

# AENOR

## Keymark Certificate Solar thermal energy



078/000288

AENOR certifies that the organization

### CETIH Carquefou – Systovi

registered office 14 AV SIRMA 44470 CARQUEFOU (Loire Atlantique - Francia)

supplies Air heating solar collectors

in compliance with Specific CEN KEYMARK Scheme Rules for Solar Thermal Products Version 28.00 – December 2015

Trade Mark R-VOLT ON TOP  
Technical characteristics Specified in Annexes to the Certificate

Production site 14 AV SIRMA 44470 CARQUEFOU (Loire Atlantique - Francia)

Certification scheme In order to grant this Certificate, AENOR has tested the product and has verified the quality system implemented for its manufacture. AENOR performs these tasks periodically while the Certificate has not been cancelled, in accordance with Specific Rules RP 078.01.

The tests have been performed according to the EN ISO 9806:2013 standard. The specific requirements for certifying solar air collectors are established in annex L of these Specific Rules.

First issued on 2017-03-16  
Last issued on 2022-03-16  
Validity date 2027-03-16


Rafael GARCÍA MEIRO  
Chief Executive Officer

Original Electronic Certificate

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Product certification body accredited by ENAC, number 1/C-PR271



|  |  |                           |  |  |  |  |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
|--|--|---------------------------|--|--|--|--|--|------------------------|--|-----------------------|--|--|--|---|--|------|--|--|--|
| Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results  |  |                           |  |  |  | Licence Number   |  | 078/000288             |  |                       |  |  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  | Date issued  |  | 2022-03-16             |  |                       |  |  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  | Issued by  |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| Licence holder   |  | CETIH Carquefou – Systovi |  |  |  | Country  |  | FRANCE                 |  |                       |  |  |  |   |  |      |  |  |  |
| Brand (optional)   |  | --                        |  |  |  | Web  |  | http://www.systovi.com |  |                       |  |  |  |   |  |      |  |  |  |
| Street, Number   |  | 14 AV SIRMA               |  |  |  | E-mail   |  | contact@systovi.com    |  |                       |  |  |  |   |  |      |  |  |  |
| Postcode, City   |  | 44470 CARQUEFOU           |  |  |  | Tel  |  | +33 02 40 92 44 20     |  |                       |  |  |  |   |  |      |  |  |  |
| Collector Type   |  |                           |  |  |  | Flat plate collector (air heating)- un-glazed  |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| Collector name   |  |                           |  |  |  | Gross area (A <sub>G</sub> )   |  | Gross length           |  | Gross width           |  | Gross height   |  |   |  |      |  |  |  |
|  |  |                           |  |  |  | m <sup>2</sup>   |  | mm                     |  | mm                    |  | mm   |  | Power output per collector module<br>G = 1000 W/m <sup>2</sup> ; u < 1m/s |  |      |  |  |  |
| R-VOLT ON TOP  |  |                           |  |  |  | 1,56   |  | 1.524                  |  | 1.023                 |  | 70   |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | T <sub>m</sub> - T <sub>a</sub> [K] =  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 4,1  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 5,9  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 8,2  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | ṁ [kg/h] =   |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 239,4  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 135  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 90,6   |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | Power output [W] =   |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 596  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 523  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | 458  |  |   |  |      |  |  |  |
| Performance parameters test method   |  |                           |  |  |  | Steady state - outdoor (air heating)   |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| Performance parameters (related to AG)   |  |                           |  |  |  | η <sub>0,hem</sub>   |  | b1                     |  | b2                    |  | b <sub>u</sub>   |  | ε/α   |  |      |  |  |  |
| Units  |  |                           |  |  |  | -  |  | W/(m <sup>2</sup> K)   |  | Ws/(m <sup>3</sup> K) |  | s/m  |  | -   |  |      |  |  |  |
| Test results   |  |                           |  |  |  | 90,6 (kg/h)  |  | 0,291                  |  | --                    |  | --   |  | 0,043   |  | 0,85 |  |  |  |
|  |  |                           |  |  |  | 135 kg/h   |  | 0,333                  |  | --                    |  | --   |  | 0,042   |  | 0,85 |  |  |  |
|  |  |                           |  |  |  | 239,4 kg/h   |  | 0,380                  |  | --                    |  | --   |  | 0,032   |  | 0,85 |  |  |  |
| Incidence angle modifier test method   |  |                           |  |  |  | Steady state - outdoor (air heating)   |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| Bi-directional incidence angle modifiers   |  |                           |  |  |  | No   |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| Incidence angle modifier   |  |                           |  |  |  | Angle  |  | 10°                    |  | 20°                   |  | 30°  |  | 40°   |  |      |  |  |  |
| Transversal  |  |                           |  |  |  | K <sub>θT, coll</sub>  |  |                        |  |                       |  |  |  | 0,86  |  |      |  |  |  |
| Longitudinal   |  |                           |  |  |  | K <sub>θL, coll</sub>  |  |                        |  |                       |  |  |  | 0,86  |  |      |  |  |  |
| Heat transfer medium for testing   |  |                           |  |  |  | Air  |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| Flow rate for testing (per gross area, A <sub>G</sub> )  |  |                           |  |  |  | dm/dt  |  | 0,016                  |  | kg/(sm <sup>2</sup> ) |  |  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  | dm/dt  |  | 0,024                  |  | kg/(sm <sup>2</sup> ) |  |  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  | dm/dt  |  | 0,043                  |  | kg/(sm <sup>2</sup> ) |  |  |  |   |  |      |  |  |  |
| Maximum temperature difference for thermal performance calculations  |  |                           |  |  |  | (θ <sub>m</sub> -θ <sub>a</sub> ) <sub>max</sub>   |  | 8,2                    |  | K                     |  |  |  |   |  |      |  |  |  |
| Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; θ <sub>a</sub> = 30 °C)   |  |                           |  |  |  | θ <sub>stg</sub>   |  | 90,9                   |  | °C                    |  |  |  |   |  |      |  |  |  |
| Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )  |  |                           |  |  |  | C/m <sup>2</sup>   |  | 4,97                   |  | kJ/(Km <sup>2</sup> ) |  |  |  |   |  |      |  |  |  |
| Maximum operating temperature  |  |                           |  |  |  | θ <sub>max, op</sub>   |  | 85                     |  | °C                    |  |  |  |   |  |      |  |  |  |
| Maximum operating pressure   |  |                           |  |  |  | p <sub>max, op</sub>   |  | 0,03                   |  | kPa                   |  |  |  |   |  |      |  |  |  |
| Testing laboratory   |  |                           |  |  |  | Fundación CENER-CIEMAT, LEST   |  |                        |  | www.cener.com         |  |  |  |   |  |      |  |  |  |
| Test report(s)   |  |                           |  |  |  | 30.2926.0-3-1<br>30.2926.0-4-1   |  |                        |  | Dated                 |  | 29/09/2016   |  |   |  |      |  |  |  |
| Comments of testing laboratory   |  |                           |  |  |  | Datasheet version: 5.01, 2016-03-01  |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| <p>1 For open to ambient solar air heaters, sucking in ambient air, it is just possible to determine the instantaneous efficiency at certain mass flow rates and ambient temperature.</p> <p>2 Thermal performance parameters are given for the PV-module working with max. electrical power output ('MPP mode')</p> |  |                           |  |  |  |  <b>CENER</b> |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
|  |  |                           |  |  |  |  |  |                        |  |                       |  | <p>Comments regarding compliance with IEC standards: Certificate by AENOR (FCS) A98/000018 in compliance with standards EN 61215 and EN 61730-1 and-2.. Test reports by CENER: 30.2782.0-01, 30.2782.0-02 and 30.2782.0-03. PV module manufacturer is Systovi.</p> |  |   |  |      |  |  |  |
| AENOR INTERNACIONAL,S.A.U. - Génova, 6. - 28004 - Madrid, España - Tel. 91 432 60 00 - www.aenor.com   |  |                           |  |  |  |  |  |                        |  |                       |  |  |  |   |  |      |  |  |  |
| Product certification body accredited by ENAC, number 1/C-PR271  |  |                           |  |  |  |  |  |                        |  |                       |  |  |  |   |  |      |  |  |  |



|   |                |            |
|---|----------------|------------|
| Annex to Solar Keymark Certificate<br>Supplementary Information | Licence Number | 078/000288 |
|   | Issued         | 2022-03-16 |

| Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$ , based on ISO 9806:2013 test results |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|--|-------------------------------------|---|------|------|-------------------------|------|------|-------------------------|------|------|-------------------------|------|------|
| 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 |
| R-VOLT ON TOP  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
|  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
| Annual output per m <sup>2</sup> gross area  |                                     |   |      |      |                         |      |      |                         |      |      |                         |      |      |
| Fixed or tracking collector  |                                     | Fixed (slope = latitude - 15°; rounded to nearest 5°) |      |      |                         |      |      |                         |      |      |                         |      |      |
| Annual irradiation on collector plane  |                                     | 1765 kWh/m <sup>2</sup>                               |      |      | 1714 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. 5.01 (March 2016). A detailed description of the calculations is available at [www.solarkeymark.org/scenocalc](http://www.solarkeymark.org/scenocalc)

| Additional Information  |  |         |
|---|--|---------|
| Collector heat transfer medium  |  | Air     |
| Hybrid Thermal and Photo Voltaic collector  |  | Yes     |
| The collector is deemed to be suitable for roof integration   |  | No      |
| The collector was tested successfully according to EN ISO 9806:2013 under the following conditions: |  |         |
| Climate class (A, B or C)   |  | A --    |
| Maximum tested positive load  |  | 2400 Pa |
| Maximum tested negative load  |  | 2400 Pa |
| Hail resistance using ice balls (diameter)  |  | 25 mm   |

| Energy Labelling Information |   |  |  |
|------------------------------|---|--|--|
|                              | Reference Area, $A_{sol}$ (m <sup>2</sup> ) | Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$  |  |
| R-VOLT ON TOP                | 1,56  | Collector efficiency ( $\eta_{col}$ )  | #iVALOR! %                               |
|                              |   | 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 9806:2013. |  |
|                              |   | Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$  |  |
|                              |   | Zero-loss efficiency ( $\eta_0$ )  | 0,368 --                                 |
|                              |   | First-order coefficient ( $a_1$ )  | #iVALOR! W/(m <sup>2</sup> K)            |
|                              |   | Second-order coefficient ( $a_2$ )   | 0,000 W/(m <sup>2</sup> K <sup>2</sup> ) |
|                              |   | Incidence angle modifier IAM (50°)   | 0,86 --                                  |
|                              |   | 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.  |  |