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IGTE

Annex to Solar Keymark Certificate		Licence Number	011-7S3193 F
		Date issued	2023-08-02
		Issued by	DIN CERTCO

Licence holder	CALDO SOLAR E.E.	**Country**	GREECE
Brand (optional)		**Web**	https://caldo.gr/
Street, Number	Leoforos Spaton 92	**E-mail**	info@caldo.gr
Postcode, City	15344 Gerakas	**Tel**	+30 210 661 7269

Collector Type	Flat plate 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	112 K
	m²	mm	mm	mm	W	W	W	W	W	W
NEXUS PLUS 15	1.51	1'503	1'007	85	1'093	1'037	921	797	666	367
NEXUS PLUS 17	1.68	1'420	1'183	85	1'216	1'154	1'024	886	741	408
NEXUS PLUS 19	1.96	1'503	1'305	85	1'419	1'346	1'195	1'034	864	476
NEXUS PLUS 20	2.02	2'006	1'007	85	1'462	1'388	1'232	1'066	890	490
NEXUS PLUS 23	2.24	1'893	1'183	85	1'621	1'539	1'366	1'182	987	544
NEXUS PLUS 25	2.52	2'006	1'257	85	1'824	1'731	1'536	1'330	1'111	612
NEXUS PLUS 27	2.67	2'261	1'183	85	1'933	1'834	1'628	1'409	1'177	648
NEXUS PLUS 29	2.92	2'006	1'457	85	2'114	2'006	1'780	1'541	1'287	709
Power output per m² gross area					724	687	610	528	441	243

Performance parameters test method	Quasi dynamic									
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	0.725	3.62	0.006	0.000	0.00	13'660	0.000	0.00	0.00	0.99

Incidence angle modifier test method		Quasi dynamic - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.00	1.00	0.99	0.96	0.87	0.63	0.32	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.99	0.96	0.87	0.63	0.32	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	$(\vartheta_m-\vartheta_a)_{max}$	82	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	230	°C
Maximum operating temperature	$\vartheta_{max\ op}$	-	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)	http://www.igte.uni-stuttgart.de	
Test report(s)	21COL1631OEM19 21COL1631QOEM19 21COL1632OEM19	**Dated**	04.07.2023 04.07.2023 04.07.2023

Comments of testing laboratory	Ver. 6.2 (13.01.2022)
Documented performance parameters are taken from 21COL1632OEM19 (NEXUS PLUS 15)	TZS Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)

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Supplementary Information	Issued	2023-08-02

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
NEXUS PLUS 15	1'793	1'286	869	1'361	958	635	997	662	419	1'091	719	449
NEXUS PLUS 17	1'994	1'431	967	1'514	1'066	707	1'109	736	466	1'214	800	500
NEXUS PLUS 19	2'327	1'669	1'128	1'767	1'244	825	1'294	859	544	1'416	934	583
NEXUS PLUS 20	2'398	1'720	1'163	1'821	1'282	850	1'334	885	560	1'460	962	601
NEXUS PLUS 23	2'659	1'907	1'289	2'019	1'421	942	1'479	981	621	1'618	1'067	666
NEXUS PLUS 25	2'992	2'146	1'451	2'272	1'599	1'060	1'664	1'104	699	1'821	1'200	750
NEXUS PLUS 27	3'170	2'273	1'537	2'407	1'694	1'123	1'763	1'170	741	1'929	1'272	794
NEXUS PLUS 29	3'466	2'486	1'681	2'632	1'853	1'228	1'928	1'279	810	2'110	1'391	869
Gross Thermal Yield per m² gross area	1'187	851	576	901	635	421	660	438	277	723	476	298
Annual efficiency, η_a	67%	48%	33%	55%	39%	26%	57%	38%	24%	58%	38%	24%
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 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-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/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >	600
Maximum tested positive load				2750	Pa
Maximum tested negative load				2400	Pa
Hail resistance using steel ball (maximum drop height)				2	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)
NEXUS PLUS 15	1.51
NEXUS PLUS 17	1.68
NEXUS PLUS 19	1.96
NEXUS PLUS 20	2.02
NEXUS PLUS 23	2.24
NEXUS PLUS 25	2.52
NEXUS PLUS 27	2.67
NEXUS PLUS 29	2.92

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

Collector efficiency (η_{col})	57%

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)
8-V-1234S-7.2,1383-20.6,1060-D	1.36
10-V-1234S-7.2,1303-20.6,1240-D	1.52
11-V-1234S-7.2,1383-20.6,1370-D	1.79
8-V-1234S-7.2,1888-20.6,1060-D	1.83
10-V-1234S-7.2,1773-20.6,1240-D	2.05
11-V-1234S-7.2,1888-20.6,1310-D	2.32
10-V-1234S-7.2,2143-20.6,1240-D	2.46
12-V-1234S-7.2,1888-20.6,1510-D	2.71

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

Zero-loss efficiency (η_0)	0.72	--
First-order coefficient (a_1)	3.62	W/(m²K)
Second-order coefficient (a_2)	0.006	W/(m²K²)
Incidence angle modifier IAM (50°)	0.98	--

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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