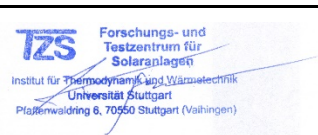


Annex to Solar Keymark Certificate					Licence Number		011-7S2963 F							
					Date issued		2020-01-07							
					Issued by		DIN CERTCO							
Licence holder		THERMIC SPLLC			Country	Greece								
Brand (optional)		THERMICSOL			Web	ww.thermicsol.com								
Street, Number		Loutsas & Mesologgiou			E-mail	info@thermicsol.com								
Postcode, City		19600 Mandra			Tel	+30 210 5555 523								
Collector Type					Flat plate collector									
Collector name					Power output per collector G _b = 850 W/m ² , G _d = 150 W/m ² & u = 1.3 m/s θ _m - θ _a									
					0 K	10 K	30 K	50 K	70 K	115 K				
					m ²	mm	mm	mm	W	W	W	W	W	W
HECTOR 1.5					1.51	1 503	1 007	85	1 055	999	880	752	613	267
HECTOR 1.7					1.68	1 420	1 183	85	1 174	1 112	979	836	682	297
HECTOR 1.9					1.96	1 503	1 305	85	1 370	1 297	1 143	976	796	346
HECTOR 2.0					2.02	2 006	1 007	85	1 412	1 337	1 178	1 006	821	357
HECTOR 2.3					2.24	1 893	1 183	85	1 565	1 482	1 306	1 115	910	396
HECTOR 2.5					2.52	2 006	1 257	85	1 761	1 668	1 469	1 254	1 024	445
Power output per m ² gross area									699	662	583	498	406	177
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		0.701	3.62	0.008	0.000	0.00	17 941	0.000	0.00	0.0	0.98			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K _{θT, coll}	1.00	0.99	0.98	0.96	0.94	0.88	0.78	0.45	0.00			
Longitudinal		K _{θL, coll}	1.00	0.99	0.98	0.96	0.94	0.88	0.78	0.45	0.00			
Heat transfer medium for testing		Water-Glycole												
Flow rate for testing (per gross area, A _G)		dm/dt	0.020	kg/(sm ²)										
Maximum temperature difference during thermal performance test		(θ _m -θ _a) _{max}	85	K										
Standard stagnation temperature (G = 1000 W/m ² ; θ _a = 30 °C)		θ _{stg}	200	°C										
Maximum operating temperature		θ _{max, op}	n.a.	°C										
Maximum operating pressure		p _{max, op}	1600	kPa										
Testing laboratory		Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)					http://www.igte.uni-stuttgart.de							
Test report(s)		10COL910/2OEM01 10COL911/2OEM01 10COL911Q/2OEM01					Dated		07.01.2020 07.01.2020 07.01.2020					
Comments of testing laboratory		Datashet version: 6.1, 2019-09-26												
Thermal performance parameters are given from 10COL910/2OEM01 (HECTOR 1.5)		 <p>Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Plattenwaldring 8, 70560 Stuttgart (Vaihingen)</p>												
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	011-7S2963 F
	Issued	2020-01-07

Annual collector output in kWh/collector at mean fluid temperature ϑ_m													
Collector name	Standard Locations	Athens			Davos			Stockholm			Würzburg		
	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
HECTOR 1.5		1 710	1 200	780	1 280	873	547	947	609	367	1 035	662	392
HECTOR 1.7		1 903	1 335	868	1 424	971	609	1 053	678	408	1 152	736	436
HECTOR 1.9		2 220	1 558	1 012	1 661	1 133	711	1 229	791	476	1 344	859	508
HECTOR 2.0		2 288	1 606	1 043	1 712	1 168	732	1 266	815	491	1 385	885	524
HECTOR 2.3		2 537	1 780	1 157	1 898	1 295	812	1 404	904	544	1 535	982	581
HECTOR 2.5		2 855	2 003	1 302	2 136	1 457	914	1 580	1 017	612	1 727	1 104	654
Annual output per m ² gross area		1 133	795	517	848	578	363	627	403	243	685	438	259
Annual efficiency, η_a		64%	45%	29%	52%	35%	22%	54%	35%	21%	55%	35%	21%
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 (September 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)	B		--
G (W/m ²) >	900	ϑ_a (°C) >	15
		H_x (MJ/m ²) >	540
Maximum tested positive load	3000		Pa
Maximum tested negative load	3000		Pa
Hail resistance using steel ball (maximum drop height)	n.a.		m

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)
HECTOR 1.5	1.51	8-V-1234S-A:14.1,1389-C:20.6,1060-D	1.36
HECTOR 1.7	1.68	10-V-1234S-A:14.1,1309-C:20.6,1240-D	1.51
HECTOR 1.9	1.96	11-V-1234S-A:14.1,1389-C:20.6,1370-D	1.79
HECTOR 2.0	2.02	8-V-1234S-A:14.1,1894-C:20.6,1060-D	1.83
HECTOR 2.3	2.24	10-V-1234S-A:14.1,1779-C:20.6,1240-D	2.03
HECTOR 2.5	2.52	11-V-1234S-A:14.1,1894-C:20.6,1310-D	2.32

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})	54%	Zero-loss efficiency (η_0)	0.70
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)	3.62
		Second-order coefficient (a_2)	0.008
		Incidence angle modifier IAM (50°)	0.93
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.			