

**Holder/Issued to/Manufacturer**

## Spectrum Solar

Kupferstrasse 1, 49843 Uelsen, Germany

**Product name and description**

Vacuum tube solar thermal collectors for water heating.  
For technical information see Appendix (2 pages).

Models:	Spectrum CPC 8	Spectrum CPC 9	Spectrum CPC 10	Spectrum CPC 12
	Spectrum CPC 14	Spectrum CPC 15	Spectrum CPC 16	Spectrum CPC 18
	Spectrum CPC 20	Spectrum CPC 21	Spectrum CPC 22	Spectrum CPC 24

**Performance specification**

The product is found to comply with the requirements in EN 12975-1:2006+A1:2010 Solar collectors, Part 1: General requirements and the Specific CEN Keymark Scheme Rules for Solar Thermal Products and are based on test results according to EN 12975-2:2006 Solar collectors Part 2: Test methods.

**Marking**

Products conforming to this certificate shall be marked in accordance with the requirements in the Specific CEN Keymark Scheme Rules for Solar Thermal Products. The marking shall, together with the Keymark logo, show the identification code of the empowered certification body (RISE Research Institutes of Sweden AB, No. 012), also see CEN-CENELEC Internal Regulations Part 4 Certification, Annex A.

**Validity**

This certificate is valid until 2024-01-20 provided that the conditions in the Solar Keymark Rules are fulfilled and the standard or rules are not modified significantly. The validity of the certificate can be checked in the database, see Solar Keymark website <http://www.solarkeymark.org>.

**Miscellaneous**

The manufacturer's factory production control procedures are under surveillance by the responsibility of RISE. This certificate was first issued 2016-06-29. RISE certification rules SPCR 402 for Keymark – Solar Thermal Products applies.



Johan Åkesson



Magnus Sturesson

Certificate No. SC0471-16 | issue 2 | 2019-04-03


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2017-08-08



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<b>Annex to Solar Keymark Certificate</b>						<b>Licence Number</b>		<b>SC0471-16</b>																																				
						<b>Date issued</b>		<b>2019-04-03</b>																																				
						<b>Issued by</b>		<b>RISE</b>																																				
<b>Licence holder</b>		Spectrum Solar				<b>Country</b>		Germany																																				
<b>Brand (optional)</b>		Spectrum Solar				<b>Web</b>		www.spectrumsolar.de																																				
<b>Street, Number</b>		Kupferstasse 1				<b>E-mail</b>		info@spectrumsolar.de																																				
<b>Postcode, City</b>		49843 Uelsen				<b>Tel</b>		+49 5942 9899888																																				
<b>Collector Type</b>						Evacuated tubular collector																																						
<b>Collector name</b>						<b>Power output per collector</b> G <sub>b</sub> = 850 W/m <sup>2</sup> , G <sub>d</sub> = 150 W/m <sup>2</sup> & u = 1.3 m/s $\vartheta_m - \vartheta_a$																																						
						Gross height		Gross area (A <sub>G</sub> )		Gross length		Gross width		Aperture area (A <sub>a</sub> )		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>0 K</td> <td>10 K</td> <td>30 K</td> <td>50 K</td> <td>70 K</td> <td>93 K</td> </tr> <tr> <td>W</td> <td>W</td> <td>W</td> <td>W</td> <td>W</td> <td>W</td> </tr> </table>		0 K	10 K	30 K	50 K	70 K	93 K	W	W	W	W	W	W															
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W	W	W	W	W	W																																							
mm		m <sup>2</sup>		mm		mm		m <sup>2</sup>																																				
Spectrum CPC 8		133		1,74		1 917		910		1,41																																		
Spectrum CPC 9		133		1,96		1 917		1 020		1,59																																		
Spectrum CPC 10		133		2,17		1 917		1 130		1,78																																		
Spectrum CPC 12		133		2,59		1 917		1 350		2,16																																		
Spectrum CPC 14		133		3,01		1 917		1 570		2,53																																		
Spectrum CPC 15		133		3,22		1 917		1 680		2,72																																		
Spectrum CPC 16		133		3,43		1 917		1 790		2,91																																		
Spectrum CPC 18		133		3,85		1 917		2 010		3,28																																		
Spectrum CPC 20		133		4,28		1 917		2 230		3,66																																		
Spectrum CPC 21		133		4,49		1 917		2 340		3,84																																		
Spectrum CPC 22		133		4,70		1 917		2 450		4,03																																		
Spectrum CPC 24		133		5,12		1 917		2 670		4,41																																		
<b>Power output per m<sup>2</sup> gross area</b>						538		526		498																																		
<b>Performance parameters test method</b>		Steady state - outdoor																																										
<b>Performance parameters (related to A<sub>G</sub>)</b>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>η<sub>0, b</sub></td> <td>a1</td> <td>a2</td> <td>a3</td> <td>a4</td> <td>a5</td> <td>a6</td> <td>a7</td> <td>a8</td> <td colspan="2">Kd</td> </tr> <tr> <td>-</td> <td>W/(m<sup>2</sup>K)</td> <td>W/(m<sup>2</sup>K<sup>2</sup>)</td> <td>J/(m<sup>3</sup>K)</td> <td>-</td> <td>J/(m<sup>2</sup>K)</td> <td>s/m</td> <td>W/(m<sup>2</sup>K<sup>4</sup>)</td> <td>W/(m<sup>2</sup>K<sup>4</sup>)</td> <td colspan="2">-</td> </tr> <tr> <td>Test results</td> <td>0,540</td> <td>1,21</td> <td>0,004</td> <td>0,000</td> <td>0,000</td> <td>0,000</td> <td>0,000</td> <td>0,000</td> <td>0,000</td> <td>0,98</td> </tr> </table>										η <sub>0, b</sub>	a1	a2	a3	a4	a5	a6	a7	a8	Kd		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-		Test results	0,540	1,21	0,004	0,000	0,000	0,000	0,000	0,000	0,000	0,98
η <sub>0, b</sub>	a1	a2	a3	a4	a5	a6	a7	a8	Kd																																			
-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-																																			
Test results	0,540	1,21	0,004	0,000	0,000	0,000	0,000	0,000	0,000	0,98																																		
<b>Incidence angle modifier test method</b>		Steady state - outdoor																																										
<b>Incidence angle modifier</b>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Angle</td> <td>10°</td> <td>20°</td> <td>30°</td> <td>40°</td> <td>50°</td> <td>60°</td> <td>70°</td> <td>80°</td> <td>90°</td> </tr> <tr> <td>Transversal</td> <td>K<sub>θT, coll</sub></td> <td>1,02</td> <td>1,03</td> <td>1,04</td> <td>1,05</td> <td>1,12</td> <td>1,18</td> <td>0,79</td> <td>0,39</td> <td>0,00</td> </tr> <tr> <td>Longitudinal</td> <td>K<sub>θL, coll</sub></td> <td>1,00</td> <td>0,99</td> <td>0,99</td> <td>0,97</td> <td>0,95</td> <td>0,91</td> <td>0,83</td> <td>0,57</td> <td>0,00</td> </tr> </table>										Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°	Transversal	K <sub>θT, coll</sub>	1,02	1,03	1,04	1,05	1,12	1,18	0,79	0,39	0,00	Longitudinal	K <sub>θL, coll</sub>	1,00	0,99	0,99	0,97	0,95	0,91	0,83	0,57	0,00	
Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°																																			
Transversal	K <sub>θT, coll</sub>	1,02	1,03	1,04	1,05	1,12	1,18	0,79	0,39	0,00																																		
Longitudinal	K <sub>θL, coll</sub>	1,00	0,99	0,99	0,97	0,95	0,91	0,83	0,57	0,00																																		
<b>Heat transfer medium for testing</b>						Water-Glycole																																						
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>						dm/dt		0,016		kg/(sm <sup>2</sup> )																																		
<b>Maximum temperature difference during thermal performance test</b>						(ϑ <sub>m</sub> -ϑ <sub>a</sub> ) <sub>max</sub>		63,24		K																																		
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; ϑ<sub>a</sub> = 30 °C)</b>						ϑ <sub>stg</sub>		280		°C																																		
<b>Maximum operating temperature</b>						ϑ <sub>max, op</sub>		120		°C																																		
<b>Maximum operating pressure</b>						p <sub>max, op</sub>		1000		kPa																																		
<b>Testing laboratory</b>		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch				http://www.intertek.com																																						
<b>Test report(s)</b>		131016040GZU-001				<b>Dated</b>		2014.01.07																																				
<b>Comments of testing laboratory</b>						Datasheet version: 6.0, 2018-10-30																																						
The "negative pressure test of the collector" according to EN12975-2:2006, 5.9.2 was not performed.						 <i>William Zheng</i>																																						
Tests were performed based on EN 12975-2:2006.																																												
<b>RISE Research Institutes of Sweden AB   Certification</b> <b>Box 857, SE-501 15 Borås, Sweden, Phone: +46 10-516 50 00, certifiering@ri.se   www.ri.se</b>																																												

<b>Annex to Solar Keymark Certificate</b>		<b>Licence Number</b>		<b>SC0471-16</b>												
<b>Supplementary Information</b>		<b>Issued</b>		<b>2019-04-03</b>												
<b>Annual collector output in kWh/collector at mean fluid temperature <math>\vartheta_m</math></b>																
<b>Collector name</b>	<b>Standard Locations</b>	<b>Athens</b>			<b>Davos</b>			<b>Stockholm</b>			<b>Würzburg</b>					
	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C			
Spectrum CPC 8		1 633	1 406	1 180	1 374	1 161	961	991	813	654	1 069	878	704			
Spectrum CPC 9		1 830	1 576	1 322	1 541	1 302	1 077	1 111	912	733	1 198	984	789			
Spectrum CPC 10		2 028	1 746	1 465	1 707	1 442	1 194	1 230	1 010	812	1 327	1 091	874			
Spectrum CPC 12		2 423	2 086	1 750	2 039	1 723	1 426	1 470	1 207	970	1 586	1 303	1 044			
Spectrum CPC 14		2 818	2 426	2 036	2 372	2 004	1 659	1 710	1 404	1 129	1 844	1 516	1 215			
Spectrum CPC 15		3 015	2 596	2 179	2 538	2 145	1 775	1 830	1 502	1 208	1 974	1 622	1 300			
Spectrum CPC 16		3 212	2 766	2 321	2 704	2 285	1 891	1 949	1 600	1 286	2 102	1 728	1 384			
Spectrum CPC 18		3 607	3 106	2 606	3 036	2 566	2 123	2 189	1 797	1 445	2 361	1 940	1 555			
Spectrum CPC 20		4 002	3 446	2 891	3 369	2 847	2 356	2 428	1 994	1 603	2 619	2 153	1 725			
Spectrum CPC 21		4 200	3 616	3 034	3 535	2 987	2 472	2 548	2 092	1 682	2 749	2 259	1 810			
Spectrum CPC 22		4 397	3 786	3 177	3 701	3 127	2 589	2 668	2 191	1 761	2 878	2 365	1 895			
Spectrum CPC 24		4 791	4 125	3 462	4 033	3 408	2 821	2 907	2 387	1 919	3 136	2 577	2 065			
Annual output per m <sup>2</sup> gross area		936	806	676	788	666	551	568	466	375	613	504	404			
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)															
Annual irradiation on collector plane	1765 kWh/m <sup>2</sup>			1714 kWh/m <sup>2</sup>			1166 kWh/m <sup>2</sup>			1244 kWh/m <sup>2</sup>						
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 $\vartheta_m$ (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 6.0 (October 2018). A detailed description of the calculations is available at <a href="http://www.solarkeymark.org/scenocalc">www.solarkeymark.org/scenocalc</a>																
<b>Additional Information</b>																
Collector heat transfer medium	Water-Glycole															
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)	C															
G (W/m <sup>2</sup> ) >	800			$\vartheta_a$ (°C) >			10			H <sub>x</sub> (MJ/m <sup>2</sup> ) >			420			
Maximum tested positive load												2860		Pa		
Maximum tested negative load												--		Pa		
Hail resistance using steel ball (maximum drop height)												0,8		m		
<b>Additional collector attribute(s)</b>																
<input type="checkbox"/> Using external power source(s) for normal operation <input type="checkbox"/> Active or passive measure(s) for self-protection <input type="checkbox"/> Co-generating thermal and electrical power <input type="checkbox"/> Wind and/or infrared sensitive collector(s) (WISC) <input type="checkbox"/> Façade collector(s)																
<b>Energy Labelling Information</b>																
	Reference Area, A <sub>sol</sub> (m <sup>2</sup> )	Hydraulic Designation Code														
Spectrum CPC 8	1,74	1-H-12S-C:19.3,985-D														
Spectrum CPC 9	1,96	1-H-12S-C:19.3,1095-D														
Spectrum CPC 10	2,17	1-H-12S-C:19.3,1205-D														
Spectrum CPC 12	2,59	1-H-12S-C:19.3,1425-D														
Spectrum CPC 14	3,01	1-H-12S-C:19.3,1645-D														
Spectrum CPC 15	3,22	1-H-12S-C:19.3,1755-D														
Spectrum CPC 16	3,43	1-H-12S-C:19.3,1865-D														
Spectrum CPC 18	3,85	1-H-12S-C:19.3,2085-D														
Spectrum CPC 20	4,28	1-H-12S-C:19.3,2305-D														
Spectrum CPC 21	4,49	1-H-12S-C:19.3,2415-D														
Spectrum CPC 22	4,70	1-H-12S-C:19.3,2525-D														
Spectrum CPC 24	5,12	1-H-12S-C:19.3,2745-D														
<b>Data required for CDR (EU) No 811/2013 - Reference Area A<sub>sol</sub></b>		<b>Data required for CDR (EU) No 812/2013 - Reference Area A<sub>sol</sub></b>														
Collector efficiency ( $\eta_{col}$ )	48%											Zero-loss efficiency ( $\eta_0$ )		0,54	--	
Remark: Collector efficiency ( $\eta_{col}$ ) 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 <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area (A <sub>sol</sub> ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2017.													First-order coefficient (a <sub>1</sub> )		1,21	W/(m <sup>2</sup> K)
													Second-order coefficient (a <sub>2</sub> )		0,004	W/(m <sup>2</sup> K <sup>2</sup> )
													Incidence angle modifier IAM (50°)		1,01	--
Remark: The data given in this section are related to collector reference area (A <sub>sol</sub> ) 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.																
<b>RISE Research Institutes of Sweden AB   Certification</b> Box 857, SE-501 15 Borås, Sweden, Phone: +46 10-516 50 00, <a href="mailto:certifying@ri.se">certifying@ri.se</a>   <a href="http://www.ri.se">www.ri.se</a>																