



| Annex to Solar Keymark Certificate   |  |                    |                   |                    | Licence Number   |                      | OEM 9999/1/10                      |                      |       |                         |       |                                      |                                    |      |
|--|--|--------------------|-------------------|--------------------|--|----------------------|------------------------------------|----------------------|-------|-------------------------|-------|--------------------------------------|------------------------------------|------|
|  |  |                    |                   |                    | Date issued  |                      | 2022-07-27                         |                      |       |                         |       |                                      |                                    |      |
|  |  |                    |                   |                    | Issued by  |                      | DQS Hellas                         |                      |       |                         |       |                                      |                                    |      |
| Licence holder   |  |                    |                   |                    | ENERGIA ITALIA Srl   |                      |                                    |                      |       | Country                 |       | Italy                                |                                    |      |
| Brand (optional)   |  |                    |                   |                    |  |                      |                                    |                      |       | Web                     |       |                                      |                                    |      |
| Street, Number   |  |                    |                   |                    | VIA VITTORIO EMANUELE II, 294  |                      |                                    |                      |       | E-mail                  |       | direzione@energiaitalia.info         |                                    |      |
| Postcode, City   |  |                    |                   |                    | 91021 CAMPOBELLO DI MAZARA (TP)  |                      |                                    |                      |       | Tel                     |       | +39 092445066                        |                                    |      |
| Collector Type   |  |                    |                   |                    | Flat plate collector   |                      |                                    |                      |       |                         |       |                                      |                                    |      |
| Collector name   | Gross area ( $A_G$ )<br>m <sup>2</sup> | Gross length<br>mm | Gross width<br>mm | Gross height<br>mm | Power output per collector   |                      |                                    |                      |       |                         |       |                                      |                                    |      |
|  |  |                    |                   |                    | Gb = 850 W/m <sup>2</sup> , Gd = 150 W/m <sup>2</sup> & u = 1.3 m/s<br>$\vartheta_m - \vartheta_a$ |                      |                                    |                      |       |                         |       |                                      |                                    |      |
|  |  |                    |                   |                    | 0 K  | 10 K                 | 30 K                               | 50 K                 | 70 K  | 84 K                    |       |                                      |                                    |      |
|  |  |                    |                   |                    | W  | W                    | W                                  | W                    | W     | W                       |       |                                      |                                    |      |
| AS-1.50  | 1,50                                   | 1.480              | 1.010             | 86                 | 1.143  | 1.087                | 963                                | 822                  | 665   | 548                     |       |                                      |                                    |      |
| AS-1.50H   | 1,50                                   | 1.010              | 1.480             | 86                 | 1.143  | 1.087                | 963                                | 822                  | 665   | 548                     |       |                                      |                                    |      |
| AS-1.82  | 1,82                                   | 1.480              | 1.230             | 86                 | 1.387  | 1.319                | 1.168                              | 997                  | 807   | 664                     |       |                                      |                                    |      |
| AS-1.82H   | 1,82                                   | 1.230              | 1.480             | 86                 | 1.387  | 1.319                | 1.168                              | 997                  | 807   | 664                     |       |                                      |                                    |      |
| AS-2.00  | 2,00                                   | 1.980              | 1.010             | 86                 | 1.524  | 1.449                | 1.284                              | 1.096                | 886   | 730                     |       |                                      |                                    |      |
| AS-2.00H   | 2,00                                   | 1.010              | 1.980             | 86                 | 1.524  | 1.449                | 1.284                              | 1.096                | 886   | 730                     |       |                                      |                                    |      |
| AS-2.37  | 2,37                                   | 1.930              | 1.230             | 86                 | 1.806  | 1.718                | 1.521                              | 1.299                | 1.050 | 865                     |       |                                      |                                    |      |
| AS-2.37H   | 2,37                                   | 1.230              | 1.930             | 86                 | 1.806  | 1.718                | 1.521                              | 1.299                | 1.050 | 865                     |       |                                      |                                    |      |
| AS-2.72  | 2,72                                   | 2.160              | 1.260             | 86                 | 2.073  | 2 (13.01             | 1.746                              | 1.491                | 1.205 | 993                     |       |                                      |                                    |      |
| AS-2.72H   | 2,72                                   | 1.260              | 2.160             | 86                 | 2.073  | 1.971                | 1.746                              | 1.491                | 1.205 | 993                     |       |                                      |                                    |      |
| Power output per m <sup>2</sup> gross area   |  |                    |                   |                    | 762  | 725                  | 642                                | 548                  | 443   | 365                     |       |                                      |                                    |      |
| Performance parameters test method   |  |                    |                   |                    | Steady state - outdoor   |                      |                                    |                      |       |                         |       |                                      |                                    |      |
| Performance parameters (related to $A_G$ )   |  |                    |                   |                    | $\eta_0, b$  | a1                   | a2                                 | a3                   | a4    | a5                      | a6    | a7                                   | a8                                 | Kd   |
| Units  |  |                    |                   |                    | -  | 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> ) | -    |
| Test results   |  |                    |                   |                    | 0,771  | 3,59                 | 0,014                              | 0,000                | 0,00  | 10.827                  | 0,000 | 0,00                                 | 0,0E+00                            | 0,92 |
| Incidence angle modifier test method   |  |                    |                   |                    | Steady state - outdoor   |                      |                                    |                      |       |                         |       |                                      |                                    |      |
| Incidence angle modifier   |  |                    |                   |                    | Angle  | 10°                  | 20°                                | 30°                  | 40°   | 50°                     | 60°   | 70°                                  | 80°                                | 90°  |
| Transversal  |  |                    |                   |                    | $K_{\theta T, coll}$   | 1,00                 | 1,00                               | 1,00                 | 0,99  | 0,96                    | 0,90  | 0,78                                 | 0,52                               | 0,00 |
| Longitudinal   |  |                    |                   |                    | $K_{\theta L, coll}$   | 1,00                 | 1,00                               | 1,00                 | 0,99  | 0,96                    | 0,90  | 0,78                                 | 0,52                               | 0,00 |
| Heat transfer medium for testing   |  |                    |                   |                    | Water  |                      |                                    |                      |       |                         |       |                                      |                                    |      |
| Flow rate for testing (per gross area, $A_G$ )   |  |                    |                   |                    | dm/dt  | 0,022                | kg/(sm <sup>2</sup> )              |                      |       |                         |       |                                      |                                    |      |
| Maximum temperature difference during thermal performance test   |  |                    |                   |                    | $(\vartheta_m - \vartheta_a)_{max}$  | 53,7                 | K                                  |                      |       |                         |       |                                      |                                    |      |
| Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30$ °C)  |  |                    |                   |                    | $\vartheta_{stg}$  | 190,5                | °C                                 |                      |       |                         |       |                                      |                                    |      |
| Maximum operating temperature  |  |                    |                   |                    | $\vartheta_{max, op}$  | 200                  | °C                                 |                      |       |                         |       |                                      |                                    |      |
| Maximum operating pressure   |  |                    |                   |                    | $p_{max, op}$  | 1000                 | kPa                                |                      |       |                         |       |                                      |                                    |      |
| Testing laboratory   |  |                    |                   |                    | NCSR Demokritos / Solar & other Energy System  |                      |                                    |                      |       | www.solar.demokritos.gr |       |                                      |                                    |      |
| Test report(s)   |  |                    |                   |                    | 4195DE2<br>4196DE2<br>4197DQ3  |                      |                                    |                      |       | Dated                   |       | 16/11/2016<br>16/11/2016<br>2/6/2017 |                                    |      |
| Comments of testing laboratory   |  |                    |                   |                    | Ver. 6.2 (13.01.2022)  |                      |                                    |                      |       |                         |       |                                      |                                    |      |
| Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +30 210 6233493-4 , Fax: +30 210 6233495, http://www.dqs.gr, e-mail: i.alexou@dqs.gr |  |                    |                   |                    |  |                      |                                    |                      |       |                         |       |                                      |                                    |      |



| Annex to Solar Keymark Certificate<br>Supplementary Information  |  | Licence Number  |                                     | OEM 9999/1/10        |                         |   |   |                                       |       |       |                         |                                    |  |    |
|--|--|---|-------------------------------------|----------------------|-------------------------|---|---|---------------------------------------|-------|-------|-------------------------|------------------------------------|--|----|
|  |  | Issued  |                                     | 2022-07-27           |                         |   |   |                                       |       |       |                         |                                    |  |    |
| <b>Gross Thermal Yield in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>   |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
| Standard Locations   |  | Athens  |                                     | Davos                |                         | Stockholm   |   | Würzburg                              |       |       |                         |                                    |  |    |
| Collector name   | $\vartheta_m$                                      | 25°C  | 50°C                                | 75°C                 | 25°C                    | 50°C  | 75°C  | 25°C                                  | 50°C  | 75°C  | 25°C                    | 50°C                               | 75°C   |    |
| AS-1.50  |  | 1.848   | 1.320                               | 859                  | 1.405                   | 970   | 605   | 1.034                                 | 675   | 405   | 1.125                   | 731                                | 431  |    |
| AS-1.50H   |  | 1.848   | 1.320                               | 859                  | 1.405                   | 970   | 605   | 1.034                                 | 675   | 405   | 1.125                   | 731                                | 431  |    |
| AS-1.82  |  | 2.243   | 1.601                               | 1.042                | 1.705                   | 1.177   | 734   | 1.254                                 | 819   | 491   | 1.365                   | 886                                | 523  |    |
| AS-1.82H   |  | 2.243   | 1.601                               | 1.042                | 1.705                   | 1.177   | 734   | 1.254                                 | 819   | 491   | 1.365                   | 886                                | 523  |    |
| AS-2.00  |  | 2.464   | 1.759                               | 1.145                | 1.874                   | 1.293   | 806   | 1.379                                 | 900   | 540   | 1.500                   | 974                                | 575  |    |
| AS-2.00H   |  | 2.464   | 1.759                               | 1.145                | 1.874                   | 1.293   | 806   | 1.379                                 | 900   | 540   | 1.500                   | 974                                | 575  |    |
| AS-2.37  |  | 2.920   | 2.085                               | 1.357                | 2.221                   | 1.532   | 955   | 1.634                                 | 1.066 | 639   | 1.778                   | 1.154                              | 682  |    |
| AS-2.37H   |  | 2.920   | 2.085                               | 1.357                | 2.221                   | 1.532   | 955   | 1.634                                 | 1.066 | 639   | 1.778                   | 1.154                              | 682  |    |
| AS-2.72  |  | 3.352   | 2.393                               | 1.558                | 2.549                   | 1.759   | 1.097   | 1.875                                 | 1.223 | 734   | 2.040                   | 1.325                              | 782  |    |
| AS-2.72H   |  | 3.352   | 2.393                               | 1.558                | 2.549                   | 1.759   | 1.097   | 1.875                                 | 1.223 | 734   | 2.040                   | 1.325                              | 782  |    |
|  |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
|  |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
|  |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
|  |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
| Gross Thermal Yield per m <sup>2</sup> gross area  |  | 1.232   | 880                                 | 573                  | 937                     | 647   | 403   | 689                                   | 450   | 270   | 750                     | 487                                | 288  |    |
| Annual efficiency, $\eta_a$  |  | 70%   | 50%                                 | 32%                  | 57%                     | 40%   | 25%   | 59%                                   | 39%   | 23%   | 60%                     | 39%                                | 23%  |    |
| 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 <a href="http://www.estif.org/solarkeymarknew/">http://www.estif.org/solarkeymarknew/</a>   |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
| <b>Additional Information</b>  |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
| 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 <sub>x</sub> (MJ/m <sup>2</sup> ) > |       |       | 600                     |                                    |  |    |
| Maximum tested positive load   |  |   |                                     |                      |                         |   |   |                                       |       |       | 3000                    |                                    | Pa   |    |
| Maximum tested negative load   |  |   |                                     |                      |                         |   |   |                                       |       |       | 3000                    |                                    | Pa   |    |
| Hail resistance using steel ball (maximum drop height)   |  |   |                                     |                      |                         |   |   |                                       |       |       | 2                       |                                    | m  |    |
| <b>Additional collector attribute(s)</b>   |  |   |                                     |                      |                         |   |   |                                       |       |       |                         |                                    |  |    |
| 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 |
| <b>Energy Labelling Information</b>  |  |   |                                     |                      |                         | <b>Additional Informative Technical Data</b>  |   |                                       |       |       |                         |                                    |  |    |
|  | Reference Area, A <sub>sol</sub> (m <sup>2</sup> ) |   | Hydraulic Designation Code          |                      |                         |   | Aperture Area, A <sub>a</sub> (m <sup>2</sup> ) |                                       |       |       |                         |                                    |  |    |
| AS-1.50  | 1,50   |   | 9-V-1234S-A:7.2,1380-C:20.6,1080-D  |                      |                         |   | 1,38  |                                       |       |       |                         |                                    |  |    |
| AS-1.50H   | 1,50   |   | 14-V-1234S-A:7.2,908-C:20.6,1560-D  |                      |                         |   | 1,38  |                                       |       |       |                         |                                    |  |    |
| AS-1.82  | 1,82   |   | 11-V-1234S-A:7.2,1378-C:20.6,1300-D |                      |                         |   | 1,72  |                                       |       |       |                         |                                    |  |    |
| AS-1.82H   | 1,82   |   | 14-V-1234S-A:7.2,1128-C:20.6,1560-D |                      |                         |   | 1,72  |                                       |       |       |                         |                                    |  |    |
| AS-2.00  | 2,00   |   | 9-V-1234S-A:7.2,1878-C:20.6,1080-D  |                      |                         |   | 1,86  |                                       |       |       |                         |                                    |  |    |
| AS-2.00H   | 2,00   |   | 18-V-1234S-A:7.2,908-C:20.6,2060-D  |                      |                         |   | 1,86  |                                       |       |       |                         |                                    |  |    |
| AS-2.37  | 2,37   |   | 11-V-1234S-A:7.2,1828-C:20.6,1300-D |                      |                         |   | 2,23  |                                       |       |       |                         |                                    |  |    |
| AS-2.37H   | 2,37   |   | 18-V-1234S-A:7.2,1128-C:20.6,2010-D |                      |                         |   | 2,23  |                                       |       |       |                         |                                    |  |    |
| AS-2.72  | 2,72   |   | 11-V-1234S-A:7.2,2060-C:20.6,1320-D |                      |                         |   | 2,57  |                                       |       |       |                         |                                    |  |    |
| AS-2.72H   | 2,72   |   | 18-V-1234S-A:7.2,1158-C:20.6,2240-D |                      |                         |   | 2,57  |                                       |       |       |                         |                                    |  |    |
| Data required for CDR (EU) No 811/2013 - Reference Area A <sub>sol</sub>   |  |   |                                     |                      |                         | Data required for CDR (EU) No 812/2013 - Reference Area A <sub>sol</sub>  |   |                                       |       |       |                         |                                    |  |    |
| Collector efficiency ( $\eta_{col}$ )  |  | 60%   |                                     |                      |                         | Zero-loss efficiency ( $\eta_0$ )   |   |                                       |       | 0,76  |                         | --                                 |  |    |
| 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 <sub>sol</sub> ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017. |  |   |                                     |                      |                         | First-order coefficient (a <sub>1</sub> )   |   |                                       |       | 3,59  |                         | W/(m <sup>2</sup> K)               |  |    |
|  |  |   |                                     |                      |                         | Second-order coefficient (a <sub>2</sub> )  |   |                                       |       | 0,014 |                         | W/(m <sup>2</sup> K <sup>2</sup> ) |  |    |
|  |  |   |                                     |                      |                         | Incidence angle modifier IAM (50°)  |   |                                       |       | 0,96  |                         | --                                 |  |    |
|  |  |   |                                     |                      |                         | Remark: The data given in this section are related to collector reference area (A <sub>sol</sub> ) 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. |   |                                       |       |       |                         |                                    |  |    |
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