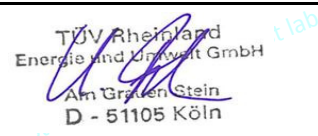


Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate					Licence Number		011-7S2227 F				
					Issued		2013-11-19				
Company holding the		Hoval AG					Country		Liechtenstein		
Brand (optional)							Website		www.hoval.com		
Street, street number		Ausstrasse 70					E-mail		info@hoval.com		
Postal Code / City, province		FL-9490	Vaduz			Tel/Fax		423 399 24 25 00/ 399 24 11			
Collector Type (flat plate glazed/un-glazed; evacuate tubular)					Flat plate collector - glazed						
Thermal / photo voltaic hybrid collector? (PVT collector)					No						
Integration in the roof possible? (manufacturers declaration)					Yes						
Power output per collector module											
G = 1000 W/m ²											
T _m -T _a											
Collector name	Aperture area (Aa)	Gross length	Gross width	Gross height	Gross area (AG)	0 K	10 K	30 K	50 K	70 K	
						W	W	W	W	W	
UltraSol vertikal	2.40	2 050	1 230	54	2.52	2 042	1 940	1 712	1 454	1 164	
UltraSol horizontal	2.40	1 230	2 050	54	2.52	2 042	1 940	1 712	1 454	1 164	
Performance test method					Glazed liquid heating collector - steady state - indoor						
Performance parameters related to aperture					η ₀	a ₁	a ₂				
Units					-	W/(m ² K)	W/(m ² K ²)				
Test results - Flow rate and fluid see note 1					0.851	4.107	0.016				
Bi-directional incidence angle		Yes									
					<i>Kθ values are obligatory for 50°.</i>						
Incidence angle modifiers Kθ(θT) transversal direction		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
		Kθ(θT)	1.00	0.98	0.96	0.92	0.89	0.86	0.75	0.37	0.00
Incidence angle modifiers Kθ(θL) longitudinal direction		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
		Kθ(θL)	1.00	0.98	0.96	0.92	0.89	0.86	0.75	0.37	0.00
Stagnation temperature - Weather conditions see note 2					T _{stg}		167 °C				
Effective thermal capacity					c _{eff} = C/Ag		7.44 kJ/(m ² K)				
Max. intended operation temperature - see note 3					T _{max,op}		190 °C				
Max. operation pressure - see note 3					p _{max,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 m ²)										
Pressure drop, ΔP	Pa										
Optional weather data		Location			Link						
Testing Laboratory		TÜV Rheinland									
Website		www.tuv.com/st									
Test report id. number		21222881_EN_ARV			Date of test report		19 November 2013				
		21222881_EN_P_ARH					19 November 2013				
During the test GDIF/GTOT was always between		0.15	and	0.46	(for IAM determination)						
Comments of testing laboratory:											
Note 1	Flow rate	0.019	kg/(s m ²)	Fluid	Water						
Note 2	Irradiance, G = 1000 W/m²; Ambient temperature, T_a=30 °C										
Note 3	Given by manufacturer										
											
					Datasheet version: 4.05, 2013-11-07						
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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S2227 F
	Issued	19.11.2013

Annual collector output kWh/module														
Collector name	Location and collector temperature (T _m)													
	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		
UltraSol vertikal	3 129	2 179	1 370	2 348	1 577	946	1 738	1 108	644	1 886	1 189	680		
UltraSol horizontal	3 129	2 179	1 370	2 348	1 577	946	1 738	1 108	644	1 886	1 189	680		

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)
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Overview of locations				
Location	Latitude °	G _{tot} kWh/m ²	T _a °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 _{tot}	Annual total irradiation on collector plane	kWh/m ²
T _a	Mean annual ambient air temperature	°C
T _m	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 (T_m). 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. 4.05 (Nov, 2013)