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Annex to Solar Keymark Certificate

Licence Number	**011-7S2729 F**
Date issued	**2020-03-30**
Issued by	**TÜV Rheinland Energy GmbH**

Licence holder	**ITALTHERM S.p.A.**	**Country**	Italy
Brand (optional)	ITALTHERM	**Web**	www.italtherm.it
Street, Number	Via Salvo D'Acquisto	**E-mail**	info@italtherm.it
Postcode, City	29010 Pontenure (PC)	**Tel**	+39 523 575 611

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	90 K
	m²	mm	mm	mm	W	W	W	W	W	W
Slim Solar 2.0	2.01	1 675	1 200	55	1 446	1 366	1 188	989	766	521
Slim Solar 2.5	2.51	2 090	1 200	55	1 804	1 704	1 483	1 233	956	651
Power output per m² gross area					719	679	591	492	381	259

Performance parameters test method	Steady state - indoor									
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	0.741	3.85	0.014	0.000	0.00	4 860	0.000	0.00	0.0E+00	0.81

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	0.96	0.92	0.86	0.74	0.51	0.26	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	0.99	0.96	0.92	0.86	0.74	0.51	0.26	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.024	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	60	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	182	°C
Maximum operating temperature	$\vartheta_{max\ op}$	n.n.	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	TÜV Rheinland Energy GmbH	www.tuv.com/solar	
Test report(s)	21238518.001r1 21238518.002	**Dated**	15.12.2016 12.12.2016

Comments of testing laboratory — Datasheet version: 6.1, 2019-07-11

The performance values related to aperture area (1.867 m² Slim Solar 2.0 / 2.348 m² Slim Solar 2.5) are η0,hem,a=0.774; a1a=4.145; a2a=0.015.

TÜVRheinland® lab
Genau. Richtig.
TÜV Rheinland Energy GmbH
Am Grauen Stein
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Supplementary Information	Issued	2020-03-30

Annual collector output 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
Slim Solar 2.0		2 142	1 428	851	1 581	1 025	582	1 168	715	398	1 267	763	415
Slim Solar 2.5		2 673	1 782	1 062	1 973	1 278	727	1 457	892	497	1 581	952	518
Annual output per m² gross area		1 066	710	423	787	510	290	581	356	198	630	380	207
Annual efficiency, η_a		60%	40%	24%	48%	31%	18%	50%	31%	17%	51%	31%	17%
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. 6.1 (July 2019). 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					5400	Pa
Maximum tested negative load					2400	Pa
Hail resistance using ice balls (diameter)					-	mm

Additional collector attribute(s)

☐ Using external power source(s) for normal operation
☐ Co-generating thermal and electrical power
☐ Active or passive measure(s) for self-protection
☐ Façade collector(s)

Energy Labelling Information

	Reference Area, A_{sol} (m²)
Slim Solar 2.0	2.01
Slim Solar 2.5	2.51

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

Collector efficiency (η_{col})	54%

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	Aperature Area, A_a (m²)
Slim Solar 2.0	1-H-1234S-A:9.2,14000-C:20.6,1150	1.87
Slim Solar 2.5	1-H-1234S-A:9.2,19000-C:20.6,1150	2.35

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

Zero-loss efficiency (η_0)	0.72	--
First-order coefficient (a_1)	3.85	W/(m²K)
Second-order coefficient (a_2)	0.014	W/(m²K²)
Incidence angle modifier IAM (50°)	0.84	--

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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