# Report of Performance Test according to EN 12975-2 for a Glazed Solar Collector

| | | |
|---|---|---|
| **Test Centre** | | |
| | Address | Institut für Solarenergieforschung GmbH, Hameln/Emmerthal<br>Am Ohrberg 1<br>31860 Emmerthal, Germany |
| | Contact person | Dipl.-Ing. C. Lampe<br>Tel.: +49 (0)5151/ 999-522<br>Fax: -500<br>E-Mail: Pruefstelle@isfh.de |
| **Test Basis** | | |
| | Test according to | EN 12975-2:2006<br>Section 6 |
| **Test Report** | | |
| | Number | 107-06/D |
| | Date | 02.11.2006 |
| | Number of pages | 19 |
| **Customer** | | |
| | Address | Thermomax Ltd.<br>Balloo Crescent<br>Bangor, BT 19 7UP<br>United Kingdom |
| | Contact person | Herr Carsten Onneken<br>Tel.: +44 2891 270-411, Fax: -572 |
| **Test Collector** | | |
| | Type | DF 100 30 |
| | Manufacturer | Thermomax Ltd. |
| | Serial- or Prototype | Serial type |
| | Year of production | 2006 |
| | Serial number | MB 08631 |

Deutscher Akkreditierungs Rat
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# Contents

**Institut für Solarenergieforschung GmbH**
**Hameln / Emmerthal**

**Test Centre for Solar Thermal Components and Systems**

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# 1. Summary

| | | | |
|---|---|---|---|
| Company: | **Thermomax Ltd.**<br>Balloo Crescent<br>Bangor, BT 19 7UP, United Kingdom | Report no.:<br>Report date: | 107-06/D<br>02.11.2006 |
| Type: | **DF 100 30** | Serial no.:<br>Year of production: | MB 08631<br>2006 |

The following results were obtained from a test of the thermal performance of a solar collector according to **EN 12975-2:2006**. They apply to the collector described more precisely in the test report no. 107-06/D and to the tests and procedures described herein.

## Description of the collector

| | | | |
|---|---|---|---|
| Type | evacuated tubular collector | Aperture area | 3.228 m² |
| Length/Width/Height | 1996 / 2127 / 97 mm | Absorber area | 3.020 m² |
| Max. operation pressure | 8 bar | Gross area | 4.245 m² |
| Weight, empty | 81.4 kg | Recommended flow rate | 60..150 kg/m²h |
| Heat transfer fluid | polypropylene | Thickness of absorber sheet | 0.12 mm |
| | | number of tubes | 30 |

## Test results

**Coefficients of efficiency**
(determined outdoor)

$$\eta = \eta_0 - a_1 \cdot (t_m - t_a)/G - a_2 \cdot (t_m - t_a)^2/G$$

| Based on: | aperture area | absorber area |
|---|---|---|
| $\eta_0$ = | 0.779 | 0.832 |
| $a_1$ = | 1.07 W/m²K | 1.14 W/m²K |
| $a_2$ = | 0.0135 W/m²K² | 0.0144 W/m²K² |

**Incident angle modifier**
(determined outdoor)

| proj. angle of incidence $\theta$ | 0° | 10° | 20° | 30° | 40° | 50° | 60° |
|---|---|---|---|---|---|---|---|
| $K_{\theta b,trans}(\theta_{trans})$ | 1.00 | 1.01 | 1.04 | 1.07 | 1.07 | 1.02 | 0.90 |
| $K_{\theta b,long}(\theta_{long})$ | 1.00 | 1.00 | 0.99 | 0.98 | 0.96 | 0.92 | 0.86 |

$K_{\theta d}$ = 0.90

**Power output per collector unit**

| $T_m - T_a$ | Irradiance 400 W/m² | 700 W/m² | 1000 W/m² |
|---|---|---|---|
| 10 K | 967 | 1721 | 2475 |
| 30 K | 863 | 1617 | 2371 |
| 50 K | 724 | 1478 | 2233 |

**Peak power per collector unit** — **2514 $W_{peak}$** at G = 1000 W/m² and $t_m - t_a$ = 0 K

**Pressure drop** (water, 20 °C)
$\Delta p$ = 1.2 mbar at $\dot{m}$ = 70.5 kg/h
$\Delta p$ = 5.9 mbar at $\dot{m}$ = 210.4 kg/h

**Thermal capacity** (calculated) c = 9.2 kJ/(m²K) C = 29.6 kJ/K

**Stagnation temperature** $t_{stg}$ = 286 °C at $G_S$ = 1000 W/m² and $t_{as}$ = 30 °C

Emmerthal, 02.11.2006 pp

Dipl.-Ing. C. Lampe, deputy head of Test Centre-EN

# 2. Description of the Collector

## 2.1. Collector

| | |
|---|---|
| Manufacturer | Thermomax Ltd.<br>Balloo Crescent; Bangor, BT 19 7UP;United Kingdom |
| Type | DF 100 30 |
| Construction | evacuated tubular collector, Serial type |
| Year of production | 2006 |
| Serial number | MB 08631 |
| Weight, empty, without glazing | 41.7 kg (according to manufacturer) |
| Weight, empty, with glazing | 81.4 kg (weighed at ISFH) |

## 2.2. Evacuated Tubes

| | |
|---|---|
| Number of tubes | 30 |
| Dimensions | 65 mm / 1.5 mm (outer diameter/ thickness) |
| Material | borosilicate glass, clear |
| Aperture area | 30 x 1735.7 mm x 62 mm = 3.228 m² |

## 2.3. Absorber

| | |
|---|---|
| Absorber material | copper sheet, thickness 0.12 mm (according to manufacturer) |
| Material of fluid tubes | copper |
| Connection between absorber and tubes | inductive welding |
| Hydraulic construction | parallel |
| Absorber layer | selective (TiNOX, type TiNOX) |
| Absorber dimensions | 30 x 1706.5 mm x 59 mm = 3.020 m² (according to manufacturer) |

## 2.4. Heat Transfer Fluid

| | |
|---|---|
| Specifications | polypropylene |
| Alternative acceptable heat transfer fluids | no details |
| Fluid content | 5.6 l (weighed at ISFH) |

## 2.5. Casing

| | |
|---|---|
| Dimensions (L / W / H) | 1996 / 2127 / 97 mm |
| Material of frame | aluminium profiles |

## 2.6. Insulation in the Distributor Casing

| | |
|---|---|
| Insulation construction | machine-cut foamed plastic |
| Insulation material | foamed melamine resin |

## 2.7. Reference Areas

| | |
|---|---|
| Absorber area | 3.020 m² |
| Aperture area | 3.228 m² |
| Gross area | 4.245 m² |

### 2.8. Collector Mounting

| | |
|---|---|
| Collector tilt angle | 0°..90° |
| On sloped roof | yes |
| Integrated into sloped roof | no |
| On flat roof | yes |
| On flat roof with stand | yes |
| Facade | yes |

## 3. Validity

1. This test report is valid for the collector DF 100 30 (description see section 2) with the serial number MB 08631.
2. According to the customers specifications the collector type DF 100 30 is distributed with the selective absorber layer type TiNOX (TiNOX) and type Sunselect (Alanod-Sunselect). In an agreement of the Erfahrungsaustauschkreis „Thermische Solaranlagen und deren Bauteile“(EK-TSuB) which consists of represantatives from all German-speaking test centres acknowledged by DIN CERTCO (Certification body of DIN) the test results of this two absorber layers are transverable (confirmed 21.03.2006). Therefore the report no. 107-06/D is also valid for the collector type DF 100 30 with the selective absorber layer type Sunselect (Alanod-Sunselect).

# 4. Photograph and Sketch of the Collector

Fig. 4-1: Picture of the collector, mounted in the sun simulator SUSI I


Fig. 4-2: Sketch of the collector

## 5. Sampling

| | |
|---|---|
| Date of sampling: | 29.03.2006 |
| Place of sampling: | Store of the company  Thermomax Ltd.; Bangor, BT 19 7UP; United Kingdom |
| Inspector: | Daniel Eggert (employee of the Test Centre) |
| Description of sampling:<br>The collector casing with the serial number MB 08631 and the evacuated tubes with the serial number C063LT00029, C063LT00031 and  C063LT00032 were chosen out of more than 6 identically products. The products were marked in the store and delivered to the test centre. The customer has proved with his quality management that the chosen products accord with the serial production. | |

## 6. Documents; Collector Identification

| | |
|---|---|
| Drawings: | The following drawings were presented by the customer<br>* sketch of the collector<br>* Top view<br>* Lateral view |
| Collector data sheet: | A data sheet with details about the tested collector was presented by the customer. |
| Labelling of the collector: | The test collector has a durable type label. The label is fixed inside the manifold lid to avoid early destruction. The manifold can be opened without any tool. The stagnation temperature isn´t printed on the label, because the determination will be carried out with this report. |
| Installer instruction manual: | The following documents were presented by the customer:<br>Installation manual (2006 B4815A)<br>Operatung manual (2006 B4986A) |

## 7. Installation of Sensors

The collector was equipped with temperature sensors (Pt 100, class A), as described in the following. Care was taken that the sensors do not influence the results of the following tests.

| Name of the sensor | Position |
|---|---|
| $t_{sm}$ | Absorber temperature sensor, at 2/3 of the height of the absorber tube, inside the 10th fluid tube (installed only during the exposure to irradiation) |
| $t_{glass}$ | Glass temperature sensor, at 2/3 of the height of the glass tube (10th tube from the left side) |
| $t_{back}$ | Backside temperature sensor (exactly beneath glass temperature sensor) |

## 8. Exposure to Irradiation

The empty collector was exposed to irradiation before the performance test.

Tab. 8-1: Test conditions during the exposure

Date: 26.04.2006 to 03.05.2006
Test facility: Tracker (outdoor test)
Inspector: Florian Kohlenberg (employee of the Test Centre)

| | Conditions stipulated in EN 12975-2 | Test conditions |
|---|---|---|
| Collector tilt angle | - | 45 ° |
| Solar irradiance | > 700 W/m² | ca. 984 W/m² |
| Ambient temperature, mean value | - | ca. 20.5 °C |
| Duration of exposure | > 5 h | 5 h |

**Result:**

The collector showed no changes during and after the exposure test.

## 9. Determination of the Stagnation Temperature

The determination of the stagnation temperature is carried out in the report 32-06/D with the collector type Solar Plus DF 20. The results are also valid for the collector type DF 100 30, because the difference between those collector types is only the number of tubes and has got no influence on the stagnation temperature.

During the exposure to irradiation (see section 8), the stagnation temperature of the collector was determined.

## 9.1. Mathematical Procedure[a]

$$t_{stg} = a \cdot G_s^{\frac{1}{1.3}} + t_{as} \qquad \text{eqn. (9.1)}$$

$t_{stg}$ = stagnation temperature under standard conditions in °C
$G_s$ = standard global irradiance
$t_{as}$ = standard ambient temperature

$$a = \frac{(t_{sm} - t_{am})}{G_m^{1/1.3}} \qquad \text{eqn. (9.2)}$$

$t_{sm}$ = measured absorber temperature in °C
$t_{am}$ = measured ambient temperature in °C
$G_m$ = measured global irradiance (in the collector plane) in W/m²

## 9.2. Test Conditions and Results

Date: 05.04.2006
Test facility: SUSI I (indoor test with sun simulator)
Inspector: Gerd Schiewe (employee of the Test Centre)
Collector tilt angle: 45°

| | Test conditions | Standard conditions according to ISO 9806-2 | |
|---|---|---|---|
| | | Class A (temperate), corresponding to conditions stipulated in EN 12975-2 | Class B (sunny) |
| Global irradiance | 895 W/m² | 1000 W/m² | 1100 W/m² |
| Surrounding air speed | < 1 m/s | < 1 m/s | < 1 m/s |
| Ambient temperature | 30.1 °C | 30 °C | 40 °C |
| Measured absorber temperature ($t_{sm}$) | 264.9 °C | | |
| **Calculated stagnation temperature ($t_{stg}$)** | | **286 °C** | 315 °C |

a. For the calculation of the stagnation temperature under standard conditions, the eqns. (9.1) and (9.2) are used, as this method has a lower uncertainty than the procedure described in EN 12975-2.

# 10. Instantaneous Collector Efficiency

## 10.1. Test Procedure

Outdoor thermal performance testing under steady state conditions (see EN 12975-2, section 6.1.4).

## 10.2. Mathematical Description

$$\eta = \eta_0 - a_1 \cdot \frac{t_m - t_a}{G} - a_2 \cdot \frac{(t_m - t_a)^2}{G} \qquad \text{eqn. (10.1)}$$

| | |
| --- | --- |
| $\eta$ | = efficiency |
| $\eta_0$ | = efficiency for $t_m - t_a = 0$ (conversion factor) |
| $a_1$ | = heat loss coefficient, independent of temperature, in W/m²K |
| $a_2$ | = heat loss coefficient, depending on temperature, in W/m²K² |
| G | = global irradiance in W/m² |
| $t_m$ | = mean fluid temperature in the collector in °C, $t_m := (t_{in} + t_e)/2$ |
| $t_{in}$ | = collector inlet temperature in °C |
| $t_e$ | = collector outlet temperature in °C |
| $t_a$ | = ambient temperature in °C |
| $T_m^*$ | = reduced temperature difference, in m²K/W |

## 10.3. Test Conditions and Results

The test conditions are shown in table 10-1. All measured data are given in table A-1 in the appendix.

Tab. 10-1: Test conditions of the efficiency measurements

Date: 03.05.2006 and 05.05.2006
Test facility: Tracker (outdoor)
Inspector: Florian Kohlenberg (employee of the Test Centre)
Heat transfer fluid: water

| | Conditions stipulated in EN 12975-2 | Test conditions |
|---|---|---|
| Collector tilt angle | 40...50° | 45° |
| Mean global irradiance | > 700 W/m² | 985.0 W/m² |
| Mean ambient temperature | - | 22.3 °C |
| Mean air speed over the collector | 3 m/s ± 1 m/s | 2 m/s |
| Mass flow rate of the heat transfer fluid | 0.02 kg/(m²s)<br>or according to manufacturer | 225 kg/h |

Tab. 10-2: Coefficients of the efficiency curve, related to different areas

| Related to area: | $\eta_0$ | $a_1$ | $a_2$ |
|---|---|---|---|
| **Aperture area (3.228 m²)** | **0.779** | **1.07 W/m²K** | **0.0135 W/m²K²** |
| Absorber area (3.020 m²) | 0.832 | 1.14 W/m²K | 0.0144 W/m²K² |
| Gross area (4.245 m²) | 0.592 | 0.81 W/m²K | 0.0102 W/m²K² |

Note:

If the parameters are given in the documents of the collector, the area to which they are related must be mentioned.

The power curve per collector unit for G = 1000 W/m² is given on page 18.

# 11. Incident Angle Modifier of the Collector

## 11.1. Test Procedure

The collector is mounted on the outdoor test facility (Tracker), facing south in a fixed position. The variation of the incident angle is achieved by the sun's path over the collector. The vacuum tube collector on hand shows a biaxial incident angle dependence. So, after determination of the transversal incident angle modifier the collector is turned by 90°, and the longitudinal incident angle modifier is determined in a second measurement. The incident angle modifiers for direct radiation and for diffuse radiation are determined separately.

## 11.2. Mathematical Description

$$K_{\theta b}(\theta) = \frac{F'(\tau\alpha)_{en}(\theta)}{F'(\tau\alpha)_{en}} \qquad \text{eqn. (11.1)}$$

$K_{\theta b}(\theta)$ = incident angle modifier for beam radiation as a function of the incident angle $\theta$

$F'(\tau\alpha)_{en}$ = conversion factor for pure beam radiation at normal incidence

$F'(\tau\alpha)_{en}(\theta)$ = conversion factor for pure beam radiation as a function of the incident angle $\theta$

The incident angle modifier for beam radiation must be split into a transversal and a longitudinal component:

$$K_{\theta b}(\theta) = K_{\theta b,\,trans}(\theta_{trans}) \cdot K_{\theta b,\,long}(\theta_{long}) \qquad \text{eqn. (11.2)}$$

$\theta_{trans}$ = transversal incident angle

$\theta_{long}$ = longitudinal incident angle

## 11.3. Test Conditions and Results

Tab. 11-1: Test conditions during the measurement of the incident angle modifier

| | | |
|---|---|---|
| Date: | 06.05.2006 to 12.05.2006 | |
| Test facility: | Tracker (outdoor) | |
| Inspector: | Florian Kohlenberg (Mitarbeiter des Prüfzentrums) | |
| Heat transfer fluid: | water | |
| | Conditions stipulated in EN 12975-2 | Test conditions |
| Collector tilt angle | 40...50° | 34.5°[1)] |
| Collector azimuth angle | - | 0° (south) |
| Mass flow rate $\dot{m}$ | 0.02 kg/(m²s)<br>or according to manufacturer | 223 kg/h |
| Latitude | - | 52.1° N |
| Longitude | - | 9.4° E |
| Local time (MEZ) at solar noon | - | 12:20 |

1) This tilt angle was selected in order to achieve the best approximation of normal irradiance. The tilt angle is only insignificantly below the smallest demanded value. The influence of the tilt angle on the collector performance is assessed to be minimal in this range of angles.

Tab. 11-2: Incident angle modifier

| $\theta_{trans}$ or $\theta_{long}$ | 0° | 10° | 20° | 30° | 40° | 50° | 60° |
|---|---|---|---|---|---|---|---|
| $K_{\theta b,trans}(\theta_{trans})$ | 1.00 | 1.01 | 1.04 | 1.07 | 1.07 | 1.02 | 0.90 |
| $K_{\theta b,long}(\theta_{long})$ | 1.00 | 1.00 | 0.99 | 0.98 | 0.96 | 0.92 | 0.86 |
| $K_{\theta d}$ | 0.90 | | | | | | |

Nomenclature

$\theta_{trans}$ = transversal incident angle
$\theta_{long}$ = longitudinal incident angle
$K_{\theta b}(\theta)$ = incident angle modifier for beam radiation as a function of the incident angle $\theta$
$K_{\theta d}$ = incident angle modifier for diffuse radiation

## 12. Thermal Capacity of the Collector

The thermal capacity of the collector is calculated according to EN 12975-2, as the sum of the capacities of its constituent elements, taking into account weighting factors. These weighting factors evaluate that some elements are only partially involved in the thermal inertia of the collector.

$$C = \sum p_i \cdot m_i \cdot c_i \qquad \text{eqn. (12.1)}$$

| | |
|---|---|
| $C$ | = effective thermal capacity of the collector in kJ/K |
| $p_i$ | = weighting factor of the component (according to tabular 6 in EN 12975-2:2001, chapter 6.1.6.2) |
| $m_i$ | = Mass of the component in kg |
| $c_i$ | = specific thermal capacity of the component kJ/(kgK) |

### 12.1. Result

Date: 20.07.2006
Inspector: Wolfgang Wetzel

| | calculated according to EN 12975-2 |
|---|---|
| effective thermal capacity | 29.6 kJ/K |
| specific thermal capacity related to the aperture area | 9.2 kJ/(m²K) |

## 13. Pressure Drop across the Collector

### 13.1. Test Procedure

The pressure drop is measured at different mass flow rates according to EN 12975-2, chapter 6.1.8.

### 13.2. Test Conditions and Results

Tab. 13-1: Results of the pressure drop measurements

| | |
|---|---|
| Date: | 26.06.2006 |
| Test facility: | Δp-test facility with U-tube differential pressure gauge |
| Inspector: | Gerd Schiewe (employee of the Test Centre) |
| Heat transfer Fluid: | water |
| Fluid temperature: | 20 ± 2°C |

| | | | | | |
|---|---|---|---|---|---|
| Mass flow rate in kg/h | 29.5 | 70.5 | 129.6 | 210.4 | 299.8 |
| Pressure drop in mbar | 0.4 | 1.2 | 2.8 | 5.9 | 10.4 |

Compared to the measurement using water, the pressure drop will be markedly higher when using a water-glycol mixture as heat transfer fluid, because its viscosity is much higher.

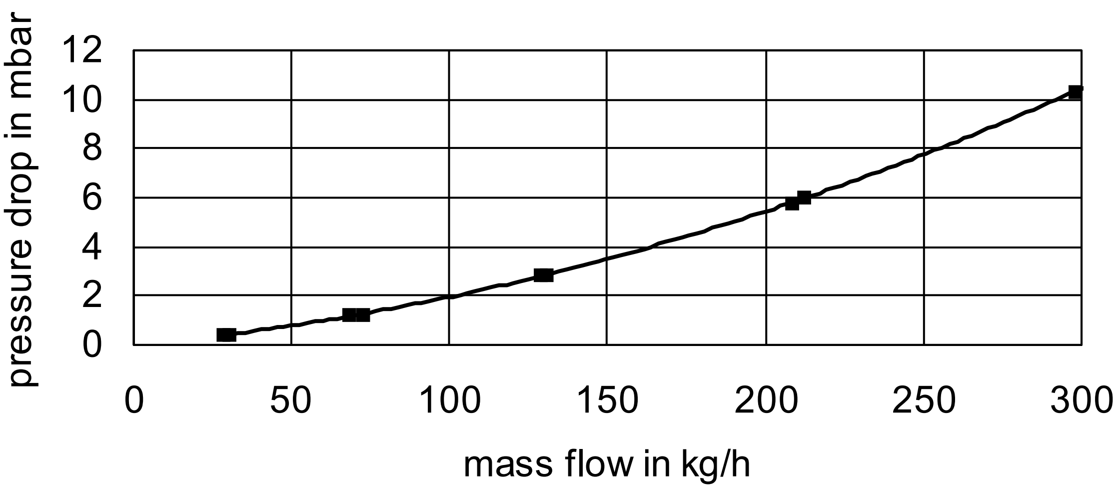


Fig. 13-1: Measured pressure drop of the collector (heat transfer fluid: water)

## 14. Observations; Status of the Collector

Status of the collector after

* delivery: faultless
* exposure to irradiation: no change
* performance test: no change
* end of tests: no change

There were no extraordinary incidents during the tests.

No sharp edges, loose fixing elements or other characteristics representing a possible endangering were observed.

## 15. Stipulations from the Test Centre

Prior to passing on to others or reproducing parts of this test report, permission must be obtained. Passing on the single pages 3, 18 and 19 or the coherent pages 1 to 16 or the complete test report is generally approved.

Test Centre for Solar Thermal

Components and Systems

pp

Dipl.-Ing. C. Lampe

deputy head of Test Centre-EN

CLa/02.11.2006
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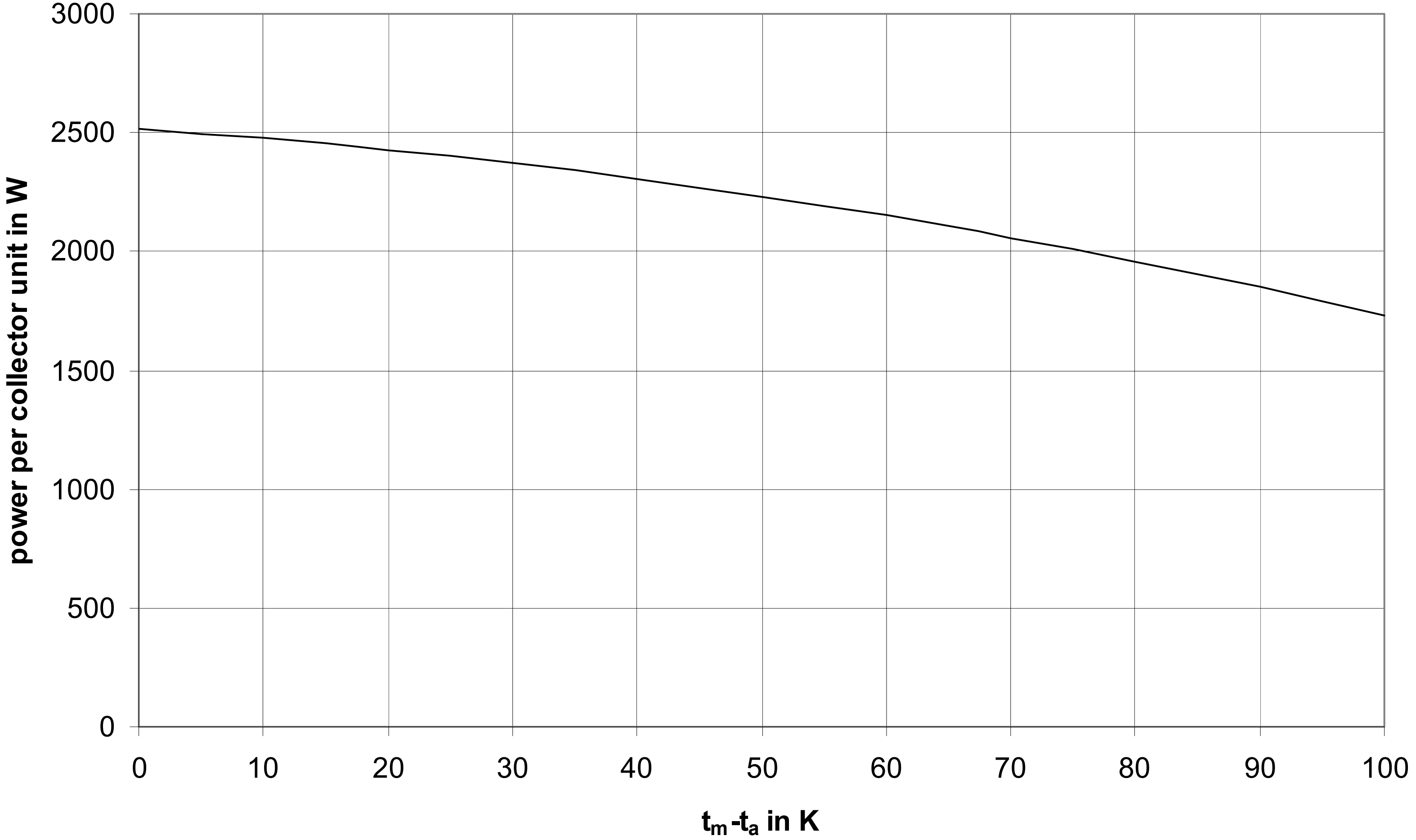
Table A-1: Measured and Calculated Data from the Efficiency Tests, Related to the Aperture Area

| No. | G | $\dot{m}$ | $t_{in}$ | $t_e$ | $t_e - t_{in}$ | $t_m$ | $t_a$ | $t_m - t_a$ | $T^*_m$ | $\eta_a$ |
|---|---|---|---|---|---|---|---|---|---|---|
| - | W/m² | kg/h | °C | °C | K | °C | °C | K | Km²/W | - |
| 1 | 949.4 | 221.5 | 39.6 | 48.5 | 8.9 | 44.0 | 23.4 | 20.6 | 0.0217 | 0.749 |
| 2 | 940.1 | 221.9 | 39.5 | 48.4 | 8.8 | 44.0 | 23.2 | 20.7 | 0.0220 | 0.749 |
| 3 | 927.2 | 222.6 | 39.5 | 48.2 | 8.7 | 43.9 | 23.2 | 20.7 | 0.0223 | 0.748 |
| 4 | 923.8 | 223.1 | 39.5 | 48.1 | 8.5 | 43.8 | 23.1 | 20.7 | 0.0224 | 0.742 |
| 5 | 1016.3 | 221.1 | 76.5 | 85.0 | 8.6 | 80.7 | 23.1 | 57.6 | 0.0567 | 0.674 |
| 6 | 1039.2 | 226.5 | 77.1 | 85.6 | 8.5 | 81.4 | 21.5 | 59.9 | 0.0576 | 0.672 |
| 7 | 1041.5 | 226.2 | 77.2 | 85.7 | 8.6 | 81.5 | 21.5 | 59.9 | 0.0575 | 0.671 |
| 8 | 1036.3 | 226.2 | 77.2 | 85.7 | 8.5 | 81.5 | 22.0 | 59.5 | 0.0574 | 0.671 |
| 9 | 983.2 | 222.5 | 58.6 | 67.0 | 8.4 | 62.8 | 24.0 | 38.8 | 0.0395 | 0.687 |
| 10 | 972.5 | 225.4 | 58.5 | 67.1 | 8.6 | 62.8 | 24.0 | 38.9 | 0.0400 | 0.718 |
| 11 | 891.0 | 228.1 | 58.5 | 66.2 | 7.7 | 62.4 | 23.6 | 38.8 | 0.0435 | 0.706 |
| 12 | 917.8 | 228.1 | 58.5 | 66.3 | 7.8 | 62.4 | 23.7 | 38.7 | 0.0422 | 0.698 |
| 13 | 1005.4 | 232.7 | 18.6 | 28.1 | 9.5 | 23.3 | 25.0 | -1.7 | -0.0017 | 0.788 |
| 14 | 1010.8 | 232.7 | 18.6 | 28.1 | 9.5 | 23.3 | 25.2 | -1.9 | -0.0018 | 0.783 |
| 15 | 1014.1 | 223.1 | 15.4 | 25.1 | 9.7 | 20.3 | 18.5 | 1.7 | 0.0017 | 0.770 |
| 16 | 1019.3 | 223.1 | 15.4 | 25.2 | 9.8 | 20.3 | 18.7 | 1.6 | 0.0016 | 0.770 |

Nomenclature:

| | | |
|---|---|---|
| G | W/m² | hemispherical (= global) solar irradiance in the collector plane |
| $\dot{m}$ | kg/h | mass flow rate of the heat transfer fluid |
| $t_{in}$, $t_e$ | °C | collector inlet temperature and collector outlet (exit) temperature |
| $t_m$ | °C | mean temperature of heat transfer fluid, $t_m$: = ($t_{in}$ + $t_e$)/2 |
| $t_a$ | °C | ambient temperature |
| $T^*_m$ | (m²K)/W | reduced temperature difference, $T^*_m$ = ($t_m$ - $t_a$)/G |
| $\eta_a$ | - | collector thermal efficiency, related to the aperture area |

# Power Curve for G = 1000 W/m², Related to Collector Unit




| | |
|---|---|
| Company: | Thermomax Ltd. |
| Collector type: | DF 100 30 |
| Serial No.: | MB 08631 |
| Aperture area: | 3.228 m² |

Solar collector test

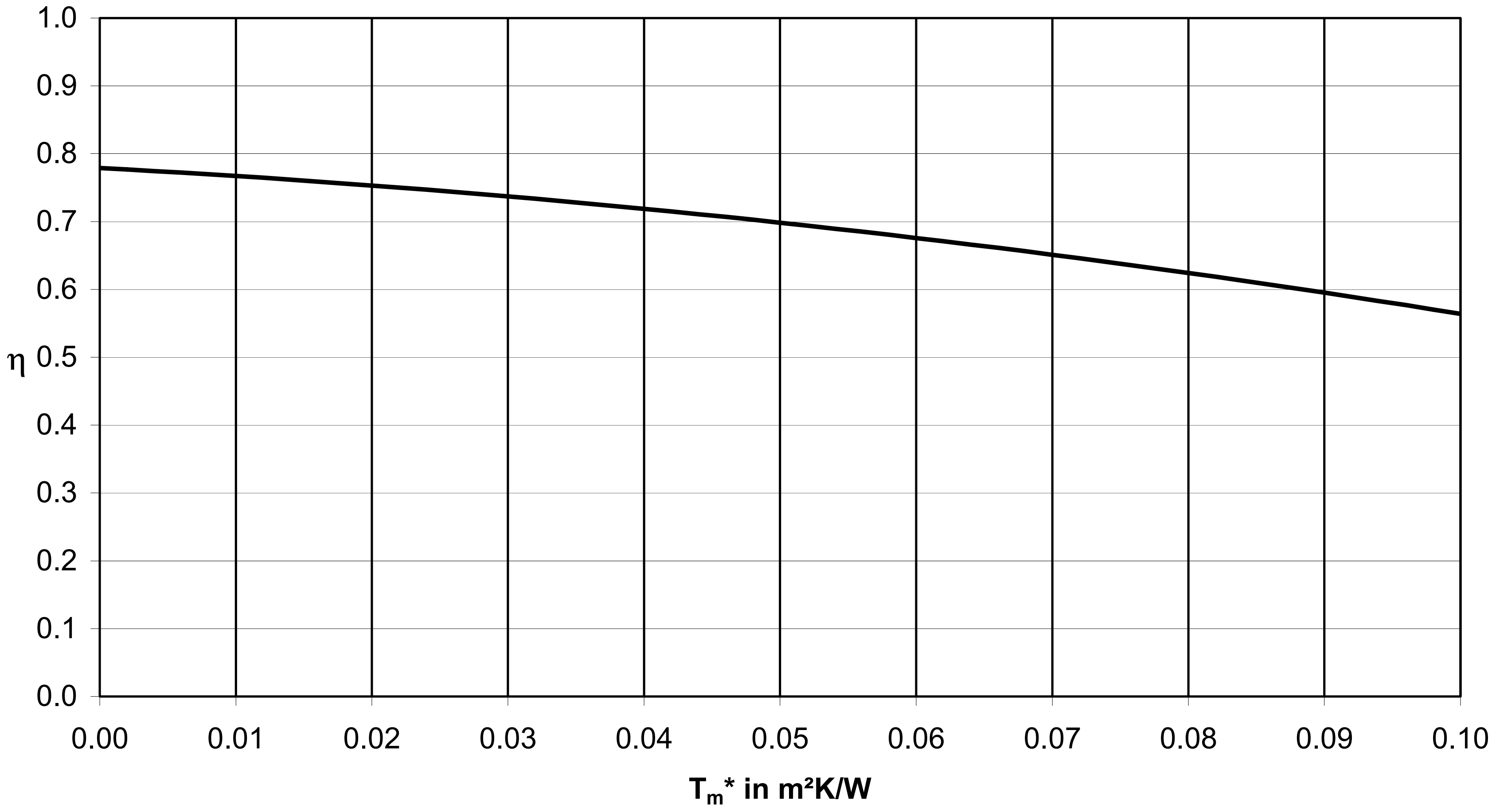
according to EN 12975-2

ISFH

Report date: 02.11.2006

Report no.: 107-06/D

## Collector Efficiency Curve for G = 800 W/m², Related to the Aperture Area




| | | | |
|---|---|---|---|
| Company: | Thermomax Ltd. | **Solar collector test** | Report date: 02.11.2006 |
| Collector type: | DF 100 30 | according to EN 12975-2 | Report no.: 107-06/D |
| Serial No.: | MB 08631 | | Page 19 of 19 |
| Aperture area: | 3.228 m² | | |