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IGTE

Annex to Solar Keymark Certificate		Licence Number	011-7S3169 F
		Date issued	2023-03-07
		Issued by	DIN CERTCO

Licence holder	THERMO SITE, LDA	Country	Portugal	
Brand (optional)		Web	www.thermosite.com	
Street, Number	Ed. Capitólio, Av. França, 352, F4.6	E-mail	pedro.soares@thermosite.com	
Postcode, City	4050-276 Porto	Tel	+351	966722640

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	104 K
	m²	mm	mm	mm	W	W	W	W	W	W
THERMWAY ATACAMA 19	1,96	1.503	1.305	103	1.457	1.393	1.254	1.099	928	602
THERMWAY ATACAMA 20	2,02	2.006	1.007	103	1.501	1.436	1.292	1.132	956	620
THERMWAY ATACAMA 23	2,24	1.893	1.183	103	1.665	1.592	1.433	1.255	1.060	687
THERMWAY ATACAMA 25	2,52	2.006	1.257	103	1.873	1.791	1.612	1.412	1.193	773
THERMWAY ATACAMA 27	2,67	2.261	1.183	103	1.985	1.898	1.708	1.497	1.264	819
THERMWAY ATACAMA 29	2,92	2.006	1.447	103	2.170	2.075	1.868	1.637	1.382	896
Power output per m² gross area					743	711	640	560	473	307

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	0,748	3,16	0,010	0,000	0,00	14.330	0,000	0,00	0,00	0,96

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	0,99	0,98	0,97	0,92	0,80	0,47	0,24	0,00
Longitudinal	$K_{\theta L,coll}$	1,00	0,99	0,98	0,97	0,92	0,80	0,47	0,24	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	$(\vartheta_m-\vartheta_a)_{max}$	74	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	220	°C
Maximum operating temperature	ϑ_{max_op}	k.A.	°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)	22COL1679OEM01 22COL1681OEM01 22COL1647Q/1OEM01	Dated	28.02.2023 28.02.2023 28.02.2023

Comments of testing laboratory	Ver. 6.2 (13.01.2022)
Documented performance parameters are taken from 22COL1679OEM01 (THERMWAY ATACAMA 19)	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	2023-03-07

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
THERMWAY ATACAMA 19	2.333	1.727	1.192	1.810	1.306	880	1.319	903	584	1.439	980	627
THERMWAY ATACAMA 20	2.404	1.779	1.229	1.866	1.345	907	1.359	931	602	1.483	1.010	646
THERMWAY ATACAMA 23	2.666	1.973	1.362	2.069	1.492	1.006	1.507	1.032	668	1.644	1.121	716
THERMWAY ATACAMA 25	2.999	2.220	1.533	2.327	1.679	1.131	1.695	1.161	751	1.850	1.261	806
THERMWAY ATACAMA 27	3.178	2.352	1.624	2.466	1.778	1.199	1.796	1.230	796	1.960	1.336	853
THERMWAY ATACAMA 29	3.475	2.572	1.776	2.697	1.945	1.311	1.964	1.345	871	2.144	1.461	933
Gross Thermal Yield per m² gross area	1.190	881	608	924	666	449	673	461	298	734	500	320
Annual efficiency, η_a	67%	50%	34%	57%	41%	28%	58%	40%	26%	59%	40%	26%
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				2600	Pa
Maximum tested negative load				1500	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 / Additional Informative Technical Data

	Reference Area, A_{sol} (m²)	Hydraulic Designation Code	Aperture Area, A_a (m²)
THERMWAY ATACAMA 19	1,96	11-V-1234S-7.2,1392-20.6,1370-D	1,79
THERMWAY ATACAMA 20	2,02	9-V-1234S-7.2,1897-20.6,1060-D	1,83
THERMWAY ATACAMA 23	2,24	10-V-1234S-7.2,1782-20.6,1240-D	2,05
THERMWAY ATACAMA 25	2,52	11-V-1234S-7.2,1897-20.6,1310-D	2,32
THERMWAY ATACAMA 27	2,67	10-V-1234S-7.2,2152-20.6,1240-D	2,46
THERMWAY ATACAMA 29	2,92	12-V-1234S-7.2,1897-20.6,1510-D	2,71

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

Collector efficiency (η_{col})	60%

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.

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

Zero-loss efficiency (η_0)	0,74	--
First-order coefficient (a_1)	3,16	W/(m²K)
Second-order coefficient (a_2)	0,010	W/(m²K²)
Incidence angle modifier IAM (50°)	0,94	--

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.