Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results

Licence Number	**011-7S2820 R**
Date issued	**2017-12-06**
Issued by	**DIN CERTCO**

Licence holder	**Jiangsu Sunrain Solar Energy Co., Ltd.**	**Country**	China
Brand (optional)	Sunrain	**Web**	www.sunrain.com
Street, Number	Ninghai Industrial Zone	**E-mail**	certification@sunrain.com
Postcode, City	222243 Lianyungang City, Jiangsu Province	**Tel**	+86 (0)518-85959993

Collector Type	Concentrating collector

	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m²; Gd = 150 W/m²; u = 3 m/s ϑm - ϑa					
					0 K	10 K	30 K	50 K	70 K	100 K
Collector name	m²	mm	mm	mm	W	W	W	W	W	W
TZ47/1500-10U	1.04	1 600	648	129	720	702	664	622	576	502
TZ47/1500-12U	1.23	1 600	768	129	853	832	786	736	683	595
TZ47/1500-15U	1.52	1 600	948	129	1 053	1 027	970	909	843	734
TZ47/1500-16U	1.61	1 600	1 008	129	1 120	1 092	1 032	966	896	781
TZ47/1500-18U	1.80	1 600	1 128	129	1 253	1 222	1 155	1 082	1 003	874
TZ47/1500-20U	2.00	1 600	1 248	129	1 387	1 352	1 278	1 197	1 110	967
TZ47/1500-25U	2.48	1 600	1 548	129	1 720	1 677	1 585	1 485	1 377	1 200
TZ47/1500-30U	2.96	1 600	1 848	129	2 054	2 002	1 892	1 773	1 644	1 432
Power output per m² gross area					695	677	640	600	556	484

Performance parameters test method		Quasi dynamic							
Performance parameters (related to AG)		η0,b	c1	c2	c3	c4	c6	Kd	
Units		-	W/(m²K)	W/(m²K²)	J/(m³K)	-	s/m	-	
Test results		0.685	1.701	0.004	0.000	0.000	0.000	1.093	
Incidence angle modifier test method		Quasi dynamic - outdoor							
Bi-directional incidence angle modifiers	Yes								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.11	1.16	1.17	1.23	1.32	1.32	1.22	1.10	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.99	0.98	0.97	0.94	0.88	0.00	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 for thermal performance calculations	$(\vartheta_m-\vartheta_a)_{max}$	100	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	236.1	°C
Effective thermal capacity, incl. fluid (per gross area, A_G)	C/m^2	24.4	kJ/(Km²)
Maximum operating temperature	$\vartheta_{max\ op}$	99	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	TÜV Rheinland (Shanghai) Co., Ltd.	www.tuv.com	
Test report(s)	154265086_Sunrain_TZ47-1500-10U_ISO_Report_chen 154265086_Sunrain_TZ47-1500-30U_ISO_Report_chen	**Dated**	2017-12-05 2017-12-05

Comments of testing laboratory — Datasheet version: 5.01, 2016-03-01

No comment.

DIN CERTCO ● Alboinstraße 56 ● 12103 Berlin
Tel: +49 30 7562-1131 ● Fax: +49 30 7562-1141 ● E-Mail: info@dincertco.de ● www.dincertco.de

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Supplementary Information	Issued	2017-12-06

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on ISO 9806:2013 test results

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
TZ47/1500-10U	1 395	1 209	1 027	1 172	1 000	840	854	709	579	917	761	621
TZ47/1500-12U	1 652	1 432	1 217	1 388	1 184	995	1 012	840	686	1 086	901	735
TZ47/1500-15U	2 040	1 767	1 502	1 714	1 462	1 228	1 249	1 037	847	1 341	1 113	907
TZ47/1500-16U	2 169	1 879	1 597	1 823	1 554	1 306	1 328	1 103	900	1 425	1 183	965
TZ47/1500-18U	2 428	2 104	1 788	2 040	1 740	1 462	1 487	1 235	1 008	1 596	1 324	1 080
TZ47/1500-20U	2 686	2 328	1 978	2 258	1 925	1 617	1 645	1 366	1 115	1 766	1 466	1 195
TZ47/1500-25U	3 332	2 887	2 454	2 800	2 388	2 006	2 041	1 695	1 383	2 190	1 818	1 482
TZ47/1500-30U	3 978	3 447	2 929	3 343	2 851	2 395	2 436	2 023	1 651	2 615	2 170	1 770
Annual output per m² gross area	1 345	1 166	991	1 131	964	810	824	684	558	884	734	599
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1714 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. 5.01 (March 2016). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc

Additional Information

Collector heat transfer medium	Water-Glycole	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	C	--
Maximum tested positive load	2400	Pa
Maximum tested negative load	2400	Pa
Hail resistance using steel ball (maximum drop height)	0.6	m

Energy Labelling Information

	Reference Area, A_{sol} (m^2)
TZ47/1500-10U	1.04
TZ47/1500-12U	1.23
TZ47/1500-15U	1.52
TZ47/1500-16U	1.61
TZ47/1500-18U	1.80
TZ47/1500-20U	2.00
TZ47/1500-25U	2.48
TZ47/1500-30U	2.96

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}		
Collector efficiency (η_{col})	62	%

Remark: Collector efficiency (η_{col}) 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 η_{col} is based on reference area (A_{sol}) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}		
Zero-loss efficiency (η_0)	0.695	--
First-order coefficient (a_1)	1.70	W/(m²K)
Second-order coefficient (a_2)	0.004	W/(m²K²)
Incidence angle modifier IAM (50°)	1.21	--

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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