



Summary of		EN12976-2	SOLAR SYSTEM test results		Licence Number		OEM 10109.4.4				
Annex to Solar KEYMARK Certificate					Issued		2021-12-20				
Company	ARISTON THERMO SpA				Country	Italy					
Brand (optional)	CHAFFOTEAUX				Website	www.aristongroup.com					
Street	Viale Aristide Merloni				E-mail	angelo.mancini@ariston.com					
Postal Code	60044	Fabriano (AN)		Tel. / Fax	+39	732 6011					
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					Solar only / Solar preheat						
Collector(s)					Heat store(s)						
Company		ARISTON THERMO SpA			Company		ARISTON THERMO SpA				
<i>Keymark lic.no. if available</i>		OEM 10109.1.2			<i>Keymark lic.no. if available</i>						
Collector name	Per module			Store name	Total nominal volume	Gross height	Gross width	Gross depth	Auxiliary heated volume	Electrical aux. heating power	
	Gross Area (A_g)	Gross length	Gross width								
	m ²	mm	mm								
CHAFFOTEAUX Collector GR2	1,90	1970	965	150L	136	1250	500				
				200L	190	1250	580				
				300L	276	1785	580				
Solar loop controller					Solar loop fluid						
<i>Keymark lic.no. if available</i>					Recommended/required		Recommended				
Company					Company		-				
Name					Name		-				
Solar loop pump - power range					W to W		Freezing point				
							-32 °C				
System family overview											
Collector name	Number of collectors in each configuration for each store										
	Store name										
	150L			200L			300L				
CHAFFOTEAUX Collector	1			1	2			2			
Testing Laboratory					NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB						
Website					www.solar.demokritos.gr						
Test report id. number					6110 DE2, 6113 DE2, 6113 F2						
Date of test report					2020-11-04						
Comments of test lab					Stamp & signature of test lab						



Summary of		EN12976-2	test results				Certification No.				OEM 10109.4.4				
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Brand (optional)		CHAFFOTEAUX				Website		www.aristongroup.com							
Street		Viale Aristide Merloni				E-mail		angelo.mancini@ariston.com							
Postal Code		60044		Fabriano (AN)		Tel. / Fax		+39		732 6011					
System family overview															
For each storage and collector size, give number of collectors															
Collector name		150L				200L				300L					
CHAFFOTEAUX Collector GR2		1				2				2					
Name of system configuration		ZELIOS THERMO GR2 150-1													
Collector name		CHAFFOTEAUX Collector				No. Collectors		1		Storage name		150L			
Calculated annual results for "solar-only / preheat system"															
Location		Daily drawoff		110		Daily drawoff		140		Daily drawoff		170			
		Qd,sh	Qd,hw	QL	Qpar	fsol	Qd,sh	QL	Qpar	fsol	Qd,sh	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	0	51	7821	3658	0	47	9492	3942	0	42	
Würzburg DE		-	5897	3185	0	54	7506	3753	0	50	9114	4131	0	45	
Davos CH		-	6654	4636	0	70	8483	5330	0	63	10281	5676	0	55	
Athens GR		-	4573	3847	0	84	5834	4636	0	80	7064	5235	0	74	
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/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				250		kPa		Max. operating press. - tank side				1000		kPa	
Testing Laboratory				NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB											
Website				www.solar.demokritos.gr											
Test report id. number				6110 DE2, 6113 DE2, 6113 F2											
Date of test report				2020-11-04											
Test method				ISO 9459-5 (DST)											
Comments of test lab															
Extrapolated															

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		60044	Fabriano (AN)		Tel. / Fax		+39 732 6011						
System family overview													
For each storage and collector size, give number of collectors													
Collector name	150L		200L				300L						
CHAFFOTEAUX Collector GR2	1		1	2			2						
Name of system configuration													
						ZELIOS THERMO GR2 2KW 150-1							
Collector name		CHAFFOTEAUX Collector		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	-	6150	3154	0	51	7821	3658	0	47	9492	3942	0	42
WürzburgDE	-	5897	3185	0	54	7506	3753	0	50	9114	4131	0	45
Davos CH	-	6654	4636	0	70	8483	5330	0	63	10281	5676	0	55
Athens GR	-	4573	3847	0	84	5834	4636	0	80	7064	5235	0	74
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)											
$f_{sol} = Q_d / Q_{d,t}$	-	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								
	± ΔTc	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.											
ΔTc	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side			250	kPa	Max. operating press. - tank side			1000	kPa				
Testing Laboratory				NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB									
Website				www.solar.demokritos.gr									
Test report id. number				6110 DE2, 6113 DE2, 6113 F2									
Date of test report				2020-11-04									
Test method				ISO 9459-5 (DST)									
Comments of test lab									Stamp & signature of test lab				
Extrapolated													

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Postal Code		60044		Fabriano (AN)		Tel. / Fax		+39 732 6011											
System family overview																			
For each storage and collector size, give number of collectors																			
Collector name		150L		200L		300L													
CHAFFOTEAUX Collector GR2		1		1 2		2													
Name of system configuration																			
						ZELIOS THERMO GR2 200-1													
Collector name		CHAFFOTEAUX Collector		No. Collectors		1		Storage name											
								200L											
Calculated annual results for "solar-only / preheat system"																			
Location		Qd,sh		Daily drawoff			Daily drawoff			Daily drawoff									
				170			200			250									
				Qd,hw		QL		Qpar		fsol		Qd,hw		QL		Qpar		fsol	
		MJ/y		MJ/y		MJ/y		MJ/y		%		MJ/y		MJ/y		MJ/y		%	
Stockholm SE		-		9492		4005		0		42		11164		4289		0		38	
WürzburgDE		-		9114		4163		0		46		10691		4510		0		42	
Davos CH		-		10281		5740		0		56		12110		6086		0		50	
Athens GR		-		7064		5298		0		75		8326		5866		0		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									
		T _{a,ave}		7,5		9,0		3,2		18,5									
		T _{c,ave}		8,5		10,0		5,4		17,8									
		± ΔTc		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.															
ΔTc		K		Seasonal variation of Tc															
Th		45 °C		Desired hot water temperature (mixing valve temperature).															
Max. operating press. - collector side				250		kPa		Max. operating press. - tank side				1000		kPa					
Testing Laboratory				NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB															
Website				www.solar.demokritos.gr															
Test report id. number				6110 DE2, 6113 DE2, 6113 F2															
Date of test report				2020-11-04															
Test method				ISO 9459-5 (DST)															
Comments of test lab				Stamp & signature of test lab															
Extrapolated																			

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Postal Code		60044		Fabriano (AN)		Tel. / Fax		+39 732 6011					
System family overview													
For each storage and collector size, give number of collectors													
Collector name		150L		200L		300L							
CHAFFOTEAUX Collector GR2		1		1	2			2					
Name of system configuration													
						ZELIOS THERMO GR2 2KW 200-1							
Collector name		CHAFFOTEAUX Collector		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	4005	0	42	11164	4289	0	38	13939	4478	0	32
WürzburgDE	-	9114	4163	0	46	10691	4510	0	42	13371	4762	0	36
Davos CH	-	10281	5740	0	56	12110	6086	0	50	15137	6307	0	42
Athens GR	-	7064	5298	0	75	8326	5866	0	70	10407	6465	0	62
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)											
$f_{sol} = Q_d / Q_{d,t}$	-	Solar fraction											
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	Ta,ave	1.157	1.230	1.684	1.736								
	Tc,ave	7,5	9,0	3,2	18,5								
	$\pm \Delta Tc$	8,5	10,0	5,4	17,8								
		6,4	3,0	0,8	7,4								
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				250	kPa	Max. operating press. - tank side				1000	kPa		
Testing Laboratory				NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB									
Website				www.solar.demokritos.gr									
Test report id. number				6110 DE2, 6113 DE2, 6113 F2									
Date of test report				2020-11-04									
Test method				ISO 9459-5 (DST)									
Comments of test lab				Extrapolated						Stamp & signature of test lab			

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

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Postal Code		60044		Fabriano (AN)		Tel. / Fax		+39 732 6011					
System family overview													
For each storage and collector size, give number of collectors													
Collector name		150L			200L			300L					
CHAFFOTEAUX Collector GR2		1			1 2			2					
Name of system configuration						ZELIOS THERMO GR2 200-2							
Collector name		CHAFFOTEAUX Collector		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	5424	0	57	11164	6055	0	54	13939	6749
WürzburgDE	-	9114	5424	0	60	10691	6118	0	57	13371	6938	0	52
Davos CH	-	10281	8105	0	79	12110	9019	0	74	15137	9997	0	66
Athens GR	-	7064	6339	0	90	8326	7222	0	87	10407	8452	0	81
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)											
$f_{sol} = Q_d / Q_{d,t}$	-	Solar fraction											
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	Ta,ave	1.157	1.230	1.684	1.736								
	Tc,ave	7,5	9,0	3,2	18,5								
	± ΔTc	8,5	10,0	5,4	17,8								
		6,4	3,0	0,8	7,4								
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				250 kPa		Max. operating press. - tank side				1000 kPa			
Testing Laboratory				NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB									
Website				www.solar.demokritos.gr									
Test report id. number				6110 DE2, 6113 DE2, 6113 F2									
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Test method				ISO 9459-5 (DST)									
Comments of test lab				Stamp & signature of test lab									
Extrapolated													

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System family overview													
For each storage and collector size, give number of collectors													
Collector name		150L			200L			300L					
CHAFFOTEAUX Collector GR2		1			1	2			2				
Name of system configuration													
						ZELIOS THERMO GR2 2KW 200-2							
Collector name		CHAFFOTEAUX Collector		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	5424	0	57	11164	6055	0	54	13939	6749
WürzburgDE	-	9114	5424	0	60	10691	6118	0	57	13371	6938	0	52
Davos CH	-	10281	8105	0	79	12110	9019	0	74	15137	9997	0	66
Athens GR	-	7064	6339	0	90	8326	7222	0	87	10407	8452	0	81
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								
	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/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				250	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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Extrapolated													

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System family overview													
For each storage and collector size, give number of collectors													
Collector name		150L		200L		300L							
CHAFFOTEAUX Collector GR2		1		1 2		2							
Name of system configuration						ZELIOS THERMO GR2 300-2							
Collector name		CHAFFOTEAUX Collector		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	7096	0	51	16746	7821	0	47	22327	8452	0	38
WürzburgDE	-	13371	7222	0	54	16052	8073	0	50	21413	8893	0	42
Davos CH	-	15137	10470	0	69	18165	11448	0	63	24220	12110	0	50
Athens GR	-	10407	8704	0	84	12488	9934	0	80	16651	11574	0	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	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	T _{a,ave}	1.157	1.230	1.684	1.736								
	T _{c,ave}	7,5	9,0	3,2	18,5								
	± ΔTc	8,5	10,0	5,4	17,8								
		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.											
ΔTc	K	Seasonal variation of Tc											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side				250 kPa		Max. operating press. - tank side				1000 kPa			
Testing Laboratory				NCSR "DEMOKRITOS"- SOLAR & ENERGY SYSTEMS LAB									
Website				www.solar.demokritos.gr									
Test report id. number				6110 DE2, 6113 DE2, 6113 F2									
Date of test report				2020-11-04									
Test method				ISO 9459-5 (DST)									
Comments of test lab				Stamp & signature of test lab									
Extrapolated													

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		EN12976-2		test results		Certification No.		OEM 10109.4.4					
Annex to Solar KEYMARK Certificate						Issued		2021-12-20					
Company		ARISTON THERMO SpA				Country		Italy					
Brand (optional)		CHAFFOTEAUX				Website		www.aristongroup.com					
Street		Viale Aristide Merloni				E-mail		angelo.mancini@ariston.com					
Postal Code		60044		Fabriano (AN)		Tel. / Fax		+39 732 6011					
System family overview													
For each storage and collector size, give number of collectors													
Collector name		150L		200L				300L					
CHAFFOTEAUX Collector GR2		1		1 2				2					
Name of system configuration						ZELIOS THERMO GR2 2KW 300-2							
Collector name		CHAFFOTEAUX Collector		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	7096	0	51	16746	7821	0	47	22327	8452	0	38
WürzburgDE	-	13371	7222	0	54	16052	8073	0	50	21413	8893	0	42
Davos CH	-	15137	10470	0	69	18165	11448	0	63	24220	12110	0	50
Athens GR	-	10407	8704	0	84	12488	9934	0	80	16651	11574	0	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)											
$f_{sol} = Q_d / Q_{d,t}$	-	Solar fraction											
Ref. conditions	G	Stockholm SE	Würzburg DE	Davos CH	Athens GR								
	T _{a,ave}	1.157	1.230	1.684	1.736								
	T _{c,ave}	7,5	9,0	3,2	18,5								
	± ΔTc	8,5	10,0	5,4	17,8								
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G	kWh/m ²	Annual irradiation South, 45°											
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