ENA G59/3
TYPE VERIFICATION TEST REPORT

Type approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G59/3.			
Generating Unit Type reference number	7500-2		
Generating Unit Type	SolarMax 10MT2		
Generating Unit technology	PV inverter		
System Supplier name	SolarMax Produktions GmbH		
Address	Zur Schönhalde 10, D-89352 Ellzee		
Tel	+49 37 33 50 78 4 0	**Fax**	+49 37 33 50 78 4 99
Email	info@solarmax.com	**Web site**	www.solarmax.com
Connection option			
-	kW single phase, single, split or three phase system		
10	kW three phase		
-	kW two phases in three phase system		
-	kW two phases split phase system		
System/supplier declaration. I certify on behalf of the company named above as a manufacturer/supplier of a Generating Unit, that all products manufactured/supplied by the company with the above Type reference number will be manufactured and tested to ensure that they perform as stated in this document, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of G59/3.			
Signed	Anton Spengler 	On behalf of	SolarMax Produktions GmbH Zur Schönhalde 10 D-89352 Ellzee +49 37 33 50 78 4 0 +49 37 33 50 78 4 99

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GENERATING UNIT TESTED TO EN 61000-3-2

SSEG rating per phase (rpp): 2 kW					NV=MV*3.68/rpp	
Harmonic	At 45-55% of rated output		100% of rated output			
	Measured Value (MV) in Amps	Measured Value (NV) in Amps	Measured Value (MV) in Amps	Measured Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2	0.028	0.031	0.024	0.027	1.080	
3	0.014	0.016	0.026	0.029	2.300	
4	0.009	0.010	0.010	0.012	0.430	
5	0.153	0.170	0.276	0.306	1.140	
6	0.007	0.008	0.011	0.013	0.300	
7	0.020	0.022	0.137	0.152	0.770	
8	0.007	0.008	0.012	0.013	0.230	
9	0.017	0.019	0.013	0.014	0.400	
10	0.007	0.008	0.012	0.013	0.184	
11	0.049	0.054	0.080	0.089	0.330	
12	0.008	0.008	0.015	0.016	0.153	
13	0.052	0.057	0.078	0.086	0.210	
14	0.007	0.008	0.012	0.014	0.131	
15	0.017	0.019	0.011	0.012	0.150	
16	0.008	0.009	0.013	0.014	0.115	
17	0.019	0.021	0.051	0.056	0.132	
18	0.007	0.008	0.016	0.017	0.102	
19	0.021	0.023	0.051	0.057	0.118	
20	0.007	0.008	0.010	0.011	0.092	
21	0.017	0.019	0.013	0.015	0.107	0.160
22	0.007	0.008	0.012	0.013	0.084	
23	0.030	0.034	0.029	0.032	0.098	0.147
24	0.006	0.007	0.011	0.012	0.077	
25	0.027	0.030	0.024	0.026	0.090	0.135

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	Measured Value (MV) in Amps	Measured Value (NV) in Amps	Measured Value (MV) in Amps	Measured Value (NV) in Amps	Limit in BS EN 61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
26	0.005	0.006	0.012	0.013	0.071	
27	0.011	0.012	0.009	0.010	0.083	0.124
28	0.005	0.005	0.009	0.010	0.066	
29	0.013	0.015	0.016	0.017	0.078	0.117
30	0.004	0.004	0.007	0.008	0.061	
31	0.010	0.011	0.013	0.015	0.073	0.109
32	0.004	0.004	0.007	0.007	0.058	
33	0.011	0.012	0.006	0.007	0.068	0.102
34	0.004	0.004	0.007	0.007	0.054	
35	0.012	0.013	0.013	0.014	0.064	0.096
36	0.003	0.003	0.006	0.007	0.051	
37	0.009	0.010	0.012	0.013	0.061	0.091
38	0.002	0.003	0.005	0.005	0.048	
39	0.006	0.007	0.005	0.006	0.058	0.087
40	0.003	0.003	0.006	0.006	0.046	

POWER QUALITY – VOLTAGE FLUCTUATIONS

	Starting			Stopping			Running	
	d_{max}	d_c	$d_{(t)}$	d_{max}	d_c	$d_{(t)}$	P_{st}	P_{lt} 2 hours
Measured values at test impedance	1.69	1.63	0.00	0.92	0.82	0.00	0.01	0.01
Normalised to standard impedance	1.69	1.63	0.00	0.92	0.82	0.00	0.01	0.01
Normalised to required maximum impedance	3.42	3.30	0.00	1.86	1.66	0.00	0.02	0.02
Limits set under EN 61000-3-11	4.00	3.30	3.30	4.00	3.30	3.30	1.00	0.65

Test Impedance	R	0.24	Ω	XI	0.15	Ω
Standard Impedance	R	0.24	Ω	XI	0.15	Ω
Maximum Impedance	R	0.49	Ω	XI	0.30	Ω

POWER QUALITY – DC INJECTION

Test power level	10 %	55 %	100 %
Recorded value	2 mA	2 mA	2 mA
as % of rated AC current	0.0125	0.0125	0.0125
Limit	0.25 %	0.25 %	0.25 %

POWER QUALITY – POWER FACTOR

	216.2 V	230 V	253 V
Measured Value	1.00	1.00	1.00
Limit	>0.95	>0.95	>0.95

PROTECTION – FREQUENCY TESTS

Function	Setting		Trip test		"No trip tests"	
	Frequency	Time delay	Frequency	Time delay	Frequency/ time	Confirm no trip
U/F stage 1	47.5 Hz	20 s	47.49 Hz	20.49 s	47.7 Hz 25 s	Yes
U/F stage 2	47 Hz	0.5 s	47.00 Hz	0.99 s	47.2 Hz 19.98 s	Yes
					46.8 Hz 0.48 s	Yes
O/F stage 1	51.5 Hz	90 s	51.51 Hz	90.47 s	51.3 Hz 95 s	Yes
O/F stage 2	52 Hz	0.5 s	52.01 Hz	0.98 s	51.8 Hz 89.98 s	Yes
					52.2 Hz 0.48 s	Yes

PROTECTION – VOLTAGE TESTS

Function	Setting		Trip test		"No trip tests"	
	Voltage	Time delay	Voltage	Time delay	Voltage/time	Confirm no trip
U/V stage 1	200.1 V	2.5 s	198.7 V	2.98 s	204.1 V 3.5 s	Yes
U/V stage 2	184 V	0.5 s	182.8 V	0.99 s	188 V 2.48 s	Yes
					180 V 0.48 s	Yes
O/V stage 1	262.2 V	1.0 s	261.7 V	1.49 s	258.2 V 2.0 s	Yes
O/V stage 2	273.7 V	0.5 s	273.0 V	0.97 s	269.7 V 0.98 s	Yes
					277.7 V 0.48 s	Yes

PROTECTION – LOSS OF MAINS TEST

Test Power	10 %	55 %	100 %	10 %	55 %	100 %
Balancing load on islanded network	95 % of Generating Unit output	95 % of Generating Unit output	95 % of Generating Unit output	105 % of Generating Unit output	105 % of Generating Unit output	105 % of Generating Unit output
Trip time. Limit is 0.5 seconds	0.06 s	0.07 s	0.08 s	0.08 s	0.07 s	0.10 s
Single phase test	Ph1 removed - confirm trip:	Yes	Ph2 removed - confirm trip:	Yes	Ph3 removed - confirm trip:	Yes

PROTECTION – FREQUENCY CHANGE STABILITY TEST

	Start Frequency	Change	End Frequency	Confirm no trip
Positive Vector Shift	49.5 Hz	+9 degrees		Yes
Negative Vector Shift	50.5 Hz	- 9 degrees		Yes
Positive Frequency drift	49.5 Hz	+0.19 Hz/sec	51.5 Hz	Yes
Negative Frequency drift	50.5 Hz	- 0.19 Hz/sec	47.5 Hz	Yes

PROTECTION – RE-CONNECTION TIMER

Time delay setting	Measured delay				
20 s	32 s	At 266.2 V	At 196.1 V	At 47.4 Hz	At 51.6 Hz
Confirmation that the Generating Unit does not re-connect:		Yes	Yes	Yes	Yes

FAULT LEVEL CONTRIBUTION

Time after fault	Volts (Peak)	Amps (Peak)
20 ms	66	36.3
100 ms	66	40
250 ms	66	35.6
500 ms	0	0
Time to trip	0.26	In seconds

SELF MONITORING SOLID STATE SWITCHING

	Yes/or NA
It has been verified that in the event of the solid state switching device failing to disconnect the Generating Unit, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 seconds.	NA