


Annex to Solar Keymark Certificate					Licence Number		011-7S2030 F							
					Date issued		2023-05-03							
					Issued by		DIN CERTCO							
Licence holder		Torneiras OFA			Country		Portugal							
Brand (optional)					Web		https://ofa.pt							
Street, Number		Rua Heliodoro Salgado 370			E-mail		ofa@ofa.pt							
Postcode, City		4786-909 Trofa			Tel		+252 409 900							
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	109 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm	mm			
					W	W	W	W	W	W				
OFASUN 2110					2.07	1 988	1 041	90	1 501	1 422	1 258	1 083	899	510
OFASUN 2512					2.42	1 988	1 218	90	1 755	1 663	1 470	1 266	1 051	597
Power output per m <sup>2</sup> gross area					725	687	608	523	434	247				
Performance parameters test method		Quasi dynamic												
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		0.726	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 <sub>θT, coll</sub>	1.00	1.00	0.99	0.98	0.95	0.81	0.58	0.29	0.00			
Longitudinal		K <sub>θL, coll</sub>	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 <sub>G</sub> )					dm/dt	0.020	kg/(sm <sup>2</sup> )							
Maximum temperature difference during thermal performance test					( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	79	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a$ = 30 °C)					$\vartheta_{stg}$	210	°C							
Maximum operating temperature					$\vartheta_{max, op}$	135	°C							
Maximum operating pressure					$\rho_{max, op}$	1000	kPa							
Testing laboratory		Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)					http://www.igte.uni-stuttgart.de							
Test report(s)		22COL1657OEM05 22COL1658QOEM05					Dated		03.05.2023 03.05.2023 03.05.2023					
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.					 Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 8, 70560 Stuttgart (Vaihingen)									
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Supplementary Information						Issued		2023-05-03					
<b>Gross Thermal Yield in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>													
	Standard Locations	Athens			Davos			Stockholm			Würzburg		
Collector name	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
OFASUN 2110		2 440	1 729	1 152	1 841	1 280	836	1 350	885	552	1 479	961	591
OFASUN 2512		2 852	2 022	1 347	2 152	1 497	977	1 579	1 034	646	1 729	1 124	691
Gross Thermal Yield per m <sup>2</sup> gross area		1 179	835	556	889	618	404	652	427	267	714	464	286
Annual efficiency, $\eta_a$		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/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 Senocalc Ver. 6.2 (13.01.2022). 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)		B										--	
G (W/m <sup>2</sup> ) >		900		$\vartheta_a$ (°C) >		15		$H_x$ (MJ/m <sup>2</sup> ) >		540			
Maximum tested positive load		2500										Pa	
Maximum tested negative load		1600										Pa	
Hail resistance using steel ball (maximum drop height)		2										m	
<b>Additional collector attribute(s)</b>													
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			
<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> )			
OFASUN 2110		2.07				10-V-1234S-7.1,1894-16.6,1087-D				1.89			
OFASUN 2512		2.42				12-V-1234S-7.1,1894-16.6,1264-D				2.27			
<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 ( $\eta_{col}$ )		57%				Zero-loss efficiency ( $\eta_0$ )				0.73			
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 ( $a_1$ )				3.74			
						Second-order coefficient ( $a_2$ )				0.006			
						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.												
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