Certificate of compliance

Applicant:	**SolarEdge Technologies Ltd.** 1 HaMada Street Herzeliya 4673335 **Israel**
Product:	**Grid-tied photovoltaic (PV) inverter**
Model:	**SE3K SE7K SE12.5K** **SE4K SE8K SE15K** **SE5K SE9K SE16K** **SE6K SE10K SE17K**

Use in accordance with regulations:

Automatic disconnection device with three-phase mains surveillance in accordance with Engineering Recommendation G99/1 for photovoltaic systems with a three-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 G99/1-3:2018
Requirements for the connection of generation equipment in parallel with public 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:	**10TH0222-G99/1_1**
Certificate number:	**U19-0297**
Date of issue:	**2019-05-17**

Certification body

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

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules	
Extract from test report according to the Engineering Recommendation G99	**Nr. 10TH0222-G99/1_1**

Type Approval and declaration of compliance with the requirements of Engineering Recommendation G99				
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	SE3K	SE4K	SE5K	SE6K
Maximum rated capacity	3kW	4kW	5kW	6kW
Rated voltage	230 / 400 3 wires, N, PE			
Rated values	SE7K	SE8K	SE9K	SE10K
Maximum rated capacity	7kW	8kW	9kW	10kW
Rated voltage	230 / 400 3 wires, N, PE			
Rated values	SE12.5K	SE15K	SE16K	SE17K
Maximum rated capacity	12,5kW	15kW	16kW	17kW
Rated voltage	230 / 400 3 wires, N, PE			
Firmware version	Main DSP software version is 1.130 Aux DSP software version is 2.19			
Measurement period:	2017-06-14 to 2017-06-29, 2019-01-10 to 2019-02-05, 2019-05-16			

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 of the SExx.xK series consist of the inverter models SE3K, SE4K, SE5K, SE6K, SE7K, SE8K, SE9K, SE10K, SE12,5K, SE15K, SE16K, SE17K. They use generally the same hardware and identical software.

The above stated Generating Units are tested according the requirements in the Engineering Recommendation G99/1. 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 G99/1.

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Operating Range.	
Test 1	Voltage = 85% of nominal (195,5 V) Frequency = 47 Hz Power Factor = 1 Period of test 20 s
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 1	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 1	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	184,1	2,782	188V / 3,5s	No trip
					180V / 2,48s	No trip
O/V stage 1	262,2	1,0	261,5	1,255	258,2V 2,0s	No trip
O/V stage 2	273,7	0,5	273,1	0,761	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 A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Protection. Voltage tests.						
Phase 2						
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	184,1	2,748	188V / 3,5s	No trip
					180V / 2,48s	No trip
O/V stage 1	262,2	1,0	261,5	1,261	258,2V 2,0s	No trip
O/V stage 2	273,7	0,5	273,1	0,748	269,7V 0,98s	No trip
					277,7V 0,48s	No trip

Protection. Voltage tests.						
Phase 3						
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	184,0	2,755	188V / 3,5s	No trip
					180V / 2,48s	No trip
O/V stage 1	262,2	1,0	261,5	1,255	258,2V 2,0s	No trip
O/V stage 2	273,7	0,5	273,2	0,755	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 A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

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	47,50	20,270	47,7Hz / 25s	No trip
U/F stage 2	47	0,5	47,00	0,785	47,2Hz / 19,98s	No trip
					46,8Hz / 0,48s	No trip
O/F stage 2	52	0,5	52,00	0,762	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.						
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]	0,217	0,035	0,325	0,043	0,096	0,115
Trip time. Ph2 fuse removed [s]	0,217	0,035	0,325	0,043	0,096	0,115
Trip time. Ph3 fuse removed [s]	0,217	0,035	0,325	0,043	0,096	0,115
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.						

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules	
Extract from test report according to the Engineering Recommendation G99	**Nr. 10TH0222-G99/1_1**

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.	
Under Voltage (182V)	
Time delay setting	**Measured delay**
20s	37,0s
Over Voltage (266,2V)	
Time delay setting	**Measured delay**
20s	35,0s
Under Frequency(47,4Hz)	
Time delay setting	**Measured delay**
20s	34,0
Over Frequency(52,1Hz)	
Time delay setting	**Measured delay**
20s	35,0

	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 A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Limited Frequency Sensitive Mode – Over Frequency							
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
P_M [kW]:	N/A	10,01	9,38	8,24	9,38	10,01	N/A
P_{E60} [kW]:	10,14	10,02	9,37	8,24	9,39	10,02	10,14
$\Delta P_{E60}/P_M$ [%]:	N/A	0,01	-0,01	0,00	0,01	0,01	N/A
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
P_M [kW]:	N/A	5,18	4,85	4,26	4,85	5,18	N/A
P_{E60} [kW]:	5,25	5,19	4,86	4,28	4,86	5,18	5,65
$\Delta P_{E60}/P_M$ [%]:	N/A	0,01	0,01	0,02	0,01	0,00	N/A
Limit $\Delta P/P_{1min}$:	+ 10 % of P_M						

Note:
The test was performed with a droop of 8% (25%Pn/Hz). The default droop setting 8% and is adjustable in the range between 2% and 10% at intervals of 1%.

Output Power with falling Frequency			
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]:	10331	10332	10341
ΔP/PM [%] per 1 Hz:			0

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. Harmonics.

SE10K

Phase 1

SSEG rating per phase (rpp)						
	At 45-55% of rated ouput 5kW		100% of rated output 10kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Harmonic % Limit inBS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,019	0,129	0,013	0,086	8%	8%
3rd	0,286	1,922	0,295	1,979	21,6%	N/A
4th	0,005	0,035	0,006	0,038	4%	4%
5th	0,054	0,365	0,055	0,372	10,7%	10,7%
6th	0,003	0,020	0,004	0,026	2,67%	2,67%
7th	0,039	0,259	0,042	0,280	7,2%	7,2%
8th	0,003	0,018	0,004	0,027	2%	2%
9th	0,033	0,219	0,030	0,203	3,8%	N/A
10th	0,003	0,020	0,003	0,019	1,6%	1,6%
11th	0,035	0,237	0,025	0,169	3,1%	3,1%
12th	0,003	0,019	0,003	0,018	1,33%	1,33%
13th	0,040	0,268	0,023	0,154	2%	2%
14th	0,003	0,018	0,002	0,016	N/A	N/A
15th	0,034	0,230	0,016	0,110	N/A	N/A
16th	0,003	0,018	0,002	0,015	N/A	N/A
17th	0,032	0,216	0,014	0,094	N/A	N/A
18th	0,002	0,016	0,002	0,014	N/A	N/A
19th	0,027	0,178	0,012	0,082	N/A	N/A
20th	0,002	0,015	0,002	0,013	N/A	N/A
21th	0,018	0,123	0,009	0,059	N/A	N/A
22th	0,002	0,014	0,002	0,013	N/A	N/A
23th	0,014	0,096	0,008	0,057	N/A	N/A
24th	0,002	0,012	0,002	0,011	N/A	N/A
25th	0,008	0,052	0,006	0,042	N/A	N/A
26th	0,002	0,012	0,002	0,011	N/A	N/A
27th	0,004	0,025	0,004	0,030	N/A	N/A
28th	0,002	0,012	0,002	0,011	N/A	N/A
29th	0,003	0,021	0,005	0,031	N/A	N/A
30th	0,002	0,011	0,002	0,011	N/A	N/A
31th	0,004	0,027	0,004	0,024	N/A	N/A
32th	0,002	0,011	0,001	0,010	N/A	N/A
33th	0,004	0,028	0,002	0,014	N/A	N/A
34th	0,002	0,010	0,001	0,010	N/A	N/A
35th	0,005	0,034	0,002	0,011	N/A	N/A
36th	0,001	0,009	0,001	0,009	N/A	N/A
37th	0,005	0,031	0,001	0,010	N/A	N/A
38th	0,001	0,010	0,001	0,009	N/A	N/A
39th	0,003	0,023	0,002	0,010	N/A	N/A
40th	0,001	0,010	0,001	0,008	N/A	N/A

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. Harmonics.

SE10K

Phase 2

SSEG rating per phase (rpp)						
	At 45-55% of rated ouput 5kW		100% of rated output 10kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Harmonic % Limit inBS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,019	0,129	0,013	0,086	8%	8%
3rd	0,286	1,922	0,295	1,979	21,6%	N/A
4th	0,005	0,035	0,006	0,038	4%	4%
5th	0,054	0,365	0,055	0,372	10,7%	10,7%
6th	0,003	0,020	0,004	0,026	2,67%	2,67%
7th	0,039	0,259	0,042	0,280	7,2%	7,2%
8th	0,003	0,018	0,004	0,027	2%	2%
9th	0,033	0,219	0,030	0,203	3,8%	N/A
10th	0,003	0,020	0,003	0,019	1,6%	1,6%
11th	0,035	0,237	0,025	0,169	3,1%	3,1%
12th	0,003	0,019	0,003	0,018	1,33%	1,33%
13th	0,040	0,268	0,023	0,154	2%	2%
14th	0,003	0,018	0,002	0,016	N/A	N/A
15th	0,034	0,230	0,016	0,110	N/A	N/A
16th	0,003	0,018	0,002	0,015	N/A	N/A
17th	0,032	0,216	0,014	0,094	N/A	N/A
18th	0,002	0,016	0,002	0,014	N/A	N/A
19th	0,027	0,178	0,012	0,082	N/A	N/A
20th	0,002	0,015	0,002	0,013	N/A	N/A
21th	0,018	0,123	0,009	0,059	N/A	N/A
22th	0,002	0,014	0,002	0,013	N/A	N/A
23th	0,014	0,096	0,008	0,057	N/A	N/A
24th	0,002	0,012	0,002	0,011	N/A	N/A
25th	0,008	0,052	0,006	0,042	N/A	N/A
26th	0,002	0,012	0,002	0,011	N/A	N/A
27th	0,004	0,025	0,004	0,030	N/A	N/A
28th	0,002	0,012	0,002	0,011	N/A	N/A
29th	0,003	0,021	0,005	0,031	N/A	N/A
30th	0,002	0,011	0,002	0,011	N/A	N/A
31th	0,004	0,027	0,004	0,024	N/A	N/A
32th	0,002	0,011	0,001	0,010	N/A	N/A
33th	0,004	0,028	0,002	0,014	N/A	N/A
34th	0,002	0,010	0,001	0,010	N/A	N/A
35th	0,005	0,034	0,002	0,011	N/A	N/A
36th	0,001	0,009	0,001	0,009	N/A	N/A
37th	0,005	0,031	0,001	0,010	N/A	N/A
38th	0,001	0,010	0,001	0,009	N/A	N/A
39th	0,003	0,023	0,002	0,010	N/A	N/A
40th	0,001	0,010	0,001	0,008	N/A	N/A

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. Harmonics.

SE10K

Phase 3

SSEG rating per phase (rpp)						
	At 45-55% of rated ouput 5kW		100% of rated output 10kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Harmonic % Limit inBS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,019	0,129	0,013	0,086	8%	8%
3rd	0,286	1,922	0,295	1,979	21,6%	N/A
4th	0,005	0,035	0,006	0,038	4%	4%
5th	0,054	0,365	0,055	0,372	10,7%	10,7%
6th	0,003	0,020	0,004	0,026	2,67%	2,67%
7th	0,039	0,259	0,042	0,280	7,2%	7,2%
8th	0,003	0,018	0,004	0,027	2%	2%
9th	0,033	0,219	0,030	0,203	3,8%	N/A
10th	0,003	0,020	0,003	0,019	1,6%	1,6%
11th	0,035	0,237	0,025	0,169	3,1%	3,1%
12th	0,003	0,019	0,003	0,018	1,33%	1,33%
13th	0,040	0,268	0,023	0,154	2%	2%
14th	0,003	0,018	0,002	0,016	N/A	N/A
15th	0,034	0,230	0,016	0,110	N/A	N/A
16th	0,003	0,018	0,002	0,015	N/A	N/A
17th	0,032	0,216	0,014	0,094	N/A	N/A
18th	0,002	0,016	0,002	0,014	N/A	N/A
19th	0,027	0,178	0,012	0,082	N/A	N/A
20th	0,002	0,015	0,002	0,013	N/A	N/A
21th	0,018	0,123	0,009	0,059	N/A	N/A
22th	0,002	0,014	0,002	0,013	N/A	N/A
23th	0,014	0,096	0,008	0,057	N/A	N/A
24th	0,002	0,012	0,002	0,011	N/A	N/A
25th	0,008	0,052	0,006	0,042	N/A	N/A
26th	0,002	0,012	0,002	0,011	N/A	N/A
27th	0,004	0,025	0,004	0,030	N/A	N/A
28th	0,002	0,012	0,002	0,011	N/A	N/A
29th	0,003	0,021	0,005	0,031	N/A	N/A
30th	0,002	0,011	0,002	0,011	N/A	N/A
31th	0,004	0,027	0,004	0,024	N/A	N/A
32th	0,002	0,011	0,001	0,010	N/A	N/A
33th	0,004	0,028	0,002	0,014	N/A	N/A
34th	0,002	0,010	0,001	0,010	N/A	N/A
35th	0,005	0,034	0,002	0,011	N/A	N/A
36th	0,001	0,009	0,001	0,009	N/A	N/A
37th	0,005	0,031	0,001	0,010	N/A	N/A
38th	0,001	0,010	0,001	0,009	N/A	N/A
39th	0,003	0,023	0,002	0,010	N/A	N/A
40th	0,001	0,010	0,001	0,008	N/A	N/A

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. Harmonics.

SE17K

Phase 1

SSEG rating per phase (rpp)						
	At 45-55% of rated ouput 8,5kW		100% of rated output 17kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Harmonic % Limit inBS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,025	0,103	0,026	0,107	8%	8%
3rd	0,206	0,839	0,241	0,982	21,6%	N/A
4th	0,009	0,037	0,008	0,031	4%	4%
5th	0,095	0,389	0,095	0,386	10,7%	10,7%
6th	0,006	0,024	0,006	0,023	2,67%	2,67%
7th	0,071	0,288	0,075	0,307	7,2%	7,2%
8th	0,005	0,020	0,005	0,020	2%	2%
9th	0,050	0,203	0,057	0,233	3,8%	N/A
10th	0,005	0,020	0,005	0,019	1,6%	1,6%
11th	0,041	0,167	0,046	0,186	3,1%	3,1%
12th	0,005	0,020	0,004	0,018	1,33%	1,33%
13th	0,039	0,159	0,038	0,154	2%	2%
14th	0,005	0,022	0,004	0,017	N/A	N/A
15th	0,036	0,148	0,030	0,124	N/A	N/A
16th	0,005	0,021	0,004	0,017	N/A	N/A
17th	0,040	0,164	0,030	0,122	N/A	N/A
18th	0,005	0,020	0,004	0,016	N/A	N/A
19th	0,037	0,152	0,025	0,101	N/A	N/A
20th	0,005	0,020	0,004	0,016	N/A	N/A
21th	0,029	0,117	0,017	0,068	N/A	N/A
22th	0,005	0,020	0,004	0,016	N/A	N/A
23th	0,030	0,124	0,016	0,065	N/A	N/A
24th	0,004	0,016	0,004	0,014	N/A	N/A
25th	0,027	0,111	0,013	0,053	N/A	N/A
26th	0,005	0,019	0,003	0,014	N/A	N/A
27th	0,018	0,073	0,008	0,034	N/A	N/A
28th	0,004	0,016	0,003	0,014	N/A	N/A
29th	0,016	0,066	0,007	0,027	N/A	N/A
30th	0,003	0,014	0,003	0,013	N/A	N/A
31th	0,012	0,049	0,005	0,021	N/A	N/A
32th	0,003	0,014	0,003	0,013	N/A	N/A
33th	0,007	0,028	0,004	0,014	N/A	N/A
34th	0,003	0,013	0,003	0,014	N/A	N/A
35th	0,006	0,024	0,003	0,013	N/A	N/A
36th	0,003	0,013	0,003	0,011	N/A	N/A
37th	0,004	0,015	0,003	0,011	N/A	N/A
38th	0,003	0,012	0,003	0,012	N/A	N/A
39th	0,003	0,012	0,003	0,010	N/A	N/A
40th	0,003	0,013	0,003	0,011	N/A	N/A

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. Harmonics.

SE17K

Phase 2

SSEG rating per phase (rpp)						
	At 45-55% of rated ouput 8,5kW		100% of rated output 17kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Harmonic % Limit inBS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,024	0,095	0,025	0,102	8%	8%
3rd	0,196	0,792	0,224	0,907	21,6%	N/A
4th	0,008	0,031	0,009	0,035	4%	4%
5th	0,089	0,361	0,090	0,365	10,7%	10,7%
6th	0,005	0,021	0,006	0,023	2,67%	2,67%
7th	0,068	0,275	0,077	0,311	7,2%	7,2%
8th	0,005	0,019	0,005	0,020	2%	2%
9th	0,049	0,197	0,061	0,246	3,8%	N/A
10th	0,006	0,022	0,005	0,020	1,6%	1,6%
11th	0,037	0,148	0,047	0,190	3,1%	3,1%
12th	0,005	0,019	0,004	0,017	1,33%	1,33%
13th	0,037	0,148	0,041	0,166	2%	2%
14th	0,005	0,020	0,004	0,017	N/A	N/A
15th	0,033	0,132	0,030	0,120	N/A	N/A
16th	0,005	0,020	0,004	0,017	N/A	N/A
17th	0,035	0,143	0,028	0,113	N/A	N/A
18th	0,004	0,017	0,004	0,015	N/A	N/A
19th	0,035	0,141	0,024	0,096	N/A	N/A
20th	0,004	0,018	0,004	0,015	N/A	N/A
21th	0,028	0,112	0,016	0,063	N/A	N/A
22th	0,004	0,017	0,003	0,014	N/A	N/A
23th	0,030	0,121	0,016	0,065	N/A	N/A
24th	0,004	0,014	0,003	0,013	N/A	N/A
25th	0,027	0,109	0,012	0,048	N/A	N/A
26th	0,004	0,016	0,003	0,013	N/A	N/A
27th	0,020	0,080	0,007	0,029	N/A	N/A
28th	0,004	0,014	0,003	0,012	N/A	N/A
29th	0,018	0,074	0,007	0,029	N/A	N/A
30th	0,003	0,012	0,003	0,012	N/A	N/A
31th	0,014	0,058	0,005	0,022	N/A	N/A
32th	0,003	0,012	0,003	0,012	N/A	N/A
33th	0,009	0,037	0,003	0,013	N/A	N/A
34th	0,003	0,012	0,003	0,012	N/A	N/A
35th	0,006	0,025	0,003	0,011	N/A	N/A
36th	0,003	0,012	0,003	0,011	N/A	N/A
37th	0,003	0,013	0,003	0,010	N/A	N/A
38th	0,003	0,011	0,003	0,010	N/A	N/A
39th	0,003	0,010	0,003	0,012	N/A	N/A
40th	0,003	0,011	0,002	0,010	N/A	N/A

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. Harmonics.

SE17K

Phase 3

SSEG rating per phase (rpp)						
	At 45-55% of rated ouput 8,5kW		100% of rated output 17kW			
Harmonic	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Measured Value (MV) in [A]	Measured Value (MV) in [%]	Harmonic % Limit inBS EN61000-3-12 in %	
					1 phase	3 phase
2nd	0,027	0,109	0,025	0,104	8%	8%
3rd	0,250	1,024	0,269	1,102	21,6%	N/A
4th	0,012	0,048	0,007	0,028	4%	4%
5th	0,032	0,132	0,036	0,149	10,7%	10,7%
6th	0,005	0,021	0,006	0,023	2,67%	2,67%
7th	0,118	0,483	0,120	0,490	7,2%	7,2%
8th	0,005	0,022	0,006	0,023	2%	2%
9th	0,046	0,187	0,038	0,158	3,8%	N/A
10th	0,004	0,018	0,004	0,018	1,6%	1,6%
11th	0,072	0,294	0,077	0,315	3,1%	3,1%
12th	0,004	0,015	0,004	0,017	1,33%	1,33%
13th	0,047	0,192	0,027	0,109	2%	2%
14th	0,004	0,017	0,004	0,017	N/A	N/A
15th	0,051	0,209	0,052	0,214	N/A	N/A
16th	0,004	0,016	0,004	0,016	N/A	N/A
17th	0,039	0,159	0,017	0,070	N/A	N/A
18th	0,004	0,015	0,003	0,014	N/A	N/A
19th	0,046	0,188	0,037	0,150	N/A	N/A
20th	0,004	0,014	0,004	0,015	N/A	N/A
21th	0,032	0,131	0,016	0,064	N/A	N/A
22th	0,004	0,015	0,003	0,014	N/A	N/A
23th	0,036	0,146	0,021	0,087	N/A	N/A
24th	0,003	0,013	0,003	0,013	N/A	N/A
25th	0,025	0,104	0,012	0,048	N/A	N/A
26th	0,004	0,015	0,003	0,013	N/A	N/A
27th	0,018	0,073	0,008	0,035	N/A	N/A
28th	0,003	0,012	0,003	0,012	N/A	N/A
29th	0,018	0,074	0,009	0,037	N/A	N/A
30th	0,003	0,011	0,003	0,011	N/A	N/A
31th	0,010	0,040	0,004	0,018	N/A	N/A
32th	0,003	0,012	0,003	0,012	N/A	N/A
33th	0,009	0,038	0,006	0,025	N/A	N/A
34th	0,003	0,011	0,003	0,011	N/A	N/A
35th	0,003	0,011	0,004	0,016	N/A	N/A
36th	0,003	0,011	0,002	0,010	N/A	N/A
37th	0,005	0,022	0,003	0,014	N/A	N/A
38th	0,003	0,011	0,003	0,011	N/A	N/A
39th	0,005	0,022	0,005	0,019	N/A	N/A
40th	0,002	0,010	0,002	0,010	N/A	N/A

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. Power factor.				
SE10K				
Output power	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1,5% of the stated level during the test.
20%	0,998	0,997	0,996	
50%	0,999	0,999	0,999	
75%	0,999	0,999	0,999	
100%	0,999	0,999	0,999	
Limit	>0,95	>0,95	>0,95	
SE17K				
Output power	216,2V	230V	253V	Measured at three voltage levels and at full output. Voltage to be maintained within ±1,5% of the stated level during the test.
20%	0,998	0,997	0,996	
50%	0,999	0,999	0,999	
75%	0,999	0,999	0,999	
100%	0,999	0,999	0,999	
Limit	>0,95	>0,95	>0,95	

Power Quality. Voltage fluctuation and Flicker.								
SE10K								
	Starting			**Stopping**			**Running**	
	dmax	**dc**	**d(t)**	**dmax**	**dc**	**d(t)**	**Pst**	**Plt 2 hours**
Measured values at test impedance	0,30%	3,03%	0%	0,30%	3,03%	0%	0,0787	0,0787
Normalised to standard impedance	0,30%	3,03%	0%	0,30%	3,03%	0%	0,0787	0,0787
Limits set under BS EN 61000-3-11	4%	3,3%	3,3% 500ms	4%	3,3%	3,3% 500ms	1,0	0,65
SE17K								
	Starting			**Stopping**			**Running**	
	dmax	**dc**	**d(t)**	**dmax**	**dc**	**d(t)**	**Pst**	**Plt 2 hours**
Measured values at test impedance	0,29%	2,97%	0%	0,29%	2,97%	0%	0,3410	0,3410
Normalised to standard impedance	0,29%	2,97%	0%	0,29%	2,97%	0%	0,3410	0,3410
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

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules

Extract from test report according to the Engineering Recommendation G99 **Nr. 10TH0222-G99/1_1**

Power Quality. DC injection.			
SE10K			
Phase 1			
Test level power [%]	10	55	100
Recorded value [mA]	0,34	7,26	2,94
Recorded value [%]	0,00	0,05	0,02
Limit [%]	0,25	0,25	0,25
Phase 2			
Test level power [%]	10	55	100
Recorded value [mA]	0	22	30
Recorded value [%]	0,00	0,14	0,19
Limit [%]	0,25	0,25	0,25
Phase 3			
Test level power [%]	10	55	100
Recorded value [mA]	1	0	2
Recorded value [%]	0,01	0,00	0,02
Limit [%]	0,25	0,25	0,25
SE17K			
Phase 1			
Test level power [%]	10	55	100
Recorded value [mA]	0,73	15,99	11,52
Recorded value [%]	0,03	0,06	0,05
Limit [%]	0,25	0,25	0,25
Phase 2			
Test level power [%]	10	55	100
Recorded value [mA]	58,04	39,96	37,65
Recorded value [%]	0,23	0,16	0,15
Limit [%]	0,25	0,25	0,25
Phase 3			
Test level power [%]	10	55	100
Recorded value [mA]	4,65	15,77	16,22
Recorded value [%]	0,02	0,06	0,06
Limit [%]	0,25	0,25	0,25

Appendix A2-3 Compliance Verification Report for Inverter Connected Power Generating Modules	
Extract from test report according to the Engineering Recommendation G99	**Nr. 10TH0222-G99/1_1**

Fault level Contribution.

SE10K

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	131,95	23,50
Initial Value of aperiodic current	A	N/A	100ms	87,46	24,97
Initial symmetrical short-circuit current*	I_k	N/A	250ms	78,39	25,46
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	75,14	25,64
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to Trip [s]**	0,508	

SE17K

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	132,82	14,63
Initial Value of aperiodic current	A	N/A	100ms	88,56	15,70
Initial symmetrical short-circuit current*	I_k	N/A	250ms	79,70	16,47
Decaying (aperiodic) component of short circuit current*	i_{DC}	N/A	500ms	76,19	16,88
Reactance/Resistance Ratio of source*	X/R	N/A	**Time to Trip [s]**	0,506	

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.

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 Power Park Module, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0,5 seconds.	N/A (No solid state switching device)

Logic Interface (input port)	**P**
Confirm that an input port is provided and can be used to shut down the module.	Yes