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Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results		Licence Number	011-7S2821 F
		Date issued	2017-12-21
		Issued by	DIN CERTCO

Licence holder	Camel Solar Ltd.	Country	Macedonia
Brand (optional)		Web	
Street, Number	Kacanicki Pat BB	E-mail	stole_filipov@yahoo.com
Postcode, City	1000-Skopje	Tel	+389 02 260 20 29

Collector Type	Flat plate collector, glazed

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m²; Gd = 150 W/m²; u = 3 m/s ϑm - ϑa: 0 K	10 K	30 K	50 K	70 K	115 K
	m²	mm	mm	mm	W	W	W	W	W	W
CSI Full Plate 2.5 - 4	2.50	2 005	1 245	85	1 918	1 824	1 626	1 417	1 195	652
Power output per m² gross area					767	730	651	567	478	261

Performance parameters test method	Quasi dynamic								
Performance parameters (related to AG)	η0,b	c1	c2	c3	c4	c6	Kd		
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	s/m	-		
Test results	0.769	3.715	0.006	0.000	0.000	0.000	0.986		

Incidence angle modifier test method	Quasi dynamic - outdoor								
Bi-directional incidence angle modifiers	No								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.00	1.00	0.99	0.96	0.90	0.80	0.40	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.99	0.96	0.90	0.80	0.40	0.00

Heat transfer medium for testing		Water-Glycole	
Flow rate for testing (per gross area, A_G)	dm/dt	0.020	kg/(sm²)
Maximum temperature difference for thermal performance calculations	$(\vartheta_m-\vartheta_a)_{max}$	115	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	213	°C
Effective thermal capacity, incl. fluid (per gross area, A_G)	C/m²	15.67	kJ/(Km²)
Maximum operating temperature	$\vartheta_{max\ op}$	n.a.	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	TZS, ITW University Stuttgart	www.itw.uni-stuttgart.de	
Test report(s)	17COL1405 17COL1405Q	Dated	11.12.2017 11.12.2017

Comments of testing laboratory	Datasheet version: 5.01, 2016-03-01
This data sheet replaces the data sheet issued on 15.12.2017. The licence number was corrected. Documented performance parameters are taken from test report 17COL1405 (CSI Full Plate 2.5 - 4).	TZS Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)

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Supplementary Information	Issued	2017-12-21

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on ISO 9806:2013 test results

Standard Locations	Athens			Davos			Stockholm			Würzburg		
Collector name / ϑ_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
CSI Full Plate 2.5 - 4	3 168	2 300	1 582	2 417	1 723	1 160	1 774	1 192	767	1 938	1 297	822
Annual output per m² gross area	1 267	920	633	967	689	464	709	477	307	775	519	329
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1714 kWh/m²			1166 kWh/m²			1244 kWh/m²		
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 ϑm (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

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	2250	Pa
Hail resistance using steel ball (maximum drop height)	2	m

Energy Labelling Information

	Reference Area, A_{sol} (m^2)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}		
CSI Full Plate 2.5 - 4	2.50	Collector efficiency (η_{col})	61	%

Remark: Collector efficiency (η_{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/m², expressed in % and rounded to the nearest integer. Deviating from the regulation η_{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 (η_0)	0.767	--
First-order coefficient (a_1)	3.72	W/(m²K)
Second-order coefficient (a_2)	0.006	W/(m²K²)
Incidence angle modifier IAM (50°)	0.96	--

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.