Annex to Solar Keymark Certificate	Licence Number	011-7S2486 P
Supplementary Information	Issued	2019-04-15

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
Hybrid 270/900 Sky	652	15		180			209	1		251	4	
Hybrid 275/900 Sky	652	15		180			209	1		251	4	
Hybrid 280/900 Sky	652	15		180			209	1		251	4	
Hybrid 285/900 Sky	652	15		180			209	1		251	4	
Hybrid 290/900 Sky	652	15		180			209	1		251	4	
Hybrid 295/900 Sky	652	15		180			209	1		251	4	
Hybrid 300/900 Sky	652	15		180			209	1		251	4	
Annual output per m² gross area	397	9		109			127	1		153	2	
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1714 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. 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	Yes	
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)	A	--
Maximum tested positive load	5400	Pa
Maximum tested negative load	2400	Pa
Hail resistance using steel ball (maximum drop height)	35	m

Energy Labelling Information

	Reference Area, A_{sol} (m^2)
Hybrid 270/900 Sky	1.64
Hybrid 275/900 Sky	1.64
Hybrid 280/900 Sky	1.64
Hybrid 285/900 Sky	1.64
Hybrid 290/900 Sky	1.64
Hybrid 295/900 Sky	1.64
Hybrid 300/900 Sky	1.64

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

Collector efficiency (η_{col})	0	%

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/m², 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)	0.504	--
First-order coefficient (a_1)	13.87	W/(m²K)
Second-order coefficient (a_2)	0.000	W/(m²K²)
Incidence angle modifier IAM (50°)	0.95	--

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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Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results	Licence Number	011-7S2486 P
	Date issued	2019-04-15
	Issued by	

Licence holder	3S Solar Plus AG	**Country**	Switzerland
Brand (optional)	–	**Web**	www.3s-solarplus.ch
Street, Number	Schorenstrasse 39	**E-mail**	info@3s-solarplus.ch
Postcode, City	CH-3645 Gwatt	**Tel**	+41 33 224 25 17

Collector Type	Flat plate collector, unglazed

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m²; Gd = 150 W/m²; ϑm - ϑa = 2K u (m/s) 1.0		1.5		3.0	
	m²	mm	mm	mm	W		W		W	
Hybrid 270/900 Sky	**1.64**	991	1'656	32	641		608		507	
Hybrid 275/900 Sky	**1.64**	991	1'656	32	641		608		507	
Hybrid 280/900 Sky	**1.64**	991	1'656	32	641		608		507	
Hybrid 285/900 Sky	**1.64**	991	1'656	32	641		608		507	
Hybrid 290/900 Sky	**1.64**	991	1'656	32	641		608		507	
Hybrid 295/900 Sky	**1.64**	991	1'656	32	641		608		507	
Hybrid 300/900 Sky	**1.64**	991	1'656	32	641		608		507	
Power output per m² gross area					391		370		309	

Performance parameters test method	Steady state - outdoor								
Performance parameters (related to AG)	η0,hem	b1	b2	bu	ε/α				
Units	-	W/(m²K)	Ws/(m³K)	s/m	-				
Test results	0.542	12.68	1.1870	0.071	0.850				

Incidence angle modifier test method	Steady state - outdoor								
Bi-directional incidence angle modifiers	No								
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T,coll}$	1.00	1.00	1.00	0.99	0.95	0.86	0.67	0.37	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	1.00	0.99	0.95	0.86	0.67	0.37	0.00

Heat transfer medium for testing	Water-Glycole		
Flow rate for testing (per gross area, A_G)	dm/dt	0.022	kg/(sm²)
Maximum temperature difference for thermal performance calculations	$(\vartheta_m-\vartheta_a)_{max}$	80	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	66	°C
Effective thermal capacity, incl. fluid (per gross area, A_G)	C/m²	16.3	kJ/(Km²)
Maximum operating temperature	$\vartheta_{max\ op}$	80	°C
Maximum operating pressure	$p_{max,op}$	600	kPa

Testing laboratory	SPF, CH-8640 Rapperswil	www.spf.ch	
Test report(s)	C1649LPEN	**Dated**	24.03.2015
	C1649QPEN		24.03.2015
	C1649add		20.02.2017

Comments of testing laboratory — Datasheet version: 5.01, 2016-03-01

Thermal performance parameters are given for the PV-module working with max. electrical power output ('MPP mode').

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