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Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results		Licence Number	011-7S2788 R
		Date issued	2018-01-30
		Issued by	DIN CERTCO

Licence holder	**Avalen Srl**	**Country**	Italy
Brand (optional)		**Web**	
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Collector Type	Evacuated tubular collector

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m²; Gd = 150 W/m²; u = 3 m/s ϑm - ϑa: 0 K	10 K	30 K	50 K	70 K	119 K
	m²	mm	mm	mm	W	W	W	W	W	W
Zefyr 83	8.24	2 040	4 041	122	5 258	5 210	5 079	4 901	4 678	3 936
Power output per m² gross area					638	632	616	595	568	478

Performance parameters test method	Quasi dynamic								
Performance parameters (related to AG)	η0,b	c1	c2	c3	c4	c6	Kd		
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	s/m	-		
Test results	0.640	0.515	0.007	0.000	0.000	0.000	0.980		

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	$K_{\theta T,coll}$	1.00	0.99	0.99	0.99	1.10	1.09	1.15	0.58	0.00
Longitudinal	$K_{\theta L,coll}$	1.00	1.00	0.98	0.95	0.89	0.81	0.65	0.33	0.00

Heat transfer medium for testing	Water		
Flow rate for testing (per gross area, A_G)	dm/dt	0.014	kg/(sm²)
Maximum temperature difference for thermal performance calculations	$(\vartheta_m-\vartheta_a)_{max}$	119	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	317	°C
Effective thermal capacity, incl. fluid (per gross area, A_G)	C/m²	23.44	kJ/(Km²)
Maximum operating temperature	ϑ_{max_op}	-	°C
Maximum operating pressure	$p_{max,op}$	1000	kPa

Testing laboratory	TZS, ITW University Stuttgart	www.itw.uni-stuttgart.de	
Test report(s)	16COL1357	**Dated**	31.07.2017
	16COL1356Q		25.01.2018

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

This data sheet replaces the data sheet issued on 18.09.2017
Documented performance parameters are taken from 17COL1357
The test report 16COL1357Q was substituted by 16COL1356Q
The gross length was corrected from 2,440mm to 2,040mm.
The climate class has changed to climate class A from climate class B

TZS Forschungs- und Testzentrum für Solaranlagen
Institut für Thermodynamik und Wärmetechnik
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Supplementary Information	Issued	2018-01-30

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on 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
Zefyr 83	9 141	8 513	7 662	8 064	7 317	6 423	5 815	5 203	4 503	6 232	5 597	4 848
Annual output per m² gross area	1 109	1 033	930	979	888	779	706	631	546	756	679	588
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	
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)	A	--
Maximum tested positive load	1800	Pa
Maximum tested negative load	1650	Pa
Hail resistance using ice balls (diameter)	25	mm

Energy Labelling Information

	Reference Area, A_{sol} (m^2)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}		
Zefyr 83	8.24	Collector efficiency (η_{col})	61	%
		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)	0.638	--
		First-order coefficient (a_1)	0.52	W/(m²K)
		Second-order coefficient (a_2)	0.007	W/(m²K²)
		Incidence angle modifier IAM (50°)	0.94	--
		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.		