



Annex to Solar Keymark Certificate					Licence Number		011-7S1219 F																	
					Date issued		2020-09-08																	
					Issued by		DIN CERTCO																	
Licence holder			Ratiotherm GmbH & Co. KG,		Country		Deutschland																	
Brand (optional)					Web		www.ratiotherm.de																	
Street, Number			Wellheimer Str. 34		E-mail		info@ratiotherm.de																	
Postcode, City			91795, Dollnstein		Tel		+49 (0)8422 99770																	
Collector Type					Flat plate collector																			
Collector name					Gross area (A _G)		Gross length		Gross width		Gross height		Power output per collector G _b = 850 W/m ² , G _d = 150 W/m ² & u = 1.3 m/s θ _m - θ _a											
					m ²		mm		mm		mm		0 K		10 K		30 K		50 K		70 K		104 K	
RA 251-4					2,51		1.500		900		50		1.712		1.630		1.453		1.258		1.046		642	
Power output per m ² gross area					682		649		579		501		416		256									
Performance parameters test method			Quasi dynamic																					
Performance parameters (related to A _G)			η _{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			0,690	3,16	0,009	0,000	0,00	8.310	0,000	0,00	0,0E+00	0,92												
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}	1,00	0,99	0,97	0,93	0,88	0,78	0,58	0,00	0,00												
Longitudinal			K _{θL, coll}	1,00	0,99	0,97	0,93	0,88	0,78	0,58	0,00	0,00												
Heat transfer medium for testing					Water																			
Flow rate for testing (per gross area, A _G)					dm/dt	0,018	kg/(sm ²)																	
Maximum temperature difference during thermal performance test					(θ _m - θ _a) _{max}	74	K																	
Standard stagnation temperature (G = 1000 W/m ² ; θ _a = 30 °C)					θ _{stg}	220	°C																	
Maximum operating temperature					θ _{max op}	100	°C																	
Maximum operating pressure					p _{max, op}	1000	kPa																	
Testing laboratory			TestLab Solar Thermal Systems, Fraunhofer ISE					http://www.collectortest.com																
Test report(s)			ktb-2020-03					Dated		08.09.2020														
Comments of testing laboratory					Datasheet version: 6.1, 2019-09-26																			
					TestLab Solar Thermal Systems Heidenhofstraße 3 D-79119 Freiburg Tel: +49 (0)761 4588 5354																			
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Supplementary Information						Issued			2020-09-08				
Annual collector output 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
RA 251-4		2.672	1.916	1.276	2.036	1.424	922	1.492	991	617	1.627	1.070	656
Annual output per m ² gross area		1.064	763	508	811	567	367	594	395	246	648	426	261
Annual efficiency, η_a		60%	43%	29%	50%	35%	23%	51%	34%	21%	52%	34%	21%
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. 6.1 (September 2019). 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 ²) >		1000		ϑ_a (°C) >		20		H _x (MJ/m ²) >		600			
Maximum tested positive load									2400		Pa		
Maximum tested negative load									2400		Pa		
Hail resistance using ice balls (diameter)									25		mm		
Additional collector attribute(s)													
<input type="checkbox"/> Using external power source(s) for normal operation						<input type="checkbox"/> Active or passive measure(s) for self-protection							
<input type="checkbox"/> Co-generating thermal and electrical power						<input type="checkbox"/> Façade collector(s)							
Energy Labelling Information						Additional Informative Technical Data							
				Reference Area, A _{sol} (m ²)		Hydraulic Designation Code			Aperture Area, A _a (m ²)				
RA 251-4				2,51		10-VH-1234S-A:7,1;1850-C:16,4;1093			2,24				
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})				54%		Zero-loss efficiency (η_0)			0,68		--		
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)			3,16		W/(m ² K)		
						Second-order coefficient (a ₂)			0,009		W/(m ² K ²)		
						Incidence angle modifier IAM (50°)			0,87		--		
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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