




Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results						Licence Number		SKM 10013/1							
						Date issued		2017-12-20							
						Issued by		DQS Hellas							
Licence holder						VENMAN S.A.									
Brand (optional)						Country						Greece			
Street, Number						Web						http://www.venman.gr			
Postcode, City						E-mail						info@venman.gr			
57022, Thessaloniki						Tel						+99 2310 784684			
Collector Type						Flat plate collector, glazed									
Collector name	Gross area (A <sub>G</sub> ) 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> ϑ <sub>m</sub> - ϑ <sub>a</sub>										
					0 K	10 K	30 K	50 K	70 K	55 K					
					W	W	W	W	W	W					
H81-15	1.40	1,460	960	80	990	933	803	654	484	613					
H81-17	1.56	1,375	1,135	80	1,103	1,039	895	729	539	683					
H81-19	1.83	1,455	1,255	80	1,294	1,219	1,050	855	633	802					
H81-20	1.88	1,960	960	80	1,329	1,252	1,079	878	650	824					
H81-21	2.00	2,000	1,000	80	1,414	1,332	1,148	934	692	876					
H81-23	2.09	1,845	1,135	80	1,478	1,392	1,199	976	723	916					
H81-25	2.37	1,960	1,210	80	1,676	1,579	1,360	1,107	820	1,038					
H81-26	2.42	2,000	1,210	80	1,711	1,612	1,389	1,130	837	1,060					
Power output per m <sup>2</sup> gross area					707	666	574	467	346	438					
Performance parameters test method						Steady state - outdoor									
Performance parameters (related to AG)						η <sub>0</sub> , hem	a1	a2							
Units						-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )							
Test results						0.707	3.900	0.018							
Incidence angle modifier test method						Steady state - outdoor									
Bi-directional incidence angle modifiers						No									
Incidence angle modifier						Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal						K <sub>θT, coll</sub>					0.94			0.00	
Longitudinal						K <sub>θL, coll</sub>					0.94			0.00	
Heat transfer medium for testing						Water									
Flow rate for testing (per gross area, A <sub>G</sub> )						dm/dt	0.020	kg/(sm <sup>2</sup> )							
Maximum temperature difference for thermal performance calculations						(ϑ <sub>m</sub> -ϑ <sub>a</sub> ) <sub>max</sub>	55	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ϑ <sub>a</sub> = 30 °C)						ϑ <sub>stg</sub>	170	°C							
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )						C/m <sup>2</sup>	8.4	kJ/(Km <sup>2</sup> )							
Maximum operating temperature						ϑ <sub>max, op</sub>	-	°C							
Maximum operating pressure						p <sub>max, op</sub>	-	kPa							
Testing laboratory						NCSR Demokritos									
Test report(s)						www.solar.demokritos.gr									
1254 DE1						Dated						20/11/2017			
4206 DE3												20/11/2017			
4207 DQ2												20/11/2017			
Comments of testing laboratory						Datasheet version: 5.01, 2016-03-01									
						<p>N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503915 Fax: +210 6544566 153 10 Ag. Paraskevi - Attiki - Greece</p> 									
Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +301 6233493-4, Fax: +301 6233495, http://www.dqshellas.gr, e-mail: ioannisalexidou@dqshellas.gr															



Annex to Solar Keymark Certificate Supplementary Information	Licence Number	SKM 10013/1
	Issued	2017-12-20

**Annual collector output in kWh/collector at mean fluid temperature  $\vartheta_m$ , based on ISO 9806:2013 test results**

Collector name	Standard Locations $\vartheta_m$	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
H81-15		1,568	1,042	599	1,149	725	385	855	511	265	932	551	282
H81-17		1,748	1,161	667	1,280	808	429	953	569	295	1,039	614	314
H81-19		2,050	1,362	783	1,501	947	503	1,118	668	346	1,218	720	368
H81-20		2,106	1,400	804	1,542	973	517	1,148	686	356	1,252	740	378
H81-21		2,240	1,489	855	1,641	1,036	550	1,222	730	378	1,332	787	402
H81-23		2,341	1,556	894	1,715	1,082	574	1,277	763	395	1,392	822	420
H81-25		2,655	1,764	1,014	1,944	1,227	651	1,448	865	448	1,578	933	477
H81-26		2,711	1,802	1,035	1,985	1,253	665	1,478	883	458	1,611	952	487
Annual output per m <sup>2</sup> gross area		1,120	744	428	820	518	275	611	365	189	666	394	201
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1714 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. 5.01 (March 2016). A detailed description of the calculations is available at [www.solarkeymark.org/scenocalc](http://www.solarkeymark.org/scenocalc)

**Additional Information**

Collector heat transfer medium	Water-Glycole	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	A	--
Maximum tested positive load	2400	Pa
Maximum tested negative load	2400	Pa
Hail resistance using steel ball (maximum drop height)	2	m

**Energy Labelling Information**

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
H81-15	1.40	Collector efficiency ( $\eta_{col}$ )	52 %
H81-17	1.56	<i>Remark: Collector efficiency (<math>\eta_{col}</math>) 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 <math>\eta_{col}</math> is based on reference area (<math>A_{sol}</math>) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.</i>	
H81-19	1.83		
H81-20	1.88		
H81-21	2.00		
H81-23	2.09		
H81-25	2.37		
H81-26	2.42		
		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
		Zero-loss efficiency ( $\eta_0$ )	0.707 --
		First-order coefficient ( $a_1$ )	3.90 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.018 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0.94 --
<i>Remark: The data given in this section are related to collector reference area (<math>A_{sol}</math>) 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.</i>			