| **Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate** | **Licence Number** | **011-7S2419 F** |
|---|---|---|
| | **Issued** | 2015-04-01 |

| | | | | |
|---|---|---|---|---|
| **Company** holding the | H. Lenz AG | **Country** | Switzerland | |
| **Brand** (optional) | – | **Website** | www.lenz.ch | |
| **Street, street number** | Hirzenstrasse 2 | **E-mail** | info@lenz.ch | |
| **Postal Code / City, province** | CH-9244 Niederuzwil | **Tel/Fax** | +41 | (0)71 955 70-20 /-25 |

| | |
|---|---|
| **Collector Type** (flat plate glazed/un-glazed; evacuate tubular) | Flat plate collector - glazed |
| **Thermal / photo voltaic hybid collector?** (PVT collector) | No |
| **Integration in the roof possible ?** (manufacturers declaration) | Yes |

| | Aperture area (Aa) | Gross length | Gross width | Gross height | Gross area (AG) | Power output per collector module G = 1000 W/m², Tm-Ta 0 K | 10 K | 30 K | 50 K | 70 K |
|---|---|---|---|---|---|---|---|---|---|---|
| **Collector name** | m² | mm | mm | mm | **m²** | W | W | W | W | W |
| **Swiss-Collector SCQ025** | **2.231** | **1'275** | **2'092** | **120** | **2.667** | **1'856** | **1'768** | **1'581** | **1'377** | **1'156** |
| **Swiss-Collector SCQ050** | **4.531** | **2'480** | **2'090** | **120** | **5.183** | **3'770** | **3'592** | **3'210** | **2'796** | **2'348** |
| Swiss-Collector SCQ075 | 6.797 | 3'690 | 2'090 | 120 | **7.712** | 5'655 | 5'387 | 4'815 | 4'193 | 3'521 |
| Swiss-Collector SCQ1.100 | 9.062 | 3'690 | 4'120 | 120 | * **10.290** | 7'540 | 7'183 | 6'421 | 5'591 | 4'695 |
| Swiss-Collector SCQ1.125 | 11.328 | 3'690 | 4'120 | 120 | ** **12.747** | 9'424 | 8'979 | 8'026 | 6'989 | 5'869 |
| Swiss-Collector SCQ1.150 | 13.593 | 3'690 | 4'120 | 120 | **15.203** | 11'309 | 10'775 | 9'631 | 8'387 | 7'043 |
| Swiss-Collector SC025 | 2.316 | 2'050 | 1'320 | 120 | **2.706** | 1'927 | 1'836 | 1'641 | 1'429 | 1'200 |
| Swiss-Collector SC050 | 4.632 | 2'050 | 2'580 | 120 | **5.289** | 3'854 | 3'672 | 3'282 | 2'858 | 2'400 |
| **Swiss-Collector SC075** | **6.851** | **2'048** | **3'840** | **120** | **7.864** | **5'700** | **5'431** | **4'854** | **4'227** | **3'550** |
| Swiss-Collector SC100 | 9.264 | 2'050 | 5'100 | 120 | **10.455** | 7'708 | 7'343 | 6'564 | 5'716 | 4'800 |
| Swiss-Collector SC125 | 11.580 | 2'050 | 6'360 | 120 | **13.038** | 9'635 | 9'179 | 8'205 | 7'145 | 6'000 |
| Swiss-Collector SC150 | 13.896 | 4'040 | 3'840 | 120 | **15.514** | 11'561 | 11'015 | 9'846 | 8'574 | 7'200 |
| Swiss-Collector SC175 | 16.212 | 4'040 | 5'100 | 120 | *** **18.021** | 13'488 | 12'851 | 11'487 | 10'003 | 8'400 |
| Swiss-Collector SC200 | 18.528 | 4'040 | 5'100 | 120 | **20.604** | 15'415 | 14'687 | 13'127 | 11'432 | 9'600 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Performance test method** | Glazed liquid heating collector - steady state - outdoor | | | | | | | | |
| **Performance parameters related to aperture** | η0 | a1 | a2 | | | | | | |
| **Units** | - | W/(m²K) | W/(m²K²) | | | | | | |
| **Test results** - *Flow rate and fluid see note 1* | 0.832 | 3.84 | 0.0092 | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Bi-directional incidence angle** | Yes | Kθ *values are obligatory for 50°.* | | | | | | | | |
| **Incidence angle modifiers Kθ(θT)** | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
| **transversal direction** | Kθ(θT) | 1.00 | 1.01 | 1.00 | 0.98 | 0.94 | 0.86 | 0.75 | 0.44 | 0.00 |
| **Incidence angle modifiers Kθ(θL)** | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
| **longitudinal direction** | Kθ(θL) | 1.00 | 1.01 | 1.00 | 0.98 | 0.94 | 0.86 | 0.75 | 0.44 | 0.00 |

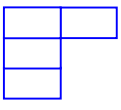
| | | | |
|---|---|---|---|
| **Stagnation temperature** - *Weather conditions see note 2* | $T_{stg}$ | 187 | °C |
| **Effective thermal capacity** | $c_{eff} = C/A_g$ | 7.2 | kJ/(m²K) |
| **Max. intende operation temperature** - *see note 3* | $T_{max,op}$ | 130 | °C |
| **Max. operation pressure** - *see note 3* | $p_{max,op}$ | 600 | kPa |

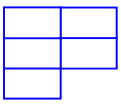
| **Pressure drop table** - for a collector family, the values shall be for the module with highest ΔP per m² aperture area | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Flow rate** | kg/(s m²) | 0.003 | 0.005 | 0.008 | 0.010 | 0.013 | 0.015 | 0.018 | 0.021 | 0.023 | 0.026 |
| **Pressure drop, ΔP** | Pa | 4198 | 10063 | 17596 | 26796 | 37664 | 50198 | 64401 | 80270 | 97807 | 117012 |

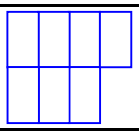
| | | | | |
|---|---|---|---|---|
| **Optional weather data** | Location | | Link | |
| **Testing Laboratory** | SPF, CH-8640 Rapperswil | | | |
| **Website** | www.spf.ch | | | |
| **Test report id. number** | C1425LPEN, C1426QPEN, C1427LPEN, C1427QPEN | **Date of test reports** | 15.12.2014 | |

| | | | |
|---|---|---|---|
| During the test $G_{DIF}/G_{TOT}$ was always between | 0.1 | and | 0.2 |

**Comments of testing laboratory:**

* 

** 

*** 

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|---|---|---|---|---|---|
| *Note 1* | **Flow rate** | 0.021 | kg/(s m²) | **Fluid** | Water-Glycole |
| *Note 2* | **Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C** | | | | |
| *Note 3* | **Given by manufacturer** | | | | |

Dr. Andreas Bohren

Datasheet version: 4.06, 2014-01-15

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| Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate | Licence Number | 011-7S2419 F |
|---|---|---|
| | Issued | 2015-04-01 |

## Annual collector output kWh/module

| | Location and collector temperature (Tm) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Athens | | | Davos | | | Stockholm | | | Würzburg | | |
| Collector name | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C | 25°C | 50°C | 75°C |
| Swiss-Collector SCQ025 | 2'979 | 2'166 | 1'481 | 2'287 | 1'631 | 1'091 | 1'675 | 1'128 | 722 | 1'819 | 1'217 | 767 |
| Swiss-Collector SCQ050 | 6'050 | 4'400 | 3'007 | 4'645 | 3'312 | 2'216 | 3'401 | 2'291 | 1'467 | 3'694 | 2'472 | 1'558 |
| Swiss-Collector SCQ075 | 9'075 | 6'599 | 4'511 | 6'967 | 4'968 | 3'323 | 5'102 | 3'436 | 2'200 | 5'541 | 3'708 | 2'337 |
| Swiss-Collector SCQ1.100 | 12'100 | 8'799 | 6'015 | 9'290 | 6'624 | 4'431 | 6'803 | 4'581 | 2'934 | 7'388 | 4'944 | 3'116 |
| Swiss-Collector SCQ1.125 | 15'125 | 10'999 | 7'518 | 11'612 | 8'280 | 5'539 | 8'504 | 5'727 | 3'667 | 9'234 | 6'180 | 3'895 |
| Swiss-Collector SCQ1.150 | 18'151 | 13'199 | 9'022 | 13'935 | 9'936 | 6'647 | 10'204 | 6'872 | 4'401 | 11'081 | 7'416 | 4'674 |
| Swiss-Collector SC025 | 3'093 | 2'249 | 1'537 | 2'374 | 1'693 | 1'132 | 1'739 | 1'171 | 750 | 1'888 | 1'264 | 796 |
| Swiss-Collector SC050 | 6'185 | 4'498 | 3'074 | 4'748 | 3'386 | 2'265 | 3'477 | 2'342 | 1'500 | 3'776 | 2'527 | 1'593 |
| Swiss-Collector SC075 | 9'148 | 6'652 | 4'547 | 7'023 | 5'008 | 3'350 | 5'143 | 3'464 | 2'218 | 5'585 | 3'738 | 2'356 |
| Swiss-Collector SC100 | 12'370 | 8'995 | 6'149 | 9'497 | 6'771 | 4'530 | 6'955 | 4'683 | 2'999 | 7'552 | 5'054 | 3'185 |
| Swiss-Collector SC125 | 15'463 | 11'244 | 7'686 | 11'871 | 8'464 | 5'662 | 8'693 | 5'854 | 3'749 | 9'440 | 6'318 | 3'982 |
| Swiss-Collector SC150 | 18'555 | 13'493 | 9'223 | 14'245 | 10'157 | 6'795 | 10'432 | 7'025 | 4'499 | 11'328 | 7'582 | 4'778 |
| Swiss-Collector SC175 | 21'648 | 15'742 | 10'760 | 16'620 | 11'850 | 7'927 | 12'171 | 8'196 | 5'249 | 13'216 | 8'845 | 5'574 |
| Swiss-Collector SC200 | 24'740 | 17'991 | 12'297 | 18'994 | 13'543 | 9'060 | 13'909 | 9'367 | 5'998 | 15'104 | 10'109 | 6'371 |
| | | | | | | | | | | | | |

| 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 |

The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool ScenoCalc. The collector output is calculated hour by hour according to the efficiency parameters from the Keymark test using constant collector operating temperature (Tm). A detailed description of the calculations is available at http://www.sp.se/en/index/services/solar/ScenoCalc/Sidor/default.aspx.

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Datasheet version: 4.06, 2014-01-15
ScenoCalc version: Ver. 4.06 (Jan, 2014)