

Version 4.5, 2017-10-24



Summary of annex to Solar KEYMARK Certificate	EN12976-2	test results	Certification No.	011-7S3262 A			
Annex to Solar KEYMARK Certificate			Issued	2024-08-28			
Company	ARYA GROUP SPA		Country	Italy			
Brand (optional)	ARYA		Website	www.aryagroupspa.com			
Street	VIA TROPEA 40		E-mail	info@aryagroupspa.com			
Postal Code	00178	ROMA	Tel. / Fax	+39 067183958			
Parameters for systems extrapolation (Annex D)							
Collector of measured system		Storage tank of measured system					
$A_{ref} [m^2]$	2.31	Volume [l]	180				
h_0	0.705	$A_{hx} [m^2]$	1.45				
$a_1 [W/Km^2]$	3.420	Piping					
$a_2 [W/Km^2]$	0.025						
IAM (50°)	0.960	$U_{loop,p}$	0.19				
Parameters of system tested (ISO 9459-2)							
		I-O Diagram Parameters and Tank heat loss coefficient					
Name of System Configuration Tested	$a_1 [1/m^2]$	$a_2 [MJ/K]$	$a_3 [MJ]$	$U_s [W/K]$			
AR180CN	1.09	0.13	1.51	2.84			
Draw-off profiles							
	H<16 MJ/m ²	H≥16 MJ/m ²	Mixing Draw-off		H<16 MJ/m ²	H≥16 MJ/m ²	Mixing Draw-off
V/V _{dep}	f(V/V _{dep})	f(V/V _{dep})	g(V/V _{dep})	V/V _{dep}	f(V/V _{dep})	f(V/V _{dep})	g(V/V _{dep})
0.1	11.61	11.58	11.25	1.6	1.77	1.29	1.26
0.2	11.32	10.67	11.29	1.7	1.66	1.24	1.18
0.3	10.72	10.56	11.08	1.8	1.62	1.19	1.10
0.4	9.55	10.09	10.43	1.9	1.55	1.12	1.02
0.5	7.06	9.68	9.02	2.0	1.47	1.06	0.99
0.6	5.38	8.32	6.69	2.1	1.40	1.00	0.94
0.7	4.26	6.33	4.65	2.2	1.33	0.94	0.88
0.8	3.62	4.26	3.22	2.3	1.25	0.92	0.81
0.9	3.08	3.10	2.74	2.4	1.20	0.88	0.81
1.0	2.72	2.55	2.19	2.5	1.17	0.83	0.80
1.1	2.35	2.06	1.88	2.6	1.10	0.78	0.75
1.2	2.16	1.80	1.61	2.7	1.01	0.72	0.70
1.3	2.07	1.65	1.49	2.8	0.95	0.71	0.66
1.4	1.97	1.49	1.38	2.9	0.89	0.70	0.62
1.5	1.85	1.37	1.32	3.0	0.86	0.60	0.58
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch					
Website		http://www.intertek.com.cn					
Test report id. number		200427029GZU-001/002, 240819128GZU-001					
Date of test report		2020/12/9, 2024/08/28					
Test method		ISO 9459-2 (CSTG)					
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 %

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Postal Code	00178	ROMA	Tel. / Fax	+39 067183958									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1		1		1		2	2					
JDL-PG2.5-80					1	1							
Name of system configuration			AR120CN										
Collector name	JDL-PG2.0-80	No. Collectors	1	Storage name	120L								
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh MJ/y	Daily drawoff 110 l				Daily drawoff 140 l				Daily drawoff 170 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	6142	1793	0	29.2	7798	1901	0	24.4	9457	1973	0	20.9	
Würzburg DE	5882	2218	0	37.7	7470	2383	0	31.9	9072	2498	0	27.5	
Davos CH	6656	3640	0	54.7	8467	3899	0	46.0	10256	4075	0	39.7	
Athens GR	4568	2981	0	65.3	5814	3298	0	56.7	7042	3521	0	50.0	
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		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T _{a,ave}	7.5	9.0	3.2	18.5								
	T _{c,ave}	8.5	10.0	5.4	17.8								
	± ΔT _c	6.4	3.0	0.8	7.4								
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		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch											
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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	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1	1	1	1			2	2					
JDL-PG2.5-80					1	1							
Name of system configuration			AR140CN										
Collector name	JDL-PG2.0-80	No. Collectors	1	Storage name	140L								
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff				Daily drawoff				Daily drawoff			
		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	6142	1832	0	29.8	7798	1940	0	24.9	9457	2012	0	21.3	
Würzburg DE	5882	2264	0	38.5	7470	2430	0	32.5	9072	2545	0	28.1	
Davos CH	6656	3697	0	55.5	8467	3964	0	46.8	10256	4140	0	40.4	
Athens GR	4568	3031	0	66.3	5814	3355	0	57.7	7042	3586	0	50.9	
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								
	T _{a,ave}	7.5	9.0	3.2	18.5								
	T _{c,ave}	8.5	10.0	5.4	17.8								
	± ΔT _c	6.4	3.0	0.8	7.4								
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		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch											
Website		http://www.intertek.com.cn											
Test report id. number		200427029GZU-001/002, 240819128GZU-001											
Date of test report		2020/12/9, 2024/08/28											
Test method		ISO 9459-2 (CSTG)											
Comments of test lab													
No comments													

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Postal Code	00178	ROMA	Tel. / Fax	+39 067183958									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1		1		1			2					
JDL-PG2.5-80					1		1						
Name of system configuration			AR150CN										
Collector name	JDL-PG2.0-80	No. Collectors	1	Storage name	150L								
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh MJ/y	Daily drawoff 110 l				Daily drawoff 140 l				Daily drawoff 170 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	6142	1847	0	30.1	7798	1958	0	25.1	9457	2030	0	21.5	
Würzburg DE	5882	2282	0	38.8	7470	2452	0	32.8	9072	2567	0	28.3	
Davos CH	6656	3722	0	55.9	8467	3989	0	47.1	10256	4172	0	40.7	
Athens GR	4568	3053	0	66.8	5814	3384	0	58.2	7042	3614	0	51.3	
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								
	T _{a,ave}	7.5	9.0	3.2	18.5								
	T _{c,ave}	8.5	10.0	5.4	17.8								
	± ΔT _c	6.4	3.0	0.8	7.4								
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											
T _h	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch											
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Postal Code	00178	ROMA	Tel. / Fax	+39 067183958									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1		1	1			2	2					
JDL-PG2.5-80					1	1							
Name of system configuration			AR160CN										
Collector name	JDL-PG2.0-80	No. Collectors	1	Storage name	160L								
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	7798	1973	0	25.3	9457	2048	0	21.7	11138	2102	0	18.9	
Würzburg DE	7470	2473	0	33.1	9072	2588	0	28.5	10685	2675	0	25.0	
Davos CH	8467	4014	0	47.4	10256	4198	0	40.9	12082	4331	0	35.8	
Athens GR	5814	3409	0	58.6	7042	3643	0	51.7	8298	3820	0	46.0	
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} =QL/Q _d	-	Solar fraction											
Ref. conditions		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T _{a,ave}	7.5	9.0	3.2	18.5								
	T _{c,ave}	8.5	10.0	5.4	17.8								
	± ΔT _c	6.4	3.0	0.8	7.4								
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		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch											
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System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1		1										
JDL-PG2.5-80					1								
Name of system configuration			AR180CN										
Collector name	JDL-PG2.5-80	No. Collectors	1		Storage name	180L							
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	9457	4289	0	45.4	11138	4529	0	40.7	13914	4640	0	33.3	
Würzburg DE	9072	4521	0	49.8	10685	4805	0	45.0	13356	4916	0	36.8	
Davos CH	10256	6200	0	60.5	12082	6384	0	52.8	15098	6491	0	43.0	
Athens GR	7042	4992	0	70.9	8298	5664	0	68.3	10382	6375	0	61.4	
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								
	T _{a,ave}	7.5	9.0	3.2	18.5								
	T _{c,ave}	8.5	10.0	5.4	17.8								
	± ΔT _c	6.4	3.0	0.8	7.4								
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											
T _h	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch											
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For each storage and collector size, give number of collectors													
Collector name	120L	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1		1				2	2					
JDL-PG2.5-80					1	1							
Name of system configuration			AR200CN										
Collector name	JDL-PG2.5-80	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	9457	2542	0	26.9	11138	2628	0	23.6	13914	2725	0	19.6	
Würzburg DE	9072	3172	0	35.0	10685	3305	0	30.9	13356	3460	0	25.9	
Davos CH	10256	5108	0	49.8	12082	5314	0	44.0	15098	5555	0	36.8	
Athens GR	7042	4331	0	61.5	8298	4601	0	55.4	10382	4921	0	47.4	
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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	T _{a,ave}	7.5	9.0	3.2	18.5								
	T _{c,ave}	8.5	10.0	5.4	17.8								
	± ΔT _c	6.4	3.0	0.8	7.4								
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											
T _h	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch											
Website		http://www.intertek.com.cn											
Test report id. number		200427029GZU-001/002, 240819128GZU-001											
Date of test report		2020/12/9, 2024/08/28											
Test method		ISO 9459-2 (CSTG)											
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 %

Version 4.5, 2017-10-24

DIN CERTCO ● Alboinstraße 56 ● D-12103 Berlin

Tel: +49 30 7562-1131 ● Fax: +49 30 7562-1141 ● E-Mail: info@dincertco.de ● www.dincertco.de



Summary of annex to Solar KEYMARK Certificate	EN12976-2	test results	Certification No.	011-7S3262 A									
Annex to Solar KEYMARK Certificate			Issued	2024-08-28									
Company	ARYA GROUP SPA		Country	Italy									
Brand (optional)	ARYA		Website	www.aryagroupspa.com									
Street	VIA TROPEA 40		E-mail	info@aryagroupspa.com									
Postal Code	00178	ROMA	Tel. / Fax	+39 067183958									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1		1		1		2	2					
JDL-PG2.5-80					1	1							
Name of system configuration			AR250CN										
Collector name	JDL-PG2.0-80	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 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	11138	3863	0	34.7	13914	4097	0	29.4	16697	4259	0	25.5	
Würzburg DE	10685	4734	0	44.3	13356	5087	0	38.1	16027	5339	0	33.3	
Davos CH	12082	7567	0	62.6	15098	8132	0	53.9	18137	8532	0	47.0	
Athens GR	8298	6127	0	73.8	10382	6840	0	65.9	12452	7348	0	59.0	
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		Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	G	1,157	1,230	1,684	1,736								
	T _{a,ave}	7.5	9.0	3.2	18.5								
	T _{c,ave}	8.5	10.0	5.4	17.8								
	± ΔT _c	6.4	3.0	0.8	7.4								
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											
T _h	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
Testing Laboratory		Intertek Testing Services Shenzhen Ltd. Guangzhou Branch											
Website		http://www.intertek.com.cn											
Test report id. number		200427029GZU-001/002, 240819128GZU-001											
Date of test report		2020/12/9, 2024/08/28											
Test method		ISO 9459-2 (CSTG)											
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 %

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Summary of annex to Solar KEYMARK Certificate	EN12976-2	test results	Certification No.	011-753262 A									
Annex to Solar KEYMARK Certificate			Issued	2024-08-28									
Company	ARYA GROUP SPA		Country	Italy									
Brand (optional)	ARYA		Website	www.aryagroupspa.com									
Street	VIA TROPEA 40		E-mail	info@aryagroupspa.com									
Postal Code	00178	ROMA	Tel. / Fax	+39 067183958									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120L	140L	150L	160L	180L	200L	250L	300L					
JDL-PG2.0-80	1		1		1		2	2					
JDL-PG2.5-80					1		1						
Name of system configuration			AR300CN										
Collector name	JDL-PG2.0-80	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 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	13914	4187	0	30.1	16697	4352	0	26.1	22295	4572	0	20.5	
Würzburg DE	13356	5202	0	38.9	16027	5458	0	34.1	21366	5796	0	27.1	
Davos CH	15098	8258	0	54.7	18137	8662	0	47.8	24167	9184	0	38.0	
Athens GR	10382	6959	0	67.0	12452	7481	0	60.1	16610	8186	0	49.3	
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								
	T _{a,ave}	7.5	9.0	3.2	18.5								
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G	kWh/m ²	Annual irradiation South, 45°											
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T _h	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		1,000	kPa	Max. operating press. - tank side		1,000	kPa						
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