



<b>Annex to Solar Keymark Certificate</b>						<b>Licence Number</b>		<b>SKM 10109.3</b>						
						<b>Date issued</b>		<b>2020-12-10</b>						
						<b>Issued by</b>		<b>DQS Hellas</b>						
<b>Licence holder</b>		<b>VENMAN S.A.</b>				<b>Country</b>		Greece						
<b>Brand (optional)</b>						<b>Web</b>		http://www.venman.gr						
<b>Street, Number</b>		7th Km Old National Road Thessaloniki –				<b>E-mail</b>		info@venman.gr						
<b>Postcode, City</b>		57022, Thessaloniki				<b>Tel</b>		+30 2310 784684						
<b>Collector Type</b>						Flat plate collector								
<b>Collector name</b>					<b>Power output per collector</b> Gb = 850 W/m <sup>2</sup> , Gd = 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	90 K				
					m <sup>2</sup>	mm	mm	mm	W	W	W	W	W	W
<b>H98 2.0</b>					1.97	1,988	993	103	1,536	1,459	1,301	1,135	960	779
<b>H98 2.5</b>					2.46	1,989	1,238	103	1,917	1,822	1,624	1,417	1,199	973
<b>Power output per m<sup>2</sup> gross area</b>						779	741	660	576	488	396			
<b>Performance parameters test method</b>		Steady state - outdoor												
<b>Performance parameters (related to A<sub>G</sub>)</b>		η <sub>0</sub> , b	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
<b>Units</b>		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>2</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> )	-			
<b>Test results</b>		0.790	3.82	0.005	0.000	0.00	0	0.000	0.00	0.0E+00	0.91			
<b>Incidence angle modifier test method</b>		Steady state - outdoor												
<b>Incidence angle modifier</b>		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
<b>Transversal</b>		K <sub>BT, coll</sub>	1.00	1.00	0.99	0.98	0.95	0.88	0.75	0.50	0.00			
<b>Longitudinal</b>		K <sub>BL, coll</sub>	1.00	1.00	0.99	0.98	0.95	0.88	0.75	0.50	0.00			
<b>Heat transfer medium for testing</b>						Water								
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>						dm/dt	0.021	kg/(sm <sup>2</sup> )						
<b>Maximum temperature difference during thermal performance test</b>						( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	59.9	K						
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; <math>\vartheta_a = 30</math> °C)</b>						$\vartheta_{stg}$	160.7	°C						
<b>Maximum operating temperature</b>						$\vartheta_{max, op}$	°C							
<b>Maximum operating pressure</b>						p <sub>max, op</sub>	kPa							
<b>Testing laboratory</b>		NCSR Demokritos				http://www.solar.demokritos.gr								
<b>Test report(s)</b>		4283 DQ1 4287 DE2 4293 DE1				<b>Dated</b>		25/11/2020 8/12/2020 25/11/2020						
<b>Comments of testing laboratory</b>						Datasheet version: 6.1, 2019-09-26								
						<b>N.C.S.R. "DEMOKRITOS"</b> <b>SOLAR ENERGY LABORATORY</b> Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece								
<b>DQS HELLAS Ltd, Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +30 210 6233493-4 , Fax: +30 210 6233495,</b> <a href="http://www.dqs.gr">http://www.dqs.gr</a> , e-mail: i.alexidou@dqs.gr														

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<b>Supplementary Information</b>		<b>Issued</b>		<b>2020-12-10</b>											
<b>Annual collector output 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>		
H98 2.0		2,464	1,778	1,220	1,880	1,338	906	1,379	923	597	1,499	997	634		
H98 2.5		3,077	2,220	1,524	2,347	1,670	1,131	1,722	1,153	745	1,872	1,245	792		
Annual output per m <sup>2</sup> gross area		1,251	903	619	954	679	460	700	469	303	761	506	322		
Annual efficiency, $\eta_a$		71%	51%	35%	59%	42%	28%	60%	40%	26%	61%	41%	26%		
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. 6.1 (September 2019). 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											3000		Pa		
Maximum tested negative load											3000		Pa		
Hail resistance using steel ball (maximum drop height)													m		
<b>Additional collector attribute(s)</b>															
<input type="checkbox"/> Using external power source(s) for normal operation											<input type="checkbox"/> Active or passive measure(s) for self-protection				
<input type="checkbox"/> Co-generating thermal and electrical power											<input type="checkbox"/> Façade collector(s)				
<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> )					
H98 2.0		1.97				12-VH-1234S-A:7.2,1870-C:20,1041-				1.83					
H98 2.5		2.46				16-VH-1234S-A:7.2,1870-C:20,1293-				2.30					
<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 ( $\eta_{col}$ )						62%		Zero-loss efficiency ( $\eta_0$ )				0.78		--	
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> )				3.82		W/(m <sup>2</sup> K)			
						Second-order coefficient (a <sub>2</sub> )				0.005		W/(m <sup>2</sup> K <sup>2</sup> )			
						Incidence angle modifier IAM (50°)				0.95		--			
						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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