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ISFH CalTeC



| Annex to Solar Keymark Certificate | | Licence Number | 011-7S3009 R |
|---|---|---|---|
| | | Date issued | 2021-06-24 |
| | | Issued by | ISFH CalTeC |

| | | | |
|---|---|---|---|
| **Licence holder** | **AKOTEC Produktionsgesellschaft** | **Country** | Germany |
| **Brand** (optional) | | **Web** | http://www.akotec.eu |
| **Street, Number** | Grundmühlenweg 3 | **E-mail** | info@akotec.eu |
| **Postcode, City** | D- 16278 Angermünde | **Tel** | +49 33 312 571 640 |

| | |
|---|---|
| **Collector Type** | Evacuated tubular 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 | 90 K |
| | m² | mm | mm | mm | W | W | W | W | W | W |
| **Weiser Protect 800**[1)] | 1.61 | 2 159 | 745 | 128 | 701 | 678 | 627 | 569 | 504 | 432 |
| **Weiser Protect 1600**[1)] | 3.23 | 2 159 | 1 495 | 128 | 1 407 | 1 361 | 1 257 | 1 141 | 1 012 | 869 |
| **Weiser Protect 2400**[1)] | 4.85 | 2 159 | 2 245 | 128 | 2 113 | 2 043 | 1 888 | 1 713 | 1 520 | 1 305 |
| | | | | | | | | | | |
| **lowest switching temperature**[2)]**:** | | | | | | | | | | |
| **Weiser Protect 800**[2)] | 1.61 | 2 159 | 745 | 128 | 701 | 678 | 627 | *539* | *321* | *103* |
| **Weiser Protect 1600**[2)] | 3.23 | 2 159 | 1 495 | 128 | 1 407 | 1 361 | 1 257 | *1 083* | *645* | *207* |
| **Weiser Protect 2400**[2)] | 4.85 | 2 159 | 2 245 | 128 | 2 113 | 2 043 | 1 888 | *1 626* | *968* | *310* |
| | | | | | | | | | | |
| | | | | | | | | | | |
| per m², lowest switching temp.[2)] | 1.00 | | | | 436 | 422 | 390 | *335* | *200* | *64* |
| **Power output per m² gross area** | | | | | 436 | 422 | 390 | 354 | 314 | 269 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Performance parameters test method** | Steady state - indoor | | | | | | | | | |
| **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** | 0.444 | 1.40 | 0.005 | | | 2 724 | | | | 0.88 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Incidence angle modifier test method** | | Quasi dynamic - outdoor | | | | | | | | |
| **Incidence angle modifier** | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
| **Transversal** | $K_{\theta T,coll}$ | 1.01 | 1.02 | 1.03 | 1.04 | 1.07 | 1.08 | 0.83 | 0.42 | 0.00 |
| **Longitudinal** | $K_{\theta L,coll}$ | 1.00 | 0.99 | 0.98 | 0.96 | 0.93 | 0.87 | 0.75 | 0.47 | 0.00 |

| | | | |
|---|---|---|---|
| **Heat transfer medium for testing** | Water | | |
| **Flow rate for testing (per gross area, $A_G$)** | dm/dt | 0.021 | kg/(sm²) |
| **Maximum temperature difference during thermal performance test** | $(\vartheta_m-\vartheta_a)_{max}$ | 132 | K |
| **Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a$ = 30 °C)** | $\vartheta_{stg}$ | 170/130 | °C (comments) |
| **Maximum operating temperature** | $\vartheta_{max\ op}$ | 100 | °C |
| **Maximum operating pressure** | $p_{max,op}$ | 100 | kPa |

| | | | |
|---|---|---|---|
| **Testing laboratory** | ISFH CalTeC | http://www.isfh.de | |
| **Test report(s)** | 006-20/K1 | **Dated** | 21.06.2021 |
| | 007-20/KT1 | | 21.06.2021 |
| | 008-20/KT1 | | 21.06.2021 |
| | 035-20/KT1 (origin of given performance parameters) | | 21.06.2021 |

**Comments of testing laboratory** — Datasheet version: 6.1, 2019-07-11

The collector shows a thermal switching behaviour caused. It is offered with different switching temperatures,

[1)]the highest results in a standard stag. temperaure of 170 °C for temperatures above the switching temperature of 117 °C (at standard conditions) the following parameters apply: $\eta_{0,hem}$* = 0.830, $a_1$*= 6.64 W/m²K (Report 007-20/KT1),

[2)]the lowest results in a standard stag. temperature of 130 °C and for temperatures above the switching temperature of 66 °C (at standard conditions) the following parameters apply: $\eta_{0,hem}$* = 0.648, $a_1$*= 6.78 W/m²K (report 008-20/KT1)

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| Supplementary Information | Issued | 2021-06-24 |

**Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$ [3)]**

[3)] the calculation tool does not consider the switching behaviour of collectors, what might lead to minor annual annual collector output at high mean fluid temperatures for the collector with the lower switching temperature.

| 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 |
| Weiser Protect 800 | 1 162 | 929 | 710 | 940 | 736 | 552 | 683 | 514 | 372 | 736 | 553 | 395 |
| Weiser Protect 1600 | 2 332 | 1 864 | 1 425 | 1 886 | 1 477 | 1 107 | 1 371 | 1 031 | 747 | 1 477 | 1 109 | 793 |
| Weiser Protect 2400 | 3 502 | 2 800 | 2 141 | 2 833 | 2 218 | 1 663 | 2 059 | 1 548 | 1 122 | 2 218 | 1 666 | 1 190 |
| Annual output per m² gross area | 722 | 578 | 442 | 584 | 458 | 343 | 425 | 319 | 231 | 458 | 344 | 246 |
| Annual efficiency, $\eta_a$ | 41% | 33% | 25% | 36% | 28% | 21% | 36% | 27% | 20% | 37% | 28% | 20% |
| 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. 6.1 (July 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 | | | | No | |
| | | | | | |
| The collector was tested successfully under the following conditions: | | | | | |
| Climate class (A+, A, B or C) | | | | A | -- |
| G (W/m²) > | 1000 | $\vartheta_a$ (°C) > | 20 | $H_x$ (MJ/m²) > | 600 |
| Maximum tested positive load | | | | 4500 | Pa |
| Maximum tested negative load | | | | 3250 | Pa |
| Hail resistance using steel ball (maximum drop height) | | | | 2 | m |

## Additional collector attribute(s)

☐ Using external power source(s) for normal operation ☐ Active or passive measure(s) for self-protection

☐ Co-generating thermal and electrical power ☐ Façade collector(s)

## Energy Labelling Information

| | Reference Area, $A_{sol}$ (m²) |
|---|---|
| Weiser Protect 800 | 1.61 |
| Weiser Protect 1600 | 3.23 |
| Weiser Protect 2400 | 4.85 |

**Data required for CDR (EU) No 811/2013 - Reference Area**

| | |
|---|---|
| Collector efficiency ($\eta_{col}$) | 37% |

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 | Aperature Area, $A_a$ (m²) |
|---|---|---|
| Weiser Protect 800 | 1-H-12S-C:33,745-D | 1.01 |
| Weiser Protect 1600 | 1-H-12S-C:33,1495-D | 2.03 |
| Weiser Protect 2400 | 1-H-12S-C:33,2245-D | 3.04 |

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

| | | |
|---|---|---|
| Zero-loss efficiency ($\eta_0$) | 0.44 | -- |
| First-order coefficient ($a_1$) | 1.40 | W/(m²K) |
| Second-order coefficient ($a_2$) | 0.005 | W/(m²K²) |
| Incidence angle modifier IAM (50°) | 0.98 | -- |

*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.*

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