


Annex to Solar Keymark Certificate					Licence Number		011-7S3044 R							
					Date issued		2021-08-25							
					Issued by		DIN CERTCO							
Licence holder		Jiangsu Sunrain Solar Energy Co., Ltd			Country	P.R.China								
Brand (optional)		Sunrain			Web	http://www.sunrain.com								
Street, Number		Ninghai Industrial Zone			E-mail	certification@sunrain.com								
Postcode, City		222000/Lianyungang City, Jiangsu Province			Tel	+86 518-85959690								
Collector Type					Evacuated tubular collector									
Collector name					Power output per collector G <sub>b</sub> = 850 W/m <sup>2</sup> , G <sub>d</sub> = 150 W/m <sup>2</sup> & u = 1.3 m/s ϑ <sub>m</sub> - ϑ <sub>a</sub>									
					0 K	10 K	30 K	50 K	70 K	77 K				
					m <sup>2</sup>	mm	mm	mm	W	W	W	W	W	W
TZ58/1800-10R (R2)					1.71	1,990	860	155	682	662	607	532	439	402
TZ58/1800-12R (R2)					2.02	1,990	1,016	155	807	783	717	629	518	476
TZ58/1800-15R (R2)					2.49	1,990	1,250	155	993	963	882	774	638	585
TZ58/1800-18R (R2)					2.95	1,990	1,484	155	1,178	1,143	1,048	919	757	695
TZ58/1800-20R (R2)					3.26	1,990	1,640	155	1,302	1,263	1,158	1,016	837	768
TZ58/1800-22R (R2)					3.57	1,990	1,796	155	1,426	1,383	1,268	1,112	917	841
TZ58/1800-24R (R2)					3.88	1,990	1,952	155	1,550	1,504	1,378	1,209	996	914
TZ58/1800-25R (R2)					4.04	1,990	2,030	155	1,612	1,564	1,433	1,257	1,036	950
TZ58/1800-28R (R2)					4.51	1,990	2,264	155	1,798	1,744	1,598	1,402	1,155	1,060
TZ58/1800-30R (R2)					4.82	1,990	2,420	155	1,923	1,866	1,710	1,500	1,236	1,134
Power output per m <sup>2</sup> gross area					399	387	355	311	256	235				
Performance parameters test method		Steady state - outdoor												
Performance parameters (related to A <sub>G</sub> )		η <sub>0, b</sub>	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-			
Test results		0.396	1.057	0.014	0.000	0.000	5,270	0.000	0.000	0.000	1.051			
Incidence angle modifier test method		Steady state - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub>θT, coll</sub>	1.02	1.04	1.14	1.24	1.38	1.46	0.97	0.49	0.00			
Longitudinal		K <sub>θL, coll</sub>	1.00	1.00	0.99	0.96	0.92	0.84	0.69	0.44	0.00			
Heat transfer medium for testing		Water												
Flow rate for testing (per gross area, A <sub>G</sub> )		dm/dt	0.020		kg/(sm <sup>2</sup> )									
Maximum temperature difference during thermal performance test		(ϑ <sub>m</sub> - ϑ <sub>a</sub> ) <sub>max</sub>	46.8		K									
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ϑ <sub>a</sub> = 30 °C)		ϑ <sub>stg</sub>	240		°C									
Maximum operating temperature		ϑ <sub>max op</sub>	120		°C									
Maximum operating pressure		p <sub>max op</sub>	600		kPa									
Testing laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou					http://www.intertek.com							
Test report(s)		161227072GZU-001, 161227072GZU-002					Dated		2017-11-07					
Comments of testing laboratory		Datashet version: 6.1, 2019-09-26												
1. Above efficiency parameters come from test type TZ58/1800-10R and test to ISO 9806:2013.		 Stamp & signature												
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<b>Annex to Solar Keymark Certificate Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S3044 R</b>
	<b>Issued</b>	<b>2021-08-25</b>

Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$													
Collector name	Standard Locations $\vartheta_m$	Athens			Davos			Stockholm			Würzburg		
		25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
TZ58/1800-10R (R2)		1,273	1,031	746	1,035	788	534	760	564	375	822	612	401
TZ58/1800-12R (R2)		1,505	1,219	883	1,224	932	631	898	667	443	971	724	474
TZ58/1800-15R (R2)		1,851	1,499	1,086	1,506	1,146	776	1,105	821	545	1,195	891	584
TZ58/1800-18R (R2)		2,198	1,780	1,289	1,787	1,361	922	1,312	974	647	1,419	1,058	693
TZ58/1800-20R (R2)		2,429	1,967	1,425	1,975	1,504	1,018	1,450	1,077	715	1,568	1,169	766
TZ58/1800-22R (R2)		2,660	2,154	1,560	2,163	1,647	1,115	1,588	1,179	783	1,717	1,280	839
TZ58/1800-24R (R2)		2,891	2,342	1,696	2,351	1,790	1,212	1,725	1,281	852	1,866	1,391	911
TZ58/1800-25R (R2)		3,006	2,435	1,763	2,445	1,861	1,261	1,794	1,333	886	1,941	1,447	948
TZ58/1800-28R (R2)		3,353	2,716	1,967	2,727	2,076	1,406	2,001	1,486	988	2,164	1,614	1,057
TZ58/1800-30R (R2)		3,587	2,906	2,104	2,917	2,221	1,504	2,141	1,590	1,057	2,316	1,726	1,131
Annual output per m <sup>2</sup> gross area		744	603	436	605	461	312	444	330	219	480	358	235
Annual efficiency, $\eta_a$		42%	34%	25%	37%	28%	19%	38%	28%	19%	39%	29%	19%
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1630 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>		
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  $\vartheta_m$  (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 (September 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)				C	--
G (W/m <sup>2</sup> ) >	800	$\vartheta_a$ (°C) >	10	$H_x$ (MJ/m <sup>2</sup> ) >	420
Maximum tested positive load				2400	Pa
Maximum tested negative load				2400	Pa
Hail resistance using steel ball (maximum drop height)				1	m

Additional collector attribute(s)	
<input type="checkbox"/> Using external power source(s) for normal operation	<input type="checkbox"/> Active or passive measure(s) for self-protection
<input type="checkbox"/> Co-generating thermal and electrical power	<input type="checkbox"/> Façade collector(s)

Energy Labelling Information		Additional Informative Technical Data	
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Hydraulic Designation Code	Aperture Area, $A_a$ (m <sup>2</sup> )
TZ58/1800-10R (R2)	1.71	1-H-12S-C:20,942-D	0.93
TZ58/1800-12R (R2)	2.02	1-H-12S-C:20,1098-D	1.12
TZ58/1800-15R (R2)	2.49	1-H-12S-C:20,1332-D	1.40
TZ58/1800-18R (R2)	2.95	1-H-12S-C:20,1566-D	1.67
TZ58/1800-20R (R2)	3.26	1-H-12S-C:20,1722-D	1.86
TZ58/1800-22R (R2)	3.57	1-H-12S-C:20,1878-D	2.05
TZ58/1800-24R (R2)	3.88	1-H-12S-C:20,2034-D	2.23
TZ58/1800-25R (R2)	4.04	1-H-12S-C:20,2112-D	2.33
TZ58/1800-28R (R2)	4.51	1-H-12S-C:20,2346-D	2.60
TZ58/1800-30R (R2)	4.82	1-H-12S-C:20,2502-D	2.79

Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
Collector efficiency ( $\eta_{col}$ )	33%	Zero-loss efficiency ( $\eta_0$ )	0.40
Remark: Collector efficiency ( $\eta_{col}$ ) 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/m <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.		First-order coefficient ( $a_1$ )	1.06
		Second-order coefficient ( $a_2$ )	0.014
		Incidence angle modifier IAM (50°)	1.17
		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.	