


<b>Annex to Solar Keymark Certificate</b>					<b>Licence Number</b>		<b>011-7S2708 F</b>							
					<b>Date issued</b>		<b>2022-07-13</b>							
					<b>Issued by</b>		<b>DIN CERTCO</b>							
<b>Licence holder</b>		<b>THERMIC SPLLC</b>			<b>Country</b>		<b>Greece</b>							
<b>Brand (optional)</b>					<b>Web</b>		<b>www.thermicsol.com</b>							
<b>Street, Number</b>		<b>Loutsas &amp; Mesologgiou</b>			<b>E-mail</b>		<b>info@thermicsol.com</b>							
<b>Postcode, City</b>		<b>19600 Mandra, Attica</b>			<b>Tel</b>		<b>+30 210 55 55 523</b>							
<b>Collector Type</b>					<b>Flat plate collector</b>									
<b>Collector name</b>					<b>Power output per collector</b>									
					$G_b = 850 \text{ W/m}^2, G_d = 150 \text{ W/m}^2 \text{ \& } u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	112 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm				
					W	W	W	W	W	W				
<b>THERMIC DELTA 1.5</b>					1.51	1 503	1 007	85	1 093	1 037	921	797	666	367
<b>THERMIC DELTA 1.7</b>					1.68	1 420	1 183	85	1 216	1 154	1 024	886	741	408
<b>THERMIC DELTA 2.0H</b>					1.96	1 503	1 305	85	1 419	1 346	1 195	1 034	864	476
<b>THERMIC DELTA 2.0</b>					2.02	2 006	1 007	85	1 462	1 388	1 232	1 066	890	490
<b>THERMIC DELTA 2.25</b>					2.24	1 893	1 183	85	1 621	1 539	1 366	1 182	987	544
<b>THERMIC DELTA 2.5</b>					2.52	2 006	1 257	85	1 824	1 731	1 536	1 330	1 111	612
<b>THERMIC DELTA 2.7</b>					2.67	2 261	1 183	85	1 933	1 834	1 628	1 409	1 177	648
<b>THERMIC DELTA 3.0</b>					2.92	2 006	1 457	85	2 114	2 006	1 780	1 541	1 287	709
<b>Power output per m<sup>2</sup> gross area</b>					<b>724</b>	<b>687</b>	<b>610</b>	<b>528</b>	<b>441</b>	<b>243</b>				
<b>Performance parameters test method</b>		<b>Quasi dynamic</b>												
<b>Performance parameters (related to A<sub>G</sub>)</b>		$\eta_0, b$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
<b>Units</b>		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-			
<b>Test results</b>		0.725	3.62	0.006	0.000	0.00	13 660	0.000	0.00	0.0	0.99			
<b>Incidence angle modifier test method</b>		<b>Quasi dynamic - outdoor</b>												
<b>Incidence angle modifier</b>		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
<b>Transversal</b>		$K_{GT, coll}$	1.00	1.00	1.00	0.99	0.96	0.87	0.63	0.32	0.00			
<b>Longitudinal</b>		$K_{GL, coll}$	1.00	1.00	1.00	0.99	0.96	0.87	0.63	0.32	0.00			
<b>Heat transfer medium for testing</b>		<b>Water-Glycole</b>												
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>		$dm/dt$		0.020	$kg/(sm^2)$									
<b>Maximum temperature difference during thermal performance test</b>		$(\vartheta_m - \vartheta_a)_{max}$		82	K									
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30 \text{ }^\circ\text{C}</math>)</b>		$\vartheta_{stg}$		230	°C									
<b>Maximum operating temperature</b>		$\vartheta_{max, op}$		-	°C									
<b>Maximum operating pressure</b>		$p_{max, op}$		1000	kPa									
<b>Testing laboratory</b>		Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)					<a href="http://www.igte.uni-stuttgart.de">http://www.igte.uni-stuttgart.de</a>							
<b>Test report(s)</b>		21COL1631OEM06 21COL1631QOEM06 21COL1632OEM06					<b>Dated</b>		22.06.2022 22.06.2022 22.06.2022					
<b>Comments of testing laboratory</b>		Ver. 6.2 (13.01.2022)												
Documented performance parameters are taken from 21COL1632OEM06 (THERMIC DELTA 1.5)		 <p>Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 8, 70560 Stuttgart (Vaihingen)</p>												
This data sheet replaces the data sheet issued on 15.03.2021														
According to the Solar Keymark Scheme rules the collector was retested after 10 years after the previous test.														
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Annex to Solar Keymark Certificate Supplementary Information		Licence Number		011-7S2708 F												
		Issued		2022-07-13												
<b>Gross Thermal Yield in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>																
Standard Locations		Athens			Davos			Stockholm			Würzburg					
Collector name	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C			
THERMIC DELTA 1.5		1 792	1 285	868	1 361	958	635	996	661	418	1 090	719	449			
THERMIC DELTA 1.7		1 993	1 430	966	1 514	1 065	706	1 109	735	465	1 213	800	499			
THERMIC DELTA 2.0H		2 326	1 668	1 127	1 766	1 243	824	1 293	858	543	1 415	933	582			
THERMIC DELTA 2.0		2 397	1 719	1 162	1 820	1 281	849	1 333	884	559	1 459	961	600			
THERMIC DELTA 2.25		2 658	1 906	1 288	2 018	1 421	941	1 478	980	620	1 618	1 066	666			
THERMIC DELTA 2.5		2 990	2 144	1 449	2 271	1 598	1 059	1 663	1 103	698	1 820	1 199	749			
THERMIC DELTA 2.7		3 168	2 272	1 535	2 406	1 693	1 122	1 762	1 169	739	1 928	1 271	793			
THERMIC DELTA 3.0		3 465	2 485	1 679	2 631	1 852	1 227	1 927	1 278	809	2 109	1 390	868			
Gross Thermal Yield per m <sup>2</sup> gross area		1 187	851	575	901	634	420	660	438	277	722	476	297			
Annual efficiency, $\eta_a$		67%	48%	33%	55%	39%	26%	57%	38%	24%	58%	38%	24%			
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)														
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1630 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>					
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 $\vartheta_m$ (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 <a href="http://www.estif.org/solarkeymarknew/">http://www.estif.org/solarkeymarknew/</a>																
<b>Additional Information</b>																
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 <sup>2</sup> ) >		1000		$\vartheta_a$ (°C) >		20		H <sub>x</sub> (MJ/m <sup>2</sup> ) >		600						
Maximum tested positive load											2750		Pa			
Maximum tested negative load											2400		Pa			
Hail resistance using steel ball (maximum drop height)											2		m			
<b>Additional collector attribute(s)</b>																
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		
<b>Energy Labelling Information</b>						<b>Additional Informative Technical Data</b>										
	Reference Area, A <sub>sol</sub> (m <sup>2</sup> )					Hydraulic Designation Code					Aperture Area, A <sub>a</sub> (m <sup>2</sup> )					
THERMIC DELTA 1.5	1.51					8-V-1234S-7.2,1383-20.6,1060-D					1.36					
THERMIC DELTA 1.7	1.68					10-V-1234S-7.2,1303-20.6,1240-D					1.52					
THERMIC DELTA 2.0H	1.96					11-V-1234S-7.2,1383-20.6,1370-D					1.79					
THERMIC DELTA 2.0	2.02					8-V-1234S-7.2,1888-20.6,1060-D					1.83					
THERMIC DELTA 2.25	2.24					10-V-1234S-7.2,1773-20.6,1240-D					2.05					
THERMIC DELTA 2.5	2.52					11-V-1234S-7.2,1888-20.6,1310-D					2.32					
THERMIC DELTA 2.7	2.67					10-V-1234S-7.2,2143-20.6,1240-D					2.46					
THERMIC DELTA 3.0	2.92					12-V-1234S-7.2,1888-20.6,1510-D					2.71					
<b>Data required for CDR (EU) No 811/2013 - Reference Area A<sub>sol</sub></b>						<b>Data required for CDR (EU) No 812/2013 - Reference Area A<sub>sol</sub></b>										
Collector efficiency ( $\eta_{col}$ )						57%						Zero-loss efficiency ( $\eta_0$ )		0.72	--	
Remark: Collector efficiency ( $\eta_{col}$ ) 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 <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area (A <sub>sol</sub> ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.												First-order coefficient (a <sub>1</sub> )		3.62	W/(m <sup>2</sup> K)	
												Second-order coefficient (a <sub>2</sub> )		0.006	W/(m <sup>2</sup> K <sup>2</sup> )	
												Incidence angle modifier IAM (50°)		0.98	--	
Remark: The data given in this section are related to collector reference area (A <sub>sol</sub> ) 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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