



Annex to Solar Keymark Certificate					Licence Number		SKM 9965/1				
					Date issued		2022-08-29				
					Issued by		DQS Hellas				
Licence holder		NOBEL INTERNATIONAL EAD			Country		BULGARIA				
Brand (optional)		APOLLON AL			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 <sup>2</sup>	Gross length mm	Gross width mm	Gross height mm	Power output per collector G <sub>b</sub> = 850 W/m <sup>2</sup> , G <sub>d</sub> = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
						0 K W	10 K W	30 K W	50 K W	70 K W	76 K W
APOLLON AL 1500		1.52	1,510	1,010	110	1,054	992	860	718	567	520
APOLLON AL 2000		2.03	2,010	1,010	110	1,408	1,325	1,148	959	757	694
APOLLON AL 2600		2.53	2,010	1,270	110	1,755	1,651	1,431	1,196	944	865
Power output per m <sup>2</sup> gross area						694	653	566	473	373	342
Performance parameters test method		Steady state - outdoor									
Performance parameters (related to $A_G$ )		$\eta_0, b$	a1	a2	a3	a4	a5	a6	a7	a8	Kd
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-
Test results		0.704	4.02	0.008	0.000	0.00	7,860	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	0.022		kg/(sm <sup>2</sup> )						
Maximum temperature difference during thermal performance test		$(\vartheta_m - \vartheta_a)_{max}$	46		K						
Standard stagnation temperature ( $G = 1000 \text{ W/m}^2$ ; $\vartheta_a = 30^\circ \text{C}$ )		$\vartheta_{stg}$	174		°C						
Maximum operating temperature		$\vartheta_{max, op}$	100		°C						
Maximum operating pressure		$p_{max, op}$	1000		kPa						
Testing laboratory		NCSR Demokritos					www.solar.demokritos.gr				
Test report(s)		4188DE1 4189DE1 4023DQ2, 4046DQ2					Dated		27/07/16 27/07/16 05/09/13		
Comments of testing laboratory		Ver. 6.2 (13.01.2022)									
		N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece									
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											

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	g <sub>a</sub> (°C) >	20	H <sub>x</sub> (MJ/m²) >	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		Additional Informative Technical Data	
	Reference Area, A <sub>sol</sub> (m²)	Hydraulic Designation Code	Aperture Area, A <sub>a</sub> (m²)
APOLLON AL 1500	1.52	10-V-1234S-A:7.2,1342-C:20.6,1060-D	1.34
APOLLON AL 2000	2.03	10-V-1234S-A:7.2,1842-C:20.6,1060-D	1.81
APOLLON AL 2600	2.53	13-V-1234S-A:7.2,1842-C:20.6,1320-D	2.32

Data required for CDR (EU) No 811/2013 - Reference Area		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$		
Collector efficiency ( $\eta_{col}$ )	52%	Zero-loss efficiency ( $\eta_0$ )	0.69	--
Remark: Collector efficiency ( $\eta_{col}$ ) 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 <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ 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.		First-order coefficient ( $a_1$ )	4.02	W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.008	W/(m <sup>2</sup> K <sup>2</sup> )
		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.		