




Annex to Solar Keymark Certificate			Licence Number		SKM 10132.6									
			Date issued		2024-12-15									
			Issued by		DQS Hellas									
Licence holder			PAPAEEMMANOUEL S.A.			Country		Greece						
Brand (optional)			SOLAR FLAME			Web		www.papaemmanouel.gr						
Street, Number			Thesi Loumaria			E-mail		exports@papaemmanouel.gr						
Postcode, City			32009 Oinofyta Viotias			Tel		+30 22620 31931						
Collector Type							Flat plate collector							
Collector name					Gross area ( $A_G$ ) m <sup>2</sup>	Gross length mm	Gross width mm	Gross height mm	Power output per collector G <sub>b</sub> = 850 W/m <sup>2</sup> , G <sub>d</sub> = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
									0 K W	10 K W	30 K W	50 K W	70 K W	102 K W
FMAX Gen2-200V					2.00	1,980	1,010	86	1,538	1,478	1,340	1,179	993	647
FMAX Gen2-200H					2.00	1,010	1,980	86	1,538	1,478	1,340	1,179	993	647
FMAX Gen2-237V					2.37	1,930	1,230	86	1,822	1,751	1,588	1,397	1,177	766
FMAX Gen2-237H					2.37	1,230	1,930	86	1,822	1,751	1,588	1,397	1,177	766
FMAX Gen2-250V					2.49	1,980	1,260	86	1,914	1,840	1,669	1,467	1,236	805
FMAX Gen2-250H					2.49	1,260	1,980	86	1,914	1,840	1,669	1,467	1,236	805
FMAX Gen2-272V					2.72	2,160	1,260	86	2,091	2,010	1,823	1,603	1,350	880
FMAX Gen2-272H					2.72	1,260	2,160	86	2,091	2,010	1,823	1,603	1,350	880
FMAX Gen2-300V					3.02	2,160	1,400	86	2,322	2,232	2,024	1,780	1,499	977
FMAX Gen2-300H					3.02	1,400	2,160	86	2,322	2,232	2,024	1,780	1,499	977
Power output per m <sup>2</sup> gross area									769	739	670	589	496	323
Performance parameters test method			Steady state - outdoor											
Performance parameters (related to $A_G$ )			$\eta_{0, b}$	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			0.781	2.84	0.015	0.000	0.00	10,239	0.000	0.00	0.0E+00	0.90		
Incidence angle modifier test method			Steady state - outdoor											
Incidence angle modifier			Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°		
Transversal			$K_{GT, coll}$	1.00	1.00	0.99	0.97	0.94	0.87	0.73	0.47	0.00		
Longitudinal			$K_{GL, coll}$	1.00	1.00	0.99	0.97	0.94	0.87	0.73	0.47	0.00		
Heat transfer medium for testing							Water-Glycole							
Flow rate for testing (per gross area, $A_G$ )							$dm/dt$	0.022	kg/(sm <sup>2</sup> )					
Maximum temperature difference during thermal performance test							$(\vartheta_m - \vartheta_a)_{max}$	71.9	K					
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30$ °C)							$\vartheta_{stg}$	240	°C					
Maximum operating temperature							$\vartheta_{max, op}$	250	°C					
Maximum operating pressure							$p_{max, op}$	1000	kPa					
Testing laboratory			NCSR Demokritos / Solar & other Energy System				www.solar.demokritos.gr							
Test report(s)			4439 DE1				Dated		20/11/24					
			4439 DQ1						12/12/24					
			4449 DE1						20/11/24					
Comments of testing laboratory										Ver. 6.2 (13.01.2022)				
Thermal efficiency data from Test Report 4449 DE1							<p>N.C.S.R. "DEMOKRITOS"  SOLAR ENERGY LABORATORY  Tel: +210 6503815 - Fax: +210 6544592  P.O. BOX 60037, 15310 Ag. Paraskevi, Greece</p> 							
<p>Central Offices: Kalavriton 2, 145 64 kifisia, Athens, Tel: +30 210 6233493-4 , Fax: +30 210 6233495,  <a href="http://www.dqsglobal.com">http://www.dqsglobal.com</a>, e-mail: <a href="mailto:i.alexiou@dqsg.gr">i.alexiou@dqsg.gr</a></p>														

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	<b>Supplementary Information</b>	<b>Issued</b>

**Gross Thermal Yield in kWh/collector at mean fluid temperature  $\vartheta_m$**

Collector name	Standard Locations $\vartheta_m$	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
FMAX Gen2-200V		2,470	1,872	1,306	1,947	1,424	957	1,420	990	641	1,539	1,072	683
FMAX Gen2-200H		2,470	1,872	1,306	1,947	1,424	957	1,420	990	641	1,539	1,072	683
FMAX Gen2-237V		2,927	2,218	1,548	2,307	1,688	1,134	1,682	1,173	760	1,823	1,270	809
FMAX Gen2-237H		2,927	2,218	1,548	2,307	1,688	1,134	1,682	1,173	760	1,823	1,270	809
FMAX Gen2-250V		3,075	2,331	1,626	2,424	1,773	1,191	1,768	1,233	798	1,915	1,334	850
FMAX Gen2-250H		3,075	2,331	1,626	2,424	1,773	1,191	1,768	1,233	798	1,915	1,334	850
FMAX Gen2-272V		3,360	2,546	1,777	2,648	1,937	1,301	1,931	1,347	872	2,092	1,457	929
FMAX Gen2-272H		3,360	2,546	1,777	2,648	1,937	1,301	1,931	1,347	872	2,092	1,457	929
FMAX Gen2-300V		3,730	2,827	1,972	2,940	2,151	1,445	2,144	1,495	968	2,323	1,618	1,031
FMAX Gen2-300H		3,730	2,827	1,972	2,940	2,151	1,445	2,144	1,495	968	2,323	1,618	1,031
Gross Thermal Yield per m <sup>2</sup> gross area		1,235	936	653	974	712	478	710	495	320	769	536	341
Annual efficiency, $\eta_a$		70%	53%	37%	60%	44%	29%	61%	42%	27%	62%	43%	27%
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 <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 <sup>2</sup> ) >	1000	$\vartheta_a$ (°C) >	20	$H_x$ (MJ/m <sup>2</sup> ) >	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	Facade collector(s)	No

**Energy Labelling Information**

**Additional Informative Technical Data**

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Hydraulic Designation Code	Aperture Area, $A_a$ (m <sup>2</sup> )
FMAX Gen2-200V	2.00	12-V-1234S-A:7.2,1880-C:20.6,1070-D	1.88
FMAX Gen2-200H	2.00	23-V-1234S-A:7.2,910-C:20.6,2040-D	1.88
FMAX Gen2-237V	2.37	14-V-1234S-A:7.2,1830-C:20.6,1290-D	2.25
FMAX Gen2-237H	2.37	23-V-1234S-A:7.2,1130-C:20.6,1990-D	2.25
FMAX Gen2-250V	2.49	14-V-1234S-A:7.2,1880-C:20.6,1320-D	2.37
FMAX Gen2-250H	2.49	23-V-1234S-A:7.2,1160-C:20.6,2040-D	2.37
FMAX Gen2-272V	2.72	14-V-1234S-A:7.2,2060-C:20.6,1320-D	2.59
FMAX Gen2-272H	2.72	25-V-1234S-A:7.2,1160-C:20.6,2220-D	2.59
FMAX Gen2-300V	3.02	16-V-1234S-A:7.2,2060-C:20.6,1460-D	2.88
FMAX Gen2-300H	3.02	25-V-1234S-A:7.2,1300-C:20.6,2220-D	2.88

<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 ( $\eta_{col}$ )	63%	Zero-loss efficiency ( $\eta_0$ )	0.77
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 ( $a_1$ )	2.84 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.015 W/(m <sup>2</sup> K <sup>2</sup> )
		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.	