Summary of	EN12976-2	SOLAR SYSTEM test results	Licence Number	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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 specifiy:	
Solar+supplementary OR Solar-only / Solar pre-heat	Solar only / Solar preheat

Collector(s)			
Company	VENMAN S.A.		
Keymark lic.no. if available	*SKM 10013.1*		
Collector name	Per module		
	Gross Area (Ag)	Gross length	Gross width
	m²	mm	mm
H81-15	1.40	1460	960
H81-17	1.56	1375	1135
H81-19	1.83	1455	1255
H81-20	1.88	1960	960
H81-21	2.00	2000	1000
H81-22	2.04	1960	1040
H81-23	2.09	1845	1135
H81-25	2.37	1960	1210
H81-26	2.42	2000	1210

Heat store(s)								
Company	VENMAN S.A.							
Keymark lic.no. if available								
Store name	Total nominal volume	Gross height	Gross width		Gross depth	Auxiliary heated volume	Electrical aux. heating power	
	litres	mm	mm		mm	litres	kW	
120L	110	1000	500		-	-	1.2-4.5	
150L	136	1250	500		-	-	1.2-4.5	
170L	154	1250	540		-	-	1.2-4.5	
200L	190	1250	580		-	-	1.2-4.5	
250L	230	1520	580		-	-	1.2-4.5	
300L	276	1760	580		-	-	1.2-4.5	

Solar loop controller				Solar loop fluid		
Keymark lic.no. if available	-			Recommended/required	Required	
Company	-			Company	FluidCompany	
Name	-			Name	FluidName	
Solar loop pump - power range	- W	to	- 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					
H81-15	1						2						2						2					
H81-17																								
H81-19																								
H81-20	1						1						1						1	2				
H81-21																								
H81-22							1												1					
H81-23																								
H81-25							1						1						1					
H81-26																								

H81-15																								
H81-17																								
H81-19																								
H81-20																								
H81-21																								
H81-22																								
H81-23																								
H81-25																								
H81-26																								

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021

Comments of test lab

N.C.S.R. "DEMOKRITOS"
SOLAR ENERGY LABORATORY
Tel: +210 6503815 - Fax: +210 6544592
P.O. BOX 60037, 15310 Ag. Paraskevi, Greece

Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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						
H81-22		1		1	2	2
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	Daily drawoff 80 l				Daily drawoff 110 l				Daily drawoff			140 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	-	4478	2277	-	51	6150	2728	-	44	7821		2961	-	38	
WürzburgDE	-	4289	2327	-	54	5897	2826	-	48	7506		3129	-	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
	Ta,ave	7.5	9.0	3.2	18.5	99.9
	Tc,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°
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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab	
Extrapolated	N.C.S.R. "DEMOKRITOS" 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 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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																																				
H81-22							1												1						2						2					
H81-23																																				
H81-25							1						1						1						1						1	2				
H81-26																																				

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 l				Daily drawoff 110 l				Daily drawoff 140 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	-	4478	2573	-	58	6150	3185	-	52	7821	3595	-	46
WürzburgDE	-	4289	2586	-	60	5897	3248	-	55	7506	3721	-	50
Davos CH	-	4857	3847	-	79	6654	4699	-	71	8483	5285	-	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		Stockholm SE	Würzburg DE	Davos CH	Athens GR	Optional OP
	G	1,157	1,230	1,684	1,736	9,999
	Ta,ave	7.5	9.0	3.2	18.5	99.9
	Tc,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°
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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab	
Extrapolated	N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Tel: +210 6503815 - Fax: +210 6544592 P.O. BOX 60037, 15310 Ag. Paraskevi, Greece

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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	2021-09-10

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																																		
H81-22							1												1						2						2			
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 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	%	
Stockholm SE	-	6150	3154	-	52	7821	3627	-	46	9492		3910	-	41	
WürzburgDE	-	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)
$f_{sol}=Q_L/Q_d$	-	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
	Ta,ave	7.5	9.0	3.2	18.5	99.9
	Tc,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°
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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab

Extrapolated

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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 outputs 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	2021-09-10

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																																		
H81-22							1												1						2						2					
H81-23																																		
H81-25							1						1						1						1						1	2				
H81-26																																		

Name of system configuration				VM151.22.10			
Collector name	H81-22	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	%
Stockholm SE	-	6150	3248	-	53	7821	3753	-	48	9492		4068	-	43
WürzburgDE	-	5897	3311	-	56	7506	3847	-	51	9114		4226	-	46
Davos CH	-	6654	4798	-	72	8483	5487	-	65	10281		5866	-	57
Athens GR	-	4573	3942	-	86	5834	4699	-	81	7064		5330	-	75

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab

Extrapolated

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Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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						
H81-22		1		1	2	2
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	%
Stockholm SE	-	6150	3469	-	57	7821	4068	-	52	9492	4478	-	47
WürzburgDE	-	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

Perf. indicators for the table above

$Q_{d,sh}$	MJ/y	Not relevant for solar domestic hot water system
Q_d	MJ/y	Annual heat demand for domestic hot water
Q_L	MJ/y	Annual heat energy delivered by the solar system
Q_{par}	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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab

Extrapolated

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Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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																																				
H81-22							1												1						2						2					
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	fsol	
	MJ/y	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		4825	-	51	
WürzburgDE	-	5897	3658	-	62	7506	4352	-	58	9114		4920	-	54	
Davos CH	-	6654	5456	-	82	8483	6488	-	76	10281		7127	-	69	
Athens GR	-	4573	4194	-	92	5834	5109	-	88	7064		5897	-	84	

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab
Extrapolated

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All values are subject to some uncertainty, e.g. the uncertainty on system outputs 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	2021-09-10

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																																				
H81-22							1												1						2						2					
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	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	3595	-	46	9492	3942	-	41	11164	4131	-	37
WürzburgDE	-	7506	3721	-	50	9114	4100	-	45	10691	4384	-	41
Davos CH	-	8488	5208	-	61	10281	5613	-	55	12110	5897	-	49
Athens GR	-	5834	4604	-	79	7064	5235	-	74	8326	5740	-	69

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
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Test report id. number	6088 DE1, 6089 DE1, 6089 F3
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Comments of test lab

Extrapolated

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Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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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																																				
H81-22							1												1						2						2					
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	4888	-	44
WürzburgDE	-	7506	4131	-	55	9114	4667	-	51	10691	5077	-	47
Davos CH	-	8488	6028	-	71	10281	6654	-	65	12110	7064	-	58
Athens GR	-	5834	4951	-	85	7064	5708	-	81	8326	6370	-	76

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
G	1,157	1,230	1,684	1,736
Ta,ave	7.5	9.0	3.2	18.5
Tc,ave	8.5	10.0	5.4	17.8
± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
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Comments of test lab

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Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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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																																				
H81-22							1												1						2						2					
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 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	4320	-	55	9492	4857	-	51	11164	5298	-	47
WürzburgDE	-	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

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
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Comments of test lab

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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	2021-09-10

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																																				
H81-22							1												1						2						2					
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	MJ/y	%	
Stockholm SE	-	9492	3910	-	41		11164	4163	-	37	13389		4352	-	31	
WürzburgDE	-	9114	4100	-	45		10691	4384	-	41	13371		4604	-	35	
Davos CH	-	10281	5582	-	54		12110	5866	-	49	15137		6118	-	40	
Athens GR	-	7064	5208	-	74		8326	5740	-	69	10407		6389	-	61	

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab

Extrapolated

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Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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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

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																																				
H81-22							1												1						2						2					
H81-23																																				
H81-25							1						1						1						1						1	2				
H81-26																																				

Name of system configuration			VM201.22.10
Collector name	H81-22	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	MJ/y	%
Stockholm SE	-	9492	4068	-	43	11164	4320	-	39	13389	4541	-	33
WürzburgDE	-	9114	4257	-	47	10691	4573	-	43	13371	4825	-	36
Davos CH	-	10281	5834	-	57	12110	6150	-	51	15137	6402	-	42
Athens GR	-	7064	5330	-	75	8326	5897	-	71	10407	6528	-	63

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
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Comments of test lab

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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						
H81-22		1		1	2	2
H81-23						
H81-25		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	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	MJ/y	%
Stockholm SE	-	9492	4541	-	48	11164	4888	-	44	13939	5203	-	37
WürzburgDE	-	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

Perf. indicators for the table above

$Q_{d,sh}$	MJ/y	Not relevant for solar domestic hot water system
Q_d	MJ/y	Annual heat demand for domestic hot water
Q_L	MJ/y	Annual heat energy delivered by the solar system
Q_{par}	MJ/y	Annual parasitic energy: (electricity for pumps/controllers)
$f_{sol}=Q_L/Q_d$	-	Solar fraction

		Stockholm SE	Würzburg DE	Davos CH	Athens GR
Ref. conditions	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
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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															
H81-17																																		
H81-19																																		
H81-20	1						1						1						1	2					2						2			
H81-21																																		
H81-22							1												1						2						2			
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	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	MJ/y	%	
Stockholm SE	-	9492	4951	-	52		11164	5456	-	49		13939	5992	-	43	
WürzburgDE	-	9114	5046	-	55		10691	5613	-	53		13371	6276	-	47	
Davos CH	-	10281	7316	-	71		12110	8010	-	66		15137	8704	-	58	
Athens GR	-	7064	6023	-	85		8326	6812	-	82		10407	7884	-	76	

Perf. indicators for the table above

$Q_{d,sh}$	MJ/y	Not relevant for solar domestic hot water system
Q_d	MJ/y	Annual heat demand for domestic hot water
Q_L	MJ/y	Annual heat energy delivered by the solar system
Q_{par}	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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab	
Tested	N.C.S.R. "DEMOKRITOS" 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 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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																
H81-21																																				
H81-22							1												1						2						2					
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	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	MJ/y	%
Stockholm SE	-	9492	5487	-	58		11164	6086	-	55		13389			6812	-	49
WürzburgDE	-	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	7258	-	87		10407			8483	-	82

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab

Extrapolated

N.C.S.R. "DEMOKRITOS"
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 outputs 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	2021-09-10

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																																				
H81-22							1												1						2						2					
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	Daily drawoff		200 l		Daily drawoff		250 l		Daily drawoff		300 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	-	11164	4857	-	44	13939	5298	-	38	16746		5519	-	33
WürzburgDE	-	10691	5077	-	47	13871	5582	-	42	16052		5866	-	37
Davos CH	-	12110	7001	-	58	15137	7506	-	50	18165		7821	-	43
Athens GR	-	8326	6370	-	76	10407	7259	-	70	12488		7916	-	64

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
G	1,157	1,230	1,684	1,736
Ta,ave	7.5	9.0	3.2	18.5
Tc,ave	8.5	10.0	5.4	17.8
± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab	
Extrapolated	N.C.S.R. "DEMOKRITOS" 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 %

Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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																																				
H81-22							1												1						2						2					
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	Daily drawoff		200 l		Daily drawoff		250 l		Daily drawoff		300 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	-	11164	5298	-	48	13939	5866	-	42	16746		6181	-	37
WürzburgDE	-	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

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
G	1,157	1,230	1,684	1,736
Ta,ave	7.5	9.0	3.2	18.5
Tc,ave	8.5	10.0	5.4	17.8
± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab
Extrapolated

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Tel: +210 6503815 - Fax: +210 6544592
P.O. BOX 60037, 15310 Ag. Paraskevi, Greece

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Summary of	EN12976-2	test results	Certification No.	SKM 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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						
H81-22		1		1	2	2
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	Daily drawoff	200 l			Daily drawoff	250 l			Daily drawoff	300 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	-	11164	6118	-	55	13939	6969	-	50	16746	7537	-	45
WürzburgDE	-	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

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab	
Extrapolated	N.C.S.R. "DEMOKRITOS" 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 10013/2
Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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						
H81-22		1		1	2	2
H81-23						
H81-25		1	1	1	1	1 2
H81-26						

Name of system configuration				VM252.22.10		
Collector name	H81-22	No. Collectors	2	Storage name		250L

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

Location	Qd,sh	Daily drawoff	200 l			Daily drawoff	250 l			Daily drawoff	300 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	7159	MJ/y	%	MJ/y	MJ/y	MJ/y	%
Stockholm SE	-	11164	6244	-	56	13939	7159	-	51	16746	7789	-	47
WürzburgDE	-	10691	6307	-	59	13371	7316	-	55	16052	8079	-	50
Davos CH	-	12110	9335	-	77	15137	10596	-	70	18165	11384	-	63
Athens GR	-	8326	7411	-	89	10407	8767	-	84	12488	9902	-	79

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
	G	1,157	1,230	1,684	1,736
	Ta,ave	7.5	9.0	3.2	18.5
	Tc,ave	8.5	10.0	5.4	17.8
	± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab
Extrapolated

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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	2021-09-10

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						
H81-22		1		1	2	2
H81-23						
H81-25		1	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		Daily drawoff		300		Daily drawoff			400	
		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	5298	-	38	16746	5582	-	33	22327		5803	-	26
WürzburgDE	-	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

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
G	1,157	1,230	1,684	1,736
Ta,ave	7.5	9.0	3.2	18.5
Tc,ave	8.5	10.0	5.4	17.8
± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
Website	www.solar.demokritos.gr
Test report id. number	6088 DE1, 6089 DE1, 6089 F3
Date of test report	23/5/2018, 7/9/2021, 15/9/2021
Test method	ISO 9459-5 (DST)

Comments of test lab
Extrapolated

N.C.S.R. "DEMOKRITOS"
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 outputs 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	2021-09-10

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						
H81-22		1		1	2	2
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	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	7001	-	50	16746	7663	-	46	22327		8231	-	37
WürzburgDE	-	13371	7190	-	54	16052	7947	-	50	21413		8704	-	41
Davos CH	-	15137	10312	-	68	18165	11164	-	61	24220		11768	-	49
Athens GR	-	10407	8641	-	83	12488	9808	-	79	16651		11384	-	68

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
G	1,157	1,230	1,684	1,736
Ta,ave	7.5	9.0	3.2	18.5
Tc,ave	8.5	10.0	5.4	17.8
± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
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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																																				
H81-22							1												1						2						2					
H81-23																																				
H81-25							1						1						1						1						1	2				
H81-26																																				

Name of system configuration				VM302.22.10			
Collector name	H81-22	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	MJ/y	%
Stockholm SE	-	13999	7190	-	52	16746	7916	-	47	22327		8578	-	38
WürzburgDE	-	13371	7348	-	55	16052	8168	-	51	21413		9051	-	42
Davos CH	-	15137	10659	-	70	18165	11574	-	64	24220		12299	-	51
Athens GR	-	10407	8799	-	85	12488	9997	-	80	16651		11700	-	70

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
G	1,157	1,230	1,684	1,736
Ta,ave	7.5	9.0	3.2	18.5
Tc,ave	8.5	10.0	5.4	17.8
± ΔTc	6.4	3.0	0.8	7.4

G	kWh/m²	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

Testing Laboratory	NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB
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Comments of test lab	
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Version 4.5, 2017-10-24

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Annex to Solar KEYMARK Certificate			Issued	2021-09-10

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System family overview

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H81-17																																				
H81-19																																				
H81-20	1						1						1						1	2					2						2					
H81-21																																				
H81-22							1												1						2						2					
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	MJ/y	%	
Stockholm SE	-	13999	7758	-	56	16746	8641	-	52	22327		9650	-	43	
WürzburgDE	-	13371	7852	-	59	16052	8880	-	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	

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
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