




Annex to Solar Keymark Certificate		Licence Number		SKM 10115.2							
		Date issued		2020-12-20							
		Issued by		DQS Hellas							
Licence holder		CICERO HELLAS S.A.		Country Greece							
Brand (optional)				Web www.calpak.gr							
Street, Number		9, Sygrou Ave.		E-mail export@calpak.gr							
Postcode, City		11743, 'Athens		Tel +30 2109247250 / 2109231616							
Collector Type				Flat plate collector							
Collector name		Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector					
						$G_b = 850 \text{ W/m}^2$, $G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$					
		m ²	mm	mm	mm	0 K	10 K	30 K	50 K	70 K	87 K
M5-300 (M4-300F)		3.00	1,996	1,500	86	2,371	2,267	2,018	1,716	1,361	1,012
M5-300H (M4-300HF)		3.00	1,500	1,996	86	2,371	2,267	2,018	1,716	1,361	1,012
Power output per m² gross area						790	756	673	572	454	337
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		0.800	3.27	0.022	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	0.021	kg/(sm ²)			
Maximum temperature difference during thermal performance test						$(\vartheta_m - \vartheta_a)_{max}$	57.3	K			
Standard stagnation temperature ($G = 1000 \text{ W/m}^2$; $\vartheta_a = 30 \text{ }^\circ\text{C}$)						ϑ_{stg}	175.7	°C			
Maximum operating temperature						$\vartheta_{max, op}$	°C				
Maximum operating pressure						$p_{max, op}$	1000	kPa			
Testing laboratory		NCSR Demokritos / Solar & other Energy System				www.solar.demokritos.gr					
Test report(s)		4295 DQ1 4301 DE1				Dated		4/12/2020 4/12/2020			
Comments of testing laboratory						Datasheet version: 6.1, 2019-09-26					
						N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6504582 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece 					
Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +301 6233493-4, Fax: +301 6233495, http://www.dqs.gr, e-mail: i.alexiou@dqs.gr											

Annex to Solar Keymark Certificate Supplementary Information		Licence Number		SKM 10115.2									
		Issued		2020-12-20									
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
M5-300 (M4-300F)		3,838	2,792	1,797	2,962	2,045	1,234	2,175	1,431	837	2,364	1,552	893
M5-300H (M4-300HF)		3,838	2,792	1,797	2,962	2,045	1,234	2,175	1,431	837	2,364	1,552	893
Annual output per m ² gross area		1,279	931	599	987	682	411	725	477	279	788	517	298
Annual efficiency, η_a		72%	53%	34%	61%	42%	25%	62%	41%	24%	63%	42%	24%
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. 6.1 (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/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)										1.6		m	
Additional collector attribute(s)													
<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"/> Façade collector(s)									
Energy Labelling Information						Additional Informative Technical Data							
		Reference Area, A _{sol} (m ²)		Hydraulic Designation Code				Aperture Area, A _a (m ²)					
M5-300 (M4-300F)		3.00		17-VH-1234S-A:7.2,1900-				2.84					
M5-300H (M4-300HF)		3.00		18-H-1234S-A:7.2,1400-C:20.6,2060-				2.84					
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})		62%				Zero-loss efficiency (η_0)		0.79		--			
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)		3.27		W/(m ² K)			
						Second-order coefficient (a_2)		0.022		W/(m ² K ²)			
						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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