| **Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate** | **Certificate No.** | **011-7S2021 F** |
|---|---|---|
| | Date of issue | 20.11.2013 |

| | | | | |
|---|---|---|---|---|
| **Company** | Solimpeks Solar Energy Corp. | **Country** | | TURKEY |
| **Brand** (optional) | | **Website** | | www.solimpeks.com |
| **Street, number** | Fevzi Çakmak Mah. 10753 Sk. No:3 | **E-mail** | | yusuf.akay@solimpeks.com |
| **Postal Code** | 42050 | **Tel.** | +90 | 4 440 602 |
| **City** | Konya - Karatay | **Fax** | +90 | 4 440 608 |

| | |
|---|---|
| **Collector Type** (flat plate / evacuate tubular / un-glazed) | Flat plate collector |
| **Integration in the roof possible ?** | Yes |

| Collector name | Aperture area (Aa) [m²] | Gross length [mm] | Gross width [mm] | Gross height [mm] | Gross area (Ag) [m²] | Power output per collector unit G = 1000 W/m² Tm-Ta : 0 K [W] | 10 K [W] | 30 K [W] | 50 K [W] | 70 K [W] |
|---|---|---|---|---|---|---|---|---|---|---|
| Wunder ALS 2108 DRAIN | 1.89 | 1 993 | 1 043 | 93 | 2.08 | 1 531 | 1 448 | 1 275 | 1 093 | 902 |
| Wunder ALS 2510 DRAIN | 2.23 | 1 991 | 1 221 | 92 | 2.43 | 1 806 | 1 708 | 1 504 | 1 289 | 1 064 |

| | | | |
|---|---|---|---|
| **Collector efficiency parameters related to aperture area (Aa)** Type of fluid and flow rate see note 1 | $\eta_{0a}$ | 0.810 | - |
| | $a_{1a}$ | 4.335 | W/(m²K) |
| | $a_{2a}$ | 0.006 | W/(m²K²) |
| **Stagnation temperature** - Weather conditions see note 2 | $t_{stg}$ | 192 | °C |
| **Effective thermal capacity** | $c_{eff} = C/A_a$ | 11.32 | kJ/(m²K) |
| **Max. operation pressure - see note 3** | $p_{max}$ | 1000 | kPa |

| **Incidence angle modifiers $K_\theta(\theta)$** | $G_{DIF}/G_{TOT}$ min | $G_{DIF}/G_{TOT}$ max | $\theta_T$ / $\theta_L$ | 50° | *10°* | *20°* | *30°* | *40°* | *60°* | *70°* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $K_\theta(\theta_T)$ | 0.95 | 1.00 | 0.99 | 0.99 | 0.97 | 0.91 | 0.83 |
| | - | - | $K_\theta(\theta_L)$ | 0.95 | 1.00 | 0.99 | 0.99 | 0.97 | 0.91 | 0.83 |

$G_{DIF}/G_{TOT}$: min&max - while measuring

***Optional values***

| | |
|---|---|
| **Testing Laboratory** | TZS, ITW University of Stuttgart |
| **Website** | www.tzs.uni-stuttgart.de |
| **Test report id. number** | 12COL1113/1, 12COL1114/1, 12COL1114Q/1 |
| **Date of test report** | 20.11.2013 |
| **Perf. test method** | EN 12975-2 6.1.4 (outdoor) |

**Comments of testing laboratory** :

* dimensions according to manufacturer

| | | | | | |
|---|---|---|---|---|---|
| Note 1 | **Fluid** | Water | **Flow rate** | 0.020 | kg/s per m² |
| Note 2 | **Irradiance, Gs=1000 W/m²** **Ambient temperature , Ta=30 °C** | | | | |
| Note 3 | **Given by manufacturer** | | | | |

VERSION 3.6, 2012.01.13

**DIN CERTCO ● Alboinstraße 56 ● 12103 Berlin**
Tel: +49 30 7562-1131 ● Fax: +49 30 7562-1141 ● E-Mail: info@dincertco.de ● www.dincertco.de

| Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate | Certificate No. | 011-7S2021 F |
|---|---|---|
| | Issued | 20.11.2013 |

## Annual collector output kWh

| Collector name | Location and collector temperature (Tm) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 |
| Wunder ALS 2108 DRAIN | 2 445 | 1 705 | 1 118 | 1 963 | 1 336 | 848 | 1 349 | 870 | 533 | 1 469 | 939 | 567 |
| Wunder ALS 2510 DRAIN | 2 885 | 2 012 | 1 319 | 2 316 | 1 576 | 1 001 | 1 592 | 1 027 | 629 | 1 733 | 1 108 | 669 |

| Collector mounting: Fixed or tracking | Fixed; slope = latitude - 15° (rounded to nearest 5°) |
|---|---|

### Overview of locations

| Location | Latitude ° | Gtot kWh/m² | Ta °C | Collector orientation or tracking mode |
|---|---|---|---|---|
| Athens | 38 | 1 765 | 18.5 | South, 25° |
| Davos | 47 | 1 714 | 3.2 | South, 30° |
| Stockholm | 59 | 1 166 | 7.5 | South, 45° |
| Würzburg | 50 | 1 244 | 9.0 | South, 35° |

| | | |
|---|---|---|
| Gtot | Annual total irradiation on collector plane | kWh/m² |
| Ta | Mean annual ambient air temperature | °C |
| Tm | Constant collector operating temperature (mean of in- and outlet temperatures) | °C |

Calculation of the annual collector performance is done by the official Solar Keymark spreadsheet tool. Hour by hour the collector output is calculated according to the efficiency parameters from the Keymark test using constant collector operating temperature (Tm). Detailed description with all equations used is available from the Solar Keymark web site (direct link: http://www.estif.org/solarkeymark/annexb1.php)

**DIN CERTCO ● Alboinstraße 56 ● 12103 Berlin**
Tel: +49 30 7562-1131 ● Fax: +49 30 7562-1141 ● E-Mail: info@dincertco.de ● www.dincertco.de

Datasheet version:
VERSION 3.6, 2012.01.13
Calculation program version:
3.07, October 2011 (SP)