



Annex to Solar Keymark Certificate					Licence Number		011-7S3120 F							
					Date issued		2022-03-24							
					Issued by		DIN CERTCO							
Licence holder		Savosolar Oyj			Country		Finland							
Brand (optional)		-			Web		https://savosolar.com							
Street, Number		Insinöörinkatu 7			E-mail		info@savosolar.com							
Postcode, City		FI-50150 Mikkeli			Tel		+358 10 271 0810							
Collector Type					Flat plate collector									
Collector name					Power output per collector									
					$G_b = 850 \text{ W/m}^2$ , $G_d = 150 \text{ W/m}^2$ & $u = 1.3 \text{ m/s}$ $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	94 K				
					W	W	W	W	W	W				
SAVO 16S B					15.96	2'489	5'976	165	13'210	12'626	11'429	10'193	8'920	7'341
Power output per m <sup>2</sup> gross area					828	791	716	639	559	460				
Performance parameters test method		Steady state - outdoor												
Performance parameters (related to A <sub>G</sub> )		$\eta_{0, b}$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-			
Test results		0.839	3.63	0.003	0.000	0.00	9'180	0.000	0.00	0.0E+00	0.91			
Incidence angle modifier test method		Steady state - outdoor												
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	0.96	0.90	0.72	0.41	0.00			
Longitudinal		$K_{\theta L, coll}$	1.00	1.00	0.99	0.98	0.95	0.89	0.76	0.51	0.00			
Heat transfer medium for testing		Water-Glycole												
Flow rate for testing (per gross area, A <sub>G</sub> )		dm/dt		0.020	kg/(sm <sup>2</sup> )									
Maximum temperature difference during thermal performance test		$(\vartheta_m - \vartheta_a)_{max}$		64	K									
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30 \text{ °C}$ )		$\vartheta_{stg}$		220	°C									
Maximum operating temperature		$\vartheta_{max, op}$		200	°C									
Maximum operating pressure		$p_{max, op}$		1000	kPa									
Testing laboratory		SPF Testing, CH-8640 Rapperswil, Switzerland					www.spf.ch							
Test report(s)		C1883ISO C1882ISO C1901					Dated		15.02.2022 16.02.2022 10.08.2022					
Comments of testing laboratory		Draft Ver. 6.2 (22.09.2021)												
		 <b>INSTITUT FÜR SOLARTECHNIK</b> 												
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S3120 F</b>
	<b>Issued</b>	<b>2022-03-24</b>

Gross Thermal Yield in kWh/collector at mean fluid temperature $\vartheta_m$													
Collector name	Standard Locations $\vartheta_m$	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
SAVO 16S B		21'318	16'003	11'640	16'619	12'377	8'955	12'115	8'521	5'897	13'152	9'209	6'280
Gross Thermal Yield per m <sup>2</sup> gross area		1'336	1'003	729	1'041	776	561	759	534	369	824	577	393
Annual efficiency, $\eta_a$		76%	57%	41%	64%	48%	34%	65%	46%	32%	66%	46%	32%
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1630 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>		
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  $\vartheta_m$  (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Draft Ver. 6.2 (22.09.2021). A detailed description of the calculations is available at <http://www.estif.org/solarkeymarknew/>

Additional Information			
Collector heat transfer medium	Water-Glycole		
The collector is deemed to be suitable for roof integration	No		
The collector was tested successfully under the following conditions:			
Climate class (A+, A, B or C)	A		--
G (W/m <sup>2</sup> ) >	1000	$\vartheta_a$ (°C) >	20
		$H_x$ (MJ/m <sup>2</sup> ) >	600
Maximum tested positive load	1150		Pa
Maximum tested negative load	1200		Pa
Hail resistance using ice balls (diameter)	45		mm

Additional collector attribute(s)			
Using external power source(s) for normal operation	No	Active or passive measure(s) for self-protection	No
Co-generating thermal and electrical power	No	Façade collector(s)	No

Energy Labelling Information		Additional Informative Technical Data	
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Hydraulic Designation Code	Aperture Area, $A_a$ (m <sup>2</sup> )
SAVO 16S B	15.96	X-H-LRS-A:X-C38.0,2523	14.81

Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
Collector efficiency ( $\eta_{col}$ )	68%	Zero-loss efficiency ( $\eta_0$ )	0.83
Remark: Collector efficiency ( $\eta_{col}$ ) 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 <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.		First-order coefficient ( $a_1$ )	3.63
		Second-order coefficient ( $a_2$ )	0.003
		Incidence angle modifier IAM (50°)	0.96
		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.	