



## Certificate EN 50438:2013

### European Standard

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

Type Tested reference number	HK_EN50438_2013_STP50-40_en_10
Generating Unit technology	Three Phase inverter
Test house details	<b>SMA Solar Technology AG</b>
Test period	From 2017-07-24 until 2017-08-21

Type reference	Max. apparent AC power (VA)	Rated AC power (W)	From FW Pack
STP 50-40	50000	50000	01.01.19.R

The results of the EN 50438:2013 are summarized in this certificate. SMA declares that all units shipped to Europe, with at least the aforementioned FW version, are within the specifications and parameters set by the EN 50438:2013 European Standard.



## Test Results - Protection

Interface protection							
Trip Tests	EN 50438:2013		Setting		Measures Values		Verification
	Function	Magnitude	Time	Magnitude	Time	Magnitude	
Undervoltage	195,5 V	1500 ms	195,5 V	1500 ms	194,91 V	1492 ms	✓
Overvoltage	264,5 V	200 ms	264,5 V	200 ms	264,93 V	192 ms	✓
Underfrequency	47,5 Hz	500 ms	47,5 Hz	500 ms	47,48 Hz	509 ms	✓
Overfrequency	52 Hz	500 ms	52 Hz	500 ms	52 Hz	490 ms	✓
Tolerances on trip values:							
- Voltage: ±1% Vnom      - Frequency: ± 0,5% from      - Clearance time: in accordance with table 4 of EN 50438/2013							

Loss of mains test according to the EN 62116						
Test power and imbalance	29 %	58 %	100 %	29 %	58 %	100 %
	-5%Q (Test 22)	-5%Q (Test 12)	-5%P (Test 5)	+5%Q (Test 31)	+5%Q (Test 21)	+5%P (Test 10)
Limit (s)	2 s	2 s	2 s	2 s	2 s	2 s
Measured Value (s)	1,64 s	0,22 s	1,63 s	0,28 s	0,27 s	0,55 s
Verification	✓	✓	✓	✓	✓	✓

Connection and starting to generate electrical power			
Test sequence	Limit	Test value	Verification
f < 47,45 Hz	no connect	no connect	✓
f ≥ 47,45 Hz	60 s	76,81 s	✓
f > 50,10 Hz	no connect	no connect	✓
f ≤ 50,10 Hz	60 s	73,32 s	✓
U < 0,84 Un	no connect	no connect	✓
U ≥ 0,84 Un	60 s	73,38 s	✓
U > 1,11 Un	no connect	no connect	✓
U ≤ 1,11 Un	60 s	73,44 s	✓
Power gradient after connection			
	Limit	Test value	Verification
max. allowed gradient	10 %P/min	9,44 %P/min	✓

Short-circuit current 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

DC injection			
P/Pn [%]	Limit	MV (A)	Verification
20	0,5% In	0,02203	✓
50	0,5% In	0,01562	✓
75	0,5% In	0,03503	✓
100	0,5% In	0,03123	✓

## Test Results - Power quality

Voltage fluctuations and flicker as per EN 61000-3-11					
	dmax	dc	d(t) in ms	Pst	Plt (2hours)
Limit	4,0%	3,3%	500	1	0,65
Test value	0,00%	0,00%	0,00	0,04	0,04
Verification	✓	✓	✓	✓	✓



## 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%	0,104 A	0,14%	0,19 A	0,26%	3,28%	✓
3	150	-	0,013 A	0,02%	0,034 A	0,05%	-	-
4	200	4,00%	0,058 A	0,08%	0,035 A	0,05%	1,98%	✓
5	250	10,70%	0,253 A	0,35%	0,296 A	0,41%	3,81%	✓
6	300	2,67%	0,041 A	0,06%	0,026 A	0,04%	2,10%	✓
7	350	7,20%	0,146 A	0,20%	0,212 A	0,29%	4,06%	✓
8	400	2,00%	0,009 A	0,01%	0,032 A	0,04%	2,19%	✓
9	450	-	0,011 A	0,01%	0,016 A	0,02%	-	-
10	500	1,60%	0,027 A	0,04%	0,027 A	0,04%	2,36%	✓
11	550	3,10%	0,07 A	0,10%	0,089 A	0,12%	3,96%	✓
12	600	1,33%	0,032 A	0,04%	0,025 A	0,03%	3,28%	✓
13	650	2,00%	0,066 A	0,09%	0,087 A	0,12%	5,97%	✓
14	700	-	0,027 A	0,04%	0,016 A	0,02%	-	-
15	750	-	0,009 A	0,01%	0,015 A	0,02%	-	-
16	800	-	0,028 A	0,04%	0,027 A	0,04%	-	-
17	850	-	0,04 A	0,06%	0,066 A	0,09%	-	-
18	900	-	0,026 A	0,04%	0,023 A	0,03%	-	-
19	950	-	0,031 A	0,04%	0,068 A	0,09%	-	-
20	1000	-	0,009 A	0,01%	0,013 A	0,02%	-	-
21	1050	-	0,009 A	0,01%	0,013 A	0,02%	-	-
22	1100	-	0,007 A	0,01%	0,011 A	0,02%	-	-
23	1150	-	0,022 A	0,03%	0,049 A	0,07%	-	-
24	1200	-	0,006 A	0,01%	0,012 A	0,02%	-	-
25	1250	-	0,019 A	0,03%	0,05 A	0,07%	-	-
26	1300	-	0,01 A	0,01%	0,01 A	0,01%	-	-
27	1350	-	0,008 A	0,01%	0,011 A	0,02%	-	-
28	1400	-	0,012 A	0,02%	0,01 A	0,01%	-	-
29	1450	-	0,019 A	0,03%	0,047 A	0,06%	-	-
30	1500	-	0,009 A	0,01%	0,009 A	0,01%	-	-
31	1550	-	0,022 A	0,03%	0,043 A	0,06%	-	-
32	1600	-	0,008 A	0,01%	0,01 A	0,01%	-	-
33	1650	-	0,008 A	0,01%	0,01 A	0,01%	-	-
34	1700	-	0,007 A	0,01%	0,008 A	0,01%	-	-
35	1750	-	0,021 A	0,03%	0,036 A	0,05%	-	-
36	1800	-	0,007 A	0,01%	0,009 A	0,01%	-	-
37	1850	-	0,021 A	0,03%	0,033 A	0,05%	-	-
38	1900	-	0,005 A	0,01%	0,007 A	0,01%	-	-
39	1950	-	0,006 A	0,01%	0,01 A	0,01%	-	-
40	2000	-	0,006 A	0,01%	0,008 A	0,01%	-	-

MV=Measured Value



## Test Results - Grid management

Operating range				
Test sequence	Voltage (V)	Frequency (Hz)	Power (W)	Verification
U=195,5 V; f=47,5 Hz P=1,00 Sn; cosφ=1	195,5	47,5	43562,8	✓
U=253 V; f=51,5 Hz P=1,00 Sn; cosφ=1	253	51,5	50344,8	✓

Active power feed-in at under-frequency				
Test sequence (Hz)	Frequency (Hz)	Power (W)	available power (W)	Verification
f <sub>nom</sub> ± 0,01	50	44975	44975	✓
f <sub>nom</sub> - 0,5	49,55	44957	44975	✓
f <sub>nom</sub> - 2,5	47,55	44975	44975	✓

Power response to over-frequency								
P > 80%, f <sub>1</sub> = 50,2 Hz and droop 12%					P > 40%, f <sub>1</sub> = 50,5 Hz and droop 2%			
Test sequence (Hz)	Frequency (Hz)	Power (W)	available power (W)	Verification	Frequency (Hz)	Power (W)	available power (W)	Verification
f <sub>nom</sub> ± 0,01	50	44822	44822	✓	50	24913	24977	✓
f <sub>1</sub> + 0,05	50,251	43835,87	44822	✓	50,551	23716,2	24977	✓
50,70 ± 0,10	50,701	40453,78	44822	✓	50,701	19974,07	24977	✓
51,15 ± 0,05	51,151	37063,23	44822	✓	51,151	8746,07	24977	✓
50,70 ± 0,10	50,701	40453,3	44822	✓	50,701	19973,57	24977	✓
f <sub>1</sub> + 0,05	50,251	43838,86	44822	✓	50,551	23716,42	24977	✓
Power gradient:							9,86 %P <sub>m</sub> /min	✓

Reactive power output								
Controllable reactive power					Reactive power output according to an assigned level			
P (%)	cosφ under-excited	cosφ unity	cosφ over-excited	Verification	Q setpoint (%P <sub>max</sub> )	Q setpoint (VA)	Q actual (VA)	Verification
5%	0,837	1	0,861	✓	0%	0	-199,5	✓
15%	0,843	1	0,856	✓	50%	25000	24979,5	✓
25%	0,845	1	0,855	✓	0%	0	-199	✓
35%	0,846	1	0,854	✓	-50%	-25000	-25353,5	✓
45%	0,846	1	0,854	✓	0%	0	-200	✓
55%	0,846	1	0,853	✓				
65%	0,846	1	0,853	✓				
75%	0,846	1	0,853	✓				
85%	0,847	1	0,853	✓				
95%	0,847	1	0,853	✓				