


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		011-7S999 R							
					Date issued		2017-02-21							
					Issued by		TÜV Rheinland Energy GmbH							
Licence holder		Orange Energy GmbH & Co. KG			Country		Germany							
Brand (optional)		Orange			Web		www.orange-energy.de							
Street, Number		Loipertshausener Str. 2			E-mail		info@orange-energy.de							
Postcode, City		85301 Schweitkirchen - Sünzhausen			Tel		+49 (0)8444 92 74-40							
Collector Type					Evacuated tubular collector									
Collector name					Power output per collector									
					Gb = 850 W/m ² ; Gd = 150 W/m ² ; u = 3 m/s ϑ _m - ϑ _a									
					0 K	10 K	30 K	50 K	70 K	90 K				
					W	W	W	W	W	W				
SUN5HP					732	724	704	677	644	605				
Power output per m ² gross area					423	418	407	392	373	350				
Performance parameters test method					Quasi dynamic									
Performance parameters (related to AG)					η _{0,b}	c ₁	c ₂	c ₃	c ₄	c ₆	K _d			
Units					-	W/(m ² K)	W/(m ² K ²)	J/(m ³ K)	-	s/m	-			
Test results					0.420	0.392	0.005	0.000	0.000	0.000	1.049			
Incidence angle modifier test method					Quasi dynamic - outdoor									
Bi-directional incidence angle modifiers					Yes									
Incidence angle modifier					Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal					K _{θT, coll}	1.00	1.01	1.02	1.03	1.01	1.01	1.00		0.00
Longitudinal					K _{θL, coll}	1.00	1.00	0.99	0.98	0.97	0.94	0.88		0.00
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A _G)					dm/dt	0.015	kg/(sm ²)							
Maximum temperature difference for thermal performance calculations					(ϑ _m -ϑ _a) _{max}	90	K							
Standard stagnation temperature (G = 1000 W/m ² ; ϑ _a = 30 °C)					ϑ _{stg}	156	°C							
Effective thermal capacity, incl. fluid (per gross area, A _G)					C/m ²	14.03	kJ/(Km ²)							
Maximum operating temperature					ϑ _{max, op}	120	°C							
Maximum operating pressure					p _{max, op}	1000	kPa							
Testing laboratory					TÜV Rheinland Energy GmbH			http://www.tuv.com/solarenergy						
Test report(s)					21210534_SUN5HP			Dated		18.11.2009				
Comments of testing laboratory					Datasheet version: 5.01, 2016-03-01									
*This data sheet is not complete as the testing of the collector was not performed according to ISO 9806:2013. The steady state test evaluation was recalculated with gross area. The former values related to 1.01 m ² aperur area: eta _{0,b} =0.72; c _{1_a} =0.672; c _{2_a} =0008.					 Genau. Richtig. TÜV Rheinland Energy GmbH Am Grauen Stein 51105 Köln									
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Annex to Solar Keymark Certificate Supplementary Information	Licence Number	011-7S999 R
	Issued	2017-02-21

Annual collector output in kWh/collector at mean fluid temperature ϑ_m , based on EN ISO 9806:2013 test results													
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
SUN5HP		1 293	1 197	1 071	1 139	1 027	895	817	725	622	881	785	674
Annual output per m ² gross area		748	692	619	658	594	518	472	419	360	509	454	390
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m ²			1714 kWh/m ²			1166 kWh/m ²			1244 kWh/m ²		
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 ϑ_m (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 5.01 (March 2016). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc													

Additional Information		
Collector heat transfer medium	Water-Glycole	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	-*	--
Maximum tested positive load	-*	Pa
Maximum tested negative load	-*	Pa
Hail resistance using steel ball (maximum drop height)	-*	m

Energy Labelling Information			
	Reference Area, A_{sol} (m ²)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}	
SUN5HP	1.73	Collector efficiency (η_{col})	40 %
		Remark: Collector efficiency (η_{col}) 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/m ² , expressed in % and rounded to the nearest integer. Deviating from the regulation η_{col} is based on reference area (A_{sol}) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.	
		Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}	
		Zero-loss efficiency (η_0)	0.423 --
		First-order coefficient (a_1)	0.39 W/(m ² K)
		Second-order coefficient (a_2)	0.005 W/(m ² K ²)
		Incidence angle modifier IAM (50°)	1.01 --
		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.	