



Summary of		EN12976-2 SOLAR SYSTEM test results		Licence Number		SKM 10013/2					
Annex to Solar KEYMARK Certificate				Issued		2018-06-20					
Company		VENMAN S.A.		Country		Greece					
Brand (optional)				Website		http://www.venman.gr					
Street		7th Km Old National Road Thessaloniki – Kilkis		E-mail		info@venman.gr					
Postal Code		57022 Thessaloniki		Tel. / Fax		+30 2310 784684 / 2310 783924					
System classification											
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							
Collector(s)				Heat store(s)							
Company		VENMAN S.A.		Company		VENMAN S.A.					
Keymark lic.no. if available		SKM 10013.1		Keymark lic.no. if available							
Collector name	Per module			Store name	Total nominal volume	Gross height	Gross width	Gross depth	Auxiliary heated volume	Electrical aux. heating power	
	Gross Area (Ag)	Gross length	Gross width								
	m ²	mm	mm		litres	mm	mm	mm	litres	kW	
H81-15	1.40	1460	960	120L	110	1000	500	-	-	1.2-4.5	
H81-17	1.56	1375	1135	150L	136	1250	500	-	-	1.2-4.5	
H81-19	1.83	1455	1255	170L	168	1250	540	-	-	1.2-4.5	
H81-20	1.88	1960	960	200L	190	1250	580	-	-	1.2-4.5	
H81-21	2.00	2000	1000	250L	242	1520	580	-	-	1.2-4.5	
H81-23	2.09	1845	1135	300L	276	1760	580	-	-	1.2-4.5	
H81-25	2.37	1960	1210								
H81-26	2.42	2000	1210								
Solar loop controller				Solar loop fluid							
Keymark lic.no. if available		ControllerLicenceNumber		Recommended/required		No recommend./requirements					
Company		ControllerCompany		Company		FluidCompany					
Name		ControllerName		Name		FluidName					
Solar loop pump - power range		99 W to 999 W		Freezing point		-4 °C					
System family overview											
Collector name	Number of collectors in each configuration for each store										
	Store name										
	120L	150L	170L	200L	250L	300L					
H81-15	1	2	2	2	2						
H81-17											
H81-19											
H81-20	1	1	1	1 2	2			2			
H81-21											
H81-23											
H81-25		1	1	1	1			1 2			
H81-26											
Testing Laboratory		NCSR "DEMOKRITOS" - SOLAR & ENERGY SYSTEMS LAB									
Website		www.solar.demokritos.gr									
Test report id. number		6088 DE1, 6089 DE1, 6089 F1									
Date of test report		2018-05-23									
Comments of test lab		<p style="text-align: center;">N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Beles Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece</p>									
Comments ...											



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Postal Code	57022	Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924										
System family overview														
For each storage and collector size, give number of collectors														
Collector name	120L	150L	170L	200L	250L	300L								
H81-15	1	2	2	2	2									
H81-17														
H81-19														
H81-20	1	1	1	1 2	2	2								
H81-21														
H81-23														
H81-25		1	1	1	1	1 2								
H81-26														
Name of system configuration			VM.121.15.10											
Collector name	H81-15	No. Collectors	1	Storage name	120L									
Calculated annual results for "solar-only / preheat system"														
Location	Qd,sh MJ/y	Daily drawoff 80 l			Daily drawoff 110 l			Daily drawoff 140 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	-	4478	2277	-	51	6150	2728	-	44	7821	2961	-	38	
Würzburg DE	-	4289	2327	-	54	5897	2826	-	48	7506	3128	-	42	
Davos CH	-	4857	3343	-	69	6654	3942	-	59	8483	4226	-	50	
Athens GR	-	3343	2804	-	84	4573	3532	-	77	5834	4068	-	70	
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-	
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 _{sol} =Q _l /Q _d	-	Solar fraction												
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP								
	G	1,157	1,230	1,684	1,736	9,999								
	T _{a,ave}	7.5	9.0	3.2	18.5	99.9								
	T _{c,ave}	8.5	10.0	5.4	17.8	9.9								
± ΔTc	6.4	3.0	0.8	7.4	9.9									
G	kWh/m ²	Annual irradiation South, 45°												
T _{a,ave}	°C	Annual average outdoor air temperature												
T _{c,ave}	°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		330	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	6088 DE1, 6089 DE1, 6089 F1													
Date of test report	2018-05-23													
Test method	ISO 9459-5 (DST)													
Comments of test lab						N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece.								
No comments														

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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Postal Code	57022 Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924										
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	150L	170L										
H81-15	1	2	2										
H81-17													
H81-19													
H81-20	1	1	1 2										
H81-21													
H81-23													
H81-25		1	1										
H81-26			1 2										
Name of system configuration VM.121.14.12													
Collector name	H81-20	No. Collectors	1										
		Storage name	120L										
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff 80				Daily drawoff 110				Daily drawoff 140			
	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	-	4478	2573	-	58	6150	3185	-	52	7821	3595	-	46
Würzburg DE	-	4289	2586	-	60	5897	3248	-	55	7506	3721	-	50
Davos CH	-	4857	3847	-	79	6654	4699	-	71	8483	5235	-	62
Athens GR	-	3343	3343	-	91	4573	3879	-	85	5834	4573	-	79
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-
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)											
$f_{sol} = Q_l / Q_d$	-	Solar fraction											
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP							
	Ta,ave	1,157	1,230	1,684	1,736	9,999							
	Tc,ave	7.5	9.0	3.2	18.5	99.9							
	$\pm \Delta T_c$	8.5	10.0	5.4	17.8	9.9							
	G	6.4	3.0	0.8	7.4	9.9							
G	kWh/m ²	Annual irradiation South, 45°											
Ta,ave	°C	Annual average outdoor air temperature											
Tc,ave	°C	Annual average mains cold water temp.											
ΔT_c	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		330	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	6088 DE1, 6089 DE1, 6089 F1												
Date of test report	2018-05-23												
Test method	ISO 9459-5 (DST)												
Comments of test lab													
No comments													
N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece													

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Street		7th Km Old National Road Thessaloniki – Kilkis				E-mail		info@venman.gr					
Postal Code		57022 Thessaloniki		Tel. / Fax		+30 2310 784684 / 2310 783924							
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	150L	170L	200L	250L	300L							
H81-15	1	2	2	2	2								
H81-17													
H81-19													
H81-20	1	1	1	1 2	2	2							
H81-21													
H81-23													
H81-25		1	1	1	1	1 2							
H81-26													
Name of system configuration				VM.151.20.10									
Collector name		H81-20		No. Collectors		1							
				Storage name		150L							
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff 110 				Daily drawoff 140 				Daily drawoff 170 			
		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	-	6150	3154	-	52	7821	3627	-	46	9492	3910	-	41
Würzburg DE	-	5897	3217	-	55	7506	3753	-	50	9114	4100	-	45
Davos CH	-	6654	4667	-	70	8483	5267	-	62	10281	5613	-	55
Athens GR	-	4573	3879	-	85	5834	4604	-	79	7064	5203	-	74
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-
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_{sol} = QL / Qd	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP							
	G	1,157	1,230	1,684	1,736	9,999							
	T_{a,ave}	7.5	9.0	3.2	18.5	99.9							
	T_{c,ave}	8.5	10.0	5.4	17.8	9.9							
	± ΔTc	6.4	3.0	0.8	7.4	9.9							
G	kWh/m²	Annual irradiation South, 45°											
T_{a,ave}	°C	Annual average outdoor air temperature											
T_{c,ave}	°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		330 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		6088 DE1, 6089 DE1, 6089 F1											
Date of test report		2018-05-23											
Test method		ISO 9459-5 (DST)											
Comments of test lab		No comments											
		N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belessiotis Tel: +210 6503815 - Fax: +210 6544515 153 10 Ag. Paraskevi - Attiki - Greece											

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Brand (optional)	0			Website	http://www.venman.gr											
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Postal Code	57022	Thessaloniki		Tel. / Fax	+30 2310 784684 / 2310 783924											
System family overview																
For each storage and collector size, give number of collectors																
Collector name	120L		150L		170L		200L		250L		300L					
H81-15	1		2		2		2		2							
H81-17																
H81-19																
H81-20	1		1		1		1	2	2			2				
H81-21																
H81-23																
H81-25			1		1		1		1			1	2			
H81-26																
Name of system configuration					VM.151.20.13											
Collector name	H81-25		No. Collectors	1		Storage name	150L									
Calculated annual results for "solar-only / preheat system"																
Location	Qd,sh	Daily drawoff 110 l					Daily drawoff 140 l					Daily drawoff 170 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	MJ/y	MJ/y	MJ/y	%
Stockholm SE	-	6150	3469	-	57	7821	4058	-	52	9492				4478	-	47
Würzburg DE	-	5897	3500	-	60	7506	4131	-	55	9114				4636	-	51
Davos CH	-	6654	5203	-	78	8483	6023	-	71	10281				6591	-	64
Athens GR	-	4573	4100	-	90	5834	4951	-	85	7064				5676	-	80
Optional OP	-	-	-	-	-	-	-	-	-	-				-	-	-
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_{sol} = QL/Qd	-	Solar fraction														
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP										
	G	1,157	1,230	1,684	1,736	9,999										
	T_{a,ave}	7.5	9.0	3.2	18.5	99.9										
	T_{c,ave}	8.5	10.0	5.4	17.8	9.9										
	± ΔTc	6.4	3.0	0.8	7.4	9.9										
G	kWh/m ²	Annual irradiation South, 45°														
T_{a,ave}	°C	Annual average outdoor air temperature														
T_{c,ave}	°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			330	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			6088 DE1, 6089 DE1, 6089 F1													
Date of test report			2018-05-23													
Test method			ISO 9459-5 (DST)													
Comments of test lab																
No comments																
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System family overview												
For each storage and collector size, give number of collectors												
Collector name	120L	150L	170L	200L	250L	300L						
H81-15	1	2	2	2	2							
H81-17												
H81-19												
H81-20	1	1	1	1 2	2	2						
H81-21												
H81-23												
H81-25		1	1	1	1	1 2						
H81-26												
Name of system configuration				VM.152.15.10								
Collector name		H81-15		No. Collectors		2						
Storage name				150L								
Calculated annual results for "solar-only / preheat system"												
Location	Qd,sh	Daily drawoff 110 l			Daily drawoff 140 l			Daily drawoff 170 l				
		Qd,hw	QL	Qpar	fsol	Qd,hw	QL	Qpar	fsol	Qd,hw	QL	Qpar
	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%
Stockholm SE	-	6150	3658	-	60	7821	4320	-	55	9492		
Würzburg DE	-	5897	3658	-	62	7506	4352	-	58	9114	4825	-
Davos CH	-	6654	5456	-	82	8483	6433	-	76	10281	7127	-
Athens GR	-	4573	4194	-	92	5834	5109	-	88	7064	5897	-
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-
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_{sol} = Q_l / Q_d	-	Solar fraction										
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP						
		1,157	1,230	1,684	1,736	9,999						
	T_{a,ave}	7.5	9.0	3.2	18.5	99.9						
	T_{c,ave}	8.5	10.0	5.4	17.8	9.9						
	± ΔT_c	6.4	3.0	0.8	7.4	9.9						
G	kWh/m²	Annual irradiation South, 45°										
T_{a,ave}	°C	Annual average outdoor air temperature										
T_{c,ave}	°C	Annual average mains cold water temp.										
ΔT_c	K	Seasonal variation of T_c										
Th	45 °C	Desired hot water temperature (mixing valve temperature).										
Max. operating press. - collector side		330 kPa		Max. operating press. - tank side		1000 kPa						
Testing Laboratory		NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB										
Website		www.solar.demokritos.gr										
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Comments of test lab		No comments										
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System family overview																
For each storage and collector size, give number of collectors																
Collector name	120L	150L	170L	200L	250L	300L										
H81-15	1	2	2	2	2											
H81-17																
H81-19																
H81-20	1	1	1	2	2	2										
H81-21																
H81-23																
H81-25		1	1	1	1	1 2										
H81-26																
Name of system configuration					VM.171.20.10											
Collector name	H81-20	No. Collectors	1	Storage name	170L											
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	3595	-	46	9492	3942	-	41	11164			4131	-	37	
Würzburg DE	-	7506	3721	-	50	9114	4100	-	45	10691			4384	-	41	
Davos CH	-	8483	5203	-	61	10281	5613	-	55	12110			5897	-	49	
Athens GR	-	5834	4604	-	79	7064	5235	-	74	8326			5740	-	69	
Optional OP	-	-	-	-	-	-	-	-	-	-			0	-	0	
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 _{sol} =Q _l /Q _d	-	Solar fraction														
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP										
	T _{a,ave}	1,157	1,230	1,684	1,736	9,999										
	T _{c,ave}	7.5	9.0	3.2	18.5	99.9										
	ΔT _c	8.5	10.0	5.4	17.8	9.9										
	± ΔT _c	6.4	3.0	0.8	7.4	9.9										
G	kWh/m ²	Annual irradiation South, 45°														
T _{a,ave}	°C	Annual average outdoor air temperature														
T _{c,ave}	°C	Annual average mains cold water temp.														
ΔT _c	K	Seasonal variation of T _c														
Th	45 °C	Desired hot water temperature (mixing valve temperature).														
Max. operating press. - collector side		330	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	6088 DE1, 6089 DE1, 6089 F1															
Date of test report	2018-05-23															
Test method	ISO 9459-5 (DST)															
Comments of test lab																
No comments																
N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6544592 158-10 Ag. Paraskevi - Attiki - 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 10013/2							
Annex to Solar KEYMARK Certificate				Issued		2018-06-20							
Company		VENMAN S.A.		Country		Greece							
Brand (optional)		0		Website		http://www.venman.gr							
Street		7th Km Old National Road Thessaloniki – Kilkis				E-mail		info@venman.gr					
Postal Code		57022 Thessaloniki		Tel. / Fax		+30 2310 784684 / 2310 783924							
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	150L	170L	200L	250L	300L							
H81-15	1	2	2	2	2								
H81-17													
H81-19													
H81-20	1	1	1	1 2	2	2							
H81-21													
H81-23													
H81-25		1	1	1	1	1 2							
H81-26													
Name of system configuration				VM.171.20.13									
Collector name		H81-25		No. Collectors		1							
Storage name		170L											
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff 140 l				Daily drawoff 170 l				Daily drawoff 200 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	-	7821	4068	-	52	9492	4541	-	48	11164			44
Würzburg DE	-	7506	4131	-	55	9114	4667	-	51	10691			47
Davos CH	-	8483	6023	-	71	10281	6654	-	65	12110			58
Athens GR	-	5834	4951	-	85	7064	5708	-	81	8326			76
Optional OP	-	-	-	-	-	-	-	-	-	-			-
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_{sol} = QL / Qd	-	Solar fraction											
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP							
		1,157	1,230	1,684	1,736	9,999							
	T_{a,ave}	7.5	9.0	3.2	18.5	99.9							
	T_{c,ave}	8.5	10.0	5.4	17.8	9.9							
	± ΔT_c	6.4	3.0	0.8	7.4	9.9							
G	kWh/m²	Annual irradiation South, 45°											
T_{a,ave}	°C	Annual average outdoor air temperature											
T_{c,ave}	°C	Annual average mains cold water temp.											
ΔT_c	K	Seasonal variation of T_c											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		330 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		6088 DE1, 6089 DE1, 6089 F1											
Date of test report		2018-05-23											
Test method		ISO 9459-5 (DST)											
Comments of test lab		No comments						N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Beles Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece					

All values are subject to some uncertainty; e.g. the uncertainty on system output is typically in the range of ± 5 % to ± 25 %

Version 4.5, 2017-10-24



Summary of		EN12976-2 test results		Certification No.		SKM 10013/2								
Annex to Solar KEYMARK Certificate				Issued		2018-06-20								
Company	VENMAN S.A.			Country	Greece									
Brand (optional)	0			Website	http://www.venman.gr									
Street	7th Km Old National Road Thessaloniki – Kilkis			E-mail	info@venman.gr									
Postal Code	57022	Thessaloniki		Tel. / Fax	+30 2310 784684 / 2310 783924									
System family overview														
For each storage and collector size, give number of collectors														
Collector name	120L	150L	170L	200L	250L	300L								
H81-15	1	2	2	2	2									
H81-17														
H81-19														
H81-20	1	1	1	1 2	2	2								
H81-21														
H81-23														
H81-25		1	1	1	1	1 2								
H81-26														
Name of system configuration				VM.172.15.10										
Collector name	H81-15		No. Collectors	2		Storage name	170L							
Calculated annual results for "solar-only / preheat system"														
Location	Qd,sh	Daily drawoff 140				Daily drawoff 170				Daily drawoff 200				
		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	-	7821	4320	-	55	9492	4857	-	51	11164	5298	-	47	
Würzburg DE	-	7506	4352	-	58	9114	4983	-	55	10691	5456	-	51	
Davos CH	-	8483	6433	-	76	10281	7190	-	70	12110	7758	-	64	
Athens GR	-	5834	5140	-	88	7064	5960	-	84	8326	6686	-	80	
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-	
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_{sol}=Q_L/Q_d	-	Solar fraction												
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP								
	G	1,157	1,230	1,684	1,736	9,999								
	T_{a,ave}	7.5	9.0	3.2	18.5	99.9								
	T_{c,ave}	8.5	10.0	5.4	17.8	9.9								
	± ΔT_c	6.4	3.0	0.8	7.4	9.9								
G	kWh/m²	Annual irradiation South, 45°												
T_{a,ave}	°C	Annual average outdoor air temperature												
T_{c,ave}	°C	Annual average mains cold water temp.												
ΔT_c	K	Seasonal variation of T_c												
Th	45 °C	Desired hot water temperature (mixing valve temperature).												
Max. operating press. - collector side		330	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		6088 DE1, 6089 DE1, 6089 F1												
Date of test report		2018-05-23												
Test method		ISO 9459-5 (DST)												
Comments of test lab		No comments										N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - 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 10013/2								
Annex to Solar KEYMARK Certificate			Issued		2018-06-20								
Company	VENMAN S.A.		Country	Greece									
Brand (optional)	0		Website	http://www.venman.gr									
Street	7th Km Old National Road Thessaloniki – Kilkis					E-mail	info@venman.gr						
Postal Code	57022	Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	150L	170L	200L	250L	300L							
H81-15	1	2	2	2	2								
H81-17													
H81-19													
H81-20	1	1	1	1 2	2	2							
H81-21													
H81-23													
H81-25		1	1	1	1	1 2							
H81-26													
Name of system configuration			VM.201.20.10										
Collector name	H81-20	No. Collectors	1	Storage name	200L								
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 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	%	
Stockholm SE	-	9492	3910	-	41	11164	4163	-	37	13939	4352	-	31
Würzburg DE	-	9114	4100	-	45	10691	4384	-	41	13371	4604	-	35
Davos CH	-	10281	5582	-	54	12110	5866	-	49	15137	6118	-	40
Athens GR	-	7064	5203	-	74	8326	5740	-	69	10407	6339	-	61
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-
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_{sol} = QL / Qd	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP							
	G	1,157	1,230	1,684	1,736	9,999							
	T_{a,ave}	7.5	9.0	3.2	18.5	99.9							
	T_{c,ave}	8.5	10.0	5.4	17.8	9.9							
	± ΔTc	6.4	3.0	0.8	7.4	9.9							
G	kWh/m²	Annual irradiation South, 45°											
T_{a,ave}	°C	Annual average outdoor air temperature											
T_{c,ave}	°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		330	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		6088 DE1, 6089 DE1, 6089 F1											
Date of test report		2018-05-23											
Test method		ISO 9459-5 (DST)											
Comments of test lab													
No comments													

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

N.C.S.R "DEMOKRITOS"
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Version 4.5, 2017-10-24



Summary of	EN12976-2	test results	Certification No.		SKM 10013/2											
Annex to Solar KEYMARK Certificate			Issued		2018-06-20											
Company	VENMAN S.A.		Country	Greece												
Brand (optional)	0		Website	http://www.venman.gr												
Street	7th Km Old National Road Thessaloniki – Kilkis		E-mail	info@venman.gr												
Postal Code	57022	Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924												
System family overview																
For each storage and collector size, give number of collectors																
Collector name	120L	150L	170L	200L	250L	300L										
H81-15	1	2	2	2	2											
H81-17																
H81-19																
H81-20	1	1	1	1 2	2	2										
H81-21																
H81-23																
H81-25		1	1	1	1	1 2										
H81-26																
Name of system configuration			VM.201.20.13													
Collector name	H81-25	No. Collectors	1	Storage name	200L											
Calculated annual results for "solar-only / preheat system"																
Location	Qd,sh MJ/y	Daily drawoff 170 l			Daily drawoff 200 l			Daily drawoff 250 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	-	9492	4541	-	48	11164	4888	-	44	13939				5203	-	37
Würzburg DE	-	9114	4667	-	51	10691	5109	-	48	13371				5519	-	41
Davos CH	-	10281	6623	-	64	12110	7064	-	58	15137				7442	-	49
Athens GR	-	7064	5708	-	81	8326	6370	-	77	10407				7190	-	69
Optional OP	-	-	-	-	-	-	-	-	-	-				-	-	-
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_{sol} = Q_l / Q_d	-	Solar fraction														
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP										
	G	1,157	1,230	1,684	1,736	9,999										
	T_{a,ave}	7.5	9.0	3.2	18.5	99.9										
	T_{c,ave}	8.5	10.0	5.4	17.8	9.9										
	± ΔT_c	6.4	3.0	0.8	7.4	9.9										
G	kWh/m ²	Annual irradiation South, 45°														
T_{a,ave}	°C	Annual average outdoor air temperature														
T_{c,ave}	°C	Annual average mains cold water temp.														
ΔT_c	K	Seasonal variation of T _c														
Th	45 °C	Desired hot water temperature (mixing valve temperature).														
Max. operating press. - collector side		330	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		6088 DE1, 6089 DE1, 6089 F1														
Date of test report		2018-05-23														
Test method		ISO 9459-5 (DST)														
Comments of test lab		No comments														
		N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - 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 10013/2											
Annex to Solar KEYMARK Certificate			Issued	2018-06-20											
Company	VENMAN S.A.		Country	Greece											
Brand (optional)	0		Website	http://www.venman.gr											
Street	7th Km Old National Road Thessaloniki – Kilkis		E-mail	info@venman.gr											
Postal Code	57022	Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924											
System family overview															
For each storage and collector size, give number of collectors															
Collector name	120L	150L	170L	200L	250L	300L									
H81-15	1	2	2	2	2										
H81-17															
H81-19															
H81-20	1	1	1	1 2	2	2									
H81-21															
H81-23															
H81-25		1	1	1	1	1 2									
H81-26															
Name of system configuration			VM.202.15.10												
Collector name	H81-15	No. Collectors	2	Storage name	200L										
Calculated annual results for "solar-only / preheat system"															
Location	Qd,sh MJ/y	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 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	-	9492	4857	-	51	11164	5330	-	48	13939			5771	-	41
Würzburg DE	-	9114	4983	-	55	10691	5487	-	51	13371			6055	-	45
Davos CH	-	10281	7190	-	70	12110	7789	-	64	15137			8294	-	55
Athens GR	-	7064	5960	-	84	8326	6717	-	81	10407			7663	-	74
Optional OP	-	-	-	-	-	-	-	-	-	-			-	-	-
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 _{sol} =Q _l /Q _d	-	Solar fraction													
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP									
	G	1,157	1,230	1,684	1,736	9,999									
	T _{a,ave}	7.5	9.0	3.2	18.5	99.9									
	T _{c,ave}	8.5	10.0	5.4	17.8	9.9									
	±ΔT _c	6.4	3.0	0.8	7.4	9.9									
G	kWh/m ²	Annual irradiation South, 45°													
T _{a,ave}	°C	Annual average outdoor air temperature													
T _{c,ave}	°C	Annual average mains cold water temp.													
ΔT _c	K	Seasonal variation of T _c													
Th	45 °C	Desired hot water temperature (mixing valve temperature).													
Max. operating press. - collector side		330	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		6088 DE1, 6089 DE1, 6089 F1													
Date of test report		2018-05-23													
Test method		ISO 9459-5 (DST)													
Comments of test lab		No comments													
		N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - 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 10013/2									
Annex to Solar KEYMARK Certificate				Issued		2018-06-20									
Company	VENMAN S.A.			Country	Greece										
Brand (optional)	0			Website	http://www.venman.gr										
Street	7th Km Old National Road Thessaloniki – Kilkis						E-mail	info@venman.gr							
Postal Code	57022	Thessaloniki		Tel. / Fax	+30 2310 784684 / 2310 783924										
System family overview															
For each storage and collector size, give number of collectors															
Collector name	120L	150L	170L	200L	250L	300L									
H81-15	1	2	2	2	2										
H81-17															
H81-19															
H81-20	1	1	1	1 2	2	2									
H81-21															
H81-23															
H81-25		1	1	1	1	1 2									
H81-26															
Name of system configuration				VM.202.20.10											
Collector name	H81-20	No. Collectors	2	Storage name	200L										
Calculated annual results for "solar-only / preheat system"															
Location	Qd,sh MJ/y	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 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	-	9492	5487	-	58	11164	6086	-	55	13939			6812	-	49
Würzburg DE	-	9114	5487	-	60	10691	6150	-	58	13371			7001	-	52
Davos CH	-	10281	8199	-	80	12110	9082	-	75	15137			10028	-	66
Athens GR	-	7064	6402	-	90	8326	7253	-	87	10407			8483	-	82
Optional OP	-	-	-	-	-	-	-	-	-	-			-	-	-
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 _{sol} =Q _l /Q _d	-	Solar fraction													
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP									
	G	1,157	1,230	1,684	1,736	9,999									
	T _{a,ave}	7.5	9.0	3.2	18.5	99.9									
	T _{c,ave}	8.5	10.0	5.4	17.8	9.9									
	± ΔT _c	6.4	3.0	0.8	7.4	9.9									
G	kWh/m ²	Annual irradiation South, 45°													
T _{a,ave}	°C	Annual average outdoor air temperature													
T _{c,ave}	°C	Annual average mains cold water temp.													
ΔT _c	K	Seasonal variation of T_c													
Th	45 °C	Desired hot water temperature (mixing valve temperature).													
Max. operating press. - collector side		330	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		6088 DE1, 6089 DE1, 6089 F1													
Date of test report		2018-05-23													
Test method		ISO 9459-5 (DST)													
Comments of test lab		No comments													
		N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - 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 10013/2								
Annex to Solar KEYMARK Certificate				Issued		2018-06-20								
Company		VENMAN S.A.		Country		Greece								
Brand (optional)		0		Website		http://www.venman.gr								
Street		7th Km Old National Road Thessaloniki – Kilkis				E-mail		info@venman.gr						
Postal Code		57022 Thessaloniki		Tel. / Fax		+30 2310 784684 / 2310 783924								
System family overview														
For each storage and collector size, give number of collectors														
Collector name	120L	150L	170L	200L	250L	300L								
H81-15	1	2	2	2	2									
H81-17														
H81-19														
H81-20	1	1	1	1 2	2	2								
H81-21														
H81-23														
H81-25		1	1	1	1	1 2								
H81-26														
Name of system configuration				VM.251.20.13										
Collector name		H81-25		No. Collectors		1								
Storage name		250L												
Calculated annual results for "solar-only / preheat system"														
Location	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	4857	-	44	13939	5298	-	38	16746	5519	-	33	
Würzburg DE	-	10691	5077	-	47	13371	5582	-	42	16052	5866	-	37	
Davos CH	-	12110	7001	-	58	15137	7506	-	50	18165	7821	-	43	
Athens GR	-	8326	6370	-	76	10407	7253	-	70	12488	7916	-	64	
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-	
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_{sol}=Q_l/Q_d	-	Solar fraction												
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP								
	T _{a,ave}	1,157	1,230	1,684	1,736	9,999								
	T _{c,ave}	7.5	9.0	3.2	18.5	99.9								
	± ΔT _c	8.5	10.0	5.4	17.8	9.9								
		6.4	3.0	0.8	7.4	9.9								
G	kWh/m ²	Annual irradiation South, 45°												
T _{a,ave}	°C	Annual average outdoor air temperature												
T _{c,ave}	°C	Annual average mains cold water temp.												
ΔT _c	K	Seasonal variation of T_c												
Th	45 °C	Desired hot water temperature (mixing valve temperature).												
Max. operating press. - collector side		330	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		6088 DE1, 6089 DE1, 6089 F1												
Date of test report		2018-05-23												
Test method		ISO 9459-5 (DST)												
Comments of test lab		No comments												
		N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vasileios Belessiotis Tel: +210 6503815 - Fax: +210 6544980 100 10 Ag. Paraskevi - Attika <small>Version 4.5, 2017-10-24</small>												

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

DQS HELLAS Ltd, Central Offices: Kalavriton 4, 145 64 kifisia, Athens, Tel: +301 6233493-4, Fax: +301 6233495, http://www.dqshellas.gr, e-mail:

ioannisalexio@dqshellas.gr



Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2018-06-20
Company	VENMAN S.A.		Country	Greece
Brand (optional)	0		Website	http://www.venman.gr
Street	7th Km Old National Road Thessaloniki – Kilkis			
Postal Code	57022	Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924

System family overview

Collector name	For each storage and collector size, give number of collectors					
	120L	150L	170L	200L	250L	300L
H81-15	1	2	2	2	2	
H81-17						
H81-19						
H81-20	1	1	1	1 2	2	2
H81-21						
H81-23						
H81-25		1	1	1	1	1 2
H81-26						

Name of system configuration VM.252.15.10

Collector name H81-15 No. Collectors 2 Storage name 250L

Calculated annual results for "solar-only / preheat system"

Location	Qd,sh MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l			
		Qd,hw		f _{sol}		Qd,hw		f _{sol}		Qd,hw		f _{sol}	
		MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%		
Stockholm SE	-	11164	5298	-	48	13939	5866	-	42	16746	6181	-	37
Würzburg DE	-	10691	5487	-	51	13371	6150	-	46	16052	6559	-	41
Davos CH	-	12110	7726	-	64	15137	8420	-	56	18165	8799	-	48
Athens GR	-	8326	6686	-	81	10407	7758	-	75	12488	8546	-	69
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-

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 _{sol} =QL/Qd	-	Solar fraction

Ref. conditions	Stockholm SE						Würzburg DE						Davos CH						Athens GR						Optional OP					
	G	T _{a,ave}	T _{c,ave}	± ΔT _c	Th	Max. operating press. - collector side	Max. operating press. - tank side	G	T _{a,ave}	T _{c,ave}	± ΔT _c	Th	Max. operating press. - collector side	Max. operating press. - tank side	G	T _{a,ave}	T _{c,ave}	± ΔT _c	Th	Max. operating press. - collector side	Max. operating press. - tank side	G	T _{a,ave}	T _{c,ave}	± ΔT _c	Th	Max. operating press. - collector side	Max. operating press. - tank side		
G	1,157	7.5	8.5	6.4	45 °C	330 kPa	1,230	9.0	10.0	3.0	45 °C	1000 kPa	1,684	3.2	5.4	0.8	45 °C	1,736	18.5	17.8	7.4	45 °C	9,999	99.9	9.9	9.9	45 °C			

G	kWh/m ²	Annual irradiation South, 45°
T _{a,ave}	°C	Annual average outdoor air temperature
T _{c,ave}	°C	Annual average mains cold water temp.
ΔT _c	K	Seasonal variation of T_c
Th	45 °C	Desired hot water temperature (mixing valve temperature).

Max. operating press. - collector side 330 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	6088 DE1, 6089 DE1, 6089 F1
Date of test report	2018-05-23
Test method	ISO 9459-5 (DST)

Comments of test lab

No comments

N.C.S.R "DEMOKRITOS"
SOLAR ENERGY LABORATORY
Head: Dr Vassilios Belassis
Tel: +210 6503815 - Fax: +210 6544592
153 10 Ag. Paraskevi - Attiki - Greece

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



Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2018-06-20
Company	VENMAN S.A.		Country	Greece
Brand (optional)	0		Website	http://www.venman.gr
Street	7th Km Old National Road Thessaloniki – Kilkis		E-mail	info@venman.gr
Postal Code	57022	Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924

System family overview

Collector name	For each storage and collector size, give number of collectors					
	120L	150L	170L	200L	250L	300L
H81-15	1	2	2	2	2	
H81-17						
H81-19						
H81-20	1	1	1	1 2	2	2
H81-21						
H81-23						
H81-25		1	1	1	1	1 2
H81-26						

Name of system configuration	VM.253.20.10
Collector name	H81-20
No. Collectors	2
Storage name	250L

Calculated annual results for "solar-only / preheat system"

Location	Qd,sh MJ/y	Daily drawoff 200 l				Daily drawoff 250 l				Daily drawoff 300 l				
		Qd,hw		Qpar		Qd,hw		Qpar		Qd,hw		Qpar		
		MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%	
Stockholm SE	-	11164	6118	-	55	13939	6969	-	50	16746	-	7537	-	45
Würzburg DE	-	10691	6181	-	58	13371	7159	-	53	16052	-	7821	-	49
Davos CH	-	12110	9114	-	75	15137	10249	-	68	18165	-	10975	-	61
Athens GR	-	8326	7285	-	88	10407	8609	-	83	12488	-	9713	-	78
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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)
$f_{sol} = Q_L / Q_d$	-	Solar fraction

Ref. conditions	Stockholm SE						Würzburg DE						Davos CH						Athens GR						Optional OP					
	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side	Max. operating press. - tank side	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side	Max. operating press. - tank side	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side	Max. operating press. - tank side	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side	Max. operating press. - tank side		
G	1,157	7.5	8.5	6.4	45 °C	330 kPa	1,230	9.0	10.0	3.0	45 °C	1000 kPa	1,684	3.2	5.4	0.8	1,736	18.5	17.8	7.4	45 °C	1000 kPa	9,999	99.9	9.9	9.9	45 °C	1000 kPa		

G	kWh/m ²	Annual irradiation South, 45°
Ta,ave	°C	Annual average outdoor air temperature
Tc,ave	°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	330 kPa	Max. operating press. - tank side	1000 kPa
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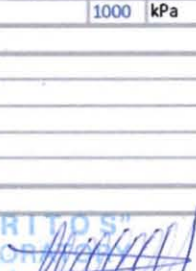
Testing Laboratory	NCSR "DEMOKRITOS" - SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F1
Date of test report	2018-05-23
Test method	ISO 9459-5 (DST)

Comments of test lab	No comments
<p>N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilios Belesiotis Tel: +210 6503816 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece</p>	

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 10013/2							
Annex to Solar KEYMARK Certificate				Issued		2018-06-20							
Company	VENMAN S.A.			Country	Greece								
Brand (optional)	0			Website	http://www.venman.gr								
Street	7th Km Old National Road Thessaloniki – Kilkis			E-mail	info@venman.gr								
Postal Code	57022	Thessaloniki		Tel. / Fax	+30 2310 784684 / 2310 783924								
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L		150L		170L		200L						
H81-15	1		2		2		2						
H81-17													
H81-19													
H81-20	1		1		1	2	2	2					
H81-21													
H81-23													
H81-25			1		1		1	1 2					
H81-26													
Name of system configuration				VM.302.20.05									
Collector name	H81-25		No. Collectors	1		Storage name	300L						
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l			
	MJ/y	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	5298	-	38	16746	5582	-	33	22327	5803	-	26
Würzburg DE	-	13371	5582	-	42	16052	5929	-	37	21413	6150	-	29
Davos CH	-	15137	7474	-	49	18165	7852	-	43	24220	8105	-	34
Athens GR	-	10407	7253	-	70	12488	7979	-	64	16651	8704	-	52
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-
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 _{sol} =Q _l /Q _d	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP							
	G	1,157	1,230	1,684	1,736	9,999							
	T _{a,ave}	7.5	9.0	3.2	18.5	99.9							
	T _{c,ave}	8.5	10.0	5.4	17.8	9.9							
± ΔTc	6.4	3.0	0.8	7.4	9.9								
G	kWh/m ²	Annual irradiation South, 45°											
T _{a,ave}	°C	Annual average outdoor air temperature											
T _{c,ave}	°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		330 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	6088 DE1, 6089 DE1, 6089 F1												
Date of test report	2018-05-23												
Test method	ISO 9459-5 (DST)												
Comments of test lab						 N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Bellos Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece							
No comments													

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 10013/2
Annex to Solar KEYMARK Certificate			Issued	2018-06-20
Company	VENMAN S.A.		Country	Greece
Brand (optional)	0		Website	http://www.venman.gr
Street	7th Km Old National Road Thessaloniki – Kilkis		E-mail	info@venman.gr
Postal Code	57022	Thessaloniki	Tel. / Fax	+30 2310 784684 / 2310 783924

System family overview

Collector name	For each storage and collector size, give number of collectors					
	120L	150L	170L	200L	250L	300L
H81-15	1	2	2	2	2	
H81-17						
H81-19						
H81-20	1	1	1	1 2	2	2
H81-21						
H81-23						
H81-25		1	1	1	1	1 2
H81-26						

Name of system configuration	VM.302.20.10
Collector name	H81-20
No. Collectors	2
Storage name	300L

Calculated annual results for "solar-only / preheat system"

Location	Qd,sh MJ/y	Daily drawoff 250 l				Daily drawoff 300 l				Daily drawoff 400 l				
		Qd,hw		Qpar		Qd,hw		Qpar		Qd,hw		Qpar		
		MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%	MJ/y	%	
Stockholm SE	-	13939	7001	-	50	16746	7663	-	46	22327	-	8231	-	37
Würzburg DE	-	13371	7190	-	54	16052	7947	-	50	21413	-	8704	-	41
Davos CH	-	15137	10312	-	68	18165	11164	-	61	24220	-	11763	-	49
Athens GR	-	10407	8641	-	83	12488	9808	-	79	16651	-	11384	-	68
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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)
$f_{sol} = Q_l / Q_d$	-	Solar fraction

Ref. conditions	Stockholm SE						Würzburg DE						Davos CH						Athens GR						Optional OP					
	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side	G	Ta,ave	Tc,ave	± ΔTc	Th	Max. operating press. - collector side						
G	1,157	7.5	8.5	6.4	45	330	1,230	9.0	10.0	3.0	45	1000	1,684	3.2	5.4	0.8	45	330	1,736	18.5	17.8	7.4	45	1000	9,999	99.9	9.9	9.9	45	1000

G	kWh/m ²	Annual irradiation South, 45°
Ta,ave	°C	Annual average outdoor air temperature
Tc,ave	°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	330	kPa	Max. operating press. - tank side	1000	kPa
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Testing Laboratory	NCSR "DEMOKRITOS" - SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F1
Date of test report	2018-05-23
Test method	ISO 9459-5 (DST)

Comments of test lab	No comments
<p>N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belostanos Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece</p>	

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



Summary of		EN12976-2 test results		Certification No.		SKM 10013/2							
Annex to Solar KEYMARK Certificate				Issued		2018-06-20							
Company	VENMAN S.A.			Country	Greece								
Brand (optional)	0			Website	http://www.venman.gr								
Street	7th Km Old National Road Thessaloniki – Kilkis						E-mail	info@venman.gr					
Postal Code	57022	Thessaloniki		Tel. / Fax	+30 2310 784684 / 2310 783924								
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L		150L		170L		200L		250L		300L		
H81-15	1		2		2		2		2				
H81-17													
H81-19													
H81-20	1		1		1		1	2	2			2	
H81-21													
H81-23													
H81-25			1		1		1		1			1 2	
H81-26													
Name of system configuration				VM.302.20.15									
Collector name		H81-25		No. Collectors		2		Storage name		300L			
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	%	
Stockholm SE	-	13939	7758	-	56	16746	8641	-	52	22327	9650	-	43
WürzburgDE	-	13371	7852	-	59	16052	8830	-	55	21413	10060	-	47
Davos CH	-	15137	11574	-	77	18165	12835	-	71	24220	14002	-	58
Athens GR	-	10407	9209	-	89	12488	10565	-	85	16651	12614	-	76
Optional OP	-	-	-	-	-	-	-	-	-	-	-	-	-
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_{sol}=Q_l/Q_d	-	Solar fraction											
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP							
	T_{a,ave}	1,157	1,230	1,684	1,736	9,999							
	T_{c,ave}	7.5	9.0	3.2	18.5	99.9							
	± ΔTc	8.5	10.0	5.4	17.8	9.9							
	± ΔTc	6.4	3.0	0.8	7.4	9.9							
G	kWh/m²	Annual irradiation South, 45°											
T_{a,ave}	°C	Annual average outdoor air temperature											
T_{c,ave}	°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		330	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		6088 DE1, 6089 DE1, 6089 F1											
Date of test report		2018-05-23											
Test method		ISO 9459-5 (DST)											
Comments of test lab		No comments											
		N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Baleski Tel: +210 6503815 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece											

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

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