



Annex to Solar Keymark Certificate					Licence Number		OEM 10078.2							
					Date issued		2023-10-30							
					Issued by		DQS Hellas							
Licence holder		BAVARIA - TSILIGIANNIS SPIRIDON			Country		Greece							
Brand (optional)					Web		www.Bavaria.com.gr							
Street, Number		79 Pantanassis			E-mail		bavaria@hotmail.gr							
Postcode, City		26221 Patra			Tel		+30 261022098							
Collector Type					Flat plate collector									
Collector name					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	10 K	30 K	50 K	70 K	75 K				
					m <sup>2</sup>	mm	mm	mm	W	W	W			
BV160					1,60	1.570	1.020	75	1.230	1.148	985	822	660	619
BV 200					1,90	1.970	965	75	1.460	1.363	1.170	976	783	735
BV 230					2,30	1.970	1.165	75	1.762	1.646	1.412	1.179	945	887
Power output per m <sup>2</sup> gross area					768	717	615	514	412	386				
Performance parameters test method		Steady state - outdoor												
Performance parameters (related to A <sub>G</sub> )		$\eta_0, b$	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		0,795	5,09	0,000	0,000	0,00	8.958	0,000	0,00	0,0E+00	0,77			
Incidence angle modifier test method		Steady state - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub><math>\theta</math>T,coil</sub>	0,99	0,97	0,94	0,88	0,80	0,68	0,52	0,31	0,00			
Longitudinal		K <sub><math>\theta</math>L,coil</sub>	0,99	0,97	0,94	0,88	0,80	0,68	0,52	0,31	0,00			
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A <sub>G</sub> )					dm/dt	0,022	kg/(sm <sup>2</sup> )							
Maximum temperature difference during thermal performance test					( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	45	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a$ = 30 °C)					$\vartheta_{stg}$	146	°C							
Maximum operating temperature					$\vartheta_{max,op}$	100	°C							
Maximum operating pressure					$\rho_{max,op}$	1000	kPa							
Testing laboratory		NCSR "DEMOKRITOS"				www.solar.demokritos.gr								
Test report(s)		4185 DE1 4186 DE1 4187 DQ1				Dated		21/9/2016 21/9/2016 20/9/2016						
Comments of testing laboratory					Ver. 6.2 (13.01.2022)									
The data was obtained from the test reports 4185 DE1 (Collector ATLAS CA160) and 4187 DQ1 (Collector ATLAS CA230).														
Central Offices: Kalavriton 2, 145 64 kifisia, Athens, Tel: +301 6233493-4 , Fax: +301 6233495, http://www.dqs.gr, e-mail: i.alexou@dqs.gr														



<b>Annex to Solar Keymark Certificate Supplementary Information</b>	<b>Licence Number</b>	<b>OEM 10078.2</b>
	<b>Issued</b>	<b>2023-10-30</b>

Gross Thermal Yield in kWh/collector at mean fluid temperature $\vartheta_m$													
Collector name	$\vartheta_m$	Athens			Davos			Stockholm			Würzburg		
		25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
BV160		1.743	1.090	646	1.234	778	459	920	539	309	999	572	319
BV 200		2.069	1.294	767	1.465	923	545	1.092	640	366	1.186	679	378
BV 230		2.498	1.562	926	1.768	1.115	658	1.319	773	442	1.432	819	457
Gross Thermal Yield per m <sup>2</sup> gross area		1.088	680	403	771	486	287	575	337	193	624	357	199
Annual efficiency, $\eta_a$		62%	39%	23%	47%	30%	18%	49%	29%	17%	50%	29%	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 <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 <sup>2</sup> ) >	1000	$\vartheta_a$ (°C) >	20
		$H_x$ (MJ/m <sup>2</sup> ) >	600
Maximum tested positive load	2400		Pa
Maximum tested negative load	2400		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		Additional Informative Technical Data	
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Hydraulic Designation Code	Aperture Area, $A_a$ (m <sup>2</sup> )
BV160	1,60	9-VH-1234S-A:7, 1449-C:20.6, 1067-D	1,56
BV 200	1,90	8-VH-1234S-A:7, 1850-C:20.6, 1016-D	1,85
BV 230	2,30	11-VH-1234S-A:7, 1850-C:20.6, 1216-D	2,25

Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
Collector efficiency ( $\eta_{col}$ )	56%	Zero-loss efficiency ( $\eta_0$ )	0,77
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 ( $a_1$ )	5,09
		Second-order coefficient ( $a_2$ )	0,000
		Incidence angle modifier IAM (50°)	0,77
		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.	