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Annex to Solar Keymark Certificate

Licence Number	**011-7S2479 R**
Date issued	**2020-02-03**
Issued by	**TÜV Rheinland Energy GmbH**

Licence holder	**HAINING JUYANG NEW ENERGY**	**Country**	P.R. China
Brand (optional)	ONOSI	**Web**	www.onosisolar.com
Street, Number	No.58 Beitang road, Puqiao Village	**E-mail**	onosi@onosisolar.com
Postcode, City	314416 / Yuanhua, Haining, Zhejiang	**Tel**	+86 0573 - 87718300

Collector Type	Evacuated tubular 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	100 K
	m²	mm	mm	mm	W	W	W	W	W	W
ONS-HPC03-8	1.89	2 010	940	137	889	882	854	807	739	601
ONS-HPC03-9	2.11	2 010	1 050	137	992	985	954	900	825	671
ONS-HPC03-10	2.33	2 010	1 160	137	1 096	1 088	1 053	994	911	741
ONS-HPC03-12	2.77	2 010	1 380	137	1 303	1 293	1 252	1 182	1 083	881
ONS-HPC03-14	3.22	2 010	1 600	137	1 515	1 503	1 455	1 374	1 259	1 024
ONS-HPC03-15	3.44	2 010	1 710	137	1 618	1 606	1 555	1 468	1 345	1 094
ONS-HPC03-16	3.66	2 010	1 820	137	1 722	1 709	1 654	1 562	1 431	1 164
ONS-HPC03-18	4.10	2 010	2 040	137	1 929	1 914	1 853	1 750	1 603	1 304
ONS-HPC03-20	4.54	2 010	2 260	137	2 135	2 119	2 052	1 937	1 775	1 444
ONS-HPC03-21	4.76	2 010	2 370	137	2 239	2 222	2 151	2 031	1 861	1 514
ONS-HPC03-22	4.99	2 010	2 480	137	2 347	2 330	2 255	2 129	1 951	1 587
ONS-HPC03-24	5.43	2 010	2 700	137	2 554	2 535	2 454	2 317	2 123	1 727
Power output per m² gross area					470	467	452	427	391	318

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	0.472	0.22	0.013	0.000	0.00	27 138	0.000	0.00	0.0E+00	0.98

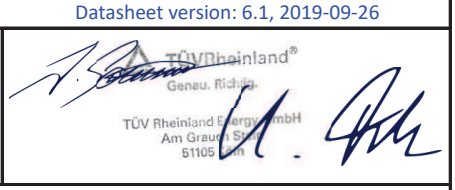
Incidence angle modifier test method		Quasi dynamic - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.02	1.09	1.11	1.16	1.25	1.27	-	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	0.99	0.98	0.97	0.94	0.90	0.81	-	0.00

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	$(\vartheta_m-\vartheta_a)_{max}$	70	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	230	°C
Maximum operating temperature	$\vartheta_{max\ op}$	99	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	TÜV Rheinland (Shanghai) Co., Ltd.	http://www.tuv.com/solarenergy	
Test report(s)	154052477a_EN_ONS-8_Report_Han 154052477_EN_ONS-24_Report_Han	**Dated**	12.02.2015 12.02.2015

Comments of testing laboratory — Datasheet version: 6.1, 2019-09-26

All input figures are taken out of the original test reports issued by TÜV Rhainland Shanghai. If necessary, the reference area and the corresponding figures are changed to gross area.



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Supplementary Information	Issued	2020-02-03

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
ONS-HPC03-8	1 604	1 479	1 257	1 414	1 235	997	1 022	886	703	1 094	954	759
ONS-HPC03-9	1 790	1 652	1 404	1 578	1 378	1 113	1 141	989	785	1 222	1 065	848
ONS-HPC03-10	1 977	1 824	1 550	1 743	1 522	1 229	1 260	1 092	867	1 349	1 176	936
ONS-HPC03-12	2 350	2 168	1 843	2 072	1 810	1 461	1 498	1 298	1 030	1 604	1 398	1 113
ONS-HPC03-14	2 732	2 520	2 142	2 409	2 104	1 698	1 741	1 509	1 198	1 864	1 625	1 294
ONS-HPC03-15	2 919	2 693	2 288	2 573	2 247	1 814	1 860	1 612	1 280	1 992	1 736	1 382
ONS-HPC03-16	3 105	2 865	2 435	2 738	2 391	1 930	1 979	1 715	1 361	2 119	1 848	1 471
ONS-HPC03-18	3 479	3 209	2 727	3 067	2 678	2 163	2 217	1 921	1 525	2 374	2 070	1 648
ONS-HPC03-20	3 852	3 554	3 020	3 396	2 966	2 395	2 455	2 128	1 689	2 629	2 292	1 824
ONS-HPC03-21	4 039	3 726	3 166	3 561	3 110	2 511	2 574	2 231	1 771	2 756	2 403	1 913
ONS-HPC03-22	4 234	3 906	3 319	3 733	3 260	2 632	2 698	2 338	1 856	2 889	2 519	2 005
ONS-HPC03-24	4 607	4 250	3 612	4 062	3 547	2 864	2 936	2 545	2 020	3 144	2 741	2 182
Annual output per m² gross area	848	783	665	748	653	527	541	469	372	579	505	402
Annual efficiency, η_a	48%	44%	38%	46%	40%	32%	46%	40%	32%	47%	41%	32%
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 (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)					B	--
G (W/m²) >	900	ϑ_a (°C) >	15	H_x (MJ/m²) >		540
Maximum tested positive load					2400	Pa
Maximum tested negative load					1000	Pa
Hail resistance using steel ball (maximum drop height)					30	m

Additional collector attribute(s)

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

Energy Labelling Information

	Reference Area, A_{sol} (m²)
ONS-HPC03-8	1.89
ONS-HPC03-9	2.11
ONS-HPC03-10	2.33
ONS-HPC03-12	2.77
ONS-HPC03-14	3.22
ONS-HPC03-15	3.44
ONS-HPC03-16	3.66
ONS-HPC03-18	4.10

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

Collector efficiency (η_{col})	44%

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)
1-H-12S-C35,940	1.51
1-H-12S-C35,1050	1.70
1-H-12S-C35,1160	1.89
1-H-12S-C35,1270	2.27
1-H-12S-C35,1490	2.65
1-H-12S-C35,1710	2.84
1-H-12S-C35,1820	3.03
1-H-12S-C35,2040	3.41

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

Zero-loss efficiency (η_0)	0.47	--
First-order coefficient (a_1)	0.22	W/(m²K)
Second-order coefficient (a_2)	0.013	W/(m²K²)
Incidence angle modifier IAM (50°)	1.06	--

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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