

<b>Annex to Solar Keymark Certificate</b>						<b>Licence Number</b>		011-7S567 F				
						<b>Date issued</b>		2019-12-09				
						<b>Issued by</b>		ISFH CalTeC				
<b>Licence holder</b>		Solvis GmbH				<b>Country</b>		Germany				
<b>Brand (optional)</b>						<b>Web</b>		http://www.solvis.de				
<b>Street, Number</b>		Grotrian-Steinweg-Straße 12				<b>E-mail</b>		info@solvis.de				
<b>Postcode, City</b>		D- 38112 Braunschweig				<b>Tel</b>		+49 531 28904-0				
<b>Collector Type</b>						Flat plate collector						
<b>Collector name</b>		<b>Gross height</b>	<b>Gross area (<math>A_G</math>)</b>	<b>Gross length</b>	<b>Gross width</b>	<b>Aperture area (<math>A_a</math>)</b>	<b>Power output per collector</b>					
							$G_b = 850 \text{ W/m}^2$ , $G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$					
		mm	m <sup>2</sup>	mm	mm	m <sup>2</sup>	0 K W	10 K W	30 K W	50 K W	70 K W	87 K W
SolvisCala 254-AR		98	2.56	2,176	1,176	2.39	1,994	1,904	1,706	1,482	1,230	996
<b>Power output per m<sup>2</sup> gross area</b>							779	744	667	579	481	389
<b>Performance parameters test method</b>		Steady state - indoor										
<b>Performance parameters (related to <math>A_G</math>)</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>		0.793	3.35	0.013			6,220				0.88	
<b>Incidence angle modifier test method</b>			Quasi dynamic - outdoor									
<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	0.74	0.37	0.00	
<b>Longitudinal</b>		$K_{\theta L, coll}$	1.00	0.99	0.98	0.96	0.93	0.87	0.74	0.37	0.00	
<b>Heat transfer medium for testing</b>						Water-Glycole						
<b>Flow rate for testing (per gross area, <math>A_G</math>)</b>						$dm/dt$	0.020	kg/(sm <sup>2</sup> )				
<b>Maximum temperature difference during thermal performance test</b>						$(\vartheta_m - \vartheta_a)_{max}$	57	K				
<b>Standard stagnation temperature (<math>G = 1000 \text{ W/m}^2</math>; <math>\vartheta_a = 30 \text{ °C}</math>)</b>						$\vartheta_{stg}$	210	°C				
<b>Maximum operating temperature</b>						$\vartheta_{max, op}$	110	°C				
<b>Maximum operating pressure</b>						$p_{max, op}$	400	kPa				
<b>Testing laboratory</b>		Institut für Solarenergieforschung Hameln				http://www.isfh.de						
<b>Test report(s)</b>		22-19/K				<b>Dated</b>		09.12.2019				
<b>Comments of testing laboratory</b>						Datasheet version: 6.0, 2018-10-30						
						Institut für Solarenergieforschung GmbH Am Ohrberg 1 D-31860 Emmerthal Tel.: 05151/999-100 Fax: 05151/999-500						
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<b>Supplementary Information</b>						<b>Issued</b>		<b>2019-12-09</b>					
<b>Annual collector output in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>													
<b>Standard Locations</b>		<b>Athens</b>			<b>Davos</b>			<b>Stockholm</b>			<b>Würzburg</b>		
<b>Collector name</b>	<b><math>\vartheta_m</math></b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>
SolvisCala 254-AR		3,145	2,295	1,544	2,424	1,717	1,116	1,776	1,194	747	1,927	1,288	793
Annual output per m <sup>2</sup> gross area		1,228	896	603	947	671	436	694	467	292	753	503	310
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1714 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. 6.0 (October 2018). A detailed description of the calculations is available at <a href="http://www.solarkeymark.org/scenocalc">www.solarkeymark.org/scenocalc</a>													
<b>Additional Information</b>													
Collector heat transfer medium								Water-Glycole					
The collector is deemed to be suitable for roof integration								Yes					
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								5500		Pa			
Maximum tested negative load								2750		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"/> Wind and/or infrared sensitive collector(s) (WISC)									
<input type="checkbox"/> Façade collector(s)													
<b>Energy Labelling Information</b>													
				Reference Area, A <sub>sol</sub> (m <sup>2</sup> )		Hydraulic Designation Code							
SolvisCala 254-AR				2.56		11-VH-12V-A:11,X-C:11,X							
<b>Data required for CDR (EU) No 811/2013 - Reference Area</b>				<b>Data required for CDR (EU) No 812/2013 - Reference Area A<sub>sol</sub></b>									
Collector efficiency ( $\eta_{col}$ )				62%		Zero-loss efficiency ( $\eta_0$ )		0.78		--			
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> )		3.35		W/(m <sup>2</sup> K)					
				Second-order coefficient (a <sub>2</sub> )		0.013		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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