


Annex to Solar Keymark Certificate					Licence Number		011-7S1808 F							
					Date issued		2022-06-29							
					Issued by		DIN CERTCO							
Licence holder		CALPACK CICERO HELLAS SA			Country		Greece							
Brand (optional)					Web		www.calpak.gr							
Street, Number		9 Sygrou Ave.			E-mail		info@calpak.gr							
Postcode, City		11743 Athens			Tel		+30 2109247250							
Collector Type					Flat plate collector									
Collector name					Power output per collector									
					Gb = 850 W/m <sup>2</sup> , Gd = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	112 K				
					W	W	W	W	W	W				
					m <sup>2</sup>	mm	mm	mm	mm	mm				
150 ES8					1.51	1 503	1 007	85	1 093	1 037	921	797	666	367
170 ES8					1.68	1 420	1 183	85	1 216	1 154	1 024	886	741	408
195 ES8					1.96	1 503	1 305	85	1 419	1 346	1 195	1 034	864	476
200 ES8					2.02	2 006	1 007	85	1 462	1 388	1 232	1 066	890	490
230 ES8					2.24	1 893	1 183	85	1 621	1 539	1 366	1 182	987	544
250 ES8					2.52	2 006	1 257	85	1 824	1 731	1 536	1 330	1 111	612
275 ES8					2.67	2 261	1 183	85	1 933	1 834	1 628	1 409	1 177	648
290 ES8					2.92	2 006	1 457	85	2 114	2 006	1 780	1 541	1 287	709
Power output per m <sup>2</sup> gross area					724	687	610	528	441	243				
Performance parameters test method		Quasi dynamic												
Performance parameters (related to A <sub>G</sub> )		$\eta_{0, b}$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	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> )	-			
Test results		0.725	3.62	0.006	0.000	0.00	13 660	0.000	0.00	0.0	0.99			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub>θT, coll</sub>	1.00	1.00	1.00	0.99	0.96	0.87	0.63	0.32	0.00			
Longitudinal		K <sub>θL, coll</sub>	1.00	1.00	1.00	0.99	0.96	0.87	0.63	0.32	0.00			
Heat transfer medium for testing		Water-Glycole												
Flow rate for testing (per gross area, A <sub>G</sub> )		dm/dt	0.020	kg/(sm <sup>2</sup> )										
Maximum temperature difference during thermal performance test		( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	82	K										
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30$ °C)		$\vartheta_{stg}$	230	°C										
Maximum operating temperature		$\vartheta_{max, op}$	-	°C										
Maximum operating pressure		p <sub>max, op</sub>	1000	kPa										
Testing laboratory		Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)					http://www.igte.uni-stuttgart.de							
Test report(s)		21COL1631OEM05 21COL1631QOEM05 21COL1632OEM05					Dated		20.06.2022 20.06.2022 20.06.2022					
Comments of testing laboratory		Ver. 6.2 (13.01.2022)												
Documented performance parameters are taken from 21COL1632OEM05 (150 ES8) According to the Solar Keymark Scheme rules the collector was retested after 10 years after the previous test.		 Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70560 Stuttgart (Vaihingen)												
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Supplementary Information						Issued		2022-06-29							
<b>Gross Thermal Yield in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>															
Collector name	Standard Locations	Athens			Davos			Stockholm			Würzburg				
	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C		
150 ES8		1 792	1 285	868	1 361	958	635	996	661	418	1 090	719	449		
170 ES8		1 993	1 430	966	1 514	1 065	706	1 109	735	465	1 213	800	499		
195 ES8		2 326	1 668	1 127	1 766	1 243	824	1 293	858	543	1 415	933	582		
200 ES8		2 397	1 719	1 162	1 820	1 281	849	1 333	884	559	1 459	961	600		
230 ES8		2 658	1 906	1 288	2 018	1 421	941	1 478	980	620	1 618	1 066	666		
250 ES8		2 990	2 144	1 449	2 271	1 598	1 059	1 663	1 103	698	1 820	1 199	749		
275 ES8		3 168	2 272	1 535	2 406	1 693	1 122	1 762	1 169	739	1 928	1 271	793		
290 ES8		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 Senocalc 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		$H_x$ (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, $A_{sol}$ (m <sup>2</sup> )		Hydraulic Designation Code				Aperture Area, $A_a$ (m <sup>2</sup> )			
150 ES8						1.51		8-V-1234S-7.2,1383-20.6,1060-D				1.36			
170 ES8						1.68		10-V-1234S-7.2,1303-20.6,1240-D				1.52			
195 ES8						1.96		11-V-1234S-7.2,1383-20.6,1370-D				1.79			
200 ES8						2.02		8-V-1234S-7.2,1888-20.6,1060-D				1.83			
230 ES8						2.24		10-V-1234S-7.2,1773-20.6,1240-D				2.05			
250 ES8						2.52		11-V-1234S-7.2,1888-20.6,1310-D				2.32			
275 ES8						2.67		10-V-1234S-7.2,2143-20.6,1240-D				2.46			
290 ES8						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 <math>A_{sol}</math></b>						<b>Data required for CDR (EU) No 812/2013 - Reference Area <math>A_{sol}</math></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 ( $A_{sol}$ ) 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		W/(m <sup>2</sup> K)	
								Second-order coefficient ( $a_2$ )				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 ( $A_{sol}$ ) 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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