Annex to Solar Keymark Certificate

Licence Number	SKM 10112.1
Date issued	2020-09-10
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	E-mail	exports@papaemmanouel.gr
Postcode, City	32011, Viotia	Tel	+99 123 456 789

Collector Type: Flat plate collector

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m2, Gd = 150 W/m2 & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
					0 K	10 K	30 K	50 K	70 K	82 K
	m^2	mm	mm	mm	W	W	W	W	W	W
OLC200	2.00	1,980	1,010	85	1,367	1,277	1,089	890	680	545
Power output per m^2 gross area					683	639	545	445	340	273

Performance parameters test method	Steady state - outdoor									
Performance parameters (related to A_G)	η0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	J/(m²K)	s/m	W/(m²K⁴)	W/(m²K⁴)	-
Test results	0.692	4.42	0.007	0.000	0.00	0	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	$K_{\theta T,coll}$	1.00	1.00	1.00	0.99	0.96	0.90	0.77	0.52	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.99	0.96	0.90	0.77	0.52	0.00

Heat transfer medium for testing		Water	
Flow rate for testing (per gross area, A_G)	dm/dt	0.020	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	52.24	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	178	°C
Maximum operating temperature	$\vartheta_{max\ op}$	210	°C
Maximum operating pressure	$p_{max,op}$	-	kPa

Testing laboratory	NCSR Demokritos / Solar & other Energy System	www.solar.demokritos.gr	
Test report(s)	4269 DE1 4270 DQ1	Dated	30/6/2020 6/8/2020

Comments of testing laboratory

Datasheet version: 6.1, 2019-09-26

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Supplementary Information	Issued	2020-09-10

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
OLC200		2,180	1,409	823	1,566	987	554	1,166	687	371	1,275	741	394
Annual output per m² gross area		1,090	704	412	783	494	277	583	344	185	638	370	197
Annual efficiency, η_a		62%	40%	23%	48%	30%	17%	50%	29%	16%	51%	30%	16%
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m²			1630 kWh/m²			1166 kWh/m²			1244 kWh/m²		
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 ϑm (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.1 (September 2019). 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/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >	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
☐ Façade collector(s)

Energy Labelling Information

	Reference Area, A_{sol} (m²)
OLC200	2.00

Data required for CDR (EU) No 811/2013 - Reference Area

Collector efficiency (η_{col})	50%

Remark: Collector efficiency (ηcol) 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/m², expressed in % and rounded to the nearest integer. Deviating from the regulation ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

Additional Informative Technical Data

Hydraulic Designation Code	Aperature Area, A_a (m²)
8-VH-1234S-A:11,1880-C:20.6,1080-	1.83

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}

Zero-loss efficiency (η_0)	0.68	--
First-order coefficient (a_1)	4.42	W/(m²K)
Second-order coefficient (a_2)	0.007	W/(m²K²)
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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