



Annex to Solar Keymark Certificate					Licence Number		SKM 9965/4				
					Date issued		2022-08-29				
					Issued by		DQS Hellas				
Licence holder		NOBEL INTERNATIONAL EAD			Country		BULGARIA				
Brand (optional)		APOLLON AL S.I. HOR			Web		http://nobel.bg				
Street, Number		48, VITOSHA BLV			E-mail		info@nobel.bg				
Postcode, City		2100 ELIN PELIN			Tel		+359 2 4210232				
Collector Type					Flat plate collector						
Collector name		Gross area (A_G) m ²	Gross length mm	Gross width mm	Gross height mm	Power output per collector G _b = 850 W/m ² , G _d = 150 W/m ² & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
						0 K W	10 K W	30 K W	50 K W	70 K W	89 K W
APOLLON AL S.I. HOR 2000		2.03	1010	2010	110	1406	1329	1151	941	698	438
APOLLON AL S.I. HOR 2600		2.53	1260	2010	110	1752	1657	1435	1173	870	545
Power output per m ² gross area						693	655	567	464	344	216
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		0.703	3.58	0.020	0.000	0.00	9750	0.000	0.00	0.0E+00	0.90
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	0.98	0.94	0.87	0.73	0.48	0.00
Longitudinal		$K_{\theta L, coll}$	1.00	1.00	0.99	0.98	0.94	0.87	0.73	0.48	0.00
Heat transfer medium for testing		Water									
Flow rate for testing (per gross area, A_G)		dm/dt		0.020		kg/(sm ²)					
Maximum temperature difference during thermal performance test		$(\vartheta_m - \vartheta_a)_{max}$		59		K					
Standard stagnation temperature (G = 1000 W/m ² ; $\vartheta_a = 30^\circ\text{C}$)		ϑ_{stg}		159		°C					
Maximum operating temperature		$\vartheta_{max, op}$				°C					
Maximum operating pressure		$p_{max, op}$		1000		kPa					
Testing laboratory		NCSR Demokritos					www.solar.demokritos.gr				
Test report(s)		4065DE5, 4066DQ2 4068DE4, 4071DE2 4103DE2, 4104DE2					Dated		05/09/13		
Comments of testing laboratory		Ver. 6.2 (13.01.2022)									
		<p>N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544582 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece</p>									
<p>Central Offices: Kalavriton 4, 145 64 Kifisia, Athens, Tel: +30 210 6233493-4, Fax: +30 210 6233495, http://www.dqs.gr, e-mail: i.alexou@dqs.gr</p>											

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Supplementary Information							Issued			2022-08-29				
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	
APOLLON AL S.I. HOR 2000		2,232	1,508	877	1,655	1,059	569	1,226	745	391	1,336	803	416	
APOLLON AL S.I. HOR 2600		2,781	1,880	1,093	2,062	1,320	709	1,528	928	487	1,665	1,001	518	
Gross Thermal Yield per m ² gross area		1,099	743	432	815	522	280	604	367	193	658	396	205	
Annual efficiency, η_a		62%	42%	24%	50%	32%	17%	52%	31%	17%	53%	32%	16%	
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. 6.2 (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/m ²) >		1000		ϑ_a (°C) >		20		H _x (MJ/m ²) >		600				
Maximum tested positive load											1000		Pa	
Maximum tested negative load											1000		Pa	
Hail resistance using steel ball (maximum drop height)													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} (m ²)		Hydraulic Designation Code					Aperture Area, A _a (m ²)						
APOLLON AL S.I. HOR 2000	2.03		20-V-12345-A:7.2,842-C:20.6,2050-D					1.81						
APOLLON AL S.I. HOR 2600	2.53		20-V-12345-A:7.2,1102-C:20.6,2050-D					2.32						
Data required for CDR (EU) No 811/2013 - Reference Area														
Collector efficiency (η_{col})		52%												
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.														
Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}														
Zero-loss efficiency (η_0)		0.69												
First-order coefficient (a_1)		3.58												
Second-order coefficient (a_2)		0.020												
Incidence angle modifier IAM (50°)		0.94												
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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