

<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>	<b>Certificate No.</b>	<b>011-752061 F</b>
	Date of issue	22-11-2012

<b>Company</b>	Winkler Solar GmbH	<b>Country</b>	Austria
<b>Brand (optional)</b>	Winkler	<b>Website</b>	www.winklersolar.com
<b>Street, number</b>	Räterweg 17	<b>E-mail</b>	solar@winklersolar.com
<b>Postal Code</b>	6800	<b>Tel.</b>	+43 (0)5522 76139
<b>City</b>	Feldkirch	<b>Fax</b>	+43 (0)5522 76121

<b>Collector Type</b> (flat plate / evacuate tubular / un-glazed)	Flat plate collector
---	----------------------

<b>Integration in the roof possible ?</b>	Yes
---	-----

Collector name	Aperture area (A <sub>a</sub> ) [m <sup>2</sup> ]	Gross length [mm]	Gross width [mm]	Gross height [mm]	Gross area (A <sub>G</sub> ) [m <sup>2</sup> ]	Power output per collector unit G = 1000 W/m <sup>2</sup> T <sub>m</sub> -T <sub>a</sub> :				
						0 K	10 K	30 K	50 K	70 K
						[W]	[W]	[W]	[W]	[W]
VarioSol A-antireflex 6x1.0	5,31	1.010	6.000	133	6,06	3.800	3.626	3.237	2.792	2.293
VarioSol A-antireflex 7x1.0	6,19	1.010	6.990	133	7,06	4.433	4.230	3.776	3.257	2.675
VarioSol A-antireflex 8x1.0	7,08	1.010	7.980	133	8,06	5.067	4.835	4.316	3.723	3.057
VarioSol A-antireflex 6x1.25	6,73	1.260	6.000	133	7,56	4.819	4.598	4.104	3.540	2.907
VarioSol A-antireflex 7x1.25	7,85	1.260	6.990	133	8,81	5.621	5.364	4.788	4.130	3.391
VarioSol A-antireflex 8x1.25	8,97	1.260	7.980	133	10,05	6.425	6.130	5.472	4.721	3.876
VarioSol A-antireflex 6x1.5	8,15	1.510	6.000	133	9,06	5.837	5.570	4.971	4.289	3.521
VarioSol A-antireflex 7x1.5	9,51	1.510	6.990	133	10,55	6.809	6.497	5.800	5.003	4.108
VarioSol A-antireflex 8x1.5	10,87	1.510	7.980	133	12,05	7.783	7.426	6.628	5.718	4.695
VarioSol A-antireflex 6x2.0	11,00	2.010	6.000	133	12,06	7.874	7.513	6.706	5.785	4.750
VarioSol A-antireflex 7x2.0	12,83	2.010	6.990	133	14,05	9.185	8.765	7.823	6.749	5.542
VarioSol A-antireflex 8x2.0	14,66	2.010	7.980	133	16,04	10.498	10.017	8.941	7.713	6.334
VarioSol A-antireflex 6x2.5	13,84	2.510	6.000	133	15,06	9.910	9.456	8.440	7.281	5.979
VarioSol A-antireflex 7x2.5	16,15	2.510	6.990	133	17,54	11.561	11.032	9.847	8.495	6.975
VarioSol A-antireflex 8x2.5	18,45	2.510	7.980	133	20,03	13.213	12.608	11.254	9.708	7.972
VarioSol A-antireflex 6x3.0	16,68	3.010	6.000	133	18,06	11.947	11.399	10.175	8.778	7.207
VarioSol A-antireflex 7x3.0	19,46	3.010	6.990	133	21,04	13.937	13.299	11.871	10.240	8.409
VarioSol A-antireflex 8x3.0	22,24	3.010	7.980	133	24,02	15.928,9	15.199,1	13.566,7	11.704	9.610

<b>Collector efficiency parameters related to aperture area (A<sub>a</sub>)</b> Type of fluid and flow rate see note 1	η <sub>0a</sub>	0,829	-
	a <sub>1a</sub>	3,648	W/(m <sup>2</sup> K)
	a <sub>2a</sub>	0,015	W/(m <sup>2</sup> K <sup>2</sup> )

<b>Stagnation temperature</b> - Weather conditions see note 2	t <sub>stg</sub>	194,5	°C
---	------------------	-------	----

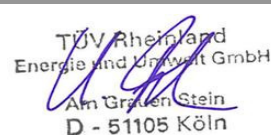
<b>Effective thermal capacity</b>	C <sub>eff</sub> = C/A <sub>a</sub>	4,95	kJ/(m <sup>2</sup> K)
-----------------------------------	-------------------------------------	------	-----------------------

<b>Max. operation pressure</b> - see note 3	p <sub>max</sub>	600	kPa
---	------------------	-----	-----

Incidence angle modifiers K <sub>θ</sub> (θ)	G <sub>DIF</sub> /G <sub>TOT</sub>		θ <sub>T</sub> / θ <sub>L</sub>	50°	10°	20°	30°	40°	60°	70°
	min	max	K <sub>θ</sub> (θ <sub>T</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
			K <sub>θ</sub> (θ <sub>L</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
G <sub>DIF</sub> /G <sub>TOT</sub> : min&max - while measuring					<b>Optional values</b>					

<b>Testing Laboratory</b>	TÜV Energie und Umwelt GmbH
<b>Website</b>	www.eco-tuv.de
<b>Test report id. number</b>	21220066_EN_R; 21220066_EN_P1; 21220066_EN_P2
<b>Date of test report</b>	22.11.2012; 22.11.2012; 22.11.2012
<b>Perf. test method</b>	EN 12975-2 6.3 (outdoor)

<b>Comments of testing laboratory :</b>	
---	--

Note 1	<b>Fluid</b>	Water	<b>Flow rate</b>	0,023 kg/s per m <sup>2</sup>	 TÜV Rheinland Energie und Umwelt GmbH Am Grünen Stein D - 51105 Köln
Note 2	<b>Irradiance, G<sub>s</sub></b>	1000 W/m <sup>2</sup>			
Note 3	<b>Given by manufacturer</b>				



<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>	<b>Certificate No.</b>	<b>011-752061 F</b>
	Date of issue	22-11-2012

<b>Company</b>	Winkler Solar GmbH	<b>Country</b>	Austria
<b>Brand (optional)</b>	Winkler	<b>Website</b>	www.winklersolar.com
<b>Street, number</b>	Räterweg 17	<b>E-mail</b>	solar@winklersolar.com
<b>Postal Code</b>	6800	<b>Tel.</b>	+43 (0)5522 76139
<b>City</b>	Feldkirch	<b>Fax</b>	+43 (0)5522 76121

<b>Collector Type</b> (flat plate / evacuate tubular / un-glazed)	Flat plate collector
---	----------------------

<b>Integration in the roof possible ?</b>	Yes
---	-----

Collector name	Aperture area (A <sub>a</sub> ) [m <sup>2</sup> ]	Gross length [mm]	Gross width [mm]	Gross height [mm]	Gross area (A <sub>G</sub> ) [m <sup>2</sup> ]	Power output per collector unit G = 1000 W/m <sup>2</sup> T <sub>m</sub> -T <sub>a</sub> :				
						0 K	10 K	30 K	50 K	70 K
						[W]	[W]	[W]	[W]	[W]
VarioSol E-antireflex 6x1.0	5,23	1.018	5.975	130	6,08	3.747	3.576	3.192	2.753	2.261
VarioSol E-antireflex 7x1.0	6,11	1.018	6.965	130	7,09	4.372	4.171	3.723	3.212	2.638
VarioSol E-antireflex 8x1.0	6,98	1.018	7.955	130	8,10	4.996	4.767	4.255	3.671	3.014
VarioSol E-antireflex 6x1.25	6,66	1.268	5.975	130	7,58	4.766	4.547	4.059	3.502	2.875
VarioSol E-antireflex 7x1.25	7,76	1.268	6.965	130	8,83	5.560	5.305	4.735	4.085	3.354
VarioSol E-antireflex 8x1.25	8,87	1.268	7.955	130	10,09	6.354	6.063	5.412	4.669	3.833
<b>VarioSol E-antireflex 6x1.5</b>	<b>8,08</b>	<b>1.518</b>	<b>5.975</b>	<b>130</b>	<b>9,07</b>	<b>5.784</b>	<b>5.519</b>	<b>4.926</b>	<b>4.250</b>	<b>3.489</b>
VarioSol E-antireflex 7x1.5	9,42	1.518	6.965	130	10,57	6.748	6.439	5.747	4.958	4.071
VarioSol E-antireflex 8x1.5	10,77	1.518	7.955	130	12,08	7.712	7.358	6.568	5.666	4.652
VarioSol E-antireflex 6x2.0	10,92	2.018	5.975	130	12,06	7.821	7.462	6.661	5.746	4.718
VarioSol E-antireflex 7x2.0	12,74	2.018	6.965	130	14,06	9.124	8.706	7.771	6.704	5.504
VarioSol E-antireflex 8x2.0	14,56	2.018	7.955	130	16,05	10.427	9.949	8.881	7.661	6.291
VarioSol E-antireflex 6x2.5	13,77	2.518	5.975	130	15,05	9.857	9.406	8.395	7.242	5.947
VarioSol E-antireflex 7x2.5	16,06	2.518	6.965	130	17,54	11.500	10.973	9.794	8.449	6.938
VarioSol E-antireflex 8x2.5	18,35	2.518	7.955	130	20,03	13.143	12.540	11.194	9.656	7.929
VarioSol E-antireflex 6x3.0	16,31	3.018	5.975	130	18,03	11.679	11.144	9.947	8.581	7.046
VarioSol E-antireflex 7x3.0	19,38	3.018	6.965	130	21,02	13.876	13.240	11.818	10.195	8.371
VarioSol E-antireflex 8x3.0	22,15	3.018	7.955	130	24,01	15.858	15.131	13.506	11.652	9.567

<b>Collector efficiency parameters related to aperture area (A<sub>a</sub>)</b> Type of fluid and flow rate see note 1	η <sub>0a</sub>	0,829	-
	a <sub>1a</sub>	3,648	W/(m <sup>2</sup> K)
	a <sub>2a</sub>	0,015	W/(m <sup>2</sup> K <sup>2</sup> )

<b>Stagnation temperature</b> - Weather conditions see note 2	t <sub>stg</sub>	194,5	°C
---	------------------	-------	----

<b>Effective thermal capacity</b>	C <sub>eff</sub> = C/A <sub>a</sub>	4,95	kJ/(m <sup>2</sup> K)
-----------------------------------	-------------------------------------	------	-----------------------

<b>Max. operation pressure</b> - see note 3	p <sub>max</sub>	600	kPa
---	------------------	-----	-----

Incidence angle modifiers K <sub>θ</sub> (θ)	G <sub>DIF</sub> /G <sub>TOT</sub>		θ <sub>T</sub> / θ <sub>L</sub>	50°	10°	20°	30°	40°	60°	70°
	min	max	K <sub>θ</sub> (θ <sub>T</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
	0,09	0,88	K <sub>θ</sub> (θ <sub>L</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
G <sub>DIF</sub> /G <sub>TOT</sub> : min&max - while measuring				<b>Optional values</b>						

<b>Testing Laboratory</b>	TÜV Energie und Umwelt GmbH
<b>Website</b>	www.eco-tuv.de
<b>Test report id. number</b>	21220066_EN_R; 21220066_EN_P1; 21220066_EN_P2
<b>Date of test report</b>	22.11.2012; 22.11.2012; 22.11.2012
<b>Perf. test method</b>	EN 12975-2 6.3 (outdoor)

<b>Comments of testing laboratory :</b>	
---	--

Note 1	<b>Fluid</b>	Water	<b>Flow rate</b>	0,023 kg/s per m <sup>2</sup>	
Note 2	<b>Irradiance, G<sub>s</sub>=1000 W/m<sup>2</sup></b>				
Note 3	<b>Given by manufacturer</b>				

**Annual collector output based on EN 12975 Test Results,  
annex to Solar KEYMARK Certificate**
**Certificate No.**
**011-7S2061 F**

Issued

22-11-2012

**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
VarioSol A-antireflex 6x1.0	6.978	5.053	3.350	5.736	3.996	2.514	3.931	2.612	1.602	4.266	2.820	1.700
VarioSol A-antireflex 7x1.0	8.140	5.894	3.909	6.692	4.662	2.933	4.586	3.047	1.868	4.977	3.290	1.984
VarioSol A-antireflex 8x1.0	9.303	6.737	4.467	7.648	5.329	3.353	5.242	3.482	2.136	5.688	3.760	2.267
VarioSol A-antireflex 6x1.25	8.847	6.406	4.248	7.273	5.067	3.188	4.985	3.312	2.031	5.409	3.575	2.156
VarioSol A-antireflex 7x1.25	10.321	7.474	4.956	8.485	5.911	3.719	5.815	3.863	2.369	6.310	4.171	2.515
VarioSol A-antireflex 8x1.25	11.796	8.542	5.664	9.698	6.756	4.251	6.646	4.415	2.708	7.212	4.767	2.875
VarioSol A-antireflex 6x1.5	10.717	7.760	5.146	8.810	6.138	3.862	6.038	4.011	2.460	6.552	4.331	2.612
VarioSol A-antireflex 7x1.5	12.502	9.053	6.003	10.278	7.161	4.505	7.044	4.680	2.870	7.644	5.053	3.047
VarioSol A-antireflex 8x1.5	14.289	10.347	6.861	11.747	8.184	5.149	8.051	5.349	3.280	8.736	5.775	3.482
VarioSol A-antireflex 6x2.0	14.456	10.468	6.941	11.884	8.280	5.209	8.145	5.411	3.318	8.838	5.842	3.523
VarioSol A-antireflex 7x2.0	16.865	12.212	8.098	13.864	9.659	6.077	9.502	6.313	3.871	10.311	6.816	4.110
VarioSol A-antireflex 8x2.0	19.275	13.957	9.255	15.846	11.040	6.946	10.860	7.215	4.424	11.784	7.789	4.697
VarioSol A-antireflex 6x2.5	18.195	13.175	8.737	14.958	10.421	6.557	10.252	6.811	4.177	11.124	7.353	4.434
VarioSol A-antireflex 7x2.5	21.227	15.371	10.193	17.451	12.158	7.649	11.960	7.946	4.873	12.978	8.579	5.173
VarioSol A-antireflex 8x2.5	24.260	17.567	11.649	19.944	13.895	8.742	13.669	9.081	5.569	14.832	9.804	5.912
VarioSol A-antireflex 6x3.0	21.934	15.883	10.532	18.032	12.563	7.904	12.358	8.210	5.035	13.410	8.864	5.345
VarioSol A-antireflex 7x3.0	25.590	18.530	12.288	21.037	14.657	9.221	14.418	9.578	5.874	15.645	10.341	6.236
VarioSol A-antireflex 8x3.0	29.246	21.177	14.043	24.043	16.751	10.539	16.478	10.947	6.713	17.881	11.819	7.127

**Collector mounting: Fixed or tracking**

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

**Overview of locations**

Location	Latitude °	G <sub>tot</sub> kWh/m <sup>2</sup>	T <sub>a</sub> °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 <sub>tot</sub>	Annual total irradiation on collector plane	kWh/m <sup>2</sup>
T <sub>a</sub>	Mean annual ambient air temperature	°C
T <sub>m</sub>	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 3.5, 2012.01.13

Calculation program version:

3.07, October 2011 (SP)

**Annual collector output based on EN 12975 Test Results,  
annex to Solar KEYMARK Certificate**
**Certificate No.**
**011-7S2061 F**

Issued

22-11-2012

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

Collector name	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			
VarioSol E-antireflex 6x1.0	6.880	4.982	3.304	5.656	3.941	2.479	3.876	2.575	1.579	4.207	2.781	1.677			
VarioSol E-antireflex 7x1.0	8.027	5.812	3.854	6.599	4.597	2.892	4.522	3.004	1.842	4.907	3.244	1.956			
VarioSol E-antireflex 8x1.0	9.173	6.642	4.405	7.541	5.254	3.306	5.168	3.434	2.106	5.608	3.707	2.235			
VarioSol E-antireflex 6x1.25	8.750	6.336	4.201	7.193	5.012	3.153	4.930	3.275	2.008	5.350	3.536	2.132			
VarioSol E-antireflex 7x1.25	10.208	7.392	4.902	8.392	5.847	3.678	5.751	3.821	2.343	6.241	4.125	2.488			
VarioSol E-antireflex 8x1.25	11.666	8.448	5.602	9.591	6.682	4.204	6.573	4.367	2.678	7.132	4.715	2.843			
<b>VarioSol E-antireflex 6x1.5</b>	<b>10.619</b>	<b>7.690</b>	<b>5.099</b>	<b>8.730</b>	<b>6.082</b>	<b>3.827</b>	<b>5.983</b>	<b>3.975</b>	<b>2.438</b>	<b>6.493</b>	<b>4.292</b>	<b>2.588</b>			
VarioSol E-antireflex 7x1.5	12.389	8.971	5.949	10.185	7.096	4.465	6.980	4.637	2.844	7.575	5.007	3.019			
VarioSol E-antireflex 8x1.5	14.159	10.253	6.799	11.640	8.110	5.102	7.977	5.300	3.250	8.657	5.722	3.450			
VarioSol E-antireflex 6x2.0	14.359	10.397	6.895	11.804	8.224	5.174	8.090	5.375	3.296	8.779	5.803	3.499			
VarioSol E-antireflex 7x2.0	16.752	12.130	8.044	13.772	9.595	6.037	9.438	6.270	3.845	10.242	6.770	4.082			
VarioSol E-antireflex 7x2.1	19.144	13.863	9.193	15.739	10.965	6.899	10.786	7.166	4.395	11.705	7.737	4.665			
VarioSol E-antireflex 7x2.2	18.098	13.105	8.690	14.878	10.366	6.522	10.197	6.774	4.154	11.065	7.314	4.410			
VarioSol E-antireflex 7x2.3	21.114	15.289	10.139	17.358	12.093	7.609	11.896	7.903	4.847	12.909	8.533	5.145			
VarioSol E-antireflex 7x2.4	24.130	17.473	11.587	19.837	13.821	8.695	13.595	9.032	5.539	14.753	9.752	5.880			
VarioSol E-antireflex 7x2.5	21.443	15.527	10.296	17.628	12.281	7.727	12.081	8.026	4.922	13.110	8.666	5.225			
VarioSol E-antireflex 7x2.6	25.476	18.448	12.233	20.944	14.592	9.181	14.354	9.536	5.848	15.576	10.296	6.208			
VarioSol E-antireflex 7x2.7	29.116	21.083	13.981	23.936	16.676	10.492	16.404	10.898	6.683	17.801	11.767	7.095			

**Collector mounting: Fixed or tracking**

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

**Overview of locations**

Location	Latitude °	G <sub>tot</sub> kWh/m <sup>2</sup>	T <sub>a</sub> °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 <sub>tot</sub>	Annual total irradiation on collector plane	kWh/m <sup>2</sup>
T <sub>a</sub>	Mean annual ambient air temperature	°C
T <sub>m</sub>	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 • www.dincertco.de

Datashheet version:

VERSION 3.5, 2012.01.13

Calculation program version:

3.07, October 2011 (SP)

<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>	<b>Certificate No.</b>	<b>011-752061 F</b>
	Date of issue	22-11-2012

<b>Company</b>	Winkler Solar GmbH	<b>Country</b>	Austria
<b>Brand (optional)</b>	Winkler	<b>Website</b>	www.winklersolar.com
<b>Street, number</b>	Räterweg 17	<b>E-mail</b>	solar@winklersolar.com
<b>Postal Code</b>	6800	<b>Tel.</b>	+43 (0)5522 76139
<b>City</b>	Feldkirch	<b>Fax</b>	+43 (0)5522 76121

<b>Collector Type</b> (flat plate / evacuate tubular / un-glazed)	Flat plate collector
---	----------------------

<b>Integration in the roof possible ?</b>	Yes
---	-----

Collector name	Aperture area (A <sub>a</sub> ) [m <sup>2</sup> ]	Gross length [mm]	Gross width [mm]	Gross height [mm]	Gross area (A <sub>G</sub> ) [m <sup>2</sup> ]	Power output per collector unit G = 1000 W/m <sup>2</sup> T <sub>m</sub> -T <sub>a</sub> :				
						0 K	10 K	30 K	50 K	70 K
						[W]	[W]	[W]	[W]	[W]
VarioSol A-antireflex 6x1.0	5,31	1.010	6.000	133	6,06	3.800	3.626	3.237	2.792	2.293
VarioSol A-antireflex 7x1.0	6,19	1.010	6.990	133	7,06	4.433	4.230	3.776	3.257	2.675
VarioSol A-antireflex 8x1.0	7,08	1.010	7.980	133	8,06	5.067	4.835	4.316	3.723	3.057
VarioSol A-antireflex 6x1.25	6,73	1.260	6.000	133	7,56	4.819	4.598	4.104	3.540	2.907
VarioSol A-antireflex 7x1.25	7,85	1.260	6.990	133	8,81	5.621	5.364	4.788	4.130	3.391
VarioSol A-antireflex 8x1.25	8,97	1.260	7.980	133	10,05	6.425	6.130	5.472	4.721	3.876
VarioSol A-antireflex 6x1.5	8,15	1.510	6.000	133	9,06	5.837	5.570	4.971	4.289	3.521
VarioSol A-antireflex 7x1.5	9,51	1.510	6.990	133	10,55	6.809	6.497	5.800	5.003	4.108
VarioSol A-antireflex 8x1.5	10,87	1.510	7.980	133	12,05	7.783	7.426	6.628	5.718	4.695
VarioSol A-antireflex 6x2.0	11,00	2.010	6.000	133	12,06	7.874	7.513	6.706	5.785	4.750
VarioSol A-antireflex 7x2.0	12,83	2.010	6.990	133	14,05	9.185	8.765	7.823	6.749	5.542
VarioSol A-antireflex 8x2.0	14,66	2.010	7.980	133	16,04	10.498	10.017	8.941	7.713	6.334
VarioSol A-antireflex 6x2.5	13,84	2.510	6.000	133	15,06	9.910	9.456	8.440	7.281	5.979
VarioSol A-antireflex 7x2.5	16,15	2.510	6.990	133	17,54	11.561	11.032	9.847	8.495	6.975
VarioSol A-antireflex 8x2.5	18,45	2.510	7.980	133	20,03	13.213	12.608	11.254	9.708	7.972
VarioSol A-antireflex 6x3.0	16,68	3.010	6.000	133	18,06	11.947	11.399	10.175	8.778	7.207
VarioSol A-antireflex 7x3.0	19,46	3.010	6.990	133	21,04	13.937	13.299	11.871	10.240	8.409
VarioSol A-antireflex 8x3.0	22,24	3.010	7.980	133	24,02	15.928,9	15.199,1	13.566,7	11.704	9.610

<b>Collector efficiency parameters related to aperture area (A<sub>a</sub>)</b> Type of fluid and flow rate see note 1	η <sub>0a</sub>	0,829	-
	a <sub>1a</sub>	3,648	W/(m <sup>2</sup> K)
	a <sub>2a</sub>	0,015	W/(m <sup>2</sup> K <sup>2</sup> )

<b>Stagnation temperature</b> - Weather conditions see note 2	t <sub>stg</sub>	194,5	°C
---	------------------	-------	----

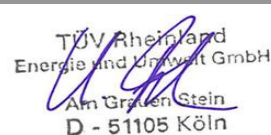
<b>Effective thermal capacity</b>	C <sub>eff</sub> = C/A <sub>a</sub>	4,95	kJ/(m <sup>2</sup> K)
-----------------------------------	-------------------------------------	------	-----------------------

<b>Max. operation pressure</b> - see note 3	p <sub>max</sub>	600	kPa
---	------------------	-----	-----

Incidence angle modifiers K <sub>θ</sub> (θ)	G <sub>DIF</sub> /G <sub>TOT</sub>		θ <sub>T</sub> / θ <sub>L</sub>	50°	10°	20°	30°	40°	60°	70°
	min	max	K <sub>θ</sub> (θ <sub>T</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
			K <sub>θ</sub> (θ <sub>L</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
G <sub>DIF</sub> /G <sub>TOT</sub> : min&max - while measuring					<b>Optional values</b>					

<b>Testing Laboratory</b>	TÜV Energie und Umwelt GmbH
<b>Website</b>	www.eco-tuv.de
<b>Test report id. number</b>	21220066_EN_R; 21220066_EN_P1; 21220066_EN_P2
<b>Date of test report</b>	22.11.2012; 22.11.2012; 22.11.2012
<b>Perf. test method</b>	EN 12975-2 6.3 (outdoor)

<b>Comments of testing laboratory :</b>	
---	--

Note 1	<b>Fluid</b>	Water	<b>Flow rate</b>	0,023 kg/s per m <sup>2</sup>	 TÜV Rheinland Energie und Umwelt GmbH Am Grünen Stein D - 51105 Köln
Note 2	<b>Irradiance, G<sub>s</sub></b>	1000 W/m <sup>2</sup>			
Note 3	<b>Given by manufacturer</b>				



<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>	<b>Certificate No.</b>	<b>011-752061 F</b>
	Date of issue	22-11-2012

<b>Company</b>	Winkler Solar GmbH	<b>Country</b>	Austria
<b>Brand (optional)</b>	Winkler	<b>Website</b>	www.winklersolar.com
<b>Street, number</b>	Räterweg 17	<b>E-mail</b>	solar@winklersolar.com
<b>Postal Code</b>	6800	<b>Tel.</b>	+43 (0)5522 76139
<b>City</b>	Feldkirch	<b>Fax</b>	+43 (0)5522 76121

<b>Collector Type</b> (flat plate / evacuate tubular / un-glazed)	Flat plate collector
---	----------------------

<b>Integration in the roof possible ?</b>	Yes
---	-----

Collector name	Aperture area (A <sub>a</sub> ) [m <sup>2</sup> ]	Gross length [mm]	Gross width [mm]	Gross height [mm]	Gross area (A <sub>G</sub> ) [m <sup>2</sup> ]	Power output per collector unit G = 1000 W/m <sup>2</sup> T <sub>m</sub> -T <sub>a</sub> :				
						0 K	10 K	30 K	50 K	70 K
						[W]	[W]	[W]	[W]	[W]
VarioSol E-antireflex 6x1.0	5,23	1.018	5.975	130	6,08	3.747	3.576	3.192	2.753	2.261
VarioSol E-antireflex 7x1.0	6,11	1.018	6.965	130	7,09	4.372	4.171	3.723	3.212	2.638
VarioSol E-antireflex 8x1.0	6,98	1.018	7.955	130	8,10	4.996	4.767	4.255	3.671	3.014
VarioSol E-antireflex 6x1.25	6,66	1.268	5.975	130	7,58	4.766	4.547	4.059	3.502	2.875
VarioSol E-antireflex 7x1.25	7,76	1.268	6.965	130	8,83	5.560	5.305	4.735	4.085	3.354
VarioSol E-antireflex 8x1.25	8,87	1.268	7.955	130	10,09	6.354	6.063	5.412	4.669	3.833
<b>VarioSol E-antireflex 6x1.5</b>	<b>8,08</b>	<b>1.518</b>	<b>5.975</b>	<b>130</b>	<b>9,07</b>	<b>5.784</b>	<b>5.519</b>	<b>4.926</b>	<b>4.250</b>	<b>3.489</b>
VarioSol E-antireflex 7x1.5	9,42	1.518	6.965	130	10,57	6.748	6.439	5.747	4.958	4.071
VarioSol E-antireflex 8x1.5	10,77	1.518	7.955	130	12,08	7.712	7.358	6.568	5.666	4.652
VarioSol E-antireflex 6x2.0	10,92	2.018	5.975	130	12,06	7.821	7.462	6.661	5.746	4.718
VarioSol E-antireflex 7x2.0	12,74	2.018	6.965	130	14,06	9.124	8.706	7.771	6.704	5.504
VarioSol E-antireflex 8x2.0	14,56	2.018	7.955	130	16,05	10.427	9.949	8.881	7.661	6.291
VarioSol E-antireflex 6x2.5	13,77	2.518	5.975	130	15,05	9.857	9.406	8.395	7.242	5.947
VarioSol E-antireflex 7x2.5	16,06	2.518	6.965	130	17,54	11.500	10.973	9.794	8.449	6.938
VarioSol E-antireflex 8x2.5	18,35	2.518	7.955	130	20,03	13.143	12.540	11.194	9.656	7.929
VarioSol E-antireflex 6x3.0	16,31	3.018	5.975	130	18,03	11.679	11.144	9.947	8.581	7.046
VarioSol E-antireflex 7x3.0	19,38	3.018	6.965	130	21,02	13.876	13.240	11.818	10.195	8.371
VarioSol E-antireflex 8x3.0	22,15	3.018	7.955	130	24,01	15.858	15.131	13.506	11.652	9.567

<b>Collector efficiency parameters related to aperture area (A<sub>a</sub>)</b> Type of fluid and flow rate see note 1	η <sub>0a</sub>	0,829	-
	a <sub>1a</sub>	3,648	W/(m <sup>2</sup> K)
	a <sub>2a</sub>	0,015	W/(m <sup>2</sup> K <sup>2</sup> )

<b>Stagnation temperature</b> - Weather conditions see note 2	t <sub>stg</sub>	194,5	°C
---	------------------	-------	----

<b>Effective thermal capacity</b>	C <sub>eff</sub> = C/A <sub>a</sub>	4,95	kJ/(m <sup>2</sup> K)
-----------------------------------	-------------------------------------	------	-----------------------

<b>Max. operation pressure</b> - see note 3	p <sub>max</sub>	600	kPa
---	------------------	-----	-----

Incidence angle modifiers K <sub>θ</sub> (θ)	G <sub>DIF</sub> /G <sub>TOT</sub>		θ <sub>T</sub> / θ <sub>L</sub>	50°	10°	20°	30°	40°	60°	70°
	min	max	K <sub>θ</sub> (θ <sub>T</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
			K <sub>θ</sub> (θ <sub>L</sub> )	0,93	1,00	0,99	0,98	0,96	0,88	0,76
G <sub>DIF</sub> /G <sub>TOT</sub> : min&max - while measuring				<b>Optional values</b>						

<b>Testing Laboratory</b>	TÜV Energie und Umwelt GmbH
<b>Website</b>	www.eco-tuv.de
<b>Test report id. number</b>	21220066_EN_R; 21220066_EN_P1; 21220066_EN_P2
<b>Date of test report</b>	22.11.2012; 22.11.2012; 22.11.2012
<b>Perf. test method</b>	EN 12975-2 6.3 (outdoor)

<b>Comments of testing laboratory :</b>	
---	--

Note 1	<b>Fluid</b>	Water	<b>Flow rate</b>	0,023 kg/s per m <sup>2</sup>	<p>TÜV Rheinland Energie und Umwelt GmbH Am Grauen Stein D - 51105 Köln</p>
Note 2	<b>Irradiance, G<sub>s</sub>=1000 W/m<sup>2</sup></b>				
Note 3	<b>Given by manufacturer</b>				

**Annual collector output based on EN 12975 Test Results,  
 annex to Solar KEYMARK Certificate**
**Certificate No.** **011-7S2061 F**  
 Issued 22-11-2012

**Annual collector output kWh**

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
VarioSol A-antireflex 6x1.0	6.978	5.053	3.350	5.736	3.996	2.514	3.931	2.612	1.602	4.266	2.820	1.700
VarioSol A-antireflex 7x1.0	8.140	5.894	3.909	6.692	4.662	2.933	4.586	3.047	1.868	4.977	3.290	1.984
VarioSol A-antireflex 8x1.0	9.303	6.737	4.467	7.648	5.329	3.353	5.242	3.482	2.136	5.688	3.760	2.267
VarioSol A-antireflex 6x1.25	8.847	6.406	4.248	7.273	5.067	3.188	4.985	3.312	2.031	5.409	3.575	2.156
VarioSol A-antireflex 7x1.25	10.321	7.474	4.956	8.485	5.911	3.719	5.815	3.863	2.369	6.310	4.171	2.515
VarioSol A-antireflex 8x1.25	11.796	8.542	5.664	9.698	6.756	4.251	6.646	4.415	2.708	7.212	4.767	2.875
VarioSol A-antireflex 6x1.5	10.717	7.760	5.146	8.810	6.138	3.862	6.038	4.011	2.460	6.552	4.331	2.612
VarioSol A-antireflex 7x1.5	12.502	9.053	6.003	10.278	7.161	4.505	7.044	4.680	2.870	7.644	5.053	3.047
VarioSol A-antireflex 8x1.5	14.289	10.347	6.861	11.747	8.184	5.149	8.051	5.349	3.280	8.736	5.775	3.482
VarioSol A-antireflex 6x2.0	14.456	10.468	6.941	11.884	8.280	5.209	8.145	5.411	3.318	8.838	5.842	3.523
VarioSol A-antireflex 7x2.0	16.865	12.212	8.098	13.864	9.659	6.077	9.502	6.313	3.871	10.311	6.816	4.110
VarioSol A-antireflex 8x2.0	19.275	13.957	9.255	15.846	11.040	6.946	10.860	7.215	4.424	11.784	7.789	4.697
VarioSol A-antireflex 6x2.5	18.195	13.175	8.737	14.958	10.421	6.557	10.252	6.811	4.177	11.124	7.353	4.434
VarioSol A-antireflex 7x2.5	21.227	15.371	10.193	17.451	12.158	7.649	11.960	7.946	4.873	12.978	8.579	5.173
VarioSol A-antireflex 8x2.5	24.260	17.567	11.649	19.944	13.895	8.742	13.669	9.081	5.569	14.832	9.804	5.912
VarioSol A-antireflex 6x3.0	21.934	15.883	10.532	18.032	12.563	7.904	12.358	8.210	5.035	13.410	8.864	5.345
VarioSol A-antireflex 7x3.0	25.590	18.530	12.288	21.037	14.657	9.221	14.418	9.578	5.874	15.645	10.341	6.236
VarioSol A-antireflex 8x3.0	29.246	21.177	14.043	24.043	16.751	10.539	16.478	10.947	6.713	17.881	11.819	7.127

**Collector mounting: Fixed or tracking**

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

**Overview of locations**

Location	Latitude °	G <sub>tot</sub> kWh/m <sup>2</sup>	T <sub>a</sub> °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 <sub>tot</sub>	Annual total irradiation on collector plane	kWh/m <sup>2</sup>
T <sub>a</sub>	Mean annual ambient air temperature	°C
T <sub>m</sub>	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 • www.dincertco.de

Datasheet version:  
 VERSION 3.5, 2012.01.13  
 Calculation program version:  
 3.07, October 2011 (SP)

**Annual collector output based on EN 12975 Test Results,  
annex to Solar KEYMARK Certificate**
**Certificate No.**
**011-7S2061 F**

Issued

22-11-2012

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

Collector name	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			
VarioSol E-antireflex 6x1.0	6.880	4.982	3.304	5.656	3.941	2.479	3.876	2.575	1.579	4.207	2.781	1.677			
VarioSol E-antireflex 7x1.0	8.027	5.812	3.854	6.599	4.597	2.892	4.522	3.004	1.842	4.907	3.244	1.956			
VarioSol E-antireflex 8x1.0	9.173	6.642	4.405	7.541	5.254	3.306	5.168	3.434	2.106	5.608	3.707	2.235			
VarioSol E-antireflex 6x1.25	8.750	6.336	4.201	7.193	5.012	3.153	4.930	3.275	2.008	5.350	3.536	2.132			
VarioSol E-antireflex 7x1.25	10.208	7.392	4.902	8.392	5.847	3.678	5.751	3.821	2.343	6.241	4.125	2.488			
VarioSol E-antireflex 8x1.25	11.666	8.448	5.602	9.591	6.682	4.204	6.573	4.367	2.678	7.132	4.715	2.843			
<b>VarioSol E-antireflex 6x1.5</b>	<b>10.619</b>	<b>7.690</b>	<b>5.099</b>	<b>8.730</b>	<b>6.082</b>	<b>3.827</b>	<b>5.983</b>	<b>3.975</b>	<b>2.438</b>	<b>6.493</b>	<b>4.292</b>	<b>2.588</b>			
VarioSol E-antireflex 7x1.5	12.389	8.971	5.949	10.185	7.096	4.465	6.980	4.637	2.844	7.575	5.007	3.019			
VarioSol E-antireflex 8x1.5	14.159	10.253	6.799	11.640	8.110	5.102	7.977	5.300	3.250	8.657	5.722	3.450			
VarioSol E-antireflex 6x2.0	14.359	10.397	6.895	11.804	8.224	5.174	8.090	5.375	3.296	8.779	5.803	3.499			
VarioSol E-antireflex 7x2.0	16.752	12.130	8.044	13.772	9.595	6.037	9.438	6.270	3.845	10.242	6.770	4.082			
VarioSol E-antireflex 7x2.1	19.144	13.863	9.193	15.739	10.965	6.899	10.786	7.166	4.395	11.705	7.737	4.665			
VarioSol E-antireflex 7x2.2	18.098	13.105	8.690	14.878	10.366	6.522	10.197	6.774	4.154	11.065	7.314	4.410			
VarioSol E-antireflex 7x2.3	21.114	15.289	10.139	17.358	12.093	7.609	11.896	7.903	4.847	12.909	8.533	5.145			
VarioSol E-antireflex 7x2.4	24.130	17.473	11.587	19.837	13.821	8.695	13.595	9.032	5.539	14.753	9.752	5.880			
VarioSol E-antireflex 7x2.5	21.443	15.527	10.296	17.628	12.281	7.727	12.081	8.026	4.922	13.110	8.666	5.225			
VarioSol E-antireflex 7x2.6	25.476	18.448	12.233	20.944	14.592	9.181	14.354	9.536	5.848	15.576	10.296	6.208			
VarioSol E-antireflex 7x2.7	29.116	21.083	13.981	23.936	16.676	10.492	16.404	10.898	6.683	17.801	11.767	7.095			

**Collector mounting: Fixed or tracking**

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

**Overview of locations**

Location	Latitude °	G <sub>tot</sub> kWh/m <sup>2</sup>	T <sub>a</sub> °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 <sub>tot</sub>	Annual total irradiation on collector plane	kWh/m <sup>2</sup>
T <sub>a</sub>	Mean annual ambient air temperature	°C
T <sub>m</sub>	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)

Datashet version:

VERSION 3.5, 2012.01.13

Calculation program version:

3.07, October 2011 (SP)