Annex to Solar Keymark Certificate

Licence Number	SKM 10115.1
Date issued	2021-01-19
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 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	88 K
	m²	mm	mm	mm	W	W	W	W	W	W
M5-210 (M4-210F)	2.09	1,696	1,230	86	1,640	1,559	1,375	1,165	928	694
M5-260 (M4-260F)	2.60	2,111	1,230	86	2,041	1,939	1,711	1,449	1,154	864
M5-260H (M4-260HF)	2.60	1,230	2,111	86	2,041	1,939	1,711	1,449	1,154	864
M5-300 (M4-300F)	3.00	1,996	1,500	86	2,355	2,237	1,974	1,672	1,332	997
M5-300H (M4-300HF)	3.00	1,500	1,996	86	2,355	2,237	1,974	1,672	1,332	997
Power output per m² gross area					785	746	658	557	444	332

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	0.795	3.75	0.016	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	0.98	0.96	0.89	0.76	0.51	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.98	0.96	0.89	0.76	0.51	0.00

Heat transfer medium for testing		Water	
Flow rate for testing (per gross area, A_G)	dm/dt	0.022	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	57.8	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °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 4302 DE1	Dated	4/12/2020 4/12/2020 4/12/2020

Comments of testing laboratory

Datasheet version: 6.1, 2019-09-26

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Supplementary Information	Issued	2021-01-19

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
M5-210 (M4-210F)		2,637	1,867	1,190	1,999	1,361	826	1,472	948	555	1,602	1,026	591
M5-260 (M4-260F)		3,281	2,323	1,480	2,487	1,693	1,027	1,832	1,180	690	1,993	1,277	736
M5-260H (M4-260HF)		3,281	2,323	1,480	2,487	1,693	1,027	1,832	1,180	690	1,993	1,277	736
M5-300 (M4-300F)		3,785	2,680	1,708	2,870	1,953	1,185	2,113	1,361	797	2,300	1,473	849
M5-300H (M4-300HF)		3,785	2,680	1,708	2,870	1,953	1,185	2,113	1,361	797	2,300	1,473	849
Annual output per m² gross area		1,262	893	569	957	651	395	704	454	266	767	491	283
Annual efficiency, η_a		71%	51%	32%	59%	40%	24%	60%	39%	23%	62%	39%	23%
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)					1.6	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)
M5-210 (M4-210F)	2.09
M5-260 (M4-260F)	2.60
M5-260H (M4-260HF)	2.60
M5-300 (M4-300F)	3.00
M5-300H (M4-300HF)	3.00

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

Collector efficiency (η_{col})	61%

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)
14-VH-1234S-A:7.2,1600-	1.96
14-VH-1234S-A:7.2,2009-	2.44
18-H-1234S-A:7.2,1131-C:20.6,2170-	2.44
17-VH-1234S-A:7.2,1900-	2.84
18-H-1234S-A:7.2,1400-C:20.6,2060-	2.84

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

Zero-loss efficiency (η_0)	0.78	--
First-order coefficient (a_1)	3.75	W/(m²K)
Second-order coefficient (a_2)	0.016	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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