



Annex to Solar Keymark Certificate						Licence Number		TSU 001-19								
						Date issued		2019-06-24								
						Issued by		TSU Piešťany, š.p.								
Licence holder		Skorut Systémy Solarne Sp. z o. o.				Country		Poland								
Brand (optional)						Web		http://www.skorut-solar.pl/								
Street, Number		ul. Wybickiego 71				E-mail		office@skorut-solar.pl								
Postcode, City		32-400 Myślenice				Tel		+48 12 272 -20 25 / -31 24								
Collector Type						Flat plate collector										
Collector name						Power output per collector										
						Gb = 850 W/m ² , Gd = 150 W/m ² & u = 1.3 m/s $\vartheta_m - \vartheta_a$										
						0 K	10 K	30 K	50 K	70 K	90 K					
						W	W	W	W	W	W					
MAX 1.1						80	2,32	2 037	1 137	2,13	1 729	1 652	1 484	1 297	1 092	868
Power output per m ² gross area						745	712	640	559	471	374					
Performance parameters test method						Steady state - outdoor										
Performance parameters (related to A _G)						η_0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd	
Units						-	W/(m ² K)	W/(m ² K ²)	J/(m ³ K)	-	J/(m ² K)	s/m	W/(m ² K ⁴)	W/(m ² K ⁴)	-	
Test results						0,759	3,22	0,010	0,000	0,00	5 690	0,000	0,00	0,0E+00	0,88	
Incidence angle modifier test method						Steady state - outdoor										
Incidence angle modifier						Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°	
Transversal						K _{ϑ_T,coll}	1,00	0,99	0,98	0,96	0,92	0,86	0,74	0,35	0,00	
Longitudinal						K _{ϑ_L,coll}	1,00	0,99	0,98	0,96	0,92	0,86	0,74	0,35	0,00	
Heat transfer medium for testing						Water										
Flow rate for testing (per gross area, A _G)						dm/dt	0,019	kg/(sm ²)								
Maximum temperature difference during thermal performance test						($\vartheta_m - \vartheta_a$) _{max}	60	K								
Standard stagnation temperature (G = 1000 W/m ² ; $\vartheta_a = 30$ °C)						ϑ_{stg}	200	°C								
Maximum operating temperature						$\vartheta_{max,op}$	100	°C								
Maximum operating pressure						p _{max,op}	1000	kPa								
Testing laboratory		Technický skúšobný ústav Piešťany, š.p.				http://www.tsu.sk										
Test report(s)		190700001/PQ				Dated		24.6.2019								
						<p>TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p. Krajinská cesta 2929/9 92101 PIEŠŤANY -316/3-</p>										
<p>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</p>																



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Supplementary Information		TSU 001-19											
		Issued											
		2019-06-24											
Annual collector output in kWh/collector at mean fluid temperature ϑ_m													
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
MAX 1.1		2 722	1 996	1 366	2 101	1 504	1 003	1 538	1 044	669	1 669	1 126	709
Annual output per m ² gross area		1 173	860	589	906	648	432	663	450	288	719	485	306
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. 6.0 (October 2018). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc													
Additional Information													
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)										B		--	
G (W/m ²) >		900		ϑ_a (°C) >		15		H_x (MJ/m ²) >		540			
Maximum tested positive load										1800		Pa	
Maximum tested negative load										1000		Pa	
Hail resistance using steel ball (maximum drop height)										2		m	
Additional collector attribute(s)													
<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)													
Energy Labelling Information													
		Reference Area, A _{sol} (m ²)		Hydraulic Designation Code									
MAX 1.1		2,32		1-VH-12V-A:12,20000									
Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}													
Collector efficiency (η_{col})		60%		Zero-loss efficiency (η_0)				0,75		--			
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 9806:2017.		First-order coefficient (a_1)				3,22		W/(m ² K)					
		Second-order coefficient (a_2)				0,010		W/(m ² K ²)					
		Incidence angle modifier IAM (50°)				0,91		--					
		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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