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): Dr. Erik Ehrentraut
Managing Board: Roland Grebe, Dr.-Ing. Jürgen Reinert, Pierre-Pascal Urbon

Certificate G59/3

Engineering Recommendation

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

Type Tested reference number	ZE_G59-3_STPxx000TL-30_en_11
Generating Unit technology	Three phase inverter
Test house details	**SMA Solar Technology AG**
Test periods	From 2014-08-25 until 2014-09-04

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
STP 25000TL-30	25000	25000	2.80.05.R
STP 20000TL-30	20000	20000	2.80.05.R
STP 17000TL-30	17000	17000	2.83.03.R
STP 15000TL-30	15000	15000	2.83.03.R

The results of the G59/3 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 G59/3 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 with the biggest inverter of the family under test. The results for the other inverters of the family are equivalent.
Two new models were included in the FW 2.83.03.R. The conformity with the G59/3 was proven during September 2016.

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Test Results

Power quality

Harmonics as per BS EN 61000-3-12								
Order	Frequency [Hz]	Thresholds I/In [%]	P/Pn [%]					
			50		100		Max. MV / Limit [%]	
			MV		MV			
2	100	8,00%	0,09 A	0,25%	0,12 A	0,33%	4,14%	✓
3	150	-	0,15 A	0,41%	0,17 A	0,47%	-	-
4	200	4,00%	0,13 A	0,36%	0,06 A	0,17%	8,98%	✓
5	250	10,70%	0,7 A	1,93%	0,55 A	1,52%	18,07%	✓
6	300	2,67%	0,05 A	0,14%	0,04 A	0,11%	5,17%	✓
7	350	7,20%	0,2 A	0,55%	0,27 A	0,75%	10,36%	✓
8	400	2,00%	0,04 A	0,11%	0,04 A	0,11%	5,52%	✓
9	450	-	0,05 A	0,14%	0,05 A	0,14%	-	-
10	500	1,60%	0,03 A	0,08%	0,04 A	0,11%	6,91%	✓
11	550	3,10%	0,28 A	0,77%	0,26 A	0,72%	24,95%	✓
12	600	1,33%	0,03 A	0,08%	0,03 A	0,08%	6,23%	✓
13	650	2,00%	0,19 A	0,52%	0,34 A	0,94%	46,96%	✓
14	700	-	0,03 A	0,08%	0,03 A	0,08%	-	-
15	750	-	0,03 A	0,08%	0,04 A	0,11%	-	-
16	800	-	0,03 A	0,08%	0,03 A	0,08%	-	-
17	850	-	0,1 A	0,28%	0,07 A	0,19%	-	-
18	900	-	0,02 A	0,06%	0,03 A	0,08%	-	-
19	950	-	0,14 A	0,39%	0,25 A	0,69%	-	-
20	1000	-	0,02 A	0,06%	0,02 A	0,06%	-	-
21	1050	-	0,02 A	0,06%	0,03 A	0,08%	-	-
22	1100	-	0,02 A	0,06%	0,02 A	0,06%	-	-
23	1150	-	0,05 A	0,14%	0,09 A	0,25%	-	-
24	1200	-	0,02 A	0,06%	0,02 A	0,06%	-	-
25	1250	-	0,09 A	0,25%	0,14 A	0,39%	-	-
26	1300	-	0,02 A	0,06%	0,02 A	0,06%	-	-
27	1350	-	0,02 A	0,06%	0,02 A	0,06%	-	-
28	1400	-	0,02 A	0,06%	0,02 A	0,06%	-	-
29	1450	-	0,05 A	0,14%	0,1 A	0,28%	-	-
30	1500	-	0,01 A	0,03%	0,02 A	0,06%	-	-
31	1550	-	0,05 A	0,14%	0,07 A	0,19%	-	-
32	1600	-	0,01 A	0,03%	0,02 A	0,06%	-	-
33	1650	-	0,01 A	0,03%	0,02 A	0,06%	-	-
34	1700	-	0,01 A	0,03%	0,02 A	0,06%	-	-
35	1750	-	0,05 A	0,14%	0,09 A	0,25%	-	-
36	1800	-	0,01 A	0,03%	0,01 A	0,03%	-	-
37	1850	-	0,03 A	0,08%	0,06 A	0,17%	-	-
38	1900	-	0,01 A	0,03%	0,02 A	0,06%	-	-
39	1950	-	0,02 A	0,06%	0,03 A	0,08%	-	-
40	2000	-	0,01 A	0,03%	0,02 A	0,06%	-	-

MV=Measured Value

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Test Results

Power quality

Voltage fluctuations and flicker as per BS EN 61000-3-11								
	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	0,5%	0,1%	0	0,4%	0,3%	0	0,05	0,05
Verification	✓	✓	✓	✓	✓	✓	✓	✓

DC injection			
	P/Pn [%]		
	10	55	100
Limit	0,25% In	0,25% In	0,25% In
MV	0,00953 A	0,0211 A	0,02431 A
%Inom	0,03%	0,06%	0,07%
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

Protection - Grid monitoring and reconnection time

Trip Tests	G59/3		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	199,36 V	2,56 s	✓
Undervoltage stage 2	184 V	0,5 s	184 V	0,5 s	183,28 V	0,57 s	✓
Overvoltage stage 1	262,2 V	1 s	262,2 V	1 s	262,63 V	1,07 s	✓
Overvoltage stage 2	273,7 V	0,5 s	273,7 V	0,5 s	274,12 V	0,57 s	✓
Underfrequency stage 1	47,5 Hz	20 s	47,5 Hz	20 s	47,5 Hz	20,1 s	✓
Underfrequency stage 2	47 Hz	0,5 s	47 Hz	0,5 s	47 Hz	0,61 s	✓
Overfrequency stage 1	51,5 Hz	90 s	51,5 Hz	90 s	51,55 Hz	90,08 s	✓
Overfrequency stage 2	52 Hz	0,5 s	52 Hz	0,5 s	52,05 Hz	0,61 s	✓

No trip test	G59/3		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	G59/3		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	32,26 s	✓

No reconnection			
At 266,2 V	At 196,1 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)	0,063	0,071	0,065	0,073	0,101	0,052
Measured Value L2 (s)*	0,103	0,104	0,066	0,108	0,068	0,063
Measured Value L3 (s)*	0,085	0,102	0,076	0,069	0,105	0,048
Measured Value L1L2L3 (s)*	0,103	0,055	0,057	0,076	0,065	0,054
Verification	✓	✓	✓	✓	✓	✓

Single phase test for three phase inverters*					
Ph1 removed	Confirm trip (t < 1 s)	Ph2 removed	Confirm trip (t < 1 s)	Ph3 removed	Confirm trip (t < 1 s)
	✓		✓		✓

* 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	230,59	37,17
100 ms	11,5	0,04
250 ms	11,45	0,04
500 ms	11,42	0,04
Time to Trip	0,53	in seconds

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

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