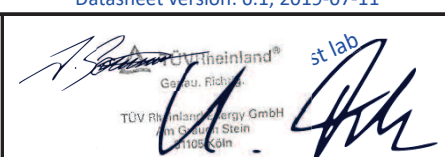


Annex to Solar Keymark Certificate						Licence Number		011-7S2985 P			
						Date issued		2020-09-02			
						Issued by		TÜV Rheinland Energy GmbH			
Licence holder		μZel ZeroEnergyLab GmbH				Country		Germany			
Brand (optional)						Web		www.zeroenergylab.de			
Street, Number		Werner-von-Siemens-Str. 6				E-mail		info@zeroenergylab.de			
Postcode, City		15236 Frankfurt (Oder)				Tel		+49 173 9139497			
Collector Type						WISC (Wind and/or infrared sensitive collector)					
Collector name					Power output per collector						
					Gb = 850 W/m ² , Gd = 150 W/m ² & u = 1.3 m/s ϑ _m - ϑ _a						
		Gross area (A _G)	Gross length	Gross width	Gross height	0 K	10 K	30 K	50 K	70 K	50 K
		m ²	mm	mm	mm	W	W	W	W	W	W
DUO-PANEL GG320Cu		1.35	1 700	998	35	233	107	0	0	--	0
Power output per m ² gross area						172	79	0	0	--	0
Performance parameters test method		Steady state - indoor									
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		0.152	9.30	0.000	0.000	0.16	33 107	0.022	0.00	0.0E+00	1.00
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	1.00	0.99	0.98	0.97	0.94	0.88	0.44	0.00
Longitudinal		K _{θL, coll}	1.00	1.00	0.99	0.98	0.97	0.94	0.88	0.44	0.00
Heat transfer medium for testing						Water					
Flow rate for testing (per gross area, A _G)						dm/dt	0.035	kg/(sm ²)			
Maximum temperature difference during thermal performance test						(ϑ _m -ϑ _a) _{max}	20	K			
Standard stagnation temperature (G = 1000 W/m ² ; ϑ _a = 30 °C)						ϑ _{stg}	60	°C			
Maximum operating temperature						ϑ _{max, op}	n.n.	°C			
Maximum operating pressure						p _{max, op}	800	kPa			
Testing laboratory		TÜV Rheinland Energy GmbH				www.tuv.com/solar					
Test report(s)		21249590.001				Dated		31.08.2020			
Comments of testing laboratory						Datasheet version: 6.1, 2019-07-11					
Thermal performance parameters are given for the PV-module working with max. electrical power output ('MPP mode'). The PV module CS-Wismar GmbH EXELLENT Glass/Glass M60 with 320 Wp (Used range for PVT:320...330Wp) is certified under: ID 1111214084/ TÜV Rheinland. The PVT module was tested according to IEC 61730: 21290588.001 TÜV Rheinland Energy GmbH											
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											

Annex to Solar Keymark Certificate				Licence Number		011-7S2985 P								
Supplementary Information				Issued		2020-09-02								
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	
DUO-PANEL GG320Cu		266	1		37			62			79			
Annual output per m ² gross area		197	0	--	27		--	46		--	59		--	
Annual efficiency, η_a		11%	0%	--	2%		--	4%		--	5%		--	
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 (July 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										1000		Pa		
Maximum tested negative load										2400		Pa		
Hail resistance using ice balls (diameter)										35		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 checked="" 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)					
DUO-PANEL GG320Cu						1.35			1-V-12345-A:11.1,4710-C:16.6,1060			1.70		
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})						Zero-loss efficiency (η_0)								
-20%						0.17								
						First-order coefficient (a_1)								
						9.30								
						Second-order coefficient (a_2)								
						0.000								
						Incidence angle modifier IAM (50°)								
						0.97								
						--								
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.						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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