



<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>						<b>Certificate No.</b>		<b>011-7S089 R</b>			
						Date of issue		25.06.2014			
<b>Company</b>			Ritter Energie- und Umwelttechnik GmbH & Co. KG			<b>Country</b>		Deutschland			
<b>Brand (optional)</b>						<b>Website</b>		<a href="http://www.ritter-gruppe.com">www.ritter-gruppe.com</a>			
<b>Street, number</b>			Kuchenäcker 2			<b>E-mail</b>		<a href="mailto:J.Budde@ritter-gruppe.com">J.Budde@ritter-gruppe.com</a>			
<b>Postal Code</b>			72135			<b>Tel.</b>		+49 715 753 591 266			
<b>City</b>			Dettenhausen			<b>Fax</b>		+49 715 753 591 269			
<b>Collector Type (flat plate / evacuate tubular / un-glazed)</b>						Evacuated tubular collector					
<b>Integration in the roof possible ?</b>						No					
						<b>Power output per collector unit</b> G = 1000 W/m <sup>2</sup> Tm-Ta :					
						0 K    10 K    30 K    50 K    70 K					
						[W]    [W]    [W]    [W]    [W]					
<b>Collector name</b>	<b>Aperture area (Aa)</b>	<b>Gross length</b>	<b>Gross width</b>	<b>Gross height</b>	<b>Gross area (Ag)</b>						
	[m <sup>2</sup> ]	[mm]	[mm]	[mm]	[m <sup>2</sup> ]						
CPC 14 Star azzurro	2.33	1 616	1 622	120	2.62	1 501	1 482	1 438	1 384	1 321	
CPC 21 Star azzurro	3.47	1 616	2 427	120	3.92	2 235	2 207	2 141	2 061	1 968	
CPC 30 Star azzurro*	3.00	2 033	1 622	120	3.30	1 932	1 908	1 851	1 782	1 701	
CPC 45 Star azzurro*	4.50	2 033	2 427	120	4.93	2 898	2 862	2 777	2 673	2 552	
CPC 14 INOX RP *	2.33	1 616	1 622	120	2.62	1 501	1 482	1 438	1 384	1 321	
CPC 21 INOX RP*	3.47	1 616	2 427	120	3.92	2 235	2 207	2 141	2 061	1 968	
CPC 14 INOX mono*	2.33	1 616	1 622	120	2.62	1 501	1 482	1 438	1 384	1 321	
CPC 21 INOX mono*	3.47	1 616	2 427	120	3.92	2 235	2 207	2 141	2 061	1 968	
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 *	3.47	1 616	2 432	122	3.93	2 235	2 207	2 141	2 061	1 968	
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	
<b>Collector efficiency parameters related to aperture area (Aa)</b>						$\eta_{0a}$		0.644		-	
Type of fluid and flow rate see note 1						$a_{1a}$		0.749		W/(m <sup>2</sup> K)	
						$a_{2a}$		0.005		W/(m <sup>2</sup> K <sup>2</sup> )	
<b>Stagnation temperature - Weather conditions see note 2</b>						t <sub>stg</sub>		301		°C	
<b>Effective thermal capacity</b>						C <sub>eff</sub> = C/A <sub>a</sub>		9.18		kJ/(m <sup>2</sup> K)	
<b>Max. operation pressure - see note 3</b>						p <sub>max</sub>		1000		kPa	
<b>Incidence angle modifiers K<sub>θ</sub>(θ)</b>						G <sub>DIF</sub> /G <sub>TOT</sub>		θ <sub>T</sub> / θ <sub>L</sub>		50°	
						min    max		K <sub>θ</sub> (θ <sub>T</sub> )		0.98	
						-		K <sub>θ</sub> (θ <sub>L</sub> )		0.95	
G <sub>DIF</sub> /G <sub>TOT</sub> : min&max - while measuring						<b>Optional values</b>					
<b>Testing Laboratory</b>						TZS, ITW University of Stuttgart					
<b>Website</b>						<a href="http://www.tzs.uni-stuttgart.de">www.tzs.uni-stuttgart.de</a>					
<b>Test report id. number</b>						06COL456/6					
<b>Date of test report</b>						25.06.2014					
<b>Perf. test method</b>						EN 12975-2 6.1.4 (outdoor)					
<b>Comments of testing laboratory :</b>											
* dimensions according to manufacturer											
Note 1	<b>Fluid</b>	Water		<b>Flow rate</b>	0.017		kg/s per m <sup>2</sup>				
Note 2	<b>Irradiance, G<sub>s</sub>=1000 W/m<sup>2</sup></b>										
Note 2	<b>Ambient temperature , Ta=30 °C</b>										
Note 3	<b>Given by manufacturer</b>										

**Annual collector output based on EN 12975 Test Results,  
annex to Solar KEYMARK Certificate**
**Certificate No.**
**011-7S089 R**

Issued

25.06.2014

**Annual collector output kWh**
**Location and collector temperature (T<sub>m</sub>)**

Collector name	Location and collector temperature (T <sub>m</sub> )											
	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
CPC 14 Star azzurro	2 591	2 375	2 124	2 408	2 182	1 929	1 628	1 436	1 240	1 747	1 545	1 334
CPC 21 Star azzurro	3 859	3 537	3 163	3 586	3 250	2 873	2 425	2 139	1 847	2 602	2 301	1 987
CPC 30 Star azzurro*	3 336	3 058	2 735	3 100	2 809	2 484	2 096	1 849	1 597	2 249	1 989	1 718
CPC 45 Star azzurro*	5 004	4 587	4 102	4 651	4 214	3 726	3 144	2 773	2 395	3 374	2 984	2 576
CPC 14 INOX RP *	2 591	2 375	2 124	2 408	2 182	1 929	1 628	1 436	1 240	1 747	1 545	1 334
CPC 21 INOX RP*	3 859	3 537	3 163	3 586	3 250	2 873	2 425	2 139	1 847	2 602	2 301	1 987
CPC 14 INOX mono*	2 591	2 375	2 124	2 408	2 182	1 929	1 628	1 436	1 240	1 747	1 545	1 334
CPC 21 INOX mono*	3 859	3 537	3 163	3 586	3 250	2 873	2 425	2 139	1 847	2 602	2 301	1 987
STAR 15/26 *	2 591	2 375	2 124	2 408	2 182	1 929	1 628	1 436	1 240	1 747	1 545	1 334
STAR 15/39 *	3 859	3 537	3 163	3 586	3 250	2 873	2 425	2 139	1 847	2 602	2 301	1 987
STAR 19/33 *	3 336	3 058	2 735	3 100	2 809	2 484	2 096	1 849	1 597	2 249	1 989	1 718
STAR 19/49 *	5 004	4 587	4 102	4 651	4 214	3 726	3 144	2 773	2 395	3 374	2 984	2 576

**Collector mounting: Fixed or tracking**

Fixed; slope = latitude - 15° (rounded to nearest 5°)

**Overview of locations**

Location	Latitude °	Gtot kWh/m <sup>2</sup>	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/m <sup>2</sup>
Ta	Mean annual ambient air temperature	°C
Tm	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

Calculation of the annual collector performance is done by the official Solar Keymark spreadsheet tool. Hour by hour the collector output is calculated according to the efficiency parameters from the Keymark test using constant collector operating temperature (T<sub>m</sub>). Detailed description with all equations used is available from the Solar Keymark web site (direct link: <http://www.estif.org/solarkeymark/annexb1.php>)

**DIN CERTCO • Alboinstraße 56 • 12103 Berlin**

 Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: [info@dincertco.de](mailto:info@dincertco.de) • [www.dincertco.de](http://www.dincertco.de)

Datasheet version:

VERSION 3.6, 2012.01.13

Calculation program version:

3.07, October 2011 (SP)