TÜVRheinland®
DIN CERTCO
Precisely Right.



| Annex to Solar Keymark Certificate | | Licence Number | 011-7S2812 F |
|---|---|---|---|
| | | Date issued | 2025-03-20 |
| | | Issued by | DIN CERTCO |

| | | | |
|---|---|---|---|
| **Licence holder** | **Linuo Ritter International Co., Ltd** | **Country** | China |
| **Brand** (optional) | Linuo Ritter | **Web** | http://www.linuo-paradigma.com |
| **Street, Number** | No. 30766 East Jingshi Road | **E-mail** | info@linuo-ritter-international.com |
| **Postcode, City** | 250103 Jinan City, Shandong Province | **Tel** | +86 531 88729950 |

| | |
|---|---|
| **Collector Type** | Flat plate collector |

| **Collector name** | **Gross area ($A_G$)** | **Gross length** | **Gross width** | **Gross height** | **Power output per collector** Gb = 850 W/m2, Gd = 150 W/m2 & u = 1.3 m/s $\vartheta_m - \vartheta_a$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0 K | 10 K | 30 K | 50 K | 70 K | 100 K |
| | m² | mm | mm | mm | W | W | W | W | W | W |
| **P-G/0.8-T/L/LT-1.82** | 2.00 | 2 000 | 1 000 | 95 | 1 552 | 1 476 | 1 313 | 1 135 | 943 | 629 |
| **P-G/0.8-T/L/LT-2.22** | 2.40 | 2 000 | 1 200 | 95 | 1 862 | 1 771 | 1 575 | 1 362 | 1 132 | 754 |
| **P-G/0.8-T/L/LT-2.80** | 3.00 | 2 000 | 1 500 | 95 | 2 328 | 2 214 | 1 969 | 1 703 | 1 415 | 943 |
| **Power output per m² gross area** | | | | | 776 | 738 | 656 | 568 | 472 | 314 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Performance parameters test method** | Quasi dynamic | | | | | | | | | |
| **Performance parameters (related to $A_G$)** | η0, b | a1 | a2 | a3 | a4 | a5 | a6 | a7 | a8 | Kd |
| **Units** | - | W/(m²K) | W/(m²K²) | J/(m³K) | - | J/(m²K) | s/m | W/(m²K⁴) | W/(m²K⁴) | - |
| **Test results** | 0.783 | 3.72 | 0.009 | 0.000 | 0.00 | 12 180 | 0.000 | 0.00 | 0.00 | 0.94 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Incidence angle modifier test method** | | Quasi dynamic - outdoor | | | | | | | | |
| **Incidence angle modifier** | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
| **Transversal** | $K_{\theta T,coll}$ | 1.00 | 1.00 | 0.98 | 0.96 | 0.93 | 0.88 | 0.77 | 0.00 | 0.00 |
| **Longitudinal** | $K_{\theta L,coll}$ | 1.00 | 1.00 | 0.98 | 0.96 | 0.93 | 0.88 | 0.77 | 0.00 | 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** | $(\vartheta_m-\vartheta_a)_{max}$ | 70 | K |
| **Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a$ = 30 °C)** | $\vartheta_{stg}$ | 190 | °C |
| **Maximum operating temperature** | $\vartheta_{max\ op}$ | 99 | °C |
| **Maximum operating pressure** | $p_{max,op}$ | 800 | kPa |

| | | | |
|---|---|---|---|
| **Testing laboratory** | TÜV Rheinland (Guangdong) Ltd. | http://www.tuv.com | |
| **Test report(s)** | 154150039_Linuo_P-G-2.80_ISO_Report_chen | **Dated** | 2017-11-08 |
| | 154150039_Linuo_P-G-1.82_ISO_Report_chen | | 2017-11-09 |
| | 200715014GZU-001 | | 2020-10-21 |
| | CN25Y0KT 001_Document check | | 2025-03-19 |

**Comments of testing laboratory** Ver. 6.2 (13.01.2022)

*No comments.*

Stamp & signature of test lab

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|---|---|---|
| Supplementary Information | Issued | 2025-03-20 |

**Gross Thermal Yield in kWh/collector at mean fluid temperature $\vartheta_m$**

| Standard Locations | | Athens | | | Davos | | | Stockholm | | | Würzburg | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Collector name | $\vartheta_m$ | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C |
| P-G/0.8-T/L/LT-1.82 | | 2 486 | 1 786 | 1 197 | 1 894 | 1 328 | 865 | 1 390 | 925 | 577 | 1 517 | 1 000 | 615 |
| P-G/0.8-T/L/LT-2.22 | | 2 984 | 2 143 | 1 436 | 2 273 | 1 594 | 1 038 | 1 668 | 1 109 | 693 | 1 820 | 1 199 | 738 |
| P-G/0.8-T/L/LT-2.80 | | 3 730 | 2 679 | 1 796 | 2 842 | 1 992 | 1 297 | 2 084 | 1 387 | 866 | 2 275 | 1 499 | 922 |
| Gross Thermal Yield per m² gross area | | 1 243 | 893 | 599 | 947 | 664 | 432 | 695 | 462 | 289 | 758 | 500 | 307 |
| Annual efficiency, $\eta_a$ | | 70% | 51% | 34% | 58% | 41% | 27% | 60% | 40% | 25% | 61% | 40% | 25% |
| Fixed or tracking collector | | Fixed (slope = latitude - 15°; rounded to nearest 5°) | | | | | | | | | | | |
| Annual irradiation on collector plane | | 1765 kWh/m² | | | 1630 kWh/m² | | | 1166 kWh/m² | | | 1244 kWh/m² | | |
| 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 ϑm (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.2 (13.01.2022). A detailed description of the calculations is available at http://www.estif.org/solarkeymarknew/

## Additional Information

| | | | | | |
|---|---|---|---|---|---|
| Collector heat transfer medium | | | | Water-Glycole | |
| The collector is deemed to be suitable for roof integration | | | | No | |
| | | | | | |
| The collector was tested successfully under the following conditions: | | | | | |
| Climate class (A+, A, B or C) | | | | C | -- |
| G (W/m²) > | 800 | $\vartheta_a$ (°C) > | 10 | $H_x$ (MJ/m²) > | 600 |
| Maximum tested positive load | | | | 2760 | Pa |
| Maximum tested negative load | | | | 1888 | Pa |
| Hail resistance using steel ball (maximum drop height) | | | | 2 | m |

## Additional collector attribute(s)

| | | | |
|---|---|---|---|
| Using external power source(s) for normal operation | No | Active or passive measure(s) for self-protection | No |
| Co-generating thermal and electrical power | No | Façade collector(s) | No |

## Energy Labelling Information

| | Reference Area, $A_{sol}$ (m²) |
|---|---|
| P-G/0.8-T/L/LT-1.82 | 2.00 |
| P-G/0.8-T/L/LT-2.22 | 2.40 |
| P-G/0.8-T/L/LT-2.80 | 3.00 |

**Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$**

| | |
|---|---|
| Collector efficiency ($\eta_{col}$) | 61% |

Remark: Collector efficiency (ηcol) 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/m², expressed in % and rounded to the nearest integer. Deviating from the regulation ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

## Additional Informative Technical Data

| Hydraulic Designation Code | Aperture Area, $A_a$ (m²) |
|---|---|
| 9-VH-1234S-A:8,1874-C:20,1050 | 1.85 |
| 11-VH-1234S-A:8,1874-C:20,1260 | 2.22 |
| 14-VH-1234S-A:8,1874-C:20,1550 | 2.83 |

**Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$**

| | | |
|---|---|---|
| Zero-loss efficiency ($\eta_0$) | 0.78 | -- |
| First-order coefficient ($a_1$) | 3.72 | W/(m²K) |
| Second-order coefficient ($a_2$) | 0.009 | W/(m²K²) |
| Incidence angle modifier IAM (50°) | 0.92 | -- |

*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.*