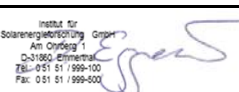


Precisely Right.

Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate						Licence Number		011-7S 059 F				
						Issued		2016-03-02				
Company holding the			Roth Werke GmbH			Country		Germany				
Brand (optional)						Website		www.roth-werke.de				
Street, street number			Am Seerain 2			E-mail		service@roth-werke.de				
Postal Code / City, province			35232 Dautphetal			Tel/Fax		49 (0)6466 922-0 / -100				
Collector Type (flat plate glazed/un-glazed; evacuate tubular)						Flat plate collector - glazed						
Thermal / photo voltaic hybrid collector? (PVT collector)						No						
Integration in the roof possible ? (manufacturers declaration)						No						
	Collector name	Aperture area (Aa) m ²	Gross length mm	Gross width mm	Gross height mm	Gross area (AG) m ²	Power output per collector module					
							G = 1000 W/m ²					
							Tm-Ta					
							0 K	10 K	30 K	50 K	70 K	
							W	W	W	W	W	
	Heliostar 218	1.97	1 820	1 200	108	2.18	1 535	1 462	1 298	1 110	899	
	Heliostar 252	2.29	2 100	1 200	109	2.52	1 784	1 699	1 508	1 290	1 045	
Performance test method						Glazed liquid heating collector - steady state - indoor						
Performance parameters related to aperture			η_0	a1	a2							
Units			-	W/(m ² K)	W/(m ² K ²)							
Test results - Flow rate and fluid see note 1			0.779	3.560	0.015							
Bi-directional incidence angle			No <i>Kθ values are obligatory for 50°.</i>									
Incidence angle modifiers Kθ(θ)			Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
			K θ (θ)	1.00	0.99	0.98	0.96	0.92	0.86	0.73	0.33	0.00
Incidence angle modifier not bi-directional - leave fields blank												
Stagnation temperature - Weather conditions see note 2						Tstg		207 °C				
Effective thermal capacity						ceff = C/Ag		4.9 kJ/(m ² K)				
Max. intended operation temperature - see note 3						Tmax,op		- °C				
Max. operation pressure - see note 3						pmax,op		1500 kPa				
Pressure drop table - for a collector family, the values shall be for the module with highest ΔP per m² aperture area												
Flow rate	kg/(s m ²)	-										
Pressure drop, ΔP	Pa	-										
Optional weather data			Location			Link						
Testing Laboratory			Institut für Solarenergieforschung Hameln									
Website			www.isfh.de									
Test report id. number			23-07/D; 87-06/D; 88-06/Q			Date of test report			26.02.2007; 09.10.2006;			
During the test GDIF/GTOT was always between			0.1	and	0.3							
Comments of testing laboratory:												
The performance parameters are related to G(DIF)/G(TOT)=0.15.												
The incidence angle modifiers were determined outdoor according to a quasi-dynamic test procedure.												
Note 1	Flow rate	0.083 kg/(s m ²)	Fluid	Water								
Note 2	Irradiance, G = 1000 W/m ² ; Ambient temperature, Ta=30 °C											
Note 3	Given by manufacturer											
						Institut für Solarenergieforschung GmbH Am Ohrberg 1 D-31860 Hameln Tel: +49 51 999-100 Fax: 0 51 51 999-500						
												
Datasheet version: 4.06, 2014-01-15												
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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S 059 F
	Issued	02.03.2016

Annual collector output kWh/module														
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		
Heliostar 218	2 407	1 716	1 111	1 834	1 263	784	1 347	881	527	1 463	949	559		
Heliostar 252	2 798	1 995	1 291	2 132	1 468	911	1 566	1 024	613	1 701	1 103	650		

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)
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Overview of locations				
Location	Latitude °	Gtot kWh/m ²	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/m ²
Ta	Mean annual ambient air temperature	°C
Tm	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool ScenoCalc. The collector output is calculated hour by hour according to the efficiency parameters from the Keymark test using constant collector operating temperature (Tm). A detailed description of the calculations is available at <http://www.sp.se/en/index/services/solar/ScenoCalc/Sidor/default.aspx>.

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	ScenoCalc version: Ver. 4.06 (Jan, 2014)