



## Certificate G59/3

### Engineering Recommendation

Manufacturer	<b>SMA Solar Technology AG</b>
Address	Sonnenallee 1, 34266 Niestetal (Germany)

Type Tested reference number	ZE_G59-3_STP50-40_en_10
Generating Unit technology	Three phase inverter
Test house details	<b>SMA Solar Technology AG</b>
Test period	From 2017-08-01 until 2017-08-16

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
STP 50-40	50000	50000	1.01.19.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.



## 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%	0,144 A	0,20%	0,262 A	0,36%	4,52%	✓
3	150	-	0,018 A	0,03%	0,047 A	0,06%	-	-
4	200	4,00%	0,079 A	0,11%	0,048 A	0,07%	2,74%	✓
5	250	10,70%	0,35 A	0,48%	0,408 A	0,56%	5,26%	✓
6	300	2,67%	0,056 A	0,08%	0,036 A	0,05%	2,89%	✓
7	350	7,20%	0,202 A	0,28%	0,292 A	0,40%	5,60%	✓
8	400	2,00%	0,012 A	0,02%	0,044 A	0,06%	3,01%	✓
9	450	-	0,015 A	0,02%	0,023 A	0,03%	-	-
10	500	1,60%	0,038 A	0,05%	0,037 A	0,05%	3,26%	✓
11	550	3,10%	0,097 A	0,13%	0,123 A	0,17%	5,47%	✓
12	600	1,33%	0,044 A	0,06%	0,035 A	0,05%	4,52%	✓
13	650	2,00%	0,091 A	0,13%	0,119 A	0,16%	8,24%	✓
14	700	-	0,037 A	0,05%	0,022 A	0,03%	-	-
15	750	-	0,012 A	0,02%	0,021 A	0,03%	-	-
16	800	-	0,038 A	0,05%	0,037 A	0,05%	-	-
17	850	-	0,056 A	0,08%	0,092 A	0,13%	-	-
18	900	-	0,035 A	0,05%	0,032 A	0,04%	-	-
19	950	-	0,042 A	0,06%	0,094 A	0,13%	-	-
20	1000	-	0,012 A	0,02%	0,018 A	0,03%	-	-
21	1050	-	0,012 A	0,02%	0,018 A	0,03%	-	-
22	1100	-	0,01 A	0,01%	0,016 A	0,02%	-	-
23	1150	-	0,03 A	0,04%	0,068 A	0,09%	-	-
24	1200	-	0,008 A	0,01%	0,017 A	0,02%	-	-
25	1250	-	0,026 A	0,04%	0,069 A	0,10%	-	-
26	1300	-	0,013 A	0,02%	0,014 A	0,02%	-	-
27	1350	-	0,012 A	0,02%	0,015 A	0,02%	-	-
28	1400	-	0,016 A	0,02%	0,013 A	0,02%	-	-
29	1450	-	0,026 A	0,04%	0,065 A	0,09%	-	-
30	1500	-	0,013 A	0,02%	0,012 A	0,02%	-	-
31	1550	-	0,03 A	0,04%	0,059 A	0,08%	-	-
32	1600	-	0,011 A	0,02%	0,014 A	0,02%	-	-
33	1650	-	0,011 A	0,01%	0,014 A	0,02%	-	-
34	1700	-	0,009 A	0,01%	0,011 A	0,01%	-	-
35	1750	-	0,029 A	0,04%	0,05 A	0,07%	-	-
36	1800	-	0,009 A	0,01%	0,012 A	0,02%	-	-
37	1850	-	0,029 A	0,04%	0,046 A	0,06%	-	-
38	1900	-	0,007 A	0,01%	0,01 A	0,01%	-	-
39	1950	-	0,008 A	0,01%	0,013 A	0,02%	-	-
40	2000	-	0,008 A	0,01%	0,011 A	0,01%	-	-

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	Plf (2hours)
Limit	4,0%	3,3%	500	4,0%	3,3%	500	1	0,65
MV	0,04%	0,01%	0,00	0,00%	0,00%	0,00	0,04	0,04
Verification	✓	✓	✓	✓	✓	✓	✓	✓

DC injection			
	P/Pn [%]		
	10	55	100
Limit	0,25% In	0,25% In	0,25% In
MV	0,03317 A	0,02023 A	0,03295 A
%Inom	0,05%	0,03%	0,05%
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	199,6 V	2,55 s	✓
Undervoltage stage 2	184 V	0,5 s	184 V	0,5 s	183,5 V	0,54 s	✓
Overvoltage stage 1	262,2 V	1 s	262,2 V	1 s	263,03 V	1,04 s	✓
Overvoltage stage 2	273,7 V	0,5 s	273,7 V	0,5 s	274,5 V	0,54 s	✓
Underfrequency stage 1	47,5 Hz	20 s	47,5 Hz	20 s	47,45 Hz	20,1 s	✓
Underfrequency stage 2	47 Hz	0,5 s	47 Hz	0,5 s	46,95 Hz	0,6 s	✓
Overfrequency stage 1	51,5 Hz	90 s	51,5 Hz	90 s	51,5 Hz	90,09 s	✓
Overfrequency stage 2	52 Hz	0,5 s	52 Hz	0,5 s	52 Hz	0,6 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	33,13 s	✓

No reconnection			
At 266,2 V	At 196,1 V	At 47,4 Hz	At 51,8 Hz
✓	✓	✓	✓



## Test Results

### Protection

Loss of mains test according to the BS EN 62116						
	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)	N/A	N/A	N/A	N/A	N/A	N/A
Measured Value L1L2L3 (s)*	0,134	0,133	0,187	0,147	0,142	0,16
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	230,05	79,26
100 ms	10,3	0,76
250 ms	10,24	0,14
500 ms	10,24	0,14
Time to Trip	0,53	in seconds

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