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ISFH CalTeC

Annex to Solar Keymark Certificate		Licence Number	011-7S2333 F
		Date issued	2022-01-17
		Issued by	DIN CERTCO

Licence holder	ATMOS Zentrallager GmbH	Country	Germany		
Brand (optional)		Web	https://atmos-zentrallager.de/		
Street, Number	Torgauer Straße 10-14	E-mail	info@atmos-zentrallager.de		
Postcode, City	D- 04862 Mockrehna	Tel	+49	34244 - 5946 - 0	

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	88 K
	m²	mm	mm	mm	W	W	W	W	W	W
ATMOSPHERE 2.3	2.32	2 037	1 137	80	1 679	1 589	1 396	1 183	953	729
Power output per m² gross area					725	686	603	511	411	315

Performance parameters test method	Steady state - indoor									
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	0.736	3.78	0.010			4 770				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	0.96	0.94	0.88	0.78	0.45	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	0.99	0.98	0.96	0.94	0.88	0.78	0.45	0.00

Heat transfer medium for testing		Water	
Flow rate for testing (per gross area, A_G)	dm/dt	0.020	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	58	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °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	https://isfh.de/	
Test report(s)	003-22/B	Dated	13.01.2022

Comments of testing laboratory	Ver. 6.2 (13.01.2022)
	Institut für Solarenergieforschung GmbH Am Ohrberg 1 D-31860 Emmerthal Tel.: 05151/999-100 Fax: 05151/999-500

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Supplementary Information	Issued	2022-01-17

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
ATMOSPHERE 2.3		2 656	1 840	1 169	1 982	1 336	818	1 466	932	549	1 596	1 004	582
Gross Thermal Yield per m² gross area		1 147	794	505	856	577	353	633	402	237	689	434	251
Annual efficiency, η_a		65%	45%	29%	53%	35%	22%	54%	34%	20%	55%	35%	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. 6.2 (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)					A	--
G (W/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >		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)

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

	Reference Area, A_{sol} (m²)
ATMOSPHERE 2.3	2.32

Data required for CDR (EU) No 811/2013 - Reference Area

Collector efficiency (η_{col})	56%

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	Aperture Area, A_a (m²)
1-VH-12S-A:11.3;16250	2.13

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

Zero-loss efficiency (η_0)	0.72	--
First-order coefficient (a_1)	3.78	W/(m²K)
Second-order coefficient (a_2)	0.010	W/(m²K²)
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.