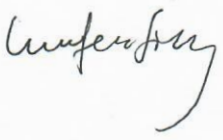
G59/3 TYPE TEST VERIFICATION REPORT

Type Tested reference number	YC500I
Generating Unit technology	Grid-connected Microinverter
System supplier name	ALTENERGY POWER SYSTEM INC.
Address	No.1 Yatai Road,Jiaxing 314050 Zhejiang Province P.R. China

Tel	+86-573-83986967	Fax	+86-573-83986966
E:mail	info@altenergy-power.com	Web site	https://apsystems.com/

Maximum export capacity, use separate sheet if more than one connection option.	0.5 per unit	kW single phase, single, split or three phase system
		kW three phase
		kW two phases in three phase system
		kW two phases split phase system

System supplier declaration. - I certify on behalf of the company named above as a supplier of a **Generating Unit**, that all products supplied by the company with the above Type Test 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 G59/3.

Signed		On behalf of	ALTENERGY POWER SYSTEM INC.

Power Quality. Harmonics. Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)			6.0*	kVA	Harmonic % =Measured Value (Amps) x 23/rating per phase (kVA)	
Harmonic	At 45-55% of rated output		100% of rated output		Limit in BS EN 61000-3-12	
	Measured Value MV in Amps	%	Measured Value MV in Amps	%	1 phase	3 phase
2	0.017	0.129	0.008	0.032	8%	8%
3	0.096	0.708	0.147	0.543	21.6%	Not stated
4	0.006	0.051	0.004	0.014	4%	4%
5	0.062	0.457	0.107	0.397	10.7%	10.7%
6	0.004	0.03	0.003	0.011	2.67%	2.67%
7	0.042	0.313	0.084	0.31	7.2%	7.2%
8	0.003	0.022	0.002	0.01	2%	2%
9	0.054	0.402	0.101	0.375	3.8%	Not stated
10	0.002	0.021	0.002	0.009	1.6%	1.6%
11	0.076	0.563	0.156	0.577	3.1%	3.1%
12	0.002	0.02	0.002	0.007	1.33%	1.33%
13	0.092	0.677	0.18	0.665	2%	2%
THD		2.052		1.89	23%	13%
PWHD		6.984		6.425	23%	22%
*system size is scalable;this is the system size tesed(12 units)						

Power Quality. Harmonics. Generating Unit tested to BS EN 61000-3-2					
Generator Unit rating per phase (rpp)		3	kW		
Harmonic	At 45-55% of rated output	100% of rated output			
	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	0.01	0.017	1.080	
3	0.043	0.096	2.300	
4	0.004	0.006	0.430	
5	0.018	0.062	1.140	
6	0.003	0.004	0.300	
7	0.015	0.042	0.770	
8	0.002	0.003	0.230	
9	0.02	0.054	0.400	
10	0.002	0.002	0.184	
11	0.039	0.076	0.330	
12	0.002	0.002	0.153	
13	0.046	0.092	0.210	
14	0.001	0.002	0.131	
15	0.054	0.109	0.150	
16	0.001	0.001	0.115	
17	0.048	0.089	0.132	
18	0.001	0.001	0.102	
19	0.044	0.085	0.118	
20	0.001	0.001	0.092	
21	0.039	0.076	0.107	0.160
22	0.001	0.001	0.084	
23	0.032	0.057	0.098	0.147
24	0.001	0.001	0.077	
25	0.024	0.048	0.090	0.135
26	0.001	0.001	0.071	
27	0.021	0.045	0.083	0.124
28	0.001	0.001	0.066	
29	0.017	0.034	0.078	0.117
30	0.001	0.001	0.061	

31	0.016	0.031	0.073	0.109
32	0.001	0.001	0.058	
33	0.017	0.035	0.068	0.102
34	0.001	0.001	0.054	
35	0.011	0.027	0.064	0.096
36	0.001	0.001	0.051	
37	0.003	0.008	0.061	0.091
38	0.001	0.001	0.048	
39	0.002	0.006	0.058	0.087
40	0.001	0.001	0.046	

Power Quality. Voltage fluctuations and Flicker. Tested to BS EN 61000-3-11								
	Starting			Stopping			Running	
	d max	d c	d(t)	d max	d c	d(t)	P st	P lt 2 hours
Measured Values at test impedance	0.88%	0.62%	0	0.88%	0.61%	0	0.15	0.15
Normalised to standard impedance	0.88%	0.62%	0	0.88%	0.61%	0	0.15	0.15
Normalised to required maximum impedance	0.88%	0.62%	0	0.88%	0.61%	0	0.15	0.15
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	Xl	0.25	Ω	
Standard Impedance	R	0.24 * 0.4 ^		Ω	Xl	0.15 * 0.25 ^	Ω	
Maximum Impedance	R	0.4		Ω	Xl	0.25	Ω	

Power quality. DC injection.				
Test power level	10%	55%	100%	
Recorded value in Amps	0.002	0.004	0.012	
as % of rated AC current	0.01%	0.01%	0.04%	
Limit	0.25%	0.25%	0.25%	

Power Quality. Power factor.				
	216.2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within + or – 1.5% of the stated level during the test.
Measured value	0.99	0.99	0.99	
Limit	>0.95	>0.95	>0.95	

Protection. Frequency tests						
Function	Setting		Trip test		"No-trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
O/F stage 1	51.5Hz	90s	51.54Hz	90.3s	51.3Hz 95s	Confirmed
O/F stage 2	52Hz	0.5s	51.95Hz	0.55s	51.8Hz 89.98s	Confirmed
					52.2Hz 0.48s	Confirmed
U/F stage 1	47.5Hz	20s	47.51Hz	20.25s	47.7Hz 25s	Confirmed
U/F stage 2	47Hz	0.5s	47.02Hz	0.61s	47.2Hz 19.98s	Confirmed
					46.8 Hz 0.48s	Confirmed

Protection. Voltage tests						
Function	Setting		Trip test		"No trip-tests" All phases at same voltage	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
O/V stage 1	262.2V	1.0s	262V	1.08s	258.2V 2.0s	Confirmed
O/V stage 2	273.7V	0.5s	274V	0.51s	269.7V 0.98s	Confirmed
					277.7V 0.48s	Confirmed
U/V stage 1	200.1V	2.5s	200V	2.84s	204.1V 3.5s	Confirmed
U/V stage 2	184V	0.5s	184V	0.51	188V 2.48s	Confirmed
					180v 0.48s	Confirmed

a) Protection. Loss of Mains test and single phase test. The tests are to be To be carried out at three output power levels plus or minus 5%, an alternative for inverter connected Generating Units can be used instead.

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Test Power	10%	55%	100%	10%	55%	100%
Balancing load on islanded network	95% of **Generating Unit** output	95% of **Generating Unit** output	95% of **Generating Unit** output	105% of **Generating Unit** output	105% of **Generating Unit** output	105% of **Generating Unit** output
Trip time. Limit is 0.5s	0.265s	0.252s	0.199s	0.266s	0.296s	0.460s

b) Protection. Frequency change, Stability test				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+9 degrees		Confirmed
Negative Vector Shift	50.5Hz	- 9 degrees		Confirmed
Positive Frequency drift	49.5Hz	$+0.19Hzs^{-1}$	51.5Hz	Confirmed
Negative Frequency drift	50.5Hz	$-0.19Hzs^{-1}$	47.5Hz	Confirmed

c) **Protection. Re-connection timer**.					
Time delay setting (s)	Measured delay (s)	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 10.5.7.1.			
30	31.5s	At 266.2V	At 196.1V	At 47.4Hz	At 51.6Hz
Confirmation that the **Generating Unit** does not re-connect		Confirmed	Confirmed	Confirmed	Confirmed

d) Fault level contribution.					
For machines with electro-magnetic output			For Inverter output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p		20ms	45.74	5.98
Initial Value of aperiodic current	A		100ms	34.47	6.36
Initial symmetrical short-circuit current*	I_k		250ms		
Decaying (aperiodic) component of short circuit current*	i_{DC}		500ms		
Reactance/Resistance Ratio of source*	$^X/_R$		Time to trip	106.4ms	In seconds

e) Self Monitoring solid state switching	Yes/NA
It has been verified that in the event of the solid state switching device failing to disconnect the **Generating Unit**, the voltage on the output side of the switching device is reduced to a value below 50 Volts within 0.5 seconds	NA

Additional comments