## Annex to Solar Keymark Certificate

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| **Licence Number** | **OEM 9999/1/15** |
| **Date issued** | **2023-02-28** |
| **Issued by** | **DQS Hellas** |

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|---|---|---|---|
| **Licence holder** | **CLIVET S.p.A.** | **Country** | Italy |
| **Brand** (optional) | | **Web** | |
| **Street, Number** | Via Camp Lonc 25 | **E-mail** | g.girardi@clivet.it |
| **Postcode, City** | 32032 Z.I. Villapaiera, Feltre (BL) | **Tel** | +39 0439 313292 |

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|---|---|
| **Collector Type** | Flat plate collector |

| **Collector name** | **Gross area ($A_G$)** | **Gross length** | **Gross width** | **Gross height** | **Power output per collector** Gb = 850 W/m2, Gd = 150 W/m2 & u = 1.3 m/s $\vartheta_m - \vartheta_a$ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 0 K | 10 K | 30 K | 50 K | 70 K | 84 K |
| | m² | mm | mm | mm | W | W | W | W | W | W |
| **ELFOSun3 F-S** | 1,50 | 1.480 | 1.010 | 86 | 1.143 | 1.087 | 963 | 822 | 665 | 548 |
| **ELFOSun3 FH-S** | 1,50 | 1.010 | 1.480 | 86 | 1.143 | 1.087 | 963 | 822 | 665 | 548 |
| **ELFOSun3 F-M** | 1,82 | 1.480 | 1.230 | 86 | 1.387 | 1.319 | 1.168 | 997 | 807 | 664 |
| **ELFOSun3 FH-M** | 1,82 | 1.230 | 1.480 | 86 | 1.387 | 1.319 | 1.168 | 997 | 807 | 664 |
| **ELFOSun3 F-L** | 2,00 | 1.980 | 1.010 | 86 | 1.524 | 1.449 | 1.284 | 1.096 | 886 | 730 |
| **ELFOSun3 FH-L** | 2,00 | 1.010 | 1.980 | 86 | 1.524 | 1.449 | 1.284 | 1.096 | 886 | 730 |
| **ELFOSun3 F-XL** | 2,37 | 1.930 | 1.230 | 86 | 1.806 | 1.718 | 1.521 | 1.299 | 1.050 | 865 |
| **ELFOSun3 FH-XL** | 2,37 | 1.230 | 1.930 | 86 | 1.806 | 1.718 | 1.521 | 1.299 | 1.050 | 865 |
| **ELFOSun3 F-XXL** | 2,72 | 2.160 | 1.260 | 86 | 2.073 | .2 (13.01 | 1.746 | 1.491 | 1.205 | 993 |
| **ELFOSun3 FH-XXL** | 2,72 | 1.260 | 2.160 | 86 | 2.073 | 1.971 | 1.746 | 1.491 | 1.205 | 993 |
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| **Power output per m² gross area** | | | | | 762 | 725 | 642 | 548 | 443 | 365 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **Performance parameters test method** | Steady state - outdoor | | | | | | | | | |
| **Performance parameters (related to $A_G$)** | η0, b | a1 | a2 | a3 | a4 | a5 | a6 | a7 | a8 | Kd |
| **Units** | - | W/(m²K) | W/(m²K²) | J/(m³K) | - | J/(m²K) | s/m | W/(m²K⁴) | W/(m²K⁴) | - |
| **Test results** | 0,771 | 3,59 | 0,014 | 0,000 | 0,00 | 10.827 | 0,000 | 0,00 | 0,0E+00 | 0,92 |

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|---|---|---|---|---|---|---|---|---|---|---|
| **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 |

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| **Heat transfer medium for testing** | | Water | |
| **Flow rate for testing (per gross area, $A_G$)** | dm/dt | 0,022 | kg/(sm²) |
| **Maximum temperature difference during thermal performance test** | $(\vartheta_m-\vartheta_a)_{max}$ | 53,7 | K |
| **Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a$ = 30 °C)** | $\vartheta_{stg}$ | 190,5 | °C |
| **Maximum operating temperature** | $\vartheta_{max_op}$ | 200 | °C |
| **Maximum operating pressure** | $p_{max,op}$ | 1000 | kPa |

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|---|---|---|---|
| **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 |

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| **Comments of testing laboratory** | Ver. 6.2 (13.01.2022) |
| | |

| Annex to Solar Keymark Certificate | Licence Number | OEM 9999/1/15 |
|---|---|---|
| Supplementary Information | Issued | 2023-02-28 |

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

| 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 |
| ELFOSun3 F-S | | 1.848 | 1.320 | 859 | 1.405 | 970 | 605 | 1.034 | 675 | 405 | 1.125 | 731 | 431 |
| ELFOSun3 FH-S | | 1.848 | 1.320 | 859 | 1.405 | 970 | 605 | 1.034 | 675 | 405 | 1.125 | 731 | 431 |
| ELFOSun3 F-M | | 2.243 | 1.601 | 1.042 | 1.705 | 1.177 | 734 | 1.254 | 819 | 491 | 1.365 | 886 | 523 |
| ELFOSun3 FH-M | | 2.243 | 1.601 | 1.042 | 1.705 | 1.177 | 734 | 1.254 | 819 | 491 | 1.365 | 886 | 523 |
| ELFOSun3 F-L | | 2.464 | 1.759 | 1.145 | 1.874 | 1.293 | 806 | 1.379 | 900 | 540 | 1.500 | 974 | 575 |
| ELFOSun3 FH-L | | 2.464 | 1.759 | 1.145 | 1.874 | 1.293 | 806 | 1.379 | 900 | 540 | 1.500 | 974 | 575 |
| ELFOSun3 F-XL | | 2.920 | 2.085 | 1.357 | 2.221 | 1.532 | 955 | 1.634 | 1.066 | 639 | 1.778 | 1.154 | 682 |
| ELFOSun3 FH-XL | | 2.920 | 2.085 | 1.357 | 2.221 | 1.532 | 955 | 1.634 | 1.066 | 639 | 1.778 | 1.154 | 682 |
| ELFOSun3 F-XXL | | 3.352 | 2.393 | 1.558 | 2.549 | 1.759 | 1.097 | 1.875 | 1.223 | 734 | 2.040 | 1.325 | 782 |
| ELFOSun3 FH-XXL | | 3.352 | 2.393 | 1.558 | 2.549 | 1.759 | 1.097 | 1.875 | 1.223 | 734 | 2.040 | 1.325 | 782 |
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| Gross Thermal Yield per m² 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/m² | | | 1630 kWh/m² | | | 1166 kWh/m² | | | 1244 kWh/m² | | |
| 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 ϑm (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

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|---|---|---|---|---|---|
| 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/m²) > | 1000 | $\vartheta_a$ (°C) > | 20 | $H_x$ (MJ/m²) > | 600 |
| Maximum tested positive load | | | | 3000 | Pa |
| Maximum tested negative load | | | | 3000 | Pa |
| Hail resistance using steel ball (maximum drop height) | | | | 2 | m |

## 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

| | Reference Area, $A_{sol}$ (m²) |
|---|---|
| ELFOSun3 F-S | 1,50 |
| ELFOSun3 FH-S | 1,50 |
| ELFOSun3 F-M | 1,82 |
| ELFOSun3 FH-M | 1,82 |
| ELFOSun3 F-L | 2,00 |
| ELFOSun3 FH-L | 2,00 |
| ELFOSun3 F-XL | 2,37 |
| ELFOSun3 FH-XL | 2,37 |
| ELFOSun3 F-XXL | 2,72 |
| ELFOSun3 FH-XXL | 2,72 |

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

| | |
|---|---|
| Collector efficiency ($\eta_{col}$) | 60% |

Remark: Collector efficiency (ηcol) 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/m², expressed in % and rounded to the nearest integer. Deviating from the regulation ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

## Additional Informative Technical Data

| Hydraulic Designation Code | Aperture Area, $A_a$ (m²) |
|---|---|
| 9-V-1234S-A:7.2,1380-C:20.6,1080-D | 1,38 |
| 14-V-1234S-A:7.2,908-C:20.6,1560-D | 1,38 |
| 11-V-1234S-A:7.2,1378-C:20.6,1300-D | 1,72 |
| 14-V-1234S-A:7.2,1128-C:20.6,1560-D | 1,72 |
| 9-V-1234S-A:7.2,1878-C:20.6,1080-D | 1,86 |
| 18-V-1234S-A:7.2,908-C:20.6,2060-D | 1,86 |
| 11-V-1234S-A:7.2,1828-C:20.6,1300-D | 2,23 |
| 18-V-1234S-A:7.2,1128-C:20.6,2010-D | 2,23 |
| 11-V-1234S-A:7.2,2060-C:20.6,1320-D | 2,57 |
| 18-V-1234S-A:7.2,1158-C:20.6,2240-D | 2,57 |

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

| | | |
|---|---|---|
| Zero-loss efficiency ($\eta_0$) | 0,76 | -- |
| First-order coefficient ($a_1$) | 3,59 | W/(m²K) |
| Second-order coefficient ($a_2$) | 0,014 | W/(m²K²) |
| Incidence angle modifier IAM (50°) | 0,96 | -- |

*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.*

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