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Annex to Solar Keymark Certificate

Licence Number	**011-7S2253 F**
Date issued	**2019-01-25**
Issued by	**TÜV Rheinland Energy GmbH**

Licence holder	**NEUMA-Solar GmbH**	**Country**	Austria
Brand (optional)		**Web**	www.neuma-solar.at
Street, Number	Wolfgangstein 7	**E-mail**	office@neuma-solar.at
Postcode, City	4550 Kremsmünster	**Tel**	+43 7583 50356

Collector Type	Flat plate collector

Collector name	**Gross height**	**Gross area (A_G)**	**Gross length**	**Gross width**	**Aperture area (A_a)**	**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	100 K
	mm	m²	mm	mm	m²	W	W	W	W	W	W
GOLIATH Premium MF 2,4m²	92	2.40	2 003	1 200	2.04	1 554	1 463	1 271	1 063	840	476
Power output per m² gross area						647	610	529	443	350	198

Performance parameters test method	Quasi dynamic									
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	0.652	3.69	0.008	0.000	0.00	8 234	0.000	0.00	0.0E+00	0.95

Incidence angle modifier test method		Quasi dynamic - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	0.99	0.97	0.94	0.89	0.81	0.63	0.31	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	0.99	0.97	0.94	0.89	0.81	0.63	0.31	0.00

Heat transfer medium for testing		Water	
Flow rate for testing (per gross area, A_G)		dm/dt	0.020 kg/(sm²)
Maximum temperature difference during thermal performance test		$(\vartheta_m-\vartheta_a)_{max}$	70 K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)		ϑ_{stg}	180 °C
Maximum operating temperature		$\vartheta_{max\ op}$	n.n. °C
Maximum operating pressure		$p_{max,op}$	1000 kPa

Testing laboratory	AIT Austrian Institute of Technology	www.ait.ac.at	
Test report(s)	2.04.01072.1.0-1-QT	**Dated**	18.09.2013
	2.04.01072.1.0-1-QT		18.09.2013
	2.04.01072.1.0-1-QT		18.09.2013

Comments of testing laboratory — Datasheet version: 6.0, 2018-10-30

The original thermal performanceparameters were recalculated from apertur to gross as reference area.

TÜVRheinland® Genau. Richtig.
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Supplementary Information	Issued	2019-01-25

Annual collector output in kWh/collector at mean fluid temperature ϑ_m

Standard Locations	Athens			Davos			Stockholm			Würzburg		
Collector name ϑ_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
GOLIATH Premium MF 2,4m²	2 446	1 643	1 007	1 792	1 169	687	1 330	817	465	1 456	884	493
Annual output per m² gross area	1 019	685	420	747	487	286	554	341	194	607	368	205
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1714 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. 6.0 (October 2018). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc

Additional Information

Collector heat transfer medium					Water-Glycole	
The collector is deemed to be suitable for roof integration					Yes	
The collector was tested successfully under the following conditions:						
Climate class (A+, A, B or C)					B	--
G (W/m²) >	900	ϑ_a (°C) >	15	H_x (MJ/m²) >		540
Maximum tested positive load					2400	Pa
Maximum tested negative load					1100	Pa
Hail resistance using steel ball (maximum drop height)					-	m

Additional collector attribute(s)

- ☐ Using external power source(s) for normal operation
- ☐ Co-generating thermal and electrical power
- ☐ Façade collector(s)
- ☐ Active or passive measure(s) for self-protection
- ☐ Wind and/or infrared sensitive collector(s) (WISC)

Energy Labelling Information

	Reference Area, A_{sol} (m²)	Hydraulic Designation Code
GOLIATH Premium MF 2,4m²	2.40	5,5-V-12V-A:7,1810-C:16,1060

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}	
Collector efficiency (η_{col})	49%

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.

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}		
Zero-loss efficiency (η_0)	0.65	--
First-order coefficient (a_1)	3.69	W/(m²K)
Second-order coefficient (a_2)	0.008	W/(m²K²)
Incidence angle modifier IAM (50°)	0.89	--

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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