Certificate of compliance

Applicant:	**SolarEdge Technologies Ltd.** 1 HaMada Street Herzeliya 4673335 **Israel**
Product:	**Compact photovoltaic inverter**
Model:	**SE1000M** **SE1500M** **SE2000M** **SE2500M**

Use in accordance with regulations:

Automatic disconnection device with single-phase mains surveillance in accordance with Engineering Recommendation G98/1 for photovoltaic systems with a single-phase parallel coupling via an inverter in the public mains supply. The automatic disconnection device is an integral part of the aforementioned inverter. This serves as a replacement for the disconnection device with isolating function that can access the distribution network provider at any time.

Applied rules and standards:

Engineering Recommendation G98/1-2:2018
Requirements for the connection of Fully Type Tested Micro-generators (up to and including 16 A per phase) in parallel with public Low Voltage Distribution Networks

DIN V VDE V 0126-1-1:2006-02 (Functional safety)
Automatic disconnection device between a generator and the public low-voltage grid

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

Report number:	**16TH0371-G98/1_0**
Certificate number:	**U19-0185**
Date of issue:	**2019-03-29**

Certification body

Holger Schaffer
Certification body of Bureau Veritas Consumer Products Services Germany GmbH
Accredited according to DIN EN ISO/IEC 17065

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98	**Nr. 16TH0371-G98/1_0**

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G98				
PGM Technology	Photovoltaic inverter			
Manufacturer:	SolarEdge Technologies Ltd.			
Address	1 HaMada Street Herzeliya 4673335 Israel			
Tel	+972-9-957-6620	**Fax**	+972-9-957-6591	
Email	info@solaredge.com	**Website**	www.solaredge.com	
Rated values	SE1000M	SE1500M	SE2000M	SE2500M
Maximum rated capacity	1000W	1500W	2000W	2500W
Rated voltage	220/230 60Hz/50Hz			
Firmware version	Main DSP software version is 1.00 Aux DSP software version is 2.01			
Measurement period:	2017-12-10 to 2018-02-20, 2019-01-10 to 2019-02-05			

Description of the structure of the power generation unit:

The power generation unit is equipped with a PV and line-side EMC filter. The power generation unit has no galvanic isolation between DC input and AC output. Output switch-off is performed with single-fault tolerance based on two series-connected relays in line and neutral. This enables a safe disconnection of the power generation unit from the network in case of error.

Differences between Generating Units:

The inverters SE1000M, SE1500M and SE20000M and are based on the inverter SE2500M. They use the same controller unit, control system and software.

Therefore testing of the SE2000M only based on the control functions are identical in the SE1000M, SE1500M and SE2500M.

The above stated Generating Units are tested according the requirements in the Engineering Recommendation G98/1. Any modification that affects the stated tests must be named by the manufacturer/supplier of the product to ensure that the product meets all requirements of the Engineering Recommendation G98/1.

Appendix C Type Test Verification Report	
Extract from test report according to the Engineering Recommendation G98	**Nr. 16TH0371-G98/1_0**

Operating Range.	
Connection:	Always connected
Limit:	Always connected
Test 1	Voltage = 85% of nominal (195,5 V) Frequency = 47.5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 2	Voltage = 110% of nominal (253 V) Frequency = 51.5 Hz Power Factor = 1 Period of test 90 minutes
Connection:	Always connected
Limit:	Always connected
Test 3	Voltage = 110% of nominal (253 V) Frequency = 52.0 Hz Power Factor = 1 Period of test 15 minutes
Connection:	Always connected
Limit:	Always connected

Protection. Voltage tests.						
Phase 1						
Function	**Setting**		**Trip test**		**No trip test**	
	Voltage [V]	**Time delay [s]**	**Voltage [V]**	**Time delay [s]**	**Voltage / time**	**Confirm no trip**
U/V	184	2,5	184,6	2,757	188V / 3,5s	No trip
					180V / 2,48s	No trip
O/V stage 1	262,2	1,0	261,9	1,259	258,2V 2,0s	No trip
O/V stage 2	273,7	0,5	273,4	0,759	269,7V 0,98s	No trip
					277,7V 0,48s	No trip
Note. For Voltage tests the Voltage required to trip is the setting ±3,45V. The time delay can be measured at a larger deviation than the minimum required to operate the protection. The No trip tests need to be carried out at the setting ±4V and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98 **Nr. 16TH0371-G98/1_0**

Protection. Frequency tests.						
Function	**Setting**		**Trip test**		**No trip test**	
	Frequency [Hz]	**Time delay [s]**	**Frequency [Hz]**	**Time delay [s]**	**Frequency / time**	**Confirm no trip**
U/F stage 1	47,5	20	47,52	20,271	47,7Hz / 25s	No trip
U/F stage 2	47	0,5	47,01	0,786	47,2Hz / 19,98s	No trip
					46,8Hz / 0,48s	No trip
O/F stage 2	52	0,5	52,01	0,784	51,8Hz / 89,98s	No trip
					52,2Hz / 0,48s	No trip
Note. For Frequency Trip tests the Frequency required to trip is the setting ±0,1Hz. In order to measure the time delay a larger deviation than the minimum required to operate the projection can be used. The “No-trip tests” need to be carried out at the setting ±0,2Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error.						

Protection. Loss of Mains.						
SE2500M						
Inverters tested according to BS EN 62116.						
Balancing load on islanded network	33% of -5% Q Test 22	66% of -5% Q Test 12	100% of -5% P Test 5	33% of +5% Q Test 31	66% of +5% Q Test 21	100% of +5% P Test 10
Trip time. Ph1 fuse removed [s]	0,093	0,080	0,113	0,043	0,115	0,117
Note. Trip time limit is 0,5s. For technologies which have a substantial shut down time this can be added to the 0,5s in establishing that the trip occurred in less than 0,5s maximum. Shut down time could therefore be up to 1,0s for these technologies.						

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Protection. Re-connection timer.	
Test should prove that the reconnection sequence starts in no less than 20 seconds for restoration of voltage and frequency to within the stage 1 settings of table 10.5.7.1.	
Over Voltage	
Time delay setting	**Measured delay**
20s	49,0s
Under Voltage	
Time delay setting	**Measured delay**
20s	58,0s
Over Frequency	
Time delay setting	**Measured delay**
20s	49,0s
Under Frequency	
Time delay setting	**Measured delay**
20s	53,0s

	Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1.			
	At 266,2V	At 196,1V	At 47,4Hz	At 52,1Hz
Confirmation that the Generating Unit does not re-connect.	No reconnection	No reconnection	No reconnection	No reconnection

Protection. Frequency change, Stability test.				
	Start Frequency [Hz]	**Change**	**Test Duration**	**Confirm no trip**
Positive Vector Shift	49,5	+50 degrees		No trip
Negative Vector Shift	50,5	-50 degrees		No trip
Positive Frequency drift	49,0 to 51,0	+0,95Hz/sec	2,1s	No trip
Negative Frequency drift	51,0 to 49,0	-0,95Hz/sec	2,1s	No trip

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98 **Nr. 16TH0371-G98/1_0**

Limited Frequency Sensitive Mode – Over Frequency							
	SE2000M						
1-min mean value [Hz]:	**a) 50,00**	**b) 50,45**	**c) 50,70**	**d) 51,15**	**e) 50,70**	**f) 50,45**	**g) 50,00**
1. Measurement a) to g): Active power output > 80% Pn							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
PM [kW]:	N/A	2,00	1,95	1,86	1,95	2,00	N/A
PE60 [kW]:	2,01	2,00	1,95	1,85	1,94	1,99	2,00
∆PE60/PM [%]:	N/A	0,00	0,00	0,00	0,00	0,00	N/A
Limit $\Delta P/P_{1min}$:	+ 10 % of PM						
2. Measurement a) to g): Active power output 40% and 60% after freezing > 80% Pn							
Frequency [Hz]:	50,00	50,45	50,70	51,15	50,70	50,45	50,00
PM [kW]:	N/A	1,05	1,02	0,98	1,02	1,05	N/A
PE60 [kW]:	1,06	1,03	1,00	0,95	1,00	1,02	1,12
∆PE60/PM [%]:	N/A	-0,02	-0,02	-0,02	-0,02	-0,03	N/A
Limit $\Delta P/P_{1min}$:	+ 10 % of PM						

Output Power with falling Frequency			
	SE2000M		
5-min mean value (each)	**a) 50 ± 0,01 Hz**	**b) - 0,4 to - 0,5 Hz**	**c) - 2,4 to - 2,5 Hz**
Frequency [Hz]:	50,00	49,55	47,55
Active power [W]:	1981	1980	1879
ΔP/PM [%] per 1 Hz:			0

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98 **Nr. 16TH0371-G98/1_0**

Power Quality. Harmonics.

SE2500M

Phase 1

SSEG rating per phase (rpp)						
	At 45-55% of rated ouput 1,21kW		100% of rated output 2,20kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (%) in [A]	Measured Value (MV) in [A]	Measured Value (%) in [A]	Limit in BS EN61000-3-2 in Amps	Higher limit for odd harmonics 21 and above
2nd	0,022	0,206	0,011	0,100	1,080	
3rd	0,075	0,696	0,073	0,679	2,300	
4th	0,014	0,129	0,011	0,104	0,430	
5th	0,026	0,243	0,029	0,271	1,140	
6th	0,011	0,098	0,012	0,109	0,300	
7th	0,024	0,223	0,022	0,206	0,770	
8th	0,011	0,105	0,012	0,108	0,230	
9th	0,022	0,208	0,027	0,253	0,400	
10th	0,011	0,098	0,012	0,112	0,184	
11th	0,022	0,206	0,026	0,237	0,330	
12th	0,011	0,104	0,013	0,118	0,153	
13th	0,023	0,217	0,023	0,212	0,210	
14th	0,011	0,104	0,012	0,109	0,131	
15th	0,023	0,214	0,023	0,216	0,150	
16th	0,012	0,112	0,013	0,119	0,115	
17th	0,024	0,227	0,027	0,249	0,132	
18th	0,013	0,117	0,014	0,133	0,102	
19th	0,024	0,219	0,026	0,240	0,118	
20th	0,014	0,131	0,015	0,141	0,092	
21th	0,023	0,217	0,023	0,213	0,107	0,160
22th	0,013	0,122	0,014	0,134	0,084	
23th	0,024	0,221	0,023	0,217	0,098	0,147
24th	0,013	0,120	0,015	0,138	0,077	
25th	0,024	0,224	0,024	0,226	0,090	0,135
26th	0,012	0,113	0,014	0,131	0,071	
27th	0,023	0,212	0,025	0,231	0,083	0,124
28th	0,012	0,108	0,013	0,123	0,066	
29th	0,022	0,203	0,023	0,210	0,078	0,117
30th	0,010	0,097	0,012	0,109	0,061	
31th	0,019	0,179	0,018	0,169	0,073	0,109
32th	0,009	0,087	0,011	0,098	0,058	
33th	0,017	0,154	0,017	0,157	0,068	0,102
34th	0,008	0,076	0,010	0,088	0,054	
35th	0,016	0,152	0,018	0,165	0,064	0,096
36th	0,008	0,074	0,009	0,079	0,051	
37th	0,016	0,146	0,015	0,144	0,061	0,091
38th	0,007	0,066	0,007	0,069	0,048	
39th	0,014	0,129	0,014	0,127	0,058	0,087
40th	0,006	0,056	0,007	0,067	0,046	

Note the higher limits for odd harmonics 21 and above are only allowable under certain conditions, if these higher limits are utilised please state the exemption used as detailed in part 6.2.3.4 of BS EN 61000-3-2 in the box below. The test had been performed on the model SE3680H, SE2200H and SE10000H the test results are valid for the SE3000H, SE3500H, SE3680H, SE4000H, SE4600H, SE5000H* (4985W), SE5000H, SE6000H and SE8000H since it is identical in hardware and just the output power derated by software.

Appendix C Type Test Verification Report

Extract from test report according to the Engineering Recommendation G98 **Nr. 16TH0371-G98/1_0**

Power Quality. Voltage fluctuation and Flicker.								
SE2500M								
	Starting			**Stopping**			**Running**	
	dmax	**dc**	**d(t)**	**dmax**	**dc**	**d(t)**	**Pst**	**Plt 2 hours**
Measured values at test impedance	1,195%	0,996%	0,00%	1,195%	0,996%	0,00%	0,213	0,166
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65
Test impedance	R	0,24* 0,4^	Ω	Xl	0,15* 0,25	Ω		
Standard impedance	R	0,24* 0,4^	Ω	Xl	0,15* 0,25^	Ω		

Power Quality. DC injection.			
SE2500M			
Test level power [%]	10	55	100
Recorded value [mA]	8,78	7,79	9,59
Recorded value [%]	0,08	0,07	0,09
Limit [%]	0,25	0,25	0,25

Fault level Contribution.					
SE2500M					
For a directly coupled SSEG			**For a Inverter SSEG**		
Parameter	**Symbol**	**Value**	**Time after fault**	**Volts [V]**	**Amps [A]**
Peak Short Circuit current	I_p	N/A	20ms	51,1	12,7
Initial Value of aperiodic current	A	N/A	100ms	34,97	9,63
Initial symmetrical short-circuit current*	I_k	N/A	250ms	31,91	9,64
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	30,86	10,16
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to Trip [s]**	0,606	

For rotating machines and linear piston machines the test should produce a 0s – 2s plot of the short circuit current as seen at the Generating Unit terminals.

* Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot.

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Self Monitoring – Solid state switching.	**N/A**
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.	
Note. Unit do not provide solid state switching relays. In case the semiconductor bridge is switched off, then the voltage on the output drops to 0. In this case the relays on the output will also open.	