| Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate | Licence number | 011-7S1946 R |
|---|---|---|
| | Date of issue | 07.11.2013 |

| | | | | | |
|---|---|---|---|---|---|
| **Company** holding the licence | Kingspan Environmental Ltd. | **Country** | | United Kingdom |
| **Brand** (optional) | Thermomax | **Website** | | www.kingspanenviro.co.uk |
| **Street, number** | 180 Gilford Road | **E-mail** | | web@kingspanenviro.co.uk |
| **Postal Code** | BT63 5LF | **Tel.** | +44 | (0)28 3836 4400 |
| **City** | Portadown | **Fax** | +44 | (0)28 3836 4445 |

| | |
|---|---|
| **Collector Type** (flat plate / evacuate tubular / un-glazed) | Evacuated tubular collector |
| **Integration in the roof possible ?** | No |

| Collector name | Aperture area (Aa) [m²] | Gross length [mm] | Gross width [mm] | Gross height [mm] | Gross area (AG) [m²] | Power output per collector unit G = 1000 W/m², Tm-Ta : 0 K [W] | 10 K [W] | 30 K [W] | 50 K [W] | 70 K [W] |
|---|---|---|---|---|---|---|---|---|---|---|
| Thermomax DF 400 20 | 2.15 | 1 954 | 1 416 | 93 | 2.77 | 1 649 | 1 619 | 1 551 | 1 474 | 1 389 |
| Thermomax DF 400 30 | 3.22 | 1 954 | 2 125 | 93 | 4.15 | 2 473 | 2 428 | 2 327 | 2 212 | 2 083 |

| | | | |
|---|---|---|---|
| **Collector efficiency parameters related to aperture area (Aa)** Type of fluid and flow rate see note 1 | $\eta_{0a}$ | 0.768 | - |
| | $a_{1a}$ | 1.36 | W/(m²K) |
| | $a_{2a}$ | 0.0053 | W/(m²K²) |
| **Stagnation temperature** - Weather conditions see note 2 | $t_{stg}$ | 313 | °C |
| **Effective thermal capacity** | $c_{eff} = C/A_a$ | 8 | kJ/(m²K) |
| **Max. operation pressure - see note 3** | $p_{max}$ | 800 | kPa |

| Incidence angle modifiers $K_\theta(\theta)$ | | | $\theta_T$ / $\theta_L$ | 50° | 10° | 20° | 30° | 40° | 60° |
|---|---|---|---|---|---|---|---|---|---|
| | $K_{\theta d}$ | 0.88 | $K_\theta(\theta_T)$ | 0.99 | *1.00* | *1.02* | *1.04* | *1.05* | *0.85* |
| | | | $K_\theta(\theta_L)$ | 0.92 | *1.00* | *0.99* | *0.98* | *0.96* | *0.86* |
| | | | | | ***Optional values*** | | | | |

| | |
|---|---|
| **Testing Laboratory** | Institut für Solarenergieforschung Hameln |
| **Website** | www.isfh.de |
| **Test report id. number** | 46-12/KD; 90-12/KQ |
| **Date of test report** | 08.06.2012; 06.07.2012 |
| **Perf. test method** | EN 12975-2 6.1.5 (indoor) |

**Comments of testing laboratory** :

| | | | | | |
|---|---|---|---|---|---|
| Note 1 | **Fluid** | Water | **Flow rate** | 0.020 | kg/s per m² |
| Note 2 | **Irradiance, Gs=1000 W/m²; Ambient temperature , Ta=30 °C** | | | | |
| Note 3 | **Given by manufacturer** | | | | |

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VERSION 3.6, 2012.01.20

| Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate | Licence number | 011-7S1946 R |
|---|---|---|
| | Issued | 07.11.2013 |

**Annual collector output kWh**

| Collector name | Location and collector temperature (Tm) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 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 | | | |
| Thermomax DF 400 20 | 2 724 | 2 401 | 2 073 | 2 474 | 2 162 | 1 846 | 1 671 | 1 413 | 1 175 | 1 795 | 1 519 | 1 259 | | | |
| Thermomax DF 400 30 | 4 079 | 3 597 | 3 104 | 3 705 | 3 238 | 2 765 | 2 503 | 2 116 | 1 759 | 2 689 | 2 274 | 1 886 | | | |

| 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 |

Calculation of the annual collector performance is done by the official Solar Keymark spreadsheet tool. Hour by hour the collector output is calculated according to the efficiency parameters from the Keymark test using constant collector operating temperature (Tm). Detailed description with all equations used is available from the Solar Keymark web site (direct link: http://www.estif.org/solarkeymark/annexb1.php)

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Datasheet version:
VERSION 3.6, 2012.01.20
Calculation program version:
3.07, October 2011 (SP)