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Annex to Solar Keymark Certificate		Licence Number	011-7S2187 F
		Date issued	2022-05-18
		Issued by	DIN CERTCO

Licence holder	KOLLECTOR BIOME BEJA - K.B.B. SA	Country	Tunesia	
Brand (optional)		Web	www.biome-solar.com	
Street, Number	Zone Industrielle - Beja Nord	E-mail	mohamed.zarrouk@solar-kbb.com	
Postcode, City	9000 Béja	Tel	+216	78 440 440

Collector Type	Flat plate 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	90 K
	m²	mm	mm	mm	W	W	W	W	W	W
K418-DH-AR	2.02	1908	1058	95	1523	1449	1285	1100	894	667
K423-DH-AR	2.51	2168	1158	95	1893	1800	1597	1367	1111	829
Power output per m² gross area					754	717	636	545	443	330

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	0.769	3.54	0.013	0.000	0.00	4700	0.000	0.00	0.0	0.87

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	0.99	0.98	0.96	0.92	0.86	0.73	0.33	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	0.99	0.98	0.96	0.92	0.86	0.73	0.33	0.00

Heat transfer medium for testing		Water	
Flow rate for testing (per gross area, A_G)		dm/dt	0.069 kg/(sm²)
Maximum temperature difference during thermal performance test		$(\vartheta_m-\vartheta_a)_{max}$	60 K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)		ϑ_{stg}	213 °C
Maximum operating temperature		ϑ_{max_op}	120 °C
Maximum operating pressure		$p_{max,op}$	1000 kPa

Testing laboratory	Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)	http://www.igte.uni-stuttgart.de	
Test report(s)	22COL111-12/KD 22COL42-16/KD 22COL112-12/KQ	Dated	18.05.2022 18.05 2022 18.05.2022

Comments of testing laboratory	Ver. 6.2 (13.01.2022)
This data sheet replaces the data sheet issued on 31.08.2016 (ISFH) Documented performance parameters are taken from 22COL46-16/KD The company details were updated.	TZS Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)

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Supplementary Information	Issued	2022-05-18

Gross Thermal Yield 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
K418-DH-AR	2 384	1 692	1 097	1 811	1 246	778	1 331	868	522	1 445	934	553
K423-DH-AR	2 962	2 102	1 363	2 250	1 549	967	1 654	1 079	649	1 796	1 161	687
Gross Thermal Yield per m² gross area	1 180	837	543	896	617	385	659	430	258	716	463	274
Annual efficiency, η_a	67%	47%	31%	55%	38%	24%	57%	37%	22%	58%	37%	22%
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. 6.2 (13.01.2022). 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				3000	Pa
Maximum tested negative load				3050	Pa
Hail resistance using steel ball (maximum drop height)					m

Additional collector attribute(s)

Using external power source(s) for normal operation	No	Active or passive measure(s) for self-protection	No
Co-generating thermal and electrical power	No	Façade collector(s)	No

Energy Labelling Information

	Reference Area, A_{sol} (m²)
K418-DH-AR	2.02
K423-DH-AR	2.51

Additional Informative Technical Data

Hydraulic Designation Code	Aperture Area, A_a (m²)
12-V-23S-A:7.2,x-C:16.x	1.83
12-V-23S-A:7.2,x-C:16.4,x	2.29

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

Collector efficiency (η_{col})	59%

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)	0.75	--
First-order coefficient (a_1)	3.54	W/(m²K)
Second-order coefficient (a_2)	0.013	W/(m²K²)
Incidence angle modifier IAM (50°)	0.91	--

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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