


<b>Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results</b>					<b>Licence Number</b>		<b>011-7S2662 R</b>							
					<b>Date issued</b>		<b>2017-02-01</b>							
					<b>Issued by</b>		<b>DIN CERTCO</b>							
<b>Licence holder</b>		<b>SOLFEX LTD</b>			<b>Country</b>		<b>UK</b>							
<b>Brand (optional)</b>					<b>Web</b>		<b>www.solfex.co.uk</b>							
<b>Street, Number</b>		<b>Units 3-5 Charnley, Bamber Bridge</b>			<b>E-mail</b>		<b>solarthermalsales@solfex.co.uk</b>							
<b>Postcode, City</b>		<b>Preston, Lancashire PR5 6PS</b>			<b>Tel</b>		<b>+44 (0)1772 312847 / (0)1772 335277</b>							
<b>Collector Type</b>					<b>Evacuated tubular collector</b>									
<b>Collector name</b>					<b>Power output per collector</b> Gb = 850 W/m <sup>2</sup> ; Gd = 150 W/m <sup>2</sup> ; u = 3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	103 K				
					m <sup>2</sup>	mm	mm	mm	W	W	W	W	W	W
<b>OEM21</b>					<b>2.38</b>	<b>1 640</b>	<b>1 452</b>	<b>103</b>	<b>998</b>	<b>978</b>	<b>932</b>	<b>879</b>	<b>817</b>	<b>700</b>
<b>Power output per m<sup>2</sup> gross area</b>					<b>419</b>	<b>411</b>	<b>392</b>	<b>369</b>	<b>343</b>	<b>294</b>				
<b>Performance parameters test method</b>					<b>Quasi dynamic</b>									
<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>					<b>0.401</b>	<b>0.803</b>	<b>0.004</b>	<b>0.000</b>	<b>0.000</b>	<b>0.000</b>	<b>1.304</b>			
<b>Incidence angle modifier test method</b>					<b>Quasi dynamic - outdoor</b>									
<b>Bi-directional incidence angle modifiers</b>					<b>Yes</b>									
<b>Incidence angle modifier</b>					Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
<b>Transversal</b>					$K_{\theta T, coll}$	<b>1.04</b>	<b>1.07</b>	<b>1.21</b>	<b>1.35</b>	<b>1.67</b>	<b>1.69</b>	<b>1.64</b>	<b>0.82</b>	<b>0.00</b>
<b>Longitudinal</b>					$K_{\theta L, coll}$	<b>0.99</b>	<b>0.98</b>	<b>0.96</b>	<b>0.94</b>	<b>0.89</b>	<b>0.82</b>	<b>0.70</b>	<b>0.35</b>	<b>0.00</b>
<b>Heat transfer medium for testing</b>					<b>Water-Glycole</b>									
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>					dm/dt		<b>0.020</b>						<b>kg/(sm<sup>2</sup>)</b>	
<b>Maximum temperature difference for thermal performance calculations</b>					$(\vartheta_m - \vartheta_a)_{max}$		<b>103</b>						<b>K</b>	
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30^\circ\text{C}</math>)</b>					$\vartheta_{stg}$		<b>239</b>						<b>°C</b>	
<b>Effective thermal capacity, incl. fluid (per gross area, A<sub>G</sub>)</b>					C/m <sup>2</sup>		<b>12.028</b>						<b>kJ/(Km<sup>2</sup>)</b>	
<b>Maximum operating temperature</b>					$\vartheta_{max, op}$		<b>n.a.</b>						<b>°C</b>	
<b>Maximum operating pressure</b>					$p_{max, op}$		<b>1000</b>						<b>kPa</b>	
<b>Testing laboratory</b>					<b>TZS, ITW University Stuttgart</b>			<b>www.itw.uni-stuttgart.de</b>						
<b>Test report(s)</b>					<b>14COL1030OEM01 14COL1030QOEM01</b>			<b>Dated</b>		<b>09.01.2017 09.01.2017</b>				
<b>Comments of testing laboratory</b>					<b>Datasheet version: 5.01, 2016-03-01</b>									
<b>Documented performance parameters are taken from 14COL1030OEM01</b>					 <p><b>TZS</b> Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmeleittechnik Universität Stuttgart Pfaflerwaldring 8, 70560 Stuttgart (Vaihingen)</p>									
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S2662 R</b>
	<b>Issued</b>	<b>2017-02-01</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													
OEM21		2 081	1 858	1 613	1 760	1 534	1 303	1 294	1 106	922	1 399	1 199	1 001
Annual output per m <sup>2</sup> gross area		874	781	678	739	645	548	544	465	387	588	504	421
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)	A	--
Maximum tested positive load	2500	Pa
Maximum tested negative load	1000	Pa
Hail resistance using ice balls (diameter)	35	mm

**Energy Labelling Information**

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
OEM21	2.38	Collector efficiency ( $\eta_{col}$ )	38 %
		<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 ( $\eta_0$ )	0.419 --
		First-order coefficient ( $a_1$ )	0.80 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°)	1.27 --
		<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>	