Annex to Solar Keymark Certificate

Licence Number	OEM 10086.5
Date issued	2024-10-25
Issued by	DQS Hellas

Licence holder	HOVAT M. Ltd	Country	Greece
Brand (optional)		Web	
Street, Number	Thesi Stefani	E-mail	info@hovat-mepe.gr
Postcode, City	19300 Aspropyrgos	Tel	+30 2105570893-4

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	89 K
	m²	mm	mm	mm	W	W	W	W	W	W
SOLO 1.50	1,50	1.485	1.013	87	1.097	1.040	919	791	654	519
SOLO 1.50H	1,50	1.485	1.013	87	1.097	1.040	919	791	654	519
SOLO 1.82	1,82	1.480	1.230	86	1.331	1.261	1.116	960	794	630
SOLO 1.82H	1,82	1.230	1.480	86	1.331	1.261	1.116	960	794	630
SOLO 2.00	2,00	1.980	1.010	86	1.462	1.386	1.226	1.055	872	692
SOLO 2.00H	2,00	1.010	1.980	86	1.462	1.386	1.226	1.055	872	692
SOLO 2.37	2,37	1.930	1.230	86	1.733	1.643	1.453	1.250	1.034	820
SOLO 2.37H	2,37	1.230	1.930	86	1.733	1.643	1.453	1.250	1.034	820
SOLO 2.72	2,73	2.162	1.264	87	1.996	.2 (13.01	1.673	1.440	1.191	944
SOLO 2.72H	2,73	2.162	1.264	87	1.996	1.892	1.673	1.440	1.191	944
Power output per m² gross area					731	693	613	527	436	346

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	0,739	3,73	0,007	0,000	0,00	8.630	0,000	0,00	0,0E+00	0,93

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	0,99	0,98	0,95	0,89	0,80	0,65	0,40	0,00
Longitudinal	$K_{\theta L,coll}$	1,00	0,99	0,98	0,95	0,89	0,80	0,65	0,40	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	$(\vartheta_m-\vartheta_a)_{max}$	58,7	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	185	°C
Maximum operating temperature	ϑ_{max_op}	210	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	NCSR Demokritos / Solar & other Energy System	www.solar.demokritos.gr	
Test report(s)	4251 DE1	Dated	2/7/2019
	4252 DQ1		1/8/2019
	4253 DE1		2/7/2019

Comments of testing laboratory	Ver. 6.2 (13.01.2022)

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Supplementary Information	Issued	2024-10-25

Gross Thermal Yield in kWh/collector at mean fluid temperature ϑ_m

	Standard Locations	Athens			Davos			Stockholm			Würzburg		
Collector name	astiagis@ 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
SOLO 1.50		1.728	1.215	799	1.299	895	575	956	621	383	1.043	671	407
SOLO 1.50H		1.728	1.215	799	1.299	895	575	956	621	383	1.043	671	407
SOLO 1.82		2.097	1.474	970	1.576	1.085	698	1.160	753	464	1.265	814	493
SOLO 1.82H		2.097	1.474	970	1.576	1.085	698	1.160	753	464	1.265	814	493
SOLO 2.00		2.304	1.620	1.065	1.731	1.193	767	1.275	827	510	1.391	894	542
SOLO 2.00H		2.304	1.620	1.065	1.731	1.193	767	1.275	827	510	1.391	894	542
SOLO 2.37		2.731	1.919	1.262	2.052	1.413	909	1.511	981	605	1.648	1.059	642
SOLO 2.37H		2.731	1.919	1.262	2.052	1.413	909	1.511	981	605	1.648	1.059	642
SOLO 2.72		3.145	2.211	1.454	2.363	1.628	1.047	1.741	1.129	696	1.898	1.220	740
SOLO 2.72H		3.145	2.211	1.454	2.363	1.628	1.047	1.741	1.129	696	1.898	1.220	740
Gross Thermal Yield per m² gross area		1.152	810	533	866	596	384	638	414	255	695	447	271
Annual efficiency, η_a		65%	46%	30%	53%	37%	24%	55%	35%	22%	56%	36%	22%
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				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	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)
SOLO 1.50	1,50
SOLO 1.50H	1,50
SOLO 1.82	1,82
SOLO 1.82H	1,82
SOLO 2.00	2,00
SOLO 2.00H	2,00
SOLO 2.37	2,37
SOLO 2.37H	2,37
SOLO 2.72	2,73
SOLO 2.72H	2,73
Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}	
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.

Additional Informative Technical Data

Hydraulic Designation Code	Aperture Area, A_a (m²)
8-V-1234S-A:7.2,1380-C:20.6,1080-D	1,38
12-V-1234S-A:7.2,908-C:20.6,1560-D	1,38
10-V-1234S-A:7.2,1378-C:20.6,1300-D	1,72
12-V-1234S-A:7.2,1128-C:20.6,1560-D	1,72
8-V-1234S-A:7.2,1878-C:20.6,1080-D	1,86
12-V-1234S-A:7.2,908-C:20.6,2060-D	1,86
10-V-1234S-A:7.2,1828-C:20.6,1300-D	2,23
16-V-1234S-A:7.2,1128-C:20.6,2010-D	2,23
10-V-1234S-A:7.2,2058-C:20.6,1340-D	2,57
17-V-1234S-A:7.2,1158-C:20.6,2240-D	2,57

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}		
Zero-loss efficiency (η_0)	0,73	--
First-order coefficient (a_1)	3,73	W/(m²K)
Second-order coefficient (a_2)	0,007	W/(m²K²)
Incidence angle modifier IAM (50°)	0,90	--

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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