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

Type Tested reference number	Growatt 4000UE/ Growatt 5000UE/ Growatt 6000UE		
Generating unit technology	Photovoltaic inverter		
System Supplier name	Shenzhen Growatt New Energy Co., Ltd		
Address	1st East & 3rd Floor, Jiayu Industrial Zone, Xibianling,Shangwu Village, Shiyan, Baoan District, Shenzhen,P.R.China		
Tel.	+86 755 2951 5888	**Fax**	+86 755 2747 2131
E:mail	info@ginverter.com	**Web site**	www.ginverter.com

Maximum export capacity	**Connection Option**	
	N/A	kW single phase, single, split or three phase system
	4	kW three phase
	5	kW three phase
	6	kW three phase
	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	James Wang	**On behalf of**	Shenzhen Growatt New Energy Co., Ltd

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 4000UE , Growatt 5000UE , Growatt 6000UE

The model Growatt 6000UE is as the representative test models in this report.

Power Quality. Harmonics						
Models: Growatt 6000UE					Harmonic %=Measured Value (Amps) × 23/rating per phase(KVA)	
Generating Unit rating per phase(rpp)			2	KVA		
Harmonic	At45-55% of rated output		100% of rated output		Limit BS EN 61000-3-2	
Average harmonic current results – Phase 1						
	Measured Value (MV) in Amps	**%**	**Measured Value (MV) in Amps**	**%**	**Limit**	**Result**
2	0.005	0.112	0.006	0.069	1.5	PASS
3	0.015	0.345	0.012	0.131	0.7	PASS
4	0.010	0.225	0.008	0.090	5.5	PASS
5	0.121	2.693	0.150	1.688	6.1	PASS
6	0.004	0.098	0.005	0.053	3.6	PASS
7	0.054	1.203	0.091	1.024	14.4	PASS
8	0.005	0.103	0.004	0.046	4.4	PASS
9	0.005	0.107	0.008	0.091	0.8	PASS
10	0.004	0.088	0.003	0.037	1.1	PASS
11	0.012	0.269	0.022	0.250	3.4	PASS
12	0.002	0.054	0.003	0.036	0.2	PASS
13	0.029	0.643	0.007	0.084	24.9	PASS
THD（At 100% rated output）			2.05%			
Average harmonic current results – Phase 2						
	Measured Value (MV) in Amps	**%**	**Measured Value (MV) in Amps**	**%**	**Limit**	**Result**
2	0.007	0.162	0.008	0.090	1.5	PASS
3	0.007	0.150	0.008	0.086	0.7	PASS
4	0.009	0.206	0.007	0.077	5.5	PASS
5	0.126	2.840	0.153	1.750	6.1	PASS
6	0.002	0.038	0.003	0.034	3.6	PASS
7	0.050	1.128	0.084	0.959	14.4	PASS
8	0.004	0.090	0.004	0.045	4.4	PASS
9	0.002	0.053	0.003	0.038	0.8	PASS
10	0.003	0.078	0.003	0.034	1.1	PASS
11	0.013	0.290	0.025	0.284	3.4	PASS
12	0.001	0.026	0.003	0.032	0.2	PASS
13	0.025	0.575	0.006	0.073	24.9	PASS
THD（At 100% rated output）			2.08%			
Average harmonic current results – Phase 3						
	Measured	**%**	**Measured**	**%**	**Limit**	**Result**

	Value (MV) in Amps		Value (MV) in Amps			
2	0.007	0.162	0.008	0.085	1.5	PASS
3	0.025	0.565	0.022	0.251	0.7	PASS
4	0.002	0.044	0.002	0.021	5.5	PASS
5	0.121	2.707	0.149	1.686	6.1	PASS
6	0.004	0.088	0.004	0.043	3.6	PASS
7	0.052	1.165	0.089	1.004	14.4	PASS
8	0.001	0.032	0.001	0.015	4.4	PASS
9	0.008	0.173	0.012	0.135	0.8	PASS
10	0.001	0.028	0.001	0.016	1.1	PASS
11	0.012	0.267	0.023	0.262	3.4	PASS
12	0.002	0.044	0.002	0.026	0.2	PASS
13	0.028	0.623	0.007	0.078	24.9	PASS
THD（At 100% rated output）			2.04%			

Power Quality. Voltage fluctuations and Flicker.					
Models: Growatt 6000UE		**Measured Values at standard impedance**			**Limits set under BS EN 61000-3-2**
		L1	**L2**	**L3**	
Starting	dmax	0.153%	0.162%	0.129%	4%
	dc	0.026%	0.022%	0.029%	3.30%
	d(t)	0.002s	0.002s	0.002s	0.5s
Stopping	dmax	0.173%	0.151%	0.167%	4%
	dc	0.027%	0.025%	0.029%	3.30%
	d(t)	0.002s	0.002s	0.002s	0.5s
Running	Pst	0.165	0.225	0.138	1
	Plt 2	0.073	0.114	0.058	0.65
Test start date		15.10.2015	**Test end date**		15.10.2015
Test location		Growatt R&D Laboratories			

Power quality. DC injection and Power factor.				
Test power level		**DC injection**		
		10%	55%	100%
Test Value	**L1**	13mA	10.1mA	9.2mA
	L2	12.1mA	9.6mA	10.3mA
	L3	14.8mA	12.2mA	10.1mA

Limit(0.25% of rated AC current)	21.7mA	21.7mA	21.7mA
Test power level	Power factor		
	221Vac	230Vac	256Vac
Test Value	0.995	0.996	0.996
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
U/F stage1	47.53Hz	20.09S	47.53Hz	20.19S	47.73Hz/25s	No Trip
U/F stage2	47Hz	638.2ms	47Hz	749ms	47.2Hz/19.98s	No Trip
					46.8Hz/0.48s	No Trip
O/F stage1	51.47Hz	90.36S	51.48Hz	90.44S	51.27Hz/95s	No Trip
O/F stage2	52Hz	575.7ms	52.01Hz	661ms	51.8Hz/89.98s	No Trip
					52.2Hz/0.48s	No Trip
Note. For frequency Trip tests the Frequency requird to trip is the setting ±0.1Hz. 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 ±0.2Hz 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
U/V stage1	201V	2.6S	200.6V	2.65S	205.1V/3.5s	No Trip
U/V stage2	184.5V	600ms	184.1V	639ms	188.5V/2.48s	No Trip
					180.5V/0.48s	No Trip
O/V stage1	262.2V	1.1S	261.4V	1.12S	258.2V/2.0s	No Trip
O/V stage2	273.7V	600ms	273.1V	633ms	269.7V/0.98s	No Trip
					277.7V/0.48s	No Trip
Note. For Voltage tests the Voltage required to trip is the setting ±3.45V. 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.						

Protection. Loss of Mains test						
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 0.5s	0.285	0.157	0.126	0.264	0.152	0.173

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	51.47Hz	No trip
Negative Frequency drift	50.5Hz	-0.19Hz/sec	47.53Hz	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**			
65s	71.5s	At 266.2V	At 197V	At 47.43Hz	At 51.57Hz
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	25.8V	1.03
Initial Value of aperiodic current	A	--	100ms	25.6V	1.12
Initial symmetrical short-circuit current	I_k	--	250ms	25.3V	0.96
Decaying component of short circuit current	i_{DC}	--	500ms	25.3V	0.94
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					