

Annex to Solar Keymark Certificate					Licence Number		011-7S3146 F							
					Date issued		2022-12-19							
					Issued by		DIN CERTCO							
Licence holder		Prinz Thermotechnik GmbH			Country		Germany							
Brand (optional)					Web		http://www.ht-prinz.de							
Street, Number		Projektierte Straße 13			E-mail		info@ht-prinz.de							
Postcode, City		D- 99880 Waltershausen			Tel		+49 362 260 375							
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	85 K				
					m ²	mm	mm	mm	mm	mm				
TP232					2.32	2 037	1 137	80	1 770	1 687	1 501	1 290	1 052	857
Power output per m² gross area					764	728	648	557	454	370				
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		0.776	3.45	0.014			5 600				0.90			
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	0.97	0.94	0.89	0.78	0.46	0.00			
Longitudinal		$K_{\theta L, coll}$	1.00	0.99	0.98	0.97	0.94	0.89	0.78	0.46	0.00			
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A_G)					dm/dt		0.036		kg/(sm²)					
Maximum temperature difference during thermal performance test					$(\vartheta_m - \vartheta_a)_{max}$		55		K					
Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30 \text{ }^\circ\text{C}$)					ϑ_{stg}		209		°C					
Maximum operating temperature					$\vartheta_{max, op}$		-		°C					
Maximum operating pressure					$p_{max, op}$		1000		kPa					
Testing laboratory		ISFH CalTeC					https://isfh.de/							
Test report(s)		150-22/B1					Dated		19.12.2022					
Comments of testing laboratory					Ver. 6.2 (13.01.2022)									
					Institut für Solarenergieforschung GmbH Am Ohrberg 1 D-31880 Emmertal Tel.: 05151/999-100 Fax: 05151/999-500									
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Supplementary Information				Issued		2022-12-19							
Gross Thermal Yield 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
TP232		2 820	2 028	1 332	2 154	1 497	942	1 584	1 044	633	1 721	1 128	673
Gross Thermal Yield per m ² gross area		1 217	876	575	930	646	407	684	451	273	743	487	290
Annual efficiency, η_a		69%	50%	33%	57%	40%	25%	59%	39%	23%	60%	39%	23%
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. 6.2 (13.01.2022). 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)										B		--	
G (W/m ²) >		900		ϑ_a (°C) >		15		H _x (MJ/m ²) >		540			
Maximum tested positive load										3000		Pa	
Maximum tested negative load										2000		Pa	
Hail resistance using steel ball (maximum drop height)										2		m	
Additional collector attribute(s)													
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			
Energy Labelling Information						Additional Informative Technical Data							
		Reference Area, A _{sol} (m ²)				Hydraulic Designation Code				Aperture Area, A _a (m ²)			
TP232		2.32				2-VH-12S-11.3,16250-16,L				2.13			
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})		60%				Zero-loss efficiency (η_0)				0.76		--	
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)				3.45		W/(m ² K)	
						Second-order coefficient (a ₂)				0.014		W/(m ² K ²)	
						Incidence angle modifier IAM (50°)				0.93		--	
						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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