



Annex to Solar Keymark Certificate					Licence Number		SKM 9965/6				
					Date issued		2022-08-30				
					Issued by		DQS Hellas				
Licence holder		NOBEL INTERNATIONAL EAD			Country		BULGARIA				
Brand (optional)		AELIOS CuS			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	90 K W
AELIOS CuS 1500		1.58	1,530	1,030	80	1,041	986	864	723	565	389
AELIOS CuS 2000		2.09	2,030	1,285	80	1,377	1,305	1,142	956	747	514
AELIOS CuS 2600		2.60	2,030	1,285	80	1,714	1,623	1,421	1,190	929	640
Power output per m <sup>2</sup> gross area						659	624	547	458	357	246
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		0.669	3.33	0.014	0.000	0.00	7,710	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	0.99	0.96	0.92	0.85	0.74	0.59	0.35	0.00
Longitudinal		$K_{\theta L, coll}$	1.00	0.99	0.96	0.92	0.85	0.74	0.59	0.35	0.00
Heat transfer medium for testing		Water									
Flow rate for testing (per gross area, $A_G$ )		dm/dt		0.017		kg/(sm <sup>2</sup> )					
Maximum temperature difference during thermal performance test		$(\vartheta_m - \vartheta_a)_{max}$		60		K					
Standard stagnation temperature ( $G = 1000 \text{ W/m}^2$ ; $\vartheta_a = 30^\circ \text{C}$ )		$\vartheta_{stg}$		152		°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)		4077DE7 4079DE8 4085DQ8					Dated		13/11/13		
Comments of testing laboratory		Ver. 6.2 (13.01.2022)									
		<p>N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 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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<b>Supplementary Information</b>							<b>Issued</b>		<b>2022-08-30</b>					
<b>Gross Thermal Yield in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>														
<b>Standard Locations</b>		<b>Athens</b>			<b>Davos</b>			<b>Stockholm</b>			<b>Würzburg</b>			
<b>Collector name</b>	<b><math>\vartheta_m</math></b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	<b>25°C</b>	<b>50°C</b>	<b>75°C</b>	
AEIOS CuS 1500		1,598	1,091	663	1,187	778	447	879	546	307	958	589	323	
AEIOS CuS 2000		2,113	1,443	877	1,571	1,029	591	1,163	722	405	1,268	779	427	
AEIOS CuS 2600		2,629	1,796	1,091	1,954	1,280	735	1,446	898	504	1,577	969	531	
Gross Thermal Yield per m <sup>2</sup> gross area		1,011	691	420	751	492	283	556	345	194	607	373	204	
Annual efficiency, $\eta_a$		57%	39%	24%	46%	30%	17%	48%	30%	17%	49%	30%	16%	
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)													
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1630 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>			
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 $\vartheta_m$ (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 <a href="http://www.estif.org/solarkeymarknew/">http://www.estif.org/solarkeymarknew/</a>														
<b>Additional Information</b>														
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 <sup>2</sup> ) >		1000		$\vartheta_a$ (°C) >		20		H <sub>x</sub> (MJ/m <sup>2</sup> ) >		600				
Maximum tested positive load											1000		Pa	
Maximum tested negative load											1000		Pa	
Hail resistance using steel ball (maximum drop height)													m	
<b>Additional collector attribute(s)</b>														
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
<b>Energy Labelling Information</b>							<b>Additional Informative Technical Data</b>							
	Reference Area, A <sub>sol</sub> (m <sup>2</sup> )			Hydraulic Designation Code					Aperture Area, A <sub>a</sub> (m <sup>2</sup> )					
AEIOS CuS 1500	1.58			8-V-1234S-A:7.2,1342-C:20.6,1060-D					1.40					
AEIOS CuS 2000	2.09			8-V-1234S-A:7.2,1842-C:20.6,1060-D					1.88					
AEIOS CuS 2600	2.60			11-V-1234S-A:7.2,1342-C:20.6,1320-D					2.37					
<b>Data required for CDR (EU) No 811/2013 - Reference Area</b>							<b>Data required for CDR (EU) No 812/2013 - Reference Area A<sub>sol</sub></b>							
Collector efficiency ( $\eta_{col}$ )				50%			Zero-loss efficiency ( $\eta_0$ )				0.66		--	
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 <sub>sol</sub> ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.				First-order coefficient (a <sub>1</sub> )				3.33		W/(m <sup>2</sup> K)				
				Second-order coefficient (a <sub>2</sub> )				0.014		W/(m <sup>2</sup> K <sup>2</sup> )				
				Incidence angle modifier IAM (50°)				0.85		--				
Remark: The data given in this section are related to collector reference area (A <sub>sol</sub> ) 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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