TÜVRheinland®
DIN CERTCO

Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	Certificate No.	011-7S2060 F
	Date of issue	22-11-2012

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

Collector Type (flat plate / evacuate tubular / un-glazed)	Flat plate collector
Integration in the roof possible ?	Yes

Collector name	Aperture area (Aa)	Gross length	Gross width	Gross height	Gross area (AG)	Power output per collector unit 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]
VarioSol A-antireflex 4x1	3.54	1 010	4 020	133	4.06	2 873	1 335	1 193	1 030	844
VarioSol A-antireflex 5x1	4.42	1 010	5 010	133	5.06	3 591	1 668	1 492	1 287	1 055
VarioSol A-antireflex 4x1.25	4.49	1 260	4 020	133	5.07	3 643	1 692	1 513	1 306	1 071
VarioSol A-antireflex 5x1.25	5.61	1 260	5 010	133	6.31	4 553	2 115	1 891	1 632	1 338
VarioSol A-antireflex 4x1.5	5.43	1 510	4 020	133	6.07	4 412	2 050	1 833	1 582	1 297
VarioSol A-antireflex 5x1.5	6.79	1 510	5 010	133	7.57	5 515	2 562	2 291	1 977	1 621
VarioSol A-antireflex 4x2	7.33	2 010	4 020	133	8.08	5 952	2 765	2 472	2 134	1 749
VarioSol A-antireflex 5x2	9.16	2 010	5 010	133	10.07	7 440	3 456	3 090	2 667	2 187
VarioSol A-antireflex 4x2.5	**9.23**	**2 510**	**4 020**	**133**	10.09	**7 492**	**3 480**	**3 112**	**2 686**	**2 202**
VarioSol A-antireflex 5x2.5	11.53	2 510	5 010	133	12.58	9 364	4 350	3 890	3 357	2 752
VarioSol A-antireflex 4x3	11.12	3 010	4 020	133	12.10	9 031	4 195	3 751	3 238	2 654
VarioSol A-antireflex 5x3	13.90	3 010	5 010	133	15.08	11 288	5 244	4 689	4 047	3 318

Collector efficiency parameters related to aperture area (Aa) Type of fluid and flow rate see note 1	η_{0a}	0.812	-
	a_{1a}	3.461	W/(m²K)
	a_{2a}	0.016	W/(m²K²)
Stagnation temperature - Weather conditions see note 2	t_{stg}	194.5	°C
Effective thermal capacity	c_{eff} = C/Aa	5.59	kJ/(m²K)
Max. operation pressure - see note 3	p_{max}	600	kPa

Incidence angle modifiers $K_\theta(\theta)$	G_{DIF}/G_{TOT} min	G_{DIF}/G_{TOT} max	θ_T / θ_L	50°	*10°*	*20°*	*30°*	*40°*	*60°*	*70°*
			$K_\theta(\theta_T)$	0.90	*1.00*	*0.99*	*0.97*	*0.94*	*0.81*	*0.64*
	0.12	0.79	$K_\theta(\theta_L)$	0.90	*1.00*	*0.99*	*0.97*	*0.94*	*0.81*	*0.64*
G_{DIF}/G_{TOT}: min&max - while measuring					***Optional values***					

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

Comments of testing laboratory :

Note 1	**Fluid**	Water	**Flow rate**	0.026	kg/s per m²
Note 2	**Irradiance, Gs=1000 W/m²**				
Note 3	**Given by manufacturer**				

TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
D - 51105 Köln

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

Collector Type (flat plate / evacuate tubular / un-glazed)	Flat plate collector
Integration in the roof possible ?	Yes

Collector name	Aperture area (A_a)	Gross length	Gross width	Gross height	Gross area (A_G)	Power output per collector unit 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]
VarioSol E-antireflex 4x1	3.49	1 018	3 995	130	4.07	2 833	2 833	2 833	2 833	2 833
VarioSol E-antireflex 5x1	4.36	1 018	4 985	130	5.07	3 541	3 541	3 541	3 541	3 541
VarioSol E-antireflex 4x1.25	4.44	1 268	3 995	130	5.07	3 603	3 603	3 603	3 603	3 603
VarioSol E-antireflex 5x1.25	5.55	1 268	4 985	130	6.32	4 503	4 503	4 503	4 503	4 503
VarioSol E-antireflex 4x1.5	5.39	1 518	3 995	130	6.06	4 373	4 373	4 373	4 373	4 373
VarioSol E-antireflex 5x1.5	6.73	1 518	4 985	130	7.57	5 466	5 466	5 466	5 466	5 466
VarioSol E-antireflex 4x2	7.28	2 018	3 995	130	8.06	5 912	5 912	5 912	5 912	5 912
VarioSol E-antireflex 5x2	9.10	2 018	4 985	130	10.06	7 390	7 390	7 390	7 390	7 390
VarioSol E-antireflex 4x2.5	9.18	2 518	3 995	130	10.06	7 452	7 452	7 452	7 452	7 452
VarioSol E-antireflex 5x2.5	11.47	2 518	4 985	130	12.55	9 314	9 314	9 314	9 314	9 314
VarioSol E-antireflex 4x3	11.07	3 018	3 995	130	12.06	8 991	8 991	8 991	8 991	8 991
VarioSol E-antireflex 5x3	13.84	3 018	4 985	130	15.04	11 239	11 239	11 239	11 239	11 239

Collector efficiency parameters related to aperture area (Aa) Type of fluid and flow rate see note 1	η_{0a}	0.812	-
	a_{1a}	3.461	W/(m²K)
	a_{2a}	0.016	W/(m²K²)
Stagnation temperature - Weather conditions see note 2	t_{stg}	194.5	°C
Effective thermal capacity	$c_{eff} = C/A_a$	5.59	kJ/(m²K)
Max. operation pressure - see note 3	p_{max}	600	kPa

Incidence angle modifiers $K_\theta(\theta)$	G_{DIF}/G_{TOT} min	G_{DIF}/G_{TOT} max	θ_T / θ_L	50°	*10°*	*20°*	*30°*	*40°*	*60°*	*70°*
			$K_\theta(\theta_T)$	0.90	*1.00*	*0.99*	*0.97*	*0.94*	*0.81*	*0.64*
	0.12	0.79	$K_\theta(\theta_L)$	0.90	*1.00*	*0.99*	*0.97*	*0.94*	*0.81*	*0.64*
G_{DIF}/G_{TOT}: min&max - while measuring					***Optional values***					

Testing Laboratory	TÜV Energie und Umwelt GmbH
Website	www.eco-tuv.de
Test report id. number	21220066_EN_R; 21220066_EN_P1; 212
Date of test report	22.11.2012; 22.11.2012; 22.11.2012
Perf. test method	EN 12975-2 6.3 (outdoor)

Comments of testing laboratory :

Note 1	**Fluid**	Water	**Flow rate**	0.026	kg/s per m²
Note 2	**Irradiance, Gs=1000 W/m²**				
Note 3	**Given by manufacturer**				

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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Certificate No.	011-7S2060 F
	Issued	22-11-2012

Annual collector output kWh

	Location and collector temperature (Tm)														
	Athens			Davos			Stockholm			Würzburg					
Collector name	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 4x1	4 413	3 189	2 100	3 629	2 522	1 580	2 484	1 654	1 011	2 693	1 776	1 068			
VarioSol A-antireflex 5x1	5 516	3 986	2 624	4 535	3 152	1 975	3 105	2 067	1 263	3 366	2 220	1 335			
VarioSol A-antireflex 4x1.25	5 596	4 044	2 662	4 601	3 198	2 004	3 150	2 097	1 282	3 414	2 252	1 355			
VarioSol A-antireflex 5x1.25	6 994	5 054	3 328	5 751	3 997	2 505	3 937	2 621	1 602	4 268	2 814	1 693			
VarioSol A-antireflex 4x1.5	6 778	4 898	3 225	5 573	3 874	2 427	3 816	2 541	1 553	4 136	2 728	1 641			
VarioSol A-antireflex 5x1.5	8 472	6 123	4 031	6 966	4 842	3 034	4 769	3 175	1 941	5 170	3 409	2 051			
VarioSol A-antireflex 4x2	9 143	6 607	4 350	7 518	5 225	3 274	5 147	3 427	2 094	5 579	3 679	2 214			
VarioSol A-antireflex 5x2	11 428	8 259	5 437	9 397	6 531	4 092	6 433	4 283	2 618	6 974	4 599	2 767			
VarioSol A-antireflex 4x2.5	**11 508**	**8 317**	**5 475**	**9 463**	**6 577**	**4 121**	**6 478**	**4 313**	**2 636**	**7 022**	**4 631**	**2 786**			
VarioSol A-antireflex 5x2.5	14 385	10 395	6 844	11 828	8 221	5 151	8 098	5 392	3 295	8 777	5 789	3 483			
VarioSol A-antireflex 4x3	13 873	10 026	6 601	11 407	7 928	4 968	7 810	5 200	3 178	8 465	5 583	3 359			
VarioSol A-antireflex 5x3	17 341	12 532	8 250	14 258	9 910	6 210	9 762	6 500	3 972	10 581	6 978	4 198			

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

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 (Tm). Detailed description with all equations used is available from the Solar Keymark web site (direct link: http://www.estif.org/solarkeymark/annexb1.php)

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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.	011-7S2060 F
	Issued	12-06-2015

Annual collector output kWh

	Location and collector temperature (Tm)														
	Athens			Davos			Stockholm			Würzburg					
Collector name	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 4x1	4 352	3 145	2 071	3 578	2 487	1 558	2 450	1 631	997	2 656	1 751	1 054			
VarioSol E-antireflex 5x1	5 440	3 931	2 588	4 473	3 109	1 948	3 062	2 039	1 246	3 319	2 189	1 317			
VarioSol E-antireflex 4x1.25	5 535	4 000	2 633	4 551	3 163	1 982	3 116	2 074	1 268	3 377	2 227	1 340			
VarioSol E-antireflex 5x1.25	6 918	4 999	3 291	5 688	3 954	2 477	3 894	2 593	1 585	4 221	2 784	1 675			
VarioSol E-antireflex 4x1.5	6 717	4 854	3 196	5 523	3 839	2 405	3 781	2 518	1 539	4 099	2 703	1 626			
VarioSol E-antireflex 5x1.5	8 396	6 068	3 995	6 904	4 798	3 007	4 726	3 147	1 923	5 123	3 379	2 033			
VarioSol E-antireflex 4x2	9 082	6 563	4 321	7 468	5 190	3 252	5 113	3 404	2 080	5 542	3 655	2 199			
VarioSol E-antireflex 5x2	11 352	8 204	5 401	9 334	6 488	4 065	6 391	4 255	2 600	6 927	4 568	2 748			
VarioSol E-antireflex 4x2.5	11 447	8 272	5 446	9 412	6 542	4 099	6 444	4 290	2 622	6 985	4 607	2 771			
VarioSol E-antireflex 5x2.5	14 309	10 340	6 808	11 765	8 177	5 124	8 055	5 363	3 277	8 731	5 758	3 464			
VarioSol E-antireflex 4x3	13 812	9 982	6 571	11 357	7 893	4 946	7 775	5 177	3 164	8 428	5 558	3 344			
VarioSol E-antireflex 5x3	17 265	12 477	8 214	14 196	9 867	6 182	9 719	6 471	3 954	10 535	6 948	4 180			

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

Overview of locations

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