Annex to Solar Keymark Certificate

Licence Number	SKM 10003
Date issued	2023-09-14
Issued by	DQS Hellas

Licence holder	COSMOSOLAR LTD	Country	Greece
Brand (optional)	Blue Solar, Cosmosolar, Delta Solar, Falcon, Federman, Skyland, Supernet, Nuevosol, primesolar, Dremmer	Web	http://www.cosmosolar.com/
Street, Number	Ntrei Road, Dervenochorion Gate	E-mail	info@cosmosolar.com
Postcode, City	32200 Viotia	Tel	+30 210 3478897 / 210 3479484

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	83 K
	m²	mm	mm	mm	W	W	W	W	W	W
EPI 20 NV	1.51	1,501	1,009	85	1,115	1,062	934	776	588	449
EPI 30 NV	1.95	1,500	1,300	85	1,435	1,367	1,202	999	757	579
EPI 25 NV	2.00	2,000	1,000	85	1,472	1,402	1,233	1,025	776	593
EPI 16 NV	2.24	1,900	1,180	85	1,650	1,572	1,383	1,148	870	665
EPI 54 NV	2.53	2,009	1,258	85	1,860	1,772	1,558	1,295	981	750
Power output per m² gross area					736	701	617	512	388	297

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	0.748	3.24	0.025	0.000	0.00	10,700	0.000	0.00	0.0E+00	0.89

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	0.99	0.97	0.93	0.85	0.71	0.46	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.99	0.97	0.93	0.85	0.71	0.46	0.00

Heat transfer medium for testing		Water	
Flow rate for testing (per gross area, A_G)	dm/dt	0.021	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	53	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	146	°C
Maximum operating temperature	ϑ_{max_op}	100	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	NCSR "DEMOKRITOS"	www.solar.demokritos.gr	
Test report(s)	4192 DE1, 4192 DE1	Dated	01/01/16
	1247 DE1		01/01/16
	4193 DQ1		01/01/16

Comments of testing laboratory — Ver. 6.2 (13.01.2022)

The data was obtained from the test reports 4193 DQ1 (Collector EPI 54NV) and 1247 DE1 (Collector EPI 20NV).

N.C.S.R. "DEMOKRITOS"
SOLAR ENERGY LABORATORY
Tel: +210 6503815 - Fax: +210 6544592
P.O. BOX 60037, 15310 Ag. Paraskevi, Greece

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Supplementary Information	Issued	2023-09-14

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
EPI 20 NV		1,767	1,242	750	1,342	887	493	989	624	340	1,075	674	361
EPI 30 NV		2,275	1,599	965	1,728	1,143	635	1,273	804	437	1,384	868	465
EPI 25 NV		2,334	1,640	990	1,772	1,172	652	1,306	824	449	1,420	891	477
EPI 16 NV		2,616	1,839	1,110	1,987	1,314	730	1,464	924	503	1,591	998	534
EPI 54 NV		2,949	2,073	1,251	2,240	1,481	823	1,650	1,041	567	1,794	1,125	602
Gross Thermal Yield per m² gross area		1,167	820	495	886	586	326	653	412	224	710	445	238
Annual efficiency, η_a		66%	46%	28%	54%	36%	20%	56%	35%	19%	57%	36%	19%
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. 6.2 (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/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >		600
Maximum tested positive load					2400	Pa
Maximum tested negative load					2400	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} (m²)
EPI 20 NV	1.51
EPI 30 NV	1.95
EPI 25 NV	2.00
EPI 16 NV	2.24
EPI 54 NV	2.53

Additional Informative Technical Data

Hydraulic Designation Code	Aperture Area, A_a (m²)
9-VH-1234S-A:7.2, 1350-C:20.6, 1090-D	1.35
11-VH-1234S-A:7.2, 1350-C:20.6, 1150-D	1.80
9-VH-1234S-A:7.2, 1850-C:20.6, 1090-D	1.83
11-VH-1234S-A:7.2, 1820-C:20.6, 1265-D	2.07
12-VH-1234S-A:7.2, 1850-C:20.6, 1350-D	2.33

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

Collector efficiency (η_{col})	57%

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.

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

Zero-loss efficiency (η_0)	0.74	--
First-order coefficient (a_1)	3.24	W/(m²K)
Second-order coefficient (a_2)	0.025	W/(m²K²)
Incidence angle modifier IAM (50°)	0.93	--

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.

Central Offices: Kalavriton 2, 145 64 kifisia, Athens, Tel: +301 6233493-4 , Fax: +301 6233495, http://www.dqs.gr, e-mail: i.alexiou@dqs.gr