



Annex to Solar Keymark Certificate					Licence Number		SKM9999/1					
					Date issued		2022-07-27					
					Issued by		DQS Hellas					
Licence holder			PAPAEMMANOUEL S.A.			Country		Greece				
Brand (optional)						Web		www.papaemmanouel.gr				
Street, Number			1o Km Inofyta – St. Thomas, Inofyta Viotia			E-mail		exports@papaemmanouel.gr				
Postcode, City			32011, Viotia			Tel		+30 22620 31931				
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 W/m ² , G _d = 150 W/m ² & u = 1.3 m/s $\vartheta_m - \vartheta_a$							
					0 K W	10 K W	30 K W	50 K W	70 K W	84 K W		
FMAX_150	1.50	1,480	1,010	86	1,143	1,087	963	822	665	548		
FMAX_150H	1.50	1,010	1,480	86	1,143	1,087	963	822	665	548		
FMAX_1.82	1.82	1,480	1,230	86	1,387	1,319	1,168	997	807	664		
FMAX_1.82_H	1.82	1,230	1,480	86	1,387	1,319	1,168	997	807	664		
FMAX_2.00	2.00	1,980	1,010	86	1,524	1,449	1,284	1,096	886	730		
FMAX_2.00H	2.00	1,010	1,980	86	1,524	1,449	1,284	1,096	886	730		
FMAX_2.37	2.37	1,930	1,230	86	1,806	1,718	1,521	1,299	1,050	865		
FMAX_2.37H	2.37	1,230	1,930	86	1,806	1,718	1,521	1,299	1,050	865		
FMAX_2.72	2.72	2,160	1,260	86	2,073	2 (13.01)	1,746	1,491	1,205	993		
FMAX_2.72H	2.72	1,260	2,160	86	2,073	1,971	1,746	1,491	1,205	993		
Power output per m ² gross area					762	725	642	548	443	365		
Performance parameters test method		Steady state - outdoor										
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		0.771	3.59	0.014	0.000	0.00	10,827	0.000	0.00	0.0E+00	0.92	
Incidence angle modifier test method		Steady state - outdoor										
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°	
Transversal		K _{θ1, coll}	1.00	1.00	1.00	0.99	0.96	0.90	0.78	0.52	0.00	
Longitudinal		K _{θL, coll}	1.00	1.00	1.00	0.99	0.96	0.90	0.78	0.52	0.00	
Heat transfer medium for testing						Water						
Flow rate for testing (per gross area, A _G)						dm/dt		0.022	kg/(sm ²)			
Maximum temperature difference during thermal performance test						$(\vartheta_m - \vartheta_a)_{max}$		53.7	K			
Standard stagnation temperature (G = 1000 W/m ² ; $\vartheta_a = 30$ °C)						ϑ_{stg}		190.5	°C			
Maximum operating temperature						$\vartheta_{max, op}$		200	°C			
Maximum operating pressure						p _{max, op}		1000	kPa			
Testing laboratory		NCSR Demokritos / Solar & other Energy System				www.solar.demokritos.gr						
Test report(s)		4195DE2 4196DE2 4197DQ3				Dated		16/11/16 16/11/16 02/06/17				
Comments of testing laboratory						Ver. 6.2 (13.01.2022)						
						N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece						
Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +30 210 6233493-4 , Fax: +30 210 6233495, http://www.dqs.gr, e-mail: i.alexou@dqs.gr												

Annex to Solar Keymark Certificate Supplementary Information		Licence Number			SKM9999/1										
		Issued			2022-07-27										
Gross Thermal Yield 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					
FMAX_150		1,848	1,320	859	1,405	970	605	1,034	675	405	1,125	731	431		
FMAX_150H		1,848	1,320	859	1,405	970	605	1,034	675	405	1,125	731	431		
FMAX_1.82		2,243	1,601	1,042	1,705	1,177	734	1,254	819	491	1,365	886	523		
FMAX_1.82_H		2,243	1,601	1,042	1,705	1,177	734	1,254	819	491	1,365	886	523		
FMAX_2.00		2,464	1,759	1,145	1,874	1,293	806	1,379	900	540	1,500	974	575		
FMAX_2.00H		2,464	1,759	1,145	1,874	1,293	806	1,379	900	540	1,500	974	575		
FMAX_2.37		2,920	2,085	1,357	2,221	1,532	955	1,634	1,066	639	1,778	1,154	682		
FMAX_2.37H		2,920	2,085	1,357	2,221	1,532	955	1,634	1,066	639	1,778	1,154	682		
FMAX_2.72		3,352	2,393	1,558	2,549	1,759	1,097	1,875	1,223	734	2,040	1,325	782		
FMAX_2.72H		3,352	2,393	1,558	2,549	1,759	1,097	1,875	1,223	734	2,040	1,325	782		
Gross Thermal Yield per m ² gross area		1,232	880	573	937	647	403	689	450	270	750	487	288		
Annual efficiency, η_a		70%	50%	32%	57%	40%	25%	59%	39%	23%	60%	39%	23%		
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 _x (MJ/m ²) >		600					
Maximum tested positive load										3000		Pa			
Maximum tested negative load										3000		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)					
FMAX_150		1.50				9-V-1234S-A:7.2,1380-C:20.6,1080-D				1.38					
FMAX_150H		1.50				14-V-1234S-A:7.2,908-C:20.6,1560-D				1.38					
FMAX_1.82		1.82				11-V-1234S-A:7.2,1378-C:20.6,1300-D				1.72					
FMAX_1.82_H		1.82				14-V-1234S-A:7.2,1128-C:20.6,1560-D				1.72					
FMAX_2.00		2.00				9-V-1234S-A:7.2,1878-C:20.6,1080-D				1.86					
FMAX_2.00H		2.00				18-V-1234S-A:7.2,908-C:20.6,2060-D				1.86					
FMAX_2.37		2.37				11-V-1234S-A:7.2,1828-C:20.6,1300-D				2.23					
FMAX_2.37H		2.37				18-V-1234S-A:7.2,1128-C:20.6,2010-D				2.23					
FMAX_2.72		2.72				11-V-1234S-A:7.2,2060-C:20.6,1320-D				2.57					
FMAX_2.72H		2.72				18-V-1234S-A:7.2,1158-C:20.6,2240-D				2.57					
Data required for CDR (EU) No 811/2013 - Reference Area						Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}									
Collector efficiency (η_{col})		60%				Zero-loss efficiency (η_0)				0.76		--			
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)				3.59		W/(m ² K)			
						Second-order coefficient (a ₂)				0.014		W/(m ² K ²)			
						Incidence angle modifier IAM (50°)				0.96		--			
						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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