




Summary of	<b>EN12976-2</b>	<b>SOLAR SYSTEM test results</b>	Licence Number	<b>SKM 10126.2</b>						
Annex to Solar KEYMARK Certificate			Issued	<b>2021-12-10</b>						
Company	PAPAEMMANOUEL S.A.		Country	Greece						
Brand (optional)			Website	www.papaemmanouel.gr						
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr						
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931						
<b>System classification</b>										
Application(s)	Hot water									
Solar loop, circulation principle	Thermosyphon									
Direct solar loop / heat exchanger	Heat exchanger									
Open, vented or closed solar loop	Closed									
Drain back/down	Always filled (no drain)									
Store location	Outdoor									
Store orientation (of main axis)	Horizontal									
Type of auxiliary heating (internal back-up heat)	Electric									
If other auxiliary/internal back-up heating, please specify:										
Solar+supplementary OR Solar-only / Solar pre-heat	Solar only / Solar preheat									
<b>Collector(s)</b>			<b>Heat store(s)</b>							
Company	PAPAEMMANOUEL S.A.		Company	PAPAEMMANOUEL S.A.						
Keymark lic.no. if available	SKM 10126.1		Keymark lic.no. if available							
Collector name	<b>Per module</b>			Store name	Total nominal volume	Gross height	Gross width	Gross depth	Auxiliary heated volume	Electrical aux. heating power
	Gross Area (A <sub>g</sub> )	Gross length	Gross width							
	m <sup>2</sup>	mm	mm							
ASL-1.50m <sup>2</sup>	1.50	1480	1011	TC21CC-120	105	1090	520	-	-	-
ASL-1.82m <sup>2</sup>	1.82	1480	1230	TC21CC-160	159	1310	520	-	-	-
ASL-2.00m <sup>2</sup>	2.00	1980	1010	TC21CC-200	192	1310	580	-	-	-
ASL-2.37m <sup>2</sup>	2.39	1935	1234	TC21CC-250	240	1530	580	-	-	-
ASL-2.72m <sup>2</sup>	2.74	2164	1266	TC21CC-300	282	1830	580	-	-	-
<b>Solar loop controller</b>					<b>Solar loop fluid</b>					
Keymark lic.no. if available					Recommended/required	Recommended				
Company					Company					
Name					Name	Antifrozen Tri-Super				
Solar loop pump - power range	- W	to	- W	Freezing point	-5 ÷ -26 °C					
<b>System family overview</b>										
Collector name	<b>Number of collectors in each configuration for each store</b>									
	<b>Store name</b>									
	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300					
ASL-1.50m <sup>2</sup>		2	2							
ASL-1.82m <sup>2</sup>	1	1	1 2					2		
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2				1 2 3		
ASL-2.37m <sup>2</sup>		1	1 2	1 2				1 2 3		
ASL-2.72m <sup>2</sup>		1	1	1 2				1 2		
Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB									
Website	www.solar.demokritos.gr									
Test report id. number	6127 DE1, 6129 DE1, 6129 F1									
Date of test report	2021-11-25									
Comments of test lab										
Comments ...										
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544599 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece										





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Brand (optional)	0		Website	www.papaemmanouel.gr				
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr				
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931				
Parameters for systems extrapolation (Annex D)								
Collector of measured system			Storage tank of measured system					
$A_{ref}$ [m <sup>2</sup> ]	2.37		Volume [l]	159				
$\eta_0$	0.770		$A_{ht}$ [m <sup>2</sup> ]	0.98				
$a_1$ [W/Km <sup>2</sup> ]	3.900		Piping					
$a_2$ [W/Km <sup>2</sup> ]	0.017		$U_{loop,p}$	0.84				
IAM (50°)	0.930							
System parameters								
Name of System Configuration	Tested/Extrapol	$A_c^*$ [m <sup>2</sup> ]	$u_c^*$ [W/Km <sup>2</sup> ]	$U_s$ [W/K]	$C_s$ [MJ/K]	$S_c$ [-]	$D_L$ [-]	$f_{aux}$ [-]
120ABL182	Extrapolated	1.25	6.96	2.23	0.486	0.15	0.03	0.00
120ABL200	Extrapolated	1.36	6.98	2.23	0.486	0.15	0.03	0.00
160ABL182	Extrapolated	1.26	6.96	2.23	0.736	0.15	0.03	0.00
160ABL200	Extrapolated	1.38	6.98	2.23	0.736	0.15	0.03	0.00
160ABL237	Tested	1.71	6.36	2.46	0.713	0.08	0.04	0.00
160ABL272	Extrapolated	1.85	6.84	2.23	0.736	0.15	0.03	0.00
160ABL300	Extrapolated	2.03	6.76	2.23	0.736	0.15	0.03	0.00
200ABL182	Extrapolated	1.27	6.93	2.61	0.889	0.15	0.03	0.00
200ABL200	Extrapolated	1.39	6.98	2.61	0.889	0.15	0.03	0.00
200ABL237	Extrapolated	1.64	6.89	2.61	0.889	0.15	0.03	0.00
200ABL272	Extrapolated	1.87	6.83	2.61	0.889	0.15	0.03	0.00
200ABL300	Extrapolated	2.05	6.75	2.61	0.889	0.15	0.03	0.00
200ABL364	Extrapolated	2.47	6.69	2.61	0.889	0.15	0.03	0.00
200ABL400	Extrapolated	2.69	6.71	2.61	0.889	0.15	0.03	0.00
200ABL474	Extrapolated	3.16	6.65	2.61	0.889	0.15	0.03	0.00
250ABL200	Extrapolated	1.39	6.98	3.03	1.111	0.15	0.03	0.00
250ABL237	Extrapolated	1.65	6.89	3.03	1.111	0.15	0.03	0.00
250ABL272	Extrapolated	1.88	6.83	3.03	1.111	0.15	0.03	0.00
250ABL300	Extrapolated	2.07	6.74	3.03	1.111	0.15	0.03	0.00
250ABL400	Extrapolated	2.72	6.69	3.03	1.111	0.15	0.03	0.00
250ABL474	Extrapolated	3.19	6.66	3.03	1.111	0.15	0.03	0.00
250ABL544	Extrapolated	3.63	6.62	3.03	1.111	0.15	0.03	0.00
300ABL200	Extrapolated	1.40	7.02	3.56	1.306	0.15	0.03	0.00
300ABL237	Extrapolated	1.65	6.93	3.56	1.306	0.15	0.03	0.00
300ABL272	Extrapolated	1.89	6.86	3.56	1.306	0.15	0.03	0.00
300ABL300	Extrapolated	2.08	6.72	3.56	1.306	0.15	0.03	0.00
300ABL364	Extrapolated	2.50	6.69	3.56	1.306	0.15	0.03	0.00
300ABL400	Extrapolated	2.74	6.69	3.56	1.306	0.15	0.03	0.00
300ABL474	Extrapolated	3.22	6.65	3.56	1.306	0.15	0.03	0.00
300ABL544	Extrapolated	3.67	6.63	3.56	1.306	0.15	0.03	0.00
300ABL600	Extrapolated	4.02	6.62	3.56	1.306	0.15	0.03	0.00
300ABL711	Extrapolated	4.70	6.61	3.56	1.306	0.15	0.03	0.00
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Website	www.solar.demokritos.gr							
Test report id. number	6127 DE1, 6129 DE1, 6129 F1							
Date of test report	2021-11-25							
Test method	ISO 9459-5 (DST)							
Comments of test lab	<p>N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6644592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece</p> 							

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of  $\pm 5\%$  to  $\pm 15\%$ 

Version 4.5, 2017-10-24





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Brand (optional)	0		Website	www.papaemmanouel.gr									
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr									
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931									
<b>System family overview</b>													
	For each storage and collector size, give number of collectors												
Collector name	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
Name of system configuration			120ABL182										
Collector name	ASL-1.82m <sup>2</sup>	No. Collectors	1	Storage name	TC21CC-120								
<b>Calculated annual results for "solar-only / preheat system"</b>													
Location	Q <sub>d,sh</sub> MJ/y	Daily drawoff 80 l		Daily drawoff 110 l		Daily drawoff 140 l							
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %				
		4478	2529	-	56	6150	3185	-	52	7821	3532	-	45
Stockholm SE	-	4478	2529	-	56	6150	3185	-	52	7821	3532	-	45
Würzburg DE	-	4289	2526	-	59	5897	3217	-	55	7506	3658	-	49
Davos CH	-	4857	3753	-	77	6654	4667	-	70	8483	5172	-	61
Athens GR	-	3343	2964	-	89	4573	3847	-	84	5834	4541	-	78
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		250	kPa	Max. operating press. - tank side		1000	kPa						
Testing Laboratory		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
Website		www.solar.demokritos.gr											
Test report id. number		6127 DE1, 6129 DE1, 6129 F1											
Date of test report		2021-11-25											
Test method		ISO 9459-5 (DST)											
Comments of test lab		system performance extrapolation											
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece											

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<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10											
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece											
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<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931											
<b>System family overview</b>															
<b>Collector name</b>	<b>For each storage and collector size, give number of collectors</b>														
	TC21CC-120			TC21CC-160			TC21CC-200			TC21CC-250			TC21CC-300		
ASL-1.50m <sup>2</sup>				2			2			2			2		
ASL-1.82m <sup>2</sup>	1			1			1	2					2		
ASL-2.00m <sup>2</sup>	1			1			1	2		1	2		1	2	3
ASL-2.37m <sup>2</sup>				1			1	2		1	2		1	2	3
ASL-2.72m <sup>2</sup>				1			1			1	2		1	2	
<b>Name of system configuration</b>															
			120ABL200												
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	1			<b>Storage name</b>	TC21CC-120								
<b>Calculated annual results for "solar-only / preheat system"</b>															
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 80 l				Daily drawoff 110 l				Daily drawoff 140 l					
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %		
Stockholm SE	-	4478	2605	-	58	6150	3280	-	53	7821	3690	-	47		
Würzburg DE	-	4289	2589	-	60	5897	3311	-	56	7506	3816	-	51		
Davos CH	-	4857	3879	-	80	6654	4857	-	73	8483	5456	-	64		
Athens GR	-	3343	3009	-	90	4573	3942	-	86	5834	4667	-	80		
<b>Perf. indicators for the table above</b>															
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system													
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water													
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system													
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)													
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction													
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR										
	G	1,157	1,230	1,684	1,736										
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5										
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8										
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4										
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°													
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature													
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.													
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>													
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).													
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa								
<b>Testing Laboratory</b>	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB														
<b>Website</b>	www.solar.demokritos.gr														
<b>Test report id. number</b>	6127 DE1, 6129 DE1, 6129 F1														
<b>Date of test report</b>	2021-11-25														
<b>Test method</b>	ISO 9459-5 (DST)														
<b>Comments of test lab</b>					<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6504593 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece										
system performance extrapolation															

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





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<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			160ABL182										
<b>Collector name</b>	ASL-1.82m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-160								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 140 l				Daily drawoff 170 l				Daily drawoff 200 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	7821	3690	-	47	9492	4037	-	43	11164	4226	-	38
Würzburg DE	-	7506	3816	-	51	9114	4226	-	46	10691	4478	-	42
Davos CH	-	8483	5393	-	64	10281	5834	-	57	12110	6055	-	50
Athens GR	-	5834	4667	-	80	7064	5330	-	75	8326	5803	-	70
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
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Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
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<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
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<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece													

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<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1		1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			160ABL200										
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-160								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 140 l				Daily drawoff 170 l				Daily drawoff 200 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	7821	3879	-	50	9492	4289	-	45	11164	4510	-	40
Würzburg DE	-	7506	3974	-	53	9114	4447	-	49	10691	4730	-	44
Davos CH	-	8483	5708	-	67	10281	6244	-	61	12110	6496	-	54
Athens GR	-	5834	4825	-	83	7064	5519	-	78	8326	6055	-	73
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 80037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





Summary of	EN12976-2	test results	Certification No.	SKM 10126.2									
Annex to Solar KEYMARK Certificate			Issued	2021-12-10									
Company	PAPAEMMANOUEL S.A.		Country	Greece									
Brand (optional)	0		Website	www.papaemmanouel.gr									
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr									
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931									
<b>System family overview</b>													
For each storage and collector size, give number of collectors													
Collector name	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
Name of system configuration			160ABL237										
Collector name	ASL-2.37m <sup>2</sup>	No. Collectors	1	Storage name	TC21CC-160								
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh MJ/y	Daily drawoff 140 l				Daily drawoff 170 l				Daily drawoff 200 l			
		Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %
Stockholm SE	-	7821	4194	-	54	9492	4699	-	50	11164	5014	-	45
Würzburg DE	-	7506	4257	-	57	9114	4825	-	53	10691	5235	-	49
Davos CH	-	8483	6244	-	74	10281	6969	-	68	12110	7379	-	61
Athens GR	-	5834	5046	-	87	7064	5834	-	83	8326	6496	-	78
Perf. indicators for the table above													
Qd,sh	MJ/y	Not relevant for solar domestic hot water system											
Qd	MJ/y	Annual heat demand for domestic hot water											
QL	MJ/y	Annual heat energy delivered by the solar system											
Qpar	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔTc	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔTc	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		250	kPa	Max. operating press. - tank side		1000	kPa						
Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
Website	www.solar.demokritos.gr												
Test report id. number	6127 DE1, 6129 DE1, 6129 F1												
Date of test report	2021-11-25												
Test method	ISO 9459-5 (DST)												
Comments of test lab													
Tested													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544582 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1		1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			160ABL272										
<b>Collector name</b>	ASL-2.72m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-160								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 140 l				Daily drawoff 170 l				Daily drawoff 200 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	7821	4384	-	56	9492	4951	-	52	11164	5361	-	48
Würzburg DE	-	7506	4415	-	59	9114	5046	-	55	10691	5519	-	52
Davos CH	-	8483	6559	-	77	10281	7379	-	72	12110	7916	-	65
Athens GR	-	5834	5172	-	89	7064	6023	-	85	8326	6749	-	81
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation										<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece			

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>											
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	<b>2021-12-10</b>											
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece											
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr											
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr											
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931											
<b>System family overview</b>															
<b>Collector name</b>	<b>For each storage and collector size, give number of collectors</b>														
	TC21CC-120		TC21CC-160		TC21CC-200		TC21CC-250		TC21CC-300						
ASL-1.50m <sup>2</sup>						2			2				2		
ASL-1.82m <sup>2</sup>	1			1			1	2						2	
ASL-2.00m <sup>2</sup>	1			1			1	2					1	2	3
ASL-2.37m <sup>2</sup>				1			1	2					1	2	3
ASL-2.72m <sup>2</sup>				1			1						1	2	
<b>Name of system configuration</b>					160ABL300										
<b>Collector name</b>	ASL-1.50m <sup>2</sup>	<b>No. Collectors</b>	2		<b>Storage name</b>	TC21CC-160									
<b>Calculated annual results for "solar-only / preheat system"</b>															
<b>Location</b>	Q <sub>d,sh</sub>	Daily drawoff 140 l				Daily drawoff 170 l				Daily drawoff 200 l					
		Q <sub>d,hw</sub>	Q <sub>L</sub>	Q <sub>par</sub>	f <sub>sol</sub>	Q <sub>d,hw</sub>	Q <sub>L</sub>	Q <sub>par</sub>	f <sub>sol</sub>	Q <sub>d,hw</sub>	Q <sub>L</sub>	Q <sub>par</sub>	f <sub>sol</sub>		
	MJ/y	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%		
Stockholm SE	-	7821	4541	-	58	9492	5172	-	54	11164	5613	-	50		
Würzburg DE	-	7506	4541	-	61	9114	5235	-	57	10691	5740	-	54		
Davos CH	-	8483	6812	-	80	10281	7726	-	75	12110	8326	-	69		
Athens GR	-	5834	5267	-	90	7064	6150	-	87	8326	6938	-	83		
<b>Perf. indicators for the table above</b>															
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system													
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water													
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system													
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)													
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction													
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR										
	G	1,157	1,230	1,684	1,736										
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5										
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8										
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4										
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°													
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature													
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.													
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>													
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).													
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa								
<b>Testing Laboratory</b>	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB														
<b>Website</b>	www.solar.demokritos.gr														
<b>Test report id. number</b>	6127 DE1, 6129 DE1, 6129 F1														
<b>Date of test report</b>	2021-11-25														
<b>Test method</b>	ISO 9459-5 (DST)														
<b>Comments of test lab</b>															
system performance extrapolation															
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece															

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	<b>2021-12-10</b>									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			200ABL182										
<b>Collector name</b>	ASL-1.82m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-200								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	9492	4005	-	42	11164	4289	-	38	13939	4478	-	32
Würzburg DE	-	9114	4194	-	46	10691	4510	-	42	13371	4762	-	36
Davos CH	-	10281	5771	-	56	12110	6086	-	50	15137	6339	-	42
Athens GR	-	7064	5298	-	75	8326	5866	-	70	10407	6465	-	62
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation												<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6504580 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece	

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	<b>2021-12-10</b>									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			200ABL200										
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-200								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	9492	4257	-	45	11164	4573	-	41	13939	4793	-	34
Würzburg DE	-	9114	4415	-	48	10691	4793	-	45	13371	5109	-	38
Davos CH	-	10281	6150	-	60	12110	6559	-	54	15137	6812	-	45
Athens GR	-	7064	5487	-	78	8326	6118	-	73	10407	6812	-	65
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>		system performance extrapolation											
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544590 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece											

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	<b>2021-12-10</b>									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			200ABL237										
<b>Collector name</b>	ASL-2.37m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-200								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	9492	4667	-	49	11164	5077	-	45	13939	5424	-	39
Würzburg DE	-	9114	4793	-	53	10691	5267	-	49	13371	5740	-	43
Davos CH	-	10281	6875	-	67	12110	7411	-	61	15137	7789	-	51
Athens GR	-	7064	5834	-	83	8326	6528	-	78	10407	7379	-	71
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			200ABL272										
<b>Collector name</b>	ASL-2.72m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-200								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	9492	4983	-	52	11164	5456	-	49	13939	5929	-	43
Würzburg DE	-	9114	5077	-	56	10691	5613	-	53	13371	6213	-	46
Davos CH	-	10281	7379	-	72	12110	8042	-	66	15137	8609	-	57
Athens GR	-	7064	6055	-	86	8326	6812	-	82	10407	7821	-	75
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>		system performance extrapolation											
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6844500 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece											

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>										
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10										
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece										
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr										
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr										
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931										
<b>System family overview</b>														
<b>For each storage and collector size, give number of collectors</b>														
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300									
ASL-1.50m <sup>2</sup>		2	2	2	2									
ASL-1.82m <sup>2</sup>	1	1	1 2		2									
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3									
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3									
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2									
<b>Name of system configuration</b>														
			200ABL300											
<b>Collector name</b>	ASL-1.50m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-200									
<b>Calculated annual results for "solar-only / preheat system"</b>														
<b>Location</b>	<b>Qd,sh</b>	<b>Daily drawoff 170</b>				<b>Daily drawoff 200</b>				<b>Daily drawoff 250</b>				
		<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>f<sub>sol</sub></b>	<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>f<sub>sol</sub></b>	<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>f<sub>sol</sub></b>	
	MI/y	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	%
Stockholm SE	-	9492	5172	-	54	11164	5708	-	51	13939	6276	-	45	
Würzburg DE	-	9114	5235	-	57	10691	5834	-	55	13371	6528	-	49	
Davos CH	-	10281	7726	-	75	12110	8483	-	70	15137	9209	-	61	
Athens GR	-	7064	6181	-	88	8326	7001	-	84	10407	8105	-	78	
<b>Perf. indicators for the table above</b>														
Qd,sh	MI/y	Not relevant for solar domestic hot water system												
Qd	MI/y	Annual heat demand for domestic hot water												
QL	MI/y	Annual heat energy delivered by the solar system												
Qpar	MI/y	Annual parasitic energy: (electricity for pumps/controllers)												
f <sub>sol</sub> =Q <sub>l</sub> /Q <sub>d</sub>	-	Solar fraction												
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR									
	G	1,157	1,230	1,684	1,736									
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5									
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8									
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4									
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°												
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature												
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.												
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>												
Th	45 °C	Desired hot water temperature (mixing valve temperature).												
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa							
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
<b>Website</b>		www.solar.demokritos.gr												
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1												
<b>Date of test report</b>		2021-11-25												
<b>Test method</b>		ISO 9459-5 (DST)												
<b>Comments of test lab</b>														
system performance extrapolation												<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544582 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece		

All values are subject to some uncertainty, e.g. the uncertainty on system output is typically in the range of ± 5 % to ± 15 %

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			200ABL364										
<b>Collector name</b>	ASL-1.82m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-200								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	<b>Qd,sh</b>	<b>Daily drawoff 170 l</b>				<b>Daily drawoff 200 l</b>				<b>Daily drawoff 250 l</b>			
		<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>f<sub>sol</sub></b>	<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>f<sub>sol</sub></b>	<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>f<sub>sol</sub></b>
	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	%	
Stockholm SE	-	9492	5550	-	58	11164	6181	-	55	13939	6906	-	50
Würzburg DE	-	9114	5550	-	61	10691	6244	-	58	13371	7096	-	53
Davos CH	-	10281	8294	-	81	12110	9240	-	76	15137	10249	-	68
Athens GR	-	7064	6402	-	91	8326	7316	-	88	10407	8578	-	82
<b>Perf. indicators for the table above</b>													
Qd,sh	MI/y	Not relevant for solar domestic hot water system											
Qd	MI/y	Annual heat demand for domestic hot water											
QL	MI/y	Annual heat energy delivered by the solar system											
Qpar	MI/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>l</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
<b>Website</b>	www.solar.demokritos.gr												
<b>Test report id. number</b>	6127 DE1, 6129 DE1, 6129 F1												
<b>Date of test report</b>	2021-11-25												
<b>Test method</b>	ISO 9459-5 (DST)												
<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544581 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty, e.g. the uncertainty on system output is typically in the range of ± 5 % to ± 15 %

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			200ABL400										
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-200								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	9492	5708	-	60	11164	6370	-	57	13939	7190	-	52
Würzburg DE	-	9114	5676	-	62	10691	6402	-	60	13371	7348	-	55
Davos CH	-	10281	8515	-	83	12110	9555	-	79	15137	10722	-	71
Athens GR	-	7064	6496	-	92	8326	7442	-	89	10407	8767	-	84
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation										<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece			

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





Summary of	EN12976-2	test results	Certification No.	SKM 10126.2									
Annex to Solar KEYMARK Certificate			Issued	2021-12-10									
Company	PAPAEMMANOUEL S.A.		Country	Greece									
Brand (optional)	0		Website	www.papaemmanouel.gr									
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr									
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931									
<b>System family overview</b>													
For each storage and collector size, give number of collectors													
Collector name	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
Name of system configuration					200ABL474								
Collector name	ASL-2.37m <sup>2</sup>	No. Collectors	2	Storage name	TC21CC-200								
Calculated annual results for "solar-only / preheat system"													
Location	Q <sub>d,sh</sub>	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 l			
		Q <sub>d,hw</sub>	Q <sub>L</sub>	Q <sub>par</sub>	f <sub>sol</sub>	Q <sub>d,hw</sub>	Q <sub>L</sub>	Q <sub>par</sub>	f <sub>sol</sub>	Q <sub>d,hw</sub>	Q <sub>L</sub>	Q <sub>par</sub>	f <sub>sol</sub>
	MJ/y	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%
Stockholm SE	-	9492	5960	-	63	11164	6717	-	60	13939	7663	-	55
Würzburg DE	-	9114	5897	-	65	10691	6686	-	63	13371	7758	-	58
Davos CH	-	10281	8893	-	87	12110	10028	-	83	15137	11479	-	76
Athens GR	-	7064	6654	-	94	8326	7632	-	92	10407	9082	-	87
Perf. indicators for the table above													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		250	kPa	Max. operating press. - tank side		1000	kPa						
Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
Website	www.solar.demokritos.gr												
Test report id. number	6127 DE1, 6129 DE1, 6129 F1												
Date of test report	2021-11-25												
Test method	ISO 9459-5 (DST)												
Comments of test lab		system performance extrapolation											
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece											

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>					250ABL200								
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-250								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	<b>Qd,sh</b>	<b>Daily drawoff 200</b>				<b>Daily drawoff 250</b>				<b>Daily drawoff 300</b>			
		<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>fsol</b>	<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>fsol</b>	<b>Qd,hw</b>	<b>QL</b>	<b>Qpar</b>	<b>fsol</b>
	MI/y	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	%
Stockholm SE	-	11164	4510	-	40	13939	4888	-	35	16746	5046	-	30
Würzburg DE	-	10691	4730	-	44	13371	5172	-	39	16052	5361	-	33
Davos CH	-	12110	6433	-	53	15137	6906	-	46	18165	7096	-	39
Athens GR	-	8326	6055	-	73	10407	6906	-	66	12488	7442	-	60
<b>Perf. indicators for the table above</b>													
Qd,sh	MI/y	Not relevant for solar domestic hot water system											
Qd	MI/y	Annual heat demand for domestic hot water											
QL	MI/y	Annual heat energy delivered by the solar system											
Qpar	MI/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>l</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
<b>Website</b>	www.solar.demokritos.gr												
<b>Test report id. number</b>	6127 DE1, 6129 DE1, 6129 F1												
<b>Date of test report</b>	2021-11-25												
<b>Test method</b>	ISO 9459-5 (DST)												
<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544500 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty, e.g. the uncertainty on system output is typically in the range of ± 5 % to ± 15 %

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>					250ABL237								
<b>Collector name</b>	ASL-2.37m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-250								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	11164	5046	-	45	13939	5550	-	40	16746	5771	-	34
Würzburg DE	-	10691	5235	-	49	13371	5834	-	44	16052	6118	-	38
Davos CH	-	12110	7316	-	60	15137	7916	-	52	18165	8199	-	45
Athens GR	-	8326	6496	-	78	10407	7506	-	72	12488	8168	-	65
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6504590 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			250ABL272										
<b>Collector name</b>	ASL-2.72m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-250								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Qd,sh MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l			
		Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %
Stockholm SE	-	11164	5456	-	49	13939	6086	-	44	16746	6370	-	38
Würzburg DE	-	10691	5582	-	52	13371	6339	-	47	16052	6749	-	42
Davos CH	-	12110	8010	-	66	15137	8799	-	58	18165	9145	-	50
Athens GR	-	8326	6812	-	82	10407	7947	-	76	12488	8767	-	70
<b>Perf. indicators for the table above</b>													
Qd,sh	MJ/y	Not relevant for solar domestic hot water system											
Qd	MJ/y	Annual heat demand for domestic hot water											
QL	MJ/y	Annual heat energy delivered by the solar system											
Qpar	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔTc	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔTc	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation												<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece	

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			250ABL300										
<b>Collector name</b>	ASL-1.50m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-250								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	11164	5740	-	51	13939	6433	-	46	16746	6843	-	41
Würzburg DE	-	10691	5834	-	55	13371	6654	-	50	16052	7190	-	45
Davos CH	-	12110	8452	-	70	15137	9429	-	62	18165	9871	-	54
Athens GR	-	8326	7001	-	84	10407	8231	-	79	12488	9145	-	73
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>		system performance extrapolation											
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 8503815 - Fax: +210 8544582 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece											

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Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>					250ABL400								
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-250								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	11164	6402	-	57	13939	7379	-	53	16746	8042	-	48
Würzburg DE	-	10691	6433	-	60	13371	7506	-	56	16052	8294	-	52
Davos CH	-	12110	9587	-	79	15137	11006	-	73	18165	11889	-	65
Athens GR	-	8326	7474	-	90	10407	8925	-	86	12488	10123	-	81
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 80037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	<b>2021-12-10</b>									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			25OABL474										
<b>Collector name</b>	ASL-2.37m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-250								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Qd,sh MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l			
		Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %
Stockholm SE	-	11164	6749	-	60	13939	7884	-	57	16746	8672	-	52
Würzburg DE	-	10691	6717	-	63	13371	7916	-	59	16052	8862	-	55
Davos CH	-	12110	10092	-	83	15137	11763	-	78	18165	12930	-	71
Athens GR	-	8326	7695	-	92	10407	9240	-	89	12488	10565	-	85
<b>Perf. indicators for the table above</b>													
Qd,sh	MJ/y	Not relevant for solar domestic hot water system											
Qd	MJ/y	Annual heat demand for domestic hot water											
QL	MJ/y	Annual heat energy delivered by the solar system											
Qpar	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔTc	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔTc	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation													
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>					25OABL544								
<b>Collector name</b>	ASL-2.72m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-250								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	11164	7001	-	63	13939	8231	-	59	16746	9145	-	55
Würzburg DE	-	10691	6969	-	65	13371	8199	-	61	16052	9272	-	58
Davos CH	-	12110	10470	-	86	15137	12299	-	81	18165	13687	-	75
Athens GR	-	8326	7821	-	94	10407	9461	-	91	12488	10880	-	87
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>		system performance extrapolation											
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece											

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>										
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10										
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece										
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr										
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr										
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931										
<b>System family overview</b>														
<b>For each storage and collector size, give number of collectors</b>														
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300									
ASL-1.50m <sup>2</sup>		2	2	2	2									
ASL-1.82m <sup>2</sup>	1	1	1 2		2									
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3									
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3									
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2									
<b>Name of system configuration</b>														
			300ABL200											
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	1	<b>Storage name</b>	TC21CC-300									
<b>Calculated annual results for "solar-only / preheat system"</b>														
<b>Location</b>	<b>Q<sub>d,sh</sub></b>	<b>Daily drawoff 250 l</b>				<b>Daily drawoff 300 l</b>				<b>Daily drawoff 400 l</b>				
		<b>Q<sub>d,hw</sub></b>	<b>Q<sub>L</sub></b>	<b>Q<sub>par</sub></b>	<b>f<sub>sol</sub></b>	<b>Q<sub>d,hw</sub></b>	<b>Q<sub>L</sub></b>	<b>Q<sub>par</sub></b>	<b>f<sub>sol</sub></b>	<b>Q<sub>d,hw</sub></b>	<b>Q<sub>L</sub></b>	<b>Q<sub>par</sub></b>	<b>f<sub>sol</sub></b>	
	MI/y	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	MI/y	%	MI/y	MI/y	MI/y	%
Stockholm SE	-	13939	4825	-	35	16746	5077	-	30	22327	5267	-	24	
Würzburg DE	-	13371	5109	-	38	16052	5393	-	34	21413	5582	-	26	
Davos CH	-	15137	6780	-	45	18165	7127	-	39	24220	7316	-	30	
Athens GR	-	10407	6843	-	66	12488	7474	-	60	16651	7947	-	48	
<b>Perf. indicators for the table above</b>														
Q <sub>d,sh</sub>	MI/y	Not relevant for solar domestic hot water system												
Q <sub>d</sub>	MI/y	Annual heat demand for domestic hot water												
Q <sub>L</sub>	MI/y	Annual heat energy delivered by the solar system												
Q <sub>par</sub>	MI/y	Annual parasitic energy: (electricity for pumps/controllers)												
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction												
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR									
	G	1,157	1,230	1,684	1,736									
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5									
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8									
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4									
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°												
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature												
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.												
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>												
Th	45 °C	Desired hot water temperature (mixing valve temperature).												
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa							
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
<b>Website</b>		www.solar.demokritos.gr												
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1												
<b>Date of test report</b>		2021-11-25												
<b>Test method</b>		ISO 9459-5 (DST)												
<b>Comments of test lab</b>														
system performance extrapolation														
<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece														

All values are subject to some uncertainty, e.g. the uncertainty on system output is typically in the range of ± 5 % to ± 15 %

Version 4.5, 2017-10-24





Summary of	EN12976-2	test results	Certification No.	SKM 10126.2									
Annex to Solar KEYMARK Certificate			Issued	2021-12-10									
Company	PAPAEMMANOUEL S.A.		Country	Greece									
Brand (optional)	0		Website	www.papaemmanouel.gr									
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr									
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931									
<b>System family overview</b>													
For each storage and collector size, give number of collectors													
Collector name	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
Name of system configuration					300ABL237								
Collector name	ASL-2.37m <sup>2</sup>	No. Collectors	1	Storage name	TC21CC-300								
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
		Qd,hw	QL	Qpar	fsol	Qd,hw	QL	Qpar	fsol	Qd,hw	QL	Qpar	fsol
	MJ/y	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%
Stockholm SE	-	13939	5487	-	39	16746	5803	-	35	22327	6055	-	27
Würzburg DE	-	13371	5771	-	43	16052	6181	-	39	21413	6402	-	30
Davos CH	-	15137	7789	-	51	18165	8231	-	45	24220	8483	-	35
Athens GR	-	10407	7442	-	72	12488	8231	-	66	16651	9051	-	54
Perf. indicators for the table above													
Qd,sh	MJ/y	Not relevant for solar domestic hot water system											
Qd	MJ/y	Annual heat demand for domestic hot water											
QL	MJ/y	Annual heat energy delivered by the solar system											
Qpar	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =QL/Qd	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔTc	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔTc	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		250	kPa	Max. operating press. - tank side		1000	kPa						
Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
Website	www.solar.demokritos.gr												
Test report id. number	6127 DE1, 6129 DE1, 6129 F1												
Date of test report	2021-11-25												
Test method	ISO 9459-5 (DST)												
Comments of test lab						N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544582 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece							
system performance extrapolation													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





Summary of	EN12976-2	test results	Certification No.	SKM 10126.2									
Annex to Solar KEYMARK Certificate			Issued	2021-12-10									
Company	PAPAEMMANOUEL S.A.		Country	Greece									
Brand (optional)	0		Website	www.papaemmanouel.gr									
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr									
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931									
<b>System family overview</b>													
For each storage and collector size, give number of collectors													
Collector name	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
Name of system configuration					300ABL272								
Collector name	ASL-2.72m <sup>2</sup>	No. Collectors	1	Storage name	TC21CC-300								
Calculated annual results for "solar-only / preheat system"													
Location	Q <sub>d,sh</sub> MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	13939	6023	-	43	16746	6433	-	38	22327	6749	-	30
Würzburg DE	-	13371	6276	-	47	16052	6812	-	42	21413	7159	-	33
Davos CH	-	15137	8672	-	57	18165	9209	-	51	24220	9524	-	39
Athens GR	-	10407	7916	-	76	12488	8799	-	70	16651	9902	-	59
Perf. indicators for the table above													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		250	kPa	Max. operating press. - tank side		1000	kPa						
Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
Website	www.solar.demokritos.gr												
Test report id. number	6127 DE1, 6129 DE1, 6129 F1												
Date of test report	2021-11-25												
Test method	ISO 9459-5 (DST)												
Comments of test lab						<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece							
system performance extrapolation													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>										
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10										
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece										
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr										
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr										
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931										
<b>System family overview</b>														
<b>For each storage and collector size, give number of collectors</b>														
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300									
ASL-1.50m <sup>2</sup>		2	2	2	2									
ASL-1.82m <sup>2</sup>	1	1	1 2		2									
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3									
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3									
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2									
<b>Name of system configuration</b>														
			300ABL300											
<b>Collector name</b>	ASL-1.50m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-300									
<b>Calculated annual results for "solar-only / preheat system"</b>														
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l				
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	
Stockholm SE	-	13939	6433	-	46	16746	6906	-	41	22327	7316	-	33	
Würzburg DE	-	13371	6623	-	50	16052	7253	-	45	21413	7758	-	36	
Davos CH	-	15137	9335	-	62	18165	9965	-	55	24220	10344	-	43	
Athens GR	-	10407	8199	-	79	12488	9240	-	74	16651	10470	-	63	
<b>Perf. indicators for the table above</b>														
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system												
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water												
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system												
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)												
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction												
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR									
	G	1,157	1,230	1,684	1,736									
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5									
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8									
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4									
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°												
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature												
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.												
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>												
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).												
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa							
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
<b>Website</b>		www.solar.demokritos.gr												
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1												
<b>Date of test report</b>		2021-11-25												
<b>Test method</b>		ISO 9459-5 (DST)												
<b>Comments of test lab</b>		system performance extrapolation												
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544590 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece												

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			300ABL364										
<b>Collector name</b>	ASL-1.82m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-300								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	13939	7096	-	51	16746	7789	-	47	22327	8420	-	38
Würzburg DE	-	13371	7253	-	54	16052	8042	-	50	21413	8862	-	41
Davos CH	-	15137	10470	-	69	18165	11384	-	63	24220	12047	-	50
Athens GR	-	10407	8704	-	84	12488	9902	-	79	16651	11542	-	69
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation										<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece			

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





Summary of	EN12976-2	test results	Certification No.	SKM 10126.2									
Annex to Solar KEYMARK Certificate			Issued	2021-12-10									
Company	PAPAEMMANOUEL S.A.		Country	Greece									
Brand (optional)	0		Website	www.papaemmanouel.gr									
Street	1o Km Inofyta – St. Thomas, Inofyta Viotia		E-mail	exports@papaemmanouel.gr									
Postal Code	32011	Viotia	Tel. / Fax	+30 22620 31931									
<b>System family overview</b>													
For each storage and collector size, give number of collectors													
Collector name	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
Name of system configuration			300ABL400										
Collector name	ASL-2.00m <sup>2</sup>	No. Collectors	2	Storage name	TC21CC-300								
Calculated annual results for "solar-only / preheat system"													
Location	Q <sub>d,sh</sub> MJ/y	Daily drawoff 250 l			Daily drawoff 300 l			Daily drawoff 400 l					
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	13939	7379	-	53	16746	8168	-	49	22327	8956	-	40
Würzburg DE	-	13371	7506	-	56	16052	8389	-	52	21413	9398	-	44
Davos CH	-	15137	10975	-	73	18165	12047	-	66	24220	12898	-	53
Athens GR	-	10407	8925	-	86	12488	10218	-	82	16651	12015	-	72
Perf. indicators for the table above													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		250	kPa	Max. operating press. - tank side		1000	kPa						
Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
Website	www.solar.demokritos.gr												
Test report id. number	6127 DE1, 6129 DE1, 6129 F1												
Date of test report	2021-11-25												
Test method	ISO 9459-5 (DST)												
Comments of test lab						<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece							
system performance extrapolation													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5 % to ± 15 %

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>					300ABL474								
<b>Collector name</b>	ASL-2.37m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-300								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	13939	7884	-	57	16746	8799	-	53	22327	9902	-	44
Würzburg DE	-	13371	7916	-	59	16052	8988	-	56	21413	10312	-	48
Davos CH	-	15137	11763	-	78	18165	13119	-	72	24220	14475	-	60
Athens GR	-	10407	9272	-	89	12488	10659	-	85	16651	12804	-	77
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
<b>Website</b>	www.solar.demokritos.gr												
<b>Test report id. number</b>	6127 DE1, 6129 DE1, 6129 F1												
<b>Date of test report</b>	2021-11-25												
<b>Test method</b>	ISO 9459-5 (DST)												
<b>Comments of test lab</b>						N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544580 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece							
system performance extrapolation													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>													
			300ABL544										
<b>Collector name</b>	ASL-2.37m <sup>2</sup>	<b>No. Collectors</b>	2	<b>Storage name</b>	TC21CC-300								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Qd,sh MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
		Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %	Qd,hw MJ/y	QL MJ/y	Qpar MJ/y	fsol %
Stockholm SE	-	13939	8231	-	59	16746	9272	-	55	22327	10628	-	48
WürzburgDE	-	13371	8231	-	62	16052	9366	-	58	21413	10943	-	51
Davos CH	-	15137	12331	-	81	18165	13876	-	76	24220	15642	-	65
Athens GR	-	10407	9492	-	91	12488	10975	-	88	16651	13371	-	80
<b>Perf. indicators for the table above</b>													
Qd,sh	MJ/y	Not relevant for solar domestic hot water system											
Qd	MJ/y	Annual heat demand for domestic hot water											
QL	MJ/y	Annual heat energy delivered by the solar system											
Qpar	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔTc	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔTc	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>													
system performance extrapolation										<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece			

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>					300ABL600								
<b>Collector name</b>	ASL-2.00m <sup>2</sup>	<b>No. Collectors</b>	3	<b>Storage name</b>	TC21CC-300								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	13939	8483	-	61	16746	9587	-	57	22327	11101	-	50
Würzburg DE	-	13371	8452	-	63	16052	9618	-	60	21413	11384	-	53
Davos CH	-	15137	12677	-	84	18165	14380	-	79	24220	16430	-	68
Athens GR	-	10407	9618	-	92	12488	11195	-	90	16651	13718	-	82
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
<b>Website</b>		www.solar.demokritos.gr											
<b>Test report id. number</b>		6127 DE1, 6129 DE1, 6129 F1											
<b>Date of test report</b>		2021-11-25											
<b>Test method</b>		ISO 9459-5 (DST)											
<b>Comments of test lab</b>		system performance extrapolation											
		<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6844580 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece											

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24





<b>Summary of</b>	<b>EN12976-2</b>	<b>test results</b>	<b>Certification No.</b>	<b>SKM 10126.2</b>									
<b>Annex to Solar KEYMARK Certificate</b>			<b>Issued</b>	2021-12-10									
<b>Company</b>	PAPAEMMANOUEL S.A.		<b>Country</b>	Greece									
<b>Brand (optional)</b>	0		<b>Website</b>	www.papaemmanouel.gr									
<b>Street</b>	1o Km Inofyta – St. Thomas, Inofyta Viotia		<b>E-mail</b>	exports@papaemmanouel.gr									
<b>Postal Code</b>	32011	Viotia	<b>Tel. / Fax</b>	+30 22620 31931									
<b>System family overview</b>													
<b>For each storage and collector size, give number of collectors</b>													
<b>Collector name</b>	TC21CC-120	TC21CC-160	TC21CC-200	TC21CC-250	TC21CC-300								
ASL-1.50m <sup>2</sup>		2	2	2	2								
ASL-1.82m <sup>2</sup>	1	1	1 2		2								
ASL-2.00m <sup>2</sup>	1	1	1 2	1 2	1 2 3								
ASL-2.37m <sup>2</sup>		1	1 2	1 2	1 2 3								
ASL-2.72m <sup>2</sup>		1	1	1 2	1 2								
<b>Name of system configuration</b>					300ABL711								
<b>Collector name</b>	ASL-2.37m <sup>2</sup>	<b>No. Collectors</b>	3	<b>Storage name</b>	TC21CC-300								
<b>Calculated annual results for "solar-only / preheat system"</b>													
<b>Location</b>	Q <sub>d,sh</sub> MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
		Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %	Q <sub>d,hw</sub> MJ/y	Q <sub>L</sub> MJ/y	Q <sub>par</sub> MJ/y	f <sub>sol</sub> %
Stockholm SE	-	13939	8830	-	63	16746	10060	-	60	22327	11858	-	53
Würzburg DE	-	13371	8767	-	66	16052	10028	-	62	21413	12047	-	56
Davos CH	-	15137	13182	-	87	18165	15074	-	83	24220	17692	-	73
Athens GR	-	10407	9839	-	95	12488	11479	-	92	16651	14254	-	86
<b>Perf. indicators for the table above</b>													
Q <sub>d,sh</sub>	MJ/y	Not relevant for solar domestic hot water system											
Q <sub>d</sub>	MJ/y	Annual heat demand for domestic hot water											
Q <sub>L</sub>	MJ/y	Annual heat energy delivered by the solar system											
Q <sub>par</sub>	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)											
f <sub>sol</sub> =Q <sub>L</sub> /Q <sub>d</sub>	-	Solar fraction											
<b>Ref. conditions</b>		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T <sub>a,ave</sub>	7.5	9.0	3.2	18.5								
	T <sub>c,ave</sub>	8.5	10.0	5.4	17.8								
	± ΔT <sub>c</sub>	6.4	3.0	0.8	7.4								
G	kWh/m <sup>2</sup>	Annual irradiation South, 45°											
T <sub>a,ave</sub>	°C	Annual average outdoor air temperature											
T <sub>c,ave</sub>	°C	Annual average mains cold water temp.											
ΔT <sub>c</sub>	K	Seasonal variation of T <sub>c</sub>											
T <sub>h</sub>	45 °C	Desired hot water temperature (mixing valve temperature).											
<b>Max. operating press. - collector side</b>		250	kPa	<b>Max. operating press. - tank side</b>		1000	kPa						
<b>Testing Laboratory</b>	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB												
<b>Website</b>	www.solar.demokritos.gr												
<b>Test report id. number</b>	6127 DE1, 6129 DE1, 6129 F1												
<b>Date of test report</b>	2021-11-25												
<b>Test method</b>	ISO 9459-5 (DST)												
<b>Comments of test lab</b>						<b>N.C.S.R. "DEMOKRITOS"</b> SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6504502 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece							
system performance extrapolation													

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5% to ± 15%

Version 4.5, 2017-10-24