


Annex to Solar Keymark Certificate						Licence Number		011-7S2918 F					
						Date issued		2019-02-15					
						Issued by		TÜV Rheinland Energy GmbH					
Licence holder		ökoTech Solarkollektoren GmbH				Country		Austria					
Brand (optional)		ökoTech				Web		www.oekotech.biz					
Street, Number		Gradnerstr. 54/C				E-mail		technik@oekotech.biz					
Postcode, City		A-8055 Graz				Tel		+43 316-576077-22					
Collector Type						Flat plate collector							
Collector name		Gross height mm	Gross area ( $A_G$ ) m <sup>2</sup>	Gross length mm	Gross width mm	Aperture area ( $A_a$ ) m <sup>2</sup>	Power output per collector $G_b = 850 \text{ W/m}^2, G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$						
							0 K W	10 K W	30 K W	50 K W	70 K W	100 K W	
ökoTech GS <sup>2</sup> *		127	4.26	2 050	2 076	3.80	2 864	2 706	2 371	2 013	1 631	1 013	
ökoTech GS <sup>2</sup> *		127	16.95	2 353	7 173	15.23	11 395	10 765	9 435	8 009	6 489	4 030	
Power output per m <sup>2</sup> gross area							672	635	557	473	383	238	
Performance parameters test method		Quasi dynamic											
Performance parameters (related to $A_G$ )		$\eta_{0, b}$	a1	a2	a3	a4	a5	a6	a7	a8	Kd		
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-		
Test results		0.679	3.65	0.007	0.000	0.00	23 299	0.000	0.00	0.0E+00	0.93		
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	1.00	0.99	0.98	0.97	0.95	0.90	0.45	0.00		
Longitudinal		$K_{\theta L, coll}$	1.00	1.00	0.99	0.98	0.97	0.95	0.90	0.45	0.00		
Heat transfer medium for testing						Water							
Flow rate for testing (per gross area, $A_G$ )						dm/dt	0.032	kg/(sm <sup>2</sup> )					
Maximum temperature difference during thermal performance test						$(\vartheta_m - \vartheta_a)_{max}$	70	K					
Standard stagnation temperature ( $G = 1000 \text{ W/m}^2; \vartheta_a = 30 \text{ °C}$ )						$\vartheta_{stg}$	210	°C					
Maximum operating temperature						$\vartheta_{max, op}$	200	°C					
Maximum operating pressure						$p_{max, op}$	600	kPa					
Testing laboratory		TÜV Rheinland Energy GmbH				www.tuv.com/solarenergy							
Test report(s)		21243777.001				Dated		15.02.2019					
Comments of testing laboratory						Datasheet version: 6.0, 2018-10-30							
<p>* The collector family ökoTech GS<sup>2</sup> includes module sizes in different specific dimensions up to a gross area of more than 20 m<sup>2</sup>.</p> <p>The efficiency parameter related to an aperture area of <math>A_a = 3.80 \text{ m}^2</math> are <math>\eta_{0, hem, a} = 0.752;</math>  <math>a_{1a} = 4.085;</math> <math>a_{2a} = 0.007.</math></p>						 TÜV Rheinland Energy GmbH Am Grauen Stein 51105 Köln							

Annex to Solar Keymark Certificate							Licence Number		011-7S2918 F				
Supplementary Information							Issued		2019-02-15				
Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$													
	Standard Locations	Athens			Davos			Stockholm			Würzburg		
Collector name	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
ökoTech GS <sup>2</sup> *		4 647	3 222	2 072	3 459	2 343	1 458	2 561	1 632	973	2 792	1 765	1 035
ökoTech GS <sup>2</sup> *		18 490	12 819	8 246	13 765	9 323	5 800	10 191	6 493	3 872	11 111	7 022	4 118
Annual output per m <sup>2</sup> gross area		1 091	756	486	812	550	342	601	383	228	656	414	243
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. 6.0 (October 2018). A detailed description of the calculations is available at <a href="http://www.solarkeymark.org/scenocalc">www.solarkeymark.org/scenocalc</a>													
<b>Additional Information</b>													
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)							A			--			
G (W/m <sup>2</sup> ) >	1000		$\vartheta_a$ (°C) >		20		$H_x$ (MJ/m <sup>2</sup> ) >			600			
Maximum tested positive load							4500			Pa			
Maximum tested negative load							3000			Pa			
Hail resistance using ice balls (diameter)							-			mm			
<b>Additional collector attribute(s)</b>													
<input type="checkbox"/> Using external power source(s) for normal operation				<input type="checkbox"/> Active or passive measure(s) for self-protection									
<input type="checkbox"/> Co-generating thermal and electrical power				<input type="checkbox"/> Wind and/or infrared sensitive collector(s) (WISC)									
<input type="checkbox"/> Façade collector(s)													
<b>Energy Labelling Information</b>													
	Reference Area, $A_{sol}$ (m <sup>2</sup> )				Hydraulic Designation Code								
ökoTech GS <sup>2</sup> *	4.26				4,3,4,3-VH-23S-A:9,1940-C:26,1950								
ökoTech GS <sup>2</sup> *	16.95				16-H-12S-A:9,6940-C:26,2230								
Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$													
Collector efficiency ( $\eta_{col}$ )	52%				Zero-loss efficiency ( $\eta_0$ )				0.67		--		
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 9806:2017.	First-order coefficient ( $a_1$ )				3.65				W/(m <sup>2</sup> K)				
	Second-order coefficient ( $a_2$ )				0.007				W/(m <sup>2</sup> K <sup>2</sup> )				
	Incidence angle modifier IAM (50°)				0.96				--				
	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.												
DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany													
Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: <a href="mailto:info@dincertco.de">info@dincertco.de</a> • <a href="http://www.dincertco.de">www.dincertco.de</a>													