SMA Solar Technology AG | Sonnenallee 1 | 34266 Niestetal | Germany
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Amtsgericht Kassel (District Court) HRB (registration number) 3972
Vorsitzender des Aufsichtsrats (Chairman of the Supervisory Board): Günther Cramer
Managing Board: Roland Grebe, Dr.-Ing. Jürgen Reinert, Lydia Sommer, Pierre-Pascal Urbon, Marko Werner

Certificate G83/2

Engineering Recommendation

Manufacturer	**SMA Solar Technology AG**
Address	Sonnenallee 1, 34266 Niestetal (Germany)

Type Tested reference number	ZE_G83-2_SBxx00SE-10_en_10
Generating Unit technology	Single phase inverter
Test house details	**SMA Solar Technology AG**
Test period	From 2014-04-03 until 2014-05-02

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
SB 5000SE-10	5000	4600	2.04.01.R
SB 3600SE-10	3680	3680	2.04.01.R

The results of the G83/2 are summarized in this certificate. SMA declares that all units shipped to the UK, with at least the aforementioned FW version, are within the specifications and parameters set by the G83/2 Engineering Recommendation. These settings cannot be changed by an installer, user or by any person other than SMA. Note that all tests were carried out in the biggest inverter of the family under test. The results for the other inverters of the family are equivalent.

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Test Results

Power quality

Harmonics as per BS EN 61000-3-2								
Order	Frequency [Hz]	Thresholds [A]	P/Pn [%]					
			50		100		Max. NV / Limit [%]	
			MV [A]	NV [A]	MV [A]	NV [A]		
2	100	1,08	0,023	0,018	0,029	0,023	2,15%	✓
3	150	2,3	0,129	0,103	0,268	0,214	9,32%	✓
4	200	0,43	0,009	0,007	0,013	0,010	2,42%	✓
5	250	1,14	0,053	0,042	0,076	0,061	5,33%	✓
6	300	0,3	0,008	0,006	0,008	0,006	2,13%	✓
7	350	0,77	0,041	0,033	0,055	0,044	5,71%	✓
8	400	0,23	0,009	0,007	0,010	0,008	3,48%	✓
9	450	0,4	0,034	0,027	0,044	0,035	8,80%	✓
10	500	0,184	0,006	0,005	0,007	0,006	3,04%	✓
11	550	0,33	0,029	0,023	0,043	0,034	10,42%	✓
12	600	0,153	0,005	0,004	0,007	0,006	3,65%	✓
13	650	0,21	0,028	0,022	0,042	0,034	16,00%	✓
14	700	0,131	0,004	0,003	0,006	0,005	3,65%	✓
15	750	0,15	0,019	0,015	0,030	0,024	16,00%	✓
16	800	0,115	0,004	0,003	0,005	0,004	3,48%	✓
17	850	0,132	0,019	0,015	0,028	0,022	16,92%	✓
18	900	0,102	0,003	0,002	0,004	0,003	3,13%	✓
19	950	0,118	0,017	0,014	0,025	0,020	16,89%	✓
20	1000	0,092	0,003	0,002	0,004	0,003	3,48%	✓
21	1050	0,107	0,015	0,012	0,023	0,018	17,17%	✓
22	1100	0,084	0,003	0,002	0,004	0,003	3,83%	✓
23	1150	0,098	0,011	0,009	0,017	0,014	13,90%	✓
24	1200	0,077	0,002	0,002	0,003	0,002	3,13%	✓
25	1250	0,09	0,013	0,010	0,020	0,016	17,78%	✓
26	1300	0,071	0,002	0,002	0,003	0,002	3,39%	✓
27	1350	0,083	0,012	0,010	0,018	0,014	17,28%	✓
28	1400	0,066	0,002	0,002	0,002	0,002	2,43%	✓
29	1450	0,078	0,008	0,006	0,013	0,010	13,40%	✓
30	1500	0,061	0,002	0,002	0,002	0,002	2,61%	✓
31	1550	0,073	0,007	0,006	0,010	0,008	11,02%	✓
32	1600	0,058	0,002	0,002	0,002	0,002	2,78%	✓
33	1650	0,068	0,006	0,005	0,010	0,008	11,73%	✓
34	1700	0,054	0,001	0,001	0,002	0,002	2,96%	✓
35	1750	0,064	0,006	0,005	0,009	0,007	11,20%	✓
36	1800	0,051	0,001	0,001	0,002	0,002	3,13%	✓
37	1850	0,061	0,006	0,005	0,009	0,007	11,84%	✓
38	1900	0,048	0,001	0,001	0,002	0,002	3,30%	✓
39	1950	0,058	0,006	0,005	0,009	0,007	12,48%	✓
40	2000	0,046	0,001	0,001	0,002	0,002	3,48%	✓

MV - Measured Value NV - Normalized Value NV=MV*3,68/power per phase

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Test Results

Power quality

Voltage fluctuations and flicker as per BS EN 61000-3-3								
	Starting			Stopping			Running	
	dmax	dc	d(t) in ms	dmax	dc	d(t) in ms	Pst	Plt (2hours)
Limit	4,0%	3,3%	500	4,0%	3,3%	500	1	0,65
MV	0,0%	0,0%	0	0,0%	0,0%	0	0,09	0,09
NV	0,0%	0,0%	0	0,0%	0,0%	0	0,07	0,07
Verification	✓	✓	✓	✓	✓	✓	✓	✓

DC injection			
	P/Pn [%]		
	10	55	100
Limit	0,25% In	0,25% In	0,25% In
MV	0,008 A	0,01 A	0,012 A
%Inom	0,04%	0,05%	0,06%
Verification	✓	✓	✓

Power factor			
	Voltage [V]		
	218,2	230	253
Limit	0,95	0,95	0,95
MV	1,00	1,00	1,00
Verification	✓	✓	✓

MV - Measured value NV - Normalized value

Protection - Grid monitoring and reconnection time

Trip Tests	G83/2		Setting		Measures Values		Verification
Function	Magnitude	Time	Magnitude	Time	Magnitude	Time	
Undervoltage stage 1	200,1 V	2,5 s	200,1 V	2,5 s	199,55 V	2,53 s	✓
Undervoltage stage 2	184 V	0,5 s	184 V	0,5 s	183,45 V	0,54 s	✓
Overvoltage stage 1	262,2 V	1 s	262,2 V	1 s	264,09 V	1,05 s	✓
Overvoltage stage 2	273,7 V	0,5 s	273,7 V	0,5 s	275,68 V	0,55 s	✓
Underfrequency stage 1	47,5 Hz	20 s	47,5 Hz	20 s	47,45 Hz	20,09 s	✓
Underfrequency stage 2	47 Hz	0,5 s	47 Hz	0,5 s	46,997 Hz	0,6 s	✓
Overfrequency stage 1	51,5 Hz	90 s	51,5 Hz	90 s	51,549 Hz	90,08 s	✓
Overfrequency stage 2	52 Hz	0,5 s	52 Hz	0,5 s	52,049 Hz	0,6 s	✓

No trip test	G83/2		Verification
	Magnitude	Time	
U/V 1	204,1 V	3,5 s	✓
U/V 2	188 V	2,48 s	✓
U/V 3	180 V	0,48 s	✓
O/V 1	258,2 V	2 s	✓
O/V 2	269,7 V	0,98 s	✓
O/V 3	277,7 V	0,48 s	✓

No trip test	G83/2		Verification
	Magnitude	Time	
U/F 1	47,7 Hz	25 s	✓
U/F 2	47,2 Hz	19,98 s	✓
U/F 3	46,8 Hz	0,48 s	✓
O/F 1	51,3 Hz	95 s	✓
O/F 2	51,8 Hz	89,98 s	✓
O/F 3	52,2 Hz	0,48 s	✓

Reconnection time			
Limit	Setting	MV	Verification
20 s	20 s	49 s	✓

No reconnection			
At 266,2 V	At 198,1 V	At 47,4 Hz	At 51,8 Hz
✓	✓	✓	✓

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Test Results

Protection

Loss of mains test according to the BS EN 62116						
Test power and imbalance	29 % -5%Q (Test 22)	58 % -5%Q (Test 12)	100 % -5%P (Test 5)	29 % +5%Q (Test 31)	58 % +5%Q (Test 21)	100 % +5%P (Test 10)
Trip time limit (s)	0,5	0,5	0,5	0,5	0,5	0,5
Measured Value L1 (s)	0,193	0,183	0,19	0,194	0,201	0,211
Measured Value L2 (s)	0	0	0	0	0	0
Measured Value L3 (s)	0	0	0	0	0	0
Measured Value L1L2L3 (s)*	0	0	0	0	0	0
Verification	✓	✓	✓	✓	✓	✓

* Only applicable to three phase inverters

Frequency change - Stability test				
	Start frequency	Change	End frequency	Verification
Positive vector shift	49,5 Hz	+9 degrees	N/A	✓
Negative vector shift	50,5 Hz	-9 degrees	N/A	✓
Positive frequency drift	49,5 Hz	+0,19 Hz/s	51,5 Hz	✓
Negative frequency drift	50,5 Hz	-0,19 Hz/s	47,5 Hz	✓

Fault level contribution		
Time after fault	Voltage (V)	Current (A)
< 50 ms	231,17	25,32
100 ms	11,5	0,02
250 ms	11,29	0,04
500 ms	11,33	0,03
Time to Trip	0,53	in seconds

Self monitoring - solid state switching
Not applicable as electro-mechanical relays are used

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