


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		011-7S2685 R							
					Date issued		2016-12-22							
					Issued by		DIN CERTCO							
Licence holder	Emmeti S.P.A.				Country	Italien								
Brand (optional)					Web	www.emmeti.com								
Street, Number	Via Brigata Osoppo 166				E-mail	alberto.fauzza@emmeti.com								
Postcode, City	33074 Fontanafredda fr. Vigonovo (PN)				Tel	+39 (0)434567911								
Collector Type					Evacuated tubular collector									
Collector name					Power output per collector Gb = 850 W/m²; Gd = 150 W/m² $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	104 K				
					m²	mm	mm	mm	W	W	W	W	W	W
Arcobaleno VP 12					2.29	1 640	1 397	103	1 287	1 271	1 234	1 189	1 137	1 032
Power output per m² gross area									562	555	539	519	497	451
Performance parameters test method					Steady state - outdoor									
Performance parameters (related to AG)					$\eta_{0,hem}$	a1	a2							
Units					-	W/(m²K)	W/(m²K²)							
Test results					0.562	0.654	0.004							
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					$K_{\theta T, coll}$	1.01	1.01	1.02	1.02	0.98	1.05	1.14	0.57	0.00
Longitudinal					$K_{\theta L, coll}$	1.00	1.00	0.99	0.98	0.95	0.89	0.76	0.38	0.00
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A_G)					dm/dt	0.020	kg/(sm²)							
Maximum temperature difference for thermal performance calculations					$(\vartheta_m - \vartheta_a)_{max}$	104	K							
Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30^\circ\text{C}$)					ϑ_{stg}	301	°C							
Effective thermal capacity, incl. fluid (per gross area, A_G)					C/m²	8.017	kJ/(Km²)							
Maximum operating temperature					$\vartheta_{max, op}$	160	°C							
Maximum operating pressure					p _{max, op}	1000	kPa							
Testing laboratory					TZS, ITW University Stuttgart			www.itw.uni-stuttgart.de						
Test report(s)					14COL1031OEM03 14COL1032QOEM03			Dated		22.12.2016 22.12.2016				
Comments of testing laboratory					Datashet version: 5.01, 2016-03-01									
Data sheet based on results of test report 06COL456 (18.07.2006) 011-7S089 R					 TZS Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70550 Stuttgart (Vaihingen)									
DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de														

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Annual collector output in kWh/collector at mean fluid temperature ϑ_m , based on ISO 9806:2013 test results

Standard Locations	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
Collector name													
Arcobaleno VP 12		2 222	2 040	1 830	1 946	1 754	1 547	1 397	1 235	1 071	1 499	1 329	1 153
Annual output per m ² gross area		970	891	799	850	766	676	610	539	468	654	580	503
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)	A	--
Maximum tested positive load	2250	Pa
Maximum tested negative load	1500	Pa
Hail resistance using ice balls (diameter)	35	mm

Energy Labelling Information

	Reference Area, A_{sol} (m ²)	Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}	
Arcobaleno VP 12	2.29	Collector efficiency (η_{col})	53 %
		<i>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.</i>	
		Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}	
		Zero-loss efficiency (η_0)	0.562 --
		First-order coefficient (a_1)	0.65 W/(m ² K)
		Second-order coefficient (a_2)	0.004 W/(m ² K ²)
		Incidence angle modifier IAM (50°)	1.00 --
		<i>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.</i>	

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Collector Type						Evacuated tubular collector										
Collector name						Power output per collector Gb = 850 W/m ² ; Gd = 150 W/m ² $\vartheta_m - \vartheta_a$										
						Gross area (A _G)	Gross length	Gross width	Gross height	0 K	10 K	30 K	50 K	70 K	104 K	
						m ²	mm	mm	mm	W	W	W	W	W	W	
Arcobaleno VP 18						3.42	1 640	2 087	103	1 932	1 908	1 853	1 786	1 708	1 551	
Power output per m² gross area						565	558	542	522	499	453					
Performance parameters test method						Steady state - outdoor										
Performance parameters (related to AG)						$\eta_{0,hem}$	a1	a2								
Units						-	W/(m ² K)	W/(m ² K ²)								
Test results						0.565	0.657	0.004								
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}	1.01	1.01	1.02	1.02	0.98	1.05	1.14	0.57	0.00	
Longitudinal						K _{θL, coll}	1.00	1.00	0.99	0.98	0.95	0.89	0.76	0.38	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						$(\vartheta_m - \vartheta_a)_{max}$		104		K						
Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30^\circ\text{C}$)						ϑ_{stg}		301		°C						
Effective thermal capacity, incl. fluid (per gross area, A_G)						C/m ²		8.053		kJ/(Km ²)						
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Arcobaleno VP 18		3 337	3 063	2 749	2 922	2 634	2 324	2 097	1 855	1 609	2 250	1 996	1 732
Annual output per m ² gross area		976	896	804	854	770	680	613	542	471	658	584	506
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		
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		First-order coefficient (a_1)	0.66	W/(m ² K)
		Second-order coefficient (a_2)	0.004	W/(m ² K ²)
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