

Annex to Solar Keymark Certificate					Licence Number		011-7S3076 R							
					Date issued		2022-07-20							
					Issued by		DIN CERTCO							
Licence holder		Zhejiang Kesun New Energy Co., Ltd			Country		China							
Brand (optional)		ENSUN			Web		http://www.ensunsolar.cn							
Street, Number		Building 1, No. 2 Jinniu Road, Jianshan New District			E-mail		Eric@ensunchina.com							
Postcode, City		314415, Haining City, Zhejiang Province			Tel		+86 (0)573-8789 8856							
Collector Type					Evacuated tubular collector									
Collector name					Gross area (A_G) m ²	Gross length mm	Gross width mm	Gross height mm	Power output per collector Gb = 850 W/m ² , Gd = 150 W/m ² & u = 1.3 m/s θ _m - θ _a					
									0 K	10 K	30 K	50 K	70 K	85 K
									W	W	W	W	W	W
ENSUN-HSC10	1.55	1 926	805	110	562	529	441	326	184	60				
ENSUN-HSC12	1.84	1 926	955	110	668	628	524	387	219	72				
ENSUN-HSC15	2.27	1 926	1 180	110	824	774	646	478	270	88				
ENSUN-HSC18	2.71	1 926	1 405	110	983	925	771	570	322	106				
ENSUN-HSC20	2.99	1 926	1 555	110	1 085	1 020	851	629	355	117				
ENSUN-HSC24	3.57	1 926	1 862	110	1 295	1 218	1 016	751	424	139				
ENSUN-HSC30	4.45	1 926	2 312	110	1 615	1 518	1 267	937	528	173				
Power output per m² gross area					363	341	285	210	119	39				
Performance parameters test method		Steady state - outdoor												
Performance parameters (related to A_G)		η ₀ , b	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈	K _d			
Units		-	W/(m ² K)	W/(m ² K ²)	J/(m ² K)	-	J/(m ² K)	s/m	W/(m ² K ⁴)	W/(m ² K ⁴)	-			
Test results		0.361	1.947	0.022	0.000	0.00	9 136	0.000	0.00	0.00	1.03			
Incidence angle modifier test method		Steady state - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K _{θT, coll}	1.06	1.12	1.19	1.25	1.31	1.29	0.86	0.43	0.00			
Longitudinal		K _{θL, coll}	1.00	0.99	0.98	0.94	0.89	0.79	0.64	0.39	0.00			
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A_G)					dm/dt		0.020		kg/(sm²)					
Maximum temperature difference during thermal performance test					(θ_m-θ_a)_{max}		54.9		K					
Standard stagnation temperature (G = 1000 W/m²; θ_a = 30 °C)					θ_{stg}		200		°C					
Maximum operating temperature					θ_{max op}		220		°C					
Maximum operating pressure					p_{max op}		600		kPa					
Testing laboratory		TÜV Rheinland (Guangdong) Ltd. (issue data sheet)					http://www.tuv.com							
Test report(s)		190612120GZU-001 (original report issued by Intertek Testing Services Shenzhen Ltd. Guangzhou Branch)					Dated		2021-11-24					
Comments of testing laboratory					Ver. 6.2 (13.01.2022)									
Above efficiency parameters come from test type ENSUN-HSC10;					 TÜVRheinland® Precisely Right. <i>Constant Zhu</i>									
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Annex to Solar Keymark Certificate Supplementary Information							Licence Number			011-753076 R					
							Issued			2022-07-20					
Gross Thermal Yield in kWh/collector at mean fluid temperature ϑ_m															
Standard Locations		Athens			Davos			Stockholm			Würzburg				
Collector name	ϑ_m	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C		
ENSUN-HSC10		1 020	677	347	749	448	190	564	329	144	614	354	156		
ENSUN-HSC12		1 210	803	412	889	532	225	670	391	171	729	420	185		
ENSUN-HSC15		1 493	991	509	1 097	656	278	826	482	211	899	519	228		
ENSUN-HSC18		1 783	1 183	607	1 310	783	332	986	575	252	1 074	619	272		
ENSUN-HSC20		1 967	1 306	670	1 445	864	366	1 088	635	278	1 185	683	300		
ENSUN-HSC24		2 348	1 559	800	1 725	1 032	437	1 299	758	332	1 414	816	359		
ENSUN-HSC30		2 927	1 943	997	2 151	1 286	545	1 619	945	414	1 763	1 017	447		
Gross Thermal Yield per m² gross area		658	437	224	483	289	122	364	212	93	396	228	100		
Annual efficiency, η_a		37%	25%	13%	30%	18%	8%	31%	18%	8%	32%	18%	8%		
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)													
Annual irradiation on collector plane		1765 kWh/m²			1630 kWh/m²			1166 kWh/m²			1244 kWh/m²				
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 ϑ_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					
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)										B		--			
G (W/m²) >		900		ϑ_a (°C) >		15		H_x (MJ/m²) >		540					
Maximum tested positive load										2300		Pa			
Maximum tested negative load										1500		Pa			
Hail resistance using steel ball (maximum drop height)										0.6		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} (m²)			Hydraulic Designation Code					Aperture Area, A_a (m²)					
ENSUN-HSC10		1.55			1-H-12S-C:20,900-D					0.94					
ENSUN-HSC12		1.84			1-H-12S-C:20,1050-D					1.13					
ENSUN-HSC15		2.27			1-H-12S-C:20,1275-D					1.41					
ENSUN-HSC18		2.71			1-H-12S-C:20,1500-D					1.69					
ENSUN-HSC20		2.99			1-H-12S-C:20,1650-D					1.88					
ENSUN-HSC24		3.57			1-H-12S-C:20,1950-D					2.26					
ENSUN-HSC30		4.45			1-H-12S-C:20,2400-D					2.81					
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 (η_{col})		25%			Zero-loss efficiency (η_0)					0.36		--			
Remark: Collector efficiency (η_{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/m², expressed in % and rounded to the nearest integer. Deviating from the regulation η_{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)					1.95		W/(m²K)			
					Second-order coefficient (a_2)					0.022		W/(m²K²)			
					Incidence angle modifier IAM (50°)					1.15		--			
					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.										
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