

Annex to Solar Keymark Certificate					Licence Number		011-7S2432 F							
					Date issued		2021-12-17							
					Issued by		ISFH CalTeC							
Licence holder		Thermic Energy RZ GmbH			Country		Germany							
Brand (optional)					Web		www.thermic-energy.com							
Street, Number		Fabrikstraße 1-3			E-mail		info@thermic-energy.com							
Postcode, City		D- 04552 Borna			Tel		+49 3433 209678-0							
Collector Type					Flat plate collector									
Collector name					Power output per collector									
					$G_b = 850 \text{ W/m}^2, G_d = 150 \text{ W/m}^2 \text{ \& } u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	87 K				
					m ²	mm	mm	mm	mm	mm	mm			
Flachkollektor FK 253 HA-4A					2.53	2 102	1 202	80	1 810	1 715	1 510	1 285	1 039	815
Power output per m² gross area					715	678	597	508	411	322				
Performance parameters test method		Steady state - indoor												
Performance parameters (related to A_G)		η_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		0.728	3.65	0.010			4 770				0.88			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		$K_{\theta T, coll}$	1.00	0.99	0.98	0.96	0.93	0.87	0.75	0.37	0.00			
Longitudinal		$K_{\theta L, coll}$	1.00	0.99	0.98	0.96	0.93	0.87	0.75	0.37	0.00			
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A_G)					dm/dt		0.096		kg/(sm²)					
Maximum temperature difference during thermal performance test					$(\vartheta_m - \vartheta_a)_{max}$		57		K					
Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30 \text{ }^\circ\text{C}$)					ϑ_{stg}		200		°C					
Maximum operating temperature					$\vartheta_{max, op}$		100		°C					
Maximum operating pressure					$p_{max, op}$		1000		kPa					
Testing laboratory		ISFH CalTeC					http://www.isfh.de							
Test report(s)		173-21/B					Dated		17.12.2021					
Comments of testing laboratory					Datasheet version: 6.1, 2019-07-11									
					Institut für Solarenergieforschung GmbH Am Ohrberg 1 D-31880 Emmerthal Tel.: 05151/999-100 Fax: 05151/999-500									
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Supplementary Information		011-7S2432 F											
		Issued											
		2021-12-17											
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
Flachkollektor FK 253 HA-4A		2 841	1 977	1 265	2 130	1 444	893	1 571	1 005	598	1 709	1 083	633
Annual output per m ² gross area		1 123	782	500	842	571	353	621	397	236	675	428	250
Annual efficiency, η_a		64%	44%	28%	52%	35%	22%	53%	34%	20%	54%	34%	20%
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											3030		Pa
Maximum tested negative load											2800		Pa
Hail resistance using steel ball (maximum drop height)											2		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)			
Flachkollektor FK 253 HA-4A		2.53				7-VH-1234S-A:7.3,1926-C:17.3,1248-				2.36			
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})		55%				Zero-loss efficiency (η_0)				0.72		--	
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)				3.65		W/(m ² K)	
						Second-order coefficient (a ₂)				0.010		W/(m ² K ²)	
						Incidence angle modifier IAM (50°)				0.92		--	
						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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