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IGTE

Annex to Solar Keymark Certificate		Licence Number	011-7S1941 F
		Date issued	2022-07-25
		Issued by	DIN CERTCO

Licence holder	**Solimpeks Solar Corp.**	**Country**	Turkey		
Brand (optional)		**Web**	https://solimpeks.com		
Street, Number	Fevzi Cakmak M. 10753. Sk. No:3-3A	**E-mail**	info@solimpeks.com		
Postcode, City	42050 Konya	**Tel**	+90	4440602	

Collector Type	Flat plate collector

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m2, Gd = 150 W/m2 & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
					0 K	10 K	30 K	50 K	70 K	109 K
	m²	mm	mm	mm	W	W	W	W	W	W
WUNDER ALS 1809	1.79	1 927	927	90	1 298	1 230	1 088	937	777	441
WUNDER ALS 2110	2.07	1 988	1 041	90	1 501	1 422	1 258	1 083	899	510
WUNDER ALS 2412	2.40	1 980	1 210	90	1 740	1 649	1 458	1 256	1 042	592
WUNDER ALS 2512	2.42	1 988	1 218	90	1 755	1 663	1 470	1 266	1 051	597
WUNDER ALS 2710	2.70	2 220	1 218	90	1 958	1 855	1 641	1 413	1 172	666
WUNDER ALS 3010	2.97	2 431	1 222	90	2 154	2 041	1 805	1 554	1 289	732
Power output per m² gross area					725	687	608	523	434	247

Performance parameters test method	Quasi dynamic									
Performance parameters (related to A_G)	η0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	J/(m²K)	s/m	W/(m²K⁴)	W/(m²K⁴)	-
Test results	0.726	3.74	0.006	0.000	0.00	9 746	0.000	0.00	0.0E+00	0.99

Incidence angle modifier test method		Quasi dynamic - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.00	0.99	0.98	0.95	0.81	0.58	0.29	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.99	0.98	0.95	0.81	0.58	0.29	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.020	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	79	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	210	°C
Maximum operating temperature	ϑ_{max_op}	135	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)	http://www.igte.uni-stuttgart.de	
Test report(s)	22COL1657 22COL1658 22COL1658Q	**Dated**	25.07.2022 25.07.2022 25.07.2022

Comments of testing laboratory Ver. 6.2 (13.01.2022)

Documented performance parameters are taken from 22COL1657 (WUNDER ALS 1809).
This data sheet replaces the data sheet issued on 21.01.2019.

TZS Forschungs- und Testzentrum für Solaranlagen
Institut für Thermodynamik und Wärmetechnik
Universität Stuttgart
Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)

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Supplementary Information	Issued	2022-07-25

Gross Thermal Yield 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
WUNDER ALS 1809	2 110	1 495	996	1 592	1 107	723	1 168	765	478	1 279	831	511
WUNDER ALS 2110	2 440	1 729	1 152	1 841	1 280	836	1 350	885	552	1 479	961	591
WUNDER ALS 2412	2 829	2 005	1 336	2 135	1 484	969	1 566	1 026	640	1 715	1 115	686
WUNDER ALS 2512	2 852	2 022	1 347	2 152	1 497	977	1 579	1 034	646	1 729	1 124	691
WUNDER ALS 2710	3 182	2 256	1 503	2 402	1 670	1 090	1 761	1 154	720	1 929	1 254	771
WUNDER ALS 3010	3 501	2 481	1 653	2 642	1 837	1 199	1 938	1 269	793	2 122	1 379	848
Gross Thermal Yield per m² gross area	1 179	835	556	889	618	404	652	427	267	714	464	286
Annual efficiency, η_a	67%	47%	32%	55%	38%	25%	56%	37%	23%	57%	37%	23%
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1630 kWh/m²			1166 kWh/m²			1244 kWh/m²		
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 ϑm (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.2 (13.01.2022). A detailed description of the calculations is available at http://www.estif.org/solarkeymarknew/

Additional Information

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)				B	--
G (W/m²) >	900	ϑ_a (°C) >	15	H_x (MJ/m²) >	540
Maximum tested positive load				2500	Pa
Maximum tested negative load				1600	Pa
Hail resistance using steel ball (maximum drop height)				2	m

Additional collector attribute(s)

Using external power source(s) for normal operation	No	Active or passive measure(s) for self-protection	No
Co-generating thermal and electrical power	No	Façade collector(s)	No

Energy Labelling Information

	Reference Area, A_{sol} (m²)
WUNDER ALS 1809	1.79
WUNDER ALS 2110	2.07
WUNDER ALS 2412	2.40
WUNDER ALS 2512	2.42
WUNDER ALS 2710	2.70
WUNDER ALS 3010	2.97

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}

Collector efficiency (η_{col})	57%

Remark: Collector efficiency (ηcol) 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 ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

Additional Informative Technical Data

	Hydraulic Designation Code	Aperture Area, A_a (m²)
WUNDER ALS 1809	9-V-1234S-7.1,1833-16.6,973-D	1.62
WUNDER ALS 2110	10-V-1234S-7.1,1894-16.6,1087-D	1.89
WUNDER ALS 2412	12-V-1234S-7.1,1886-16.6,1256-D	2.26
WUNDER ALS 2512	12-V-1234S-7.1,1894-16.6,1264-D	2.27
WUNDER ALS 2710	10-V-1234S-7.1,2126-16.6,1264-D	2.54
WUNDER ALS 3010	10-V-1234S-7.1,2333-16.6,1264-D	2.75

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}

Zero-loss efficiency (η_0)	0.73	--
First-order coefficient (a_1)	3.74	W/(m²K)
Second-order coefficient (a_2)	0.006	W/(m²K²)
Incidence angle modifier IAM (50°)	0.97	--

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.