


Annex to Solar Keymark Certificate					Licence Number		011-7S3256 F							
					Date issued		2024-07-09							
					Issued by		DIN CERTCO							
Licence holder			TIGI Ltd.		Country		Israel							
Brand (optional)					Web		www.tigisolar.com							
Street, Number			3 Hamechonai St.		E-mail		sales@tigisolar.com							
Postcode, City			IL-4527712 Hod Hasharon		Tel		+972 52 6949980							
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 θ <sub>m</sub> - θ <sub>a</sub>									
					0 K	10 K	30 K	50 K	70 K	144 K				
					m <sup>2</sup>	mm	mm	mm	mm	mm	mm			
HC12					2.54	2'110	1'205	200	1'865	1'822	1'714	1'575	1'406	515
Power output per m <sup>2</sup> gross area					734	717	675	620	554	203				
Performance parameters test method			Steady state - outdoor											
Performance parameters (related to A <sub>G</sub> )			η <sub>0, b</sub>	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			0.750	1.53	0.015	0.000	0.00	5'630	0.000	0.00	0.0E+00	0.86		
Incidence angle modifier test method			Steady state - outdoor											
Incidence angle modifier			Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°		
Transversal			K <sub>θT, coll</sub>	1.00	1.00	0.98	0.95	0.91	0.80	0.61	0.33	0.00		
Longitudinal			K <sub>θL, coll</sub>	1.00	1.00	0.98	0.95	0.91	0.80	0.61	0.33	0.00		
Heat transfer medium for testing					Water-Glycole									
Flow rate for testing (per gross area, A <sub>G</sub> )					dm/dt	0.020	kg/(sm <sup>2</sup> )							
Maximum temperature difference during thermal performance test					(θ <sub>m</sub> -θ <sub>a</sub> ) <sub>max</sub>	114	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; θ <sub>a</sub> = 30 °C)					θ <sub>stg</sub>	150	°C							
Maximum operating temperature					θ <sub>max op</sub>	120	°C							
Maximum operating pressure					p <sub>max, op</sub>	600	kPa							
Testing laboratory			SPF Institute for Solar Technology				www.spf.ch							
Test report(s)			C1902				Dated		07.07.2024					
Comments of testing laboratory					Draft Ver. 6.2 (22.09.2021)									
At collector temperatures θ <sub>m</sub> >100°C, overheating is limited by a passive overheating protection device.														
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S3256 F</b>
	<b>Issued</b>	<b>2024-07-09</b>

Gross Thermal Yield in kWh/collector at mean fluid temperature $\vartheta_m$													
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
HC12		2'955	2'469	1'921	2'475	1'987	1'493	1'779	1'386	1'011	1'914	1'495	1'078
Gross Thermal Yield per m <sup>2</sup> gross area		1'163	972	756	974	782	588	700	546	398	754	589	424
Annual efficiency, $\eta_a$		66%	55%	43%	60%	48%	36%	60%	47%	34%	61%	47%	34%
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 Draft Ver. 6.2 (22.09.2021). 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	3000		Pa
Maximum tested negative load	3000		Pa
Hail resistance using ice balls (diameter)	45		mm

Additional collector attribute(s)			
Using external power source(s) for normal operation	No	Active or passive measure(s) for self-protection	Yes
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> )
HC12	2.54	12-V-1234S-7.2,1940-20.4,1195-D	2.41

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 ( $\eta_{col}$ )	65%	Zero-loss efficiency ( $\eta_0$ )	0.73	
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 ( $a_1$ )	1.53	
		Second-order coefficient ( $a_2$ )	0.015	
		Incidence angle modifier IAM (50°)	0.90	--
		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.		