



|  |   |
|--|---|
| <b>TEST REPORT</b><br><b>IEC 61215-series:2016</b><br><b>MQT 17 Hail Test</b>  |   |
| Report Number .....  | 6066499.056.001   |
| Date of issue .....  | 2019-12-10  |
| Total number of pages .....  | 17  |
| Name of Testing Laboratory preparing the Report .....  | DEKRA Testing and Certification (Shanghai) Ltd.                           |
| Applicant's name .....   | Chint Solar (Zhejiang) Co., Ltd.  |
| Address .....  | 1335 Bin An Rd, Binjiang District, Hangzhou, Zhejiang, 310053, P.R. China |
| <b>Test specification:</b>   |   |
| Standard .....   | IEC 61215-2: 2016 MQT 17  |
| Test procedure .....   |   |
| Non-standard test method .....   | N/A   |
| Test Report Form No .....  | HI_A  |
| Test Report Form(s) Originator .....   | DEKRA Testing and Certification (Shanghai) Ltd.                           |
| Master TRF .....   | 2019-05-20  |
| <b>General disclaimer:</b>   |   |
| <p>The test results presented in this report relate only to the object tested.<br/> This report shall not be reproduced, except in full, without the written approval of the Testing Laboratory.<br/> This report does not entitle to carry any test mark.</p> |   |
|  |   |

|   |  |  |
|---|--|--|
| <b>Test item description</b> ..... :  | PV Module  |  |
| <b>Trade Mark</b> ..... :   | Chint/ Astronergy  |  |
| <b>Manufacturer</b> .....   | Chint Solar (Zhejiang) Co., Ltd.   |  |
| <b>Model/Type reference</b> .....   | Type with poly cells:<br>CHSM72P-HC-xxx (xxx=315-405 in step of 5, 144cells)<br>CHSM60P-HC-xxx (xxx=260-335 in step of 5, 120cells)<br>Type with mono cells:<br>CHSM72M-HC-xxx (xxx=330-455 in step of 5, 144cells)<br>CHSM60M-HC-xxx (xxx=275-380 in step of 5, 120cells) |  |
| <b>Ratings</b> .....  | Refer to Attachment 1 for more details.  |  |
| <b>Responsible Testing Laboratory (as applicable), testing procedure and testing location(s):</b> |  |  |
| <input type="checkbox"/>  | <b>CB Testing Laboratory:</b>  |  |
| <b>Testing location/ address</b> ..... :  |  |  |
| <b>Tested by (name, function, signature)</b> ..... :  |  |  |
| <b>Approved by (name, function, signature)</b> ... :  |  |  |
| <input checked="" type="checkbox"/>   | <b>Testing procedure: CTF Stage 1:</b>   | DEKRA Testing and Certification (Shanghai) Ltd.  |
| <b>Testing location/ address</b> ..... :  |  | 3F #250, Jiangchangsang Road, Building 16, Headquarter Economy Park Shibe Hi-Tech Park, Jing'an District, Shanghai, 200436, P.R. China |
| <b>Tested by (name, function, signature)</b> ..... :  |  | Lee Huang   |
| <b>Approved by (name, function, signature)</b> ... :  |  | Kevin Lu    |

| <b>List of Attachments (including a total number of pages in each attachment):</b> |                                     |
|--|-------------------------------------|
|  | attachment number / number of pages |
| Installation manual  |                                     |
| Drawings mechanical  |                                     |
| Circuit diagram  |                                     |
| Photographs  | Annex 1                             |
| Component datasheets / certificates  |                                     |
| Others:  |                                     |
| List of test equipment used  | Annex 2                             |
| IV curve   | Annex 3                             |
| EL image   | Annex 4                             |
| CDF  | Attachment 1                        |

| <b>Summary of testing:</b>   |   |
|--|---|
| <b>Tests performed (name of test and test clause):</b><br>Hail Test  | <b>Testing location:</b><br>Changzhou HuaYang Inspection and Testing Technology Co., Ltd.<br>No.8 Lanxiang Road, Wujin Economic Development Zone, Changzhou, Jiangsu, P.R.China |
| <b>Summary of compliance with National Differences (List of countries addressed):</b><br>N/A   |   |
| <input type="checkbox"/> The product fulfils the requirements of _____ (insert standard number and edition and delete the text in parenthesis, leave it blank or delete the whole sentence, if not applicable) |   |

**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.)



|  |   |
|--|---|
| Test item particulars..... :   |   |
| Accessories and detachable parts included in the evaluation .....        |   |
| Mounting system used..... :  |   |
| Other options included..... :  |   |
| 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  | $\alpha$ – Current temperature coefficient                                |
| Voc – Open circuit voltage   | $\beta$ – Voltage temperature coefficient                                 |
| FF – Fill factor   | $\delta$ – power temperature coefficient                                  |
| STC – Standard Test Conditions (25°C, 1 000 W/m <sup>2</sup> )           | NMOT – Nominal Module Operating Temperature (20°C, 800 W/m <sup>2</sup> ) |
| MQT – Module Quality Tests   | VFM <sub>rated</sub> – 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 .....                                   | 2019-12-06  |
| Dates of tests (beginning/end).....                                      | 2019-12-06/2019-12-09   |

|  |                |  |   |  |
|--|----------------|--|---|--|
| <b>GENERAL REMARKS:</b>  |                |  |   |  |
| <p>"(See Enclosure #)" refers to additional information appended to the report.<br/> "(See appended table)" refers to a table appended to the report.</p> <p>Throughout this report a <input type="checkbox"/> comma / <input checked="" type="checkbox"/> point is used as the decimal separator.</p> |                |  |   |  |
| Manufacturer's Declaration per sub-clause 4.2.5 of IEC61215-2:   |                |  |   |  |
| 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 ..... :                            |                |  | <input type="checkbox"/> Yes<br><input checked="" type="checkbox"/> Not applicable                            |  |
| When differences exist; they shall be identified in the General product information section.   |                |  |   |  |
| Name and address of factory (factories) .....  |                |  | Chint Solar (Zhejiang) Co., Ltd.<br>1335 Bin An Rd, Binjiang District, Hangzhou, Zhejiang, 310053, P.R. China |  |
| <b>PRODUCT ELECTRICAL RATINGS:</b>   |                |  |   |  |
| Module type  | CHSM72M-HC-440 |  |   |  |
| Voc [V] /Tolerance   | 48.50/±3%      |  |   |  |
| Vmp [V]  | 40.85          |  |   |  |
| I <sub>max</sub> [A <sub>dc</sub> ]  | 10.77          |  |   |  |
| I <sub>sc</sub> [A <sub>dc</sub> ] /Tolerance  | 11.24/±5%      |  |   |  |
| P <sub>mp</sub> [W] /Tolerance   | 440/±3%        |  |   |  |
| Maximum system voltage [V]   | 1500           |  |   |  |
| Maximum Over-Current Protection Rating [A]   | 20             |  |   |  |
| 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:

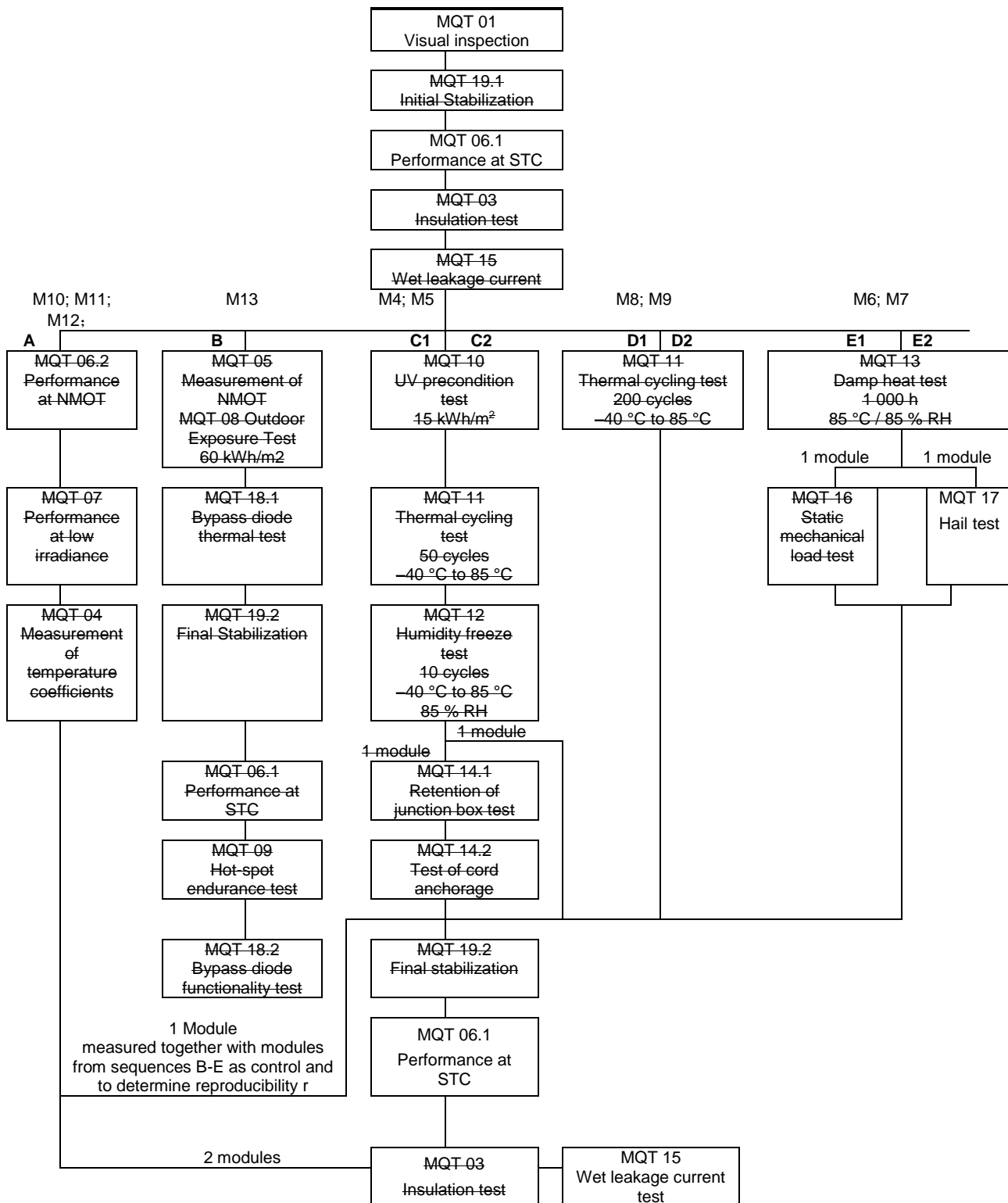
- |  |   |
|--|---|
| <input type="checkbox"/> Test programs for crystalline silicon PV modules  | <input type="checkbox"/> Test programs for thin-film PV modules   |
| <input type="checkbox"/> 4.1.1 Modification to frontsheet  | <input type="checkbox"/> 4.2.1 Modification to frontsheet   |
| <input 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

| <b>MODULE GROUP ASSIGNMENT:</b> |  |                  |        |
|---------------------------------|--|------------------|--------|
| Sample #                        | Type/model   | Sample S/N       | Remark |
| M6                              | CHSM72M-HC-440   | 6927337297000009 | HI     |
| 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   |                  |        |



|           |  |
|-----------|--|
| <b>11</b> | <p><b>TEST FLOW (if it is not a full test, strikethrough non-performed test)</b></p> <p>Note: Deviations from test sequence are possible but must be documented.</p> |
|-----------|--|



| IEC 61215-2 |                    |                 |         |
|-------------|--------------------|-----------------|---------|
| Clause      | Requirement + Test | Result - Remark | Verdict |

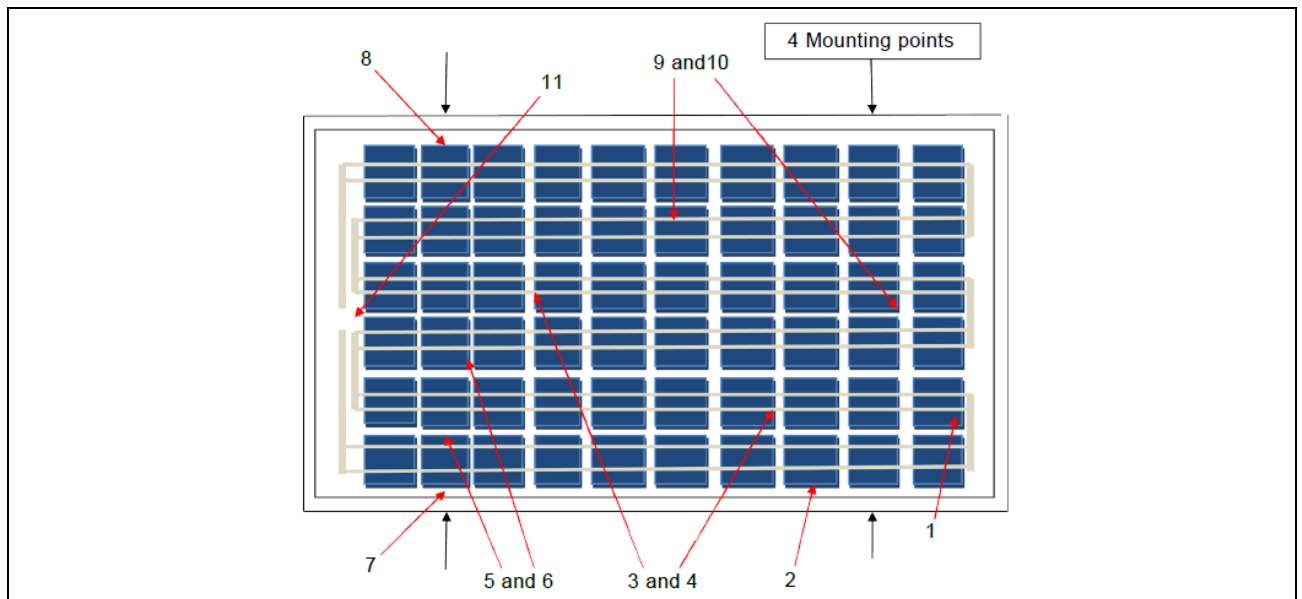
| TABLE 01: MQT 01 ini: Initial Visual inspection |   |            | P |
|---|---|------------|---|
| Test Date [YYYY-MM-DD]..... :                   |   | 2019-12-06 | — |
| Sample #  | Nature and position of initial findings – comments or attach photos |            | — |
| M6  | No major visual defects found                                       |            | P |
| Supplementary information:N/A                   |   |            |   |

| TABLE 02: MQT 19.1 ini: Initial stabilization                             |         |   |         |         |          |        |        |   |
|---|---------|---|---------|---------|----------|--------|--------|---|
| TABLE 02.1: MQT 06.1 ini: Performance at STC before initial stabilization |         |   |         |         |          |        |        |   |
| Test Date [YYYY-MM-DD]..... :   |         | 2019-12-06  |         |         |          |        |        | — |
| Test method..... :  |         | <input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight |         |         |          |        |        | — |
| Sample #  | Isc [A] | Voc [V]   | Imp [A] | Vmp [V] | Pmax [W] | FF [%] | Result |   |
| M6  | 11.289  | 48.812  | 10.787  | 40.670  | 438.707  | 79.62  | —      |   |
| Supplementary information:  |         |   |         |         |          |        |        |   |

| TABLE 19.8: MQT 17 - Hail impact test                     |       |            |       |       |       |       |    |   |
|---|-------|------------|-------|-------|-------|-------|----|---|
| Test Date [YYYY-MM-DD]..... :                             |       | 2019-12-09 |       |       |       |       |    | — |
| Sample #  |       | M6         |       |       |       |       |    | — |
| Ice ball size [mm] .....                                  | 1     | 2          | 3     | 4     | 5     | 6     | —  |   |
|   | 43.6  | 44.1       | 45.5  | 45.3  | 44.8  | 45.1  |    |   |
|   | 7     | 8          | 9     | 10    | 11    |       |    |   |
| Ice ball weight [g] .....                                 | 1     | 2          | 3     | 4     | 5     | 6     | —  |   |
|   | 44.98 | 43.75      | 45.15 | 44.62 | 44.56 | 45.35 |    |   |
|   | 7     | 8          | 9     | 10    | 11    |       |    |   |
| Ice ball velocity [m/s].....                              | 1     | 2          | 3     | 4     | 5     | 6     | —  |   |
|   | 30.5  | 30.2       | 31.1  | 29.9  | 30.0  | 30.8  |    |   |
|   | 7     | 8          | 9     | 10    | 11    |       |    |   |
| Number of impact locations .....                          | 11    |            |       |       |       |       | 11 |   |
| Supplementary information: (impact location descriptions) |       |            |       |       |       |       |    |   |

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| Clause | Requirement + Test | Result - Remark | Verdict |
|--------|--------------------|-----------------|---------|
|--------|--------------------|-----------------|---------|



| <b>TABLE 19.9: MQT 01 - Visual inspection after hail impact test</b> |   | P |
|--|---|---|
| Test Date [YYYY-MM-DD].....:   | 2019-12-09  | — |
| Sample #   | Nature and position of initial findings – comments or attach photos | — |
| M6   | No major visual defects found                                       | P |
| Supplementary information:   |   |   |

| <b>TABLE 19.10: MQT 15 - Wet leakage current test after hail impact test</b> |               |                          |        |
|--|---------------|--------------------------|--------|
| Test Date [YYYY-MM-DD].....:   | 2019-12-09    | —                        |        |
| Test Voltage applied [V].....:   | 1500          | —                        |        |
| Solution temperature [°C].....:  | 21.5          | —                        |        |
| Size of module [m²].....:  | 2.20          | —                        |        |
| Sample #   | Measured [MΩ] | Required Resistance [MΩ] | Result |
| M6   | >2000         | 18.2                     | P      |
| Supplementary information: N/A   |               |                          |        |

| IEC 61215-2 |                    |                 |         |
|-------------|--------------------|-----------------|---------|
| Clause      | Requirement + Test | Result - Remark | Verdict |

| TABLE 20.3: MQT 06.1: Final Performance at STC |         |         |         |   |          |        |                       |        |
|--|---------|---------|---------|---|----------|--------|-----------------------|--------|
| Test Date [YYYY-MM-DD]..... :                  |         |         |         | 2019-12-09  |          |        |                       | —      |
| Test method.....                               |         |         |         | <input checked="" type="checkbox"/> Simulator <input type="checkbox"/> Natural sunlight |          |        |                       | —      |
| Sample #                                       | Isc [A] | Voc [V] | Imp [A] | Vmp [V]   | Pmax [W] | FF [%] | Power Degradation [%] | Result |
| M6   | 11.220  | 48.610  | 10.755  | 40.441  | 434.951  | 79.75  | -0.86                 | —      |
| Supplementary information:                     |         |         |         |   |          |        |                       |        |

**Annex 1: Photographs of test sample**

**Module type: CHSM72M-HC-440**



Fig. 1: front view of test sample



Fig. 2: rear view of test sample



Fig. 3: view of type label



Fig. 4: view of serial number



*Fig. 5: view of junction box*



*Fig. 6: view of solar cell*



*Fig. 7: view of cables*

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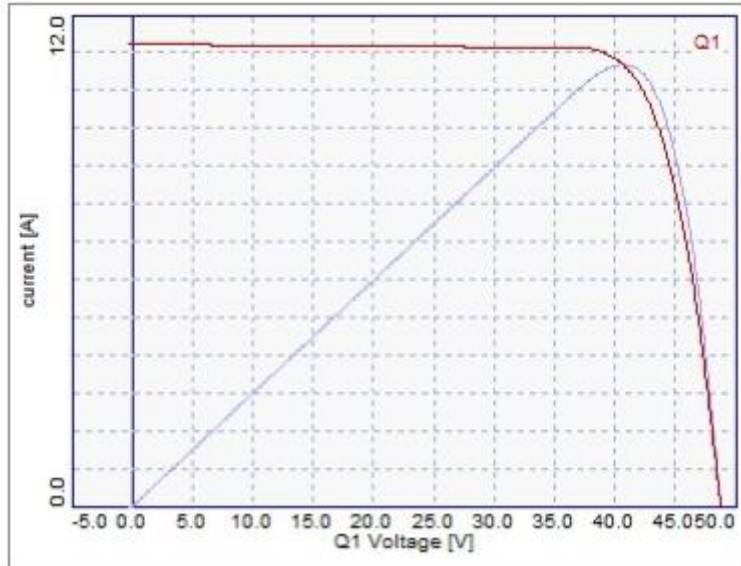
## Annex 2: List of measurement equipment

| Clause | Measurement / testing       | Testing / measuring equipment / material used, (Equipment ID) | Range used                | Last Calibration date | Calibration due date |
|--------|-----------------------------|---|---------------------------|-----------------------|----------------------|
| 1      | Visual inspection           | Visual inspection table<br>HYJC-YS-033                        | /                         | 2019.09.15            | 2020.09.14           |
|        |                             | Illumination photometer<br>HYJC-YS-070                        | 0~40.0klux                | 2019.08.15            | 2020.08.14           |
| 2      | Performance at STC and NMOT | Module pulse simulator<br>HYJC-YS-021                         | AAA                       | 2019.12.04            | 2020.12.03           |
| 3      | Hail test                   | Hail tester<br>HYJC-YS-036                                    | 25mm、<br>35mm、45mm        | 2018.12.20            | 2019.12.19           |
| 4      | Wet leakage current test    | Programmable control voltage insulation meter<br>HYJC-YS-155  | DC:0~8kV                  | 2019.09.15            | 2020.09.14           |
|        |                             | Conductance meter<br>HYJC-YS-076                              | 0.000US/cm~<br>200.0ms/cm | 2019.07.09            | 2020.07.08           |

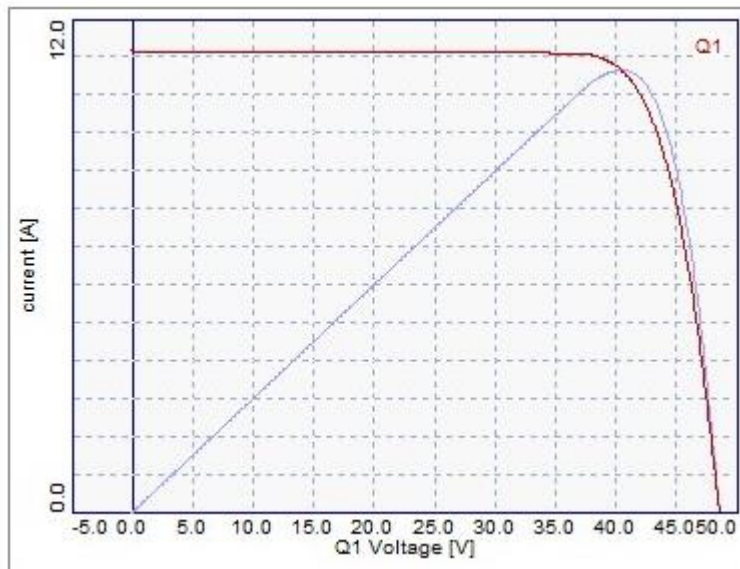
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**Annex 3: IV curve for STC and Low irradiance measurement**

**IV-curves for Module type: CHSM72M-HC-440**



*Sample no 6927337297000009  
Initial*



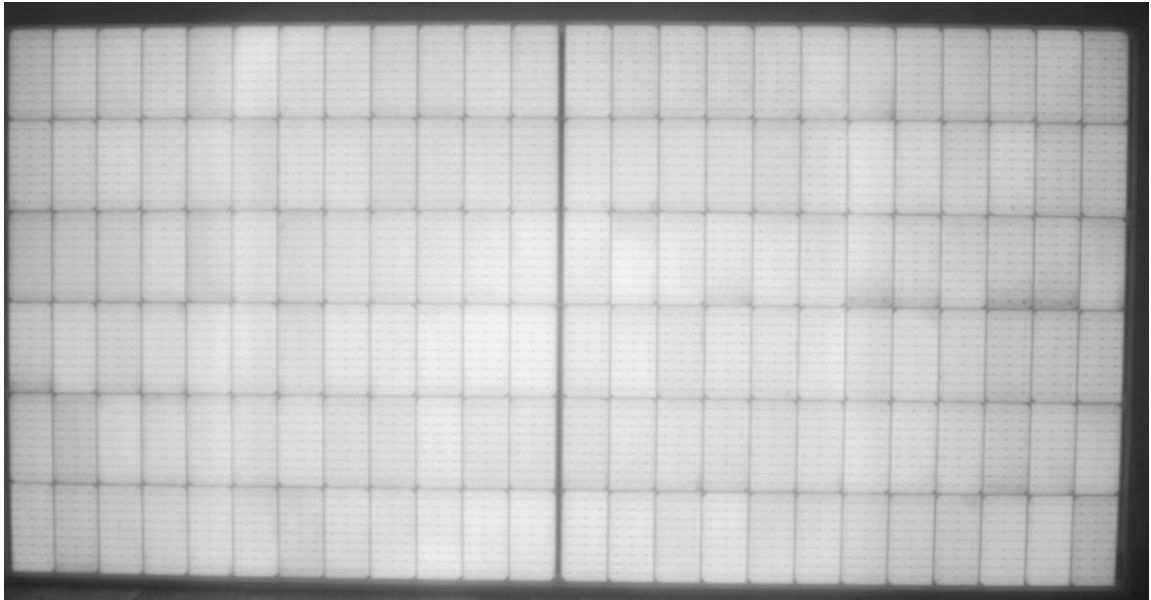
*Sample no 6927337297000009  
Final*



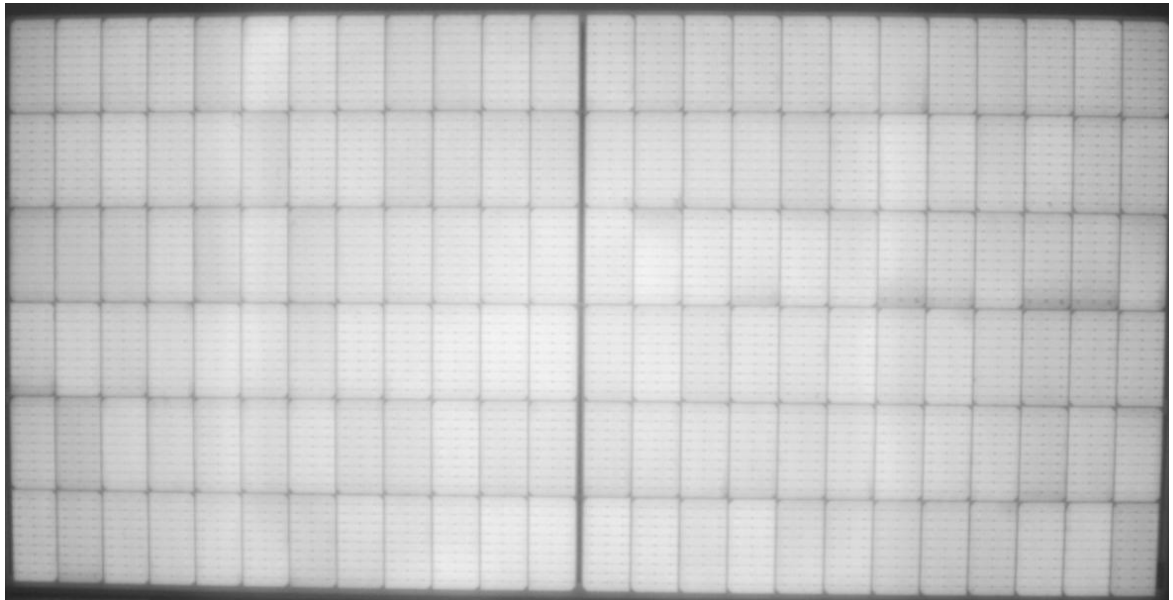
IEC 61215-2

**Annex 4: EL image**

**EL image for Module type: CHSM72M-HC-440**




*Sample no 6927337297000009  
Initial*



*Sample no 6927337297000009  
Final*

**Attachment 1**


**CDF of PV Modules**

|   |                 |   |
|---|-----------------|---|
| <b>Produkte</b><br><i>Products</i>                                  |                 |  |
| <b>Our Reference</b>  | 6066499.056.001 | <b>Appendix No. 1</b>   |
| <b>Constructional Data Form (CDF) for Photovoltaic (PV) Modules</b> |                 | Page 1 of 8   |

|   |  |
|---|--|
| License Holder .....                      | Chint Solar (Zhejiang) Co., Ltd<br>(full address) 1335 Bin An Rd, Binjiang District, Hangzhou, 310053, Zhejiang, China   |
| Production Factory 1...<br>(full address) | Chint New Energy (Haining) Co., Ltd<br>No.1 Jisheng Road, Jianshan New District, Haining City, Zhejiang Province, 314415 P. R. China                             |
| Production Factory 2...<br>(full address) | Chint Solar (Zhejiang) Co., Ltd.<br>1335 Bin An Rd, Binjiang District, Hangzhou, 310053, Zhejiang, China   |
| Production Factory 3...<br>(full address) | Ningbo Qixin Solar Electrical Appliance Co., Ltd.<br>No.37, Jingang Road, Binhai Industrial Park, Xiangshan, Ningbo City, Zhejiang Province, 315700, P. R. China |
| Production Factory 4...<br>(full address) | ECONESS ENERGY CO., LTD.<br>No. 58 Haida Road, Huashi Town, 214421 Jianguyin, Jiangsu, P. R. China.  |
| Type of Product.....                      | Photovoltaic (PV) Modules  |
| Trademark .....                           |  <b>ASTRONERGY</b> ASTRONERGY/Chint   |

|   |  |
|---|--|
| Shanghai, 2019-12-23  | <u>Hangzhou</u> 2019-12-23<br>(City) (Date)  |
|  | <br>(Stamp and/or signature of applicant) |
| TÜV Rheinland Group<br>QMF-RT-39008SHG  | Version: 1.1 / 2010-03-11/ approved by: U.Therhaag   |

## Attachment 1

|   |                 |   |
|---|-----------------|---|
| <b>Produkte</b><br>Products   |                 |  |
| <b>Our Reference</b>  | 6066499.056.001 | <b>Appendix No. 1</b>   |
| <b>Constructional Data Form (CDF) for Photovoltaic (PV) Modules</b> |                 | Page 2 of 8   |

| Module family A: ½ cut 6" Poly c-Si cell type |   |  |
|---|---|--|
| Type Name or Model No.....                    | CHSM72P-HC-xxx<br>(6" poly 144cells)  | CHSM60P-HC-xxx<br>(6" poly 120cells)   |
| Maximum System Voltage [VDC]                  | 1500  | 1500   |
| Rated Maximum Power [W].....                  | 315, 320, 325, 330, 335, 340, 345, 350,<br>355,360,365,370,375,380,385,390,395,400,405  | 260, 265, 270, 275, 280, 285, 290,<br>295,300,305,310,315,320,325,330,335  |
| Rated Short Circuit Current [A].....          | 8.98, 9.08, 9.18, 9.28, 9.37, 9.47, 9.57, 9.65,<br>9.74,9.76,9.81,9.87,9.93,10.00,10.08,10.16,10.23,10.28<br>,10.36   | 8.91, 9.00, 9.09, 9.18, 9.27, 9.34, 9.43,<br>9.52,10.01,10.05,10.08,10.12,10.17,10.21,10.23,<br>10.25                                    |
| Rated Open Circuit Voltage [V].....           | 45.23, 45.53, 45.74, 45.86, 46.04, 46.25,<br>46.45,47.15,47.36,47.63,47.87,48.15,48.37,48.55,48.66<br>,48.78,48.87  | 37.45, 37.69, 37.93, 38.17, 38.41, 38.65, 38.90,<br>39.14,38.52,38.75,39.01,39.27,39.52,39.78,40.07,40.37                                |
| Tolerance of Rating Pmax / Isc / Voc [%]..... | 3 / 5 / 3   | 3 / 5 / 3  |
| Over-current protection rating[A]:            | 15/20   | 15/20  |
| Classification (IEC 61730).....               | Class II  | Class II   |
| Fire rating .....                             | Class C   | Class C  |
| Dimensions (l x w x h) [mm] .....             | 1986x992x40(45),<br>2000 x 992 x40(45),<br>2018 x1002 x40(45)   | 1666x992x35(40),<br>1675 x 992 x35(40) ,<br>1692 x1002 x35(40)   |
| Module area [m²].....                         | 1.97/1.98/2.02  | 1.65/1.66/1.70   |
| Min- creepage distance [mm] .....             | 11  | 11   |
| Number of solar cells                         | 144   | 120  |
| Cells per bypass diode                        | 48  | 40   |
| Serial/parallel connection of cells           | SP  | SP   |
| Module family B: ½ cut 6" Mono c-Si cell type |   |  |
| Type Name or Model No.....                    | CHSM72M-HC-xxx<br>(6" mono 144 cells)   | CHSM60M-HC-xxx<br>(6" mono 120 cells)  |
| Maximum System Voltage [VDC]                  | 1500  | 1500   |
| Rated Maximum Power [W].....                  | 330, 335, 340, 345, 350, 355, 360, 365, 370, 375,<br>380,385,390,395,400,405,410,415,420,425,430,435,440<br>,445,450,455  | 275, 280, 285, 290, 295, 300, 305, 310,<br>315,320,325,330,335,340,345,350,355,360,365,370,375<br>,380                                   |
| Rated Short Circuit Current [A].....          | 9.30, 9.36, 9.41, 9.46, 9.52, 9.57, 9.64, 9.71, 9.80, 9.88,<br>9.95,10.02,10.10,10.17,10.24,10.31,10.38,10.45,10.95,1<br>1.03,11.10,11.16,11.24,11.30,11.37,11.44 | 9.28, 9.36, 9.43, 9.51, 9.59, 9.64, 9.73, 9.82,<br>9.90,9.98,10.06,10.14,10.22,10.30,10.38,11.08,11.15,11<br>.21,11.29,11.35,11.42,11.49 |

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|  |  |  |
|--|--|--|
| Rated Open Circuit Voltage [V].....:           | 45.30, 45.61, 45.91, 46.21, 46.52, 46.83, 47.13, 47.44, 47.64, 47.89, 48.18, 48.47, 48.70, 48.98, 49.25, 49.53, 49.80, 50.06, 47.48, 47.73, 47.99, 48.25, 48.50, 48.80, 49.05, 49.35 | 38.18, 38.50, 38.79, 39.09, 39.39, 39.75, 39.84, 40.11, 40.42, 40.72, 41.03, 41.32, 41.61, 41.88, 42.16, 39.49, 39.80, 40.14, 40.41, 40.75, 41.05, 41.34 |
| Tolerance of Rating Pmax / Isc / Voc [%].....: | 3 / 5 / 3  | 3 / 5 / 3  |
| Over-current protection rating[A]:             | 15/20  | 15/20  |
| Classification (IEC 61730).....:               | Class II   | Class II   |
| Fire rating.....:                              | Class C  | Class C  |
| Dimensions (l x w x h) [mm].....:              | 1986x992x40(45),<br>2000 x 992 x40(45),<br>2018 x1002 x40(45)<br>2108 x1046 x40(45)<br>2108 x1048 x40(45)  | 1666x992x35(40),<br>1675 x 992 x35(40) ,<br>1692 x1002 x35(40)<br>1768 x1046 x35(40)<br>1765 x1048 x35(40)   |
| Module area [m²].....:                         | 1.97/1.98/2.02/2.20  | 1.65/1.66/1.70/1.85  |
| Min- creepage distance [mm].....:              | 11   | 11   |
| Number of solar cells                          | 144  | 120  |
| Cells per bypass diode                         | 48   | 40   |
| Serial/parallel connection of cells            | SP   | SP   |

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| Object      | Manufacturer / trademark   | Type / model   | Technical data / ratings  | Standard (if applicable) | Certificates (if applicable) |
|-------------|--|--|---|--------------------------|------------------------------|
| Front cover | Xinyi PV Products (Anhui) Holdings Ltd.                                      | External AR Coating Glass  | Thickness = 3.2mm/4.0mm   | —                        | —                            |
| Rear cover  | SuZhou First PV Material Co., Ltd.   | BEC-301D<br>Color: White   | Thickness=0.300±0.02mm<br>(Fluororesin/PET/ Fluororesin)<br>TI=124°C, FSI=47.87<br>System voltage=1500V   | 2 PfG<br>1793/04.14      | R 50302160                   |
| EVA         | Hangzhou First Applied Material Co., Ltd.                                    | F406PS<br>(between front cover and cells)                                  | Thickness=0.55±0.05mm<br>Unit weight: 480g/m <sup>2</sup><br>Thickness= 0.50mm ± 0.05 mm<br>Unit weight: 410g/m <sup>2</sup><br>Thickness=0.60 mm ± 0.05 mm<br>Unit weight: 520g/m <sup>2</sup> | —                        | —                            |
|             |  | F806PS<br>(between cell and rear cover)                                    | Thickness=0.45±0.05mm;<br>Unit weight: 370g/m <sup>2</sup>  | —                        | —                            |
|             |  |  | Thickness=0.40 ±0.05mm<br>Unit weight: 350g/m <sup>2</sup>  | —                        | —                            |
|             |  | F806W<br>(between cell and rear cover)                                     | Thickness=0.50 ± 0.05 mm<br>Thickness=0.45 ± 0.05 mm<br>Thickness=0.55 mm ± 0.05 mm<br>Thickness=0.60 mm ± 0.05 mm  | —                        | —                            |
| Solar cell  | Chint Solar (Zhejiang) Co., Ltd.<br>M. L. T. Solar Energy Products CO., LTD. | 1.1 CHSC-156P5SB-P<br>(dotted 5 busbars, poly PERC cell)                   | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|             |  | 1.2 CHSC-156P5SB-N<br>(dotted 5 busbars, poly cell)                        | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|             |  | 1.3 CHSC-156M5SB-N<br>(dotted 5 busbars, mono cell)                        | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|             |  | 1.4 CHSC-156M5SB-P<br>(dotted 5 busbars, mono PERC cell, available for SE) | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|             |  | 1.5 CHSC-156P5SB-B<br>(dotted 5 busbars, poly cell)                        | 156.75mm x78.375mm x<br>200µm±(10µm)  | —                        | —                            |

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| Object   | Manufacturer / trademark   | Type / model  | Technical data / ratings            | Standard (if applicable) | Certificates (if applicable) |
|--|--|---|-------------------------------------|--------------------------|------------------------------|
| Solar cell   | Chint Solar (Zhejiang) Co., Ltd.<br>M. L. T. Solar Energy Products CO., LTD. | 1.6<br>CHSC-156P5SB-BP<br>(dotted 5 busbars, PERC poly cell)                    | 156.75mm x78.375mm x<br>200µm±(10%) | —                        | —                            |
|  |  | 1.7<br>CHSC-156MMSB-P<br>(dotted 12 busbars, PERC Mono cell, available for SE)  | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.10<br>CHSC-156PMSB-P<br>(dotted 12 busbars, PERC Poly cell)                   | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.11<br>CHSC-158M5SB-P<br>(dotted 5 busbars, PERC Mono cell, available for SE)  | 158.75mm x79.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.12<br>CHSC-158M5SB-N<br>(dotted 5 busbars, Mono cell)                         | 158.75mm x79.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.13<br>CHSC-158MMSB-P<br>(dotted 12 busbars, PERC Mono cell, available for SE) | 158.75mm x79.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.14<br>CHSC-158MMSB-N<br>(dotted 12 busbars, Mono cell)                        | 158.75mm x79.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.15<br>CHSC-156MMSB-N<br>(dotted 12 busbars, Mono cell)                        | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.16<br>CHSC-156PMSB-N<br>(dotted 12 busbars, Poly cell)                        | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
|  |  | 1.17<br>CHSC-156M9SB-P<br>(dotted 9 busbars, PERC Mono cell, available for SE)  | 156.75mm x78.375mm x<br>200µm±20µm  | —                        | —                            |
| 1.18<br>CHSC-158M9SB-P<br>(dotted 9 busbars, PERC Mono cell, available for SE) | 158.75mm x79.375mm x<br>200µm±20µm   | —   | —                                   |                          |                              |

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| Object            | Manufacturer / trademark   | Type / model   | Technical data / ratings  | Standard (if applicable)               | Certificates (if applicable) |   |
|-------------------|--|--|---|--|------------------------------|---|
| Solar cell        | Chint Solar (Zhejiang) Co., Ltd.<br>M. L. T. Solar Energy Products CO., LTD. | 1.19   | CHSC-156P9SB-P<br>(dotted 9 busbars, PERC Poly cell)  | 157mm x78.5mm x<br>200µm±20µm          | —                            | — |
|                   |  | 1.20   | CHSC-158P9SB-P<br>(dotted 9 busbars, PERC Poly cell)  | 158.75mm x79.375mm x<br>200µm±20µm     | —                            | — |
|                   |  | 1.21   | CHSC-156M9SB-PT<br>(dotted 9 busbars, mono Si cell, available for SE)                               | 156.75mm x78.375mm x<br>200µm (±20 µm) | —                            | — |
|                   |  | 1.22   | CHSC-158M9SB-PT<br>(dotted 9 busbars, PERC Mono Si cell, available for SE)                          | 158.75mm x79.375mm x<br>200µm±20µm     | —                            | — |
|                   |  | 1.23   | CHSC-166M9SB-PT<br>(dotted 9 busbars, PERC Mono Si cell, available for SE)                          | 166 mm x 83mm x<br>200µm±20µm          | —                            | — |
| Cell connectors   | Xi'an Telison New Materials co., Ltd.  | Sn60Pb40   | Φ=0.35mm/0.4mm  | —                                      | —                            |   |
| String connectors | Hangzhou Xiaoshan Jianghai Industrial Co., LTD.                              | Sn60Pb40   | L(mm) X T(mm) :<br>5.0 x 0.35<br>8.0x0.35   | —                                      | —                            |   |
| Frame parts       | Hangzhou Xiaoshan Jianghai Industrial co., LTD.                              | Anodized Aluminium Alloy<br>6063-T5<br>Oxide layer thickness: AA15<br>Silver and Black | H(mm) x W(mm): 40x32<br>Drawing No. Q/ZTIS J0101-0362 &<br>Q/ZTIS J0101-0452<br>Assembled by clamps | —                                      | —                            |   |
|                   |  |  | H(mm) x W(mm): 35x35<br>Drawing No. Q/ZTIS J0101-0446 &<br>Q/ZTIS J0101-0355<br>Assembled by clamps |  |                              |   |
|                   |  |  | H(mm) x W(mm): 45x32  |  |                              |   |
| Adhesive (frame)  | Hangzhou Zhijiang Silicone Chemical Co., Ltd                                 | JS-606   | Silicon   | —                                      | —                            |   |
| Fluxing agent     | Singapore Asahi Chemical & Solder Industries Pte Ltd.                        | SF56<br>SF56 (MBB)   | —   | —                                      | —                            |   |
|                   | Asahi solder technology (wuxi) company limited                               |  |   |  |                              |   |
|                   | Asahi solder technology (wuxi) company limited                               |  |   |  |                              |   |

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| Object                 | Manufacturer / trademark          | Type / model | Technical data / ratings   | Standard (if applicable) | Certificates (if applicable) |
|------------------------|-----------------------------------|--------------|--|--------------------------|------------------------------|
| Fixing tape            | 3M                                | UV-1         | Thickness= 0.056-0.066mm   | —                        | —                            |
| Insulation tape        | SuZhou First PV Material Co., Ltd | BEC-201      | Thickness:445µm  | —                        | —                            |
| Light redirecting film | 3M                                | T80-X        | Thickness = 0.115mm<br>combine with EVA:<br>F406PS+F806W and fluxing agent:<br>SF56) | —                        | —                            |

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| Object  | Manufacturer / trademark                               | Type / model   | Technical data / ratings                         | Standard                        | Certificates |
|---|--|--|--|---------------------------------|--------------|
| Junction Box Combination<br>With rear cover BEC-301D with adhesive 1, 2 and 3 |  |  |  |                                 |              |
| Junction box  | Zhejiang Chuang Yuan Photovoltaic Technology Co., Ltd. | PV-CY1802  | Max. Voltage = 1500V<br>Max. Rated Current = 18A | IEC 62790:2014<br>EN 62790:2015 | R 50437008   |
| Cable   | Zhejiang Chuang Yuan Photovoltaic Technology Co., Ltd. | H1Z2Z2-K 1x4.0 mm2   | Max. Voltage = 1800V<br>Max. Current = 40A       | EN 50618:2014                   | R 50337137   |
| Connectors 1  | Zhejiang Chuang Yuan Photovoltaic Technology Co., Ltd. | PV-CY03L   | Max. Voltage = 1500V<br>Max. Current = 30A       | IEC 62852:2014                  | R 50378729   |
| Connectors 2  | Staubli Electrical Connectors AG                       | PV-KST4-EVO2/XY-UR (male);<br>PV-KBT4-EVO2/XY-UR (female); | Max. Voltage = 1500V<br>Max. Current = 45A       | IEC 62852:2014                  | R 60127169   |
| Bypass diode  | Yangzhou Yangjie Electronic Technology Co., Ltd.       | GF3045MG (3)   | Tj max =200                                      | —                               | —            |
| Adhesive 1  | Tonsan Adhesives Co., Ltd.                             | 1527<br>Color: White and Black                             | —  | —                               | —            |
| Adhesive 2  | Shanghai Huitian New Chemical Material Co., Ltd.       | 906Z<br>(White and Black)                                  | —  | —                               | —            |
| Adhesive 3  | Hangzhou Zhijiang Silicone Chemical Co., Ltd.          | JS-606<br>Color: White and Black                           | —  | —                               | —            |
| Potting material 1  | Shanghai Huitian New Chemical Material Co., Ltd.       | 5299W-S<br>Color: White and Black                          | —  | —                               | —            |

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