

Annex to Solar Keymark Certificate						Licence Number		SKM 10045									
						Date issued		2019-10-01									
						Issued by		DQS Hellas									
Licence holder		PAPAEMMANOUEL S.A.				Country		Greece									
Brand (optional)		FOXAL20-2019				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						Power output per collector Gb = 850 W/m <sup>2</sup> , Gd = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$											
						Gross height	Gross area (A <sub>G</sub> )	Gross length	Gross width	Aperture area (A <sub>a</sub> )	0 K	10 K	30 K	50 K	70 K	84 K	
						mm	m <sup>2</sup>	mm	mm	m <sup>2</sup>	W	W	W	W	W	W	
FOXAL 20-2019						71	2.01	1,984	1,014	1.88	1,274	1,203	1,028	808	544	339	
Power output per m <sup>2</sup> gross area						634	599	511	402	271	169						
Performance parameters test method		Quasi dynamic															
Performance parameters (related to A <sub>G</sub> )		$\eta_0, b$	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		0.644	3.26	0.028	0.000	0.00	0	0.000	0.00	0.0E+00	0.89						
Incidence angle modifier test method		Quasi dynamic - outdoor															
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°						
Transversal		K <sub>GT, coll</sub>	1.00	0.99	0.96	0.92	0.85	0.75	0.59	0.36	0.00						
Longitudinal		K <sub>GL, coll</sub>	1.00	0.99	0.96	0.92	0.85	0.75	0.59	0.36	0.00						
Heat transfer medium for testing						Water-Glycole											
Flow rate for testing (per gross area, A <sub>G</sub> )						dm/dt	0.021	kg/(sm <sup>2</sup> )									
Maximum temperature difference during thermal performance test						$(\vartheta_m - \vartheta_a)_{max}$	53.6	K									
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30^\circ\text{C}$ )						$\vartheta_{stg}$	139.24	°C									
Maximum operating temperature						$\vartheta_{max, op}$	160	°C									
Maximum operating pressure						p <sub>max, op</sub>	1000	kPa									
Testing laboratory		NCSR Demokritos / Solar & other Energy Systems				www.solar.demokritos.gr											
Test report(s)		4249 DE1 4250 DQ1				Dated		12/6/2019 1/8/2019									
Comments of testing laboratory						Datasheet version: 6.0, 2018-10-30											
						N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belasidis Tel: +210 6543815 - Fax: +210 6544507 153 10 Ag. Paraskevi - Attiki - Greece											
Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +301 6233493-4, Fax: +301 6233495, http://www.dqshellas.gr, e-mail: ioannisalexou@dqshellas.gr																	

# CERTIFICATION BODY HEADER

field available for logo etc.

<b>Annex to Solar Keymark Certificate Supplementary Information</b>				<b>Licence Number</b>		<b>SKM 10045</b>									
				<b>Issued</b>		<b>2019-09-24</b>									
<b>Annual collector output in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>															
<b>Standard Locations</b>		<b>Athens</b>			<b>Davos</b>			<b>Stockholm</b>			<b>Würzburg</b>				
<b>Collector name</b>	<b><math>\vartheta_m</math></b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>		
FOXAL 20-2019		1,946	1,263	658	1,419	847	385	1,059	606	278	1,156	653	295		
Annual output per m <sup>2</sup> gross area		968	628	327	706	421	192	527	302	138	575	325	147		
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)													
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1714 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. 6.0 (October 2018). A detailed description of the calculations is available at <a href="http://www.solarkeymark.org/scenocalc">www.solarkeymark.org/scenocalc</a>															
<b>Additional Information</b>															
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 <sub>x</sub> (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		
<b>Additional collector attribute(s)</b>															
<input type="checkbox"/> Using external power source(s) for normal operation				<input type="checkbox"/> Active or passive measure(s) for self-protection											
<input type="checkbox"/> Co-generating thermal and electrical power				<input type="checkbox"/> Wind and/or infrared sensitive collector(s) (WISC)											
<input type="checkbox"/> Façade collector(s)															
<b>Energy Labelling Information</b>															
		Reference Area, A <sub>sol</sub> (m <sup>2</sup> )				Hydraulic Designation Code									
FOXAL 20-2019		2.01				{F}-{O}-{CL}-{A:Ø,L}-{C:Ø,L}-{D}									
						{F}-{O}-{CL}-{A:Ø,L}-{C:Ø,L}-{D}									
<b>Data required for CDR (EU) No 811/2013 - Reference Area</b>				<b>Data required for CDR (EU) No 812/2013 - Reference Area A<sub>sol</sub></b>											
Collector efficiency ( $\eta_{col}$ )				46%				Zero-loss efficiency ( $\eta_0$ )		0.63		--			
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 <sub>sol</sub> ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.								First-order coefficient (a <sub>1</sub> )		3.26		W/(m <sup>2</sup> K)			
								Second-order coefficient (a <sub>2</sub> )		0.028		W/(m <sup>2</sup> K <sup>2</sup> )			
								Incidence angle modifier IAM (50°)		0.86		--			
								Remark: The data given in this section are related to collector reference area (A <sub>sol</sub> ) 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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