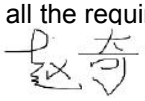
G59/3 TYPE TEST VERIFICATION SHEET

Type Test reference number	MI-500/MI-600		
Generating Unit technology	Photovoltaic Microinverter		
System Supplier name	Hoymiles Converter Technology Co.,Ltd		
Address	3rd Floor,Building 11,18#Kangjing road,KangQiao Industrial Zone,HangZhou City,Zhejiang Province		
Tel	+86 571 28056101	Fax	+86 571 28056137
E:mail	zhaoqi@hzconverter.com	Web site	www.hoymiles.com
Maximum export capacity, use separate sheet if more than one connection option.	0.5/0.6 per Unit	kW single phase, single, split or three phase system	
	NA	kW three phase	
	NA	kW two phases in three phase system	
	NA	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	Hoymiles Converter Technology 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 organisations 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.			

Power Quality - Harmonic Generation Generating Unit tested to BS EN 61000-3-12						
Generating Unit rating per phase (rpp)			6	kW	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	0.0333	0.1277	0.0939	0.3600	8%	8%
3	0.0446	0.1710	0.1416	0.5428	21.6%	Not stated
4	0.0139	0.0533	0.0359	0.1376	4%	4%
5	0.1783	0.6835	0.3567	1.3674	10.7%	10.7%
6	0.0138	0.0529	0.0344	0.1319	2.67%	2.67%

7	0.0431	0.1652	0.0346	0.1326	7.2%	7.2%
8	0.0089	0.0341	0.0198	0.0759	2%	2%
9	0.0749	0.2871	0.1331	0.5102	3.8%	Not stated
10	0.0066	0.0253	0.0115	0.0441	1.6%	1.6%
11	0.0223	0.0855	0.0554	0.2124	3.1%	3.1%
12	0.003	0.0115	0.0132	0.0506	1.33%	1.33%
13	0.0648	0.2484	0.0971	0.3722	2%	2%
THD		3.2257		3.1624	23%	13%
PWHD		5.2929		3.8265	23%	22%
system size is scalable ;this is the system size tested						

Power Quality - Harmonic Generation **Generating Unit tested to BS EN 61000-3-2**						
Generating Unit rating per phase (rpp)			3	kW	Harmonic % =Measured Value (Amps) x 23/rating per phase (kVA)	
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	0.0072	0.0276	0.0169	0.0648	1.080	
3	0.0011	0.0042	0.0184	0.0705	2.300	
4	0.0044	0.0169	0.0058	0.0222	0.430	
5	0.0056	0.0215	0.0147	0.0564	1.140	
6	0.0037	0.0142	0.0036	0.0138	0.300	
7	0.0043	0.0165	0.0077	0.0295	0.770	
8	0.0011	0.0042	0.003	0.0115	0.230	
9	0.001	0.0038	0.0043	0.0165	0.400	
10	0.0012	0.0046	0.0028	0.0107	0.184	
11	0.0034	0.0130	0.0036	0.0138	0.330	
12	0.0024	0.0092	0.002	0.0077	0.153	
13	0.0038	0.0146	0.0043	0.0165	0.210	
14	0.0023	0.0088	0.0021	0.0081	0.131	
15	0.0023	0.0088	0.0042	0.0161	0.150	
16	0.0006	0.0023	0.002	0.0077	0.115	
17	0.0021	0.0081	0.005	0.0192	0.132	
18	0.0007	0.0027	0.0015	0.0058	0.102	
19	0.0029	0.0111	0.0047	0.0180	0.118	
20	0.002	0.0077	0.0014	0.0054	0.092	

21	0.0031	0.0119	0.0043	0.0165	0.107	0.160
22	0.0009	0.0035	0.0016	0.0061	0.084	
23	0.0021	0.0081	0.0036	0.0138	0.098	0.147
24	0.0005	0.0019	0.0013	0.0050	0.077	
25	0.002	0.0077	0.0025	0.0096	0.090	0.135
26	0.0005	0.0019	0.0016	0.0061	0.071	
27	0.0028	0.0107	0.0024	0.0092	0.083	0.124
28	0.0009	0.0035	0.0013	0.0050	0.066	
29	0.0032	0.0123	0.0034	0.0130	0.078	0.117
30	0.0004	0.0015	0.002	0.0077	0.061	
31	0.0029	0.0111	0.0044	0.0169	0.073	0.109
32	0.0006	0.0023	0.0012	0.0046	0.058	
33	0.0031	0.0119	0.0051	0.0196	0.068	0.102
34	0.0003	0.0012	0.001	0.0038	0.054	
35	0.0034	0.0130	0.0045	0.0173	0.064	0.096
36	0.0006	0.0023	0.0013	0.0050	0.051	
37	0.003	0.0115	0.004	0.0153	0.061	0.091
38	0.0005	0.0019	0.0012	0.0046	0.048	
39	0.0029	0.0111	0.0035	0.0134	0.058	0.087
40	0.0003	0.0012	0.0012	0.0046	0.046	
system size is scalable ;this is the system size tested						

Power Quality. Voltage fluctuations and Flicker Test to BS EN 61000-3-11								
	Starting			Stopping			Running	
	dmax [%]	dc [%]	d(t) [%]	dmax [%]	dc [%]	d(t) [%]	Pst	Plt 2 hours
Measured Values at test impedance	0.36	0.3	0	0.36	0.3	0	0.133	0.058
Normalised to standard impedance	0.36	0.3	0	0.36	0.3	0	0.133	0.058
Normalised to required maximum impedance	0.36	0.3	0	0.36	0.3	0	0.133	0.058
Limits set under BS EN 61000-3-11	4%	3.3%	3.3%	4%	3.3%	3.3%	1	0.65
Test impedance	R	0.4	Ω		XI	0.25		Ω
Standard impedance	R	0.24*	Ω		XI	0.15*		Ω

		0.4^			0.25^	
Maximum impedance	R	0.4	Ω	XI	0.25	Ω
Test start date		2017-06-14	Test end date		2017-06-14	
Test location		No.8 Chunxin East Road, Wuxi, Jiangsu				

Power quality. DC injection				
Test power level	10%	55%	100%	
Recorded value(mA)	1.1229	2.6406	2.3144	
as % of rated AC current	0.049%	0.115%	0.101%	
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 ±1.5% of the stated level during the test.
Measured value	0.9955	0.9950	0.9940	
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	47.5Hz	20.19	51.3Hz/95s	Confirmed
O/F stage 2	52Hz	0.5s	47.0Hz	0.541	51.8Hz/89.98s	Confirmed
					52.2Hz/0.48s	Confirmed
U/F stage 1	47.5Hz	20s	51.5Hz	90.0	47.7Hz/25s	Confirmed
U/F stage 2	47Hz	0.5s	52.0Hz	0.541	47.2Hz/19.98s	Confirmed
					46.8Hz/0.48s	Confirmed

Protection. Voltage tests						
Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
O/V stage 1	262.2V	1.0s	198.1V	2.531	258.2V/2.0s	Confirmed
O/V stage 2	273.7V	0.5s	182V	0.518	269.7V/0.98s	Confirmed
					180V/0.48s	Confirmed
U/V stage 1	200.1V	2.5s	264.2V	1.022	204.1V/3.5s	Confirmed
U/V stage 2	184V	0.5s	275.7V	0.515	188V/2.48s	Confirmed
					180V/0.48s	Confirmed

Protection. Loss of Mains test
Note: Inverter tested according to BS EN 62116.

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	19.07ms	427.1ms	435.1ms	21.47ms	413.5ms	429.5ms

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	+0.19Hz/sec	51.5Hz	Confirmed
Negative Frequency drift	50.5Hz	-0.19Hz/sec	47.5Hz	Confirmed

Protection. Re-connection timer					
Test should prove that the reconnection sequence starts in no less than 20s 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.			
40s	40.3s	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

Fault level contribution					
For machines with electro-magnetic output			For Inverter output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	ip	N/A	20ms	14.60V	0.124A
Initial Value of aperiodic current	A	N/A	100ms	5.85V	0.116A
Initial symmetrical short-circuit current*	Ik	N/A	250ms	5.80V	0.114A
Decaying (aperiodic) component of short circuit current*	iDC	N/A	500ms	5.11V	0.109A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0.0012	(in seconds)

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. * Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot

Self-Monitoring solid state switching	Yes/or 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	N/A

Additional comments