


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2017 Test Results						Licence Number		011-7S2827 R							
						Date issued		2018-06-06							
						Issued by		TÜV Rheinland Energy GmbH							
Licence holder		Ako Tec Produktionsgesellschaft mbH				Country		Germany							
Brand (optional)		Ako Tec				Web		www.akotec.eu							
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Postcode, City		16278 Angermünde				Tel		+49 (0)3331 25 716 30							
Collector Type						Evacuated tubular collector									
Collector name					Power output per collector G <sub>b</sub> = 850 W/m <sup>2</sup> ; G <sub>d</sub> = 150 W/m <sup>2</sup> ; u = 3 m/s ∅ <sub>m</sub> - ∅ <sub>a</sub>										
					0 K	10 K	30 K	50 K	70 K	90 K					
					m <sup>2</sup>	mm	mm	mm	W	W	W	W	W	W	
MEGA-Kollektor Segment mit 26 Röhren					4.33	1 983	2 184	159	2 147	2 121	2 070	2 019	1 968	1 916	
MEGA-Kollektor Segment mit 78 Röhren					12.99	5 950	2 184	159	6 440	6 363	6 210	6 056	5 903	5 749	
Power output per m <sup>2</sup> gross area									496	490	478	466	454	443	
Performance parameters test method						Quasi dynamic									
Performance parameters (related to AG)						η <sub>0,b</sub>	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	c <sub>6</sub>	K <sub>d</sub>			
Units						-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	s/m	-			
Test results						0.487	0.591	0.000	0.000	0.000	0.000	1.120			
Incidence angle modifier test method						Quasi dynamic - outdoor									
Bi-directional incidence angle modifiers						Yes									
Incidence angle modifier						Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal						K <sub>θT, coll</sub>	1.25	1.26	1.26	1.07	1.21	1.16	1.13	0.92	0.00
Longitudinal						K <sub>θL, coll</sub>	1.00	1.00	0.99	0.98	0.97	0.94	0.89	0.44	0.00
Heat transfer medium for testing						Water									
Flow rate for testing (per gross area, A <sub>G</sub> )						dm/dt	0.036	kg/(sm <sup>2</sup> )							
Maximum temperature difference for thermal performance calculations						(∅ <sub>m</sub> -∅ <sub>a</sub> ) <sub>max</sub>	90	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ∅ <sub>a</sub> = 30 °C)						∅ <sub>stg</sub>	170	°C							
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )						C/m <sup>2</sup>	8.136	kJ/(Km <sup>2</sup> )							
Maximum operating temperature						∅ <sub>max, op</sub>	180	°C							
Maximum operating pressure						p <sub>max, op</sub>	1000	kPa							
Testing laboratory						TÜV Rheinland Energy GmbH			http://www.tuv.com/solarpower						
Test report(s)						21242732.001			Dated		30.05.2018				
Comments of testing laboratory						Datashet version: 5.01, 2016-03-01									
The collector was tested according to EN ISO 9806:2017. As the data sheet is not transferred to the nomenclature of the latest edition, the old nomenclature was used in this data sheet without any impact on results.						 Genau. Richtig. TÜV Rheinland Energy GmbH Am Grauen Stein 51105 Köln									
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	<b>Issued</b>	<b>2018-06-06</b>

**Annual collector output in kWh/collector at mean fluid temperature  $\vartheta_m$ , based on EN ISO 9806:2013 test results**

Standard Locations Collector name	$\vartheta_m$	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
MEGA-Kollektor Segment mit 26 Röhren		4 241	3 977	3 730	3 761	3 510	3 281	2 698	2 474	2 282	2 880	2 645	2 435
MEGA-Kollektor Segment mit 78 Röhren		12 722	11 932	11 189	11 282	10 531	9 843	8 095	7 423	6 845	8 640	7 934	7 306
Annual output per m <sup>2</sup> gross area		979	919	861	869	811	758	623	571	527	665	611	562
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1714 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>		
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  $\vartheta_m$  (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 5.01 (March 2016). A detailed description of the calculations is available at [www.solarkeymark.org/scenocalc](http://www.solarkeymark.org/scenocalc)

**Additional Information**

Collector heat transfer medium	Water-Glycole	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	A	--
Maximum tested positive load	3000	Pa
Maximum tested negative load	2000	Pa
Hail resistance using ice balls (diameter)	35	mm

**Energy Labelling Information**

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
MEGA-Kollektor Segment mit 26 Röhren	4.33	Collector efficiency ( $\eta_{col}$ )	47 %
MEGA-Kollektor Segment mit 78 Röhren	12.99	Remark: Collector efficiency ( $\eta_{col}$ ) 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/m <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.	
		<b>Data required for CDR (EU) No 812/2013 - Reference Area <math>A_{sol}</math></b>	
		Zero-loss efficiency ( $\eta_0$ )	0.496 --
		First-order coefficient ( $a_1$ )	0.59 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.000 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	1.05 --
		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.	
The collector was tested according to EN			