| Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate | | Licence Number | SK-0010 |
|---|---|---|---|
| | | Issued | 2015-10-26 |

| | | | | | |
|---|---|---|---|---|---|
| Company holding the | HELIOFRANCE | | Country | France | |
| Brand (optional) | COPERNIC H272 / V272 / H232 / V232 | | Website | www.heliofrance.com | |
| Street, street number | 2862 Route de Toulouse | | E-mail | mykieta@heliofrance.com | |
| Postal Code / City, province | 31370 | Bérat | Tel/Fax | 33 | 561 444 689 -1 |

| | |
|---|---|
| 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) | No |

| | 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 |
| COPERNIC H272.12-N-AR | 2,60 | 2 192 | 90 | 1 241 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC H272.12-AR | 2,60 | 2 192 | 90 | 1 241 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC V272.12-N-AR | 2,60 | 1 241 | 90 | 2 192 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC V272.12-AR | 2,60 | 1 241 | 90 | 2 192 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC H232.12-N-AR | 2,30 | 1 870 | 90 | 1 241 | 2,32 | 1 764 | 1 655 | 1 431 | 1 199 | 957 |
| COPERNIC H232.12-AR | 2,30 | 1 870 | 90 | 1 241 | 2,32 | 1 764 | 1 655 | 1 431 | 1 199 | 957 |
| COPERNIC V232.12-N-AR | 2,30 | 1 241 | 90 | 1 870 | 2,32 | 1 764 | 1 655 | 1 431 | 1 199 | 957 |
| COPERNIC V232.12-AR | 2,30 | 1 241 | 90 | 1 870 | 2,32 | 1 764 | 1 655 | 1 431 | 1 199 | 957 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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 | 0,774 | 4,729 | 0,005 | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bi-directional incidence angle | No | *Kϑ values are obligatory for 50°.* | | | | | | | | |
| Incidence angle modifiers Kθ(θ) | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
| | Kθ(θ) | | | | | 0,97 | | | | 0,00 |
| Incidence angle modifier not bi-directional - leave fields blank | | | | | | | | | | |
| | | | | | | | | | | |

| | | |
|---|---|---|
| Stagnation temperature - Weather conditions see note 2 | Tstg | 185 °C |
| Effective thermal capacity | ceff = C/Ag | 8,9 kJ/(m²K) |
| Max. intende operation temperature - see note 3 | Tmax,op | 200 °C |
| Max. operation pressure - see note 3 | pmax,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) | 0,004 | 0,006 | 0,011 | 0,015 | 0,019 | | | | | |
| Pressure drop, ΔP | Pa | 18 | 41 | 114 | 224 | 370 | | | | | |

| | | | | |
|---|---|---|---|---|
| Optional weather data | Location | | Link | |
| Testing Laboratory | CSTB/Instituto Giordano | | | |
| Website | http://www.cstb.fr / www.giodano.it | | | |
| Test report id. number | N° VAL 14-26049352 /N°296464/ | Date of test report | 24/10/2015 16/07/2012 | |

During the test GDIF/GTOT was always between 0,1 and 0,2

**Comments of testing laboratory:**

The Company HelioFrance has changed her certification body from ICIM to Eurovent Certita Certification. This certificate is established with the previous results used for the certification of the range COPERNIC H272 / V272 / H232 / V232 (report N°296464).

| | | | | | |
|---|---|---|---|---|---|
| *Note 1* | Flow rate | 0,019 | kg/(s m²) | Fluid | Water |
| *Note 2* | Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C | | | | |
| *Note 3* | Given by manufacturer | | | | |

Jean-Luc BUISSON CSTB

Datasheet version: 4.06 2014-01-15

| Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate | Licence Number | SK-0010 |
|---|---|---|
| | Issued | 26/10/2015 |

**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 |
| COPERNIC H272.12-N-AR | 3 275 | 2 195 | 1 368 | 2 383 | 1 565 | 948 | 1 779 | 1 089 | 630 | 1 942 | 1 179 | 671 |
| COPERNIC H272.12-AR | 3 275 | 2 195 | 1 368 | 2 383 | 1 565 | 948 | 1 779 | 1 089 | 630 | 1 942 | 1 179 | 671 |
| COPERNIC V272.12-N-AR | 3 275 | 2 195 | 1 368 | 2 383 | 1 565 | 948 | 1 779 | 1 089 | 630 | 1 942 | 1 179 | 671 |
| COPERNIC V272.12-AR | 3 275 | 2 195 | 1 368 | 2 383 | 1 565 | 948 | 1 779 | 1 089 | 630 | 1 942 | 1 179 | 671 |
| COPERNIC H232.12-N-AR | 2 898 | 1 942 | 1 210 | 2 108 | 1 385 | 839 | 1 573 | 963 | 557 | 1 718 | 1 043 | 593 |
| COPERNIC H232.12-AR | 2 898 | 1 942 | 1 210 | 2 108 | 1 385 | 839 | 1 573 | 963 | 557 | 1 718 | 1 043 | 593 |
| COPERNIC V232.12-N-AR | 2 898 | 1 942 | 1 210 | 2 108 | 1 385 | 839 | 1 573 | 963 | 557 | 1 718 | 1 043 | 593 |
| COPERNIC V232.12-AR | 2 898 | 1 942 | 1 210 | 2 108 | 1 385 | 839 | 1 573 | 963 | 557 | 1 718 | 1 043 | 593 |

| **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.

| Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate | Licence Number | SK-0010 |
|---|---|---|
| | Issued | 2015-10-26 |

| | | | |
|---|---|---|---|
| Company holding the | HELIOFRANCE | Country | France |
| Brand (optional) | COPERNIC H272 / V272 / H232 / V232 | Website | www.heliofrance.com |
| Street, street number | 2862 Route de Toulouse | E-mail | mykieta@heliofrance.com |
| Postal Code / City, province | 31370 Bérat | Tel/Fax | 33 561 444 689 -1 |

| | |
|---|---|
| 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) | No |

| Collector name | 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 |
|---|---|---|---|---|---|---|---|---|---|---|
| | m² | mm | mm | mm | m² | W | W | W | W | W |
| COPERNIC H272.12-N-AR | 2,60 | 2 192 | 90 | 1 241 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC H272.12-AR | 2,60 | 2 192 | 90 | 1 241 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC V272.12-N-AR | 2,60 | 1 241 | 90 | 2 192 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC V272.12-AR | 2,60 | 1 241 | 90 | 2 192 | 2,72 | 1 994 | 1 871 | 1 618 | 1 355 | 1 082 |
| COPERNIC H232.12-N-AR | 2,30 | 1 870 | 90 | 1 241 | 2,32 | 1 764 | 1 655 | 1 431 | 1 199 | 957 |
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| COPERNIC V232.12-AR | 2,30 | 1 241 | 90 | 1 870 | 2,32 | 1 764 | 1 655 | 1 431 | 1 199 | 957 |

| 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 | 0,774 | 4,729 | 0,005 | | | | | | |

| Bi-directional incidence angle | No | Kϑ values are obligatory for 50°. | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Incidence angle modifiers Kθ(θ) | Angle | 10° | 20° | 30° | 40° | 50° | 60° | 70° | 80° | 90° |
| | Kθ(θ) | | | | | 0,97 | | | | 0,00 |
| Incidence angle modifier not bi-directional - leave fields blank | | | | | | | | | | |
| | | | | | | | | | | |

| | | | |
|---|---|---|---|
| Stagnation temperature - Weather conditions see note 2 | Tstg | 185 | °C |
| Effective thermal capacity | ceff = C/Ag | 8,9 | kJ/(m²K) |
| Max. Intende operation temperature - see note 3 | Tmax,op | 200 | °C |
| Max. operation pressure - see note 3 | pmax,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) | 0,004 | 0,006 | 0,011 | 0,015 | 0,019 | | | | | |
| Pressure drop, ΔP | Pa | 18 | 41 | 114 | 224 | 370 | | | | | |

| Optional weather data | Location | | Link | |
|---|---|---|---|---|
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| Website | http://www.cstb.fr / www.giodano.it | | | |
| Test report id. number | N° VAL 14-26049352 /N°296464/ | Date of test report | 24/10/2015 16/07/2012 | |
| During the test GDIF/GTOT was always between | 0,1 | and | 0,2 | |

**Comments of testing laboratory:**

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|---|---|---|---|---|---|
| Note 1 | Flow rate | 0,019 | kg/(s m²) | Fluid | Water |
| Note 2 | Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C | | | | |
| Note 3 | Given by manufacturer | | | | |

Jean-Luc BUISSON CSTB

Data sheet version: 4.06 2014-01-15

| Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate | Licence Number | SK-0010 |
|---|---|---|
| | Issued | 26/10/2015 |

**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 |
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| COPERNIC H272.12-AR | 3 275 | 2 195 | 1 368 | 2 383 | 1 565 | 948 | 1 779 | 1 089 | 630 | 1 942 | 1 179 | 671 |
| COPERNIC V272.12-N-AR | 3 275 | 2 195 | 1 368 | 2 383 | 1 565 | 948 | 1 779 | 1 089 | 630 | 1 942 | 1 179 | 671 |
| COPERNIC V272.12-AR | 3 275 | 2 195 | 1 368 | 2 383 | 1 565 | 948 | 1 779 | 1 089 | 630 | 1 942 | 1 179 | 671 |
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| COPERNIC H232.12-AR | 2 898 | 1 942 | 1 210 | 2 108 | 1 385 | 839 | 1 573 | 963 | 557 | 1 718 | 1 043 | 593 |
| COPERNIC V232.12-N-AR | 2 898 | 1 942 | 1 210 | 2 108 | 1 385 | 839 | 1 573 | 963 | 557 | 1 718 | 1 043 | 593 |
| COPERNIC V232.12-AR | 2 898 | 1 942 | 1 210 | 2 108 | 1 385 | 839 | 1 573 | 963 | 557 | 1 718 | 1 043 | 593 |

| **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** |
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| 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 |
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