TÜVRheinland®
DIN CERTCO

Precisely Right.

Annex to Solar Keymark Certificate

Licence Number	011-7S2938 F
Date issued	2019-06-25
Issued by	DINCERTCO

Licence holder	CHROMAGEN	Country	ISRAEL
Brand (optional)	--	Web	htpp://www.chromagen.com
Street, Number	Kibbutz Sha'ar Ha'amakim	E-mail	yair@chromagen.com
Postcode, City	3658800	Tel	+972 4-953-8888/8897

Collector Type	Flat plate collector

Collector name	Gross height	Gross area (A_G)	Gross length	Gross width	Aperture area (A_a)	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	81 K
	mm	m²	mm	mm	m²	W	W	W	W	W	W
QR-SK	90	1,66	1.815	915	1,51	1.133	1.069	926	766	589	485
QR-SD	90	2,02	1.891	1.071	1,87	1.379	1.300	1.127	933	717	590
QR-SE	90	2,33	2.180	1.071	2,16	1.591	1.500	1.300	1.076	827	680
QR-SF	90	2,77	2.182	1.271	2,57	1.891	1.783	1.545	1.279	984	809
Power output per m² gross area						683	644	558	462	355	292

Performance parameters test method	Steady state - indoor									
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	0,689	3,77	0,013	0,000	0,00	5.104	0,000	0,00	0,0E+00	0,94

Incidence angle modifier test method		Steady state - outdoor								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1,00	0,99	0,98	0,96	0,93	0,87	0,75	0,39	0,00
Longitudinal	$K_{\theta L,coll}$	1,00	0,99	0,98	0,96	0,93	0,87	0,75	0,39	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	$(\vartheta_m-\vartheta_a)_{max}$	51	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	190,5	°C
Maximum operating temperature	ϑ_{max_op}	210	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	Fundación CENER - CIEMAT, LEST	http://www.cener.com	
Test report(s)	30.3300.0-008 R 30.3300.0-009 / 30.3300.0-010 R 30.3300.3 R	Dated	13/06/2019 25/06/2019

Comments of testing laboratory

Datasheet version: 6.0, 2018-10-30

The collectors models QR-SK and QR-SF were tested according to ISO9806:2017. According to SKM rules, the results of the collector model QR-SF are representative for the whole QR family.

CENER

TÜVRheinland®
DIN CERTCO

Precisely Right.

Annex to Solar Keymark Certificate	Licence Number	011-7S2938 F
Supplementary Information	Issued	2019-06-25

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
QR-SK	1.805	1.215	728	1.327	857	483	985	602	329	1.077	651	350
QR-SD	2.196	1.478	886	1.614	1.043	588	1.199	732	401	1.311	792	426
QR-SE	2.533	1.705	1.021	1.862	1.203	678	1.383	845	462	1.512	913	492
QR-SF	3.012	2.027	1.214	2.214	1.430	806	1.644	1.004	550	1.797	1.086	584
Annual output per m² gross area	1.087	732	438	799	516	291	594	363	198	649	392	211
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. 6.0 (October 2018). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc

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				2400	Pa
Maximum tested negative load				1500	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
- ☐ Wind and/or infrared sensitive collector(s) (WISC)
- ☐ Façade collector(s)

Energy Labelling Information

	Reference Area, A_{sol} (m²)	Hydraulic Designation Code
QR-SK	1,66	8-V-1234S-A:7,1703-C:20,980-D
QR-SD	2,02	10-V-1234S-A:7,1788-C:20,1144-D
QR-SE	2,33	10-V-1234S-A:7,2068-C:20,1144-D
QR-SF	2,77	12-V-1234S-A:7,2072-C:20,1342-D

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}	
Collector efficiency (η_{col})	51%

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)	0,68	--
First-order coefficient (a_1)	3,77	W/(m²K)
Second-order coefficient (a_2)	0,013	W/(m²K²)
Incidence angle modifier IAM (50°)	0,92	--

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.

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