


<b>Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results</b>					<b>Licence Number</b>		<b>011-7S2712 F</b>							
					<b>Date issued</b>		<b>2016-12-08</b>							
					<b>Issued by</b>		<b>DIN CERTCO</b>							
<b>Licence holder</b>			FK Solartechnik GmbH		<b>Country</b>		Deutschland							
<b>Brand (optional)</b>					<b>Web</b>		www.fksolar.de							
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<b>Postcode, City</b>			01968	Senftenberg	<b>Tel</b>		+49	3573 806725 / 3573 806738						
<b>Collector Type</b>					Flat plate collector, glazed									
					<b>Power output per collector</b> Gb = 850 W/m <sup>2</sup> ; Gd = 150 W/m <sup>2</sup> ; u = 3 m/s $\vartheta_m - \vartheta_a$									
<b>Collector name</b>					<b>Gross area (A<sub>G</sub>)</b>	<b>Gross length</b>	<b>Gross width</b>	<b>Gross height</b>	0 K	10 K	30 K	50 K	70 K	109 K
					m <sup>2</sup>	mm	mm	mm	W	W	W	W	W	W
<b>Basic Comfort</b>					2.34	2 043	1 143	80	1 767	1 671	1 468	1 253	1 025	541
<b>Power output per m<sup>2</sup> gross area</b>					755	714	628	535	438	231				
<b>Performance parameters test method</b>					Quasi dynamic									
<b>Performance parameters (related to AG)</b>					$\eta_{0,b}$	c1	c2	c3	c4	c6	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)	-	s/m	-			
<b>Test results</b>					0.756	4.042	0.007	0.000	0.000	0.000	0.992			
<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>θT, coll</sub>	1.00	0.99	0.98	0.96	0.92	0.86	0.73	0.33	0.00
<b>Longitudinal</b>					K <sub>θL, coll</sub>	1.00	0.99	0.98	0.96	0.92	0.86	0.73	0.33	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		0.020	kg/(sm <sup>2</sup> )						
<b>Maximum temperature difference for thermal performance calculations</b>					$(\vartheta_m - \vartheta_a)_{max}$		109	K						
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30^\circ\text{C}</math>)</b>					$\vartheta_{stg}$		177	°C						
<b>Effective thermal capacity, incl. fluid (per gross area, A<sub>G</sub>)</b>					C/m <sup>2</sup>		11.487	kJ/(Km <sup>2</sup> )						
<b>Maximum operating temperature</b>					$\vartheta_{max, op}$		n.a.	°C						
<b>Maximum operating pressure</b>					p <sub>max, op</sub>		1000	kPa						
<b>Testing laboratory</b>			TZS, ITW University Stuttgart		<a href="http://www.itw.uni-stuttgart.de">www.itw.uni-stuttgart.de</a>									
<b>Test report(s)</b>			10COL871/10EM12		<b>Dated</b>		22.11.2016							
<b>Comments of testing laboratory</b>					Datashet version: 5.01, 2016-03-01									
This data sheet replaces the data sheet issued on 22.11.2016 Postcode was corrected from 09168 to 01968 Additional information: A <sub>a</sub> = 2.13 m <sup>2</sup>					 <b>TZS</b> Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)									
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S2712 F</b>
	<b>Issued</b>	<b>2016-12-08</b>

**Annual collector output in kWh/collector at mean fluid temperature  $\vartheta_m$ , based on ISO 9806:2013 test results**

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
Collector name													
Basic Comfort		2 859	1 992	1 293	2 131	1 448	911	1 575	1 008	608	1 725	1 096	650
Annual output per m <sup>2</sup> gross area		1 222	851	553	910	619	389	673	431	260	737	468	278
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 [www.solarkeymark.org/scenocalc](http://www.solarkeymark.org/scenocalc)

**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)	B	--
Maximum tested positive load	3000	Pa
Maximum tested negative load	2000	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 $A_{sol}$	
Basic Comfort	2.34	Collector efficiency ( $\eta_{col}$ )	58 %
		<i>Remark: Collector efficiency (<math>\eta_{col}</math>) 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 <math>\eta_{col}</math> is based on reference area (<math>A_{sol}</math>) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.</i>	
		<b>Data required for CDR (EU) No 812/2013 - Reference Area <math>A_{sol}</math></b>	
		Zero-loss efficiency ( $\eta_0$ )	0.755 --
		First-order coefficient ( $a_1$ )	4.04 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.007 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0.92 --
		<i>Remark: The data given in this section are related to collector reference area (<math>A_{sol}</math>) 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.</i>	