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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)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m²; Gd = 150 W/m² ϑm - ϑa: 0 K	10 K	30 K	50 K	70 K	65 K
	m²	mm	mm	mm	W	W	W	W	W	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)	η0,hem	a1	a2						
Units	-	W/(m²K)	W/(m²K²)						
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	$K_{\theta T,coll}$	1,00	0,99	0,98	0,95	0,90	0,81	0,66	0,41	0,00
Longitudinal	$K_{\theta L,coll}$	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/(sm²)
Maximum temperature difference for thermal performance calculations	$(\vartheta_m-\vartheta_a)_{max}$	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/m²	5,4	kJ/(Km²)
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

Datasheet version: 5.01, 2016-03-01

This data sheet is not complete as the testing of the collector was not performed according to ISO 9806:2013.
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 η0,hem for a global hemispherical irradiance of 1000 W/m².

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Supplementary Information	Issued	2017-02-14

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 vertrieb@ 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
FK200	2.606	1.842	1.172	1.980	1.349	820	1.455	940	553	1.579	1.011	585
Annual output per m² 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/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)	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/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)	0,720	--
		First-order coefficient (a_1)	3,30	W/(m²K)
		Second-order coefficient (a_2)	0,015	W/(m²K²)
		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.		