Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	Certificate No.	SKM 9934
	Date of issue	22.01.2014

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.forthr
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)	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]
MSFC100-1.50	1.38	1'480	1'010	100	1.50	1'141	1'083	959	826	684
MSFC100-1.82	1.70	1'480	1'230	100	1.82	1'406	1'334	1'181	1'017	842
MSFC100-2.00	1.87	1'980	1'010	100	2.00	1'546	1'467	1'300	1'119	926
MSFC100-2.37	2.24	1'930	1'230	100	2.37	1'852	1'758	1'557	1'341	1'110
MSFC100-2.72	2.58	2'160	1'260	100	2.72	2'134	2'024	1'793	1'544	1'278

Collector efficiency parameters related to aperture area (Aa) Note 1	η_{0a}	0.827	-
	a_{1a}	4.15	W/(m²K)
	a_{2a}	0.0084	W/(m²K²)
Stagnation temperature - Note 2	t_{stg}	205	°C
Effective thermal capacity	c_{eff} = C/Aa	8.0	kJ/(m²K)
Max. operation pressure - Note 3	p_{max}	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°
			$K_\theta(\theta_T)$	0.85	1.00	0.98	0.95	0.90	0.77	0.60
	0.12	0.17	$K_\theta(\theta_L)$	0.85	1.00	0.98	0.95	0.90	0.77	0.60
G_{DIF}/G_{TOT}: min&max - while measuring					***Optional values***					

Testing Laboratory	SPF, CH-8640 Rapperswil
Website	www.solarenergy.ch
Test report id. number	C1576LPEN, C1577LPEN, C1577QPEN
Date of test report	09.01.2014
Perf. test method	EN 12975-2 6.1.4 (outdoor/außen/extérieur)

Comments of testing laboratory :

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Note 1	**Test conditions**	**Fluid**	Water-Glycole	**Flow rate**	0.021	kg/s per m²	Dr. Andreas Bohren
Note 2	**Irradiance, Gs=1000 W/m²** **Ambient temperature , Ta=30 °C**						
Note 3	**Given by manufacturer**						

VERSION 3.4, 30-11-2011

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Certificate No.	SKM 9934
	Issued	22.01.2014

Annual collector output kWh / Jährliche Kollektor Leistung kWh / Energie annuelle produite par le capteur kWh

Collector name	Location and collector temperature (Tm)														
	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	25°C	50°C	75°C
MSFC100-1.50	1'688	1'170	757	1'264	863	548	933	601	368	1'010	641	385			
MSFC100-1.82	2'080	1'442	933	1'558	1'063	675	1'149	740	453	1'244	790	475			
MSFC100-2.00	2'288	1'586	1'026	1'713	1'170	743	1'264	814	499	1'369	869	522			
MSFC100-2.37	2'741	1'900	1'230	2'053	1'401	890	1'514	975	597	1'639	1'040	625			
MSFC100-2.72	3'157	2'188	1'416	2'364	1'614	1'025	1'744	1'123	688	1'888	1'198	720			

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 3.4, 30-11-2011
Calculation program version:
3.07 October 2011