# G59/3 (RoCoF amendment) Type Test Report – SE4K – SE17K

| Engineering Recommendation G59/3 | | | |
|---|---|---|---|
| Type Tested Reference Number | | U16 -0412 | |
| Generating Unit Technology | | Photovoltaic Inverter | |
| Manufacturer | | SolarEdge Technologies Ltd | |
| Address | | 1 HaMada Street<br>Herzeliya<br>4673335<br>Israel | |
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I certify on behalf of the company named above as a supplier of a Generating Unit, that all products supplied by the company with the above Type Test 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

| | | |
|---|---|---|
| Herzeliya<br>Israel | June 25 2018 | |
| PLACE | Date | Meir Adest, VP Core Technologies |

| Generating Unit | SE4K | SE5K | SE7K | SE8K | SE9K | SE10K | SE12.5K | SE15K | SE16K | SE17K |
|---|---|---|---|---|---|---|---|---|---|---|
| Rated AC Power (kW) | 4 | 5 | 7 | 8 | 9 | 10 | 12.5 | 15 | 16 | 17 |

Note: All test results stated in the following document are obtained from testing the largest inverter covered by this Type Test Report. All smaller inverters named on this report will be equivalent values.

| Harmonics | | | | | |
|---|---|---|---|---|---|
| Generator tested to BS EN 61000-3-2 | | | | | |
| Harmonic | 50% of rated output | | 100% of rated output | | BS EN 61000-3-2 Limit - Class A |
| | Result (A) | Result (%) | Result (A) | Result (%) | |
| 2nd | 0.025 | 0.103 | 0.026 | 0.107 | 8 % |
| 3rd | 0.206 | 0.839 | 0.241 | 0.982 | 21.6 % |
| 4th | 0.009 | 0.037 | 0.008 | 0.031 | 4 % |
| 5th | 0.095 | 0.389 | 0.095 | 0.386 | 10.7 % |
| 6th | 0.006 | 0.024 | 0.006 | 0.023 | 2.67 % |
| 7th | 0.071 | 0.288 | 0.075 | 0.307 | 7.2 % |
| 8th | 0.005 | 0.020 | 0.005 | 0.020 | 2 % |
| 9th | 0.050 | 0.203 | 0.057 | 0.233 | 3.8 % |
| 10th | 0.005 | 0.020 | 0.005 | 0.019 | 1.6 % |
| 11th | 0.041 | 0.167 | 0.046 | 0.186 | 3.1 % |
| 12th | 0.005 | 0.020 | 0.004 | 0.018 | 1.33 % |
| 13th | 0.039 | 0.159 | 0.038 | 0.154 | 2 % |
| THD | 1.960 | - | 1.180 | - | 23 % |
| PWTHD | 2.960 | - | 1.050 | - | 23 % |

| Voltage Fluctuations and Flicker | | | | |
|---|---|---|---|---|
| BS EN 61000-3-11 | | | | |
| | Starting | Stopping | Running | |
| Limit | 4 % | 4 % | Pst = 1.0 | Plt = 0.65 |
| Result | 0.30 % | 0.30 % | 0.0787 | 0.0787 |

| DC Current Injection | | | |
|---|---|---|---|
| Test Power Level | 10 % | 55 % | 100 % |
| Limit | 0.25 % | | |
| Result | 0.23 % | 0.16 % | 0.15 % |

| Power Factor | | | |
|---|---|---|---|
| Test Voltage | 216.2 V | 230 V | 253 V |
| Limit | > 0.95 | | |
| Result | 0.99 | 0.99 | 0.99 |

| Frequency Tests | | | | | | |
|---|---|---|---|---|---|---|
| Function | Setting | | Result | | No Trip Test | |
| | Frequency | Time Delay | Frequency | Time Delay | Test Value | Result |
| O/F Stage 1 | 51.5 Hz | 90 sec | 51.5 Hz | 90.042 sec | 51.3 Hz for 95 sec | No trip |
| O/F Stage 2 | 52 Hz | 0.5 sec | 52.0 Hz | 0.536 sec | 51.8 Hz for 89.98 sec | No trip |
| | | | | | 52.2 Hz for 0.48 sec | No trip |
| U/F Stage 1 | 47.5 Hz | 20 sec | 47.5 Hz | 20.015 sec | 47.7 Hz for 25 sec | No trip |
| U/F Stage 2 | 47 Hz | 0.5 sec | 47.0 Hz | 0.527 sec | 47.2 Hz for 19.98 sec | No trip |
| | | | | | 46.8 Hz for 0.48 sec | No trip |

| Voltage Tests | | | | | | |
|---|---|---|---|---|---|---|
| Function | Setting | | Result | | No Trip Test | |
| | Voltage | Time Delay | Voltage | Time Delay | Test Value | Result |
| O/V Stage 1 | 262.2 V | 1 sec | 263.4 V | 1.035 sec | 258.2 V for 2 sec | No trip |
| O/V Stage 2 | 273.7 V | 0.5 sec | 274.4 V | 0.537 sec | 269.7 V for 0.98 sec | No trip |
| | | | | | 277.7 V for 0.48 sec | No trip |
| U/V Stage 1 | 200.1 V | 2.5 sec | 200.9 V | 2.521 sec | 204.1 V for 3.5 sec | No trip |
| U/V Stage 2 | 184 V | 0.5 sec | 184.7 V | 0.533 sec | 188 V for 2.48 sec | No trip |
| | | | | | 180 V for 0.48 sec | No trip |

| Loss of Mains and Single Phase Tests | | | | | | |
|---|---|---|---|---|---|---|
| LoM methods | RoCoF | | | | | |
| Test Power and Imbalance | 33 % -5 % Q Test 22 | 66 % -5 % Q Test 12 | 100 % -5 % Q Test 5 | 33 % 5 % Q Test 31 | 66 % 5 % Q Test 21 | 100 % 5 % Q Test 10 |
| Limit | 500 msec | | | | | |
| Result - RocOF | 267 msec | 278 msec | 267 msec | 280 msec | 276 msec | 284 msec |
| Phase Removed | | | | 1 | 2 | 3 |
| Result | | | | Trip | Trip | Trip |

| Protection. Frequency change, RoCoF Stability test | | | |
|---|---|---|---|
| Ramp range | Test frequency ramp | Test Duration | Confirm no trip |
| 49.0Hz to 51.0Hz | +0.95Hzs$^{-1}$ | 2.1s | Pass |
| 51.0Hz to 49.0Hz | -0.95Hzs$^{-1}$ | 2.1s | Pass |

| Re-connection Timer | | | | |
|---|---|---|---|---|
| Timer | Delay Setting | 20 sec | Measured Delay | 29 sec |
| Test Value | 266.2 V | 196.1 V | 47.4 Hz | 51.6 Hz |
| Result | No re-connect | No re-connect | No re-connect | No re-connect |

| Fault Level Contribution | | |
|---|---|---|
| Time after fault | Volts | Amps |
| 20 msec | 131.95 V | 23.5 A |
| 100 msec | 87.46 V | 24.97 A |
| 250 msec | 78.39 V | 25.46 A |
| 500 msec | 75.14 V | 25.64 A |
| Time to trip | 0.508 sec | |

| Self monitoring - Solid State Switching | |
|---|---|
| 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. | Result |
| | NA |