


<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>						<b>Licence Number</b>		<b>011-7S2575 F</b>							
						<b>Issued</b>		<b>2015-09-10</b>							
<b>Company holding the</b>			<b>Westfalen AG</b>			<b>Country</b>		<b>Deutschland</b>							
<b>Brand (optional)</b>						<b>Website</b>		<b>www.westfalen-ag.de</b>							
<b>Street, street number</b>			<b>Industrieweg 43</b>			<b>E-mail</b>		<b>c.schmidt@westfalen.com</b>							
<b>Postal Code / City, province</b>		<b>48155</b>	<b>Münster</b>			<b>Tel/Fax</b>		<b>+49 251 695-290 / 251 69573-290</b>							
<b>Collector Type (flat plate glazed/un-glazed; evacuate tubular)</b>						<b>Flat plate collector - glazed</b>									
<b>Thermal / photo voltaic hybrid collector? (PVT collector)</b>						<b>No</b>									
<b>Integration in the roof possible ? (manufacturers declaration)</b>						<b>No</b>									
	<b>Collector name</b>	<b>Aperture area (Aa)</b> m <sup>2</sup>	<b>Gross length</b> mm	<b>Gross width</b> mm	<b>Gross height</b> mm	<b>Gross area (AG)</b> m <sup>2</sup>	<b>Power output per collector module</b>								
							Gb = 850 W/m <sup>2</sup> ; Gd = 150 W/m <sup>2</sup>								
							Tm-Ta								
							0 K	10 K	30 K	50 K	70 K				
							W	W	W	W	W				
	<b>Solacept FK23</b>	2.13	2 043	1 143	80	2.34	1 766	1 669	1 467	1 250	1 020				
<b>Performance test method</b>						<b>Liquid heating collector - quasi-dynamic - outdoor</b>									
<b>Performance parameters related to aperture</b>						$\eta_{0b}$	c1	c2	c3	c4	c6	K $\theta$ d			
<b>Units</b>						-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K)	J/(m <sup>3</sup> K)	-	s/m	-			
<b>Test results - Flow rate and fluid see note 1</b>						0.830**	4.441**	0.008**	0.000	0.000	0.000	0.992			
<b>Bi-directional incidence angle</b>						<b>No</b>									
<b>Incidence angle modifiers K<math>\theta</math>(<math>\theta</math>)</b>						<i>K<math>\theta</math> values are obligatory for 50°.</i>									
						Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
						K $\theta$ ( $\theta$ )	1.00	0.99	0.98	0.96	0.92	0.86	0.73	0.33	0.00
<b>Incidence angle modifier not bi-directional - leave fields blank</b>															
<b>Stagnation temperature - Weather conditions see note 2</b>						Tstg		177	°C						
<b>Effective thermal capacity</b>						ceff = C/Ag		12.62	kJ/(m <sup>2</sup> K)						
<b>Max. intended operation temperature - see note 3</b>						Tmax,op		-	°C						
<b>Max. operation pressure - see note 3</b>						pmax,op		1000	kPa						
<b>Pressure drop table - for a collector family, the values shall be for the module with highest <math>\Delta</math>P per m<sup>2</sup> aperture area</b>															
<b>Flow rate</b>	kg/(s m <sup>2</sup> )	-	-	-	-	-	-	-	-	-	-				
<b>Pressure drop, <math>\Delta</math>P</b>	Pa	-	-	-	-	-	-	-	-	-	-				
<b>Optional weather data</b>	Location	-				Link	-								
<b>Testing Laboratory</b>						<b>TZS, ITW University Stuttgart</b>									
<b>Website</b>						<b>http://www.itw.uni-stuttgart.de</b>									
<b>Test report id. number</b>						<b>10COL871/1OEM09</b>			<b>Date of test report</b>			<b>2015.09.10</b>			
During the test GDIF/GTOT was always between						0	and	1							
<b>Comments of testing laboratory:</b>															
** Werte beziehen sich auf die Ergebnisse im Annex B des Prüfberichts 10COL871/1OEM09															
values are to the results in annex B of test report 10COL871/1OEM09															
$\eta_{0b} = F'(\alpha)_en$			c1 = a1			c2 = a2									
<b>Note 1</b> Flow rate 0.020 kg/(s m <sup>2</sup> ) Fluid Water															
<b>Note 2</b> Irradiance, G = 1000 W/m <sup>2</sup> ; Ambient temperature, Ta=30 °C															
<b>Note 3</b> Given by manufacturer															
<div style="text-align: right;">  <p><small>Forschungs- und Testzentrum für Solaranlagen Institut für Thermische Energie- und Wasserverfahren Universität Stuttgart Postfach 8, 7050 Stuttgart (Vollring)</small></p> </div> <p>Datasheet version: 4.06, 2014-01-15</p>															

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S2575 F
	Issued	10.09.2015

Annual collector output kWh/module															
Collector name	Location and collector temperature (T <sub>m</sub> )														
	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			
Solacept FK23	2 853	1 984	1 283	2 124	1 440	901	1 570	1 003	601	1 721	1 091	644			

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)
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Overview of locations				
Location	Latitude °	G <sub>tot</sub> kWh/m <sup>2</sup>	T <sub>a</sub> °C	Collector orientation or tracking mode
Athens	38	1 765	18.5	South, 25°
Davos	47	1 714	3.2	South, 30°
Stockholm	59	1 166	7.5	South, 45°
Würzburg	50	1 244	9.0	South, 35°

G <sub>tot</sub>	Annual total irradiation on collector plane	kWh/m <sup>2</sup>
T <sub>a</sub>	Mean annual ambient air temperature	°C
T <sub>m</sub>	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool ScenoCalc. The collector output is calculated hour by hour according to the efficiency parameters from the Keymark test using constant collector operating temperature (T<sub>m</sub>). A detailed description of the calculations is available at <http://www.sp.se/en/index/services/solar/ScenoCalc/Sidor/default.aspx>.

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	ScenoCalc version: Ver. 4.06 (Jan, 2014)