


Annex to Solar Keymark Certificate					Licence Number		011-7S1889 R							
					Date issued		2022-09-28							
					Issued by		DIN CERTCO							
Licence holder		Ritter Energie- und Umwelttechnik GmbH & Co. KG			Country		Germany							
Brand (optional)					Web		http://www.ritter-energie.de							
Street, Number		Kuchenäcker 2			E-mail		t.althaus@ritter-gruppe.com							
Postcode, City		72135 Dettenhausen			Tel		+49 7157 5359 1270							
Collector Type					Evacuated tubular collector									
Collector name					Power output per collector									
					Gb = 850 W/m ² , Gd = 150 W/m ² & u = 1.3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	120 K				
					W	W	W	W	W	W				
					W	W	W	W	W	W				
AQUA PLASMA 15/27					2.67	1 642	1 627	111	1 566	1 552	1 521	1 482	1 438	1 299
AQUA PLASMA 15/40					3.99	1 642	2 432	111	2 340	2 320	2 272	2 215	2 149	1 941
AQUA PLASMA 19/34					3.35	2 058	1 627	111	1 964	1 947	1 908	1 860	1 804	1 629
AQUA PLASMA 19/50					5.01	2 058	2 432	111	2 938	2 913	2 853	2 782	2 698	2 437
SOLAR PLASMA+ 15/27					2.67	1 642	1 627	111	1 566	1 552	1 521	1 482	1 438	1 299
SOLAR PLASMA+ 15/40					3.99	1 642	2 432	111	2 340	2 320	2 272	2 215	2 149	1 941
SOLAR PLASMA+ 19/34					3.35	2 058	1 627	111	1 964	1 947	1 908	1 860	1 804	1 629
SOLAR PLASMA+ 19/50					5.01	2 058	2 432	111	2 938	2 913	2 853	2 782	2 698	2 437
Power output per m² gross area					586	581	569	555	539	486				
Performance parameters test method		Quasi dynamic												
Performance parameters (related to A_G)		$\eta_{0, b}$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	W/(m ² K)	W/(m ² K ²)	J/(m ³ K)	-	J/(m ² K)	s/m	W/(m ² K ⁴)	W/(m ² K ⁴)	-			
Test results		0.576	0.47	0.003	0.000	0.00	13 340	0.000	0.00	0.0E+00	1.12			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K _{θT, coll}	1.01	1.01	1.03	1.04	0.97	1.06	1.13	0.57	0.00			
Longitudinal		K _{θL, coll}	1.00	1.00	0.99	0.97	0.91	0.85	0.70	0.35	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 during thermal performance test					$(\vartheta_m - \vartheta_a)_{max}$		90	K						
Standard stagnation temperature (G = 1000 W/m²; $\vartheta_a = 30$ °C)					ϑ_{stg}		330	°C						
Maximum operating temperature					$\vartheta_{max, op}$		160	°C						
Maximum operating pressure					$p_{max, op}$		1000	kPa						
Testing laboratory		Institut für Gebäudeenergetik, Thermotechnik und Energiespeicherung (IGTE)					http://www.igte.uni-stuttgart.de							
Test report(s)		21COL1623 21COL1624 21COL1624Q					Dated		22.09.2022 22.09.2022 22.09.2022					
Comments of testing laboratory					Ver. 6.2 (13.01.2022)									
Documented performance parameters are taken from 22COL1623 (AQUA PLASMA 15/27)					 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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Supplementary Information							Issued		2022-09-28					
Gross Thermal Yield in kWh/collector at mean fluid temperature ϑ_m														
	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	
AQUA PLASMA 15/27		2 838	2 679	2 492	2 517	2 342	2 147	1 809	1 658	1 500	1 953	1 797	1 627	
AQUA PLASMA 15/40		4 241	4 004	3 724	3 762	3 500	3 209	2 704	2 478	2 241	2 918	2 685	2 431	
AQUA PLASMA 19/34		3 561	3 362	3 127	3 159	2 938	2 694	2 270	2 081	1 882	2 450	2 254	2 041	
AQUA PLASMA 19/50		5 325	5 028	4 676	4 724	4 394	4 029	3 395	3 112	2 815	3 664	3 372	3 052	
SOLAR PLASMA+ 15/27		2 838	2 679	2 492	2 517	2 342	2 147	1 809	1 658	1 500	1 953	1 797	1 627	
SOLAR PLASMA+ 15/40		4 241	4 004	3 724	3 762	3 500	3 209	2 704	2 478	2 241	2 918	2 685	2 431	
SOLAR PLASMA+ 19/34		3 561	3 362	3 127	3 159	2 938	2 694	2 270	2 081	1 882	2 450	2 254	2 041	
SOLAR PLASMA+ 19/50		5 325	5 028	4 676	4 724	4 394	4 029	3 395	3 112	2 815	3 664	3 372	3 052	
Gross Thermal Yield per m ² gross area		1 063	1 004	933	943	877	804	678	621	562	731	673	609	
Annual efficiency, η_a		60%	57%	53%	58%	54%	49%	58%	53%	48%	59%	54%	49%	
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)												
Annual irradiation on collector plane		1765 kWh/m ²			1630 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. 6.2 (13.01.2022). A detailed description of the calculations is available at http://www.estif.org/solarkeymarknew/														
Additional Information														
Collector heat transfer medium											Water			
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 ²) >		1000		ϑ_a (°C) >		20		H_x (MJ/m ²) >			600			
Maximum tested positive load											3000		Pa	
Maximum tested negative load											3000		Pa	
Hail resistance using ice balls (diameter)											35		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 ²)		Hydraulic Designation Code			Aperture Area, A_a (m ²)		
AQUA PLASMA 15/27							2.67		7-V-12S			2.33		
AQUA PLASMA 15/40							3.99		7-V-12S			3.49		
AQUA PLASMA 19/34							3.35		7-V-12S			3.00		
AQUA PLASMA 19/50							5.01		7-V-12S			4.50		
SOLAR PLASMA+ 15/27							2.67		7-V-12S			2.33		
SOLAR PLASMA+ 15/40							3.99		7-V-12S			3.49		
SOLAR PLASMA+ 19/34							3.35		7-V-12S			3.00		
SOLAR PLASMA+ 19/50							5.01		7-V-12S			4.50		
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 (η_{col})							56%		Zero-loss efficiency (η_0)			0.59		--
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 9806:2017.							First-order coefficient (a_1)			0.47		W/(m ² K)		
							Second-order coefficient (a_2)			0.003		W/(m ² K ²)		
							Incidence angle modifier IAM (50°)			1.03		--		
							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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