


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		TSU 005-13/D																	
					Date issued		2018-03-01																	
					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		obchod@thermosolar.sk																	
Postcode, City		965 01 Žiar nad Hronom			Tel		+421 (0)456016080																	
Collector Type					Evacuated tubular collector																			
Collector name					Gross area (A_G)		Gross length		Gross width		Gross height		Power output per collector Gb = 850 W/m ² ; Gd = 150 W/m ² $\vartheta_m - \vartheta_a$											
					m ²		mm		mm		mm		0 K		10 K		30 K		50 K		70 K		90 K	
TS10					1,95		2 210		880		162		704		690		658		624		586		545	
Power output per m² gross area					362		355		338		321		301		280									
Performance parameters test method					Steady state - outdoor																			
Performance parameters (related to AG)					$\eta_{0,hem}$		a1		a2															
Units					-		W/(m ² K)		W/(m ² K ²)															
Test results					0,362		0,728		0,002															
Incidence angle modifier test method					Steady state - outdoor																			
Bi-directional incidence angle modifiers					Yes																			
Incidence angle modifier					Angle		10°		20°		30°		40°		50°		60°		70°		80°		90°	
Transversal					$K_{\theta T, coll}$		1,00		1,00		1,01		1,01		1,01		1,01		1,00				0,00	
Longitudinal					$K_{\theta L, coll}$										0,87								0,00	
Heat transfer medium for testing					Water																			
Flow rate for testing (per gross area, A_G)					dm/dt		0,011		kg/(sm ²)															
Maximum temperature difference for thermal performance calculations					$(\vartheta_m - \vartheta_a)_{max}$		90		K															
Standard stagnation temperature ($G = 1000 \text{ W/m}^2$; $\vartheta_a = 30 \text{ }^\circ\text{C}$)					ϑ_{stg}		169,5		°C															
Effective thermal capacity, incl. fluid (per gross area, A_G)					C/m ²		2,55		kJ/(Km ²)															
Maximum operating temperature					$\vartheta_{max, op}$		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)		130700004/QP(D1))			Dated		26.3.2013																	
Comments of testing laboratory					Datashet 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.					 TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p. Krajinská cesta 2929/9 92101 PIEŠŤANY -316/3-																			
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Annex to Solar Keymark Certificate Supplementary Information	Licence Number	TSU 005-13/D
	Issued	2018-03-01

Annual collector output in kWh/collector at mean fluid temperature ϑ_m based on ISO 9806:2013 test results													
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
TS10		1 134	983	835	959	819	689	693	576	472	743	618	504
Annual output per m ² gross area		583	506	429	493	421	354	357	296	243	382	318	259
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	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	1000	Pa
Maximum tested negative load		Pa
Hail resistance using steel ball (maximum drop height)		m

Energy Labelling Information				
	Reference Area, A_{ref} (m ²)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}		
TS10	1,95	Collector efficiency (η_{col})	33	%
		<i>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/m², 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.</i>		
		Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}		
		Zero-loss efficiency (η_0)	0,362	--
		First-order coefficient (a_1)	0,73	W/(m ² K)
		Second-order coefficient (a_2)	0,002	W/(m ² K ²)
		Incidence angle modifier IAM (50°)	0,00	--
		<i>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.</i>		

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