TÜVRheinland®
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ISFH CalTeC



## Annex to Solar Keymark Certificate

| | |
|---|---|
| **Licence Number** | **011-7S2578 F** |
| **Date issued** | **2020-07-30** |
| **Issued by** | **DIN CERTCO** |

| | | | |
|---|---|---|---|
| **Licence holder** | **ALTECH e.K.** | **Country** | Germany |
| **Brand** (optional) | | **Web** | www.altech.de |
| **Street, Number** | Am Mutterberg 6 | **E-mail** | info@altech.de |
| **Postcode, City** | D-97833 Frammersbach | **Tel** | +49 935 599 834 |

| | |
|---|---|
| **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 | 115 K |
| | m² | mm | mm | mm | W | W | W | W | W | W |
| **EUROTHERM 4.0** | 2.32 | 2,037 | 1,137 | 80 | 1,773 | 1,690 | 1,504 | 1,292 | 1,054 | 423 |
| **Power output per m² gross area** | | | | | 764 | 728 | 648 | 557 | 454 | 182 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **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** | 0.776 | 3.45 | 0.014 | | | 5,600 | | | | 0.90 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **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 | 0.99 | 0.98 | 0.97 | 0.94 | 0.89 | 0.78 | 0.46 | 0.00 |
| **Longitudinal** | $K_{\theta L,coll}$ | 1.00 | 0.99 | 0.98 | 0.97 | 0.94 | 0.89 | 0.78 | 0.46 | 0.00 |

| | | | |
|---|---|---|---|
| **Heat transfer medium for testing** | Water | | |
| **Flow rate for testing (per gross area, $A_G$)** | dm/dt | 0.036 | kg/(sm²) |
| **Maximum temperature difference during thermal performance test** | $(\vartheta_m-\vartheta_a)_{max}$ | 85 | K |
| **Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a$ = 30 °C)** | $\vartheta_{stg}$ | 209 | °C |
| **Maximum operating temperature** | $\vartheta_{max\ op}$ | - | °C |
| **Maximum operating pressure** | $p_{max,op}$ | 1000 | kPa |

| | | | |
|---|---|---|---|
| **Testing laboratory** | ISFH CalTeC | http://www.isfh.de | |
| **Test report(s)** | 38-15/KT<br>39-15/KT | **Dated** | 09.11.2015<br>09.11.2015 |

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

*The performence parameter are related to G(DIF)/G(TOT)=0.15*

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| Supplementary Information | Issued | 2020-07-30 |

**Annual collector output 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 |
| EUROTHERM 4.0 | | 2 824 | 2 032 | 1 334 | 2 157 | 1 499 | 943 | 1 587 | 1 046 | 634 | 1 724 | 1 130 | 674 |
| Annual output per m² gross area | | 1 217 | 876 | 575 | 930 | 646 | 407 | 684 | 451 | 273 | 743 | 487 | 290 |
| Annual efficiency, $\eta_a$ | | 69% | 50% | 33% | 57% | 40% | 25% | 59% | 39% | 23% | 60% | 39% | 23% |
| 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) | | | | | B | -- |
| G (W/m²) > | 900 | $\vartheta_a$ (°C) > | 15 | $H_X$ (MJ/m²) > | | 540 |
| Maximum tested positive load | | | | | 3000 | Pa |
| Maximum tested negative load | | | | | 2000 | 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) |
|---|---|
| EUROTHERM 4.0 | 2.32 |

## Additional Informative Technical Data

| Hydraulic Designation Code | Aperature Area, $A_a$ (m²) |
|---|---|
| 2-VH-12S-11.3,16250-16,L | 2.13 |

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

| | |
|---|---|
| Collector efficiency ($\eta_{col}$) | 60% |

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.

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

| | | |
|---|---|---|
| Zero-loss efficiency ($\eta_0$) | 0.76 | -- |
| First-order coefficient ($a_1$) | 3.45 | W/(m²K) |
| Second-order coefficient ($a_2$) | 0.014 | W/(m²K²) |
| Incidence angle modifier IAM (50°) | 0.93 | -- |

*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.*