Annex to Solar Keymark Certificate		Licence Number	OEM 9999.1.20
		Date issued	2024-04-12
		Issued by	DQS Hellas

Licence holder	**W.S.E. S.R.L.**	**Country**	Italy
Brand (optional)		**Web**	
Street, Number	Via Prato Nuovo 23/B	**E-mail**	wse@legalmail.it
Postcode, City	10040 Leinì (TO)	**Tel**	+39 011/4464371

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	84 K
	m²	mm	mm	mm	W	W	W	W	W	W
DecaSol 15V	1,50	1.480	1.010	86	1.143	1.087	963	822	665	548
DecaSol 15H	1,50	1.010	1.480	86	1.143	1.087	963	822	665	548
DecaSol 18V	1,82	1.480	1.230	86	1.387	1.319	1.168	997	807	664
DecaSol 18H	1,82	1.230	1.480	86	1.387	1.319	1.168	997	807	664
DecaSol 20V	2,00	1.980	1.010	86	1.524	1.449	1.284	1.096	886	730
DecaSol 20H	2,00	1.010	1.980	86	1.524	1.449	1.284	1.096	886	730
DecaSol 24V	2,37	1.930	1.230	86	1.806	1.718	1.521	1.299	1.050	865
DecaSol 24H	2,37	1.230	1.930	86	1.806	1.718	1.521	1.299	1.050	865
DecaSol 27V	2,72	2.160	1.260	86	2.073	.2 (13.01	1.746	1.491	1.205	993
DecaSol 27H	2,72	1.260	2.160	86	2.073	1.971	1.746	1.491	1.205	993
Power output per m² gross area					762	725	642	548	443	365

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	0,771	3,59	0,014	0,000	0,00	10.827	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	0,78	0,52	0,00
Longitudinal	$K_{\theta L,coll}$	1,00	1,00	1,00	0,99	0,96	0,90	0,78	0,52	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	$(\vartheta_m-\vartheta_a)_{max}$	53,7	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	190,5	°C
Maximum operating temperature	ϑ_{max_op}	200	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	NCSR Demokritos / Solar & other Energy System	www.solar.demokritos.gr	
Test report(s)	4195DE2	**Dated**	16/11/2016
	4196DE2		16/11/2016
	4197DQ3		2/6/2017

Comments of testing laboratory	Ver. 6.2 (13.01.2022)

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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
DecaSol 15V		1.848	1.320	859	1.405	970	605	1.034	675	405	1.125	731	431
DecaSol 15H		1.848	1.320	859	1.405	970	605	1.034	675	405	1.125	731	431
DecaSol 18V		2.243	1.601	1.042	1.705	1.177	734	1.254	819	491	1.365	886	523
DecaSol 18H		2.243	1.601	1.042	1.705	1.177	734	1.254	819	491	1.365	886	523
DecaSol 20V		2.464	1.759	1.145	1.874	1.293	806	1.379	900	540	1.500	974	575
DecaSol 20H		2.464	1.759	1.145	1.874	1.293	806	1.379	900	540	1.500	974	575
DecaSol 24V		2.920	2.085	1.357	2.221	1.532	955	1.634	1.066	639	1.778	1.154	682
DecaSol 24H		2.920	2.085	1.357	2.221	1.532	955	1.634	1.066	639	1.778	1.154	682
DecaSol 27V		3.352	2.393	1.558	2.549	1.759	1.097	1.875	1.223	734	2.040	1.325	782
DecaSol 27H		3.352	2.393	1.558	2.549	1.759	1.097	1.875	1.223	734	2.040	1.325	782
Gross Thermal Yield per m² gross area		1.232	880	573	937	647	403	689	450	270	750	487	288
Annual efficiency, η_a		70%	50%	32%	57%	40%	25%	59%	39%	23%	60%	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. 6.2 (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)
DecaSol 15V	1,50
DecaSol 15H	1,50
DecaSol 18V	1,82
DecaSol 18H	1,82
DecaSol 20V	2,00
DecaSol 20H	2,00
DecaSol 24V	2,37
DecaSol 24H	2,37
DecaSol 27V	2,72
DecaSol 27H	2,72

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}

Collector efficiency (η_{col})	60%

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)
DecaSol 15V	9-V-1234S-A:7.2,1380-C:20.6,1080-D	1,38
DecaSol 15H	14-V-1234S-A:7.2,908-C:20.6,1560-D	1,38
DecaSol 18V	11-V-1234S-A:7.2,1378-C:20.6,1300-D	1,72
DecaSol 18H	14-V-1234S-A:7.2,1128-C:20.6,1560-D	1,72
DecaSol 20V	9-V-1234S-A:7.2,1878-C:20.6,1080-D	1,86
DecaSol 20H	18-V-1234S-A:7.2,908-C:20.6,2060-D	1,86
DecaSol 24V	11-V-1234S-A:7.2,1828-C:20.6,1300-D	2,23
DecaSol 24H	18-V-1234S-A:7.2,1128-C:20.6,2010-D	2,23
DecaSol 27V	11-V-1234S-A:7.2,2060-C:20.6,1320-D	2,57
DecaSol 27H	18-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)	0,76	--
First-order coefficient (a_1)	3,59	W/(m²K)
Second-order coefficient (a_2)	0,014	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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