


<b>Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results</b>					<b>Licence Number</b>		<b>TSU 001-17/D</b>				
					<b>Date issued</b>		<b>2017-04-24</b>				
					<b>Issued by</b>		<b>TSU Piešťany, š.p.</b>				
<b>Licence holder</b>	<b>GREEN ENERGY SAVE GROUP, d.o.o.</b>				<b>Country</b>	<b>Serbia</b>					
<b>Brand (optional)</b>					<b>Web</b>	<b>www.gesg.rs</b>					
<b>Street, Number</b>	<b>Sumadijska 16A</b>				<b>E-mail</b>	<b>rajko.bojicic@gesg.rs</b>					
<b>Postcode, City</b>	<b>Novi Sad</b>				<b>Tel</b>	<b>+381 638037405</b>					
<b>Collector Type</b>					<b>Flat plate collector, glazed</b>						
<b>Collector name</b>	<b>Gross area (A<sub>G</sub>)</b> m <sup>2</sup>	<b>Gross length</b> mm	<b>Gross width</b> mm	<b>Gross height</b> mm	<b>Power output per collector</b> G <sub>b</sub> = 850 W/m <sup>2</sup> ; G <sub>d</sub> = 150 W/m <sup>2</sup> θ <sub>m</sub> - θ <sub>a</sub>						
					0 K W	10 K W	30 K W	50 K W	70 K W	90 K W	
<b>Meander 2.53</b>	2,53	2 009	1 259	74	1 828	1 745	1 563	1 361	1 139	897	
<b>Power output per m<sup>2</sup> gross area</b>					723	690	618	538	450	354	
<b>Performance parameters test method</b>		<b>Steady state - outdoor</b>									
<b>Performance parameters (related to AG)</b>		η <sub>0,hem</sub>	a <sub>1</sub>	a <sub>2</sub>							
<b>Units</b>		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )							
<b>Test results</b>		0,723	3,207	0,010							
<b>Incidence angle modifier test method</b>		<b>Steady state - outdoor</b>									
<b>Bi-directional incidence angle modifiers</b>		<b>No</b>									
<b>Incidence angle modifier</b>		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
<b>Transversal</b>		K <sub>GT, coll</sub>					0,95				0,00
<b>Longitudinal</b>		K <sub>GL, coll</sub>					0,95				0,00
<b>Heat transfer medium for testing</b>					<b>Water-Glycole</b>						
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>					dm/dt	0,012	kg/(sm <sup>2</sup> )				
<b>Maximum temperature difference for thermal performance calculations</b>					(θ <sub>m</sub> -θ <sub>a</sub> ) <sub>max</sub>	90	K				
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; θ<sub>a</sub> = 30 °C)</b>					θ <sub>ste</sub>	196	°C				
<b>Effective thermal capacity, incl. fluid (per gross area, A<sub>G</sub>)</b>					C/m <sup>2</sup>	5,375	kJ/(Km <sup>2</sup> )				
<b>Maximum operating temperature</b>					θ <sub>max, op</sub>	100	°C				
<b>Maximum operating pressure</b>					p <sub>max, op</sub>	600	kPa				
<b>Testing laboratory</b>	<b>Technický skúšobný ústav Piešťany, š.p</b>				<b>http://www.tsu.sk</b>						
<b>Test report(s)</b>	<b>110700001/1/PQ(D7)</b>				<b>Dated</b>	<b>21.4.2017</b>					
<b>Comments of testing laboratory</b>					Datasheet version: 5.01, 2016-03-01						
Performance parameters - complete re-evaluation of the test data of the previous test (according to EN 12975-2:2006) taking into account gross area. This data sheet is not complete as the testing of the collector was performed according to EN 12975-2:2006(which is replaced by EN ISO 9806:2013)					 <b>TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p.</b> Krajinská cesta 2929/9 92101 PIEŠŤANY -316/3-						
<b>Technický skúšobný ústav Piešťany, š.p.</b> Address: Krajinská cesta 2929/9, 92101 Piešťany, Slovak Republic Phone: +421 33 79 57 111, Fax: +421 33 77 23 716, E-mail: sv@tsu.sk, web: www.tsu.eu											

<b>Annex to Solar Keymark Certificate Supplementary Information</b>	<b>Licence Number</b>	<b>TSU 001-17/D</b>
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<b>Annual collector output in kWh/collector at mean fluid temperature <math>\vartheta_m</math>, based on ISO 9806:2013 test results</b>													
<b>Standard Locations</b>		<b>Athens</b>			<b>Davos</b>			<b>Stockholm</b>			<b>Würzburg</b>		
<b>Collector name</b>	<b><math>\vartheta_m</math></b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>
Meander 2.53		2 954	2 162	1 476	2 271	1 618	1 069	1 670	1 126	714	1 813	1 219	760
Annual output per m <sup>2</sup> gross area		1 168	855	583	898	640	423	660	445	282	717	482	300
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)

<b>Additional Information</b>		
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)	C	--
Maximum tested positive load	2300	Pa
Maximum tested negative load	2500	Pa
Hail resistance using steel ball (maximum drop height)		m

<b>Energy Labelling Information</b>				
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	<b>Data required for CDR (EU) No 811/2013 - Reference Area <math>A_{sol}</math></b>		
Meander 2.53	2,53	Collector efficiency ( $\eta_{col}$ )	58	%
		<i>Remark: Collector efficiency (<math>\eta_{col}</math>) 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 <math>\eta_{col}</math> is based on reference area (<math>A_{sol}</math>) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.</i>		
		<b>Data required for CDR (EU) No 812/2013 - Reference Area <math>A_{sol}</math></b>		
		Zero-loss efficiency ( $\eta_0$ )	0,723	--
		First-order coefficient ( $a_1$ )	3,21	W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0,010	W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0,95	--
		<i>Remark: The data given in this section are related to collector reference area (<math>A_{sol}</math>) 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.</i>		

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