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|---|--|---------------------|--|--|---|--|---------------------------------------|-------------------------------|---------------------------------------|-------------------|---------------------------------------|--|
| Annex to Solar Keymark Certificate | | | | | Licence Number | | 011-7S073 F | | | | | |
| | | | | | Date issued | | 2019-11-20 | | | | | |
| | | | | | Issued by | | TÜV Rheinland Energy GmbH | | | | | |
| Licence holder | | Gasokol GmbH | | | Country | | Austria | | | | | |
| Brand (optional) | | - | | | Web | | www.gasokol.at | | | | | |
| Street, Number | | Solarpark 1 | | | E-mail | | office@gasokol.at | | | | | |
| Postcode, City | | A-4351 Saxen | | | Tel | | +43 726 976 600 | | | | | |
| Collector Type | | | | | Flat plate collector | | | | | | | |
| Collector name | | | | | 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 | | 90 K | | | | | |
| | | | | | m² | | mm | | mm | | mm | |
| topSol 22 | | | | | 2.20 | | 2 098 | | 1 050 | | 122 | |
| | | | | | W | | W | | W | | W | |
| | | | | | 1 567 | | 1 497 | | 1 345 | | 1 177 | |
| | | | | | 994 | | 794 | | | | | |
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| Power output per m² gross area | | | | | 712 | | 681 | | 611 | | 535 | |
| | | | | | 452 | | 361 | | | | | |
| Performance parameters test method | | | | | Steady state - indoor | | | | | | | |
| Performance parameters (related to A_G) | | | | | η_0, 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) | | W/(m²K⁴) | | - | | - | |
| Test results | | | | | 0.720 | | 3.10 | | 0.009 | | 0.000 | |
| | | | | | 0.00 | | 15 930 | | 0.000 | | 0.00 | |
| | | | | | 0.0E+00 | | 0.93 | | | | | |
| Incidence angle modifier test method | | | | | Quasi dynamic - outdoor | | | | | | | |
| Incidence angle modifier | | | | | Angle | | 10° | | 20° | | 30° | |
| | | | | | 40° | | 50° | | 60° | | 70° | |
| | | | | | 80° | | 90° | | | | | |
| Transversal | | | | | K_{GT, coll} | | 1.00 | | 0.99 | | 0.98 | |
| | | | | | 0.96 | | 0.92 | | 0.86 | | 0.72 | |
| | | | | | 0.32 | | 0.00 | | | | | |
| Longitudinal | | | | | K_{GL, coll} | | 1.00 | | 0.99 | | 0.98 | |
| | | | | | 0.96 | | 0.92 | | 0.86 | | 0.72 | |
| | | | | | 0.32 | | 0.00 | | | | | |
| Heat transfer medium for testing | | | | | Water | | | | | | | |
| Flow rate for testing (per gross area, A_G) | | | | | dm/dt | | 0.051 | | kg/(sm²) | | | |
| Maximum temperature difference during thermal performance test | | | | | ($\vartheta_m - \vartheta_a$)_{max} | | 60 | | K | | | |
| Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30$ °C) | | | | | ϑ_{stg} | | 200 | | °C | | | |
| Maximum operating temperature | | | | | $\vartheta_{max, op}$ | | - | | °C | | | |
| Maximum operating pressure | | | | | p_{max, op} | | 1000 | | kPa | | | |
| Testing laboratory | | | | | TÜV Rheinland Energy GmbH | | | www.tuv.com/solarpower | | | | |
| Test report(s) | | | | | 2.04.01243.1.0-1-LT (by AIT) | | | Dated | | 23.07.2015 | | |
| | | | | | 2.04.01243.1.0-1-QT (by AIT) | | | | | 23.07.2015 | | |
| Comments of testing laboratory | | | | | Datasheet version: 6.1, 2019-09-26 | | | | | | | |
| The collector had been tested according to EN ISO 9806:2013 by AIT Austrian Institute for Technology GmbH. According to an aperture area of 2.02 m ² , the collector parameter would be $\eta_{0, hem, a} = 0.776$; $a_{1a} = 3.372$ and $a_{2a} = 0.010$. | | | | |  TÜVRheinland® TÜV Rheinland Energy GmbH Am Graubühl 51109 Köln | | | | | | | |
| DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de | | | | | | | | | | | | |

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|---|----------------|-------------|
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| | Issued | 2019-11-20 |

| Annual collector output in kWh/collector at mean fluid temperature ϑ_m | | | | | | | | | | | | | |
|--|--------------------|---|-------|-------|-------------------------|-------|------|-------------------------|------|------|-------------------------|-------|------|
| Collector name | Standard Locations | Athens | | | Davos | | | Stockholm | | | Würzburg | | |
| | ϑ_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 |
| topSol 22 | | 2 507 | 1 845 | 1 271 | 1 935 | 1 389 | 930 | 1 417 | 965 | 620 | 1 542 | 1 045 | 662 |
| | | | | | | | | | | | | | |
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| Annual output per m ² gross area | | 1 140 | 839 | 578 | 880 | 631 | 423 | 644 | 439 | 282 | 701 | 475 | 301 |
| Annual efficiency, η_a | | 65% | 48% | 33% | 54% | 39% | 26% | 55% | 38% | 24% | 56% | 38% | 24% |
| 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-Glycole | | | | |
| 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) | B | | -- | | |
| G (W/m ²) > | 900 | ϑ_a (°C) > | 15 | H_x (MJ/m ²) > | 540 |
| Maximum tested positive load | 1500 | | Pa | | |
| Maximum tested negative load | 1000 | | Pa | | |
| Hail resistance using steel ball (maximum drop height) | - | | 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) |
| topSol 22 | 2.20 | 8-V-12T-7.2,1976-20.4,2067 | 2.02 |
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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}) | 57% | 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) | 3.10 |
| | | Second-order coefficient (a_2) | 0.009 |
| | | 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. | | | |