TÜVRheinland®
DIN CERTCO
Precisely Right.

Annex to Solar Keymark Certificate

Licence Number	**011-7S559 R**
Date issued	**2021-07-02**
Issued by	**DIN CERTCO**

Licence holder	**D&K Solar GmbH**	**Country**	Germany
Brand (optional)	-	**Web**	www.dk-solar.de
Street, Number	Bergheimer strasse 2	**E-mail**	info@dk-solar.de
Postcode, City	53909 Zülpich	**Tel**	+49 02252-834971

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	120 K
	m²	mm	mm	mm	W	W	W	W	W	W
Gravitation CPC 20	3.72	1 700	2 193	85	1 913	1 878	1 805	1 729	1 650	1 440
Power output per m² gross area					514	505	485	465	444	387

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	0.512	0.94	0.001	0.000	0.00	17 193	0.000	0.00	0.0E+00	1.03

Incidence angle modifier test method		Quasi dynamic - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	0.99	1.02	0.94	0.93	1.07	1.05	1.14	1.41	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.99	0.99	0.98	0.96	0.92	0.80	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.019	kg/(sm²)
Maximum temperature difference during thermal performance test	$(\vartheta_m-\vartheta_a)_{max}$	90	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	260	°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)	21249869.001	**Dated**	02.07.2021

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

TÜVRheinland®
TÜV Rheinland Energy GmbH
Am Grauen Stein
51105 Köln
lab

TÜVRheinland®
DIN CERTCO
Precisely Right.

Annex to Solar Keymark Certificate	Licence Number	011-7S559 R
Supplementary Information	Issued	2021-07-02

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
Gravitation CPC 20		3 338	2 976	2 629	2 846	2 509	2 197	2 070	1 780	1 525	2 226	1 916	1 639
Annual output per m² gross area		897	800	707	765	674	591	556	479	410	598	515	441
Annual efficiency, η_a		51%	45%	40%	47%	41%	36%	48%	41%	35%	48%	41%	35%
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)					A	--
G (W/m²) >	1000	ϑ_a (°C) >	20	H_x (MJ/m²) >		600
Maximum tested positive load					5000	Pa
Maximum tested negative load					3000	Pa
Hail resistance using ice balls (diameter)					25	mm

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)
Gravitation CPC 20	3.72

Additional Informative Technical Data

Hydraulic Designation Code	Aperature Area, A_a (m²)
20-V-1122S-A:6,3000-C:20,2190	3.20

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

Collector efficiency (η_{col})	48%

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.

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

Zero-loss efficiency (η_0)	0.51	--
First-order coefficient (a_1)	0.94	W/(m²K)
Second-order coefficient (a_2)	0.001	W/(m²K²)
Incidence angle modifier IAM (50°)	0.94	--

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.