


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		TSU 008-12																	
					Date issued		2017-12-06																	
					Issued by		TSU Piešťany, š.p.																	
Licence holder		THERMO/SOLAR Žiar s.r.o.			Country		Slovak republic																	
Brand (optional)					Web		www.thermosolar.sk																	
Street, Number		Na vartičke 14			E-mail		info@thermosolar.sk																	
Postcode, City		965 01 Žiar nad Hronom			Tel		+421 (0)456016080																	
Collector Type					Flat plate collector, glazed																			
Collector name					Gross area (A_G)		Gross length		Gross width		Gross height		Power output per collector G _b = 850 W/m ² ; G _d = 150 W/m ² ϑ _m - ϑ _a											
					m ²		mm		mm		mm		0 K		10 K		30 K		50 K		70 K		80 K	
TS 101					2,03		2 009		1 009		100		1 460		1 393		1 245		1 079		896		797	
TS 111					2,51		2 009		1 249		100		1 805		1 722		1 539		1 335		1 108		986	
Power output per m² gross area					719		686		613		532		441		393									
Performance parameters test method					Steady state - outdoor																			
Performance parameters (related to AG)					η _{0,hem}		a ₁		a ₂															
Units					-		W/(m ² K)		W/(m ² K ²)															
Test results					0,719		3,200		0,011															
Incidence angle modifier test method					Steady state - outdoor																			
Bi-directional incidence angle modifiers					No																			
Incidence angle modifier					Angle		10°		20°		30°		40°		50°		60°		70°		80°		90°	
Transversal					K _{θT, coll}										0,95								0,00	
Longitudinal					K _{θL, coll}										0,95								0,00	
Heat transfer medium for testing					Water																			
Flow rate for testing (per gross area, A_G)					dm/dt		0,013		kg/(sm ²)															
Maximum temperature difference for thermal performance calculations					(ϑ _m -ϑ _a) _{max}		80		K															
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)					ϑ _{stg}		195		°C															
Effective thermal capacity, incl. fluid (per gross area, A_G)					C/m ²		6,3		kJ/(Km ²)															
Maximum operating temperature					ϑ _{max, op}		100		°C															
Maximum operating pressure					p _{max, op}		600		kPa															
Testing laboratory					Technický skúšobný ústav Piešťany, š.p.							http://www.tsu.sk												
Test report(s)					170700006/1/PQ 170700006/2/P							Dated		1.12.2011 20.10.2017										
Comments of testing laboratory					Datashet version: 5.01, 2016-03-01																			
Thermal performance testing was performed according to ISO 9806:2013. The equivalent values according to EN 12975-2:2006 considering aperture area 1.78 m ² are / correspond to eta0a=0.8202; a1a=3.65; a2a=0.012.					 TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p. Krajinská cesta 2929/9 92101 PIEŠŤANY -316/3-																			
Technický skúšobný ústav Piešťany, š.p. 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																								

Annex to Solar Keymark Certificate Supplementary Information	Licence Number	TSU 008-12
	Issued	2017-12-06

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on ISO 9806:2013 test results													
Collector name	Standard Locations ϑ_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
TS 101		2 358	1 719	1 160	1 809	1 280	833	1 332	892	557	1 446	965	593
TS 111		2 915	2 125	1 435	2 237	1 583	1 029	1 647	1 102	689	1 788	1 194	733
Annual output per m ² gross area		1 162	847	572	891	631	410	656	439	275	712	476	292
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m ²			1714 kWh/m ²			1166 kWh/m ²			1244 kWh/m ²		
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 ϑ_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

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	Yes	
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	2300	Pa
Maximum tested negative load	2500	Pa
Hail resistance using steel ball (maximum drop height)	2	m

Energy Labelling Information				
	Reference Area, A_{sol} (m ²)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}		
TS 101	2,03	Collector efficiency (η_{col})	57	%
TS 111	2,51	Remark: Collector efficiency (η_{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 ² , expressed in % and rounded to the nearest integer. Deviating from the regulation η_{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.		
		Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}		
		Zero-loss efficiency (η_0)	0,719	--
		First-order coefficient (a_1)	3,20	W/(m ² K)
		Second-order coefficient (a_2)	0,011	W/(m ² K ²)
		Incidence angle modifier IAM (50°)	0,95	--
		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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