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|---|--|---|----------------------------------|------------------------------------|---|------------------|----------------------|------------------|------------------------------------|------------------------------------|--------------|
| Annex to Solar Keymark Certificate | | Licence Number | 011-7S3043 F | | | | | | | | |
| | | Date issued | 2021-08-23 | | | | | | | | |
| | | Issued by | DIN CERTCO | | | | | | | | |
| Licence holder | Jiangsu Sunrain Solar Energy Co., Ltd | Country | P.R.China | | | | | | | | |
| Brand (optional) | Sunrain | Web | http://www.sunrain.com | | | | | | | | |
| Street, Number | Ninghai Industrial Zone | E-mail | certification@sunrain.com | | | | | | | | |
| Postcode, City | 222000/Lianyungang City, Jiangsu Province | Tel | +86 518-85959690 | | | | | | | | |
| Collector Type | | Flat plate collector | | | | | | | | | |
| Collector name | Gross area (A_G) m ² | Gross length mm | Gross width mm | Gross height mm | Power output per collector G _b = 850 W/m ² , G _d = 150 W/m ² & u = 1.3 m/s $\vartheta_m - \vartheta_a$ | | | | | | |
| | | | | | 0 K W | 10 K W | 30 K W | 50 K W | 70 K W | 82 K W | |
| FPC1200D | 2.00 | 2,000 | 1,000 | 80 | 1,413 | 1,319 | 1,104 | 852 | 564 | 375 | |
| Power output per m² gross area | | | | | 706 | 660 | 552 | 426 | 282 | 188 | |
| Performance parameters test method | | Steady state - outdoor | | | | | | | | | |
| Performance parameters (related to A_G) | | η_0, b | a1 | a2 | a3 | a4 | a5 | a6 | a7 | a8 | Kd |
| Units | | - | W/(m ² K) | W/(m ² K ²) | J/(m ³ K) | - | J/(m ² K) | s/m | W/(m ² K ⁴) | W/(m ² K ⁴) | - |
| Test results | | 0.723 | 4.46 | 0.023 | 0.000 | 0.000 | 5,150 | 0.000 | 0.000 | 0.000 | 0.847 |
| Incidence angle modifier test method | | Steady state - outdoor | | | | | | | | | |
| Incidence angle modifier | | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
| Transversal | | K _{θT, coll} | 1.00 | 0.99 | 0.97 | 0.94 | 0.88 | 0.78 | 0.63 | 0.39 | 0.00 |
| Longitudinal | | K _{θL, coll} | 1.00 | 0.99 | 0.97 | 0.94 | 0.88 | 0.78 | 0.63 | 0.39 | 0.00 |
| Heat transfer medium for testing | | Water | | | | | | | | | |
| Flow rate for testing (per gross area, A_G) | | dm/dt | 0.020 | | kg/(sm²) | | | | | | |
| Maximum temperature difference during thermal performance test | | ($\vartheta_m - \vartheta_a$) _{max} | 51.84 | | K | | | | | | |
| Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C) | | ϑ_{stg} | 160.5 | | °C | | | | | | |
| Maximum operating temperature | | $\vartheta_{max, op}$ | 120 | | °C | | | | | | |
| Maximum operating pressure | | p _{max, op} | 1200 | | kPa | | | | | | |
| Testing laboratory | Intertek Testing Services Shenzhen Ltd. Guangzhou | http://www.intertek.com | | | | | | | | | |
| Test report(s) | 130617017GZU-002 | Dated | 2020-08-12 | | | | | | | | |
| Comments of testing laboratory | | Datasheet version: 6.1, 2019-09-26 | | | | | | | | | |
| Tests were performed based on EN 12975-2:2006. | |  | | | | | | | | | |
| DIN CERTCO ● Alboinstraße 56 ● D-12103 Berlin Tel: +49 30 7562-1131 ● Fax: +49 30 7562-1141 ● E-Mail: info@dincertco.de ● www.dincertco.de | | | | | | | | | | | |

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| | Issued | 2021-08-23 |

| Annual collector output in kWh/collector at mean fluid temperature ϑ_m | | | | | | | | | | | | | |
|--|-------------------------------------|---|-------|------|-------------------------|------|------|-------------------------|------|------|-------------------------|------|------|
| Collector name | Standard Locations ϑ_m | Athens | | | Davos | | | Stockholm | | | Würzburg | | |
| | | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C |
| FPC1200D | | 2,134 | 1,307 | 657 | 1,508 | 869 | 388 | 1,130 | 618 | 276 | 1,233 | 661 | 293 |
| Annual output per m ² gross area | | 1,067 | 654 | 329 | 754 | 435 | 194 | 565 | 309 | 138 | 616 | 331 | 147 |
| Annual efficiency, η_a | | 60% | 37% | 19% | 46% | 27% | 12% | 48% | 26% | 12% | 50% | 27% | 12% |
| Fixed or tracking collector | | Fixed (slope = latitude - 15°; rounded to nearest 5°) | | | | | | | | | | | |
| Annual irradiation on collector plane | | 1765 kWh/m ² | | | 1630 kWh/m ² | | | 1166 kWh/m ² | | | 1244 kWh/m ² | | |
| Mean annual ambient air temperature | | 18.5°C | | | 3.2°C | | | 7.5°C | | | 9.0°C | | |
| Collector orientation or tracking mode | | South, 25° | | | South, 30° | | | South, 45° | | | South, 35° | | |

The collector is operated at constant temperature ϑ_m (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.1 (September 2019). A detailed description of the calculations is available at <http://www.estif.org/solarkeymarknew/>

| Additional Information | | | |
|---|-------|----------------------|---------|
| Collector heat transfer medium | Water | | |
| The collector is deemed to be suitable for roof integration | Yes | | |
| The collector was tested successfully under the following conditions: | | | |
| Climate class (A+, A, B or C) | | | C |
| G (W/m ²) > | 800 | ϑ_a (°C) > | 10 |
| Maximum tested positive load | | | 5900 Pa |
| Maximum tested negative load | | | 3000 Pa |
| Hail resistance using steel ball (maximum drop height) | | | 2 m |

| Additional collector attribute(s) | | | |
|--|---|--|--|
| <input type="checkbox"/> Using external power source(s) for normal operation | <input type="checkbox"/> Active or passive measure(s) for self-protection | | |
| <input type="checkbox"/> Co-generating thermal and electrical power | <input type="checkbox"/> Façade collector(s) | | |

| Energy Labelling Information | | Additional Informative Technical Data | |
|------------------------------|---|---------------------------------------|--|
| | Reference Area, A_{sol} (m ²) | Hydraulic Designation Code | Aperture Area, A_a (m ²) |
| FPC1200D | 2.00 | 9-VH-1234S-A:8,1878-C:22,1061-D | 1.85 |
| | | | |
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| Data required for CDR (EU) No 811/2013 - Reference Area A_{sol} | | Data required for CDR (EU) No 812/2013 - Reference Area A_{sol} | |
|--|-----|---|--|
| Collector efficiency (η_{col}) | 49% | Zero-loss efficiency (η_0) | 0.71 |
| Remark: Collector efficiency (η_{col}) is defined in CDR (EU) No 811/2013 as collector efficiency of the solar collector at a temperature difference between the solar collector and the surrounding air of 40 K and a global solar irradiance of 1000 W/m ² , expressed in % and rounded to the nearest integer. Deviating from the regulation η_{col} is based on reference area (A_{sol}) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017. | | First-order coefficient (a_1) | 4.46 W/(m ² K) |
| | | Second-order coefficient (a_2) | 0.023 W/(m ² K ²) |
| | | Incidence angle modifier IAM (50°) | 0.88 |

Remark: The data given in this section are related to collector reference area (A_{sol}) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806. Consistent data sets for either aperture or gross area can be used in calculations like in the regulation 811 and 812 and simulation programs.