TÜVRheinland®
DIN CERTCO
Precisely Right.

Annex to Solar Keymark Certificate		Licence Number	011-7S263 F
		Date issued	2020-01-14
		Issued by	DIN CERTCO

Licence holder	**FK Solartechnik GmbH**	**Country**	Germany		
Brand (optional)	–	**Web**	www.fksolar.de		
Street, Number	Industriepark Kleinkoschen	**E-mail**	verkauf@fksolar.de		
Postcode, City	DE-01968 Senftenberg	**Tel**	+49	3573 806725	

Collector Type	Flat plate collector

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 = 1.3 m/s $\vartheta_m - \vartheta_a$					
					0 K	10 K	30 K	50 K	70 K	129 K
	m²	mm	mm	mm	W	W	W	W	W	W
FK Basic	2.11	2’035	1’035	90	1’462	1’387	1’231	1’067	895	341
Power output per m² gross area					694	659	584	507	425	162

Performance parameters test method	Steady state - outdoor									
Performance parameters (related to A_G)	η0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	J/(m²K)	s/m	W/(m²K⁴)	W/(m²K⁴)	-
Test results	0.714	3.52	0.005	0.000	0.00	3’980	0.000	0.00	0.0E+00	0.82

Incidence angle modifier test method		Steady state - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	0.99	0.97	0.94	0.86	0.67	0.49	0.26	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.99	0.95	0.89	0.72	0.54	0.30	0.00

Heat transfer medium for testing	Water-Glycole		
Flow rate for testing (per gross area, A_G)	dm/dt	0.021	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	99	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	200	°C
Maximum operating temperature	$\vartheta_{max\ op}$	130	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	SPF Testing, CH-8640 Rapperswil, Switzerland	www.spf.ch	
Test report(s)	C1794ISO	**Dated**	19.12.2019

Comments of testing laboratory — Datasheet version: 6.1, 2019-09-26

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SPF INSTITUT FÜR SOLARTECHNIK

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Supplementary Information	Issued	2020-01-14

Annual collector output in kWh/collector at mean fluid temperature ϑ_m

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
FK Basic	2'195	1'536	1'023	1'660	1'157	767	1'211	792	504	1'313	848	528
Annual output per m² gross area	1'042	729	486	788	549	364	575	376	239	624	403	251
Annual efficiency, η_a	59%	41%	28%	48%	34%	22%	49%	32%	21%	50%	32%	20%
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1630 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. 6.1 (September 2019). A detailed description of the calculations is available at http://www.estif.org/solarkeymarknew/

Additional Information

Collector heat transfer medium				Water-Glycole	
The collector is deemed to be suitable for roof integration				No	
The collector was tested successfully under the following conditions:					
Climate class (A+, A, B or C)				A	--
G (W/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >	600
Maximum tested positive load				2400	Pa
Maximum tested negative load				2400	Pa
Hail resistance using ice balls (diameter)				35	mm

Additional collector attribute(s)

- ☐ Using external power source(s) for normal operation
- ☐ Active or passive measure(s) for self-protection
- ☐ Co-generating thermal and electrical power
- ☐ Façade collector(s)

Energy Labelling Information

	Reference Area, A_{sol} (m²)
FK Basic	2.11

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}

Collector efficiency (η_{col})	55%

Remark: Collector efficiency (ηcol) 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 ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

Additional Informative Technical Data

Hydraulic Designation Code	Aperature Area, A_a (m²)
4,4-VH-12V-A:7,1880-C:16.6,1200	1.90

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}

Zero-loss efficiency (η_0)	0.69	--
First-order coefficient (a_1)	3.52	W/(m²K)
Second-order coefficient (a_2)	0.005	W/(m²K²)
Incidence angle modifier IAM (50°)	0.88	--

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.