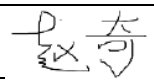
G99/1 Form A3-3: Compliance Verification Report for Inverter Connected Power Generating Modules

Type Test reference number		MI-1200/MI-1000		
Generating Unit technology		Photovoltaic Microinverter		
System Supplier name		Hoymiles Converter Technology Co., Ltd.		
Address		No.18 Kangjing Road, Hangzhou, Zhejiang Province, P.R. China.		
Tel	+86 15088682210		Fax	+86 571 28056137
E:mail	zhangxingyao@hzconverter.com		Web site	www.hoymiles.com
Registered Capacity, use separate sheet if more than one connection option.	1.2/1.0 per Unit	kW single phase, single, split or three phase system		
	NA	kW three phase		
	NA	kW two phases in three phase system		
	N`A	kW two phases split phase system		
Manufacturer compliance declaration. - I certify that all products supplied by the company with the above Type Tested Manufacturer's 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 EREC G99.				
Signed		On behalf of	Hoymiles Converter Technology Co., Ltd.	
Note that testing can be done by the Manufacturer of an individual component or by an external test house. Where parts of the testing are carried out by persons or organisations other than the Manufacturer then that person or organisation 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.				

1. Operating Range				
	Test1	Test2	Test3	Test4
MI-1200	195.5V,47Hz	195.5V,47.5Hz	253V,51.5Hz	253V,52Hz
MI-1000				

2. Power Quality - Harmonic Generation **Generating Unit tested to BS EN 61000-3-12**				
Generating Unit rating per phase (rpp)		7.2	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	0.0107	0.0342	0.0182	0.0581	8%	8%
3	0.0417	0.1332	0.0509	0.1626	21.6%	Not stated
4	0.0083	0.0265	0.0081	0.0259	4%	4%
5	0.0239	0.0763	0.0206	0.0659	10.7%	10.7%
6	0.0035	0.0112	0.0060	0.0190	2.67%	2.67%
7	0.0088	0.0281	0.0150	0.0478	7.2%	7.2%
8	0.0031	0.0099	0.0053	0.0168	2%	2%
9	0.0095	0.0303	0.0102	0.0324	3.8%	Not stated
10	0.0033	0.0105	0.0046	0.0147	1.6%	1.6%
11	0.0053	0.0169	0.0090	0.0288	3.1%	3.1%
12	0.0025	0.0080	0.0023	0.0072	1.33%	1.33%
13	0.0033	0.0105	0.0056	0.0179	2%	2%
THD		2.5028		2.7303	23%	13%
PWHD		4.2216		5.2490	23%	22%
system size is scalable ;this is the system size tested by 6 Units (MI-1200).						

3. 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	0.1	0	0	0.1	0	0	0.064	0.064
Normalised to standard impedance	0.1	0	0	0.1	0	0	0.064	0.064
Normalised to required maximum impedance	0.1	0	0	0.1	0	0	0.064	0.064
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* 0.4^		Ω	XI	0.15* 0.25^		Ω

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				

4. **Power quality. DC injection**				
Test power level	10%	55%	100%	
Recorded value(mA)	1.098	4.857	2.351	
as % of rated AC current	0.21%	0.17%	0.045%	
Limit	0.25%	0.25%	0.25%	

5. **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	0.9983	0.9973	0.9952	
Limit	>0.95	>0.95	>0.95	

6. Protection. Frequency tests						
Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency /time	Confirm no trip
U/F stage 1	47.5Hz	20s	47.5Hz	20.1s	47.7Hz/25s	no trip
U/F stage 2	47Hz	0.5s	47Hz	0.54s	47.2Hz/19.98s	no trip
					46.8Hz/0.48s	no trip
O/F stage 1	52Hz	0.5s	52Hz	0.52s	51.8Hz/89.98s	no trip
					52.2Hz/0.48s	no trip

7. **Protection. Voltage tests**						
Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage /time	Confirm no trip
U/V stage 2	184V	2.5s	183.4V	2.53s	188V/3.5s	no trip
					180V/2.48s	no trip
OV stage 1	262.2V	1.0s	263.2V	1.02s	258.2V/2.0s	no trip
O/V stage 2	273.7V	0.5s	274.4V	0.52s	269.7V/0.98s	no trip
					277.7V/0.48s	no trip

8. **Power Park Modules - Protection - Loss of Mains test**						
Note: Inverter tested according to BS EN 62116.						
Test Power and	33%	66%	100%	33%	66%	100%

imbalance	-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 0.5s	82.5ms	173.6ms	227.4ms	84.8ms	171.3ms	237.8ms

9. Loss of Mains Protection, Vector Shift Stability test and RoCoF Stability test				
	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5Hz	+50 degrees		no trip
Negative Vector Shift	50.5Hz	- 50 degrees		no trip
	Ramp range	Test frequency ramp	Test Duration	Confirm no trip
Positive Frequency drift	49Hz to 51Hz	+0.95Hz/sec	2.1s	no trip
Negative Frequency drift	51Hz to 49Hz	-0.95Hz/sec	2.1s	no trip

10. **Limited Frequency Sensitive Mode - Over frequency test**				
Active Power response to rising frequency/time plots are attached if frequency injection tests are undertaken in accordance with Annex A.8.2.4				**N**
Test sequence at Registered Capacity >80 %	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	1199.4W	50Hz		-
Step b) 50.45Hz ±0.01Hz	1193.2W	50.45Hz		-
Step c) 50.70Hz ±0.10Hz	1162.6W	50.7Hz		-
Step d) 51.15Hz ±0.05Hz	1108.5W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	1162.8W	50.7Hz		-
Step f) 50.45Hz ±0.05Hz	1192.8W	50.45Hz		-
Step g) 50.00Hz ±0.01Hz	1198.6W	50Hz		-
Test sequence at Registered Capacity 40%~60%	Measured Active Power Output	Frequency	Primary Power Source	Active Power Gradient
Step a) 50.00Hz ±0.01Hz	613.2W	50Hz		-
Step b) 50.45Hz ±0.05Hz	609.6W	50.45Hz		-
Step c) 50.70Hz	594.7W	50.7Hz		-

±0.10Hz				
Step d) 51.15Hz ±0.05Hz	567.3W	51.15Hz		-
Step e) 50.70Hz ±0.10Hz	593.5W	50.7Hz		-

11. **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 180V	At 47.4Hz	At 52.1Hz
Confirmation that the **Generating Unit** does not re-connect.		No Re-connection	No Re-connection	No Re-connection	No Re-connection

12. 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	17.8V	0.324A
Initial Value of aperiodic current	A	N/A	100ms	7.24V	0.158A
Initial symmetrical short-circuit current*	Ik	N/A	250ms	6.55V	0.142A
Decaying (aperiodic) component of short circuit current*	iDC	N/A	500ms	5.67V	0.134A
Reactance/Resistance Ratio of source*	X/R	N/A	Time to trip	0.0044s	(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					

13. Self-Monitoring solid state switching	Yes/or NA
It has been verified that in the event of the solid state switching device failing to	N/A

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	

14. Wiring functional tests: If required by para 15.2.1	Yes/or NA
Confirm that the relevant test schedule is attached (tests to be undertaken at time of commissioning).	N/A

15. Logic interface (input port)	Yes/or NA
Confirm that an input port is provided and can be used to shut down the module.	N/A