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# G83/2 Engineering Recommendation

| Type Approval and manufacturer/supplier declaration of compliance with the requirements of Engineering Recommendation G83/2. | | | |
|---|---|---|---|
| SSEG Type reference number | | DQ131101 | |
| SSEG Type | | Solis-3.6K-2G | |
| System Supplier name | | Ningbo Ginlong Technologies Co., Ltd. | |
| Address | | No. 57 Jintong Road, Seafront (Binhai) Industrial Park, Xiangshan, Ningbo, Zhejiang, 315712,P.R.China | |
| Tel | (+86) 574 6580 3377 | Fax | (+86) 574 6578 1606 |
| E:mail | kun.zhang@ginlong.com | Web site | www.ginlong.com |

| Maximum rated capacity | Connection Option | |
|---|---|---|
| | 3.6 | kW single phase, single, split or three phase system |
| | -- | kW three phase |
| | -- | kW two phases in three phase system |
| | -- | kW two phases split phase system |

SSEG manufacturer/supplier declaration.
I certify on behalf of the company named above as a manufacturer/supplier of Small Scale Embedded Generators, that all products manufactured/supplied by the company with the above SSEG Type reference number will be manufactured and tested to ensure that they perform as stated in this Type Verification Test Report, prior to shipment to site and that no site modifications are required to ensure that the product meets all the requirements of G83/2.

| Signed | Zhang Kun | On behalf of | Ginlong Technologies |
|---|---|---|---|
| Date | 2013.12.15 | Manufacturer stamp | |

宁波锦浪新能源科技有限公司
NINGBO GINLONG TECHNOLOGIES CO., LTD.

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# G83/2 Appendix 4 Type Verification Test Report

## Power Quality

| Harmonics.<br>The requirement is specified in section 5.4.1, test procedure in Annex A or B 1.4.1 | | | | | | |
|---|---|---|---|---|---|---|
| SSEG rating per phase (rpp) | | | 3.6 | kW | NV=MV*3.68/rpp | |
| Harmonic | At 45-55% of rated output | | 100% of rated output | | | |
| | Measured Value (MV) in Amps | Normalised Value (NV) in Amps | Measured Value (MV) in Amps | Normalised Value (NV) in Amps | Limit in BS EN 61000-3-2 in Amps | Higher limit for odd harmonics 21 and above |
| 2 | 0.034 | 0.039 | 0.041 | 0.048 | 1.080 | |
| 3 | 0.232 | 0.275 | 0.221 | 0.262 | 2.300 | |
| 4 | 0.027 | 0.033 | 0.032 | 0.041 | 0.430 | |
| 5 | 0.128 | 0.136 | 0.134 | 0.144 | 1.140 | |
| 6 | 0.017 | 0.023 | 0.018 | 0.023 | 0.300 | |
| 7 | 0.083 | 0.095 | 0.064 | 0.072 | 0.770 | |
| 8 | 0.017 | 0.025 | 0.015 | 0.022 | 0.230 | |
| 9 | 0.035 | 0.043 | 0.043 | 0.057 | 0.400 | |
| 10 | 0.015 | 0.019 | 0.013 | 0.019 | 0.184 | |
| 11 | 0.037 | 0.046 | 0.048 | 0.060 | 0.330 | |
| 12 | 0.012 | 0.020 | 0.010 | 0.017 | 0.153 | |
| 13 | 0.025 | 0.034 | 0.033 | 0.041 | 0.210 | |
| 14 | 0.011 | 0.018 | 0.015 | 0.020 | 0.131 | |
| 15 | 0.022 | 0.027 | 0.021 | 0.026 | 0.150 | |
| 16 | 0.012 | 0.016 | 0.010 | 0.014 | 0.115 | |
| 17 | 0.023 | 0.028 | 0.018 | 0.022 | 0.132 | |
| 18 | 0.008 | 0.015 | 0.009 | 0.015 | 0.102 | |
| 19 | 0.013 | 0.024 | 0.024 | 0.032 | 0.118 | |
| 20 | 0.007 | 0.017 | 0.010 | 0.017 | 0.092 | |
| 21 | 0.008 | 0.013 | 0.004 | 0.012 | 0.107 | 0.160 |
| 22 | 0.006 | 0.012 | 0.005 | 0.011 | 0.084 | |
| 23 | 0.009 | 0.015 | 0.006 | 0.013 | 0.098 | 0.147 |
| 24 | 0.004 | 0.008 | 0.003 | 0.009 | 0.077 | |
| 25 | 0.005 | 0.009 | 0.013 | 0.016 | 0.090 | 0.135 |
| 26 | 0.007 | 0.009 | 0.007 | 0.012 | 0.071 | |
| 27 | 0.009 | 0.013 | 0.002 | 0.008 | 0.083 | 0.124 |
| 28 | 0.011 | 0.015 | 0.004 | 0.009 | 0.066 | |
| 29 | 0.013 | 0.018 | 0.012 | 0.016 | 0.078 | 0.117 |
| 30 | 0.006 | 0.012 | 0.001 | 0.003 | 0.061 | |
| 31 | 0.007 | 0.014 | 0.006 | 0.008 | 0.073 | 0.109 |
| 32 | 0.009 | 0.018 | 0.007 | 0.013 | 0.058 | |
| 33 | 0.004 | 0.008 | 0.006 | 0.009 | 0.068 | 0.102 |
| 34 | 0.002 | 0.005 | 0.005 | 0.008 | 0.054 | |
| 35 | 0.002 | 0.005 | 0.005 | 0.007 | 0.064 | 0.096 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 36 | 0.007 | 0.013 | 0.006 | 0.012 | 0.051 | |
| 37 | 0.003 | 0.007 | 0.004 | 0.006 | 0.061 | 0.091 |
| 38 | 0.005 | 0.008 | 0.003 | 0.005 | 0.048 | |
| 39 | 0.002 | 0.006 | 0.004 | 0.006 | 0.058 | 0.087 |
| 40 | 0.002 | 0.005 | 0.003 | 0.006 | 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. | | | | | | |

| Voltage fluctuations and Flicker.<br>The requirement is specified in section 5.4.2, test procedure in Annex A or B 1.4.3 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Starting | | | Stopping | | | Running | |
| | $d_{max}$ | $d_c$ | $d_{(t)}$ | $d_{max}$ | $d_c$ | $d_{(t)}$ | $P_{st}$ | $P_{lt}$ 2 hours |
| Measured Values | 0.43 | 0.35 | 0 | 0.37 | 0.24 | 0 | 0.06 | 0.07 |
| Normalised to standard impedance and 3.68kW for multiple units | 0.43 | 0.35 | 0 | 0.37 | 0.24 | 0 | 0.06 | 0.07 |
| Limits set under BS EN 61000-3-2 | 4% | 3.3% | 3.3% 500ms | 4% | 3.3% | 3.3% 500ms | 1.0 | 0.65 |

| | | | |
|---|---|---|---|
| Test start date | 2013.11.29 | Test end date | 2013.11.29 |
| Test location | Ningbo Ginlong electrical R&D LAB | | |

| DC injection.<br>The requirement is specified in section 5.5, test procedure in Annex A or B 1.4.4 | | | |
|---|---|---|---|
| Test power level | 10% | 55% | 100% |
| Recorded value | 15.2mA | 13.3mA | 16.4mA |
| as % of rated AC current | 0.096% | 0.083% | 0.10% |
| Limit | 0.25% | 0.25% | 0.25% |

| Power factor.<br>The requirement is specified in section 5.6, test procedure in Annex A or B 1.4.2 | | | | |
|---|---|---|---|---|
| Test voltage | 216.2V | 230V | 253V | Measured at three voltage levels and at full output.<br>Voltage to be maintained within ±1.5% of the stated level during the test. |
| Measured value | >0.99 | >0.99 | >0.99 | |
| Limit | >0.95 | >0.95 | >0.95 | |

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## Protection tests

| Frequency tests<br>The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.3 | | | | | | |
|---|---|---|---|---|---|---|
| Function | Setting | | Trip test | | "No trip tests" | |
| | Frequency | Time delay | Frequency | Time delay | Frequency /time | Confirm no trip |
| U/F stage 1 | 47.55Hz | 20.2s | 47.56Hz | 20.2s | 47.7Hz / 25s | Yes |
| U/F stage 2 | 47.05Hz | 0.6s | 47.04Hz | 0.62s | 47.2Hz / 19.98s | Yes |
| | | | | | 46.8Hz / 0.48s | Yes |
| O/F stage 1 | 51.45Hz | 90.3s | 51.45 | 90.3s | 51.3Hz / 95s | Yes |
| O/F stage 2 | 51.95Hz | 0.52s | 51.95 | 0.53s | 51.8Hz / 89.98s | Yes |
| | | | | | 52.2Hz / 0.48s | Yes |

| Voltage tests<br>The requirement is specified in section 5.3.1, test procedure in Annex A or B 1.3.2 | | | | | | |
|---|---|---|---|---|---|---|
| Function | Setting | | Trip test | | "No trip tests" | |
| | Voltage | Time delay | Voltage | Time delay | Voltage /time | Confirm no trip |
| U/V stage 1 | 202V | 2.7s | 202.5 | 2.7s | 204.1V / 3.5s | Yes |
| U/V stage 2 | 186V | 0.6s | 186.2 | 0.62s | 188V / 2.48s | Yes |
| | | | | | 180V / 0.48s | Yes |
| O/V stage 1 | 260V | 1.2s | 259.6 | 1.2s | 258.2V / 2.0s | Yes |
| O/V stage 2 | 272V | 0.6s | 271.8 | 0.63s | 269.7V / 0.98s | Yes |
| | | | | | 277.7V / 0.48s | Yes |
| 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. | | | | | | |

| Loss of Mains test.<br>The requirement is specified in section 5.3.2, test procedure in Annex A or B 1.3.4 | | | | | | |
|---|---|---|---|---|---|---|
| Test Power | 10% | 55% | 100% | 10% | 55% | 100% |
| Balancing load on islanded network | 95% of SSEG output | 95% of SSEG output | 95% of SSEG output | 105% of SSEG output | 105% of SSEG output | 105% of SSEG output |
| Trip time. Limit is 0.5 seconds | 0.29s | 0.37s | 0.15s | 0.42s | 0.27s | 0.35s |

| Frequency change, Stability test<br>The requirement is specified in section 5.3.3, test procedure in Annex A or B 1.3.6 | | | | |
|---|---|---|---|---|
| | Start Frequency | Change | End Frequency | Confirm no trip |
| Positive Vector Shift | 49.5Hz | +9 degrees | | Yes |
| Negative Vector Shift | 50.5Hz | - 9 degrees | | Yes |
| Positive Frequency drift | 49.5Hz | +0.19Hz/sec | 51.5Hz | Yes |
| Negative Frequency drift | 50.5Hz | -0.19Hz/sec | 47.5Hz | Yes |

| Re-connection timer.<br>The requirement is specified in section 5.3.4, test procedure in Annex A or B 1.3.5 | | | | | |
|---|---|---|---|---|---|
| Time delay setting | Measured delay | Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 1. | | | |
| 30s | 32s | At 266.2V | At 196.1V | At 47.4Hz | At 51.6Hz |
| Confirmation that the SSEG does not re-connect. | | Yes | Yes | Yes | Yes |

## Fault level contribution

| Fault level contribution.<br>The requirement is specified in section 5.7, test procedure in Annex A or B 1.4.6 | | | | | |
|---|---|---|---|---|---|
| For a directly coupled SSEG | | | For a Inverter SSEG | | |
| Parameter | Symbol | Value | Time after fault | Volts | Amps |
| Peak Short Circuit current | $i_p$ | -- | 20ms | 5.78V | 37.3A$_{peak}$ |
| Initial Value of aperiodic current | $A$ | -- | 100ms | 0 | 0 |
| Initial symmetrical short-circuit current* | $I_k$ | -- | 250ms | 0 | 0 |
| Decaying (aperiodic) component of short circuit current* | $i_{DC}$ | -- | 500ms | 0 | 0 |
| Reactance/Resistance Ratio of source* | $X/R$ | -- | Time to trip | <20ms | In seconds |

## Self-Monitoring solid state switching

| Self-Monitoring solid state switching<br>The requirement is specified in section 5.3.1, No specified test requirements. | Yes/or NA |
|---|---|
| It has been verified that in the event of the solid state switching device failing to disconnect the SSEG, the voltage on the output side of the switching device is reduced to a value below 50 volts within 0.5 seconds. | NA |