

<b>Annex to Solar Keymark Certificate</b>					<b>Licence Number</b>		<b>011-7S2509 F</b>							
					<b>Date issued</b>		<b>2022-01-26</b>							
					<b>Issued by</b>		<b>DIN CERTCO</b>							
<b>Licence holder</b>		<b>ASOTEC Alternativ- und</b>			<b>Country</b>		<b>Germany</b>							
<b>Brand (optional)</b>					<b>Web</b>		<b>www.asotec.de</b>							
<b>Street, Number</b>		<b>Hauptstraße 65</b>			<b>E-mail</b>		<b>info@asotec.de</b>							
<b>Postcode, City</b>		<b>D- 56744 Hattert</b>			<b>Tel</b>		<b>49 2662 / 939617</b>							
<b>Collector Type</b>					<b>Flat plate collector</b>									
<b>Collector name</b>					<b>Power output per collector</b>									
					$G_b = 850 \text{ W/m}^2, G_d = 150 \text{ W/m}^2 \text{ \& } u = 1.3 \text{ m/s}$									
					$\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	88 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm				
<b>AS-Sunline 2100</b>					2.05	1952	1052	80	1488	1408	1236	1048	844	646
<b>Power output per m<sup>2</sup> gross area</b>					<b>725</b>	<b>686</b>	<b>602</b>	<b>511</b>	<b>411</b>	<b>314</b>				
<b>Performance parameters test method</b>		<b>Steady state - indoor</b>												
<b>Performance parameters (related to A<sub>G</sub>)</b>		$\eta_0, b$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
<b>Units</b>		-	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> )	-			
<b>Test results</b>		0.736	3.78	0.010			4 770				0.90			
<b>Incidence angle modifier test method</b>		<b>Quasi dynamic - outdoor</b>												
<b>Incidence angle modifier</b>		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
<b>Transversal</b>		$K_{\theta T, coll}$	1.00	0.99	0.98	0.96	0.94	0.88	0.78	0.45	0.00			
<b>Longitudinal</b>		$K_{\theta L, coll}$	1.00	0.99	0.98	0.96	0.94	0.88	0.78	0.45	0.00			
<b>Heat transfer medium for testing</b>					<b>Water</b>									
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>					<b>dm/dt</b>		0.020		<b>kg/(sm<sup>2</sup>)</b>					
<b>Maximum temperature difference during thermal performance test</b>					$(\vartheta_m - \vartheta_a)_{max}$		58		<b>K</b>					
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30 \text{ }^\circ\text{C}</math>)</b>					$\vartheta_{stg}$		200		<b>°C</b>					
<b>Maximum operating temperature</b>					$\vartheta_{max, op}$		100		<b>°C</b>					
<b>Maximum operating pressure</b>					$p_{max, op}$		1000		<b>kPa</b>					
<b>Testing laboratory</b>		<b>ISFH CalTeC</b>			<b>https://isfh.de/</b>									
<b>Test report(s)</b>		<b>022-22/B</b>			<b>Dated</b>		<b>26.01.2022</b>							
<b>Comments of testing laboratory</b>					<b>Ver. 6.2 (13.01.2022)</b>									
					Institut für Solarenergieforschung GmbH Am Ohrberg 1 D-31860 Emmerthal Tel.: 05151/999-100 Fax: 05151/999-500									
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Supplementary Information		Issued		2022-01-26										
<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	
AS-Sunline 2100		2 351	1 627	1 033	1 754	1 182	723	1 297	824	485	1 412	888	515	
Gross Thermal Yield per m <sup>2</sup> gross area		1 145	793	503	854	575	352	632	401	236	687	432	251	
Annual efficiency, $\eta_a$		65%	45%	29%	52%	35%	22%	54%	34%	20%	55%	35%	20%	
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. 6.2 (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)										A		--		
G (W/m <sup>2</sup> ) >		1000		$\vartheta_a$ (°C) >		20		H <sub>x</sub> (MJ/m <sup>2</sup> ) >		600				
Maximum tested positive load										3030		Pa		
Maximum tested negative load										2800		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 <sub>sol</sub> (m <sup>2</sup> )				Hydraulic Designation Code			Aperture Area, A <sub>a</sub> (m <sup>2</sup> )					
AS-Sunline 2100		2.05				1-VH-12S-A:11.3,12027			1.88					
<b>Data required for CDR (EU) No 811/2013 - Reference Area A<sub>sol</sub></b>						<b>Data required for CDR (EU) No 812/2013 - Reference Area A<sub>sol</sub></b>								
Collector efficiency ( $\eta_{col}$ )		56%				Zero-loss efficiency ( $\eta_0$ )			0.72			--		
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 <sub>sol</sub> ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.						First-order coefficient (a <sub>1</sub> )			3.78			W/(m <sup>2</sup> K)		
						Second-order coefficient (a <sub>2</sub> )			0.010			W/(m <sup>2</sup> K <sup>2</sup> )		
						Incidence angle modifier IAM (50°)			0.92			--		
						Remark: The data given in this section are related to collector reference area (A <sub>sol</sub> ) 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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