


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		011-7S 2181 F							
					Date issued		2017-08-10							
					Issued by		TÜV Rheinland Energy GmbH							
Licence holder		Bosch Solarthermie GmbH			Country		Germany							
Brand (optional)		Bosch; Worcester; e.l.m. leblanc			Web		www.bosch-thermotechnology.com							
Street, Number		Prozessionsweg 10			E-mail		-							
Postcode, City		48493 Wettringen			Tel		- -							
Collector Type					Flat plate collector, glazed									
Collector name					Gross area (A _G)	Gross length	Gross width	Gross height	Power output per collector G _b = 850 W/m ² ; G _d = 150 W/m ² ϑ _m - ϑ _a					
					m ²	mm	mm	mm	0 K	10 K	30 K	50 K	70 K	90 K
Bosch FCC220-2V					2.09	2 026	1 032	67	1 474	1 393	1 216	1 021	808	576
Worcester Solar Lito					2.09	2 026	1 032	67	1 474	1 393	1 216	1 021	808	576
e.l.m. leblanc FCC-2S					2.09	2 026	1 032	67	1 474	1 393	1 216	1 021	808	576
Power output per m ² gross area					705	666	582	489	387	276				
Performance parameters test method					Steady state - indoor									
Performance parameters (related to AG)					η _{0,hem}	a ₁	a ₂							
Units					-	W/(m ² K)	W/(m ² K ²)							
Test results					0.705	3.780	0.011							
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 _{θT,coil}	1.00	0.99	0.98	0.97	0.94	0.89	0.79	0.40	0.00
Longitudinal					K _{θL,coil}	1.00	0.99	0.98	0.97	0.94	0.89	0.79	0.40	0.00
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A _G)					dm/dt	0.020	kg/(sm ²)							
Maximum temperature difference for thermal performance calculations					(ϑ _m -ϑ _a) _{max}	90	K							
Standard stagnation temperature (G = 1000 W/m ² ; ϑ _a = 30 °C)					ϑ _{stg}	195	°C							
Effective thermal capacity, incl. fluid (per gross area, A _G)					C/m ²	3.8	kJ/(Km ²)							
Maximum operating temperature					ϑ _{max,op}	-	°C							
Maximum operating pressure					p _{max,op}	600	kPa							
Testing laboratory		TÜV Rheinland Energy GmbH			www.tuv.com/solarpower									
Test report(s)		21218975_EN2_Bosch; 21218975_EN2_Worcester; 21218975_EN2_E.L.M.			Dated		01.08.2012 (all)							
Comments of testing laboratory					Datasheet version: 5.01, 2016-03-01									
<p><i>*This data sheet is not complete as the testing of the collector was not performed according to ISO 9806:2013. The steady state test evaluation was recalculated with gross area.</i></p> <p><i>The former values related to 1.936 m² aperture area had been: eta0a=0.761; a1a=4.083; a2a=0.012</i></p> <p><i>Alternatively, the collector name with annex TSS, CTE or CTE TSS to the type designation can be used.</i></p> <p><i>TSS: identical collector type distributed without temperature sensor pipe</i></p> <p><i>CTE: CTE tube connections instead of EPDM hose</i></p>					 TÜVRheinland® Genau. Richtig. TÜV Rheinland Energy GmbH Am Grauen Stein 51105 Köln									
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Annex to Solar Keymark Certificate Supplementary Information	Licence Number	011-7S 2181 F
	Issued	2017-08-10

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on EN 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
Bosch FCC220-2V		2 330	1 593	988	1 729	1 146	681	1 280	800	458	1 394	863	486
Worcester Solar Lito		2 330	1 593	988	1 729	1 146	681	1 280	800	458	1 394	863	486
e.l.m. leblanc FCC-2S		2 330	1 593	988	1 729	1 146	681	1 280	800	458	1 394	863	486
Annual output per m ² gross area		1 114	762	473	827	548	326	612	383	219	667	412	232
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m ²			1714 kWh/m ²			1166 kWh/m ²			1244 kWh/m ²		
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 ϑ_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													

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)	*	--
Maximum tested positive load	*	Pa
Maximum tested negative load	*	Pa
Hail resistance using steel ball (maximum drop height)	*	m

Energy Labelling Information			
	Reference Area, A_{sol} (m ²)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}	
Bosch FCC220-2V	2.09	Collector efficiency (η_{col})	54 %
Worcester Solar Lito	2.09	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/m ² , 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.	
e.l.m. leblanc FCC-2S	2.09		
		Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}	
		Zero-loss efficiency (η_0)	0.705 --
		First-order coefficient (a_1)	3.78 W/(m ² K)
		Second-order coefficient (a_2)	0.011 W/(m ² K ²)
		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.			