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Annex to Solar Keymark Certificate

Licence Number	**011-7S3019 R**
Date issued	**2021-07-12**
Issued by	**DIN CERTCO**

Licence holder	**TWL Technologie GmbH**	**Country**	Germany
Brand (optional)	EtaSun Pro® VRK	**Web**	http://www.twl-technologie.de
Street, Number	Im Gewerbegebiet 2-12	**E-mail**	vertrieb@twl-technologie.de
Postcode, City	92271, Freihung	**Tel**	+49 4351 7517-00

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	94 K
	m²	mm	mm	mm	W	W	W	W	W	W
EtaSun Pro® VRK20	3.10	1,983	1,565	162	1,431	1,390	1,297	1,190	1,067	902
EtaSun Pro® VRK30	4.57	1,983	2,303	162	2,109	2,048	1,911	1,753	1,572	1,330
Power output per m² gross area					462	449	419	384	344	291

Performance parameters test method	Steady state - outdoor									
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	0.461	1.259	0.006	0.000	0.000	3,470	0.000	0.000	0.000	1.01

Incidence angle modifier test method		Steady state - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\vartheta T,coll}$	1.04	*1.08*	1.15	*1.22*	1.31	*1.39*	0.93	0.46	0.00
Longitudinal	$K_{\vartheta L,coll}$	1.00	0.99	0.97	0.93	0.88	0.78	0.58	0.29	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.013	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	64	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	230	°C
Maximum operating temperature	$\vartheta_{max\ op}$	95	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch	http://www.intertek.com	
Test report(s)	131101048GZU-001	**Dated**	2014/1/15

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

1. The "negative pressure test of the collector" according to EN 12975-2:2006, 5.9.2 was not performed;
2. Tests were performed based on EN 12975-2:2006;
3. EtaSun Pro® VRK20, EtaSun Pro® VRK30 are come from HRZJ-58/1800-20, HRZJ-58/1800-30 which are come from OEM Jiangsu HETE;
4. Above efficiency parameters come from test type HRZJ-58/1800-10 from OEM.

intertek
Steve Zhu

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Supplementary Information	Issued	2021-07-12

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
EtaSun Pro® VRK20		2,629	2,199	1,762	2,167	1,765	1,383	1,582	1,251	954	1,703	1,348	1,018
EtaSun Pro® VRK30		3,873	3,239	2,596	3,193	2,601	2,038	2,330	1,843	1,405	2,509	1,986	1,500
Annual output per m² gross area		848	709	568	699	570	446	510	404	308	549	435	328
Annual efficiency, η_a		48%	40%	32%	43%	35%	27%	44%	35%	26%	44%	35%	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. 6.1 (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/m²) >	800	ϑ_a (°C) >	10	H_X (MJ/m²) >		420
Maximum tested positive load					3400	Pa
Maximum tested negative load					--	Pa
Hail resistance using steel ball (maximum drop height)					1.0	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)
EtaSun Pro® VRK20	3.10
EtaSun Pro® VRK30	4.57

Data required for CDR (EU) No 811/2013 - Reference Area

Collector efficiency (η_{col})	40%

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-C:24,1615-D	1.87
1-H-12S-C:24,2365-D	2.81

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

Zero-loss efficiency (η_0)	0.46	--
First-order coefficient (a_1)	1.26	W/(m²K)
Second-order coefficient (a_2)	0.006	W/(m²K²)
Incidence angle modifier IAM (50°)	1.12	--

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.