

<b>Annex to Solar Keymark Certificate</b>					<b>Licence Number</b>		<b>011-7S2162 F</b>							
					<b>Date issued</b>		<b>2021-12-20</b>							
					<b>Issued by</b>		<b>ISFH CalTeC</b>							
<b>Licence holder</b>		<b>AES-Energiesysteme GmbH</b>			<b>Country</b>		<b>Germany</b>							
<b>Brand (optional)</b>					<b>Web</b>		<b>www.aes-energiesysteme.de</b>							
<b>Street, Number</b>		<b>Hauptstr. 42</b>			<b>E-mail</b>		<b>info@aes-energiesysteme.de</b>							
<b>Postcode, City</b>		<b>D- 27412 Kirchtimke</b>			<b>Tel</b>		<b>+49 4289-9259070</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	87 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm				
<b>AES-REGENERATIO 2500</b>					2.53	2 102	1 202	80	1 810	1 715	1 510	1 285	1 039	815
<b>Power output per m<sup>2</sup> gross area</b>					<b>715</b>	<b>678</b>	<b>597</b>	<b>508</b>	<b>411</b>	<b>322</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>		<b>0.728</b>	<b>3.65</b>	<b>0.010</b>			<b>4 770</b>				<b>0.88</b>			
<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	0.93	0.87	0.75	0.37	0.00			
<b>Longitudinal</b>		$K_{\theta L, coll}$	1.00	0.99	0.98	0.96	0.93	0.87	0.75	0.37	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>		<b>0.096</b>		<b>kg/(sm<sup>2</sup>)</b>					
<b>Maximum temperature difference during thermal performance test</b>					$(\vartheta_m - \vartheta_a)_{max}$		<b>57</b>		<b>K</b>					
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30</math> °C)</b>					$\vartheta_{stg}$		<b>200</b>		<b>°C</b>					
<b>Maximum operating temperature</b>					$\vartheta_{max, op}$		<b>100</b>		<b>°C</b>					
<b>Maximum operating pressure</b>					$p_{max, op}$		<b>1000</b>		<b>kPa</b>					
<b>Testing laboratory</b>		<b>ISFH CalTeC</b>			<b>http://www.isfh.de</b>									
<b>Test report(s)</b>		<b>175-21/B</b>			<b>Dated</b>		<b>20.12.2021</b>							
<b>Comments of testing laboratory</b>					<b>Datasheet version: 6.1, 2019-07-11</b>									
					<b>Institut für Solarenergieforschung GmbH</b> <b>An Ohrberg 1</b> <b>D-31890 Emmenrol</b> <b>Tel.: 05151/999-100</b> <b>Fax: 05151/999-500</b>									
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Supplementary Information		011-7S2162 F												
		Issued												
		2021-12-20												
Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$														
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	
AES-REGENERATIO 2500		2 841	1 977	1 265	2 130	1 444	893	1 571	1 005	598	1 709	1 083	633	
Annual output per m <sup>2</sup> gross area		1 123	782	500	842	571	353	621	397	236	675	428	250	
Annual efficiency, $\eta_a$		64%	44%	28%	52%	35%	22%	53%	34%	20%	54%	34%	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. 6.1 (July 2019). 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>														
<input type="checkbox"/> Using external power source(s) for normal operation <input type="checkbox"/> Active or passive measure(s) for self-protection <input type="checkbox"/> Co-generating thermal and electrical power <input type="checkbox"/> Façade collector(s)														
<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> )			
AES-REGENERATIO 2500		2.53					7-VH-1234S-A:7.3,1926-C:17.3,1248-				2.36			
<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 ( $\eta_{col}$ )		55%					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> )				3.65			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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