


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results						Licence Number		011-7S2779 R							
						Date issued		2018-01-30							
						Issued by		DIN CERTCO							
Licence holder		Avalen Srl				Country		Italy							
Brand (optional)						Web		-							
Street, Number		Contrada Alano, Via Santa Rosa SN				E-mail		info@avalen.it							
Postcode, City		Cap 84048 – Castellabate (Sa)				Tel		+39 0974354619							
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 ̑m - ̑a									
						Gross area (A _G)	Gross length	Gross width	Gross height	0 K	10 K	30 K	50 K	70 K	108 K
						m ²	mm	mm	mm	W	W	W	W	W	W
Zefyr 24						2.38	2 040	1 166	122	1 525	1 502	1 449	1 389	1 321	1 171
Zefyr 36						3.55	2 040	1 741	122	2 275	2 240	2 161	2 072	1 971	1 747
Zefyr 48						4.72	2 040	2 316	122	3 024	2 978	2 874	2 754	2 620	2 323
Zefyr 59						5.90	2 040	2 891	122	3 780	3 722	3 592	3 443	3 275	2 904
Zefyr 71						7.07	2 040	3 466	122	4 530	4 460	4 304	4 126	3 925	3 480
Power output per m ² gross area						641	631	609	584	555	492				
Performance parameters test method						Quasi dynamic									
Performance parameters (related to AG)						̑ _{0,b}	c1	c2	c3	c4	c6	Kd			
Units						-	W/(m ² K)	W/(m ² K ²)	J/(m ³ K)	-	s/m	-			
Test results						0.637	0.943	0.004	0.000	0.000	0.000	1.039			
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 _{̑T, coll}	1.00	1.00	1.00	1.00	1.10	1.14	1.30	0.65	0.00
Longitudinal						K _{̑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	0.020	kg/(sm ²)							
Maximum temperature difference for thermal performance calculations						(̑ _m -̑ _a) _{max}	108	K							
Standard stagnation temperature (G = 1000 W/m ² ; ̑ _a = 30 °C)						̑ _{stg}	310	°C							
Effective thermal capacity, incl. fluid (per gross area, A _G)						C/m ²	28.61	kJ/(Km ²)							
Maximum operating temperature						̑ _{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)						16COL1355 16COL1356Q				Dated 31.07.2017 25.01.2018					
Comments of testing laboratory						Datashet version: 5.01, 2016-03-01									
<p>This data sheet replaces the data sheet issued on 31.07.2017.</p> <p>Documented performance parameters are taken from 16COL1355 (Zefyr 24).</p> <p>The test report 16COL1357Q was substituted by 16COL1356Q.</p> <p>The gross length was corrected from 2,440mm to 2,040mm.</p> <p>The climate class has changed to climate class A from climate class B.</p>						 TZS Forschungs- und Testzentrum für Solaranlagen <small>Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70560 Stuttgart (Vaihingen)</small>									
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Annex to Solar Keymark Certificate Supplementary Information	Licence Number	011-7S2779 R
	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 Collector name	ϑ_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
Zefyr 24		2 704	2 446	2 167	2 328	2 068	1 803	1 688	1 469	1 257	1 818	1 585	1 357
Zefyr 36		4 033	3 648	3 233	3 473	3 085	2 689	2 518	2 192	1 875	2 711	2 365	2 024
Zefyr 48		5 362	4 851	4 298	4 617	4 102	3 576	3 348	2 914	2 493	3 605	3 144	2 692
Zefyr 59		6 702	6 063	5 372	5 771	5 127	4 469	4 185	3 642	3 116	4 506	3 930	3 365
Zefyr 71		8 031	7 266	6 438	6 916	6 144	5 356	5 015	4 365	3 734	5 400	4 710	4 032
Annual output per m ² gross area		1 136	1 028	911	978	869	758	709	617	528	764	666	570
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	
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 24	2.38	Collector efficiency (η_{col})	60 %
Zefyr 36	3.55	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.	
Zefyr 48	4.72		
Zefyr 59	5.90		
Zefyr 71	7.07		
		Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}	
		Zero-loss efficiency (η_0)	0.641 --
		First-order coefficient (a_1)	0.94 W/(m ² K)
		Second-order coefficient (a_2)	0.004 W/(m ² K ²)
		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.			