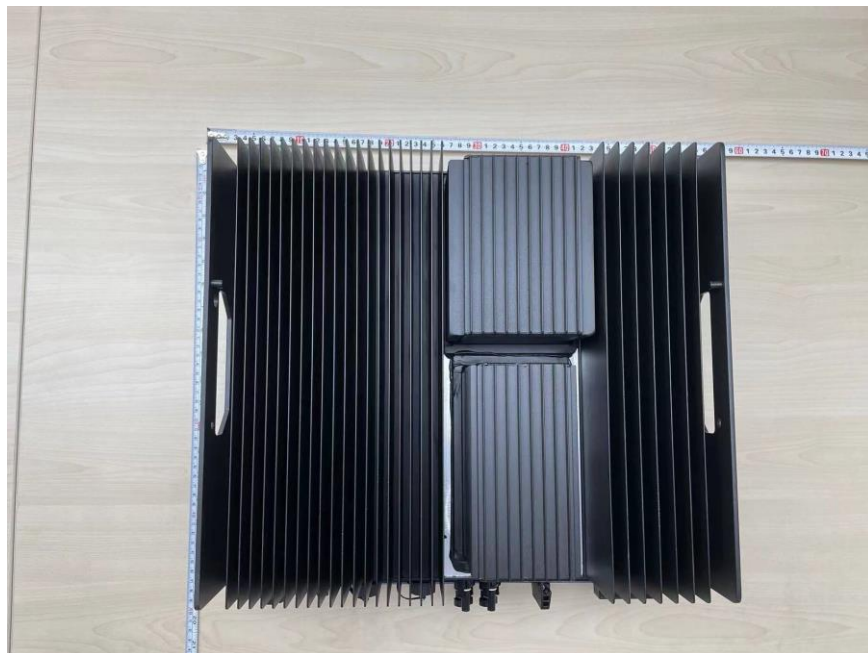
(Pictures of the EUT and Electrical Schemes)

1 PICTURES

Front view



Back Side view



Connection interface view



Top Side view



Internal view



Serial Number and Software Version

13:26



PB60000112250003

DC

→ PV1	451.2 V
	0.2 A
→ PV2	450.2 V
	0.1 A

Inverter SN PB60000112250003

E-today 13.2 kWh

E-total 424.0 kWh

H-total 137 h

Power 0 W

Power factor -

Error code 0

Last time of update 2022-07-29 13:26:23

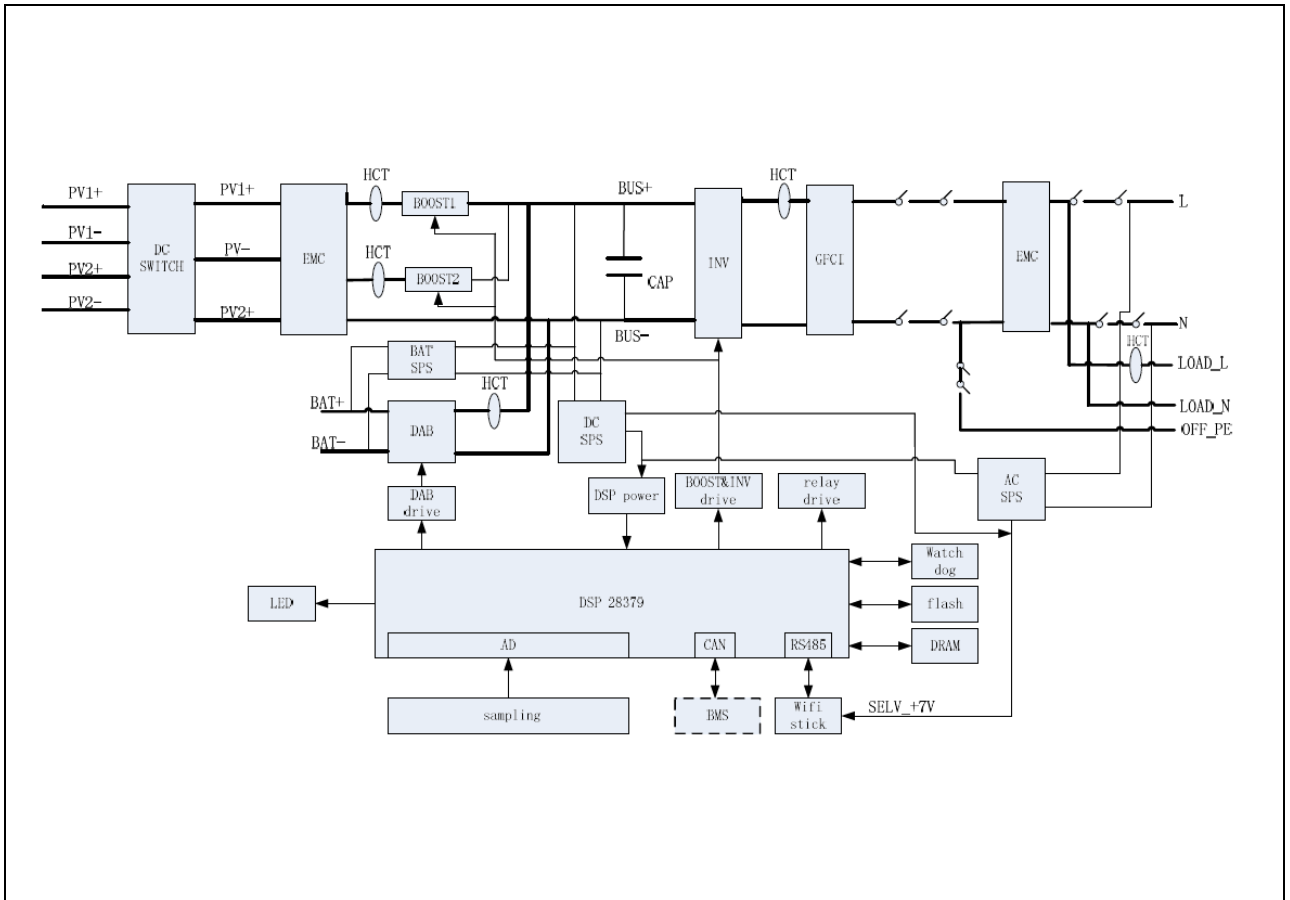
50HZ

Master: V610-02003-01 Slave: V610-60009-00 Safety: V610-10008-03

60HZ

Master: V610-02003-03 Slave: V610-60009-00 Safety: V610-10008-05

2 ELECTRICAL SCHEMES



ATTACHMENT II

(Testing information)

1 TESTING CIRCUIT

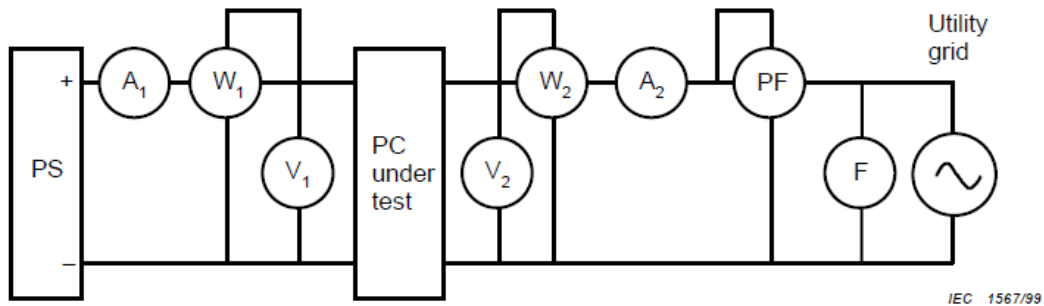


Figure 1b – Utility-interactive type

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 – 1800 Vdc
b) Current range	0 – 30 A
2) AC power source	
a) Output wiring	Three phase
b) Output capacity	30 kVA
c) Output voltage	0 - 300 Vrms
d) Output frequency	30 - 100 Hz
e) Voltage stability	/
f) Output voltage distortion	/
3) Digital meter	
a) Voltage range	0 – 1000 Vdc, 0 – 1000 Va.c.
b) Current range	0 – 10 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) Waveform recorder	
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.