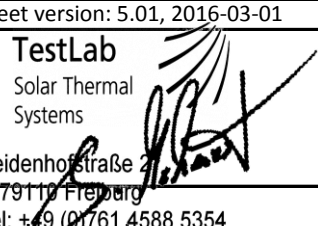


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		011-7S1854 F							
					Date issued		2017-02-14							
					Issued by		Din Certco							
Licence holder		TWL Technologie GmbH			Country		Germany							
Brand (optional)					Web		www.twl-technologie.de							
Street, Number		Im Gewerbegebiet 2-12			E-mail		vertrieb@twl-technologie.de							
Postcode, City		92271 Freihung			Tel/Fax		+49 4351 -751700 / -751701							
Collector Type					Flat plate collector, glazed									
Collector name					Gross area (A_G) m ²	Gross length mm	Gross width mm	Gross height mm	Power output per collector G _b = 850 W/m ² ; G _d = 150 W/m ² θ _m - θ _a					
									0 K W	10 K W	30 K W	50 K W	70 K W	65 K W
FK200					2,34	2.000	1.170	83	1.685	1.604	1.421	1.209	969	1.032
Power output per m² gross area								720	686	607	517	414	441	
Performance parameters test method					Steady state - outdoor									
Performance parameters (related to AG)					η _{0,hem}	a ₁	a ₂							
Units					-	W/(m ² K)	W/(m ² K ²)							
Test results					0,720	3,30	0,015							
Incidence angle modifier test method					Steady state - outdoor									
Bi-directional incidence angle modifiers					No									
Incidence angle modifier					Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal					K _{θT, coll}	1,00	0,99	0,98	0,95	0,90	0,81	0,66	0,41	0,00
Longitudinal					K _{θL, coll}	1,00	0,99	0,98	0,95	0,90	0,81	0,66	0,41	0,00
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A_G)					dm/dt	0,017	kg/(sm ²)							
Maximum temperature difference for thermal performance calculations					(θ _m -θ _a) _{max}	65	K							
Standard stagnation temperature (G = 1000 W/m²; θ_a = 30 °C)					θ _{stg}	184	°C							
Effective thermal capacity, incl. fluid (per gross area, A_G)					C/m ²	5,4	kJ/(Km ²)							
Maximum operating temperature					θ _{max, op}	n. a.	°C							
Maximum operating pressure					p _{max, op}	1000	kPa							
Testing laboratory					TestLab Solar Thermal Systems, Fraunhofer ISE				http://www.collectortest.com					
Test report(s)					ktb-2006-39-a-en				Dated		31.01.2012			
Comments of testing laboratory					<p>Datasheet version: 5.01, 2016-03-01</p> <p><i>This data sheet is not complete as the testing of the collector was not performed according to ISO 9806:2013.</i></p> <p><i>According to Scenocalc v5.01 the power output per collector unit of a steady state performance test does not consider the fraction of the diffuse irradiance, but it is calculated based on η_{0,hem} for a global hemispherical irradiance of 1000 W/m².</i></p>									
<p>DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany</p> <p>Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de</p>					<p>TestLab Solar Thermal Systems Heidenhofstraße D-79111 Freiburg Tel: +49 (0)761 4588 5354</p> 									

Annex to Solar Keymark Certificate Supplementary Information	Licence Number	011-7S1854 F
	Issued	2017-02-14

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on EN ISO 9806:2013 test results													
Collector name	Standard Locations vertrieb@ ϑ_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
FK200		2.606	1.842	1.172	1.980	1.349	820	1.455	940	553	1.579	1.011	585
Annual output per m ² gross area		1.114	787	501	846	576	350	622	402	236	675	432	250
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)	C	--
Maximum tested positive load	1000	Pa
Maximum tested negative load	1000	Pa
Hail resistance using ice balls (diameter)	0	mm

Energy Labelling Information			
	Reference Area, A_{sol} (m ²)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}	
FK200	2,34	Collector efficiency (η_{col})	56 %
		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.	
		Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}	
		Zero-loss efficiency (η_0)	0,720 --
		First-order coefficient (a_1)	3,30 W/(m ² K)
		Second-order coefficient (a_2)	0,015 W/(m ² K ²)
		Incidence angle modifier IAM (50°)	0,90 --
		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.	