

<b>Annex to Solar Keymark Certificate</b>						<b>Licence Number</b>		<b>011-7S471 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>		<a href="http://www.akotec.eu">http://www.akotec.eu</a>									
<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	88 K						
						mm	m <sup>2</sup>	mm	mm	mm	m <sup>2</sup>	W	W	W	W	W	W
<b>Weiser Power 1000</b>						120	1.57	2 110	745	1.44	907	889	850	806	757	709	
<b>Weiser Power 1500</b>						120	2.36	2 110	1 120	2.16	1 363	1 337	1 278	1 212	1 138	1 065	
<b>Weiser Power 2000</b>						120	3.15	2 110	1 495	2.89	1 820	1 784	1 706	1 618	1 519	1 422	
<b>Weiser Power 3000</b>						120	4.74	2 110	2 245	4.33	2 733	2 680	2 562	2 429	2 282	2 136	
<b>Power output per m<sup>2</sup> gross area</b>						<b>577</b>	<b>566</b>	<b>541</b>	<b>513</b>	<b>482</b>	<b>451</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>0.583</b>	<b>1.08</b>	<b>0.004</b>			<b>4 100</b>				<b>0.93</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>		$K_{\theta T, coll}$	1.02	1.05	1.05	1.04	1.05	1.05	0.87	0.43	0.00						
<b>Longitudinal</b>		$K_{\theta L, coll}$	1.00	0.99	0.98	0.95	0.91	0.84	0.69	0.34	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>						dm/dt		0.020	kg/(sm <sup>2</sup> )								
<b>Maximum temperature difference during thermal performance test</b>						$(\vartheta_m - \vartheta_a)_{max}$		58	K								
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30^\circ\text{C}</math>)</b>						$\vartheta_{stg}$		310	°C								
<b>Maximum operating temperature</b>						$\vartheta_{max, op}$		100	°C								
<b>Maximum operating pressure</b>						$p_{max, op}$		100	kPa								
<b>Testing laboratory</b>		<b>Institut für Solarenergieforschung GmbH</b>				<a href="http://www.isfh.de">http://www.isfh.de</a>											
<b>Test report(s)</b>		16-19/K1 50-19/KT1				<b>Dated</b>		21.06.2021 21.06.2021									
<b>Comments of testing laboratory</b>						Datashet version: 6.0, 2018-10-30											
The given collector efficiency parameters were determined at the collector type Weiser Power 3000 (report No. 16-19/K1). The power output for each subtype was calculated with the collector efficiency parameters from the Weiser Power 3000.						<b>Institut für Solarenergieforschung GmbH</b> An Ohrberg 1 D-31880 Emmenthal Tel.: 05151/999-100 Fax: 05151/999-500											
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Supplementary Information		011-7S471 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 1000		1 549	1 361	1 169	1 323	1 142	969	951	801	662	1 022	861	710
Weiser Power 1500		2 329	2 046	1 757	1 988	1 718	1 456	1 430	1 204	995	1 536	1 294	1 067
Weiser Power 2000		3 108	2 732	2 345	2 654	2 293	1 944	1 909	1 608	1 328	2 050	1 727	1 424
Weiser Power 3000		4 667	4 102	3 522	3 986	3 443	2 919	2 867	2 414	1 994	3 078	2 594	2 139
Annual output per m <sup>2</sup> gross area		985	866	744	841	727	616	605	510	421	650	548	451
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		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			$H_x$ (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"/> 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											
Weiser Power 1000	1.57	10-VH-12S-A:5,3880-C:13,745											
Weiser Power 1500	2.36	15-VH-12S-A:5,3880-C:13,1115											
Weiser Power 2000	3.15	20-VH-12S-A:5,3880-C:13,1495											
Weiser Power 3000	4.74	30-VH-12S-A:5,3880-C:13,2245											
<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 ( $\eta_{col}$ )	53%						Zero-loss efficiency ( $\eta_0$ )	0.58			--		
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 ( $a_1$ )	1.08			W/(m <sup>2</sup> K)		
							Second-order coefficient ( $a_2$ )	0.004			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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