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Annex to Solar Keymark Certificate		Licence Number	011-7S3243 R
		Date issued	2024-10-08
		Issued by	DIN CERTCO

Licence holder	SUNWOOD srl	**Country**	Italy
Brand (optional)	SUNWOOD	**Web**	http://www.sunwoodsrl.it
Street, Number	viale del Lavoro 18v	**E-mail**	stefano.bertolin@sunwoodsrl.it
Postcode, City	37096 Villafrance di Verona(VR)	**Tel**	39 045 7903582

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	84 K
	m²	mm	mm	mm	W	W	W	W	W	W
SW HP CPC 10	2.24	1980	1130	133	1,298	1,262	1,152	994	788	619
SW HP CPC 12	2.67	1980	1350	133	1,551	1,507	1,377	1,188	942	740
SW HP CPC 14	3.11	1980	1570	133	1,804	1,753	1,601	1,382	1,095	860
SW HP CPC 15	3.33	1980	1680	133	1,930	1,876	1,713	1,479	1,172	920
SW HP CPC 16	3.54	1980	1790	133	2,057	1,999	1,825	1,575	1,249	981
SW HP CPC 18	3.98	1980	2010	133	2,309	2,244	2,050	1,769	1,402	1,101
SW HP CPC 20	4.42	1980	2230	133	2,562	2,490	2,274	1,963	1,556	1,222
SW HP CPC 21	4.63	1980	2340	133	2,689	2,613	2,386	2,059	1,633	1,282
SW HP CPC 22	4.85	1980	2450	133	2,815	. 6.2 (22.	2,498	2,156	1,709	1,342
SW HP CPC 24	5.29	1980	2670	133	3,068	2,981	2,723	2,350	1,863	1,463
SW HP CPC 25	5.50	1,980	2,780	133	3,194	3,104	2,835	2,447	1,940	1,523
SW HP CPC 28	6.04	1,980	3,050	133	3,504	3,406	3,110	2,684	2,128	1,671
Power output per m² gross area					580	564	515	444	352	277

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	0.583	1.37	0.027	0.000	0.00	12220	0.000	0.00	0	0.97

Incidence angle modifier test method		Steady state - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.02	1.03	1.04	1.05	1.12	1.18	0.79	0.39	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.99	0.98	0.95	0.88	0.75	0.50	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	$(\vartheta_m-\vartheta_a)_{max}$	53.72	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	280	°C
Maximum operating temperature	$\vartheta_{max\ op}$	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)	231031204GZU-005 231031204GZU-001	**Dated**	2024/10/8 2024/7/10

Comments of testing laboratory — Draft Ver. 6.2 (22.09.2021)

Above efficiency parameters come from OEM test type SHC10;

intertek
Starr Steve Zhu

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Supplementary Information	Issued	2024-10-08

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
SW HP CPC 10		2,242	1,779	1,206	1,823	1,333	823	1,331	950	577	1,440	1,032	618
SW HP CPC 12		2,678	2,126	1,441	2,177	1,593	983	1,590	1,135	689	1,720	1,233	738
SW HP CPC 14		3,114	2,472	1,676	2,532	1,852	1,143	1,849	1,319	802	2,001	1,434	859
SW HP CPC 15		3,333	2,645	1,793	2,710	1,982	1,223	1,978	1,412	858	2,141	1,535	919
SW HP CPC 16		3,551	2,819	1,911	2,887	2,112	1,303	2,108	1,504	914	2,281	1,636	979
SW HP CPC 18		3,987	3,165	2,146	3,242	2,371	1,463	2,367	1,689	1,026	2,561	1,837	1,100
SW HP CPC 20		4,424	3,511	2,380	3,597	2,631	1,623	2,626	1,874	1,139	2,842	2,038	1,220
SW HP CPC 21		4,642	3,685	2,498	3,774	2,760	1,704	2,755	1,966	1,195	2,982	2,138	1,280
SW HP CPC 22		4,860	3,858	2,615	3,952	2,890	1,784	2,885	2,059	1,251	3,122	2,239	1,340
SW HP CPC 24		5,296	4,204	2,850	4,307	3,150	1,944	3,144	2,244	1,363	3,402	2,440	1,461
SW HP CPC 25		5,515	4,378	2,968	4,484	3,280	2,024	3,273	2,336	1,419	3,542	2,540	1,521
SW HP CPC 28		6,050	4,803	3,256	4,920	3,598	2,220	3,591	2,563	1,557	3,886	2,787	1,668
Gross Thermal Yield per m² gross area		1,002	795	539	815	596	368	595	424	258	644	461	276
Annual efficiency, η_a		57%	45%	31%	50%	37%	23%	51%	36%	22%	52%	37%	22%
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				2800	Pa
Maximum tested negative load				1000	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

	Reference Area, A_{sol} (m²)
SW HP CPC 10	2.24
SW HP CPC 12	2.67
SW HP CPC 14	3.11
SW HP CPC 15	3.33
SW HP CPC 16	3.54
SW HP CPC 18	3.98
SW HP CPC 20	4.42
SW HP CPC 21	4.63
SW HP CPC 22	4.85
SW HP CPC 24	5.29
SW HP CPC 25	5.50
SW HP CPC 28	6.04

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

Collector efficiency (η_{col})	48%

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:19,1205-D	1.82
1-H-12S-C:19,1425-D	2.16
1-H-12S-C:19,1645-D	2.52
1-H-12S-C:19,1755-D	2.70
1-H-12S-C:19,1865-D	2.87
1-H-12S-C:19,2085-D	3.23
1-H-12S-C:19,2305-D	3.59
1-H-12S-C:19,2415-D	3.77
1-H-12S-C:19,2525-D	3.95
1-H-12S-C:19,2745-D	4.41
1-H-12S-C:19,2855-D	4.59
1-H-12S-C:19,3185-D	5.24

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

Zero-loss efficiency (η_0)	0.58	--
First-order coefficient (a_1)	1.37	W/(m²K)
Second-order coefficient (a_2)	0.027	W/(m²K²)
Incidence angle modifier IAM (50°)	1.02	--

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.