
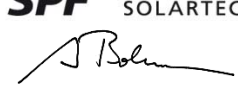


| Annex to Solar Keymark Certificate - Summary of EN 12975-2 Test Results | | | | | | Licence Number | | 011-7S2296 F | | | | | |
|--|--|---|----------------------|------------------------------------|--|------------------------------|-------|---------------------|-------|-------|------|--|--|
| | | | | | | Date issued | | 2016-11-29 | | | | | |
| | | | | | | Issued by | | | | | | | |
| Licence holder | | SOLTOP Schuppisser AG | | | | Country | | Switzerland | | | | | |
| Brand (optional) | | -- | | | | Web | | www.soltop.ch | | | | | |
| Street, Number | | St. Gallerstrasse 5a | | | | E-mail | | info@soltop.ch | | | | | |
| Postcode, City | | CH-8353, Elgg | | | | Tel | | +41 52 397 77 77 | | | | | |
| Collector Type | | | | | | Flat plate collector, glazed | | | | | | | |
| Collector name | Gross area (A _G) m ² | Gross length mm | Gross width mm | Gross height mm | Power output per collector G = 1000 W/m ² ϑ _m - ϑ _a | | | | | | | | |
| | | | | | 0 K | 10 K | 30 K | 50 K | 70 K | 130 K | | | |
| | | | | | W | W | W | W | W | W | | | |
| COBRA AK 2.2 V | 2.212 | 1'897 | 1'166 | 100 | 1'668 | 1'585 | 1'410 | 1'221 | 1'019 | 331 | | | |
| COBRA AK 2.3 H | 2.277 | 970 | 2'347 | 100 | 1'717 | 1'632 | 1'451 | 1'257 | 1'049 | 341 | | | |
| COBRA AK 2.7 V | 2.588 | 2'243 | 1'154 | 100 | 1'951 | 1'855 | 1'649 | 1'429 | 1'192 | 388 | | | |
| COBRA AK 2.7 H | 2.606 | 1'173 | 2'222 | 100 | 1'965 | 1'868 | 1'661 | 1'439 | 1'200 | 390 | | | |
| COBRA AK 2.8 V | 2.768 | 2'368 | 1'169 | 100 | 2'087 | 1'984 | 1'764 | 1'528 | 1'275 | 415 | | | |
| COBRA AK 2.8 H | 2.791 | 1'189 | 2'347 | 100 | 2'104 | 2'000 | 1'779 | 1'541 | 1'285 | 418 | | | |
| Power output per m ² gross area | | | | | 754 | 717 | 637 | 552 | 461 | 150 | | | |
| Performance parameters test method | | Steady state - outdoor | | | | | | | | | | | |
| Performance parameters (aperture area) | | η _{0,hem} | a ₁ | a ₂ | | | | | | | | | |
| Units | | - | W/(m ² K) | W/(m ² K ²) | | | | | | | | | |
| Test results | | 0.846 | 4.11 | 0.009 | | | | | | | | | |
| Incidence angle modifier test method | | Steady state - outdoor | | | | | | | | | | | |
| Bi-directional incidence angle modifiers | | No | | | | | | | | | | | |
| Incidence angle modifier | | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° | | |
| Transversal | | K _{GT, coll} | 1.00 | 1.00 | 0.99 | 0.97 | 0.94 | 0.86 | 0.70 | 0.40 | 0.00 | | |
| Longitudinal | | K _{GL, coll} | 1.00 | 1.00 | 0.99 | 0.97 | 0.94 | 0.86 | 0.70 | 0.40 | 0.00 | | |
| Heat transfer medium for testing | | Water-Glycole | | | | | | | | | | | |
| Flow rate for testing (per gross area, A _G) | | dm/dt | 0.021 | kg/(sm ²) | | | | | | | | | |
| Maximum temperature difference for thermal performance calculations | | (ϑ _m -ϑ _a) _{max} | 130 | K | | | | | | | | | |
| Standard stagnation temperature (G = 1000 W/m ² ; ϑ _a = 30 °C) | | ϑ _{stg} | 195 | °C | | | | | | | | | |
| Effective thermal capacity, incl. fluid (per gross area, A _G) | | C/m ² | 6.54 | kJ/(Km ²) | | | | | | | | | |
| Maximum operating temperature | | ϑ _{max, op} | 130 | °C | | | | | | | | | |
| Maximum operating pressure | | p _{max, op} | 600 | kPa | | | | | | | | | |
| Testing laboratory | | SPF, CH-8640 Rapperswil | | | | www.spf.ch | | | | | | | |
| Test report(s) | | C1590LPEN, C1591LPEN, C1591QPEN, C1592QPEN | | | | Dated | | 29.04.2014 | | | | | |
| Comments of testing laboratory | | Datashet version: 5.01, 2016-03-01 | | | | | | | | | | | |
| -- | |  INSTITUT FÜR SOLARTECHNIK  | | | | | | | | | | | |
| 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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|---|-----------------------|---------------------|
| Annex to Solar Keymark Certificate Supplementary Information | Licence Number | 011-7S2296 F |
| | Issued | 2016-11-29 |

| Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on EN ISO 9806:2013 test results | | | | | | | | | | | | | |
|--|-------------------------------------|---|-------|-------|-------------------------|-------|-------|-------------------------|-------|------|-------------------------|-------|------|
| 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 |
| COBRA AK 2.2 V | | 2'643 | 1'891 | 1'270 | 2'011 | 1'413 | 931 | 1'475 | 978 | 616 | 1'602 | 1'053 | 654 |
| COBRA AK 2.3 H | | 2'721 | 1'946 | 1'307 | 2'070 | 1'455 | 958 | 1'518 | 1'006 | 634 | 1'650 | 1'084 | 673 |
| COBRA AK 2.7 V | | 3'093 | 2'212 | 1'486 | 2'353 | 1'654 | 1'089 | 1'726 | 1'144 | 721 | 1'875 | 1'232 | 765 |
| COBRA AK 2.7 H | | 3'114 | 2'227 | 1'496 | 2'369 | 1'665 | 1'097 | 1'738 | 1'152 | 726 | 1'888 | 1'241 | 770 |
| COBRA AK 2.8 V | | 3'308 | 2'366 | 1'589 | 2'517 | 1'769 | 1'165 | 1'846 | 1'223 | 771 | 2'005 | 1'318 | 818 |
| COBRA AK 2.8 H | | 3'335 | 2'385 | 1'602 | 2'538 | 1'783 | 1'175 | 1'861 | 1'233 | 778 | 2'022 | 1'329 | 825 |
| Annual output per m ² aperture area | | 1'195 | 855 | 574 | 909 | 639 | 421 | 667 | 442 | 279 | 724 | 476 | 296 |
| Fixed or tracking collector | | Fixed (slope = latitude - 15°; rounded to nearest 5°) | | | | | | | | | | | |
| Annual irradiation on collector plane | | 1765 kWh/m ² | | | 1714 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. 5.01 (March 2016). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc

Additional Information

| | |
|---|---------------|
| Collector heat transfer medium | Water-Glycole |
| Hybrid Thermal and Photo Voltaic collector | No |
| The collector is deemed to be suitable for roof integration | Yes |
| The collector was tested successfully according to EN 12975-2 under the following conditions: | |
| No valid climate reference class | -- |
| Maximum tested positive load | 1000 Pa |
| Maximum tested negative load | 1000 Pa |
| Hail resistance using ice balls (diameter) | 35 mm |

Energy Labelling Information

| | Reference Area, A_{sol} (m ²) | Data required for CDR (EU) No 811/2013 - Reference Area A_{sol} | |
|----------------|---|--|--|
| COBRA AK 2.2 V | 1.96 | Collector efficiency (η_{col}) | 67 % |
| COBRA AK 2.3 H | 2.02 | 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 9806:2013. | |
| COBRA AK 2.7 V | 2.31 | | |
| COBRA AK 2.7 H | 2.33 | | |
| COBRA AK 2.8 V | 2.47 | | |
| COBRA AK 2.8 H | 2.46 | | |
| | | | |
| | | Data required for CDR (EU) No 812/2013 - Reference Area A_{sol} | |
| | | Zero-loss efficiency (η_0) | 0.846 -- |
| | | First-order coefficient (a_1) | 4.11 W/(m ² K) |
| | | Second-order coefficient (a_2) | 0.009 W/(m ² K ²) |
| | | Incidence angle modifier IAM (50°) | 0.94 -- |
| | | 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. | |