Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	**Licence number**	**011-7S2364 R**
	Date of issue	24.05.2014

Company holding the licence	August Brötje GmbH	**Country**		Germany
Brand (optional)	-	**Website**		www.broetje.de
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City	Rastede	**Fax**	+49	(0) 4402 80 583

Collector Type (flat plate / evacuate tubular / un-glazed)	Evacuated tubular 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]
Solar Plus DF 20 B	2.15	1 954	1 416	93	2.77	1 649	1 619	1 551	1 474	1 389
Solar Plus DF 30 B	3.22	1 954	2 125	93	4.15	2 473	2 428	2 327	2 212	2 083

Collector efficiency parameters related to aperture area (Aa) Type of fluid and flow rate see note 1	η_{0a}	0.768	-
	a_{1a}	1.36	W/(m²K)
	a_{2a}	0.0053	W/(m²K²)
Stagnation temperature - Weather conditions see note 2	t_{stg}	313	°C
Effective thermal capacity	$c_{eff} = C/A_a$	8	kJ/(m²K)
Max. operation pressure - see note 3	p_{max}	800	kPa

Incidence angle modifiers $K_\theta(\theta)$			θ_T / θ_L	50°	*10°*	*20°*	*30°*	*40°*	*60°*
	$K_{\theta d}$	0.88	$K_\theta(\theta_T)$	0.99	*1.00*	*1.02*	*1.04*	*1.05*	*0.85*
			$K_\theta(\theta_L)$	0.92	*1.00*	*0.99*	*0.98*	*0.96*	*0.86*
					Optional values				

Testing Laboratory	Institut für Solarenergieforschung Hameln
Website	www.isfh.de
Test report id. number	21-14/KD2; 22-14/KQ2
Date of test report	24.05.2014
Perf. test method	EN 12975-2 6.1.5 (indoor)

Comments of testing laboratory :

Note 1	**Fluid**	Water	**Flow rate**	0.020	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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VERSION 3.6, 2012.01.20

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence number	011-7S2364 R
	Issued	24.05.2014

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			
Solar Plus DF 20 B	2 724	2 401	2 073	2 474	2 162	1 846	1 671	1 413	1 175	1 795	1 519	1 259			
Solar Plus DF 30 B	4 079	3 597	3 104	3 705	3 238	2 765	2 503	2 116	1 759	2 689	2 274	1 886			

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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Datasheet version:
VERSION 3.6, 2012.01.20
Calculation program version:
3.07, October 2011 (SP)