



Annex to Solar Keymark Certificate					Licence Number		011-7S2347 L							
					Date issued		2024-11-27							
					Issued by		Din Certco							
Licence holder		GRAMMER Solar GmbH			Country		Deutschland							
Brand (optional)					Web		https://grammer-solar.com/de/							
Street, Number		Oskar-von-Miiller Straße 8			E-mail		info @ grammer-solar.de							
Postcode, City		92224, Amberg			Tel		09621-30857-0							
Collector Type					Flat plate collector									
Collector name					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									
					0 K	10 K	30 K	50 K	70 K	118 K				
					m ²	mm	mm	mm	mm	mm	mm			
GLK-M; GLK-E, GLK-F					2,53	2.500	1.013	187	1.764	1.601	1.275	950	624	0
Power output per m ² gross area					697	633	504	375	247	0				
Performance parameters test method		Steady state - outdoor												
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		0,708	6,43	0,000	0,000	0,00	12.800	0,000	0,00	0,0E+00	0,90			
Incidence angle modifier test method		Steady state - 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	0,94	0,87	0,73	0,48	0,00			
Longitudinal		K _{θL, coll}	1,00	1,00	0,99	0,97	0,94	0,87	0,73	0,37	0,00			
Heat transfer medium for testing					Air									
Flow rate for testing (per gross area, A _G)					dm/dt		0,099		kg/(sm ²)					
Maximum temperature difference during thermal performance test					(ϑ _m -ϑ _a) _{max}		88		K					
Standard stagnation temperature (G = 1000 W/m ² ; ϑ _a = 30 °C)					ϑ _{stg}		126		°C					
Maximum operating temperature					ϑ _{max op}		110		°C					
Maximum operating pressure					p _{max,op}		0,4		kPa					
Testing laboratory		TestLab Solar Thermal Systems, Fraunhofer ISE					http://www.collectortest.com							
Test report(s)		KTB 2024-03					Dated		27.11.2024					
Comments of testing laboratory											Ver. 6.2 (13.01.2022)			
Efficiency results for further mass flow rates are given within the mentioned test report														
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Annex to Solar Keymark Certificate Supplementary Information	Licence Number	011-7S2347 L
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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
GLK-M; GLK-E, GLK-F		2.728	1.484	700	1.789	953	419	1.362	670	286	1.498	719	308
Gross Thermal Yield per m ² gross area		1.078	586	277	707	376	166	538	265	113	592	284	122
Annual efficiency, η_a		61%	33%	16%	43%	23%	10%	46%	23%	10%	48%	23%	10%
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			Air
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			5400 Pa
Maximum tested negative load			2000 Pa
Hail resistance using steel ball (maximum drop height)			0,035 m

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)	Yes

Energy Labelling Information		Additional Informative Technical Data	
	Reference Area, A _{sol} (m ²)	Hydraulic Designation Code	Aperture Area, A _a (m ²)
GLK-M; GLK-E, GLK-F	2,53	n.a.	"[Aa]"

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})	44%	Zero-loss efficiency (η_0)	0,70 --
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)	6,43 W/(m ² K)
		Second-order coefficient (a_2)	0,000 W/(m ² K ²)
		Incidence angle modifier IAM (50°)	0,94 --
		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.	