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Annex to Solar Keymark Certificate		Licence Number	011-7S3207 R
		Date issued	2024-09-10
		Issued by	DIN CERTCO

Licence holder	**Haining Sunfull Technology CO., LTD**	**Country**	China.
Brand (optional)	SUNFULL	**Web**	www.cn-sunfull.com
Street, Number	No.18 Panhong Road, Industrial Zone, Yuanhua Town	**E-mail**	sales5@cn-full.com
Postcode, City	Haining City, Zhejiang Province	**Tel**	+86 13608636153

Collector Type	Evacuated tubular collector

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m2, Gd = 150 W/m2 & u = 1.3 m/s $\vartheta_m - \vartheta_a$					
					0 K	10 K	30 K	50 K	70 K	91 K
	m²	mm	mm	mm	W	W	W	W	W	W
SF-10	1.57	1,920	820	135	670	644	581	503	409	298
SF-12	1.88	1,920	980	135	800	769	694	600	489	356
SF-14	2.19	1,920	1,139	135	930	894	807	698	569	414
SF-15	2.34	1,920	1,219	135	995	957	863	747	609	443
SF-16	2.49	1,920	1,299	135	1,060	1,019	920	796	648	472
SF-18	2.80	1,920	1,458	135	1,191	1,145	1,033	894	728	530
SF-20	3.11	1,920	1,618	135	1,321	1,270	1,146	992	808	588
SF-24	3.72	1,920	1,937	135	1,581	1,520	1,372	1,187	967	703
SF-25	3.87	1,920	2,016	135	1,646	1,583	1,428	1,236	1,007	732
SF-30	4.64	1,920	2,415	135	1,972	1,896	1,710	1,480	1,206	877
Power output per m² gross area					425	409	369	319	260	189

Performance parameters test method	Steady state - outdoor									
Performance parameters (related to A_G)	η0, b	a1	a2	a3	a4	a5	a6	a7	a8	Kd
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	J/(m²K)	s/m	W/(m²K⁴)	W/(m²K⁴)	-
Test results	0.425	1.52	0.012	0.000	0.00	8319	0.000	0.00	0.00	1.01

Incidence angle modifier test method		Steady state - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.00	0.99	0.97	0.92	0.84	0.69	0.44	0.00
Longitudinal	$K_{\theta L,coll}$	1.05	1.09	1.14	1.16	1.19	1.19	0.79	0.40	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	$(\vartheta_m-\vartheta_a)_{max}$	60.55	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	210	°C
Maximum operating temperature	ϑ_{max_op}	230	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch	http://www.intertek.com	
Test report(s)	230620129GZU-001	**Dated**	2024/9/9

Comments of testing laboratory Draft Ver. 6.2 (22.09.2021)

All result are tested from model SF-10.

intertek
Steve Zhu

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Supplementary Information	Issued	2024-09-10

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
SF-10		1,155	883	606	922	671	437	662	459	285	723	503	309
SF-12		1,380	1,054	724	1,101	802	522	791	548	341	864	601	369
SF-14		1,605	1,226	842	1,281	932	607	920	637	396	1,004	699	430
SF-15		1,717	1,312	901	1,370	998	649	984	682	424	1,075	748	460
SF-16		1,830	1,398	960	1,460	1,063	692	1,049	727	451	1,145	797	490
SF-18		2,054	1,569	1,078	1,639	1,193	777	1,177	816	507	1,286	895	550
SF-20		2,279	1,741	1,196	1,819	1,324	862	1,306	905	562	1,426	993	610
SF-24		2,729	2,085	1,432	2,178	1,585	1,032	1,564	1,084	673	1,707	1,188	730
SF-25		2,841	2,170	1,491	2,267	1,650	1,074	1,628	1,128	701	1,778	1,237	760
SF-30		3,403	2,600	1,785	2,716	1,977	1,286	1,950	1,352	840	2,129	1,482	911
Gross Thermal Yield per m² gross area		734	561	385	586	426	277	421	291	181	459	320	196
Annual efficiency, η_a		42%	32%	22%	36%	26%	17%	36%	25%	16%	37%	26%	16%
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 ϑm (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)					B	--
G (W/m²) >	900	ϑ_a (°C) >	15	H_X (MJ/m²) >		540
Maximum tested positive load					2400	Pa
Maximum tested negative load					1450	Pa
Hail resistance using steel ball (maximum drop height)					0.8	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

	Reference Area, A_{sol} (m²)
SF-10	1.57
SF-12	1.88
SF-14	2.19
SF-15	2.34
SF-16	2.49
SF-18	2.80
SF-20	3.11
SF-24	3.72
SF-25	3.87
SF-30	4.64

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}

Collector efficiency (η_{col})	35%

Remark: Collector efficiency (ηcol) 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 ηcol is based on reference area (Asol) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.

Additional Informative Technical Data

Hydraulic Designation Code	Aperture Area, A_a (m²)
1-H-12S-C:31,901-D	0.93
1-H-12S-C:31,1050-D	1.11
1-H-12S-C:31,1198-D	1.30
1-H-12S-C:31,1273-D	1.39
1-H-12S-C:31,1347-D	1.48
1-H-12S-C:31,1496-D	1.67
1-H-12S-C:31,1644-D	1.85
1-H-12S-C:31,1942-D	2.22
1-H-12S-C:31,2016-D	2.32
1-H-12S-C:31,2388-D	2.78

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}

Zero-loss efficiency (η_0)	0.43	--
First-order coefficient (a_1)	1.52	W/(m²K)
Second-order coefficient (a_2)	0.012	W/(m²K²)
Incidence angle modifier IAM (50°)	1.10	--

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.