



Annex to Solar Keymark Certificate					Licence Number		011-7S3278 R							
					Date issued		2024-12-17							
					Issued by		DIN CERTCO							
Licence holder		Sunda Solar GmbH			Country		Germany							
Brand (optional)					Web		www.sunda.de							
Street, Number		Friedhofsweg 8			E-mail		info@sunda.de							
Postcode, City		DE-36381 Schlüchtern			Tel		+49 6661 60699914							
Collector Type					Evacuated tubular collector									
Collector name					Power output per collector									
					$G_b = 850 \text{ W/m}^2, G_d = 150 \text{ W/m}^2 \text{ \& } u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	123 K				
					m ²	mm	mm	mm	mm	mm	mm			
AS100-HP8					2.03	2'137	952	150	1'057	1'032	976	913	844	630
AS100-HP12					3.06	2'137	1'432	150	1'594	1'555	1'471	1'377	1'273	950
AS100-HP16					4.09	2'137	1'912	150	2'130	2'079	1'966	1'840	1'701	1'269
Power output per m² gross area					521	508	481	450	416	310				
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		0.528	1.22	0.004	0.000	0.00	4'584	0.000	0.00	0.0E+00	0.91			
Incidence angle modifier test method		Steady state - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		$K_{\theta T, coll}$	1.00	1.01	1.02	1.04	1.02	0.93	0.70	0.38	0.00			
Longitudinal		$K_{\theta L, coll}$	1.00	1.00	0.98	0.96	0.91	0.82	0.67	0.42	0.00			
Heat transfer medium for testing		Water-Glycole												
Flow rate for testing (per gross area, A_G)		dm/dt		0.019	kg/(sm ²)									
Maximum temperature difference during thermal performance test		$(\vartheta_m - \vartheta_a)_{max}$		93	K									
Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30 \text{ }^\circ\text{C}$)		ϑ_{stg}		230	°C									
Maximum operating temperature		$\vartheta_{max, op}$		130	°C									
Maximum operating pressure		$p_{max, op}$		600	kPa									
Testing laboratory		SPF Institute for Solar Technology					www.spf.ch							
Test report(s)		C1684LPEN C1827ISO C1963 / C1964					Dated		17.12.2015 09.03.2021 17.12.2024 / 17.12.2024					
Comments of testing laboratory		Draft Ver. 6.2 (22.09.2021)												
		 INSTITUT FÜR SOLARTECHNIK 												
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Supplementary Information		Issued		2024-12-17									
Gross Thermal Yield in kWh/collector at mean fluid temperature ϑ_m													
Collector name	Standard Locations ϑ_m	Athens			Davos			Stockholm			Würzburg		
		25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
AS100-HP8		1'754	1'490	1'231	1'471	1'227	1'002	1'058	855	677	1'139	921	724
AS100-HP12		2'644	2'246	1'856	2'217	1'850	1'510	1'595	1'289	1'020	1'717	1'389	1'092
AS100-HP16		3'533	3'001	2'481	2'964	2'473	2'018	2'132	1'723	1'363	2'295	1'856	1'459
Gross Thermal Yield per m ² gross area		864	734	607	725	605	493	521	421	333	561	454	357
Annual efficiency, η_a		49%	42%	34%	44%	37%	30%	45%	36%	29%	45%	36%	29%
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m ²			1630 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 Draft Ver. 6.2 (22.09.2021). 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)										A		--	
G (W/m ²) >		1000		ϑ_a (°C) >		20		H _x (MJ/m ²) >		600			
Maximum tested positive load										1000		Pa	
Maximum tested negative load										1000		Pa	
Hail resistance using ice balls (diameter)										35		mm	
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						Additional Informative Technical Data							
		Reference Area, A _{sol} (m ²)		Hydraulic Designation Code			Aperture Area, A _a (m ²)						
AS100-HP8		2.03		1-H-12S-C:23,952			1.48						
AS100-HP12		3.06		1-H-12S-C:23,1432			2.23						
AS100-HP16		4.09		1-H-12S-C:23,1912			2.97						
Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}						Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}							
Collector efficiency (η_{col})		47%				Zero-loss efficiency (η_0)		0.52		--			
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)		1.22		W/(m ² K)							
		Second-order coefficient (a ₂)		0.004		W/(m ² K ²)							
		Incidence angle modifier IAM (50°)		0.99		--							
						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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