Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	**Licence number**	**011-7S324 F**
	Date of issue	**14.08.2013**

Company holding the licence	KBB Kollektorbau GmbH	**Country**		Germany
Brand (optional)	-	**Website**		www.kbb-solar.com
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Postal Code	12439	**Tel.**	+49	(0)30 678 1789 -0
City	Berlin	**Fax**	+49	(0)30 678 1789 -55

Collector Type (flat plate / evacuate tubular / un-glazed)	Flat plate collector
Integration in the roof possible ?	No

Collector name	Aperture area (Aa) [m²]	Gross length [mm]	Gross width [mm]	Gross height [mm]	Gross area (AG) [m²]	Power output per collector unit G = 1000 W/m² Tm-Ta : 0 K [W]	10 K [W]	30 K [W]	50 K [W]	70 K [W]
K420-EM	1.97	1 878	1 158	75	2.17	1 582	1 499	1 315	1 111	886
K423-EM	2.30	2 168	1 158	75	2.51	1 841	1 743	1 530	1 293	1 031

Collector efficiency parameters related to aperture area (Aa) Type of fluid and flow rate see note 1	η_{0a}	0.802	-
	a_{1a}	4.11	W/(m²K)
	a_{2a}	0.0133	W/(m²K²)
Stagnation temperature - Weather conditions see note 2	t_{stg}	209	°C
Effective thermal capacity	$c_{eff} = C/A_a$	5.9	kJ/(m²K)
Max. operation pressure - see note 3	p_{max}	1000	kPa

Incidence angle modifiers $K_\theta(\theta)$			θ_T / θ_L	50°		
	$K_{\theta d}$	0.88	$K_\theta(\theta)$	0.93	at G_{DIF}/G_{TOT}	0.15
	b_0	0.14				

Testing Laboratory	Institut für Solarenergieforschung Hameln
Website	www.isfh.de
Test report id. number	132-12/KD, 133-12/KQ, 134-12/KD
Date of test report	29.05.2013, 14.06.2013, 30.05.2013
Perf. test method	EN 12975-2 6.1.5 (indoor)

Comments of testing laboratory :

Note 1	**Fluid**	Water	**Flow rate**	0.033	kg/s per m²
Note 2	**Irradiance, Gs=1000 W/m²; Ambient temperature , Ta=30 °C**				
Note 3	**Given by manufacturer**				

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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence number	011-7S324 F
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Annual collector output kWh

Collector name	Location and collector temperature (Tm)														
	Athens			Davos			Stockholm			Würzburg					
	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C			
K420-EM	2 477	1 711	1 074	1 986	1 319	785	1 367	865	502	1 486	931	532			
K423-EM	2 881	1 991	1 250	2 311	1 534	913	1 590	1 006	584	1 729	1 083	619			

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)

Overview of locations

Location	Latitude °	Gtot kWh/m²	Ta °C	Collector orientation or tracking mode
Athens	38	1 765	18.5	South, 25°
Davos	47	1 714	3.2	South, 30°
Stockholm	59	1 166	7.5	South, 45°
Würzburg	50	1 244	9.0	South, 35°

Gtot	Annual total irradiation on collector plane	kWh/m²
Ta	Mean annual ambient air temperature	°C
Tm	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

Calculation of the annual collector performance is done by the official Solar Keymark spreadsheet tool. Hour by hour the collector output is calculated according to the efficiency parameters from the Keymark test using constant collector operating temperature (Tm). Detailed description with all equations used is available from the Solar Keymark web site (direct link: http://www.estif.org/solarkeymark/annexb1.php)

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Calculation program version:
3.07, October 2011 (SP)