TÜVRheinland®
DIN CERTCO
Precisely Right.

Annex to Solar Keymark Certificate		Licence Number	011-7S3277 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	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector G_b = 850 W/m², G_d = 150 W/m² & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
					0 K	10 K	30 K	50 K	70 K	110 K
	m²	mm	mm	mm	W	W	W	W	W	W
AS100-DF6	1.51	2'096	720	129	856	841	806	764	715	595
Power output per m² gross area					567	557	534	506	474	394

Performance parameters test method	Steady state - outdoor									
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	0.571	0.91	0.006	0.000	0.00	7'289	0.000	0.00	0.0E+00	0.95

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	1.03	1.06	1.03	0.96	0.85	0.51	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.98	0.96	0.90	0.77	0.52	0.00

Heat transfer medium for testing	Water-Glycole		
Flow rate for testing (per gross area, A_G)	dm/dt	0.020	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	80	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	250	°C
Maximum operating temperature	$\vartheta_{max\ op}$	120	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	SPF Institute for Solar Technology	www.spf.ch	
Test report(s)	C1787ISO C1962	**Dated**	25.08.2020 17.12.2024

Comments of testing laboratory	Draft Ver. 6.2 (22.09.2021)
	SPF INSTITUT FÜR SOLARTECHNIK

Annex to Solar Keymark Certificate	Licence Number	011-7S3277 R
Supplementary Information	Issued	2024-12-17

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
AS100-DF6		1'463	1'298	1'112	1'259	1'090	915	903	764	625	972	823	674
Gross Thermal Yield per m² gross area		969	859	736	834	722	606	598	506	414	644	545	446
Annual efficiency, η_a		55%	49%	42%	51%	44%	37%	51%	43%	35%	52%	44%	36%
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 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/m²) >	1000	ϑ_a (°C) >	20	H_X (MJ/m²) >	600
Maximum tested positive load				2400	Pa
Maximum tested negative load				2400	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)	Yes

Energy Labelling Information

	Reference Area, A_{sol} (m²)
AS100-DF6	1.51

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

Collector efficiency (η_{col})	52%

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)
6-VH-12S-A:4.8,3950-C:22,700	1.12

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

Zero-loss efficiency (η_0)	0.57	--
First-order coefficient (a_1)	0.91	W/(m²K)
Second-order coefficient (a_2)	0.006	W/(m²K²)
Incidence angle modifier IAM (50°)	1.03	--

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.