


Annex to Solar Keymark Certificate					Licence Number		011-7S2983 R							
					Date issued		2020-09-01							
					Issued by		TÜV Rheinland Energy GmbH							
Licence holder		IES (Asia) Limited			Country		China							
Brand (optional)					Web		http://www.ies-group.com							
Street, Number		3 Dai Hei Street			E-mail		info@ies-group.com.hk							
Postcode, City		Tai Po Industrial Estate, Tai Po, N.T., HK			Tel		+852 2992 0830							
Collector Type					Evacuated tubular collector									
Collector name					Power output per collector									
					Gb = 850 W/m ² , Gd = 150 W/m ² & u = 1.3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	110 K				
					m ²	mm	mm	mm	mm	mm	mm			
FKA-VP-10					1,74	2.000	870	150	1.307	1.261	1.169	1.077	985	801
FKA-VP-15					2,52	2.000	1.260	150	1.893	1.827	1.694	1.560	1.427	1.161
FKA-VP-20					3,30	2.000	1.650	150	2.479	2.392	2.218	2.043	1.869	1.520
FKA-VP-25					4,08	2.000	2.040	150	3.066	2.958	2.742	2.526	2.311	1.879
FKA-VP-30					4,86	2.000	2.430	150	3.652	3.523	3.266	3.009	2.752	2.239
Power output per m ² gross area					751	725	672	619	566	461				
Performance parameters test method		Steady state - outdoor												
Performance parameters (related to A _G)		$\eta_{0,b}$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	W/(m ² K)	W/(m ² K ²)	J/(m ³ K)	-	J/(m ² K)	s/m	W/(m ² K ⁴)	W/(m ² K ⁴)	-			
Test results		0,733	2,64	0,000	0,000	0,00	63.570	0,000	0,00	0,0E+00	1,17			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K _{GT, coll}	1,02	1,08	1,19	1,37	1,52	1,58	1,50	1,20	0,00			
Longitudinal		K _{GL, coll}	1,00	1,00	0,99	0,98	0,96	0,94	0,88	0,44	0,00			
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A _G)					dm/dt	0,028	kg/(sm ²)							
Maximum temperature difference during thermal performance test					($\vartheta_m - \vartheta_a$) _{max}	80	K							
Standard stagnation temperature (G = 1000 W/m ² ; $\vartheta_a = 30$ °C)					ϑ_{stg}	227	°C							
Maximum operating temperature					$\vartheta_{max, op}$	120	°C							
Maximum operating pressure					p _{max, op}	600	kPa							
Testing laboratory		TÜV Rheinland Energy GmbH					www.tuv.com/solar							
Test report(s)		154019941_EN_P_Sunrain_10_Report_Gao 154019941_EN_Sunrain_30_Report_Gao					Dated		04.12.2013 04.12.2013					
Comments of testing laboratory					Datasheet version: 6.1, 2019-07-11									
					 Digital unterschrieben von Stefan Schaub Datum: 2020.09.01 15:34:53 +0200 TÜV Rheinland Energy GmbH Graef-Stein 51105 Köln									
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Supplementary Information		Issued		2020-09-01										
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	
FKA-VP-10		2.617	2.175	1.794	2.120	1.745	1.432	1.566	1.245	987	1.692	1.344	1.064	
FKA-VP-15		3.791	3.151	2.598	3.071	2.528	2.073	2.267	1.804	1.429	2.450	1.947	1.541	
FKA-VP-20		4.964	4.126	3.402	4.022	3.310	2.715	2.969	2.362	1.872	3.209	2.550	2.018	
FKA-VP-25		6.137	5.101	4.206	4.972	4.092	3.357	3.671	2.920	2.314	3.967	3.153	2.495	
FKA-VP-30		7.310	6.076	5.010	5.923	4.875	3.999	4.373	3.478	2.757	4.726	3.755	2.972	
Annual output per m ² gross area		1.504	1.250	1.031	1.219	1.003	823	900	716	567	972	773	611	
Annual efficiency, η_a		85%	71%	58%	75%	62%	50%	77%	61%	49%	78%	62%	49%	
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)												
Annual irradiation on collector plane		1765 kWh/m ²			1630 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. 6.1 (July 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/m ²) >		1000		ϑ_a (°C) >		20		H_x (MJ/m ²) >		600				
Maximum tested positive load										2250		Pa		
Maximum tested negative load										--		Pa		
Hail resistance using steel ball (maximum drop height)										--		m		
Additional collector attribute(s)														
<input type="checkbox"/> Using external power source(s) for normal operation										<input type="checkbox"/> Active or passive measure(s) for self-protection				
<input type="checkbox"/> Co-generating thermal and electrical power										<input type="checkbox"/> Façade collector(s)				
Energy Labelling Information						Additional Informative Technical Data								
						Reference Area, A_{sol} (m ²)		Hydraulic Designation Code			Aperture Area, A_a (m ²)			
FKA-VP-10						1,74		1-H-12S-C:X			0,92			
FKA-VP-15						2,52		1-H-12S-C:X			1,38			
FKA-VP-20						3,30		1-H-12S-C:X			1,84			
FKA-VP-25						4,08		1-H-12S-C:X			2,31			
FKA-VP-30						4,86		1-H-12S-C:X			2,77			
Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}						Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}								
Collector efficiency (η_{col})						65%		Zero-loss efficiency (η_0)			0,75		--	
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 9806:2017.								First-order coefficient (a_1)			2,64		W/(m ² K)	
								Second-order coefficient (a_2)			0,000		W/(m ² K ²)	
								Incidence angle modifier IAM (50°)			1,32		--	
						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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