TÜVRheinland®
DIN CERTCO

Fraunhofer ISE

Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	0117S-2347 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 hybid collector? (PVT collector)	No
Integration in the roof possible ? (manufacturers declaration)	No

Collector name	Aperture area (Aa)	Gross length	Gross width	Gross height	Gross area (AG)	Power output per collector module G = 1000 W/m² Tm-Ta 0 K	10 K	30 K	50 K	70 K
	m²	mm	mm	mm	**m²**	W	W	W	W	W
GLK-M; GLK-F	2,33	2.500	1.003	175	**2,51**	1.853	1.631	1.187	743	300
GLK-E	2,33	2.500	1.003	175	2,01 (3)	1.484	1.306	851	595	240

Performance test method	Glazed liquid heating collector - steady state - outdoor		
Performance parameters related to aperture	η0	a1	a2
Units	-	W/(m²K)	W/(m²K²)
Test results - Flow rate and fluid see note 1	0,794	9,508	0,000

Bi-directional incidence angle modifiers?	No	*Kϑ values are obligatory for 50°.*								
Incidence angle modifiers Kθ(θ)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
	Kθ(θ)					0,94 (1)				0,00
Incidence angle modifier not bi-directional - leave fields blank										

Stagnation temperature - Weather conditions see note 2	Tstg	140	°C
Effective thermal capacity	ceff = C/Ag	12,3	kJ/(m²K)
Max. intended operation temperature - see note 3	Tmax,op	110	°C
Max. operation pressure - see note 3	pmax,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 m²)	2									
Pressure drop, ΔP	Pa	2									

Testing Laboratory	TestLab Solar Thermal Systems, Fraunhofer ISE		
Website	www.collectortest.com		
Test report id. number	ktb-2014-05-a	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-2014-05-a
3 In comparison to the collector model GLK-M, used for the efficiency measurement, the collector model GLK-E is constructed with a round connector on one side. This leads to changes in the flow distribution within the the collector
GLK-E. In order to represent a comparability of the collector behavior, the following given perfomance of collector model GLK-E was calculated with a reduced, effective gross collector area.

Note 1	**Flow rate**	0,086	kg/(s m²)	**Fluid**	Air
Note 2	**Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C**				
Note 3	**Given by manufacturer**				

TestLab
Solar Thermal Systems
Heidenhofstraße 2
D-79110 Freiburg
Tel: +49 (0)761 4588 5354

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	0117S-2347 L
	Issued	18.05.2015

Annual collector output kWh/module

Collector name	Location and collector temperature (Tm)											
	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
GLK-M; GLK-F	2.820	1.258	414	1.675	693	185	1.316	513	134	1.459	552	154
GLK-E	2.258	1.007	331	1.341	555	148	1.054	411	107	1.168	442	123

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)

Overview of locations

Location	Latitude °	Gtot kWh/m²	Ta °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°

Gtot	Annual total irradiation on collector plane	kWh/m²
Ta	Mean annual ambient air temperature	°C
Tm	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 (Tm). A detailed description of the calculations is available at http://www.sp.se/en/index/services/solar/ScenoCalc/Sidor/default.aspx.

DIN CERTCO • Alboinstraße 56 • 12103 Berlin
Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de •
www.dincertco.de

Datasheet version: 4.06, 2014-01-15

ScenoCalc version: Ver. 4.06 (Jan, 2014)