Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate				Licence Number	011-7S089 R
				Issued	2015-11-30

Company holding the	Ritter Energie- und Umwelttechnik GmbH & Co. KG		Country	Deutschland	
Brand (optional)			Website	www.ritter-gruppe.com	
Street, street number	Kuchenäcker 2		E-mail	info@ritter-gruppe.com	
Postal Code / City, province	D-72135	Dettenhausen	Tel/Fax	49	(0)7157 5359 -1200 / -1209

Collector Type (flat plate glazed/un-glazed; evacuate tubular)	Evacuated tubular collector
Thermal / photo voltaic hybid collector? (PVT collector)	No
Integration in the roof possible ? (manufacturers declaration)	No

	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
Collector name	m²	mm	mm	mm	m²	W	W	W	W	W
Star 15/26	2.33	1 616	1 627	122	**2.63**	1 501	1 482	1 438	1 384	1 321
Star 15/39	3.49	1 616	2 432	122	**3.93**	2 248	2 220	2 153	2 073	1 979
Star 19/33	3.00	2 033	1 627	122	**3.31**	1 932	1 908	1 851	1 782	1 701
Star 19/49	4.50	2 033	2 432	122	**4.94**	2 898	2 862	2 777	2 673	2 552

Performance test method	Glazed liquid heating collector - steady state - outdoor			
Performance parameters related to aperture area	η0	a1	a2	
Units	-	W/(m²K)	W/(m²K²)	
Test results - Flow rate and fluid see note 1	0.644	0.749	0.005	

Bi-directional incidence angle modifiers?	Yes	*Kθ values are obligatory for 50°.*									
Incidence angle modifiers Kθ(θT) transversal direction	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°	
	Kθ(θT)	1.01	1.01	1.02	1.02	0.98	1.05	1.14	0.57	0.00	
Incidence angle modifiers Kθ(θL) longitudinal direction	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°	
	Kθ(θL)	1.00	1.00	0.99	0.98	0.95	0.89	0.76	0.38	0.00	

Stagnation temperature - Weather conditions see note 2	Tstg	301	°C
Effective thermal capacity	ceff = C/Ag	9.18	kJ/(m²K)
Max. intende operation temperature - see note 3	Tmax,op	160	°C
Max. operation pressure - see note 3	pmax,op	1000	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)	-	-	-	-	-	-	-	-	-	-	-
Pressure drop, ΔP	Pa	-	-	-	-	-	-	-	-	-	-	-

Optional weather data	Location		Link	
Testing Laboratory	TZS, ITW Unsiversity of Stuttgart			
Website	www.itw.uni-stuttgart.de/institut/abteilungen/tzs/			
Test report id. number	14COL1031, 14COL1032Q	Date of test report	2015.11.30	
During the test GDIF/GTOT was always between	0	and	1	

Comments of testing laboratory:

No comment.

Note 1	Flow rate	0.020	kg/(s m²)	Fluid	Water
Note 2	Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C				
Note 3	Given by manufacturer				

Datasheet version: 4.06, 2014-01-15

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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S089 R
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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
Star 15/26	2 589	2 374	2 123	2 266	2 037	1 789	1 626	1 435	1 239	1 746	1 544	1 333
Star 15/39	3 879	3 556	3 180	3 394	3 051	2 680	2 436	2 150	1 855	2 615	2 313	1 997
Star 19/33	3 334	3 057	2 733	2 918	2 623	2 304	2 094	1 848	1 595	2 248	1 988	1 717
Star 19/49	5 001	4 585	4 100	4 377	3 934	3 456	3 141	2 772	2 392	3 372	2 982	2 575

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.

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ScenoCalc version: Ver. 4.06 (Jan, 2014)