


|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|---|--|---|----------------------|------------------------------------|---|-------|----------------------------------|-------|--|------------------------------------|-------|-------|-------|-------|---|
| <b>Annex to Solar Keymark Certificate</b>   |  |   |                      |                                    | <b>Licence Number</b>   |       | <b>011-7S2971 R</b>              |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    | <b>Date issued</b>  |       | <b>2022-09-14</b>                |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    | <b>Issued by</b>  |       | <b>DIN CERTCO</b>                |       |  |                                    |       |       |       |       |   |
| <b>Licence holder</b>   |  | <b>Bio Energie op Maat BV</b>   |                      |                                    | <b>Country</b>  |       | Netherlands                      |       |  |                                    |       |       |       |       |   |
| <b>Brand (optional)</b>   |  | SolCol  |                      |                                    | <b>Web</b>  |       | www.solcol.nl                    |       |  |                                    |       |       |       |       |   |
| <b>Street, Number</b>   |  | Julianaweg 4  |                      |                                    | <b>E-mail</b>   |       | info@solcol.nl                   |       |  |                                    |       |       |       |       |   |
| <b>Postcode, City</b>   |  | 6265 AJ Sint Geertruid  |                      |                                    | <b>Tel</b>  |       | +31 46 711 12 13                 |       |  |                                    |       |       |       |       |   |
| <b>Collector Type</b>   |  |   |                      |                                    | Evacuated tubular collector   |       |                                  |       |  |                                    |       |       |       |       |   |
| <b>Collector name</b>   |  |   |                      |                                    | <b>Power output per collector</b><br>$G_b = 850 \text{ W/m}^2$ , $G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$<br>$\vartheta_m - \vartheta_a$   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    | 0 K   | 10 K  | 30 K                             | 50 K  | 70 K                                   | 104 K                              |       |       |       |       |   |
|   |  |   |                      |                                    | m <sup>2</sup>  | mm    | mm                               | mm    | mm                                     | W                                  | W     | W     | W     | W     | W |
| <b>SolCol CPC 6</b>   |  |   |                      |                                    | 1.16  | 1 640 | 707                              | 103   | 644                                    | 636                                | 618   | 595   | 569   | 516   |   |
| <b>SolCol CPC 12</b>  |  |   |                      |                                    | 2.29  | 1 640 | 1 397                            | 103   | 1272                                   | 1256                               | 1219  | 1175  | 1123  | 1 019 |   |
| <b>SolCol CPC 18</b>  |  |   |                      |                                    | 3.42  | 1 640 | 2 087                            | 103   | 1899                                   | 1876                               | 1821  | 1754  | 1677  | 1 521 |   |
| <b>SolCol CPC 6XL</b>   |  |   |                      |                                    | 1.45  | 2 057 | 707                              | 103   | 805                                    | 795                                | 772   | 744   | 711   | 645   |   |
| <b>SolCol CPC 12XL</b>  |  |   |                      |                                    | 2.87  | 2 057 | 1 397                            | 103   | 1 594                                  | 1 574                              | 1 528 | 1 472 | 1 408 | 1 277 |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
|   |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
| <b>Power output per m<sup>2</sup> gross area</b>  |  |   |                      |                                    | 555   | 548   | 532                              | 513   | 490                                    | 445                                |       |       |       |       |   |
| <b>Performance parameters test method</b>   |  | Steady state - outdoor  |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
| <b>Performance parameters (related to A<sub>G</sub>)</b>  |  | $\eta_0, b$   | a1                   | a2                                 | a3  | a4    | a5                               | a6    | a7                                     | a8                                 | Kd    |       |       |       |   |
| <b>Units</b>  |  | -   | W/(m <sup>2</sup> K) | W/(m <sup>2</sup> K <sup>2</sup> ) | J/(m <sup>3</sup> K)  | -     | J/(m <sup>2</sup> K)             | s/m   | W/(m <sup>2</sup> K <sup>4</sup> )     | W/(m <sup>2</sup> K <sup>4</sup> ) | -     |       |       |       |   |
| <b>Test results</b>   |  | 0.559   | 0.646                | 0.004                              | 0.000   | 0.00  | 7 914                            | 0.000 | 0.00                                   | 0.0                                | 0.956 |       |       |       |   |
| <b>Incidence angle modifier test method</b>   |  | Quasi dynamic - outdoor   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |
| <b>Incidence angle modifier</b>   |  | Angle   | 10°                  | 20°                                | 30°   | 40°   | 50°                              | 60°   | 70°                                    | 80°                                | 90°   |       |       |       |   |
| <b>Transversal</b>  |  | K <sub>GT, coll</sub>   | 1.01                 | 1.01                               | 1.02  | 1.02  | 0.98                             | 1.05  | 1.14                                   | 0.57                               | 0.00  |       |       |       |   |
| <b>Longitudinal</b>   |  | K <sub>GL, coll</sub>   | 1.00                 | 1.00                               | 0.99  | 0.98  | 0.95                             | 0.89  | 0.76                                   | 0.38                               | 0.00  |       |       |       |   |
| <b>Heat transfer medium for testing</b>   |  |   |                      |                                    | Water   |       |                                  |       |  |                                    |       |       |       |       |   |
| <b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>  |  |   |                      |                                    | dm/dt   | 0.172 | kg/(sm <sup>2</sup> )            |       |  |                                    |       |       |       |       |   |
| <b>Maximum temperature difference during thermal performance test</b>   |  |   |                      |                                    | ( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>  | 74    | K                                |       |  |                                    |       |       |       |       |   |
| <b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30 \text{ }^\circ\text{C}</math>)</b>   |  |   |                      |                                    | $\vartheta_{stg}$   | 301   | °C                               |       |  |                                    |       |       |       |       |   |
| <b>Maximum operating temperature</b>  |  |   |                      |                                    | $\vartheta_{max, op}$   | 160   | °C                               |       |  |                                    |       |       |       |       |   |
| <b>Maximum operating pressure</b>   |  |   |                      |                                    | p <sub>max, op</sub>  | 1000  | kPa                              |       |  |                                    |       |       |       |       |   |
| <b>Testing laboratory</b>   |  | Institut für Gebäudeenergetik, Thermotechnik und<br>Energiespeicherung (IGTE) |                      |                                    |   |       | http://www.igte.uni-stuttgart.de |       |  |                                    |       |       |       |       |   |
| <b>Test report(s)</b>   |  | 14COL1031OEM09<br>14COL1032Q/2OEM09<br>06COL456/7                             |                      |                                    |   |       | <b>Dated</b>                     |       | 13.05.2020<br>13.05.2020<br>26.06.2015 |                                    |       |       |       |       |   |
| <b>Comments of testing laboratory</b>   |  |   |                      |                                    | Ver. 6.2 (13.01.2022)   |       |                                  |       |  |                                    |       |       |       |       |   |
| Documented performance parameters are taken from test report 06COL456/7<br>This data sheet replaces the data sheet issued on 25.01.2021<br>The page number was corrected. |  |   |                      |                                    |  <b>Forschungs- und Testzentrum für Solaranlagen</b><br>Institut für Thermodynamik und Wärmetechnik<br>Universität Stuttgart<br>Pfaffenwaldring 8, 70550 Stuttgart (Vaihingen) |       |                                  |       |  |                                    |       |       |       |       |   |
| DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany<br>Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de                      |  |   |                      |                                    |   |       |                                  |       |  |                                    |       |       |       |       |   |

|   |                       |                     |
|---|-----------------------|---------------------|
| <b>Annex to Solar Keymark Certificate<br/>Supplementary Information</b> | <b>Licence Number</b> | <b>011-7S2971 R</b> |
|   | <b>Issued</b>         | <b>2022-09-14</b>   |

**Gross Thermal Yield in kWh/collector at mean fluid temperature  $\vartheta_m$** 

| Collector name                                    | Standard Locations<br>$\vartheta_m$ | 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  |
| SolCol CPC 6                                      |                                     | 1 113   | 1 021 | 916   | 974                     | 878   | 774   | 699                     | 618   | 536   | 751                     | 665   | 577   |
| SolCol CPC 12                                     |                                     | 2 197   | 2 016 | 1 809 | 1 923                   | 1 733 | 1 528 | 1 380                   | 1 221 | 1 058 | 1 482                   | 1 313 | 1 139 |
| SolCol CPC 18                                     |                                     | 3 281   | 3 012 | 2 701 | 2 873                   | 2 588 | 2 282 | 2 062                   | 1 823 | 1 580 | 2 213                   | 1 961 | 1 701 |
| SolCol CPC 6XL                                    |                                     | 1 391   | 1 277 | 1 145 | 1 218                   | 1 097 | 968   | 874                     | 773   | 670   | 938                     | 832   | 721   |
| SolCol CPC 12XL                                   |                                     | 2 753   | 2 527 | 2 267 | 2 411                   | 2 172 | 1 915 | 1 730                   | 1 530 | 1 326 | 1 857                   | 1 646 | 1 427 |
| Gross Thermal Yield per m <sup>2</sup> gross area |                                     | 959   | 881   | 790   | 840                     | 757   | 667   | 603                     | 533   | 462   | 647                     | 574   | 497   |
| Annual efficiency, $\eta_a$                       |                                     | 54%   | 50%   | 45%   | 52%                     | 46%   | 41%   | 52%                     | 46%   | 40%   | 52%                     | 46%   | 40%   |
| Fixed or tracking collector                       |                                     | Fixed (slope = latitude - 15°; rounded to nearest 5°) |       |       |                         |       |       |                         |       |       |                         |       |       |
| Annual irradiation on collector plane             |                                     | 1765 kWh/m <sup>2</sup>                               |       |       | 1630 kWh/m <sup>2</sup> |       |       | 1166 kWh/m <sup>2</sup> |       |       | 1244 kWh/m <sup>2</sup> |       |       |
| 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  $\vartheta_m$  (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.2 (13.01.2022). 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/m <sup>2</sup> ) >   | 1000          | $\vartheta_a$ (°C) > | 20      |
| $H_x$ (MJ/m <sup>2</sup> ) >  |               |                      | 600     |
| Maximum tested positive load  |               |                      | 2400 Pa |
| Maximum tested negative load  |               |                      | 3000 Pa |
| Hail resistance using ice balls (diameter)                            |               |                      | 35 mm   |

**Additional collector attribute(s)**

|   |    |  |    |
|---|----|--|----|
| Using external power source(s) for normal operation | No | Active or passive measure(s) for self-protection | No |
| Co-generating thermal and electrical power          | No | Façade collector(s)                              | No |

**Energy Labelling Information**
**Additional Informative Technical Data**

|                 | Reference Area, $A_{sol}$ (m <sup>2</sup> ) | Hydraulic Designation Code | Aperture Area, $A_a$ (m <sup>2</sup> ) |
|-----------------|---|----------------------------|--|
| SolCol CPC 6    | 1.16  | 6-V-12S-                   | 1.00                                   |
| SolCol CPC 12   | 2.29  | 6-V-12S-                   | 2.00                                   |
| SolCol CPC 18   | 3.42  | 6-V-12S-                   | 3.00                                   |
| SolCol CPC 6XL  | 1.45  | 6-V-12S-                   | 1.29                                   |
| SolCol CPC 12XL | 2.87  | 6-V-12S-                   | 2.57                                   |

**Data required for CDR (EU) No 811/2013 - Reference Area**
**Data required for CDR (EU) No 812/2013 - Reference Area  $A_{sol}$** 

|  |     |                                    |       |                                    |
|--|-----|------------------------------------|-------|------------------------------------|
| Collector efficiency ( $\eta_{col}$ )  | 52% | Zero-loss efficiency ( $\eta_0$ )  | 0.56  | --                                 |
| Remark: Collector efficiency ( $\eta_{col}$ ) 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/m <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017. |     | First-order coefficient ( $a_1$ )  | 0.65  | W/(m <sup>2</sup> K)               |
|  |     | Second-order coefficient ( $a_2$ ) | 0.004 | W/(m <sup>2</sup> K <sup>2</sup> ) |
|  |     | Incidence angle modifier IAM (50°) | 0.99  | --                                 |

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.