



Certificate G59/3

Engineering Recommendation

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

Type Tested reference number	ZE_G59-3_FLX PRO 1x_en_10
Generating Unit technology	Three Phase inverter
Test house details	SMA Solar Technology AG
Test period	From 2014-10-23 until 2014-11-03

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
FLX PRO 17	17660	17000	3.10
FLX PRO 15	15594	15000	3.10

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 in the biggest inverter of the family under test. The results for the other inverters of the family are equivalent.



Test Results

Power quality

Harmonics as per BS EN 61000-3-12								
Order	Frequency [Hz]	Thresholds I/In [%]	P/Pn [%]				Max. MV / Limit [%]	
			50		100			
			MV		MV			
2	100	8,00%	0,035 A	0,14%	0,091 A	0,37%	4,63%	✓
3	150	-	0,012 A	0,05%	0,015 A	0,06%	-	-
4	200	4,00%	0,012 A	0,05%	0,027 A	0,11%	2,75%	✓
5	250	10,70%	0,017 A	0,07%	0,027 A	0,11%	1,03%	✓
6	300	2,67%	0,015 A	0,06%	0,02 A	0,08%	3,00%	✓
7	350	7,20%	0,017 A	0,07%	0,017 A	0,07%	0,97%	✓
8	400	2,00%	0,007 A	0,03%	0,012 A	0,05%	2,50%	✓
9	450	-	0,054 A	0,22%	0,042 A	0,17%	-	-
10	500	1,60%	0,01 A	0,04%	0,01 A	0,04%	2,50%	✓
11	550	3,10%	0,057 A	0,23%	0,054 A	0,22%	7,42%	✓
12	600	1,33%	0,01 A	0,04%	0,007 A	0,03%	3,01%	✓
13	650	2,00%	0,067 A	0,27%	0,077 A	0,31%	15,50%	✓
14	700	-	0,007 A	0,03%	0,012 A	0,05%	-	-
15	750	-	0,067 A	0,27%	0,082 A	0,33%	-	-
16	800	-	0,01 A	0,04%	0,007 A	0,03%	-	-
17	850	-	0,064 A	0,26%	0,086 A	0,35%	-	-
18	900	-	0,01 A	0,04%	0,007 A	0,03%	-	-
19	950	-	0,049 A	0,20%	0,074 A	0,30%	-	-
20	1000	-	0,005 A	0,02%	0,01 A	0,04%	-	-
21	1050	-	0,035 A	0,14%	0,062 A	0,25%	-	-
22	1100	-	0,005 A	0,02%	0,005 A	0,02%	-	-
23	1150	-	0,02 A	0,08%	0,049 A	0,20%	-	-
24	1200	-	0,005 A	0,02%	0,007 A	0,03%	-	-
25	1250	-	0,02 A	0,08%	0,037 A	0,15%	-	-
26	1300	-	0,01 A	0,04%	0,007 A	0,03%	-	-
27	1350	-	0,025 A	0,10%	0,022 A	0,09%	-	-
28	1400	-	0,01 A	0,04%	0,005 A	0,02%	-	-
29	1450	-	0,03 A	0,12%	0,017 A	0,07%	-	-
30	1500	-	0,007 A	0,03%	0,005 A	0,02%	-	-
31	1550	-	0,025 A	0,10%	0,017 A	0,07%	-	-
32	1600	-	0,01 A	0,04%	0,005 A	0,02%	-	-
33	1650	-	0,022 A	0,09%	0,022 A	0,09%	-	-
34	1700	-	0,005 A	0,02%	0,002 A	0,01%	-	-
35	1750	-	0,022 A	0,09%	0,03 A	0,12%	-	-
36	1800	-	0,007 A	0,03%	0,002 A	0,01%	-	-
37	1850	-	0,02 A	0,08%	0,027 A	0,11%	-	-
38	1900	-	0,005 A	0,02%	0,002 A	0,01%	-	-
39	1950	-	0,017 A	0,07%	0,025 A	0,10%	-	-
40	2000	-	0,005 A	0,02%	0,002 A	0,01%	-	-

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MV=Measured Value



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	0,3%	3,0%	N/A	0,3%	3,0%	N/A	0,08	0,08
Verification	✓	✓	N/A	✓	✓	N/A	✓	✓

DC injection			
	P/Pn [%]		
	10	55	100
Limit	0,25% In	0,25% In	0,25% In
MV	0,0617 A	0,0454 A	0,043 A
%Inom	0,25%	0,18%	0,17%
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
	Magnitude	Time	Magnitude	Time	Magnitude	Time	
Undervoltage stage 1	200,1 V	2,5 s	200,1 V	2,5 s	201,4 V	2,54 s	✓
Undervoltage stage 2	184 V	0,5 s	184 V	0,5 s	184,8 V	0,54 s	✓
Overvoltage stage 1	262,2 V	1 s	262,2 V	1 s	263,7 V	1,04 s	✓
Overvoltage stage 2	273,7 V	0,5 s	273,7 V	0,5 s	274,7 V	0,54 s	✓
Underfrequency stage 1	47,5 Hz	20 s	47,5 Hz	20 s	47,498 Hz	20,05 s	✓
Underfrequency stage 2	47 Hz	0,5 s	47 Hz	0,5 s	46,998 Hz	0,55 s	✓
Overfrequency stage 1	51,5 Hz	90 s	51,5 Hz	90 s	51,55 Hz	90,04 s	✓
Overfrequency stage 2	52 Hz	0,5 s	52 Hz	0,5 s	51,998 Hz	0,54 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	59,32 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 L1L2L3 (s)*	0,322	0,206	0,214	0,434	0,253	0,242
Verification	✓	✓	✓	✓	✓	✓

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

* 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	34,66	21,07
100 ms	17,93	9,42
250 ms	13,76	5,96
500 ms	12,05	4,29
Time to Trip	0,531	in seconds

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