



Test Report issued under the responsibility of:



| TEST REPORT | |
|---|---|
| Report Number : | 6160501.64A |
| Date of issue : | 2024-01-17 |
| Total number of pages | 16 |
| DEKRA Branch : | DEKRA Testing and Certification (Shanghai) Ltd. |
| Applicant's name | Solar Fabrik GmbH |
| Address : | Hermann-Niggemann-Straße 7, D-63846 Laufach, Germany |
| Test specification: | |
| Standard | <input checked="" type="checkbox"/> IEC 61215-1:2016, EN 61215-1:2016 <input checked="" type="checkbox"/> IEC 61215-2:2016, EN 61215-2:2017 <input checked="" type="checkbox"/> IEC 61215-1-1:2016, EN 61215-1-1:2016 |
| Test procedure | N/A |
| Non-standard test method | N/A |
| Test Report Form No. | Hail_A |
| Test Report Form(s) Originator : | DEKRA Testing and Certification (Shanghai) Ltd. |
| Master TRF | 2019-05-20 |
| 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 Testing Laboratory. This report does not entitle to carry any test mark. | |
| | |

| | | |
|---|--|--|
| Test item description : | Photovoltaic (PV) Module(s) | |
| Trade Mark : | solar fabrik | |
| Manufacturer | Solar Fabrik GmbH | |
| Model/Type reference | MS5 HC V xxx BF-DG (xxx=300-320, in steps of 5) | |
| Ratings | Refer to section below for detail information | |
| Responsible Testing Laboratory (as applicable), testing procedure and testing location(s): | | |
| <input checked="" type="checkbox"/> | DEKRA Branch: | DEKRA Testing and Certification (Shanghai) Ltd. |
| | Location/address | 3F #250, Jiangchangsang Road, Building 16, Headquarter Economy Park Shibe Hi-Tech Park, Jing'an District, Shanghai, 200436, P.R. China |
| <input checked="" type="checkbox"/> | Associated Testing Laboratory: | Shanghai Institute of Quality Inspection and Technical Research |
| | Testing location/ address | 900 Jianguyue Rd., Shanghai, China |
| | Tested by (name, function, signature) | Lee Huang  |
| | Approved by (name, function, signature) .. | Kevin Lu  |
| <input type="checkbox"/> | Testing procedure: CTF Stage 1: | |
| | Testing location/ address | |
| | Tested by (name, function, signature) | |
| | Approved by (name, function, signature) .. | |
| <input type="checkbox"/> | Testing procedure: CTF Stage 2: | |
| | Testing location/ address | |
| | Tested by (name + signature) | |
| | Witnessed by (name, function, signature) | |
| | Approved by (name, function, signature) .. | |
| <input type="checkbox"/> | Testing procedure: CTF Stage 3: | |
| <input type="checkbox"/> | Testing procedure: CTF Stage 4: | |
| | Testing location/ address | |
| | Tested by (name, function, signature) | |
| | Witnessed by (name, function, signature) | |
| | Approved by (name, function, signature) .. | |

| | | |
|---|--|--|
| Supervised by (name, function, signature)..... | | |
| | | |






| List of Attachments (including a total number of pages in each attachment): | |
|--|-------------------|
| | attachment number |
| Installation manual | |
| Drawings mechanical | |
| Circuit diagram | |
| Photographs | Annex 1 |
| Lower and higher output power modules | |
| Others: | |
| Product Description Sheet (Manufacturers and type references) | |
| List of measurement equipment | Annex 2 |
| Measurement uncertainty | Annex 3 |

| Summary of testing: | |
|---|---|
| Tests performed (name of test and test clause): Refer to section below for detail information | Testing location: Shanghai Institute of Quality Inspection and Technical Research Institute of Electronics & Household Appliances Quality Inspection (SQI_DZ) No. 900 Jiang Yue Roa, Shanghai, 201114, China |
| Summary of compliance with National Differences (List of countries addressed): N/A | |

Copy of marking plate:

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBS that own these marks.

(Note: The marking plate represents all models covered by this report except for difference in electrical ratings and model designation. See "General product information" for electrical ratings for all models. As there will be other lower wattages to be covered under same report which follows same back label format.)

| | | | | | |
|---|--|-------------------------------------|----|---|------|
|  <p>Solar Fabrik GmbH Hermann-Niggemann-Str. 7-9 65846 Laufach/Germany Phone: +49(0)6093 20770-0 Fax: +49(0)6093 20770-99 Web: www.solar-fabrik.de</p> |  <p>ACHTUNG: Bei Installation, Inbetriebnahme oder Wartung die Installations- und Bedienungsanleitung befolgen. Steckkontakte niemals unter Laststrom trennen oder stecken. WARNING: For installation, starting up or servicing please refer to the installation and operation manual before proceeding. Do not connect or disconnect plug contacts while system is under current load.</p> | Solarstrommodul/Photovoltaic module | | Mono S5 Installer Series | |
| | | Modell / type | | MS5 HC V315 BF-DG | |
| Nennleistung / Max power (0/+3 %) | P max | 315 | WP | Tolerance of rated Pmpp | ±3 % |
| Spannung / Voltage at max power point | V MPP | 35,84 | V | Tolerance of rated Voc | ±2 % |
| Leerlaufspannung / Open circuit voltage | V OC | 42,42 | A | Tolerance of rated Isc | ±4 % |
| Strom / Current at max power point | I MPP | 8,79 | V |    | |
| Kurzschlussstrom / Short circuit current | I SC | 9,28 | A | | |
| Max. Systemspannung / Max. system voltage | | 1500 | v | | |
| Nennwerte bei STC / Electrical performance at STC: 1.000 W/m ² , 25°C, AM 1.5 | | | | | |

| | |
|--|---|
| Test item particulars..... : | |
| Accessories and detachable parts included in the evaluation | N/A |
| Mounting system used..... | with default mounting method |
| Other options included..... | N/A |
| 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) |
| Abbreviations used in the report: | |
| Pmax – Maximum power | HF – Humidity Freeze |
| Vmp – Maximum power voltage | DH – Damp Heat |
| Imp – Maximum power current | TC – Thermal Cycling |
| Isc – Short circuit current | α – Current temperature coefficient |
| Voc – Open circuit voltage | β – Voltage temperature coefficient |
| FF – Fill factor | δ – power temperature coefficient |
| STC – Standard Test Conditions (25°C, 1 000 W/m ²) | NMOT – Nominal Module Operating Temperature (20°C, 800 W/m ²) |
| MQT – Module Quality Tests | VFM _{rated} – Rated diode(s) forward voltage |
| VFM – Measured diode(s) forward voltage | NP – Nameplate |
| m_1 – the measurement uncertainty in % of laboratory for Pmax | m_2 – the measurement uncertainty in % of laboratory for Voc |
| m_3 – the measurement uncertainty in % of laboratory for Isc | t_1 – the manufacturer's rated lower production tolerance in % for Pmax |
| t_2 – the manufacturer's rated upper production tolerance in % for Voc | t_3 – the manufacturer's rated upper production tolerance in % for Isc |
| r – Pmax measurement reproducibility | |
| Testing Dates (YYYY-MM-DD) | |
| Date of first test item received | 2024-01-15 |
| Dates of tests (beginning/end)..... | 2024-01-15 / 2024-01-15 |

GENERAL REMARKS:

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

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

"(See appended table)" refers to a table appended to the report.

Additional disclaimer: This report shall not be reproduced, except in full, without the written approval of the Testing Laboratory. This report does not entitle to carry any test mark.

Manufacturer's Declaration per sub-clause 4.2.5 of IEC 60335-1:

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
 Not applicable

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

Name and address of factory (factories)

Solar Fabrik GmbH
Hermann-Niggemann-Straße 7, D-63846 Laufach,
Germany

| Product Electrical Ratings: | | | | |
|--|-------------------|--|--|--|
| Module type | MS5 HC V315 BF-DG | | | |
| Voc [V] /Tolerance | 42.42/±3% | | | |
| Isc [A] /Tolerance | 9.28 /±4% | | | |
| Pmp [W] /Tolerance | 315 /±2% | | | |
| Maximum system voltage [V] | 1500 | | | |
| Maximum Over-Current Protection Rating [A] | 30 | | | |
| Note: N/A | | | | |

GENERAL PRODUCT INFORMATION AND OTHER REMARKS:Modifications:

- Initial module design qualification
- Extension of module design qualification
- Original test report ref. No.:

Model differences and modification:

- | | |
|--|---|
| <input type="checkbox"/> Test programs for crystalline silicon PV modules | <input type="checkbox"/> Test programs for thin-film PV modules |
| <input type="checkbox"/> 4.1.1 Modification to frontsheet | <input type="checkbox"/> 4.2.1 Modification to frontsheet |
| <input type="checkbox"/> 4.1.2 Modification to encapsulation system | <input type="checkbox"/> 4.2.2 Modification to encapsulation system |
| <input type="checkbox"/> 4.1.3 Modification to cell technology | <input type="checkbox"/> 4.2.3 Modification to front contact (e. g. TCO) |
| <input type="checkbox"/> 4.1.4 Modification to cell and string interconnect material or technique | <input type="checkbox"/> 4.2.4 Modification to cell technology |
| <input type="checkbox"/> 4.1.5 Modification to backsheet | <input type="checkbox"/> 4.2.5 Modification to cell layout |
| <input type="checkbox"/> 4.1.6 Modification to electrical termination | <input type="checkbox"/> 4.2.6 Modification to back contact |
| <input type="checkbox"/> 4.1.7 Modification to bypass diode | <input type="checkbox"/> 4.2.7 Modification to edge deletion |
| <input type="checkbox"/> 4.1.8 Modification to electrical circuitry | <input type="checkbox"/> 4.2.8 Modification to interconnect material or technique |
| <input type="checkbox"/> 4.1.9 Modification to edge sealing | <input type="checkbox"/> 4.2.9 Modification to backsheet |
| <input type="checkbox"/> 4.1.10 Modification to frame and/or mounting structure | <input type="checkbox"/> 4.2.10 Modification to electrical termination |
| <input type="checkbox"/> 4.1.11 Change in PV module size | <input type="checkbox"/> 4.2.11 Modification to bypass diode |
| <input type="checkbox"/> 4.1.12 Higher or lower output power (by 10 % or more) with the identical design and size and using the identical cell process | <input type="checkbox"/> 4.2.12 Modification to edge sealing |
| <input type="checkbox"/> 4.1.13 Increase of over-current protection rating | <input type="checkbox"/> 4.2.13 Modification to frame and/or mounting structure |
| <input type="checkbox"/> 4.1.14 Increase of system voltage | <input type="checkbox"/> 4.2.14 Change in PV module size |
| <input type="checkbox"/> 4.1.15 Change in cell fixing tape | <input type="checkbox"/> 4.2.15 Higher or lower output power (by 10 % or more) with the identical design and size |
| | <input type="checkbox"/> 4.2.16 Increase of over-current protection rating |
| | <input type="checkbox"/> 4.2.17 Increase of system voltage |

Note: The clause references modifications extracted from IEC 62915

| Module group assignment: | | | | |
|---------------------------------|--|-------------------|-------------------|--------|
| Sample # | Sample Group ID | Type/model | Sample S/N | Remark |
| 1 | - | MS5 HC V315 BF-DG | M730W010103000001 | - |
| Supplementary information: N/A | | | | |
| Note (1) | Use the "General product information" field to give any information on model differences within a product type family covered by the test report and to describe the range of electrical and safety ratings, if the TRF covers a type family of modules. | | | |
| Note (3) | Use Annex 1 to list the used materials and components of the module (manufacturer/supplier and type reference). | | | |
| Note (4) | The module numbers/identifiers are set in accordance to IEC 62915 Photovoltaic (PV) modules – Retesting for type approval, design and safety qualification, Annex A3 | | | |

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| TABLE 01: MQT 01 ini: Initial Visual inspection | | P |
|--|---|---|
| Test Date [YYYY-MM-DD]..... : 2024-01-15 | | — |
| Sample # | Nature and position of initial findings – comments or attach photos | — |
| 1 | No visual defects found | P |
| Supplementary information: N/A | | |

| TABLE 02: MQT 02: Performance at STC | | | | | | | — |
|---|---------|---|---------|---------|----------|--------|---|
| Test Date [YYYY-MM-DD] : | | 2024-01-15 | | | | | — |
| Test method : | | <input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight | | | | | — |
| Irradiance [W/m ²] : | | 1000 | | | | | — |
| Module temperature [°C] : | | 25 | | | | | — |
| Sample # | Isc [A] | Voc [V] | Imp [A] | Vmp [V] | Pmax [W] | FF [%] | — |
| 1 | 9,235 | 42.553 | 8.75 | 35.887 | 314.011 | 79.91 | — |
| Supplementary information: N/A | | | | | | | |

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| TABLE 04: MQT 03 ini: Initial Insulation test | | | | P |
|--|-------------|----------------------|----|--------|
| Test Date [YYYY-MM-DD] | 2024-01-15 | | | — |
| Test Voltage applied [V] | 8000 / 1500 | | | — |
| Size of module [m ²] | 1.45 | | | — |
| Required Resistance [MΩ]..... | 27.5 | | | — |
| Sample # | Measured | Dielectric breakdown | | Result |
| | MΩ | Yes (description) | No | |
| 1 | >5000 | - | No | P |
| Supplementary information: N/A | | | | |

| TABLE 05: MQT 15 ini: Initial Wet leakage current test | | | | P |
|---|--------------------------|---------------|--|--------|
| Test Date [YYYY-MM-DD] | 2024-01-15 | | | — |
| Test Voltage applied [V] | 1500 | | | — |
| Solution temperature [°C]..... | 21.2 | | | — |
| Size of module [m ²] | 1.45 | | | — |
| Sample # | Required Resistance [MΩ] | Measured [MΩ] | | Result |
| 1 | 27.5 | >5000 | | P |
| Supplementary information: N/A | | | | |

| TABLE 21.30: MQT 17 - Hail impact test | | | | | | | P |
|---|------------|-------|-------|-------|-------|-------|---|
| Test Date [YYYY-MM-DD] | 2024-01-15 | | | | | | — |
| Sample # | 1 | | | | | | — |
| Ice ball size [mm]..... | 1 | 2 | 3 | 4 | 5 | 6 | — |
| | 49.38 | 49.07 | 49.28 | 49.55 | 49.46 | 49.48 | |
| | 7 | 8 | 9 | 10 | 11 | — | |
| Ice ball weight [g] | 1 | 2 | 3 | 4 | 5 | 6 | — |
| | 61.75 | 60.60 | 61.38 | 62.39 | 62.05 | 62.13 | |
| | 7 | 8 | 9 | 10 | 11 | — | |
| Ice ball velocity [m/s] | 1 | 2 | 3 | 4 | 5 | 6 | — |
| | 30.85 | 31.25 | 31.85 | 30.55 | 30.65 | 31.45 | |
| | 7 | 8 | 9 | 10 | 11 | — | |
| | 30.65 | 31.75 | 32.15 | 31.45 | 32.15 | — | |
| Supplementary information: (impact location descriptions) | | | | | | | |

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| TABLE 19.9: MQT 01 – Visual inspection after hail impact test | | P |
|--|---|---|
| Test Date [YYYY-MM-DD].....: | 2024-01-15 | — |
| Sample # | Nature and position of initial findings – comments or attach photos | — |
| 1 | No visual defects found | P |
| Supplementary information: N/A | | |

| TABLE 19.10: MQT 15 – Wet leakage current test after hail impact test | | P | |
|--|---------------|--------------------------|--------|
| Test Date [YYYY-MM-DD].....: | 2024-01-15 | — | |
| Test Voltage applied [V].....: | 1500 | — | |
| Solution temperature [°C].....: | 27.5 | — | |
| Size of module [m ²].....: | 1.45 | — | |
| Sample # | Measured [MΩ] | Required Resistance [MΩ] | Result |
| 1 | >5000 | 27.5 | P |
| Supplementary information: N/A | | | |

| TABLE 20.3: MQT 06.1: Final Performance at STC | | | | | | | | | P |
|--|---------|---|---------|---------|----------|--------|----------------------------|-----------------------|--------|
| Test Date [YYYY-MM-DD].....: | | 2024-01-15 | | | | | | | — |
| Test method.....: | | <input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight | | | | | | | — |
| Sample # | Isc [A] | Voc [V] | Imp [A] | Vmp [V] | Pmax [W] | FF [%] | Pmax [W] (Lab_GateNo.1) | Power Degradation [%] | Result |
| 1 | 9.07 | 42.077 | 8.735 | 35.063 | 306.275 | 80.25 | 314.011 | -2.46 | P |
| Supplementary information: Pmax [W] (Lab_GateNo.1) is calculated by considering the reproducibility r of control module. | | | | | | | | | |

| TABLE 21: MQT 03 fin: Final Insulation test | | | | | P |
|--|----------|-------------|----------------------|----|--------|
| Test Date [YYYY-MM-DD].....: | | 2024-01-15 | | | — |
| Test Voltage applied [V].....: | | 8000 / 1500 | | | — |
| Size of module [m ²].....: | | 1.45 | | | — |
| Sample # | Required | Measured | Dielectric breakdown | | Result |
| | MΩ | MΩ | Yes (description) | No | |
| 1 | 27.5 | >5000 | - | No | P |
| Supplementary information: N/A | | | | | |

| TABLE 22: MQT 15 fin: Final Wet leakage current test | | P |
|---|------------|---|
| Test Date [YYYY-MM-DD].....: | 2024-01-15 | — |
| Test Voltage applied [V].....: | 1500 | — |

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|--|---------------|------------|--------|
| Solution temperature [°C]..... : | | 20.6 | — |
| Size of module [m ²] : | | 1.45 | — |
| Required Resistance [MΩ]..... : | | 27.5 | — |
| Sample # | Measured [MΩ] | Limit [MΩ] | Result |
| 1 | >5000 | 27.5 | P |
| Supplementary information: N/A | | | |

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Annex 1: Photographs

Module type: MS5 HC V315 BF-DG

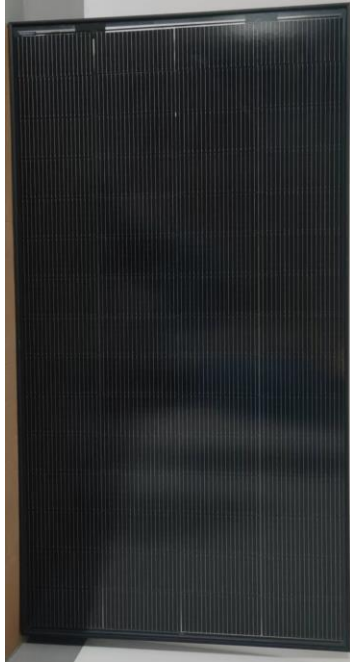


Fig. 1: front view of test sample



Fig. 2: rear view of test sample

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Annex 2: List of measurement equipment

| Clause | Measurement / testing | Testing / measuring equipment / material used, (Equipment ID) | Range used | Last Calibration date | Calibration due date |
|----------|-----------------------|---|---|-----------------------|----------------------|
| MQT 01 | Visual inspection | Band tape DZ-B-A1-0014 | 3.5m | 2021-09-09 | 2024-09-08 |
| MQT 03 | Insulation test | Insulation tester DZ-A-A1-0258 | Applied voltage:0~6kV Insulation resistance:1~50GΩ | 2023-07-05 | 2024-07-04 |
| | | Withstand voltage tester DZ-A-A1-0256 | 0~10kV | 2023-02-21 | 2024-02-20 |
| MQT 06.1 | performance at STC | Pulse solar simulator DZ-A-A2-0156 | 200~1200W/m ² | 2023-09-21 | 2024-09-20 |
| MQT 17 | Hail test | Hail tester DZ-A-A2-0165 | 25~75mm | 2023-08-02 | 2024-08-01 |
| | | Electrical balance DZ-A-A2-0019-1 | 300g | 2023-06-25 | 2024-06-24 |
| MQT 19.1 | Initial Stabilization | Steady state solar simulator DZ-A-A2-0024 | 800~1000 W/m ² | 2023-03-16 | 2024-03-15 |
| | | Pulse solar simulator DZ-A-A2-0156 | 200~1200 W/m ² | 2023-09-21 | 2024-09-20 |

Annex 3: Measurement uncertainty

The total measuring uncertainty of P_{mpp} is ≤ 2.1%

The total measuring uncertainty of I_{sc} is ≤ 2.0%

The total measuring uncertainty of V_{oc} is ≤ 0.8%