TÜVRheinland®
DIN CERTCO

SPF Solartechnik Prüfung Forschung

| Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate | Certificate No. | 011-7S602 F |
|---|---|---|
| | Date of issue | 25.09.2012 |

| | | | | |
|---|---|---|---|---|
| **Company** | Citrin Solar GmbH | **Country** | | Germany |
| **Brand** (optional) | -- | **Website** | | www.citrinsolar.de |
| **Street, number** | Böhmerwaldstr. 32 | **E-mail** | | info@citrinsolar.de |
| **Postal Code** | 85368 | **Tel.** | +49 | 8761 33400 |
| **City** | Moosburg | **Fax** | +49 | 8761 334042 |

| | |
|---|---|
| **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 ($A_G$) [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] |
|---|---|---|---|---|---|---|---|---|---|---|
| CS 100 F | 1.889 | 1'984 | 1'042 | 93 | 2.067 | 1'489 | 1'417 | 1'261 | 1'087 | 895 |

| | | | |
|---|---|---|---|
| **Collector efficiency parameters related to aperture area (Aa)** Type of fluid and flow rate see note 1 | $\eta_{0a}$ | 0.788 | - |
| | $a_{1a}$ | 3.65 | W/(m²K) |
| | $a_{2a}$ | 0.0120 | W/(m²K²) |
| **Stagnation temperature** - Weather conditions see note 2 | $t_{stg}$ | 198 | °C |
| **Effective thermal capacity** | $c_{eff}$ = C/Aa | 3.9 | kJ/(m²K) |
| **Max. operation pressure - see note 3** | $p_{max}$ | 1000 | kPa |

| **Incidence angle modifiers $K_\theta(\theta)$** | $G_{DIF}/G_{TOT}$ min | max | $\theta_T$ / $\theta_L$ | 50° | 10° | 20° | 30° | 40° | 60° | 70° |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $K_\theta(\theta_T)$ | 0.94 | 1.00 | 1.00 | 0.99 | 0.98 | 0.86 | 0.73 |
| | 0.18 | 0.26 | $K_\theta(\theta_L)$ | 0.94 | 1.00 | 1.00 | 0.99 | 0.98 | 0.86 | 0.73 |
| $G_{DIF}/G_{TOT}$: min&max - while measuring | | | | | *Optional values* | | | | | |

| | |
|---|---|
| **Testing Laboratory** | SPF, CH-8640 Rapperswil |
| **Website** | www.solarenergy.ch |
| **Test report id. number** | C1450LPEN, C1450QPEN |
| **Date of test report** | 10.09.2012 /10.09.2012 |
| **Perf. test method** | EN 12975-2 6.1.4 (outdoor) |

**Comments of testing laboratory** :

| | | | | | | |
|---|---|---|---|---|---|---|
| Note 1 | **Fluid** | Water-Glycole | **Flow rate** | 0.043 | kg/s per m² | Dr. Andreas Bohren |
| Note 2 | **Irradiance, Gs=1000 W/m²** **Ambient temperature , Ta=30 °C** | | | | | |
| Note 3 | **Given by manufacturer** | | | | | |

VERSION 3.5, 2012.01.13

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| Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate | Certificate No. | 011-7S602 F |
|---|---|---|
| | Issued | 25.09.2012 |

## 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 |
| CS 100 F | 2'382 | 1'713 | 1'137 | 1'949 | 1'356 | 863 | 1'335 | 884 | 545 | 1'451 | 953 | 580 |

| 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)

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Datasheet version:
VERSION 3.5, 2012.01.13
Calculation program version:
3.07, October 2011 (SP)