Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	**Certificate No.**	**SKM 9949/1**
	Date of issue	25/7/2013

Company	PAPAEMMANOUEL S.A.	**Country**		Greece
Brand (optional)		**Website**		www.papaemmanouel.gr
Street, number	1o Km Inofyta – St. Thomas, Inofyta Viotia	**E-mail**		papaemmanouel-sa@liv.f
Postal Code	32011	**Tel.**	+030	2262031931
City	Viotia	**Fax**	+030	2262032166

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

Collector name	**Aperture area (Aa)** [m²]	**Gross length** [mm]	**Gross width** [mm]	**Gross height** [mm]	**Gross area (AG)** [m²]	**Power output per collector unit** G = 1000 W/m² Tm-Ta : 0 K [W]	10 K [W]	30 K [W]	50 K [W]	70 K [W]
TER-SOL 1.50	1.38	1,480	1,010	100	1.50	1,112	1,045	898	733	552
TER-SOL 1.82	1.72	1,480	1,230	100	1.82	1,386	1,303	1,119	914	688
TER-SOL 2.00	1.86	1,980	1,010	100	2.00	1,499	1,409	1,210	988	743
TER-SOL 2.00HOR	1.86	1,010	1,980	100	2.00	1,499	1,409	1,210	988	743
TER-SOL 2.37	2.23	1,930	1,230	100	2.37	1,797	1,689	1,451	1,185	891
TER-SOL 2.37HOR	2.23	1,230	1,930	100	2.37	1,797	1,689	1,451	1,185	891
TER-SOL 2.72	2.57	2,160	1,260	100	2.72	2,071	1,946	1,672	1,366	1,027
TER-SOL 2.72HOR	2.57	1,260	2,160	100	2.72	2,071	1,946	1,672	1,366	1,027

Collector efficiency parameters related to aperture area (Aa) Note 1	η_{0a}	0.806	-
	a_{1a}	4.712	W/(m²K)
	a_{2a}	0.0156	W/(m²K²)
Stagnation temperature - Note 2	tstg	160.50	°C
Effective thermal capacity	ceff = C/Aa	10.25	kJ/(m²K)
Max. operation pressure - Note 3	pmax	1	Mpa

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°
			$K_\theta(\theta_T)$	0.882						
			$K_\theta(\theta_L)$							
G_{DIF}/G_{TOT}: min&max - while measuring					***Optional values***					

Testing Laboratory	Demokritos
Website	www.solar.demokritos.gr
Test report id. number	4126 DE1, 4127 DQ1, 4129 DE1
Date of test report	5/6/13, 23/7/13, 12/7/13
Perf. test method	EN 12975-2 6.1.4 (outdoor/außen/extérieu

Comments of testing laboratory :

Note 1	**Test conditions**	**Fluid**	Water	**Flow rate**	0.02	kg/s per m²
Note 2	**Irradiance, Gs=1000 W/m²** **Ambient temperature , Ta=30 °C**					
Note 3	**Given by manufacturer**					

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Stamp

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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Certificate No.	SKM 9949/1
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Annual collector output kWh / Jährliche Kollektor Leistung kWh / Energie annuelle produite par le capteur kWh

	Location and collector temperature (T_m)														
	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	25°C	50°C	75°C
TER-SOL 1.50	1,667	1,079	617	1,211	760	410	896	531	281	976	567	294			
TER-SOL 1.82	2,077	1,344	769	1,509	947	511	1,117	662	350	1,216	707	367			
TER-SOL 2.00	2,246	1,454	832	1,632	1,024	552	1,208	716	378	1,315	765	397			
TER-SOL 2.00HOR	2,246	1,454	832	1,632	1,024	552	1,208	716	378	1,315	765	397			
TER-SOL 2.37	2,693	1,743	997	1,956	1,228	662	1,448	859	453	1,577	917	476			
TER-SOL 2.37HOR	2,693	1,743	997	1,956	1,228	662	1,448	859	453	1,577	917	476			
TER-SOL 2.72	3,104	2,009	1,149	2,254	1,415	763	1,669	990	523	1,817	1,056	548			
TER-SOL 2.72HOR	3,104	2,009	1,149	2,254	1,415	763	1,669	990	523	1,817	1,056	548			

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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Calculation program version:
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