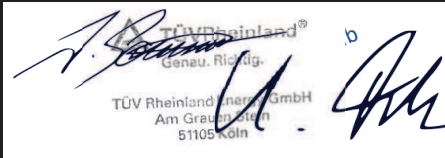


Annex to Solar Keymark Certificate					Licence Number		011-7S2463 R							
					Date issued		2021-03-11							
					Issued by		TÜV Rheinland Energy GmbH							
Licence holder		Consolar Solare Energiesysteme GmbH			Country		Germany							
Brand (optional)		Consolar			Web		www.consolar.com							
Street, Number		Kasseler Straße 1a			E-mail		info@consolar.de							
Postcode, City		60486 Frankfurt a.M.			Tel		49 (0)7621 42228-500							
Collector Type					Evacuated tubular 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	90 K				
					m ²	mm	mm	mm	mm	mm	mm			
Consolar TUBO II C (2 Modules)					2.44	1 947	1 248	87	1 445	1 422	1 369	1 305	1 232	1 150
Power output per m² gross area					592	583	561	535	505	471				
Performance parameters test method		Quasi dynamic												
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		0.595	0.90	0.005	0.000	0.00	18 836	0.000	0.00	0.0E+00	0.97			
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	1.01	1.00	1.00	1.01	1.00	1.00	0.00			
Longitudinal		$K_{\theta L, coll}$	1.00	0.98	0.95	0.90	0.83	0.72	0.56	0.33	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		$(\vartheta_m - \vartheta_a)_{max}$		60		K								
Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30 \text{ }^\circ\text{C}$)		ϑ_{stg}		310		°C								
Maximum operating temperature		$\vartheta_{max, op}$		-		°C								
Maximum operating pressure		$p_{max, op}$		1000		kPa								
Testing laboratory		TÜV Rheinland Energy GmbH					www.tuv.com/solarenergy							
Test report(s)		21249958.001 21249958.003 (EN 12975-1 Doc-check)					Dated		15.09.2020 11.03.2021					
Comments of testing laboratory		Datasheet version: 6.1, 2019-07-11 Because of product size 2 samples were combined for testing incl. additional CPC-element. Dimension of single element (l/w/h) [mm]: 1947 / 624 / 87 Areas of single element (Aa/Ag) [m ²]: 0.98 / 1.22 Due to the design that used single elements to enlarge final collector field area; combined with additional CPC-elements; the enclosed maximum power peak-values had been documented in test report.												
 TÜV Rheinland Energy GmbH Am Grauhof 1 51105 Köln														
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													Licence Number			011-7S2463 R		
Supplementary Information													Issued			2021-03-11		
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					
Consolar TUBO II C (2 Modules)		2 449	2 191	1 905	2 100	1 837	1 565	1 526	1 307	1 089	1 638	1 405	1 172					
Annual output per m ² gross area		1 004	898	781	861	753	642	625	536	446	671	576	480					
Annual efficiency, η_a		57%	51%	44%	53%	46%	39%	54%	46%	38%	54%	46%	39%					
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												2700		Pa				
Maximum tested negative load												2250		Pa				
Hail resistance using ice balls (diameter)												25		mm				
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)						
Consolar TUBO II C (2 Modules)				2.44				1-V-1122S-A:6,21660-C:15.8,625				2.06						
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)				0.59 --						
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)				0.90				W/(m ² K)						
				Second-order coefficient (a ₂)				0.005				W/(m ² K ²)						
				Incidence angle modifier IAM (50°)				0.91				--						
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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