

Annex to Solar Keymark Certificate						Licence Number		SKM 10086					
						Date issued		2019-10-01					
						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 height mm	Gross area (A _G) m ²	Gross length mm	Gross width mm	Aperture area (A _a) m ²	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	10 K	30 K	50 K	70 K	89 K		
						W	W	W	W	W	W		
SOLO 1.50	87	1.50	1,485	1,013	1.39	1,097	1,040	919	791	654	519		
SOLO 1.50H	87	1.50	1,485	1,013	1.39	1,097	1,040	919	791	654	519		
SOLO 1.82	86	1.82	1,480	1,230	1.72	1,331	1,261	1,116	960	794	630		
SOLO 1.82H	86	1.82	1,230	1,480	1.72	1,331	1,261	1,116	960	794	630		
SOLO 2.00	86	2.00	1,980	1,010	1.86	1,462	1,386	1,226	1,055	872	692		
SOLO 2.00H	86	2.00	1,010	1,980	1.86	1,462	1,386	1,226	1,055	872	692		
SOLO 2.37	86	2.37	1,930	1,230	2.23	1,733	1,643	1,453	1,250	1,034	820		
SOLO 2.37H	86	2.37	1,230	1,930	2.23	1,733	1,643	1,453	1,250	1,034	820		
SOLO 2.72	87	2.73	2,162	1,264	2.56	1,996	1,892	1,673	1,440	1,191	945		
SOLO 2.72H	87	2.73	2,162	1,264	2.56	1,996	1,892	1,673	1,440	1,191	945		
Power output per m ² gross area						731	693	613	527	436	346		
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		0.739	3.73	0.007	0.000	0.00	0	0.000	0.00	0.0E+00	0.93		
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	0.95	0.89	0.80	0.65	0.40	0.00		
Longitudinal		K _{θL, coll}	1.00	0.99	0.98	0.95	0.89	0.80	0.65	0.40	0.00		
Heat transfer medium for testing						Water-Glycole							
Flow rate for testing (per gross area, A _G)						dm/dt	0.021	kg/(sm ²)					
Maximum temperature difference during thermal performance test						($\vartheta_m - \vartheta_a$) _{max}	58.68	K					
Standard stagnation temperature (G = 1000 W/m ² ; ϑ_a = 30 °C)						ϑ_{stg}	185.13	°C					
Maximum operating temperature						$\vartheta_{max, op}$	210	°C					
Maximum operating pressure						p _{max, op}	1000	kPa					
Testing laboratory		NCSR Demokritos / Solar & other Energy System				www.solar.demokritos.gr							
Test report(s)		4251 DE1 4252 DQ1 4253 DE1				Dated		2/7/2019 1/8/2019 2/7/2019					
Comments of testing laboratory						Datasheet version: 6.0, 2018-10-30							
													
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CERTIFICATION BODY HEADER
field available for logo etc.

Annex to Solar Keymark Certificate Supplementary Information							Licence Number			SKM 10086			
							Issued			2019-10-01			
Annual collector output 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	25°C	50°C	75°C
SOLO 1.50		1,728	1,215	799	1,299	895	575	956	621	383	1,043	671	407
SOLO 1.50H		1,728	1,215	799	1,299	895	575	956	621	383	1,043	671	407
SOLO 1.82		2,097	1,474	970	1,576	1,085	698	1,160	753	464	1,265	814	493
SOLO 1.82H		2,097	1,474	970	1,576	1,085	698	1,160	753	464	1,265	814	493
SOLO 2.00		2,304	1,620	1,065	1,731	1,193	767	1,275	827	510	1,391	894	542
SOLO 2.00H		2,304	1,620	1,065	1,731	1,193	767	1,275	827	510	1,391	894	542
SOLO 2.37		2,731	1,919	1,262	2,052	1,413	909	1,511	981	605	1,648	1,059	642
SOLO 2.37H		2,731	1,919	1,262	2,052	1,413	909	1,511	981	605	1,648	1,059	642
SOLO 2.72		3,145	2,211	1,454	2,363	1,628	1,047	1,741	1,129	696	1,898	1,220	740
SOLO 2.72H		3,145	2,211	1,454	2,363	1,628	1,047	1,741	1,129	696	1,898	1,220	740
Annual output per m ² gross area		1,152	810	533	866	596	384	638	414	255	695	447	271
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)												
Annual irradiation on collector plane	1765 kWh/m ²			1714 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. 6.0 (October 2018). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc													
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						☐ Active or passive measure(s) for self-protection							
☐ Co-generating thermal and electrical power						☐ Wind and/or infrared sensitive collector(s) (WISC)							
☐ Façade collector(s)													
Energy Labelling Information													
		Reference Area, A _{sol} (m ²)			Hydraulic Designation Code								
SOLO 1.50		1.50			{F}-{O}-{CL}-{A:Ø,L}-{C:Ø,L}-{D}								
SOLO 1.50H		1.50			{F}-{O}-{CL}-{A:Ø,L}-{C:Ø,L}-{D}								
SOLO 1.82		1.82											
SOLO 1.82H		1.82											
SOLO 2.00		2.00											
SOLO 2.00H		2.00											
SOLO 2.37		2.37											
SOLO 2.37H		2.37											
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})		57%			Zero-loss efficiency (η_0)				0.73		--		
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)		3.73		W/(m ² K)		
							Second-order coefficient (a_2)		0.007		W/(m ² K ²)		
							Incidence angle modifier IAM (50°)		0.90		--		
							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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