

## Certificate

## UK-G59 issue 3


This Type Test sheet shall be used to record the results of the type testing of Generating unit between 16A per phase and 17kW per phase maximum output at 230V(17kW limit single phase, 34kW limit split phase, 50kW limit 3 phase)  
It include the Generating Units supplier declaration of compliance with the requirements of Engineering Recommendation G59/3

Type Tested reference number	Evershine TLC6000 Evershine TLC5000 Evershine TLC4000		
Generating Unit technology	Photovoltaic Inverter		
System Supplier name	Jiangsu Zeversolar New Energy CO., LTD.		
Address	No. 198 Xiangyang Road, Suzhou, 215011 China		
Tel	+86 512 6937 0998	Fax	+86 512 6937 0630
E:mail	<a href="mailto:service.china@zeversolar.com">service.china@zeversolar.com</a>	Web site	<a href="http://www.zeversolar.com">www.zeversolar.com</a>

Maximum export capacity	Connection Option	
	N/A	kW single phase, single, split or three phase system
	6.0	kW three phase (Evershine TLC6000)
	5.5	kW three phase (Evershine TLC5000)
	4.4	kW three phase (Evershine TLC4000)
	N/A	kW two phases in three phase system
N/A	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	Jiangsu Zeversolar New Energy CO., LTD.
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The result of the G59/3 tests are summarized in this certificate. The models TLC4000 and TLC5000 are same as TLC6000 on hardware except that the output power was decreased. The function was achieved by software. Zeversolar declares that the units installed in UK market and set for G59/3 operations are characterized by the following features:

- The internal specification and parameters are set to be compliant with: Engineering Recommendation G59 issue 3, September 2013
- These parameters can't be changed by user, an installer or by any person other than Zeversolar (password protected)
- The function that the output power can be achieved 110%Pn for TLC5000 and TLC 4000 is disabled as a default.

## POWER QUALITY

## Harmonic current emissions as per BS EN 61000-3-2

These tests should be carried out as specified in BS EN61000-3-2. The test should be undertaken with a fixed source of energy at two power level a) between 45 and 55% and b) at 100% of maximum export capacity. The result need to comply with the limits of table 1 of BS EN 61000-3-2.

The Generating Units meeting the requirement of BS EN 61000-3-2 will need no further assessment with regards to harmonics according to G59/3.

SSEG rating per phase (rpp)		2.0	KW		
Harmonic	At 45-55% of rated output	100% of rated output		NV=MV*3.68/rpp	
	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	0.0114	0.0066		1.080	
3	0.0123	0.0213		2.300	
4	0.0058	0.0074		0.430	
5	0.0812	0.0986		1.140	
6	0.0025	0.0050		0.300	
7	0.0509	0.0594		0.770	
8	0.0199	0.0211		0.230	
9	0.0035	0.0048		0.400	
10	0.0187	0.0226		0.184	
11	0.0299	0.0427		0.330	
12	0.0017	0.0017		0.153	
13	0.0172	0.0322		0.210	
14	0.0062	0.0061		0.131	
15	0.0003	0.0016		0.150	
16	0.0026	0.0021		0.115	
17	0.0126	0.0279		0.132	
18	0.0010	0.0022		0.102	
19	0.0069	0.0224		0.118	
20	0.0018	0.0014		0.092	
21	0.0020	0.0026		0.107	0.160
22	0.0037	0.0024		0.084	
23	0.0078	0.0251		0.098	0.147
24	0.0012	0.0012		0.077	
25	0.0064	0.0222		0.090	0.135
26	0.0009	0.0011		0.071	
27	0.0011	0.0015		0.083	0.124
28	0.0003	0.0013		0.066	
29	0.0099	0.0226		0.078	0.117
30	0.0017	0.0009		0.061	
31	0.0079	0.0184		0.073	0.109
32	0.0011	0.0023		0.058	

33	0.0007	0.0019	0.068	0.102
34	0.0024	0.0007	0.054	
35	0.0133	0.0182	0.064	0.096
36	0.0018	0.0003	0.051	
37	0.0123	0.0180	0.061	0.091
38	0.0011	0.0006	0.048	
39	0.0014	0.0010	0.058	0.087
40	0.0007	0.0006	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 as per BS EN 61000-3-3

The Generating Units meeting the requirement of BS EN 61000-3-3 can be stated as an alternative and there is no need to specify the maximum supply impedance according to G59/3.

	Starting			Stopping			Running	
	dmax	dc	d(t)	dmax	dc	d(t)	Pst	Plt 2 hours
Measured Values	0.85%	0.32%	0.44%	1.52%	0.32%	0.44%	0.31	0.26
Normalised to standard impedance and 3.68kW for multiple units	1.54%	0.58%	0.81%	2.80%	0.58%	0.81%	0.57	0.48
Limits set under BS EN 61000-3-2	4%	3.3%	3.3% 500ms	4%	3.3%	3.3% 500ms	1.0	0.65
Test start date	2013.12.20			Test end date			2013.12.20	
Test location	Audix Technology (Wujiang) Co., Ltd.							

	DC injection			Power factor *		
	10%	55%	100%	216.2 V	230 V	253 V
Recorded value in Amps	18mA	20mA	20mA	0.995	0.997	0.998
as % of rated AC current	0.20%	0.23%	0.23%	-	-	-
Limit	0.25%	0.25%	0.25%	>0.95	>0.95	>0.95

\* Measured at three voltage levels and at full output. The voltage was maintained within  $\pm 1.5\%$  of the stated level during the test.

## 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	51.5 Hz	90.0s	51.51Hz	90.10s	51.3Hz/95s	No trip
O/F Stage 2	52.0 Hz	0.5s	52.01Hz	0.51s	51.8Hz/89.98s	No trip

					52.2Hz/0.48s	No trip
U/F Stage 1	47.5Hz	20s	47.50Hz	20.10s	47.7Hz/25s	No trip
U/F Stage 2	47.0Hz	0.5s	47.01Hz	0.51s	47.2Hz/19.98s	No trip
					46.8Hz/0.48s	No trip

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

### Voltage tests

Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage/time	Confirm no trip
O/V Stage 1 L1	262.2V	1.0s	261.3V	1.008s	258.2V/2.0s	No trip
O/V Stage 1 L2	262.2V	1.0s	262.9V	1.016s	258.2V/2.0s	No trip
O/V Stage 1 L3	262.2V	1.0s	262.7V	1.026s	258.2V/2.0s	No trip
O/V Stage 2 L1	273.7V	0.5s	272.7V	0.514s	269.7V/0.98s	No trip
O/V Stage 2 L2	273.7V	0.5s	273.6V	0.522s	269.7V/0.98s	No trip
O/V Stage 2 L3	273.7V	0.5s	274.3V	0.504s	269.7V/0.98s	No trip
L1					277.7V/0.48s	No trip
L2					277.7V/0.48s	No trip
L3					277.7V/0.48s	No trip
U/V Stage 1 L1	200.1V	2.5s	201.5V	2.515s	204.1V/3.5s	No trip
U/V Stage 1 L2	200.1V	2.5s	200.9V	2.525s	204.1V/3.5s	No trip
U/V Stage 1 L3	200.1V	2.5s	202.3V	2.515s	204.1V/3.5s	No trip
U/V Stage 2 L1	184.0V	0.5s	182.4V	0.513s	188V/2.48s	No trip
U/V Stage 2 L2	184.0V	0.5s	183.8V	0.514s	188V/2.48s	No trip
U/V Stage 2 L3	184.0V	0.5s	184.5V	0.512s	188V/2.48s	No trip
L1					180V/0.48s	No trip
L2					180V/0.48s	No trip
L3					180V/0.48s	No trip

Note. For Voltage tests the Voltage required to trip is the setting  $\pm 3.45$ 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

±4V 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

Note as an alternative, inverters can be tested to BS EN 62116. The following sub set of tests should be recorded in the following table.

Test Power	33%	66%	100%	33%	66%	100%
Balancing load on islanded network	33%	66%	100%	33%	66%	100%
	-5% Q Test 22	-5% Q Test 12	-5% P Test 5	+5% Q Test 31	+5% Q Test 21	+5% P Test 10
Trip time. Limit is 0.5 seconds	0.48s	0.42s	0.37s	0.38s	0.39s	0.28s
Single phase test for multi phase Generating units. Confirm that when generating in parallel with a network operating at around 50Hz with no network disturbance, that the removal of a single phase connection to the Generating Unit, with the remaining phases connected causes a disconnection of the generating unit within a maximum of 1s.						
	Confirm Trip		Confirm Trip		Confirm Trip	
Ph1 removed	0.41s	Ph2 removed	0.42s	Ph3 removed	0.39s	

### Frequency change, Stability test

	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+9 degrees		No trip
Negative Vector Shift	50.5Hz	- 9 degrees		No trip
Positive Frequency drift	49.5Hz	+0.19Hz/sec	51.5Hz	No trip
Negative Frequency drift	50.5Hz	-0.19Hz/sec	47.5Hz	No trip

### 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 10.5.7.1.

Time delay setting	Measured delay	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 10.5.7.1.			
30s	35s	At 266.2V	At 196.1V	At 47.4Hz	At 51.6Hz
Confirmation that the SSEG does not reconnect.		No reconnect	No reconnect	No reconnect	No reconnect

## 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	96V	3.182A
Initial Value of aperiodic current	A	-	100ms	31V	1.496A
Initial symmetrical short-circuit current*	$I_k$	-	250ms	31V	1.037A

Decaying (aperiodic) component of short circuit current*	$i_{DC}$	-	500ms	29V	0.8A
Reactance/Resistance Ratio of source*	X/R	-	Time to trip	0.009	In seconds
<p>For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals.</p> <p>*Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.</p>					

## SELF-MONITORING SOLID STATE SWITCHING

Not applicable as electro-mechanical relays are used.