
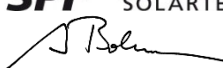


Annex to Solar Keymark Certificate						Licence Number		011-7S1538 F			
						Date issued		2023-01-26			
						Issued by		DIN CERTCO			
Licence holder		SAMMLER B. Michalopoulos AEBE				Country	Greece				
Brand (optional)						Web	www.sammler.gr				
Street, Number		Pyli Dervenoxoria				E-mail	sammler@sammler.gr				
Postcode, City		32 009 Voiotias				Tel	+30	21023 82868			
Collector Type						Flat plate collector					
Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector						
					$G_b = 850 \text{ W/m}^2$, $G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$						
					0 K	10 K	30 K	50 K	70 K	119 K	
	m^2	mm	mm	mm	W	W	W	W	W	W	
ALTER 2004	2.12	2'040	1'040	90	1'515	1'446	1'295	1'126	941	415	
ALTER 2304	2.33	2'040	1'140	90	1'665	1'589	1'423	1'238	1'034	457	
ALTER 2504	2.53	2'040	1'240	90	1'808	1'726	1'545	1'344	1'123	496	
Power output per m^2 gross area						715	682	611	531	444	196
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		-	$\text{W}/(\text{m}^2\text{K})$	$\text{W}/(\text{m}^2\text{K}^2)$	$\text{J}/(\text{m}^3\text{K})$	-	$\text{J}/(\text{m}^2\text{K})$	s/m	$\text{W}/(\text{m}^2\text{K}^4)$	$\text{W}/(\text{m}^2\text{K}^4)$	-
Test results		0.729	3.17	0.010	0.000	0.00	5'082	0.000	0.00	0.0E+00	0.87
Incidence angle modifier test method		Steady state - outdoor									
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal		$K_{\theta T, \text{coll}}$	1.00	1.00	0.99	0.98	0.95	0.86	0.65	0.35	0.00
Longitudinal		$K_{\theta L, \text{coll}}$	1.00	1.00	0.99	0.98	0.95	0.86	0.65	0.35	0.00
Heat transfer medium for testing						Water-Glycole					
Flow rate for testing (per gross area, A_G)						dm/dt	0.018	$\text{kg}/(\text{sm}^2)$			
Maximum temperature difference during thermal performance test						$(\vartheta_m - \vartheta_a)_{\text{max}}$	89	K			
Standard stagnation temperature ($G = 1000 \text{ W/m}^2$; $\vartheta_a = 30 \text{ }^\circ\text{C}$)						ϑ_{stg}	180	$^\circ\text{C}$			
Maximum operating temperature						$\vartheta_{\text{max, op}}$	150	$^\circ\text{C}$			
Maximum operating pressure						$p_{\text{max, op}}$	1000	kPa			
Testing laboratory		SPF Testing, CH-8640 Rapperswil, Switzerland				www.spf.ch					
Test report(s)		C1891 C1892				Dated		25.01.2023 25.01.2023			
Comments of testing laboratory						Draft Ver. 6.2 (22.09.2021)					
						 INSTITUT FÜR SOLARTECHNIK 					
DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de											

Annex to Solar Keymark Certificate Supplementary Information	Licence Number	011-7S1538 F
	Issued	2023-01-26

Gross Thermal Yield in kWh/collector at mean fluid temperature ϑ_m													
Collector name	Standard Locations ϑ_m	Athens			Davos			Stockholm			Würzburg		
		25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
ALTER 2004		2'395	1'746	1'185	1'848	1'317	873	1'349	910	578	1'464	980	614
ALTER 2304		2'633	1'919	1'302	2'032	1'447	959	1'483	1'000	636	1'608	1'077	675
ALTER 2504		2'859	2'083	1'414	2'206	1'572	1'041	1'610	1'086	690	1'747	1'170	732
Gross Thermal Yield per m ² gross area													
Annual efficiency, η_a													
Fixed or tracking collector													
Annual irradiation on collector plane													
Mean annual ambient air temperature													
Collector orientation or tracking mode													

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 Draft Ver. 6.2 (22.09.2021). 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	2400		Pa
Maximum tested negative load	2400		Pa
Hail resistance using ice balls (diameter)	35		mm

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)
ALTER 2004	2.12	1-H-1234S-7.2,19630-20.4,1080	1.91
ALTER 2304	2.33	1-H-1234S-7.2,21640-20.4,1180	2.10
ALTER 2504	2.53	1-H-1234S-7.2,23750-20.4,1280	2.30

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})	57%	Zero-loss efficiency (η_0)	0.71
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)	3.17
		Second-order coefficient (a_2)	0.010
		Incidence angle modifier IAM (50°)	0.95
		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.	