



Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate						Licence Number		0117S-2367 L								
						Issued		2015-05-18								
Company holding the			Grammer Solar GmbH			Country		Deutschland								
Brand (optional)						Website		www.grammer-solar.de								
Street, street number			Oskar von Miller Str. 8			E-mail		r.ettl@grammer-solar.de								
Postal Code / City, province			92224 Amberg			Tel/Fax		+49 (0)9621 30857 13								
Collector Type (flat plate glazed/un-glazed; evacuate tubular)						Flat plate collector - glazed										
Thermal / photo voltaic hybrid collector? (PVT collector)						No										
Integration in the roof possible ? (manufacturers declaration)						No										
						Power output per collector module										
						G = 1000 W/m ²										
						T _m -T _a										
						0 K	10 K	30 K	50 K	70 K						
Collector name						m ²	mm	mm	mm	m ²	W	W	W	W	W	
SLK-M; SLK-F						1,84	2.000	1.006	137	2,01	1.404	1.233	890	547	204	
SLK-E						1,84	2.000	1.006	137	1,61 ⁽³⁾	1.125	987	713	438	164	
SLK-FPV1						1,84	2.000	1.006	137	1,51 ⁽³⁾	1.055	926	669	411	153	
Performance test method						Glazed liquid heating collector - steady state - outdoor										
Performance parameters related to aperture						η ₀	a ₁	a ₂								
Units						-	W/(m ² K)	W/(m ² K ²)								
Test results - Flow rate and fluid see note 1						0,762	9,302	0,000								
Bi-directional incidence angle						No	<i>K_θ values are obligatory for 50°.</i>									
Incidence angle modifiers K _θ (θ)						Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°	
						K _θ (θ)					0,93 ⁽¹⁾				0,00	
Incidence angle modifier not bi-directional - leave fields blank																
Stagnation temperature - Weather conditions see note 2						T _{stg}		140		°C						
Effective thermal capacity						c _{eff} = C/Ag		11		kJ/(m ² K)						
Max. intended operation temperature - see note 3						T _{max,op}		110		°C						
Max. operation pressure - see note 3						p _{max,op}		0,4		kPa						
Pressure drop table - for a collector family, the values shall be for the module with highest ΔP per m² aperture area																
Flow rate			kg/(s m ²)	2												
Pressure drop, ΔP			Pa	2												
Testing Laboratory						TestLab Solar Thermal Systems, Fraunhofer ISE										
Website						www.collectortest.com										
Test report id. number				ktb-2014-06		Date of test report			2014.05.16							
During the test GDIF/GTOT was always between						0,1	and	0,2								
Comments of testing laboratory:																
1 IAM estimated based on the IAM of the glass cover and geometrical calculations of the shadow effect																
2 The pressure drop table is given in the test report ktb-2014-06																
3 In comparison to the collector model SLK-M, used for the efficiency measurement, the collectors SLK-E and SLK-FPV1 differs in construction (for more Information see test report). In order to represent a comparability of the collector behavior, the performance of collector model SLK-E and SLK-FPV1 was calculated with reduced, effective gross collector area (see above).																
												 Solar Thermal Systems 				
Note 1	Flow rate		0,086	kg/(s m ²)	Fluid	Air										
Note 2	Irradiance, G = 1000 W/m ² ; Ambient temperature , T _a =30 °C											Heidenhofstraße 2 D-79110 Freiburg Tel: +49 (0)761 4588 5354				
Note 3	Given by manufacturer											Datasheet version: 4.06, 2014-01-15				
												DIN CERTCO • Alboinstraße 56 • 12103 Berlin Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de				



Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	0117S-2367 L
	Issued	18.05.2015

Annual collector output kWh/module													
Collector name	Location and collector temperature (T _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	
SLK-M; SLK-F	2.115	922	292	1.245	502	127	980	374	93	1.086	402	107	
SLK-E	1.694	739	234	997	402	102	785	299	74	870	322	86	
SLK-FPV1	1.589	693	219	935	377	96	736	281	70	816	302	80	

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)
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Overview of locations				
Location	Latitude °	G _{tot} kWh/m ²	T _a °C	Collector orientation or tracking mode
Athens	38	1.765	18,5	South, 25°
Davos	47	1.714	3,2	South, 30°
Stockholm	59	1.166	7,5	South, 45°
Würzburg	50	1.244	9,0	South, 35°

G _{tot}	Annual total irradiation on collector plane	kWh/m ²
T _a	Mean annual ambient air temperature	°C
T _m	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool ScenoCalc. The collector output is calculated hour by hour according to the efficiency parameters from the Keymark test using constant collector operating temperature (T_m). A detailed description of the calculations is available at <http://www.sp.se/en/index/services/solar/ScenoCalc/Sidor/default.aspx>.

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	ScenoCalc version: Ver. 4.06 (Jan, 2014)