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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Form C: Type Test Verification Report**  Type Approval and **Manufacturer** declaration of compliance with the requirements of G98.  This form should be used when making a Type Test submission to the Energy Networks Association (ENA).  If the **Micro-generator** is **Fully** **Type Tested** and already registered with the ENA **Type Test Verification Report** Register, the **Installation Document** should include the **Manufacturer**’s Reference Number (the Product ID), and this form does not need to be submitted.  Where the **Micro-generator** is not registered with the ENA **Type Test Verification Report** Register this form needs to be completed and provided to the **DNO**, to confirm that the **Micro-generator** has been tested to satisfy the requirements of this EREC G98. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Manufacturer’s** reference number | | | | | | | | | | | | | | | | | | | | | | | | SPA 3000TL BL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Micro-generator** technology | | | | | | | | | | | | | | | | | | | | | | | | SPA 1000TL BL，SPA 2000TL BL，SPA 3000TL BL. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Manufacturer** name | | | | | | | | | | | | | | | | | | | | | | | | Shenzhen Growatt New Energy Co., Ltd. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Address | | | | | | | | | | | | | | | | | | | | | | | | 4-13th Floor, Building A, Sino-German Europe Industrial Demonstration Park, No. 1, Hangcheng Avenue, Bao'an District, Shenzhen, Guangdong, China. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tel | | | | +86 755 2951 5888 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Fax | | | | | | | | | | +86 755 2747 2131 | | | | | | | | | | |
| E-mail | | | | peng.zhu@growatt.com | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Web site | | | | | | | | | | www.ginverter.com | | | | | | | | | | |
| **Registered Capacity**, use separate sheet if more than one connection option. | | | | | | | | | | | | | Connection Option | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0-3.0 | | | | | | | | | | | kW single phase, single, split or three phase system | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NA | | | | | | | | | | | kW three phase | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NA | | | | | | | | | | | kW two phases in three phase system | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NA | | | | | | | | | | | kW two phases split phase system | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Manufacturer** **Type Test** declaration. - I certify that all products supplied by the company with the above **Type Tested** 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 EREC G98. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Signed | | | |  | | | | | | | | | | | | | | | | | | | | On behalf of | | | | | | | | | | | | | | | | | | | Shenzhen Growatt New Energy Co., Ltd. | | | | | | | | | | |
| Note that testing can be done by the **Manufacturer** of an individual component or by an external test house.  Where parts of the testing are carried out by persons or organisations other than the **Manufacturer** then that person or organisation shall keep copies of all test records and results supplied to them to verify that the testing has been carried out by people with sufficient technical competency to carry out the tests. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **1.Operating Range:** This test should be carried out as specified in A.1.2.10.  **Active Power** shall be recorded every second. The tests will verify that the **Micro-generator** can operate within the required ranges for the specified period of time.  The **Interface Protection** shall be disabled during the tests.  In case of a PV **Micro-generator** the PV primary source may be replaced by a **DC** source.  In case of a full converter **Micro-generator** (eg wind) the primary source and the prime mover **Inverter**/rectifier may be replaced by a **DC** source.  In case of a DFIG **Micro-generator** the mechanical drive system may be replaced by a test bench motor. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test 1  Voltage = 85% of nominal (195.5 V),  Frequency = 47 Hz,  Power Factor = 1,  Period of test 20 s | | | | | | | | | | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test 2  Voltage = 85% of nominal (195.5 V)  Frequency = 47.5 Hz  Power factor = 1  Period of test 90 minutes | | | | | | | | | | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test 3  Voltage = 110% of nominal (253 V).  Frequency = 51.5 Hz  Power factor = 1  Period of test 90 minutes | | | | | | | | | | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test 4  Voltage = 110% of nominal (253 V).  Frequency = 52.0 Hz  Power factor = 1  Period of test 15 minutes | | | | | | | | | | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test 5  Voltage = 100% of nominal (230 V),  Frequency = 50.0 Hz,  Power Factor = 1,  Period of test = 90 minutes | | | | | | | | | | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test 6 RoCoF withstand  Confirm that the Power Generating Module is capable of staying connected to the Distribution Network and operate at rates of change of frequency up to 1 Hzs-1 as measured over a period of 500 ms. Note that this is not expected to be demonstrated on site. | | | | | | | | | | | | | | | | | | | | | | | | | |  | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **2.Power Quality – Harmonics:** These tests should be carried out as specified in BS EN 61000-3-2. The chosen test should be undertaken with a fixed source of energy at two power levels a) between 45 and 55% and b) at 100% of Registered Capacity. The test requirements are specified in Annex A1 A.1.3.1 (Inverter connected) or Annex A2 A.2.3.1 (Synchronous). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Micro-generator tested to BS EN 61000-3-2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Micro-generator** rating per phase (rpp) | | | | | | | | | | | | | | | | | | | | | | | | 3.0 | | | | | | | | kW | | | | | | | | | |  | | | | | | | | | | | |
| Harmonic | | At 45-55% of **Registered Capacity** | | | | | | | | | | | | | | | | | | | | | | 100% of **Registered Capacity** | | | | | | | | | | | | | | | | | |
|  | | Measured Value MV in Amps | | | | | | | | | | | | | | Norma lised Value (NV) in Amps | | | | | | | | Measured Value MV in Amps | | | | | | | | | | | Normali sed Value (NV) in Amps | | | | | | | Limit in BS EN 61000-3-2 in Amps | | | | | | | | Higher limit for odd harmonics 21 and above | | | |
| 2 | | 0.0479 | | | | | | | | | | | | | | 0.080 | | | | | | | | 0.0695 | | | | | | | | | | | 0.135 | | | | | | | 1.080 | | | | | | | |  | | | |
| 3 | | 0.0219 | | | | | | | | | | | | | | 0.229 | | | | | | | | 0.0477 | | | | | | | | | | | 0.258 | | | | | | | 2.300 | | | | | | | |  | | | |
| 4 | | 0.0513 | | | | | | | | | | | | | | 0.033 | | | | | | | | 0.061 | | | | | | | | | | | 0.049 | | | | | | | 0.430 | | | | | | | |  | | | |
| 5 | | 0.0847 | | | | | | | | | | | | | | 0.139 | | | | | | | | 0.0761 | | | | | | | | | | | 0.161 | | | | | | | 1.140 | | | | | | | |  | | | |
| 6 | | 0.0155 | | | | | | | | | | | | | | 0.023 | | | | | | | | 0.0056 | | | | | | | | | | | 0.036 | | | | | | | 0.300 | | | | | | | |  | | | |
| 7 | | 0.1325 | | | | | | | | | | | | | | 0.085 | | | | | | | | 0.027 | | | | | | | | | | | 0.097 | | | | | | | 0.770 | | | | | | | |  | | | |
| 8 | | 0.0085 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0086 | | | | | | | | | | | 0.011 | | | | | | | 0.230 | | | | | | | |  | | | |
| 9 | | 0.1111 | | | | | | | | | | | | | | 0.055 | | | | | | | | 0.0514 | | | | | | | | | | | 0.072 | | | | | | | 0.400 | | | | | | | |  | | | |
| 10 | | 0.0079 | | | | | | | | | | | | | | 0.006 | | | | | | | | 0.0082 | | | | | | | | | | | 0.023 | | | | | | | 0.184 | | | | | | | |  | | | |
| 11 | | 0.0692 | | | | | | | | | | | | | | 0.033 | | | | | | | | 0.0113 | | | | | | | | | | | 0.060 | | | | | | | 0.330 | | | | | | | |  | | | |
| 12 | | 0.0106 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0082 | | | | | | | | | | | 0.011 | | | | | | | 0.153 | | | | | | | |  | | | |
| 13 | | 0.0753 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0104 | | | | | | | | | | | 0.063 | | | | | | | 0.210 | | | | | | | |  | | | |
| 14 | | 0.0062 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0058 | | | | | | | | | | | 0.026 | | | | | | | 0.131 | | | | | | | |  | | | |
| 15 | | 0.0351 | | | | | | | | | | | | | | 0.010 | | | | | | | | 0.0079 | | | | | | | | | | | 0.038 | | | | | | | 0.150 | | | | | | | |  | | | |
| 16 | | 0.0048 | | | | | | | | | | | | | | 0.010 | | | | | | | | 0.0062 | | | | | | | | | | | 0.026 | | | | | | | 0.115 | | | | | | | |  | | | |
| 17 | | 0.0246 | | | | | | | | | | | | | | 0.021 | | | | | | | | 0.0028 | | | | | | | | | | | 0.060 | | | | | | | 0.132 | | | | | | | |  | | | |
| 18 | | 0.0039 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0031 | | | | | | | | | | | 0.023 | | | | | | | 0.102 | | | | | | | |  | | | |
| 19 | | 0.0304 | | | | | | | | | | | | | | 0.033 | | | | | | | | 0.0085 | | | | | | | | | | | 0.060 | | | | | | | 0.118 | | | | | | | |  | | | |
| 20 | | 0.0049 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0048 | | | | | | | | | | | 0.023 | | | | | | | 0.092 | | | | | | | |  | | | |
| 21 | | 0.0522 | | | | | | | | | | | | | | 0.045 | | | | | | | | 0.0021 | | | | | | | | | | | 0.085 | | | | | | | 0.107 | | | | | | | | 0.160 | | | |
| 22 | | 0.0062 | | | | | | | | | | | | | | 0.021 | | | | | | | | 0.0038 | | | | | | | | | | | 0.023 | | | | | | | 0.084 | | | | | | | |  | | | |
| 23 | | 0.0091 | | | | | | | | | | | | | | 0.033 | | | | | | | | 0.003 | | | | | | | | | | | 0.072 | | | | | | | 0.098 | | | | | | | | 0.147 | | | |
| 24 | | 0.0034 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0025 | | | | | | | | | | | 0.036 | | | | | | | 0.077 | | | | | | | |  | | | |
| 25 | | 0.0199 | | | | | | | | | | | | | | 0.045 | | | | | | | | 0.0041 | | | | | | | | | | | 0.072 | | | | | | | 0.090 | | | | | | | | 0.135 | | | |
| 26 | | 0.0032 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0035 | | | | | | | | | | | 0.011 | | | | | | | 0.071 | | | | | | | |  | | | |
| 27 | | 0.0116 | | | | | | | | | | | | | | 0.033 | | | | | | | | 0.0024 | | | | | | | | | | | 0.045 | | | | | | | 0.083 | | | | | | | | 0.124 | | | |
| 28 | | 0.0034 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0015 | | | | | | | | | | | 0.009 | | | | | | | 0.066 | | | | | | | |  | | | |
| 29 | | 0.0045 | | | | | | | | | | | | | | 0.047 | | | | | | | | 0.0047 | | | | | | | | | | | 0.060 | | | | | | | 0.078 | | | | | | | | 0.117 | | | |
| 30 | | 0.0022 | | | | | | | | | | | | | | 0.010 | | | | | | | | 0.0028 | | | | | | | | | | | 0.011 | | | | | | | 0.061 | | | | | | | |  | | | |
| 31 | | 0.0022 | | | | | | | | | | | | | | 0.022 | | | | | | | | 0.0017 | | | | | | | | | | | 0.036 | | | | | | | 0.073 | | | | | | | | 0.109 | | | |
| 32 | | 0.0028 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0022 | | | | | | | | | | | 0.021 | | | | | | | 0.058 | | | | | | | |  | | | |
| 33 | | 0.0024 | | | | | | | | | | | | | | 0.021 | | | | | | | | 0.0024 | | | | | | | | | | | 0.033 | | | | | | | 0.068 | | | | | | | | 0.102 | | | |
| 34 | | 0.0013 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0016 | | | | | | | | | | | 0.023 | | | | | | | 0.054 | | | | | | | |  | | | |
| 35 | | 0.0018 | | | | | | | | | | | | | | 0.021 | | | | | | | | 0.0024 | | | | | | | | | | | 0.036 | | | | | | | 0.064 | | | | | | | | 0.096 | | | |
| 36 | | 0.0014 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0014 | | | | | | | | | | | 0.011 | | | | | | | 0.051 | | | | | | | |  | | | |
| 37 | | 0.0045 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0022 | | | | | | | | | | | 0.023 | | | | | | | 0.061 | | | | | | | | 0.091 | | | |
| 38 | | 0.0015 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0015 | | | | | | | | | | | 0.011 | | | | | | | 0.048 | | | | | | | |  | | | |
| 39 | | 0.0077 | | | | | | | | | | | | | | 0.009 | | | | | | | | 0.0033 | | | | | | | | | | | 0.023 | | | | | | | 0.058 | | | | | | | | 0.087 | | | |
| 40 | | 0.0018 | | | | | | | | | | | | | | 0.010 | | | | | | | | 0.0017 | | | | | | | | | | | 0.013 | | | | | | | 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. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **3.Power Quality – Voltage fluctuations and Flicker**: These tests should be undertaken in accordance with EREC G98 Annex A1 A.1.3.3 (**Inverter** connected) or Annex A2 A.2.3.3 (Synchronous). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | Starting | | | | | | | | | | | | | | | | | | | | Stopping | | | | | | | | | | | | | | | | | | | Running | | | | | | | | |
|  | | | | | | d max | | | | | d c | | | | | | | | | | d(t) | | | | | d max | | | | | | | d c | | | | | | d(t) | | | | | | Pst | | | | | | | Plt 2 hours | |
| Measured Values at test impedance | | | | | | 0.38 | | | | | 0.28 | | | | | | | | | | 0 | | | | | 0.42 | | | | | | | 0.35 | | | | | | 0 | | | | | | 0.21 | | | | | | | 0.21 | |
| Normalised to standard impedance | | | | | | 0.38 | | | | | 0.28 | | | | | | | | | | 0 | | | | | 0.42 | | | | | | | 0.35 | | | | | | 0 | | | | | | 0.21 | | | | | | | 0.21 | |
| Normalised to required maximum impedance | | | | | | - | | | | | - | | | | | | | | | | - | | | | | - | | | | | | | - | | | | | | - | | | | | | - | | | | | | | - | |
| Limits set under BS EN 61000-3-11 | | | | | | 4% | | | | | 3.3% | | | | | | | | | | 3.3% | | | | | 4% | | | | | | | 3.3% | | | | | | 3.3% | | | | | | 1.0 | | | | | | | 0.65 | |
|  | | | | | |  | | | | | | |  | | | | | | | | | | |  | | | | | | | |  | | | | | | | | | |  | | | | | | | |  | | | |
| Test Impedance | | | | | | R | | | | | | | 0.4 | | | | | | | | | | | Ω | | | | | | | | X | | | | | | | | | | 0.25 | | | | | | | | Ω | | | |
| Standard Impedance | | | | | | R | | | | | | | 0.24\*  0.4^ | | | | | | | | | | | Ω | | | | | | | | X | | | | | | | | | | 0.15\*  0.25^ | | | | | | | | Ω | | | |
| Maximum Impedance | | | | | | R | | | | | | | - | | | | | | | | | | | Ω | | | | | | | | X | | | | | | | | | | - | | | | | | | | Ω | | | |
| Applies to three phase and split single phase **Micro-generators**.  ^ Applies to single phase **Micro-generators** and **Micro-generators** using two phases on a three phase system.  For voltage change and flicker measurements the following formula is to be used to convert the measured values to the normalised values where the power factor of the generation output is 0.98 or above.  Normalised value = Measured value\*reference source resistance/measured source resistance at test point.  Single phase units reference source resistance is 0.4 Ω  Two phase units in a three phase system reference source resistance is 0.4 Ω.  Two phase units in a split phase system reference source resistance is 0.24 Ω.  Three phase units reference source resistance is 0.24 Ω.  Where the power factor of the output is under 0.98 then the X to R ratio of the test impedance should be close to that of the Standard Impedance.  The stopping test should be a trip from full load operation.  The duration of these tests need to conform to the particular requirements set out in the testing notes for the technology under test. Dates and location of the test need to be noted below. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test start date | | | | | | | | | | | | 19,Nov,2022 | | | | | | | | | | | | | | | | | | Test end date | | | | | | | | | | | | | | | | | | 19, Nov,2022 | | | | | |
| Test location | | | | | | | | | | | | Growatt Global Certification Lab | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **4.** **Power quality – DC injection: This test should be carried out in accordance with A 1.3.4 as applicable.**  **The % DC injection (“as % of rated AC current” below) is calculated as follows:**  **% DC injection = Recorded DC value in Amps / base current**  **where the base current is the Registered Capacity (W) / 230 V. The % DC injection should not be greater**  **than 0.25%.** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test power level(1.0k) | | | | | | | | 20% | | | | | | | | | | | | 50% | | | | | | | | | | 75% | | | | | | | | | | | | 100% | | | | | | | | | | | |
| Recorded value in Amps | | | | | | | | 5.62mA | | | | | | | | | | | | 6.21mA | | | | | | | | | | 7.24mA | | | | | | | | | | | | 8.56mA | | | | | | | | | | | |
| as % of rated AC current | | | | | | | | 0.13% | | | | | | | | | | | | 0.14% | | | | | | | | | | 0.17% | | | | | | | | | | | | 0.20% | | | | | | | | | | | |
| Limit | | | | | | | | 0.25% | | | | | | | | | | | | 0.25% | | | | | | | | | | 0.25% | | | | | | | | | | | | 0.25% | | | | | | | | | | | |
| Test power level(2.0k) | | | | | | | | 20% | | | | | | | | | | | | 50% | | | | | | | | | | 75% | | | | | | | | | | | | 100% | | | | | | | | | | | |
| Recorded value in Amps | | | | | | | | 11.2mA | | | | | | | | | | | | 13.2 mA | | | | | | | | | | 15.8mA | | | | | | | | | | | | 17.4mA | | | | | | | | | | | |
| as % of rated AC current | | | | | | | | 0.13% | | | | | | | | | | | | 0.15% | | | | | | | | | | 0.18% | | | | | | | | | | | | 0.20% | | | | | | | | | | | |
| Limit | | | | | | | | 0.25% | | | | | | | | | | | | 0.25% | | | | | | | | | | 0.25% | | | | | | | | | | | | 0.25% | | | | | | | | | | | |
| Test power level(3.0k) | | | | | | | | 20% | | | | | | | | | | | | 50% | | | | | | | | | | 75% | | | | | | | | | | | | 100% | | | | | | | | | | | |
| Recorded value in Amps | | | | | | | | 16.6mA | | | | | | | | | | | | 20.1 mA | | | | | | | | | | 23.4 mA | | | | | | | | | | | | 26.1mA | | | | | | | | | | | |
| as % of rated AC current | | | | | | | | 0.13% | | | | | | | | | | | | 0.15% | | | | | | | | | | 0.18% | | | | | | | | | | | | 0.20% | | | | | | | | | | | |
| Limit | | | | | | | | 0.25% | | | | | | | | | | | | 0.25% | | | | | | | | | | 0.25% | | | | | | | | | | | | 0.25% | | | | | | | | | | | |
| **5.Power Quality – Power factor**: This test shall be carried out in accordance with EN 50548 Annex D.3.4.1 but with nominal voltage -6% and +10%. Voltage to be maintained within ±1.5% of the stated level during the test. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | 216.2 V | | | | | | | | | | | | | | | | | | | 230 V | | | | | | | | | | | | 253 V | | | | | | | | | | | |
| 20% of **Registered Capacity** | | | | | | | | | | | 0.96523 | | | | | | | | | | | | | | | | | | | 0.96636 | | | | | | | | | | | | 0.96583 | | | | | | | | | | | |
| 50% of **Registered Capacity** | | | | | | | | | | | 0.99302 | | | | | | | | | | | | | | | | | | | 0.99389 | | | | | | | | | | | | 0.99311 | | | | | | | | | | | |
| 75% of **Registered Capacity** | | | | | | | | | | | 0.99635 | | | | | | | | | | | | | | | | | | | 0.99652 | | | | | | | | | | | | 0.99619 | | | | | | | | | | | |
| 100% of **Registered Capacity** | | | | | | | | | | | 0.99762 | | | | | | | | | | | | | | | | | | | 0.99775 | | | | | | | | | | | | 0.99758 | | | | | | | | | | | |
| Limit | | | | | | | | | | | >0.95 | | | | | | | | | | | | | | | | | | | >0.95 | | | | | | | | | | | | >0.95 | | | | | | | | | | | |
| **6.Protection – Frequency tests:** These tests should be carried out in accordance with EN 50438 Annex D.2.4 and the notes in EREC G98 Annex A1 A.1.2.3 (**Inverter** connected) or Annex A2 A.2.2.3 (Synchronous) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Function | | | | Setting | | | | | | | | | | | | | | | | | | | Trip test | | | | | | | | | | | | | | | “No trip tests” | | | | | | | | | | | | | | | |
|  | | | | Frequency | | | | | | | | | | | Time delay | | | | | | | | Frequency | | | | | | | | Time delay | | | | | | | Frequency /time | | | | | | | | | | | | | Confirm no trip | | |
| U/F stage 1 | | | | 47.5 Hz | | | | | | | | | | | 20 s | | | | | | | | 47.51Hz | | | | | | | | 20.019s | | | | | | | 47.7 Hz 30 s | | | | | | | | | | | | | No trip | | |
| U/F stage 2 | | | | 47 Hz | | | | | | | | | | | 0.5 s | | | | | | | | 47.01Hz | | | | | | | | 0.521s | | | | | | | 47.2 Hz 19.5 s | | | | | | | | | | | | | No trip | | |
|  | | | |  | | | | | | | | | | |  | | | | | | | |  | | | | | | | |  | | | | | | | 46.8 Hz  0.45 s | | | | | | | | | | | | | No trip | | |
| O/F stage 1 | | | | 52 Hz | | | | | | | | | | | 0.5 s | | | | | | | | 52.00Hz | | | | | | | | 0.518s | | | | | | | 51.8 Hz  120.0 s | | | | | | | | | | | | | No trip | | |
|  | | | |  | | | | | | | | | | |  | | | | | | | |  | | | | | | | |  | | | | | | | 52.2 Hz 0.45 s | | | | | | | | | | | | | No trip | | |
| Note. For frequency trip tests the frequency required to trip is the setting ± 0.1 Hz. 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 ± 0.2 Hz and for the relevant times as shown in the table above to ensure that the protection will not trip in error. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **7.Protection – Voltage tests:** These tests should be carried out in accordance with EN 50438 Annex D.2.3 and the notes in EREC G98 Annex A1 A.1.2.2 (**Inverter** connected) or Annex A2 A.2.2.2 (Synchronous) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Function | | | | | | | Setting | | | | | | | | | | | | | | | | Trip test | | | | | | | | | | | | | | | “No trip tests” | | | | | | | | | | | | | | | |
|  | | | | | | | Voltage | | | | | | | | Time delay | | | | | | | | Voltage | | | | | | | | Time delay | | | | | | | Voltage /time | | | | | | | | | | | | | Confirm no trip | | |
| U/V | | | | | | | 184 V | | | | | | | | 2.5 s | | | | | | | | 184.7V | | | | | | | | 2.522s | | | | | | | 188 V 5.0 s | | | | | | | | | | | | | No trip | | |
|  | | | | | | |  | | | | | | | |  | | | | | | | |  | | | | | | | |  | | | | | | | 180 V 2.45 s | | | | | | | | | | | | | No trip | | |
| O/V stage 1 | | | | | | | 262.2 V | | | | | | | | 1.0 s | | | | | | | | 262.8V | | | | | | | | 1.017s | | | | | | | 258.2 V 5.0 s | | | | | | | | | | | | | No trip | | |
| O/V stage 2 | | | | | | | 273.7 V | | | | | | | | 0.5 s | | | | | | | | 274.3V | | | | | | | | 0.516s | | | | | | | 269.7 V 0.95 s | | | | | | | | | | | | | No trip | | |
|  | | | | | | |  | | | | | | | |  | | | | | | | |  | | | | | | | |  | | | | | | | 277.7 V 0.45 s | | | | | | | | | | | | | No trip | | |
| Note for Voltage tests the Voltage required to trip is the setting ±3.45 V. 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 ±4 V and for the relevant times as shown in the table above to ensure that the protection will not trip in error. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **8.Protection – Loss of Mains test:** For PV Inverters shall be tested in accordance with BS EN 62116. Other Inverters should be tested in accordance with EN 50438 Annex D.2.5 at 10%, 55% and 100% of rated power. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| To be carried out at three output power levels with a tolerance of plus or minus 5% in Test Power levels. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test Power | | | | | | | | | 10% | | | | | | | | | | | | | 55% | | | | | | | | 100% | | | | | | | | | | 10% | | | | | | | | | 55% | | | | 100% |
| Balancing load on islanded network | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | 105% of **Registered Capacity** | | | | | | | | | 105% of **Registered Capacity** | | | | 105% of **Registered Capacity** |
| Trip time. Limit is 0.5 s | | | | | | | | | 0.296S | | | | | | | | | | | | | 0.312S | | | | | | | | 0.387S | | | | | | | | | | 0.276S | | | | | | | | | 0.324S | | | | 0.395S |
| For Multi phase **Micro-generators** confirm that the device shuts down correctly after the removal of a single fuse as well as operation of all phases. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test Power | | | | | | | | | 10% | | | | | | | | | | | | | 55% | | | | | | | | 100% | | | | | | | | | | 10% | | | | | | | | | 55% | | | | 100% |
| Balancing load on islanded network | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | 105% of **Registered Capacity** | | | | | | | | | 105% of **Registered Capacity** | | | | 105% of **Registered Capacity** |
| Trip time. Ph1 fuse removed | | | | | | | | | - | | | | | | | | | | | | | - | | | | | | | | - | | | | | | | | | | - | | | | | | | | | - | | | | - |
| Test Power | | | | | | | | | 10% | | | | | | | | | | | | | 55% | | | | | | | | 100% | | | | | | | | | | 10% | | | | | | | | | 55% | | | | 100% |
| Balancing load on islanded network | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | 105% of **Registered Capacity** | | | | | | | | | 105% of **Registered Capacity** | | | | 105% of **Registered Capacity** |
| Trip time. Ph2 fuse removed | | | | | | | | | - | | | | | | | | | | | | | - | | | | | | | | - | | | | | | | | | | - | | | | | | | | | - | | | | - |
| Test Power | | | | | | | | | 10% | | | | | | | | | | | | | 55% | | | | | | | | 100% | | | | | | | | | | 10% | | | | | | | | | 55% | | | | 100% |
| Balancing load on islanded network | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | | | | 95% of **Registered Capacity** | | | | | | | | 95% of **Registered Capacity** | | | | | | | | | | 105% of **Registered Capacity** | | | | | | | | | 105% of **Registered Capacity** | | | | 105% of **Registered Capacity** |
| Trip time. Ph3 fuse removed | | | | | | | | | - | | | | | | | | | | | | | - | | | | | | | | - | | | | | | | | | | - | | | | | | | | | - | | | | - |
| Note for technologies which have a substantial shut down time this can be added to the 0.5 s in establishing that the trip occurred in less than 0.5 s. Maximum shut down time could therefore be up to 1.0 s for these technologies. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Indicate additional shut down time included in above results. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 40 ms | | | | | | | | | | |
| For **Inverters** tested to BS EN 62116 the following sub set of tests should be recorded in the following table. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test Power and imbalance | | | | | | | | | | 33%  -5% Q  Test 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 0.5 s | | | | | | | | | | 0.246s | | | | | | | | | | | | 0.306s | | | | | | | | 0.364s | | | | | | | | | | 0.247s | | | | | | | | | 0.316s | | | | 0.359s |
| **9.Protection – Frequency change, Vector Shift Stability test:** This test should be carried out in accordance with EREC G98 Annex A1 A.1.2.6 (**Inverter** connected) or Annex A2 A.2.2.6 (Synchronous). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | Start Frequency | | | | | | | | | | | | Change | | | | | | | | | | | | Confirm no trip | | | | | | | | | | | | |
| Positive Vector Shift | | | | | | | | | | | | | | | | | 49.0 Hz | | | | | | | | | | | | +50 degrees | | | | | | | | | | | | No trip | | | | | | | | | | | | |
| Negative Vector Shift | | | | | | | | | | | | | | | | | 50.0 Hz | | | | | | | | | | | | - 50 degrees | | | | | | | | | | | | No trip | | | | | | | | | | | | |
| **10.Protection – Frequency change, RoCoF Stability test:** The requirement is specified in section 11.3, test procedure in Annex A.1.2.6 (**Inverter** connected) or Annex A2 A.2.2.6 (Synchronous). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ramp range | | | | | | | | | | | | | | | | | Test frequency ramp: | | | | | | | | | | | | | | | | | | | Test Duration | | | | | | | | | | Confirm no trip | | | | | | | |
| 49.0 Hz to 51.0 Hz | | | | | | | | | | | | | | | | | +0.95 Hzs-1 | | | | | | | | | | | | | | | | | | | 2.1 s | | | | | | | | | | No trip | | | | | | | |
| 51.0 Hz to 49.0 Hz | | | | | | | | | | | | | | | | | -0.95 Hzs-1 | | | | | | | | | | | | | | | | | | | 2.1 s | | | | | | | | | | No trip | | | | | | | |
| **11.Limited Frequency Sensitive Mode – Overfrequency test:** This test should be carried out in accordance with EN 50438 Annex D.3.3 Power response to over- frequency. The test should be carried out using the specific threshold frequency of 50.4 Hz and **Droop** of 10%. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test sequence at **Registered Capacity** >80% | | | | | | | | | | | | | | | | | | | Measured **Active Power** Output | | | | | | | | | | | Frequency | | | | | | | | | | Primary Power Source | | | | | | | | | | | | | **Active Power** Gradient |
| Step a) 50.00 Hz ±0.01 Hz | | | | | | | | | | | | | | | | | | | 2986.42W | | | | | | | | | | | 50.01Hz | | | | | | | | | | 3125.26W | | | | | | | | | | | | | - |
| Step b) 50.45 Hz ±0.05 Hz | | | | | | | | | | | | | | | | | | | 2938.66W | | | | | | | | | | | 50.45Hz | | | | | | | | | | - |
| Step c) 50.70 Hz ±0.10 Hz | | | | | | | | | | | | | | | | | | | 2792.12W | | | | | | | | | | | 50.70Hz | | | | | | | | | | - |
| Step d) 51.15 Hz ±0.05 Hz | | | | | | | | | | | | | | | | | | | 2513.47W | | | | | | | | | | | 51.16Hz | | | | | | | | | | - |
| Step e) 50.70 Hz ±0.10 Hz | | | | | | | | | | | | | | | | | | | 2785.42W | | | | | | | | | | | 50.71Hz | | | | | | | | | | - |
| Step f) 50.45 Hz ±0.05 Hz | | | | | | | | | | | | | | | | | | | 2940.35W | | | | | | | | | | | 50.44Hz | | | | | | | | | | - |
| Step g) 50.00 Hz ±0.01 Hz | | | | | | | | | | | | | | | | | | | 2952.88 W | | | | | | | | | | | 50.00Hz | | | | | | | | | |  |
| Test sequence at **Registered Capacity** 40% - 60% | | | | | | | | | | | | | | | | | | | Measured **Active Power** Output | | | | | | | | | | | Frequency | | | | | | | | | | Primary Power Source | | | | | | | | | | | | | **Active Power** Gradient |
| Step a) 50.00 Hz ±0.01 Hz | | | | | | | | | | | | | | | | | | | 1496.27W | | | | | | | | | | | 50.01Hz | | | | | | | | | | 1565.86W | | | | | | | | | | | | | - |
| Step b) 50.45 Hz ±0.05 Hz | | | | | | | | | | | | | | | | | | | 1470.14 W | | | | | | | | | | | 50.44Hz | | | | | | | | | | - |
| Step c) 50.70 Hz ±0.10 Hz | | | | | | | | | | | | | | | | | | | 1320.25 W | | | | | | | | | | | 50.71Hz | | | | | | | | | | - |
| Step d) 51.15 Hz ±0.05 Hz | | | | | | | | | | | | | | | | | | | 1057.86 W | | | | | | | | | | | 51.16Hz | | | | | | | | | | - |
| Step e) 50.70 Hz ±0.10 Hz | | | | | | | | | | | | | | | | | | | 1317.84 W | | | | | | | | | | | 50.69Hz | | | | | | | | | | - |
| Step f) 50.45 Hz ±0.05 Hz | | | | | | | | | | | | | | | | | | | 1471.08 W | | | | | | | | | | | 50.46Hz | | | | | | | | | | - |
| Step g) 50.00 Hz ±0.01 Hz | | | | | | | | | | | | | | | | | | | 1504.63W | | | | | | | | | | | 50.00Hz | | | | | | | | | |  |
| Steps as defined in EN 50438 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **12.Power output with falling frequency test:** This test should be carried out in accordance with EN 50438 Annex D.3.2 active power feed-in at under-frequency. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test sequence | | | | | | | | | | | | | | | | | | | | | | Measured **Active Power** Output | | | | | | | | | | | | | | | Frequency | | | | | | | | | | | | | Primary power source | | | |
| Test a) 50 Hz ± 0.01 Hz | | | | | | | | | | | | | | | | | | | | | | 2989.16W | | | | | | | | | | | | | | | 50.01Hz | | | | | | | | | | | | | 3116.94W | | | |
| Test b) Point between 49.5 Hz and 49.6 Hz | | | | | | | | | | | | | | | | | | | | | | 2985.53W | | | | | | | | | | | | | | | 49.54Hz | | | | | | | | | | | | | 3110.49W | | | |
| Test c) Point between 47.5 Hz and 47.6 Hz | | | | | | | | | | | | | | | | | | | | | | 2975.98W | | | | | | | | | | | | | | | 47.55Hz | | | | | | | | | | | | | 3100.95W | | | |
| NOTE: The operating point in Test (b) and (c) shall be maintained for at least 5 minutes | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **13.Re-connection timer**. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Test should prove that the reconnection sequence starts after a minimum delay of 20 s for restoration of  voltage and frequency to within the stage 1 settings of Table 2. Both the time delay setting and the  measured delay should be provided in this form; both should be greater than 20 s to pass. Confirmation  should be provided that the Micro-generating Plant does not reconnect at the voltage and frequency  settings below; a statement of “no reconnection” can be made. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Time delay setting | | | Measured delay | | | | | | | | | | | | | | |  | | | | | Checks on no reconnection when voltage or frequency is brought to just outside stage 1 limits of table 2. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | 30S | | | | | | | | | | | | | | |  | | | | | At 266.2 V | | | | | | | | At 180.0 V | | | | | | | | | | | At 47.4 Hz | | | | | | | | | | At 52.1 Hz | |
| Confirmation that the **Micro-generator** does not re-connect. | | | | | | | | | | | | | | | | | | | | | | | Yes | | | | | | | | Yes | | | | | | | | | | | Yes | | | | | | | | | | Yes | |
| **14.Fault level contribution**: These tests shall be carried out in accordance with EREC G98 Annex A1 A.1.3.5 (**Inverter** connected) and Annex A2 A.2.3.4 (Synchronous). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| For machines with electro-magnetic output | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | For **Inverter** output | | | | | | | | | | | | | | | | |
| Parameter | | | | | | | | | | | | | | | | | | | | | | Symbol | | | | | | Value | | | | | | | | | Time after fault | | | | | | | | | | Volts | | | | | Amps | |
| Peak Short Circuit current | | | | | | | | | | | | | | | | | | | | | | *ip* | | | | | | - | | | | | | | | | 20 ms | | | | | | | | | | 75.6V | | | | | 15.5A | |
| Initial Value of aperiodic current | | | | | | | | | | | | | | | | | | | | | | *A* | | | | | | - | | | | | | | | | 100 ms | | | | | | | | | | 57.9V | | | | | 10.8A | |
| Initial symmetrical short-circuit current\* | | | | | | | | | | | | | | | | | | | | | | *Ik* | | | | | | - | | | | | | | | | 250 ms | | | | | | | | | | 24.6V | | | | | 6.34A | |
| Decaying (aperiodic) component of short circuit current\* | | | | | | | | | | | | | | | | | | | | | | *iDC* | | | | | | - | | | | | | | | | 500 ms | | | | | | | | | | 13.2V | | | | | 5.66A | |
| Reactance/Resistance Ratio of source\* | | | | | | | | | | | | | | | | | | | | | | *X/R* | | | | | | - | | | | | | | | | Time to trip | | | | | | | | | | 0.308 | | | | | In seconds | |
| For rotating machines and linear piston machines the test should produce a 0 s – 2 s plot of the short circuit current as seen at the **Micro-generator** terminals.  \* Values for these parameters should be provided where the short circuit duration is sufficiently long to enable interpolation of the plot | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **15.Logic Interface.** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Yes |
| the DNO logic interface will take the form of a simple binary output that can be operated by the circuit breaker.When the circuit breaker is opened the Power Generating Module can operate normally. When the circuitbreaker is closed the Power Generating Module will reduce its Active Power to zero within 5 s. The signal fromthe Power Generating Module that is being switched is DC (maximum value 110 V). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **16.Self-Monitoring solid state switching:** No specified test requirements. Refer to EREC G98 Annex A1 A.1.3.6 (**Inverter** connected). | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Yes or NA |
| It has been verified that in the event of the solid state switching device failing to disconnect the **Micro-generator**, the voltage on the output side of the switching device is reduced to a value below 50 V within 0.5 s. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | NA |
| **17. Cyber security** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Yes or NA |
| Confirm that the Manufacturer or Installer of the Micro-generator has provided a  statement describing how the Micro-generator has been designed to comply with cyber  security requirements, as detailed in 9.7. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | Yes |
| Additional comments | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**Manufacturer's declaration in accordance with the requirements of**

**G98-Amd. 6 (2021-09) standard Sec.s 9.7.1, 9.7.2, and G99-Amd. 8 (2021-09) standard Sec.s 9.1.7, 9.1.8 regarding "Cyber Security"**

**The undersigned \*\*\*\*\***,

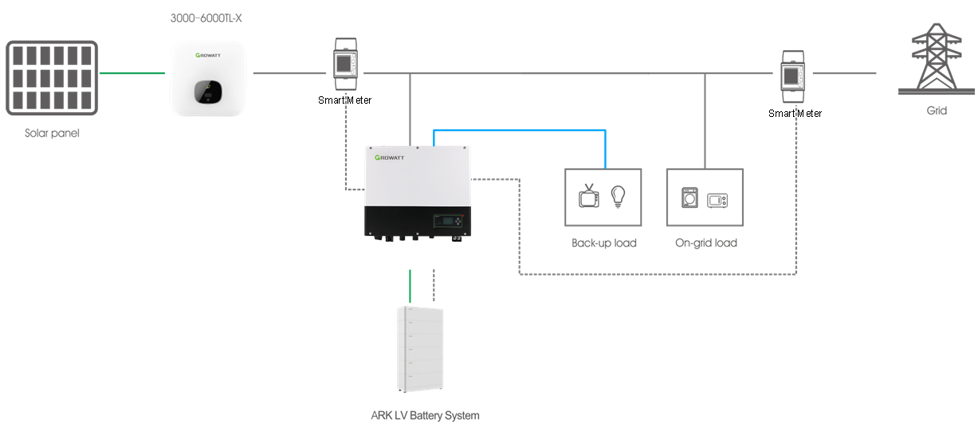
**as Marketing department** of the Company **ShenZhen Growatt New Energy Co.,Ltd.** ,

based in 4-13/F, Building A, Sino- German(Europe) Industrial Park, Hangcheng Ave, Guxing Community, Xixiang Subdistrict, Bao'an District, Shenzhen, China

**on behalf of the same Company declares the following:**

1) The ShenZhen Growatt New Energy Co.,Ltd company’s inverters include a system of internal and

external logic communications as summarized in the following scheme:



where the main components involved and their main functions are explained in the following table:

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Meaning | Function | Location |
| PMS | Power Management System | monitoring and management of power fluxes through the inverter, execution of local logic functions depending on grid parameters values | Inverter |
| Monitoring | WIFI/GPRS | Monitoring device to realize remote monitoring function | Monitoring device |
| Router | Router device | transmission of data to cloud server, reception of  commands/settings from external stakeholder | Third-party device |
| Meter | External Power Meter | meter at the AC input site, and possible  meter at AC port of third party generator/inverter, for power measures | Third-party device |

and the subjects/parties involved in communications with the Growatt inverters are listed in the

following table, together with the purposes of the respective communications:

|  |  |  |
| --- | --- | --- |
| Subject | Meaning | Operations |
| End-user | mobile device (App), PC ( web portal) | monitoring of historical data, settings for special functions |
| Service | PC (via web portal) | remote diagnosis, system behaviour monitoring, remote updates, remote settings |

2) All communications between internal components of the inverter, and supplied External Power Meter(s), take place via appropriate serial lines (RS485, CanBus) .

3) The only communication port between the inverter and the outside is constituted by the monitoring device on the system; the communication between inverter and the outside world can take place via an Ethernet line, WiFi or GPRS router according to the customer's request.

4) All communications between the Growatt server and the subjects/parties are cyber-protected by SSL

technology.

5) The cyber-security assessment of the Growatt was performed according to the ETSI EN 303 645

standard, and it is reported according to the Table B.1 form of the same standard:

|  |  |  |  |
| --- | --- | --- | --- |
| EN 303 645 v2.1.1 (2020-06) Table B.1: Implementation of provisions for consumer IoT security | | | |
| Clause number and title | | | |
| Reference | Status | Support | Detail |
| 5.1 No universal default passwords | | | |
| Provision 5.1-1 | M C (1) | N/A | There is no default passwords for users |
| Provision 5.1-2 | M C (1) | N/A |
| Provision 5.1-3 | M | N/A |
| Provision 5.1-4 | M C (8) | N/A |
| Provision 5.1-5 | M C (5) | N/A |
| 5.2 Implement a means to manage reports of vulnerabilities | | | |
| Provision 5.2-1 | M | Y |  |
| Provision 5.2-2 | R | Y |  |
| Provision 5.2-3 | R | Y |  |
| 5.3 Keep software updated | | | |
| Provision 5.3-1 | R | Y |  |
| Provision 5.3-2 | MC (5) | Y |  |
| Provision 5.3-3 | MC (12) | N/A |  |
| Provision 5.3-4 | RC (12) | Y | The manufacturer manages the updates of the systems by means of remote automatic, selectively by type of machine or by activating  special functions at the request of the user |
| Provision 5.3-5 | RC (12) | N | Check note at 5.3-4 |
| Provision 5.3-6 | RC (9,12) | N | Check note at 5.3-4 |
| Provision 5.3-7 | M C (12) | Y |  |
| Provision 5.3-8 | M C (12) | N | note at 5.3-4 |
| Provision 5.3-9 | R C (12) | N |  |
| Provision 5.3-10 | M (11,12) | Y |  |
| Provision 5.3-11 | RC (12) | N |  |
| Provision 5.3-12 | RC (12) | N |  |
| Provision 5.3-13 | M | Y |  |
| Provision 5.3-14 | R C (3,4) | N/A |  |
| Provision 5.3-15 | R C (3,4) | N/A |  |
| Provision 5.3-16 | M | Y |  |
| 5.4 Securely store sensitive security parameters | | | |
| Provision 5.4-1 | M | Y |  |
| Provision 5.4-2 | M(10) | Y |  |
| Provision 5.4-3 | M | N/A | hard-coded identity not used in source code |
| Provision 5.4-4 | M | Y |  |
| 5.5 Communicate securely | | | |
| Provision 5.5-1 | M | Y |  |
| Provision 5.5-2 | R | Y |  |
| Provision 5.5-3 | R | Y |  |
| Provision 5.5-4 | R | N |  |
| Provision 5.5-5 | M | Y |  |
| Provision 5.5-6 | R | Y |  |
| Provision 5.5-7 | M | Y |  |
| Provision 5.5-8 | M | Y |  |
| 5.6 Minimize exposed attack surfaces | | | |
| Provision 5.6-1 | M | Y |  |
| Provision 5.6-2 | M | Y |  |
| Provision 5.6-3 | R | Y |  |
| Provision 5.6-4 | MC(13) | N/A |  |
| Provision 5.6-5 | R | Y |  |
| Provision 5.6-6 | R | Y |  |
| Provision 5.6-7 | R | Y |  |
| Provision 5.6-8 | R | N |  |
| Provision 5.6-9 | R | Y |  |
| 5.7 Ensure software integrity | | | |
| Provision 5.7-1 | R | N |  |
| Provision 5.7-2 | R | N |  |
| 5.8 Ensure that personal data is secure | | | |
| Provision 5.8-1 | R | N/A |  |
| Provision 5.8-2 | M | Y | applicable to server/cloud services and to the customer App for mobile  devices |
| Provision 5.8-3 | M | Y |  |
| 5.9 Make systems resilient to outages | | | |
| Provision 5.9-1 | R | Y |  |
| Provision 5.9-2 | R | Y |  |
| Provision 5.9-3 | R | Y |  |
| 5.10 Examine system telemetry data | | | |
| Provision 5.10-1 | RC (6) | N |  |
| 5.11 Make it easy for users to delete user data | | | |
| Provision 5.11-1 | M | N/A |  |
| Provision 5.11-2 | R | N/A |  |
| Provision 5.11-3 | R | N/A |  |
| Provision 5.11-4 | R | N/A |  |
| 5.12 Make installation and maintenance of devices easy | | | |
| Provision 5.12-1 | R | N/A | no istallation/maintenance operations are available to the final user |
| Provision 5.12-2 | R | N/A | no istallation/maintenance operations are available to the final user |
| Provision 5.12-3 | R | N/A | check note at 5.3-4 |
| 5.13 Validate input data | | | |
| Provision 5.13-1 | M | Y |  |
| 6 Data protection provisions for consumer IoT | | | |
| Provision 6.1 | M | Y | it only applies to the server/cloud side of the service |
| Provision 6.2 | MC (7) | Y | it only applies to the server/cloud side of the service |
| Provision 6.3 | M | Y | it only applies to the server/cloud side of the service |
| Provision 6.4 | RC (6) | Y |  |
| Provision 6.5 | MC(6) | Y |  |
| Conditions: | | | |
| 1) passwords are used;  2) pre-installed passwords are used;  3) software components are not updateable;  4) the device is constrained;  5) the device is not constrained;  6) telemetry data being collected;  7) personal data is processed on the basis of consumers' consent;  8) the device allowing user authentication;  9) the device supports automatic updates and/or update notifications;  10) a hard-coded unique per device identity is used for security purposes;  11) updates are delivered over a network interface;  12) an update mechanism is implemented;  13) a debug interface is physically accessible. | | | |
| Status' Column:  M: Mandatory provision  R: Recommended provision  M C: Mandatory and conditional provision  R C: Recommended and conditional provision | | | |
| Support' Column:  Y: Implemented  N: Not implemented  N/A: Not applicable | | | |