Manufacture's Declaration

Confirmation of Compliance with the Requirements of Engineering Recommendation G98/1

AISWEI New Energy Technology (Jiangsu) Co., Ltd. hereby confirms that the inverter types listed below table meet the requirements of Engineering Recommendation G98/1.

Manufacturer's reference number	ASW3000-S ASW3680-S		
Micro-generator technology	Photovoltaic Inverter		
Manufacturer name	AISWEI New Energy Technology (Jiangsu) Co., Ltd		
Brand	Solplanet		
Adress	No.198 Xiangyang Road, 215011 Suzhou, China		
Tel	+86 512 6937 0998	**Fax**	+86 512 6937 3159
E:mail	service.eu@aiswei-tech.com	**Web Site**	www.aiswei-tech.com

Registered Capacity	**Connection Option**	
	3.0	kW single phase, single, split or three phase system (ASW3000-S)
	3.68	kW single phase, single, split or three phase system (ASW3680-S)
	N/A	kW three phase
	N/A	kW two phases in three phase system
	N/A	kW two phases split phase system

Manufacturer Type Test declaration.
I certify that all products supplied by the company with the above Fully Type Tested reference number will be manufactured and tested to ensure that they perform as stated in this document, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of EREC G98.

Signed	Winston Wu	**On behalf of**	AISWEI New Energy Technology (Jiangsu) Co., Ltd

Test Results

Operating Range

This test should be carried out as specified in EN 50438 D.3.1.
Active Power shall be recorded every second. The tests will verify that the Micro-generator can operate within the required ranges for the specified period of time.
The Interface Protection shall be disabled during the tests.
In case of a PV Micro-generator the PV primary source may be replaced by a DC source.
In case of a full converter Micro-generator (eg wind) the primary source and the prime mover Inverter/rectifier may be replaced by a DC source.
In case of a DFIG Micro-generator the mechanical drive system may be replaced by a test bench motor.

Test sequence	Voltage[V]	Frequency[Hz]	Output power[W]	Primary power source[W]
Test 1	195.5	47.5	3097.0	4048.0
Test 2	253.0	51.5	3667.3	4048.0
Test 3	253.0	52.0	3670.2	4048.0

Power quality

Harmonics

These tests should be carried out as specified in BS EN 61000-3-2. The chosen test should be undertaken with a fixed source of energy at two power levels a) between 45 and 55% and b) at 100% of Registered Capacity. The test requirements are specified in Annex A1 A.1.3.1 (Inverter connected) or Annex A2 A.2.3.1 (Synchronous).

Micro-generator tested to BS EN 61000-3-2

Micro-generator rating per phase (rpp)				kW		
Harmonic	At 45-55% of Registered Capacity		100% of Registered Capacity			
	Measured Value (MV) in Amps	%	Measured Value (MV) in Amps	%	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.015	0.092	0.021	0.132	1.080	
3	0.022	0.139	0.027	0.169	2.300	
4	0.007	0.044	0.008	0.052	0.430	
5	0.011	0.068	0.056	0.354	1.140	
6	0.009	0.056	0.007	0.046	0.300	
7	0.050	0.314	0.047	0.294	0.770	
8	0.009	0.058	0.006	0.036	0.230	
9	0.067	0.423	0.096	0.603	0.400	
10	0.013	0.082	0.007	0.047	0.184	
11	0.063	0.397	0.100	0.630	0.330	
12	0.016	0.101	0.011	0.067	0.153	
13	0.047	0.296	0.088	0.553	0.210	
14	0.016	0.098	0.010	0.062	0.131	
15	0.036	0.228	0.070	0.442	0.150	
16	0.016	0.104	0.013	0.081	0.115	
17	0.025	0.155	0.036	0.225	0.132	
18	0.012	0.078	0.011	0.071	0.102	

19	0.015	0.093	0.028	0.177	0.118	
20	0.011	0.070	0.010	0.064	0.092	
21	0.013	0.085	0.020	0.126	0.107	0.160
22	0.010	0.064	0.009	0.057	0.084	
23	0.014	0.088	0.018	0.112	0.098	0.147
24	0.010	0.063	0.006	0.038	0.077	
25	0.012	0.074	0.017	0.105	0.090	0.135
26	0.007	0.041	0.005	0.034	0.071	
27	0.009	0.058	0.016	0.098	0.083	0.124
28	0.006	0.040	0.006	0.037	0.066	
29	0.007	0.046	0.011	0.068	0.078	0.117
30	0.005	0.035	0.005	0.030	0.061	
31	0.007	0.044	0.011	0.071	0.073	0.109
32	0.005	0.035	0.004	0.028	0.058	
33	0.007	0.044	0.013	0.081	0.068	0.102
34	0.005	0.033	0.003	0.020	0.054	
35	0.005	0.033	0.010	0.063	0.064	0.096
36	0.005	0.032	0.004	0.026	0.051	
37	0.005	0.033	0.011	0.067	0.061	0.091
38	0.005	0.030	0.004	0.022	0.048	
39	0.004	0.024	0.009	0.057	0.058	0.087
40	0.005	0.030	0.003	0.021	0.046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below.

Voltage fluctuations and Flicker

These tests should be undertaken in accordance with EREC G98 Annex A1 A.1.3.3 (Inverter connected) or Annex A2 A.2.3.3 (Synchronous).

	Starting			Stopping			Running	
	dmax	dc	d(t)	dmax	dc	d(t)	Pst	Plt 2 hours
Measured Values at test impedance	0.76%	0.51%	0.00%	0.95%	0.80%	0.00%	0.247	0.194
Normalised to standard impedance	0.76%	0.51%	0.00%	0.95%	0.80%	0.00%	0.247	0.194
Normalised to required maximum impedance	2.51%	1.68%	0.00%	3.14%	2.64%	0.00%	0.82	0.64
Limits set under BS EN 61000-3-11	4%	3.3%	3.3%	4%	3.3%	3.3%	1.0	0.65

Test Impedance	R	0.4	Ω	X	0.25	Ω
Standard Impedance	R	0.24 * 0.4 ^		X	0.15 * 0.25 ^	
Maximum Impedance	R	1.32	Ω	X	1.32	Ω

*Applies to three phase and split single phase Micro-generators.

^ Applies to single phase Micro-generators and Micro-generators using two phases on a three phase system.

AISWEI New Energy Technology (Jiangsu) Co., Ltd.
No. 198 Xiangyang Road • 215011 Suzhou • China
Tel: +86 512 6937 0998
Fax: +86 512 6937 3159

For voltage change and flicker measurements the following formula is to be used to convert the measured values to the normalised values where the power factor of the generation output is 0.98 or above.
Normalised value = Measured value*reference source resistance/measured source resistance at test point.
Single phase units reference source resistance is 0.4 Ω
Two phase units in a three phase system reference source resistance is 0.4 Ω.
Two phase units in a split phase system reference source resistance is 0.24 Ω.
Three phase units reference source resistance is 0.24 Ω.
Where the power factor of the output is under 0.98 then the X to R ratio of the test impedance should be close to that of the Standard Impedance.
The stopping test should be a trip from full load operation.
The duration of these tests need to conform to the particular requirements set out in the testing notes for the technology under test. Dates and location of the test need to be noted below.

Test start date	2020.10.11	Test end date	2020.10.11
Test location	Audix Technology (Wujiang) Co., Ltd.		

DC injection

This test should be carried out in accordance with EN 50438 Annex D.3.10

Test power level	20%Pn	50%Pn	75%Pn	100%Pn
Measured value in Amps	0.026	0.039	0.024	0.008
As % of rated AC current	0.17%	0.24%	0.15%	0.05%
Limit	0.25%	0.25%	0.25%	0.25%

Power factor

This test shall be carried out in accordance with EN 50538 Annex D.3.4.1 but with nominal voltage -6% and +10%.
Voltage to be maintained within ±1.5% of the stated level during the test.

Test Voltage level	216.2 V	230 V	253 V
20% of Registered Capacity	0.9988	0.9983	0.9974
50% of Registered Capacity	0.9999	0.9998	0.9997
75% of Registered Capacity	0.9999	0.9999	0.9999
100% of Registered Capacity	0.9999	0.9999	0.9999
Limit	>0.95	>0.95	>0.95

Protection

Frequency tests

These tests should be carried out in accordance with EN 50438 Annex D.2.4 and the notes in EREC G98 Annex A1 A.1.2.3 (Inverter connected) or Annex A2 A.2.2.3 (Synchronous)

Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency/time	Confirm no trip
U/F Stage 1	47.5Hz	20.0s	47.49Hz	20.01s	47.7Hz/30s	No trip
U/F Stage 2	47.0Hz	0.5s	46.99Hz	0.58s	47.2Hz/19.5s	No trip
					46.8Hz/0.45s	No trip

O/F Stage 1	52.0Hz	0.5s	52.01Hz	0.56s	51.8Hz/120s	No trip
					52.2Hz/0.45s	No trip

Note. For frequency trip tests the frequency required to trip is the setting ± 0.1 Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The "No trip tests" need to be carried out at the setting ± 0.2 Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Voltage tests

These tests should be carried out in accordance with EN 50438 Annex D.2.3 and the notes in EREC G98 Annex A1 A.1.2.2 (Inverter connected) or Annex A2 A.2.2.2 (Synchronous)

Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage/time	Confirm no trip
U/V Stage 1	184V	2.5s	183.9V	2.56s	188V/5.0s	No trip
					180V/2.45s	No trip
O/V Stage 1	262.2V	1.0s	262.9V	1.06s	258.2V/5.0s	No trip
O/V Stage 2	273.7V	0.5s	275.0V	0.58s	269.7V/0.95s	No trip
					277.7V/0.45s	No trip

Note for Voltage tests the Voltage required to trip is the setting ±3.45 V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4 V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

Loss of Mains test

For PV Inverters shall be tested in accordance with BS EN 62116. Other Inverters should be tested in accordance with EN 50438 Annex D.2.5 at 10%, 55% and 100% of rated power.

For Inverters tested to BS EN 62116 the following sub set of tests should be recorded in the following table.

Test Power and imbalance	33% -5% Q Test 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5 s	0.214s	0.223s	0.366s	0.294s	0.325s	0.405s

Frequency change, Vector Shift Stability test

This test should be carried out in accordance with EREC G98 Annex A1 A.1.2.6 (Inverter connected) or Annex A2 A.2.2.6 (Synchronous).

	Start Frequency	Change	Confirm no trip
Positive Vector Shift	49.0Hz	+50 degrees	No trip
Negative Vector Shift	50.0Hz	-50 degrees	No trip

Frequency change, RoCoF Stability test

The requirement is specified in section 11.3, test procedure in Annex A.1.2.6 (Inverter connected) or Annex A2 A.2.2.6 (Synchronous).

AISWEI New Energy Technology (Jiangsu) Co., Ltd.
No. 198 Xiangyang Road • 215011 Suzhou • China
Tel: +86 512 6937 0998
Fax: +86 512 6937 3159

Ramp range	Test frequency ramp:	Test Duration	Confirm no trip
49.0 Hz to 51.0 Hz	+ 0.95Hzs^{-1}	2.1s	No trip
51.0 Hz to 49.0 Hz	- 0.95Hzs^{-1}	2.1s	No trip

Limited Frequency Sensitive Mode

Overfrequency test This test should be carried out in accordance with EN 50438 Annex D.3.3 Power response to over- frequency. The test should be carried out using the specific threshold frequency of 50.4 Hz and Droop of 10%				
Test sequence at Registered Capacity >80%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00 Hz ±0.01 Hz	3667.5W	50.00Hz	4048.0W	-
Step b) 50.45 Hz ±0.05 Hz	3562.1W	50.45Hz	4048.0W	-
Step c) 50.70 Hz ±0.10 Hz	3379.1W	50.70Hz	4048.0W	-
Step d) 51.15 Hz ±0.05 Hz	3051.8W	51.15Hz	4048.0W	-
Step e) 50.70 Hz ±0.10 Hz	3379.6W	50.70Hz	4048.0W	-
Step f) 50.45 Hz ±0.05 Hz	3563.8W	50.45Hz	4048.0W	-
Step g) 50.00 Hz ±0.01 Hz	3660.8W	50.00Hz	4048.0W	-
Test sequence at Registered Capacity 40%-60%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00 Hz ±0.01 Hz	1845.0W	50.00Hz	1910.0W	-
Step b) 50.45 Hz ±0.05 Hz	1837.8W	50.45Hz	1910.0W	-
Step c) 50.70 Hz ±0.10 Hz	1734.4W	50.70Hz	1910.0W	-
Step d) 51.15 Hz ±0.05 Hz	1561.7W	51.15Hz	1910.0W	-
Step e) 50.70 Hz ±0.10 Hz	1722.3W	50.70Hz	4048.0W	-
Step f) 50.45 Hz ±0.05 Hz	1816.3W	50.45Hz	4048.0W	-
Step g) 50.00 Hz ±0.01 Hz	3657.4W	50.00Hz	4048.0W	9.53%Pn/min
Steps as defined in EN 50438				

Power output with falling frequency test

This test should be carried out in accordance with EN 50438 Annex D.3.2 active power feed-in at under-frequency.			
	Measured Active Power Output	Frequency	Primary power source
Test a) 50 Hz ± 0.01 Hz	3667.4W	50.00Hz	4048.0W
Test b) Point between 49.5 Hz and 49.6 Hz	3660.5W	49.60Hz	4048.0W
Test c) Point between 47.5 Hz and 47.6 Hz	3654.6W	47.60Hz	4048.0W
NOTE: The operating point in Test (b) and (c) shall be maintained for at least 5 minutes			

Re-connection timer

Test should prove that the reconnection sequence starts after a minimum delay of 20 seconds for restoration of voltage

and frequency to within the stage 1 settings of table 2.					
Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 2.			
60s	65.2s	At 266.2V	At 180.0V	At 47.4Hz	At 52.1Hz
Confirmation that the Micro-generator does not re-connect.		No reconnect	No reconnect	No reconnect	No reconnect

Fault level contribution

These tests shall be carried out in accordance with EREC G98 Annex A1 A.1.3.5 (Inverter connected) and Annex A2 A.2.3.4 (Synchronous).					
For machines with electro-magnetic output			For Inverter output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	-	20ms	38.0V	18.4A
Initial Value of aperiodic current	A	-	100ms	36.7V	10.7A
Initial symmetrical short-circuit current*	I_k	-	250ms	6.8V	2.3A
Decaying (aperiodic) component of short circuit current*	i_{DC}	-	500ms	3.1V	1.5A
Reactance/Resistance Ratio of source*	X/R	-	Time to trip	0.037	In seconds
For rotating machines and linear piston machines the test should produce a 0 s – 2 s plot of the short circuit current as seen at the Micro-generator terminals. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot					

Logic Interface

Yes.

Self-Monitoring solid state switching

Not applicable as electro-mechanical relays are used.

Additional comments

The type ASW3000-S is similar to ASW3680-S in circuit and construction except for the output rating of current and power. The test result can refer to ASW3680-S.