

## ER G59/3 TYPE TEST SHEET

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 requirements of Engineering Recommendation G59/3

<b>Type Tested reference number</b>	Growatt 20000UE		
<b>Generating unit technology</b>	Photovoltaic inverter		
<b>System Supplier name</b>	Growatt New Energy CO.,LTD		
<b>Address</b>	1st East & 3rd Floor, Jiayu Industrial Zone, Xibianling,Shangwu Village, Shiyao, Baoan District, Shenzhen,P.R.China		
<b>Tel.</b>	+86 755 2951 5888	<b>Fax</b>	+86 755 2747 2131
<b>E:mail</b>	info@ginverter.com	<b>Web site</b>	<a href="http://www.ginverter.com">www.ginverter.com</a>

<b>Maximum export capacity</b>	<b>Connection Option</b>		
	N/A	kW single phase, single, split or three phase system	
	20	kW three phase	
	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.

<b>Signed</b>	<i>James Wang</i>	<b>On behalf of</b>	Growatt New Energy CO.,LTD
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Note that testing can be done by the manufacturer of an individual component, by an external test house, or by the supplier of the complete system, or any combination of them as appropriate. Where parts of the testing are carried out by persons or organizations other than the supplier then the supplier shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests.

The family product model is made by the following products:

Growatt 7000UE Growatt 8000UE Growatt 9000UE  
 Growatt 10000UE Growatt 12000UE Growatt 18000UE Growatt 20000UE

The model Growatt 20000UE is as the representative test models in this report.

Power Quality. Harmonics						
Models: Growatt 20000UE					Harmonic %=Measured Value (Amps) × 23/rating per phase (KVA)	
Generating Unit rating per phase(rpp)		20000	KVA			
Harmonic	At 66% of rated output	100% of rated output		Limit BS EN 61000-3-12		
<b>Average harmonic current results – Phase 1</b>						
	Measured Value (MV) in Amps	%	Measured Value (MV) in Amps	%	Limit	Result
1	17.086	100.000	26.504	100.000	-	
2	0.1788	1.046	0.1825	0.689	8.00%	PASS
3	0.0361	0.211	0.02920	0.110	21.60%	PASS
4	0.2241	1.312	0.2273	0.858	4.00%	PASS
5	0.3280	1.919	0.4903	1.850	10.70%	PASS
6	0.0117	0.069	0.0126	0.048	2.67%	PASS
7	0.2000	1.171	0.3107	1.172	7.20%	PASS
8	0.0861	0.504	0.0899	0.339	2.00%	PASS
9	0.0070	0.041	0.0075	0.029	3.80%	PASS
10	0.0202	0.118	0.0223	0.084	1.60%	PASS
11	0.0474	0.278	0.0813	0.307	3.10%	PASS
12	0.0065	0.038	0.0057	0.022	1.33%	PASS
13	0.0324	0.190	0.0384	0.145	2.00%	PASS
THD (At 100% rated output)			2.1%		13%	PASS
<b>Average harmonic current results – Phase 2</b>						
	Measured Value (MV) in Amps	%	Measured Value (MV) in Amps	%	Limit	Result
1	17.065	100.000	26.510	100.000	-	
2	0.0922	0.540	0.1000	0.377	8.00%	PASS
3	0.0158	0.093	0.0157	0.059	21.60%	PASS
4	0.2190	1.283	0.2257	0.851	4.00%	PASS
5	0.3485	2.042	0.5101	1.924	10.70%	PASS
6	0.0089	0.053	0.0083	0.031	2.67%	PASS
7	0.1991	1.166	0.3098	1.169	7.20%	PASS
8	0.0911	0.534	0.0964	0.364	2.00%	PASS
9	0.0102	0.060	0.0101	0.038	3.80%	PASS
10	0.0172	0.10.	0.0213	0.080	1.60%	PASS
11	0.0480	0.281	0.0828	0.312	3.10%	PASS
12	0.0058	0.034	0.0062	0.023	1.33%	PASS

13	0.0323	0.190	0.0408	0.153	2.00%	PASS
THD ( At 100% rated output )			2.2%		13%	PASS
<b>Average harmonic current results – Phase 3</b>						
	Measured Value (MV) in Amps	%	Measured Value (MV) in Amps	%	Limit	Result
1	17.200	100.000	26.677	100.000	-	
2	0.2025	1.178	0.2209	0.828	8.00%	PASS
3	0.0154	0.090	0.0122	0.046	21.60%	PASS
4	0.2379	1.383	0.2417	0.906	4.00%	PASS
5	0.3367	1.958	0.4945	1.854	10.70%	PASS
6	0.0088	0.051	0.0088	0.033	2.67%	PASS
7	0.2068	1.202	0.3183	1.193	7.20%	PASS
8	0.0844	0.491	0.0900	0.337	2.00%	PASS
9	0.0062	0.036	0.0056	0.021	3.80%	PASS
10	0.0208	0.121	0.0236	0.089	1.60%	PASS
11	0.0470	0.273	0.0820	0.307	3.10%	PASS
12	0.0072	0.042	0.0075	0.028	1.33%	PASS
13	0.0313	0.182	0.0403	0.151	2.00%	PASS
THD ( At 100% rated output )			2.2%		13%	PASS

#### Power Quality. Voltage fluctuations and Flicker.

Models: Growatt 20000UE		Measured Values at standard impedance			Limits set under BS EN 61000-3-2
		L1	L2	L3	
<b>Starting</b>	dmax	0.286%	0.135%	0.137%	4%
	dc	0.030%	0.026%	0.028%	3.30%
	d(t)	0.000s	0.000s	0.000s	0.5s
<b>Stopping</b>	dmax	0.286%	0.135%	0.137%	4%
	dc	0.030%	0.026%	0.028%	3.30%
	d(t)	0.000s	0.000s	0.000s	0.5s
<b>Running</b>	Pst	0.028	0.028	0.028	1
	Pit 2	0.028	0.028	0.028	0.65
<b>Test start date</b>		20/02/2013		<b>Test end date</b> 20/02/2013	
<b>Test location</b>		Eurotest Laboratory Srl Via Marconi,23-35020 BRUGING(PD)ITALY			

#### Power quality. DC injection and Power factor.

Test power level		DC injection		
		10%	55%	100%
<b>Test Value</b>	<b>L1</b>	26.5mA	31.2mA	45.3mA
	<b>L2</b>	50.4mA	53.3mA	46.4mA
	<b>L3</b>	37.3mA	-22.1mA	-38.7mA

<b>Limit(0.25% of rated AC current)</b>	65mA	65mA	65mA
<b>Test power level</b>	<b>Power factor</b>		
	216.2Vac	230Vac	253Vac
<b>Test Value</b>	0.997	0.999	0.998
<b>Limit</b>	>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
<b>U/F stage1</b>	47.5Hz	20.05s	47.51Hz	20.05s	47.7Hz/25s	No Trip
<b>U/F stage2</b>	47Hz	0.55s	47.01Hz	0.548s	47.2Hz/19.98s	No Trip
					46.8Hz/0.48s	No Trip
<b>O/F stage1</b>	51.5Hz	90.05s	51.50Hz	90.04s	51.3Hz/95s	No Trip
<b>O/F stage2</b>	52Hz	0.55s	52.00Hz	0.548s	51.8Hz/89.98s	No Trip
					52.2Hz/0.48s	No Trip

Note. For frequency Trip tests the Frequency required to trip is the setting  $\pm 0.1\text{Hz}$ . 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  $\pm 0.2\text{Hz}$  and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

### Protection. Voltage tests.

Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage/time	Confirm no trip
<b>U/V stage1</b>	200.1V	2.55s	200.45V	2.582s	204.1V/3.5s	No Trip
<b>U/V stage2</b>	184V	0.55s	184.5V	0.584s	188V/2.48s	No Trip
					180V/0.48s	No Trip
<b>O/V stage1</b>	262.2V	1.05s	262.38V	1.062s	258.2V/2.0s	No Trip
<b>O/V stage2</b>	273.7V	0.55s	273.9V	0.574s	269.7V/0.98s	No Trip
					277.7V/0.48s	No Trip

Note. For Voltage tests the Voltage required to trip is the setting  $\pm 3.45\text{V}$ . 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  $\pm 4\text{V}$  and for the relevant times as shown in the table above to ensure that the protection will not trip in error.

### Protection. Loss of Mains test

Test Power and imbalance	33%	66%	100%	33%	66%	100%
	-5%Q	-5%Q	-5%P	+5%Q	+5%Q	+5%P
	Test 22	Test 12	Test 5	Test 31	Test 21	Test 10
<b>Trip time. Limit is 0.5s</b>	0.370	0.385	0.402	0.355	0.362	0.390

Protection. Frequency change, Stability test.				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+9degrees	--	No trip
Negative Vector Shift	50.5Hz	-9degrees	--	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

Protection. Re-connection timer.					
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			
20s	35s	At 266.2V	At 196.1V	At 47.4Hz	At 51.6Hz
Confirmation that the Generating Unit does not re-connect		No reconnection	No reconnection	No reconnection	No reconnection

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	9V	68A
Initial Value of aperiodic current	A	--	100ms	8.4V	47.6A
Initial symmetrical short-circuit current	$I_x$	--	250ms	8.2V	35A
Decaying component of short circuit current	$i_{DC}$	--	500ms	7.8V	32A
Reactance/Resistance Ratio of source	X/R	--	Time to trip	20ms	In seconds

For rotating machines and linear piston machines the test should produce a 0s-2s plot of the sort circuit current as seen as the Generating Unit terminals