Test Report issued under the responsibility of:

# TEST REPORT
# IEC 61683

## Photovoltaic systems – Power conditioners – Procedure for measuring efficiency

| | |
|---|---|
| **Report Number. .....:** | 2219 / 0190-3-M1 |
| **Date of issue .....:** | 17/10/2019 |
| **Total number of pages.....** | 17 |
| **Applicant's name.....:** | EVOLVE ENERGY GROUP CO., LIMITED |
| **Address .....:** | RM 702, 7/F FU FAI COMM CTR 27 HILLIER ST SHEUNG WAN, HK |
| **Test specification:** | |
| **Standard .....:** | IEC 61683:1999 (First Edition) |
| **Test procedure .....:** | Characteristic Examination |
| **Non-standard test method .....:** | N/A |
| **Test Report Form No. .....:** | IEC61683A |
| **Test Report Form(s) Originator ....:** | TÜV SÜD Product Service GmbH |
| **Master TRF.....:** | Dated 2014-10 |

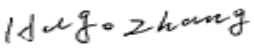


**This report is not valid as a CB Test Report unless signed by an approved CB Testing Laboratory and appended to a CB Test Certificate issued by an NCB in accordance with IECEE 02.**

**General disclaimer:**

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing CB Testing Laboratory. The authenticity of this Test Report and its contents can be verified by contacting the NCB, responsible for this Test Report.

| | |
|---|---|
| **Test item description ..... :** | Solar Grid-tied Inverter |
| **Trade Mark ..... :** | EVVO |
| **Manufacturer ..... :** | EVOLVE ENERGY GROUP CO., LIMITED |
| **Model/Type reference ..... :** | **EVVO 15000TLG23P, EVVO 12000TLG23P, EVVO 10000TLG23P** |
| **Ratings ..... :** | **EVVO 15000TLG23P**<br>DC input: 160-960V Max.21A /11A<br>Full load DC Voltage Range: 500V-850V<br>AC output: 3/N/PE 230/400Vac, 50Hz, Max. 3x24A, 15000W<br><br>**EVVO 12000TLG23P**<br>DC input: 160-960V Max.21A /11A<br>Full load DC Voltage Range: 500V-850V<br>AC output: 3/N/PE 230/400Vac, 50Hz, Max. 3x20A, 12000W<br><br>**EVVO 10000TLG23P**<br>DC input: 160-960V Max.21A /11A<br>Full load DC Voltage Range: 350V-850V<br>AC output: 3/N/PE 230/400Vac, 50Hz, Max. 3x16.5A, 10000W<br><br>**Serial Number:** SN1CS015K3G061<br>**Firmware version:** V0.21 |

| | | | |
|---|---|---|---|
| **Testing procedure and testing location:** | | | |
| ☐ | ~~**CB Testing Laboratory:**~~ | | |
| ~~**Testing location/ address.....:**~~ | | | |
| ☐ | ~~**Associated CB Testing Laboratory:**~~ | | |
| | | | |
| ☒ | **Testing procedure: TMP/CTF Stage 1:** | Shenzhen SOFAR SOLAR Co., Ltd. | |
| **Testing location/ address.....:** | | 401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China | |
| **Tested by (name + signature).....:** | | Hugo zhang<br>(Project Engineer) |  |
| | | Roger Hu<br>(Project Engineer) |  |
| **Approved by (name + signature).....:** | | Jacobo Tevar<br>(Technical Reviewer) |   |
| | | | |
| ☐ | ~~**Testing procedure: WMT/CTF Stage 2:**~~ | | |
| | | | |
| ☐ | ~~**Testing procedure:**<br>**SMT/CTF Stage 3 or 4:**~~ | | |

**List of Attachments (including a total number of pages in each attachment):**

| 50Hz | | |
|---|---|---|
| Attachment # | Description | Pages |
| Attachment I | Pictures of the EUT and Electrical Schemes | 12pages |
| Attachment II | Testing Information | 5 pages |

**Summary of testing:**

**Tests performed (name of test and test clause):**

The equipment has been tested according to the standard:
IEC 61683:1999. Testing has been carried out at 50Hz.

All applicable tests according to the above specified standard have been carried out.

From the result of inspection and tests on the submitted sample, we conclude that it complies with the requirements of the standard.

**Remarks:** All the test results are from the report below:

- IEC 61683:1999 (First Edition)

Test Report No: 2219 / 0190-3 which issued by SGS Tecnos, S.A. (Electrical Testing Laboratory) on19/06/2019

**Testing location:**

Shenzhen SOFAR SOLAR Co., Ltd.

401, Building 4, AnTongDa Industrial Park, District 68, XingDong Community, XinAn Street, BaoAn District, Shenzhen City, Guangdong Province, P.R. China

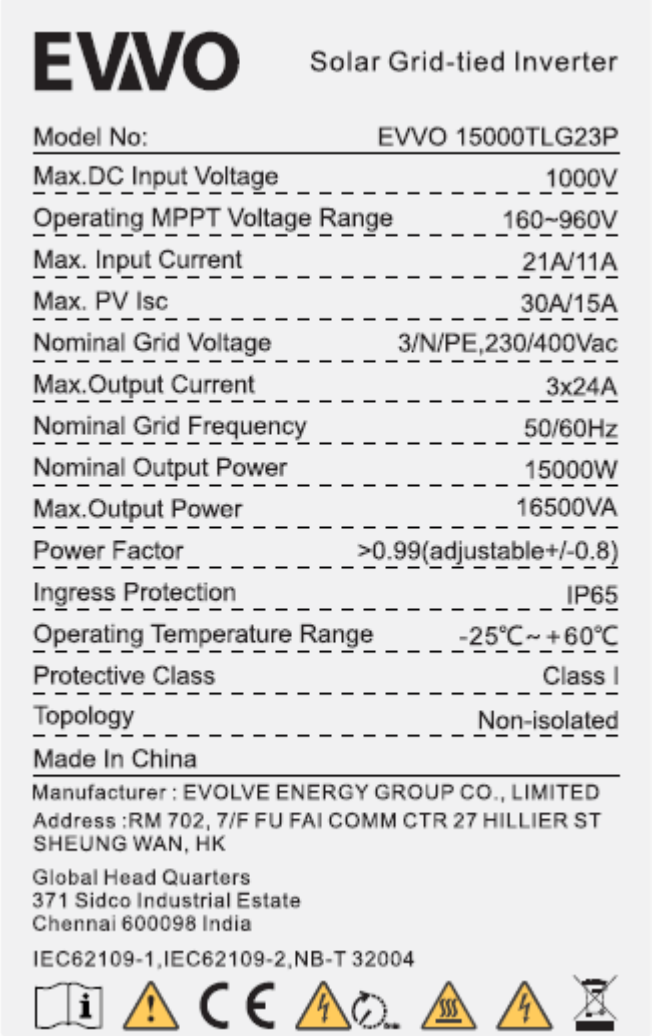
(All clauses)

**Summary of compliance with National Differences**

**List of countries addressed**

No National Differences are addressed to this test report

**Copy of marking plate(representative):**




**Note:**

1. The above markings are the minimum requirements required by the safety standard. For the final production samples, the additional markings which do not give rise to misunderstanding may be added.
2. Label is attached on the side surface of enclosure and visible after installation
3. Labels of other models are as the same wit **EVVO 15000TLG23P**'s except the parameters of rating.

| | |
|---|---|
| **Test item particulars..... :** | Solar Grid-tied Inverter (Three Phase Inverter) |
| **Classification of installation and use..... :** | Fixed(permanent connection) |
| **Supply Connection ..... :** | DC; PV |
| **..... :** | AC; Grid connection |
| **Possible test case verdicts:** | |
| **- test case does not apply to the test object.....:** | N/A |
| **- test object does meet the requirement.....:** | P (Pass) |
| **- test object does not meet the requirement.....:** | F (Fail) |
| **Testing.....:** | CTF Stage 1 procedure |
| **Date of receipt of test item .....:** | N/A |
| **Date (s) of performance of tests .....:** | From 08/05/2019 to 13/05/2019 |

**General remarks:**

"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.



**Throughout this report a ☐ comma / ☒ point is used as the decimal separator.**

**Manufacturer's Declaration per sub-clause 4.2.5 of IECEE 02:**

| | |
|---|---|
| The application for obtaining a CB Test Certificate includes more than one factory location and a declaration from the Manufacturer stating that the sample(s) submitted for evaluation is (are) representative of the products from each factory has been provided ..... : | ☐ **Yes**<br>☒ **Not applicable** |

**When differences exist; they shall be identified in the General product information section.**

| | |
|---|---|
| **Name and address of factory (ies) ..... :** | Dongguan SOFAR SOLAR Co.,Ltd.<br>1F - 6F, Building E, No. 1 JinQi Road, Bihu Industrial Park, Wulian Village, Fenggang Town, Dongguan City,Guangdong Province,P.R. China. |

**General product information:**

Product covered by this report is grid-connected PV inverter for indoor or outdoor installation. The connection to the DC input and AC output are through connectors.

The Solar inverter converts DC voltage into AC voltage.
The input and output are protected by varistors to Earth. The unit is providing EMC filtering at the output toward mains. The unit does not provide galvanic separation from input to output (transformerless). The output is switched off redundant by the high power switching bridge and a two relays. This assures that the opening of the output circuit can operate in case of one error.

**Equipment Under Testing:**

– **EVVO 15000TLG23P**
– **EVVO 12000TLG23P**
– **EVVO 10000TLG23P**

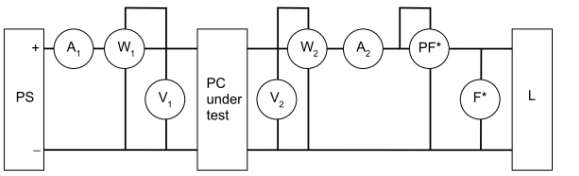
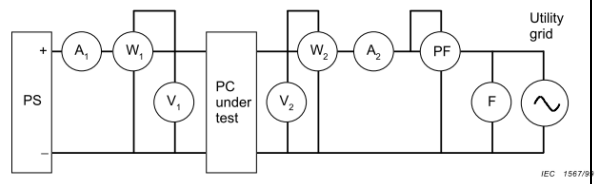
| Model Number | **EVVO 15000TLG23P** | **EVVO 12000TLG23P** | **EVVO 10000TLG23P** |
|---|---|---|---|
| Max. input voltage | 1000Vd.c. | | |
| Max. input current | 21A/11A | | |
| Operating MPPT voltage range | 160V-960V | | |
| Rated voltage | 600V | | |
| Full load DC Voltage Range | 500V-850V | 500V-850V | 350V-850V |
| Rated grid voltage | 3/N/PE 230/400Va.c | | |
| Rated grid frequency | 50Hz | | |
| Rated output power | 15000W | 12000W | 10000W |
| Max. output current | 3 x 24A | 3 x 20A | 3 x 16.5A |
| Power factor | 0.8 leading to 0.8 lagging | | |
| Ambient temperature | -25 ºC ~60 ºC | | |
| Ingress protection | IP65 | | |
| Protective class | Class I | | |

The variants models have been included in this test report without tests because the following features don´t change regarding to the tested model:

- Same connection system and hardware topology
- Same control algorithm.
- Same Firmware Version

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |
| 4 | Efficiency measurement conditions | | P |
| | Efficiency is measured under the conditions in the following clauses. | | P |
| | Specific conditions may be excluded by mutual agreement when those conditions are outside the manufacturer's allowable operating range. | | P |
| 4.1 | DC power source for testing | | P |
| | For power conditioners operating with fixed input voltage, the d.c. power source is a storage battery or constant voltage power source to maintain the input voltage. | | N/A |
| | For power conditioners that employ maximum power point tracking (MPPT) and shunt-type power conditioners, either a photovoltaic array or a photovoltaic array simulator is utilized. | | P |
| 4.2 | Temperature | | P |
| | All measurements are to be made at an ambient temperature of 25 °C ± 2 °C. | | N/A |
| | Other ambient temperatures may be allowed by mutual agreement. However, the temperature used must be clearly stated in all documentation. | By mutual agreement all measurements at 50 Hz have been carried out at 25ºC±5ºC | P |
| 4.3 | Output voltage and frequency | | P |
| | The output voltage and frequency are maintained at the manufacturer's stated nominal values. | L/N/PE 230Vac, 50Hz | P |
| 4.4 | Input voltage | | P |
| | Measurements performed in each of the following tests are repeated at three power conditioner input voltages:<br>a) manufacturer's minimum rated input voltage;<br>b) the inverter's nominal voltage or the average of its rated input range;<br>c) 90 % of the inverter's maximum input voltage. | | P |
| | In the case where a power conditioner is to be connected with a battery at its input terminals, only the nominal or rated input voltage may be applied. | | N/A |
| 4.5 | Ripple and distortion | | P |
| | Record input voltage and current ripple for each measurement. Also record output voltage and current distortion (if a.c.) or ripple (if d.c.). Ensure that these measurements remain within the manufacturer's specified values. | | P |
| 4.6 | Resistive loads/utility grid | | P |
| | At unity power factor, or at the intrinsic power factor of grid-connected inverters without power | | P |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |
| | factor adjustment, measure the efficiency for power levels of 10 %, 25 %, 50 %, 75 %, 100 % and 120 % of the inverter's rating. | | |
| | Stand-alone inverters are also measured at a power level of 5 % of rated. The power conditioner test is conducted with a specified resistive and reactive grid impedance. | | N/A |
| 4.7 | Reactive loads | | N/A |
| | For stand-alone inverters, measure the efficiency with a load which provides a power factor equal to the manufacturer's specified minimum level (or 0,25, whichever is greater) and at power levels of 25 %, 50 % and 100 % of rated VA. | | N/A |
| | Repeat for power factors of 0,5 and 0,75 (do not go below the manufacturer's specified minimum PF) and power levels of 25 %, 50 %, and 100 % of rated VA. | | N/A |
| 4.8 | Resistive plus non-linear loads | | N/A |
| | For stand-alone inverters, measure the efficiency with a fixed non-linear load (total harmonic distortion (THD) = (80 ± 5) %) equal to (25 ± 5) % of the inverter's rated VA plus sufficient resistive load in parallel to achieve a total load of 25 %, 50 % and 100 % of rated VA. | | N/A |
| | Repeat the measurements with a fixed non-linear load equivalent to (50 ± 5) % of the inverter’s rated VA plus sufficient resistive load in parallel to achieve a total load of 50% and 100% of rated VA. | | N/A |
| | The type of non-linear load must be clearly stated in all documentation. | | N/A |
| 4.9 | Complex loads | | N/A |
| | When a non-linear plus a sufficient reactive load condition is specified for stand-alone inverters, measure the efficiency with a fixed non-linear load (THD = (80 ± 5) %) equal to (50 ± 5) % of the inverter's rated VA plus a sufficient reactive load (PF = 0,5) in parallel to achieve a total load of 50 % and 100 % of rated VA. | | N/A |
| | The type of complex load is clearly stated in all documentation. | | N/A |
| 5 | Efficiency calculations | | P |
| 5.1 | Rated output efficiency | | P |
| 5.2 | Partial output efficiency | | P |
| 5.3 | Energy efficiency | | P |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |
| 5.4 | Efficiency tolerances | | P |
| 6 | Conditions of loading for output ports | | P |
| 6.1 | Test circuit | | P |
| | Figure 1a is applied to standard-alone power conditioners | | N/A |
| |  Figure 1a – Stand-alone type | | N/A |
| | Figure 1b is applied to utility-interactive power conditioners | | P |
| |  Figure 1b – Utility-interactive type<br>PC power conditioner<br>PS variable voltage-current d.c. power supply<br>$A_1$ DC ammeter<br>$A_2$ AC or d.c. ammeter<br>$W_1$ DC wattmeter<br>$W_2$ AC or d.c. wattmeter<br>L load<br>F frequency meter<br>$V_1$ DC voltmeter<br>$V_2$ AC or d.c. voltmeter<br>PF power factor meter | | P |
| 6.2 | Measurement procedure | | P |
| 7 | Loss measurement | | P |
| 7.1 | No-load loss | | P |
| 7.2 | Standby loss | | P |
| Annex A | Power conditioner description | | P |
| Annex B | Power efficiency and conversion factor | | P |
| Annex C | Weighted-average energy efficiency | | P |
| Annex D | Derivation of efficiency tolerance in table 2 | | P |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |

| **TABLE** | Efficiency recording and efficient calculation sheet | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| power conditioner type | Grid-connected | | | | | | | | |
| Model: | **EVVO 15000TLG23P** | | | | | | | | |
| Parameters of power conditioner | Minimum full load input voltage:500V<br>Nominal voltage:600V<br>90% of the inverter's maximum input voltage:765V<br>Rated output voltage: 230Vac<br>Rated output frequency:50Hz<br>Rated output power: **15000W** | | | | | | | | |
| PV input voltage | a) Manufacturer's minimum rated input voltage 500V(±7.5V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1.5 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 496.1 | 496.2 | 499.5 | 499.1 | 500.8 | / | / | / |
| Input voltage ripple (V) | / | 0.9 | 0.9 | 1.1 | 0.9 | 1.1 | / | / | / |
| Input current (A) | / | 3.1 | 7.8 | 15.4 | 23.2 | 30.8 | / | / | / |
| Input current ripple (mA) | / | 52.8 | 64.1 | 75.7 | 85.1 | 107.7 | / | / | / |
| Input power (Pi) (W) | / | 1547 | 3862 | 7713 | 11563 | 15435 | / | / | / |
| Output power (Po) (W) | / | 1489 | 3763 | 7532 | 11277 | 15028 | / | / | / |
| Output efficiency(%) | / | 96.24 | 97.43 | 97.65 | 97.53 | 97.36 | / | / | / |
| Input energy (Wi) (Wh) | / | 38.68 | 96.56 | 192.82 | 289.06 | 385.89 | / | / | / |
| Output energy (Wo) (Wh) | / | 37.22 | 94.08 | 188.29 | 281.92 | 375.70 | / | / | / |
| Energy efficiency(%) | / | 96.23 | 97.43 | 97.65 | 97.53 | 97.37 | / | / | / |
| | | | | | | | | | |
| PV input voltage | b) The inverter's nominal voltage 600V(±9.0V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1.5 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 598.6 | 604.9 | 599.3 | 599.8 | 599.1 | / | / | / |
| Input voltage ripple (V) | / | 1.0 | 1.0 | 1.0 | 0.9 | 1.0 | / | / | / |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Input current (A) | / | 2.6 | 6.4 | 13.0 | 19.2 | 25.7 | / | / | / |
| Input current ripple (mA) | / | 18.5 | 18.5 | 21.2 | 21.8 | 21.1 | / | / | / |
| Input power (Pi) (W) | / | 1547 | 3856 | 7714 | 11563 | 15412 | / | / | / |
| Output power (Po) (W) | / | 1502 | 3780 | 7572 | 11338 | 15047 | / | / | / |
| Output efficiency(%) | / | 97.14 | 98.03 | 98.16 | 98.05 | 97.63 | / | / | / |
| Input energy (Wi) (Wh) | / | 38.67 | 96.39 | 192.85 | 289.10 | 385.30 | / | / | / |
| Output energy (Wo) (Wh) | / | 37.55 | 94.49 | 189.30 | 283.44 | 376.18 | / | / | / |
| Energy efficiency(%) | / | 97.12 | 98.02 | 98.16 | 98.04 | 97.71 | / | / | / |
| | | | | | | | | | |
| PV input voltage | c) 90% of the inverter's maximum input voltage 765V(±11.5V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1.5 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 766.7 | 768.0 | 760.0 | 766.5 | 763.7 | / | / | / |
| Input voltage ripple (V) | | 1.3 | 1.0 | 1.0 | 1.0 | 1.1 | / | / | / |
| Input current (A) | / | 2.0 | 5.0 | 10.2 | 15.1 | 20.2 | / | / | / |
| Input current ripple (mA) | | 18.2 | 18.4 | 21.3 | 22.2 | 26.0 | / | / | / |
| Input power (Pi) (W) | / | 1546 | 3864 | 7704 | 11569 | 15430 | / | / | / |
| Output power (Po) (W) | / | 1475 | 3755 | 7526 | 11282 | 15029 | / | / | / |
| Output efficiency(%) | / | 95.40 | 97.17 | 97.55 | 97.51 | 97.41 | / | / | / |
| Input energy (Wi) (Wh) | / | 38.66 | 96.60 | 192.89 | 289.25 | 385.74 | / | / | / |
| Output energy (Wo) (Wh) | / | 36.88 | 93.87 | 188.17 | 282.06 | 375.73 | / | / | / |
| Energy efficiency(%) | / | 95.40 | 97.17 | 97.55 | 97.51 | 97.41 | / | / | / |
| Remark:<br>*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived; | | | | | | | | | |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |

| **TABLE** | Efficiency recording and efficient calculation sheet | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| power conditioner type | Grid-connected | | | | | | | | |
| Model: | **EVVO 12000TLG23P** | | | | | | | | |
| Parameters of power conditioner | Minimum full load input voltage:500V<br>Nominal voltage:600V<br>90% of the inverter's maximum input voltage: 765V<br>Rated output voltage: 230Vac<br>Rated output frequency:50Hz<br>Rated output power: **12000W** | | | | | | | | |
| PV input voltage | a) Manufacturer's minimum rated input voltage 500V(±7.5V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1.5 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 504.3 | 497.6 | 498.4 | 500.0 | 498.7 | / | / | / |
| Input voltage ripple (V) | / | 0.8 | 0.2 | 0.8 | 1.0 | 0.9 | / | / | / |
| Input current (A) | / | 2.5 | 6.2 | 12.4 | 18.5 | 24.8 | / | / | / |
| Input current ripple (mA) | / | 48.2 | 65.8 | 72.0 | 82.8 | 96.2 | / | / | / |
| Input power (Pi) (W) | / | 1237 | 3090 | 6172 | 9252 | 12320 | / | / | / |
| Output power (Po) (W) | / | 1185 | 2998 | 6029 | 9033 | 12015 | / | / | / |
| Output efficiency(%) | / | 95.81 | 97.25 | 97.65 | 97.64 | 97.53 | / | / | / |
| Input energy (Wi) (Wh) | / | 30.93 | 77.25 | 154.37 | 231.31 | 308.01 | / | / | / |
| Output energy (Wo) (Wh) | / | 29.63 | 75.13 | 150.74 | 225.84 | 300.40 | / | / | / |
| Energy efficiency(%) | / | 95.81 | 97.24 | 97.65 | 97.64 | 97.53 | / | / | / |
| | | | | | | | | | |
| PV input voltage | b) The inverter's nominal voltage 600V(±9.0V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 606.5 | 602.4 | 596.9 | 600.8 | 598.5 | / | / | / |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Input voltage ripple (V) | / | 0.9 | 0.8 | 1.0 | 0.9 | 0.9 | / | / | / |
| Input current (A) | / | 2.0 | 5.1 | 10.3 | 15.4 | 20.6 | / | / | / |
| Input current ripple (mA) | / | 20.2 | 20.7 | 20.3 | 21.5 | 28.1 | / | / | / |
| Input power (Pi) (W) | / | 1238 | 3091 | 6175 | 9265 | 12341 | / | / | / |
| Output power (Po) (W) | / | 1198 | 3026 | 6045 | 9068 | 12065 | / | / | / |
| Output efficiency(%) | / | 96.69 | 97.92 | 97.90 | 97.88 | 97.76 | / | / | / |
| Input energy (Wi) (Wh) | / | 30.96 | 77.27 | 154.38 | 231.62 | 308.54 | / | / | / |
| Output energy (Wo) (Wh) | / | 29.93 | 75.66 | 151.13 | 226.70 | 301.62 | / | / | / |
| Energy efficiency(%) | / | 96.68 | 97.91 | 97.89 | 97.88 | 97.76 | / | / | / |
| | | | | | | | | | |
| PV input voltage | c) 90% of the inverter's maximum input voltage 765V(±11.5V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 763.7 | 765.0 | 765.2 | 763.1 | 761.5 | / | / | / |
| Input voltage ripple (V) | / | 1.0 | 0.8 | 0.9 | 1.0 | 1.0 | / | / | / |
| Input current (A) | / | 1.6 | 4.0 | 8.1 | 12.1 | 16.2 | / | / | / |
| Input current ripple (mA) | / | 18.9 | 18.9 | 21.2 | 20.8 | 23.1 | / | / | / |
| Input power (Pi) (W) | / | 1237 | 3092 | 6175 | 9244 | 12340 | / | / | / |
| Output power (Po) (W) | / | 1171 | 2998 | 6025 | 9025 | 12037 | / | / | / |
| Output efficiency(%) | / | 94.64 | 96.96 | 97.57 | 97.63 | 97.55 | / | / | / |
| Input energy (Wi) (Wh) | / | 30.93 | 77.29 | 154.39 | 231.10 | 308.49 | / | / | / |
| Output energy (Wo) (Wh) | / | 29.26 | 74.94 | 150.63 | 225.61 | 300.93 | / | / | / |
| Energy efficiency(%) | / | 94.62 | 96.96 | 97.57 | 97.63 | 97.55 | / | / | / |
| Remark:<br>*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived; | | | | | | | | | |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |

| **TABLE** | Efficiency recording and efficient calculation sheet | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| power conditioner type | Grid-connected | | | | | | | | |
| Model: | **EVVO 10000TLG23P** | | | | | | | | |
| Parameters of power conditioner | Minimum full load input voltage:350V<br>Nominal voltage:600V<br>90% of the inverter's maximum input voltage: 765V<br>Rated output voltage: 230Vac<br>Rated output frequency:50Hz<br>Rated output power: **10000W** | | | | | | | | |
| PV input voltage | a) Manufacturer's minimum rated input voltage 350(±5.3V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1.5 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 347.1 | 349.2 | 346.2 | 346.2 | 352.3 | / | / | / |
| Input voltage ripple (V) | / | 0.2 | 1.0 | 0.9 | 0.5 | 1.0 | / | / | / |
| Input current (A) | / | 3.0 | 7.4 | 14.9 | 22.4 | 29.2 | / | / | / |
| Input current ripple (mA) | / | 65.5 | 110.0 | 128.9 | 152.7 | 178.7 | / | / | / |
| Input power (Pi) (W) | / | 1035 | 2593 | 5163 | 7740 | 10288 | / | / | / |
| Output power (Po) (W) | / | 972 | 2492 | 5000 | 7508 | 9972 | / | / | / |
| Output efficiency(%) | / | 93.91 | 96.08 | 96.84 | 97.00 | 96.93 | / | / | / |
| Input energy (Wi) (Wh) | / | 25.88 | 64.83 | 129.09 | 193.50 | 257.17 | / | / | / |
| Output energy (Wo) (Wh) | / | 24.30 | 62.29 | 125.02 | 187.71 | 249.27 | / | / | / |
| Energy efficiency(%) | / | 93.90 | 96.08 | 96.84 | 97.00 | 96.94 | / | / | / |
| | | | | | | | | | |
| PV input voltage | b) The inverter's nominal voltage 600V(±9.0V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1.5 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 589.8 | 596.1 | 602.2 | 596.1 | 599.4 | / | / | / |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Input voltage ripple (V) | / | 0.8 | 0.9 | 0.8 | 0.1 | 2.1 | / | / | / |
| Input current (A) | / | 1.7 | 4.3 | 8.5 | 12.9 | 17.1 | / | / | / |
| Input current ripple (mA) | / | 24.1 | 21.6 | 22.7 | 20.3 | 22.6 | / | / | / |
| Input power (Pi) (W) | / | 1030 | 2574 | 5141 | 7706 | 10265 | / | / | / |
| Output power (Po) (W) | / | 981 | 2501 | 5041 | 7539 | 10040 | / | / | / |
| Output efficiency(%) | / | 95.21 | 97.49 | 98.06 | 97.83 | 97.80 | / | / | / |
| Input energy (Wi) (Wh) | / | 25.75 | 64.34 | 128.53 | 192.66 | 256.64 | / | / | / |
| Output energy (Wo) (Wh) | / | 24.52 | 62.72 | 126.04 | 188.47 | 251.00 | / | / | / |
| Energy efficiency(%) | / | 95.22 | 97.58 | 98.06 | 97.83 | 97.80 | / | / | / |
| | | | | | | | | | |
| PV input voltage | c) 90% of the inverter's maximum input voltage 765V(±11.5V) | | | | | | | | |
| Temperature (°C) | 25ºC ± 5ºC | | | | | | | | |
| Operating period for energy measurement (min) | 1.5 | | | | | | | | |
| Percentage of rated output VA | / | 10% | 25% | 50% | 75% | 100% | 120%* | / | / |
| Input voltage (V) | / | 764.9 | 763.1 | 766.1 | 763.5 | 761.6 | / | / | / |
| Input voltage ripple (V) | / | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 | / | / | / |
| Input current (A) | / | 1.3 | 3.4 | 6.7 | 10.1 | 13.5 | / | / | / |
| Input current ripple (mA) | / | 19.3 | 20.2 | 19.4 | 20.1 | 24.3 | / | / | / |
| Input power (Pi) (W) | / | 1025 | 2557 | 5130 | 7710 | 10274 | / | / | / |
| Output power (Po) (W) | / | 957 | 2470 | 4999 | 7524 | 10028 | / | / | / |
| Output efficiency(%) | / | 93.41 | 96.57 | 97.44 | 97.60 | 97.61 | / | / | / |
| Input energy (Wi) (Wh) | / | 25.63 | 63.93 | 128.25 | 192.73 | 256.85 | / | / | / |
| Output energy (Wo) (Wh) | / | 23.94 | 61.73 | 124.97 | 188.10 | 250.71 | / | / | / |
| Energy efficiency(%) | / | 93.43 | 96.57 | 97.44 | 97.60 | 97.61 | / | / | / |
| Remark:<br>*If limited by design, inverter is not capable to operate with the 120% of rated output load, test under this condition is waived; | | | | | | | | | |

| IEC 61683: 1999 | | | |
|---|---|---|---|
| Clause | Requirement – Test | Measuring result – Remark | Verdict |

| | | |
|---|---|---|
| **TABLE** | No load loss | **P** |
| power conditioner type | Utility-interactive | |
| **EVVO 15000TLG23P** | | |
| Measure input voltage (V) | 600.2 | |
| Measured input power(W) | 14.010 | |
| **EVVO 12000TLG23P** | | |
| Measure input voltage (V) | 600.2 | |
| Measured input power(W) | 14.070 | |
| **EVVO 10000TLG23P** | | |
| Measure input voltage (V) | 600.2 | |
| Measured input power(W) | 14.050 | |
| Remark: No load loss is measured when the power conditioner works at rated input voltage and it's load is disconnected. | | |
| **TABLE** | Standby loss | **P** |
| power conditioner type | Utility-interactive | |
| **EVVO 15000TLG23P** | | |
| Measure input voltage (V) | 229.9 | |
| Measured input power(W) | 611.000 | |
| **EVVO 12000TLG23P** | | |
| Measure input voltage (V) | 229.5 | |
| Measured input power(W) | 618.000 | |
| **EVVO 10000TLG23P** | | |
| Measure input voltage (V) | 229.8 | |
| Measured input power(W) | 612.000 | |
| Remark: Standby loss is measured when the power conditioner works at rated input voltage and in standby mode. | | |

**--- End of test report---**