

<b>Annex to Solar Keymark Certificate</b>					<b>Licence Number</b>		<b>011-7S2994 R</b>							
					<b>Date issued</b>		<b>2021-06-24</b>							
					<b>Issued by</b>		<b>ISFH CalTeC</b>							
<b>Licence holder</b>		<b>AkoTec Produktionsgesellschaft mbH</b>			<b>Country</b>		<b>Germany</b>							
<b>Brand (optional)</b>					<b>Web</b>		<b>http://www.akotec.eu</b>							
<b>Street, Number</b>		<b>Grundmühlenweg, 3</b>			<b>E-mail</b>		<b>info@akotec.eu</b>							
<b>Postcode, City</b>		<b>D-16278 Angermünde</b>			<b>Tel</b>		<b>+49 3331 2571640</b>							
<b>Collector Type</b>					<b>Evacuated tubular collector</b>									
<b>Collector name</b>					<b>Power output per collector</b>									
					$G_b = 850 \text{ W/m}^2$ , $G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	92 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm	mm			
					W	W	W	W	W	W				
<b>Weiser Power 800</b>					1.57	2 110	745	128	763	750	715	672	620	553
<b>Weiser Power 1200</b>					2.36	2 110	1 120	128	1 148	1 127	1 076	1 011	932	831
<b>Weiser Power 1600</b>					3.15	2 110	1 495	128	1 532	1 504	1 436	1 349	1 244	1 109
<b>Weiser Power 2400</b>					4.74	2 110	2 245	128	2 301	2 259	2 156	2 026	1 869	1 665
<b>Power output per m<sup>2</sup> gross area</b>					<b>486</b>	<b>477</b>	<b>455</b>	<b>428</b>	<b>395</b>	<b>351</b>				
<b>Performance parameters test method</b>		<b>Steady state - outdoor</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>0.495</b>	<b>0.80</b>	<b>0.007</b>			<b>4 060</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>		$K_{\theta T, coll}$	1.01	1.02	1.03	1.04	1.07	1.08	0.83	0.42	0.00			
<b>Longitudinal</b>		$K_{\theta L, coll}$	1.00	0.99	0.98	0.96	0.93	0.87	0.75	0.38	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>0.020</b>		<b>kg/(sm<sup>2</sup>)</b>					
<b>Maximum temperature difference during thermal performance test</b>					$(\vartheta_m - \vartheta_a)_{max}$		<b>62</b>		<b>K</b>					
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30 \text{ °C}</math>)</b>					$\vartheta_{stg}$		<b>280</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>016-20/KT1</b>			<b>Dated</b>		<b>21.06.2021</b>							
		<b>16-19/K1</b>					<b>21.06.2021</b>							
		<b>50-19/KT1</b>					<b>21.06.2021</b>							
<b>Comments of testing laboratory</b>					<b>Datasheet version: 6.1, 2019-07-11</b>									
The given collector efficiency parameters were determined at the collector type Weiser Power 2400 (report No. 016-20/KT1). The power output for each subtype was calculated with the collector efficiency parameters from the Weiser Power 2400.					<b>Institut für Solarenergieforschung GmbH</b> Am Ohrberg 1 D-37880 Emmerthal Tel: 05151/999-100 Fax: 05151/999-500									
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Supplementary Information		011-7S2994 R													
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<b>Annual collector output 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		
Weiser Power 800		1 281	1 122	937	1 096	931	758	788	655	519	845	703	556		
Weiser Power 1200		1 926	1 686	1 408	1 648	1 399	1 140	1 185	984	780	1 270	1 056	835		
Weiser Power 1600		2 571	2 251	1 879	2 200	1 868	1 521	1 582	1 313	1 041	1 696	1 410	1 115		
Weiser Power 2400		3 861	3 381	2 822	3 304	2 805	2 285	2 375	1 972	1 564	2 546	2 118	1 675		
Annual output per m <sup>2</sup> gross area		815	714	596	698	592	482	501	416	330	538	447	353		
Annual efficiency, $\eta_a$		46%	40%	34%	43%	36%	30%	43%	36%	28%	43%	36%	28%		
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											4500		Pa		
Maximum tested negative load											3250		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> )					
Weiser Power 800	1.57					10-VH-12S-A:5,3880-C:13,745				1.01					
Weiser Power 1200	2.36					15-VH-12S-A:5,3880-C:13,1115				1.52					
Weiser Power 1600	3.15					20-VH-12S-A:5,3880-C:13,1495				2.03					
Weiser Power 2400	4.74					30-VH-12S-A:5,3880-C:13,2245				3.04					
<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 ( $\eta_{col}$ )						44%		Zero-loss efficiency ( $\eta_0$ )				0.49		--	
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> )				0.80				W/(m <sup>2</sup> K)	
						Second-order coefficient (a <sub>2</sub> )				0.007				W/(m <sup>2</sup> K <sup>2</sup> )	
						Incidence angle modifier IAM (50°)				0.98				--	
						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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