




Summary of	EN12976-2	SOLAR SYSTEM test results		Licence Number	011-7S2817 A					
Annex to Solar KEYMARK Certificate				Issued	2022-12-15					
Company	Ariston S.p.A			Country	Italy					
Brand (optional)	Chaffoteaux			Website	www.ariston.com					
Street	Via A. Merloni 45			E-mail	maria.ciavetta@ariston.com					
Postal Code	60044	Fabriano		Tel. / Fax	+39	02763209 -1 / -40				
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 S.p.A			Company	Ariston Thermo S.p.A					
Keymark lic.no. if available	011-7S2618 F			Keymark lic.no. if available	-					
Collector name	Per module			Store name	Total nominal volume	Gross height	Gross width	Gross depth	Auxiliary heated volume	Electrical aux. heating power
	Gross Area (AG)	Gross length	Gross width							
	m ²	mm	mm							
Zelios CF2.0-1	2.01	2004	1004	Solar Eneveled Tank 150 L	144	1285	500	-	-	3.5
				Solar Eneveled Tank 200 L	190	1285	580	-	-	2.0
				Solar Eneveled Tank 300 L	276	1795	580	-	-	2.0
Solar loop controller				Solar loop fluid						
Keymark lic.no. if available	-			Recommended/required	Required					
Company Name	-			Company Name	-					
Solar loop pump - power range	- W to - W			Freezing point	-15 °C					
System family overview										
Collector name	Number of collectors in each configuration for each store									
	Store name									
	Solar Eneveled Tank 150 L	Solar Eneveled Tank 200 L	Solar Eneveled Tank 300 L							
Zelios CF2.0-1	1	1	2							
Testing Laboratory	TÜV Rheinland Solar GmbH									
Website	www.tuv.com/st									
Test report id. number	21241271.004Rev1									
Date of test report	2018-09-17									
Comments of test lab										
 TÜV Rheinland Solar GmbH Am Grauen Stein 51105 Köln										



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Parameters for systems extrapolation (Annex D)								
	Collector of measured system				Storage tank of measured system			
	$A_{ref} [m^2]$	1.83		Volume [l]	144			
	η_0	0.740		$A_{hx} [m^2]$	0.64			
	$a_1 [W/Km^2]$	3.820		Piping				
	$a_2 [W/Km^2]$	0.013						
	IAM (50°)	0.900		$U_{loop,p}$	3.20			
System parameters								
Name of System Configuration	Tested/Extrapol	A_c^* [m ²]	u_c^* [W/Km ²]	U_s [W/K]	C_s [MJ/K]	S_c [-]	D_L [-]	f_{aux} [-]
ZELIOS THERMO CF-GR 150/1 TR/ TT/ TT DT		1.160	7.564	2.712	0.575	0.1519	0.0302	-
ZELIOS THERMO CF-GR 200/1 TR/ TT/ TT DT		1.178	7.564	3.230	0.792	0.1519	0.0302	-
ZELIOS THERMO CF-GR 300/2 TR/ TT/ TT DT		2.349	7.138	4.299	1.150	0.1519	0.0302	-
Testing Laboratory		TÜV Rheinland Solar GmbH						
Website		www.tuv.com/st						
Test report id. number		21241271.004Rev1						
Date of test report		2018-09-17						
Test method		ISO 9459-5 (DST)						
Comments of test lab		The system configuration 150/1 was used for testing and as basis for scalling.						
		Stamp & signature of test lab						



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Postal Code	60044	Fabriano	Tel. / Fax	+39 02763209 -1 / -40									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	Solar Enemeled Tank 150 L	Solar Enemeled Tank 200 L	Solar Enemeled Tank 300 L										
Zelios CF2.0-1	1	1	2										
Name of system configuration			ZELIOS THERMO CF-GR 150/1 TR/ TT/ TT DT										
Collector name	Zelios CF2.0-1	No. Collectors	1	Storage name	Solar Enemeled Tank 150 L								
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	%
Stockholm SE	0	6150	2990	-	49	7821	3406	-	44	9492	3595	-	38
WürzburgDE	0	5897	3040	-	52	7506	3532	-	47	9114	3784	-	42
Davos CH	0	6654	4352	-	65	8483	4920	-	58	10281	5109	-	50
Athens GR	0	4573	3721	-	82	5834	4447	-	76	7064	4920	-	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	-							
± 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		150	kPa	Max. operating press. - tank side		1 000	kPa						
Testing Laboratory		TÜV Rheinland Solar GmbH											
Website		www.tuv.com/st											
Test report id. number		21241271.004Rev1											
Date of test report		2018-09-17											
Test method		ISO 9459-5 (DST)											
Comments of test lab													
No comments													



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Postal Code	60044	Fabriano	Tel. / Fax	+39 02763209 -1 / -40									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	Solar Eneveled Tank 150 L	Solar Eneveled Tank 200 L	Solar Eneveled Tank 300 L										
Zelios CF2.0-1	1	1	2										
Name of system configuration													
ZELIOS THERMO CF-GR 200/1 TR/ TT/ TT DT													
Collector name	Zelios CF2.0-1	No. Collectors	1	Storage name									
Solar Eneveled Tank 200 L													
Calculated annual results for "solar-only / preheat system"													
Location	Qd,sh	Daily drawoff 170 l				Daily drawoff 200 l				Daily drawoff 250 l			
		Qd,hw	QL	Qpar	fsol	Qd,hw	QL	Qpar	fsol	Qd,hw	QL	Qpar	fsol
		MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%
Stockholm SE	0	9492	3721	-	39	11164	3910	-	35	13939	4037	-	29
Würzburg DE	0	9114	3910	-	43	10691	4163	-	39	13371	4289	-	32
Davos CH	0	10281	5267	-	51	12110	5519	-	46	15137	5645	-	37
Athens GR	0	7064	5046	-	71	8326	5519	-	66	10407	5992	-	58
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		150	kPa	Max. operating press. - tank side		1 000	kPa						
Testing Laboratory		TÜV Rheinland Solar GmbH											
Website		www.tuv.com/st											
Test report id. number		21241271.004Rev1											
Date of test report		2018-09-17											
Test method		ISO 9459-5 (DST)											
Comments of test lab													
No comments													

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

Version 4.5, 2017-10-24

Stamp & signature of test lab



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System family overview													
For each storage and collector size, give number of collectors													
Collector name	Solar Eneveled Tank 150 L	Solar Eneveled Tank 200 L	Solar Eneveled Tank 300 L										
Zelios CF2.0-1	1	1	2										
Name of system configuration													
ZELIOS THERMO CF-GR 300/2 TR/ TT/ TT DT													
Collector name	Zelios CF2.0-1	No. Collectors	2	Storage name									
Solar Eneveled Tank 300 L													
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	0	13939	6717	-	48	16746	7222	-	43	22327	7632	-	34
Würzburg DE	0	13371	6875	-	51	16052	7537	-	47	21413	8042	-	38
Davos CH	0	15137	9808	-	65	18165	10501	-	58	24220	10817	-	45
Athens GR	0	10407	8420	-	81	12488	9492	-	76	16651	10785	-	65
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											
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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°											
T _{a,ave}	°C	Annual average outdoor air temperature											
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ΔT _c	K	Seasonal variation of T _c											
Th	45 °C	Desired hot water temperature (mixing valve temperature).											
Max. operating press. - collector side		150	kPa	Max. operating press. - tank side		1 000	kPa						
Testing Laboratory		TÜV Rheinland Solar GmbH											
Website		www.tuv.com/st											
Test report id. number		21241271.004Rev1											
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Test method		ISO 9459-5 (DST)											
Comments of test lab													
No comments													
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 ± 5 % to ± 15 %

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Postal Code	60044	Fabriano	Tel. / Fax	+39	02763209 -1 / -40

System family overview

Collector name	For each storage and collector size, give number of collectors			
	Solar Enemeled Tank 150 L	Solar Enemeled Tank 200 L	Solar Enemeled Tank 300 L	
Zelios CF2.0-1	1	1	2	

Annual performance parameters in the frame of the EU regulation CDR 811, 812 and 813 dated 2013

Name of system configuration	ZELIOS THERMO CF-GR 150/1 TR/ TT/ TT DT				
Collector name	Zelios CF2.0-1	No. Collectors	1	Storage name	Solar Enemeled Tank 150 L

Annual performance parameters in the frame of the EU regulation CDR 811, 812 and 813 dated 2013

Load profile	M	L	XL	XXL	
Annual heat demand (kWh)	1523	2799	4477	5626	
Auxiliary heat contribution	Qnonsol				section 5.9.3.6, see note 1
Average climate (kWh)	557	1534	2987	4159	Strasbourg
Cold climate (kWh)					Helsinki
Hot climate (kWh)					Athens
Qaux (kWh)					section 5.9.3.4, see note 1
Comply to the load profile (Yes/No)					section 5.10.6, see note 1
ηwh_nonsol (%)					section 5.9.3.5, see note 1
Qelec (kWh)					section 5.9.3.5, see note 1
Qfuel (kWh)					section 5.9.3.5, see note 1
V40, measured (l)					section 5.10.7, see note 1

Auxiliary thermostat setting	55	°C	Effective power of auxiliary heater	3.5	kW
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Note 1: Clause of EN 12976-2:2017

Testing Laboratory	TÜV Rheinland Solar GmbH
Website	www.tuv.com/st
Test report id. number	21241271.004Rev1
Date of test report	2018-09-17
Test method	ISO 9459-5 (DST)

Comments of test lab	Stamp & signature of test lab
No comments	



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System family overview

Collector name	For each storage and collector size, give number of collectors			
	Solar Enemeled Tank 150 L	Solar Enemeled Tank 200 L	Solar Enemeled Tank 300 L	
Zelios CF2.0-1	1	1	2	

Annual performance parameters in the frame of the EU regulation CDR 811, 812 and 813 dated 2013

Name of system configuration	ZELIOS THERMO CF-GR 200/1 TR/ TT/ TT DT		
Collector name	Zelios CF2.0-1	No. Collectors	1
		Storage name	Solar Enemeled Tank 200 L

Annual performance parameters in the frame of the EU regulation CDR 811, 812 and 813 dated 2013

Load profile	M	L	XL	XXL	
Annual heat demand (kWh)	1523	2799	4477	5626	
Auxiliary heat contribution	Qnonsol				section 5.9.3.6, see note 1
Average climate (kWh)	565	1472	2899	4054	Strasbourg
Cold climate (kWh)					Helsinki
Hot climate (kWh)					Athens
Qaux (kWh)					section 5.9.3.4, see note 1
Comply to the load profile (Yes/No)					section 5.10.6, see note 1
η_{wh_nonsol} (%)					section 5.9.3.5, see note 1
Qelec (kWh)					section 5.9.3.5, see note 1
Qfuel (kWh)					section 5.9.3.5, see note 1
V40, measured (l)					section 5.10.7, see note 1

Auxiliary thermostat setting	55	°C	Effective power of auxiliary heater	2.0	kW
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Note 1: Clause of EN 12976-2:2017

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System family overview

Collector name	For each storage and collector size, give number of collectors			
	Solar Eneveled Tank 150 L	Solar Eneveled Tank 200 L	Solar Eneveled Tank 300 L	
Zelios CF2.0-1	1	1	2	

Annual performance parameters in the frame of the EU regulation CDR 811, 812 and 813 dated 2013

Name of system configuration			ZELIOS THERMO CF-GR 300/2 TR/ TT/ TT DT		
Collector name	Zelios CF2.0-1	No. Collectors	2	Storage name	Solar Eneveled Tank 300 L

Annual performance parameters in the frame of the EU regulation CDR 811, 812 and 813 dated 2013

Load profile	M	L	XL	XXL	
Annual heat demand (kWh)	1523	2799	4477	5626	
Auxiliary heat contribution	Qnonsol				section 5.9.3.6, see note 1
Average climate (kWh)	363	928	1932	2929	Strasbourg
Cold climate (kWh)					Helsinki
Hot climate (kWh)					Athens
Qaux (kWh)					section 5.9.3.4, see note 1
Comply to the load profile (Yes/No)					section 5.10.6, see note 1
η_{wh_nonsol} (%)					section 5.9.3.5, see note 1
Qelec (kWh)					section 5.9.3.5, see note 1
Qfuel (kWh)					section 5.9.3.5, see note 1
V40, measured (l)					section 5.10.7, see note 1

Auxiliary thermostat setting	55	°C	Effective power of auxiliary heater	2.0	kW
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Note 1: Clause of EN 12976-2:2017

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