

Annex to Solar Keymark Certificate					Licence Number		011-7S2790 F				
					Date issued		2023-02-09				
					Issued by		DIN CERTCO				
Licence holder		THERMIC S.P.L.L.C			Country		Greece				
Brand (optional)					Web		www.thermicsol.com				
Street, Number		Loutsas & Mesologgiou			E-mail		alkis.metzalis@thermicsol.com				
Postcode, City		19600 Mandra, Attica			Tel		+30 2105555523				
Collector Type					Flat plate collector						
Collector name		Gross area (A_G) m ²	Gross length mm	Gross width mm	Gross height mm	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	104 K
						W	W	W	W	W	W
TS 1.90 FP		1,96	1.503	1.305	103	1.457	1.393	1.254	1.099	928	602
TS 2.00 FP		2,02	2.006	1.007	103	1.501	1.436	1.292	1.132	956	620
TS 2.25 FP		2,24	1.893	1.183	103	1.665	1.592	1.433	1.255	1.060	687
TS 2.50 FP		2,52	2.006	1.257	103	1.873	1.791	1.612	1.412	1.193	773
TS 2.70 FP		2,67	2.261	1.183	103	1.985	1.898	1.708	1.497	1.264	819
TS 3.00 FP		2,92	2.006	1.447	103	2.170	2.075	1.868	1.637	1.382	896
Power output per m ² gross area						743	711	640	560	473	307
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		0,748	3,16	0,010	0,000	0,00	14.330	0,000	0,00	0,00	0,96
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	0,92	0,80	0,47	0,24	0,00
Longitudinal		$K_{\theta L, coll}$	1,00	0,99	0,98	0,97	0,92	0,80	0,47	0,24	0,00
Heat transfer medium for testing		Water									
Flow rate for testing (per gross area, A_G)		dm/dt		0,020		kg/(sm ²)					
Maximum temperature difference during thermal performance test		$(\vartheta_m - \vartheta_a)_{max}$		74		K					
Standard stagnation temperature ($G = 1000 \text{ W/m}^2$; $\vartheta_a = 30 \text{ °C}$)		ϑ_{stg}		220		°C					
Maximum operating temperature		$\vartheta_{max, op}$		k.A.		°C					
Maximum operating pressure		$p_{max, op}$		1000		kPa					
Testing laboratory		Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)					http://www.igte.uni-stuttgart.de				
Test report(s)		22COL1679OEM02 22COL1681OEM02 22COL1647Q/1OEM02					Dated		09.02.2023 09.02.2023 09.02.2023		
Comments of testing laboratory		Ver. 6.2 (13.01.2022)									
Documented performance parameters are taken from 22COL1679OEM02 (TS 1.90 FP) This data sheet replaces the data sheet issued on 18.09.2017.		 Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)									
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Supplementary Information

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Gross Thermal Yield in kWh/collector at mean fluid temperature ϑ_m

Collector name	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		
TS 1.90 FP		2.333	1.727	1.192	1.810	1.306	880	1.319	903	584	1.439	980	627		
TS 2.00 FP		2.404	1.779	1.229	1.866	1.345	907	1.359	931	602	1.483	1.010	646		
TS 2.25 FP		2.666	1.973	1.362	2.069	1.492	1.006	1.507	1.032	668	1.644	1.121	716		
TS 2.50 FP		2.999	2.220	1.533	2.327	1.679	1.131	1.695	1.161	751	1.850	1.261	806		
TS 2.70 FP		3.178	2.352	1.624	2.466	1.778	1.199	1.796	1.230	796	1.960	1.336	853		
TS 3.00 FP		3.475	2.572	1.776	2.697	1.945	1.311	1.964	1.345	871	2.144	1.461	933		
Gross Thermal Yield per m ² gross area		1.190	881	608	924	666	449	673	461	298	734	500	320		
Annual efficiency, η_a		67%	50%	34%	57%	41%	28%	58%	40%	26%	59%	40%	26%		
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)										A		--			
G (W/m ²) >		1000		ϑ_a (°C) >		20		H (MJ/m) >				600			
Maximum tested positive load										2600		Pa			
Maximum tested negative load										1500		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)					
TS 1.90 FP		1,96				11-V-1234S-7.2,1392-20.6,1370-D				1,79					
TS 2.00 FP		2,02				9-V-1234S-7.2,1897-20.6,1060-D				1,83					
TS 2.25 FP		2,24				10-V-1234S-7.2,1782-20.6,1240-D				2,05					
TS 2.50 FP		2,52				11-V-1234S-7.2,1897-20.6,1310-D				2,32					
TS 2.70 FP		2,67				10-V-1234S-7.2,2152-20.6,1240-D				2,46					
TS 3.00 FP		2,92				12-V-1234S-7.2,1897-20.6,1510-D				2,71					
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)				0,74		--			
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)				3,16		W/(m ² K)			
						Second-order coefficient (a_2)				0,010		W/(m ² K ²)			
						Incidence angle modifier IAM (50°)				0,94		--			
						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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