



Annex to Solar Keymark Certificate					Licence Number		SKM 10132.1							
					Date issued		2024-09-20							
					Issued by		DQS Hellas							
Licence holder		PAPAEMMANOUEL S.A.			Country		Greece							
Brand (optional)					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 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	87 K W
MSFC100-200V					2.00	1,980	1,010	86	1,594	1,523	1,368	1,198	1,013	847
MSFC100-200H					2.00	1,010	1,980	86	1,594	1,523	1,368	1,198	1,013	847
MSFC100-237V					2.37	1,930	1,230	86	1,892	1,808	1,624	1,422	1,202	1,006
MSFC100-237H					2.37	1,230	1,930	86	1,889	1,805	1,622	1,420	1,200	1,004
MSFC100-250V					2.49	1,980	1,260	86	1,989	1,900	1,707	1,495	1,264	1,057
MSFC100-250H					2.49	1,260	1,980	86	1,985	1,896	1,704	1,492	1,261	1,055
MSFC100-272V					2.72	2,160	1,260	86	2,168	2,071	1,861	1,630	1,378	1,152
MSFC100-272H					2.72	1,260	2,160	86	2,168	2,071	1,861	1,630	1,378	1,152
MSFC100-300V					3.02	2,160	1,400	86	2,411	2 (13.01)	2,069	1,812	1,532	1,281
MSFC100-300H					3.02	1,400	2,160	86	2,408	2,300	2,066	1,810	1,530	1,279
Power output per m ² gross area									797	761	684	599	506	424
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		0.806	3.48	0.010	0.000	0.00	9,607	0.000	0.00	0.0E+00	0.93			
Incidence angle modifier test method		Steady state - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		$K_{\theta T, coll}$	1.00	1.00	1.00	0.99	0.97	0.92	0.80	0.55	0.00			
Longitudinal		$K_{\theta L, coll}$	1.00	1.00	1.00	0.99	0.97	0.92	0.80	0.55	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		$(\vartheta_m - \vartheta_a)_{max}$	56.6		K									
Standard stagnation temperature (G = 1000 W/m ² ; ϑ_a = 30 °C)		ϑ_{stg}	231		°C									
Maximum operating temperature		$\vartheta_{max, op}$	250		°C									
Maximum operating pressure		$p_{max, op}$	kPa											
Testing laboratory		NCSR "DEMOKRITOS"					www.solar.demokritos.gr							
Test report(s)		4416 DE1					Dated		17/07/24					
		4418 DE1							18/07/24					
		4420 DQ1							13/09/24					
Comments														
The data was obtained from the test reports 4416 DE1 (Collector MSFC100-200) and 4420 DQ1 (Collector MSFC100-300).								Ver. 6.2 (13.01.2022)						
								N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6844582 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece						
Central Offices: Kalavriton 2, 145 64 kifisia, Athens, Tel: +30 210 6233493-4 , Fax: +30 210 6233495, http://www.dqsglobal.com, e-mail: i.alexou@dqs.gr														

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Supplementary Information							Issued		2024-09-20					
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	25°C	50°C	75°C	
MSFC100-200V		2,600	1,927	1,340	2,015	1,457	986	1,476	1,009	655	1,604	1,094	698	
MSFC100-200H		2,601	1,927	1,340	2,015	1,457	986	1,476	1,009	655	1,604	1,094	698	
MSFC100-237V		3,087	2,287	1,590	2,392	1,729	1,170	1,752	1,198	778	1,904	1,299	829	
MSFC100-237H		3,082	2,284	1,588	2,388	1,726	1,168	1,749	1,196	776	1,900	1,297	828	
MSFC100-250V		3,244	2,404	1,671	2,513	1,817	1,230	1,841	1,259	817	2,000	1,365	871	
MSFC100-250H		3,238	2,399	1,668	2,509	1,814	1,227	1,837	1,257	816	1,997	1,362	870	
MSFC100-272V		3,537	2,621	1,822	2,740	1,981	1,341	2,007	1,373	891	2,181	1,488	950	
MSFC100-272H		3,537	2,621	1,822	2,740	1,981	1,341	2,007	1,373	891	2,181	1,488	950	
MSFC100-300V		3,932	2,914	2,026	3,047	2,203	1,490	2,231	1,526	990	2,425	1,655	1,056	
MSFC100-300H		3,927	2,910	2,023	3,043	2,200	1,488	2,228	1,524	989	2,422	1,652	1,055	
Gross Thermal Yield per m ² gross area		1,300	964	670	1,007	728	493	738	505	328	802	547	349	
Annual efficiency, η_a		74%	55%	38%	62%	45%	30%	63%	43%	28%	64%	44%	28%	
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														
	Reference Area, A _{sol} (m ²)			Hydraulic Designation Code					Aperture Area, A _a (m ²)					
MSFC100-200V	2.00			1-H-1234S-A:7.2,24070-C:20.6,1080-D					1.88					
MSFC100-200H	2.00			1-H-1234S-A:7.2,26620-C:20.6,2050-D					1.88					
MSFC100-237V	2.37			1-H-1234S-A:7.2,32207-C:20.6,1300-D					2.25					
MSFC100-237H	2.37			1-H-1234S-A:7.2,31530-C:20.6,2000-D					2.25					
MSFC100-250V	2.49			1-H-1234S-A:7.2,34215-C:20.6,1330-D					2.37					
MSFC100-250H	2.49			1-H-1234S-A:7.2,34080-C:20.6,2050-D					2.37					
MSFC100-272V	2.72			1-H-1234S-A:7.2,34560-C:20.6,1330-D					2.59					
MSFC100-272H	2.72			1-H-1234S-A:7.2,37335-C:20.6,2230-D					2.59					
MSFC100-300V	3.02			1-H-1234S-A:7.2,39040-C:20.6, 1470-D					2.88					
MSFC100-300H	3.02			1-H-1234S-A:7.2,41590-C:20.6, 2230-D					2.88					
Data required for CDR (EU) No 811/2013 - Reference Area														
Collector efficiency (η_{col})		64%												
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.														
Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}														
Zero-loss efficiency (η_0)		0.80												
First-order coefficient (a_1)		3.48												
Second-order coefficient (a_2)		0.010												
Incidence angle modifier IAM (50°)		0.97												
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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