


<b>Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results</b>						<b>Licence Number</b>		<b>011-7S1952 F</b>							
						<b>Date issued</b>		<b>2017-05-22</b>							
						<b>Issued by</b>		<b>DIN CERTCO</b>							
<b>Licence holder</b>			hassler energia alternative ag			<b>Country</b>		Schweiz							
<b>Brand (optional)</b>						<b>Web</b>		www.hassler-solarenergie.ch							
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<b>Postcode, City</b>		7432	Zillis		<b>Tel</b>		+41 81 650-7777								
<b>Collector Type</b>						Flat plate collector, glazed									
<b>Collector name</b>					<b>Gross area (A<sub>G</sub>)</b> m <sup>2</sup>	<b>Gross length</b> mm	<b>Gross width</b> mm	<b>Gross height</b> mm	<b>Power output per collector</b> G <sub>b</sub> = 850 W/m <sup>2</sup> ; G <sub>d</sub> = 150 W/m <sup>2</sup> ̘ <sub>m</sub> - ̘ <sub>a</sub>						
									0 K W	10 K W	30 K W	50 K W	70 K W	104 K W	
<b>Serpentino ADV</b>					2.51	2 070	1 213	96	1 898	1 813	1 626	1 418	1 187	744	
<b>Serpentino ADH</b>					2.51	1 213	2 070	96	1 898	1 813	1 626	1 418	1 187	744	
<b>Power output per m<sup>2</sup> gross area</b>									756	722	648	565	473	297	
<b>Performance parameters test method</b>						Steady state - indoor									
<b>Performance parameters (related to AG)</b>						̘ <sub>0,hem</sub>	a1	a2							
<b>Units</b>						-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )							
<b>Test results</b>						0.756	3.274	0.011							
<b>Incidence angle modifier test method</b>						Quasi dynamic - outdoor									
<b>Bi-directional incidence angle modifiers</b>						No									
<b>Incidence angle modifier</b>						Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
<b>Transversal</b>						K <sub>̘T, coll</sub>	1.00	0.99	0.98	0.97	0.94	0.89	0.78	0.46	0.00
<b>Longitudinal</b>						K <sub>̘L, coll</sub>	1.00	0.99	0.98	0.97	0.94	0.89	0.78	0.46	0.00
<b>Heat transfer medium for testing</b>						Water									
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>						dm/dt		0.018	kg/(sm <sup>2</sup> )						
<b>Maximum temperature difference for thermal performance calculations</b>						(̘ <sub>m</sub> -̘ <sub>a</sub> ) <sub>max</sub>		104	K						
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; ̘<sub>a</sub> = 30 °C)</b>						̘ <sub>stg</sub>		196	°C						
<b>Effective thermal capacity, incl. fluid (per gross area, A<sub>G</sub>)</b>						C/m <sup>2</sup>		8.206	kJ/(Km <sup>2</sup> )						
<b>Maximum operating temperature</b>						̘ <sub>max, op</sub>		n.a.	°C						
<b>Maximum operating pressure</b>						p <sub>max, op</sub>		600	kPa						
<b>Testing laboratory</b>						TZS, ITW University Stuttgart			www.itw.uni-stuttgart.de						
<b>Test report(s)</b>						09COL847OEM02			<b>Dated</b>		27.06.2012				
<b>Comments of testing laboratory</b>						Datashet version: 5.01, 2016-03-01									
This data sheet replaces the data sheet issued on 12.03.2014 Documented performance parameters are taken from Serpentino ADV.															
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S1952 F</b>
	<b>Issued</b>	<b>2017-05-22</b>

Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$ , based on ISO 9806:2013 test results													
Collector name	Standard Locations $\vartheta_m$	Athens			Davos			Stockholm			Würzburg		
		25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
Serpentino ADV		3 026	2 219	1 513	2 334	1 666	1 101	1 712	1 158	736	1 858	1 252	782
Serpentino ADH		3 026	2 219	1 513	2 334	1 666	1 101	1 712	1 158	736	1 858	1 252	782
Annual output per m <sup>2</sup> gross area		1 206	884	603	930	664	439	682	461	293	740	499	311
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. 5.01 (March 2016). A detailed description of the calculations is available at <a href="http://www.solarkeymark.org/scenocalc">www.solarkeymark.org/scenocalc</a>													

Additional Information		
Collector heat transfer medium	Water-Glycole	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	C	--
Maximum tested positive load	3000	Pa
Maximum tested negative load	2300	Pa
Hail resistance using steel ball (maximum drop height)	n.a.	m

Energy Labelling Information				
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$		
Serpentino ADV	2.51	Collector efficiency ( $\eta_{col}$ )	61	%
Serpentino ADH	2.51	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 ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.		
		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$		
		Zero-loss efficiency ( $\eta_0$ )	0.756	--
		First-order coefficient ( $a_1$ )	3.27	W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.011	W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0.94	--
		Remark: The data given in this section are related to collector reference area ( $A_{sol}$ ) 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.		