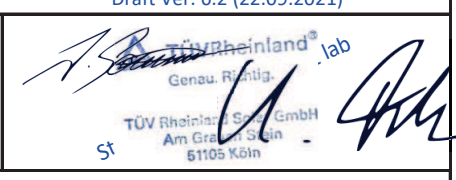


Annex to Solar Keymark Certificate					Licence Number		011-7S1915 F							
					Date issued		2023-07-04							
					Issued by		DINCertco							
Licence holder		STI - Solar Technologie International GmbH			Country		Germany							
Brand (optional)		-			Web		www.sti-solar.de							
Street, Number		Seiferitzer Allee 14			E-mail		info@sti-solar.de							
Postcode, City		08393 Meerane			Tel		+49 3763 7956 10							
Collector Type					Flat plate collector									
Collector name					Power output per collector									
					Gb = 850 W/m <sup>2</sup> , Gd = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	100 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm	mm			
FKF 200 V Cu/Cu					2.10	1 746	1 200	85	1 413	1 337	1 168	978	765	406
FKF 240 V Cu/Cu					2.52	2 100	1 200	85	1 696	1 604	1 402	1 173	918	487
FKF 270 V Cu/Cu					2.85	2 373	1 200	85	1 918	1 815	1 586	1 327	1 039	551
FKF 200 H Cu/Cu					2.10	1 200	1 746	85	1 413	1 337	1 168	978	765	406
FKF 240 H Cu/Cu					2.52	1 200	2 100	85	1 696	1 604	1 402	1 173	918	487
FKF 270 H Cu/Cu					2.85	1 200	2 373	85	1 918	1 815	1 586	1 327	1 039	551
Power output per m <sup>2</sup> gross area					673	637	556	466	364	193				
Performance parameters test method		Steady state - outdoor												
Performance parameters (related to A <sub>G</sub> )		$\eta_0, b$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-			
Test results		0.676	3.50	0.013	0.000	0.00	3 230	0.000	0.00	0.0E+00	0.97			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub>gT, coll</sub>	1.00	0.99	0.97	0.94	0.90	0.82	0.65	0.33	0.00			
Longitudinal		K <sub>gL, coll</sub>	1.00	0.99	0.97	0.94	0.90	0.82	0.65	0.33	0.00			
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A <sub>G</sub> )					dm/dt	0.024	kg/(sm <sup>2</sup> )							
Maximum temperature difference during thermal performance test					( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	70	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30$ °C)					$\vartheta_{stg}$	200	°C							
Maximum operating temperature					$\vartheta_{max, op}$	120	°C							
Maximum operating pressure					p <sub>max, op</sub>	600	kPa							
Testing laboratory		TÜV Rheinland Solar GmbH			www.tuv.com/solar									
Test report(s)		DE23JE54 001 DE2319BXO 001 DE23NEYH 001			Dated		04.07.2023 04.07.2023 04.07.2023							
Comments of testing laboratory					Draft Ver. 6.2 (22.09.2021)									
														
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Annex to Solar Keymark Certificate						Licence Number		011-7S1915 F							
Supplementary Information						Issued		2023-07-04							
<b>Gross Thermal Yield in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>															
Collector name	Standard Locations			Athens			Davos			Stockholm			Würzburg		
	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C		
FKF 200 V Cu/Cu		2 248	1 542	947	1 668	1 097	635	1 236	770	433	1 353	836	461		
FKF 240 V Cu/Cu		2 697	1 851	1 136	2 002	1 317	763	1 483	924	520	1 624	1 003	554		
FKF 270 V Cu/Cu		3 050	2 093	1 285	2 264	1 489	862	1 677	1 045	588	1 836	1 134	626		
FKF 200 H Cu/Cu		2 248	1 542	947	1 668	1 097	635	1 236	770	433	1 353	836	461		
FKF 240 H Cu/Cu		2 697	1 851	1 136	2 002	1 317	763	1 483	924	520	1 624	1 003	554		
FKF 270 H Cu/Cu		3 050	2 093	1 285	2 264	1 489	862	1 677	1 045	588	1 836	1 134	626		
Gross Thermal Yield per m <sup>2</sup> gross area		1 070	734	451	794	523	303	588	367	206	644	398	220		
Annual efficiency, $\eta_a$		61%	42%	26%	49%	32%	19%	50%	31%	18%	52%	32%	18%		
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)														
Annual irradiation on collector plane	1765 kWh/m <sup>2</sup>			1630 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>					
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 $\vartheta_m$ (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Draft Ver. 6.2 (22.09.2021). A detailed description of the calculations is available at <a href="http://www.estif.org/solarkeymarknew/">http://www.estif.org/solarkeymarknew/</a>															
<b>Additional Information</b>															
Collector heat transfer medium										Water-Glycole					
The collector is deemed to be suitable for roof integration										Yes					
The collector was tested successfully under the following conditions:															
Climate class (A+, A, B or C)										A		--			
G (W/m <sup>2</sup> ) >		1000		$\vartheta_a$ (°C) >		20		$H_x$ (MJ/m <sup>2</sup> ) >		600					
Maximum tested positive load										3000		Pa			
Maximum tested negative load										2000		Pa			
Hail resistance using ice balls (diameter)										35		mm			
<b>Additional collector attribute(s)</b>															
Using external power source(s) for normal operation						No		Active or passive measure(s) for self-protection				No			
Co-generating thermal and electrical power						No		Façade collector(s)				No			
<b>Energy Labelling Information</b>						<b>Additional Informative Technical Data</b>									
						Reference Area, $A_{sol}$ (m <sup>2</sup> )		Hydraulic Designation Code			Aperture Area, $A_a$ (m <sup>2</sup> )				
FKF 200 V Cu/Cu						2.10		1-H-1234S-A:9.0,17680-C:20.6,1169			1.83				
FKF 240 V Cu/Cu						2.52		1-H-1234S-A:9.0,22100-C:20.6,1169			2.33				
FKF 270 V Cu/Cu						2.85		1-H-1234S-A:9.0,25415-C:20.6,1169			2.52				
FKF 200 H Cu/Cu						2.10		1-H-1234S-A:9.0,16500-C:20.6,1715			1.80				
FKF 240 H Cu/Cu						2.52		1-H-1234S-A:9.0,20070-C:20.6,2069			2.33				
FKF 270 H Cu/Cu						2.85		1-H-1234S-A:9.0,22770-C:20.6,2342			2.52				
<b>Data required for CDR (EU) No 811/2013 - Reference Area <math>A_{sol}</math></b>						<b>Data required for CDR (EU) No 812/2013 - Reference Area <math>A_{sol}</math></b>									
Collector efficiency ( $\eta_{col}$ )						51%		Zero-loss efficiency ( $\eta_0$ )			0.67		--		
Remark: Collector efficiency ( $\eta_{col}$ ) 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 <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.						First-order coefficient ( $a_1$ )			3.50			W/(m <sup>2</sup> K)			
						Second-order coefficient ( $a_2$ )			0.013			W/(m <sup>2</sup> K <sup>2</sup> )			
						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.									
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