TÜVRheinland®
DIN CERTCO
Precisely Right.

ISFH CalTeC

Annex to Solar Keymark Certificate		Licence Number	011-7S1494 F
		Date issued	2022-01-27
		Issued by	DIN CERTCO

Licence holder	OEG Oel- und Gasfeuerungsbedarf	Country	Germany
Brand (optional)		Web	www.oeg.net
Street, Number	Industriestr. 1	E-mail	info@oeg.net
Postcode, City	D- 31840 Hessisch Oldendorf	Tel	+49 5152 699-0

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
4Plus	2.53	2 102	1 202	80	1 856	1 762	1 556	1 327	1 072	823
Power output per m² gross area					735	697	616	525	424	326

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	0.748	3.59	0.012			5 660				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	0.020 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)	172-21/B	Dated	16.12.2021

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	2022-01-27

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
4Plus	2 916	2 049	1 316	2 200	1 500	927	1 621	1 046	622	1 762	1 126	660
Gross Thermal Yield per m² gross area	1 154	811	521	871	594	367	641	414	246	697	446	261
Annual efficiency, η_a	65%	46%	30%	53%	36%	23%	55%	35%	21%	56%	36%	21%
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)
4Plus	2.53

Additional Informative Technical Data

Hydraulic Designation Code	Aperture Area, A_a (m²)
1-VH-12S-A:11.3,17042	2.36

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}

Collector efficiency (η_{col})	57%

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.

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

Zero-loss efficiency (η_0)	0.73	--
First-order coefficient (a_1)	3.59	W/(m²K)
Second-order coefficient (a_2)	0.012	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.