primara
Test- und Zertifizier-GmbH

Certificate

Applicant: **SolarEdge Technologies LTD**
1 HaMada Street
4673335 Herzeliya
Israel

Product: **Photovoltaic Inverter with integrated automatic disconnection device between a generator and the public low-voltage grid**

Model:	**SE 2200H**	**SE 3000H**	**SE 3500H**	**SE 3680H**	**SE 4000H**	**SE 5000H**	**SE 6000H**	**SE 8000H**	**SE 10000H**
Rating:	**2,2kVA**	**3,0kVA**	**3,5kVA**	**3,68kVA**	**4,0kVA**	**5,0kVA**	**6,0kVA**	**8,0kVA**	**10,0kVA**

Intended use:

An automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G59/3 for photovoltaic systems with a single-phase parallel coupling via an inverter to the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter.

Applied standards and guidelines:

Engineering Recommendation G59/3-2
Issue 3 Amendment 2 September 2015
Recommendations for the connection of generating plant to the distribution systems of licensed distribution network operators

The safety concept of an aforementioned representative product corresponds at the time of issue of this certificate to the valid safety specifications for the specified use in accordance with regulations.

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DAkkS
Deutsche
Akkreditierungsstelle
D-ZE-12089-01-00

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- Digitally signed | see http://ca.primara.net for more details -

Certification Department

CERTIFICATION primara Test- und Zertifizier-GmbH Grid Code Compliance G59/3

Power Quality. Harmonics.

SE2200H, SE3000H, SE3500H, SE3680H

Equipment Phases: Single Phase

Harmonic:	At 45-55% of rated output	At 100% of rated output	Harmonic Limit (A)
	Measured Value (A)		
2nd	0,013	0,024	1,080
3rd	0,162	0,264	2,300
4th	0,011	0,019	0,430
5th	0,018	0,022	1,140
6th	0,005	0,011	0,300
7th	0,069	0,064	0,770
8th	0,008	0,014	0,230
9th	0,098	0,117	0,400
10th	0,013	0,016	0,184
11th	0,018	0,032	0,330
12th	0,006	0,013	0,153
13th	0,118	0,091	0,210
14th	0,011	0,019	0,131
15th	0,090	0,091	0,150
16th	0,014	0,014	0,115
17th	0,026	0,024	0,132
18th	0,006	0,011	0,102
19th	0,024	0,021	0,118
20th	0,003	0,010	0,092
21st	0,019	0,013	0,107
22nd	0,003	0,003	0,084
23rd	0,019	0,011	0,098
24th	0,002	0,003	0,077
25th	0,013	0,010	0,090
26th	0,002	0,002	0,071
27th	0,010	0,005	0,083
28th	0,002	0,002	0,066
29th	0,010	0,005	0,078
30th	0,002	0,002	0,061
31st	0,010	0,006	0,073
32nd	0,000	0,002	0,058
33rd	0,008	0,005	0,068
34th	0,000	0,002	0,054
35th	0,008	0,005	0,064
36th	0,000	0,002	0,051
37th	0,006	0,005	0,061
38th	0,000	0,002	0,048
39th	0,006	0,005	0,058
40th	0,002	0,002	0,046

Power Quality. Harmonics.

SE4000H, SE5000H, SE6000H

Generating Unit tested to BS EN 61000-3-12

Harmonic	At 45-55% of rated output		100% of rated output		Harmonics % = Measured Value (Amps) x 23/rating per phase (kVA)
	Measured Value (MV) in Amps		Measured Value (MV) in Amps		Limit in BS EN 61000-3-12 in Amps
2	0,026	0,10	0,057	0,22	8,00%
3	0,047	0,18	0,110	0,42	21,60%
4	0,010	0,04	0,037	0,14	4,00%
5	0,157	0,60	0,138	0,53	10,70%
6	0,013	0,05	0,010	0,04	2,67%
7	0,052	0,20	0,037	0,14	7,20%
8	0,010	0,04	0,010	0,04	2,00%
9	0,031	0,12	0,052	0,20	3,80%
10	0,005	0,02	0,018	0,07	1,60%
11	0,039	0,15	0,115	0,44	3,10%
12	0,010	0,04	0,023	0,09	1,33%
13	0,133	0,51	0,190	0,73	2,00%
THD	-	2,07	-	1,46	23,00%
PWHD	-	4,26	-	3,36	23,00%

SE8000H, SE10000H

Generating Unit tested to BS EN 61000-3-12

Harmonic	At 45-55% of rated output		100% of rated output		Harmonics % = Measured Value (Amps) x 23/rating per phase (kVA)
	Measured Value (MV) in Amps	%	Measured Value (MV) in Amps	%	Limit in BS EN 61000-3-12 in Amps
2	0,030	0,32	0,060	0,16	8,00%
3	0,090	0,90	0,170	0,48	21,60%
4	0,010	0,11	0,020	0,05	4,00%
5	0,170	0,90	0,170	0,90	10,70%
6	0,010	0,16	0,030	0,05	2,67%
7	0,100	0,42	0,080	0,53	7,20%
8	0,020	0,11	0,020	0,11	2,00%
9	0,070	0,53	0,100	0,37	3,80%
10	0,020	0,05	0,010	0,11	1,60%
11	0,100	0,69	0,130	0,53	3,10%
12	0,020	0,11	0,020	0,11	1,33%
13	0,140	0,95	0,180	0,74	2,00%
THD	–	2,011	–	0,805	23,00%
PWHD	–	4,596	–	1,682	23,00%

Power Quality. Voltage Fluctuations and Flicker.

SE2200H, SE3000H, SE3500H, SE3680H

	Starting			Stopping			Running	
	dmax	dc	d(t)	Dmax	dc	d(t)	Pst	Plt 2 hours
Measured Values	0,60%	0,54%	0	0,78	0,78	0	0,059	0,059
Normalised to standard impedance	0,60%	0,54%	0	0,78	0,78	0	0,059	0,059
Limits	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

SE4000H, SE5000H, SE6000H

	Starting			Stopping			Running	
	dmax	dc	d(t)	Dmax	dc	d(t)	Pst	Plt 2 hours
Measured Values	4,79%	5,05%	0	4,91%	5,08%	0	0,12	0,12
Normalised to maximum impedance of 0,26Ohms	3,11%	3,28%	0	3,19%	3,30%	0	0,08	0,08
Limits	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

SE8000H, SE10000H

	Starting			Stopping			Running	
	dmax	dc	d(t)	Dmax	dc	d(t)	Pst	Plt 2 hours
Measured Values	6,69%	6,65%	–	6,86%	6,61%	–	0,24	0,24
Normalised to maximum impedance of 0,26Ohms	3,32%	3,30%	–	3,40%	3,28%	–	0,12	0,12
Limits	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65

Power Quality. DC injection.

Test power level	10%	55%	100%
Recorded value in Amps	-15mA	-19mA	-21mA
As % of rated AC current	-0,09%	-0,12%	-0,13%
Limit	0,25%	0,25%	0,25%

Power Quality. Power factor.

	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within + or – 1,5% of the stated level during test.
Measured Value	0,999	0,999	0,999	
Limit	>0,95	>0,95	>0,95	

Protection. Frequency tests

Function	Setting		Trip test		No trip test	
	Frequency	Time delay	Frequency	Time delay	Frequency time	Confirm no trip
U/F stage 1	47,5Hz	20s	47,49Hz	20,15s	47,7Hz 25s	No trip
U/F stage 2	47,0Hz	0,5s	46,99Hz	0,53s	47,2Hz 19,98s	No trip
					46,8Hz 0,48s	No trip
O/F stage 1	51,5Hz	90s	51,51Hz	90,10s	51,3Hz 95s	No trip
O/F stage 2	52,0Hz	0,5s	52,01Hz	0,61s	51,8Hz 89,98s	No trip
					52,2Hz 0,48s	No trip

Protection. Voltage tests

Function	Setting		Trip test		No trip test	
	Voltage	Time delay	Voltage	Time delay	Voltage time	Confirm no trip
U/V stage 1	200,1V	2,5s	199,6V	2,59s	204,1V 3,5s	No trip
U/V stage 2	184,0V	0,5s	183,6V	0,59s	188V 2,48s	No trip
					180V 0,48s	No trip
O/V stage 1	262,2V	1,0s	262,0V	1,09s	258,2V 2,0s	No trip
O/V stage 2	273,7V	0,5s	273,3V	0,59s	269,7V 0,98s	No trip
					277,7V 0,48s	No trip

a) Protection. Loss of Mains test and single phase test

Note as an alternative, inverters can be tested to BS EN 62116. The following sub set of tests should be recorded in the following table.

SE2200H, SE3000H, SE3500H, SE3680H						
Test power and imbalance	33% -5% Q Tests 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5s	0,17s	0,10s	0,09s	0,05s	0,10s	0,13s
SE4000H, SE5000H, SE6000H						
Test power and imbalance	33% -5% Q Tests 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5s	0,57s	0,65s	0,59s	0,60s	0,59s	0,60s
SE8000H, SE10000H						
Test power and imbalance	33% -5% Q Tests 22	66% -5% Q Test 12	100% -5% P Test 5	33% +5% Q Test 31	66% +5% Q Test 21	100% +5% P Test 10
Trip time. Limit is 0.5s	0,09s	0,08s	0,10s	0,10s	0,09s	0,10s

Single phase test for multi phase **Generating Units**. Confirm that when generating in parallel with a network operating at around 50Hz with no network disturbance, that the removal of a single phase connection to the **Generating Unit**, with the remaining phases connected causes a disconnection of the generating unit within a maximum of 1s.

Ph 1 removed	Confirm trip	Ph 2 removed	Confirm trip	Ph 3 removed	Confirm trip

b) Protection. Frequency change, Stability test.

	Start frequnecy	Change	End frequency	Confirm no trip
Positive vector shift	49,5Hz	+9 dregrees		No trip
Negative vector shift	50,5Hz	-9 dregrees		No trip
Positive frequency drift	49,5Hz	+0,19Hz/sec	51,5Hz	No trip
Negative frequency drift	50,5Hz	-0,19Hz/sec	47,5Hz	No trip

c) Protection. Re-connection timer.

Time delay settings (s)	Measured delay (s)	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 10.5.7.1			
20	36	At 266,2V	At 196,1V	At 47,4Hz	At 51,6Hz
Confirmation that the **Generating Unit** does not re-connect		No reconnection	No reconnection	No reconnection	No reconnection

d) Faul Level contribution.

For machines with electro-magnetic output			For inverter output		
Parameter	Symbol	Value	Time after fault	Volts	Amps
Peak Short Circuit current	i_p	-	20ms	64,2	43,0
Initial Value of aperiodic current	A	-	100ms	23,5	45,7
Initial symmetrical short-circuit current	I_K	-	250ms	22,1	47,9
Decaying (aperiodic) component of short-circuit current	i_{DC}	-	500ms	22,1	47,9
Reactance/Resistance Ratio of source	X/R	-	Time to trip	0,61	In seconds

e) Self Monitoring solid state switching.

It has been verified that in the event of the solid state switching device failing to disconnect the Generating Plant, the voltage on the output side of the switching device is reduced to a value below 50 volt within 0,5s.	N/A