




Annex to Solar Keymark Certificate					Licence Number		TSU 002-15							
					Date issued		2020-10-29							
					Issued by		TSU Piešťany, š.p.							
Licence holder		T.W.I. spol. s r.o.			Country		Czech republic							
Brand (optional)					Web		www.twi.cz							
Street, Number		Mnichov 146			E-mail		v.precan@twi.cz							
Postcode, City		793 26 Vrbno pod Pradědem			Tel		+420 737258601							
Collector Type					Flat plate collector									
Collector name					Power output per collector									
					Gb = 850 W/m <sup>2</sup> , Gd = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	93 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm	mm			
SUN WING T4 Alu 1,9					1.90	1,774	1,092	82	1,472	1,405	1,257	1,087	896	649
SUN WING T4 Alu 2,2					2.20	2,015	1,092	82	1,704	1,627	1,455	1,258	1,037	752
SUN WING T4 Alu 2,5					2.50	2,294	1,092	82	1,936	1,849	1,653	1,430	1,178	855
SUN WING T4 Alu 2,66					2.66	2,433	1,092	82	2,060	1,967	1,759	1,521	1,254	909
Power output per m <sup>2</sup> gross area					774	740	661	572	471	342				
Performance parameters test method		Steady state - outdoor												
Performance parameters (related to A <sub>G</sub> )		$\eta_0, b$	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		0.784	3.35	0.014	0.000	0.00	4,600	0.000	0.00	0.0E+00	0.92			
Incidence angle modifier test method		Steady state - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub>θT, coll</sub>	1.00	0.99	0.99	0.97	0.95	0.91	0.83	0.57	0.00			
Longitudinal		K <sub>θL, coll</sub>	1.00	0.99	0.99	0.97	0.95	0.91	0.83	0.57	0.00			
Heat transfer medium for testing		Water												
Flow rate for testing (per gross area, A <sub>G</sub> )		dm/dt	0.018	kg/(sm <sup>2</sup> )										
Maximum temperature difference during thermal performance test		( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	63	K										
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30$ °C)		$\vartheta_{stg}$	201	°C										
Maximum operating temperature		$\vartheta_{max, op}$	100	°C										
Maximum operating pressure		p <sub>max, op</sub>	600	kPa										
Testing laboratory		Technický skúšobný ústav Piešťany, š.p					http://www.tsu.sk							
Test report(s)		150700004/1/PQ, 150700004/2/P					Dated		28-10-2015					
Comments of testing laboratory		Datasheet version: 6.1, 2019-09-26												
Tested according to EN ISO 9806:2013		 <p>TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p. Krajinská cesta 2929/9 92101 PIEŠŤANY -316/3-</p>												
<p><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</p>														

Annex to Solar Keymark Certificate Supplementary Information		Licence Number		TSU 002-15									
		Issued		2020-10-29									
<b>Annual collector output in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>													
Collector name	Standard Locations	Athens			Davos			Stockholm			Würzburg		
	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
SUN WING T4 Alu 1,9		2,374	1,735	1,162	1,826	1,288	827	1,343	899	556	1,459	973	592
SUN WING T4 Alu 2,2		2,749	2,008	1,345	2,115	1,492	958	1,555	1,041	643	1,689	1,127	685
SUN WING T4 Alu 2,5		3,124	2,282	1,529	2,403	1,695	1,088	1,767	1,182	731	1,920	1,281	778
SUN WING T4 Alu 2,66		3,324	2,428	1,627	2,557	1,804	1,158	1,880	1,258	778	2,043	1,363	828
Annual output per m <sup>2</sup> gross area		1,250	913	612	961	678	435	707	473	292	768	512	311
Annual efficiency, $\eta_a$		71%	52%	35%	59%	42%	27%	61%	41%	25%	62%	41%	25%
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1630 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. 6.1 (September 2019). A detailed description of the calculations is available at <a href="http://www.estif.org/solarkeymarknew/">http://www.estif.org/solarkeymarknew/</a>													
<b>Additional Information</b>													
Collector heat transfer medium											Water-Glycole		
The collector is deemed to be suitable for roof integration											No		
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											1800		Pa
Maximum tested negative load											1000		Pa
Hail resistance using steel ball (maximum drop height)											2		m
<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 checked="" type="checkbox"/> Façade collector(s)		
<b>Energy Labelling Information</b>						<b>Additional Informative Technical Data</b>							
		Reference Area, $A_{sol}$ (m <sup>2</sup> )		Hydraulic Designation Code				Aperture Area, $A_a$ (m <sup>2</sup> )					
SUN WING T4 Alu 1,9		1.90		12-VH-12S-7,1655-16,1121				1.81					
SUN WING T4 Alu 2,2		2.20		12-VH-12S-7,1892-16,1121				2.10					
SUN WING T4 Alu 2,5		2.50		12-VH-12S-7,2174-16,1121				2.35					
SUN WING T4 Alu 2,66		2.66		12-VH-12S-7,2311-16,1121				2.50					
<b>Data required for CDR (EU) No 811/2013 - Reference Area <math>A_{sol}</math></b>						<b>Data required for CDR (EU) No 812/2013 - Reference Area <math>A_{sol}</math></b>							
Collector efficiency ( $\eta_{col}$ )		62%				Zero-loss efficiency ( $\eta_0$ )		0.77		--			
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 ( $a_1$ )		3.35		W/(m <sup>2</sup> K)					
				Second-order coefficient ( $a_2$ )		0.014		W/(m <sup>2</sup> K <sup>2</sup> )					
				Incidence angle modifier IAM (50°)		0.94		--					
				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.									
<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													