



ICIM S.p.A.

Piazza Don Enrico Mapelli, 75 - 20099 Sesto San Giovanni (MI)
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 Capitale Soc EUR. 260.000,00 int. versato ed esistente
 C.F./P. IVA e Iscriz. Reg. Imprese di Milano n. 12908230159 - R.E.A. n. 1596292

Summary of		EN12976-2	SOLAR SYSTEM test results		Licence Number	ICIM-CLS-000170				
Annex to Solar KEYMARK Certificate					Issued	2021-06-18				
Company	ARISTON THERMO S.p.A.			Country	Italy					
Brand (optional)	Chaffoteaux			Website	www.aristonthermo.com					
Street	Viale Aristide Merloni, 45			E-mail	info@aristonthermo.com					
Postal Code	IT-60044	Fabriano (AN)		Tel. / Fax	+39	(0) 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)				None						
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.			
<i>Keymark lic.no. if available</i>		ICIM-CLS-000172			<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 (Ag)	Gross length	Gross width							
VN 2.2-2	2,20	1100	1995	SOLAR ENAMELED TANK 150	136	500	1785	500	--	--
				SOLAR ENAMELED TANK 200	190	580	1285	580		
				SOLAR ENAMELED TANK 300	276	580	1785	580		
Solar loop controller				Solar loop fluid						
<i>Keymark lic.no. if available</i>		--			Recommended/required	Required				
Company		--			Company	--				
Name		--			Name	Water or Water/Glycol				
Solar loop pump - power range		-- W to -- W			Freezing point	-- °C				
System family overview										
Collector name	Number of collectors in each configuration for each store									
	Store name									
	SOLAR ENAMELED TANK 150		SOLAR ENAMELED TANK 200			SOLAR ENAMELED TANK 300				
VN 2.2-2	1			1			2			
Testing Laboratory	Institut für Solartechnik SPF, CH-8640 Rapperswil									
Website	www.spf.ch									
Test report id. number	S273EN									
Date of test report	2021-03-25									
--					 INSTITUT FÜR SOLARTECHNIK 					



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Summary of	EN12976-2	test results	Certification No.	ICIM-CLS-000170
Annex to Solar KEYMARK Certificate			Issued	2021-06-18

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Brand (optional)	Chaffoteaux		Website	www.aristonthermo.com
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Postal Code	IT-60044	Fabriano (AN)	Tel. / Fax	+39 (0) 732 6011

Parameters for systems extrapolation (Annex D)

Collector of measured system		Storage tank of measured system	
A_{ref} [m ²]	2,01	Volume [l]	136
η_0	0,77	A_{hx} [m ²]	0,57
a_1 [W/Km ²]	3,91	Piping	
a_2 [W/Km ²]	0,0040	$U_{loop,p}$	1,28
IAM (50°)	0,960		

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 HF-2 150-1	Tested	1,39	4,72	3,10	0,58	0,11	0,08	--
ZELIOS THERMO HF-2 200-1	Extrapol	1,48	6,37	3,71	0,82	0,13	0,11	--
ZELIOS THERMO HF-2 300-2	Extrapol	2,97	6,26	4,91	1,19	0,13	0,11	--

Testing Laboratory	Institut für Solartechnik SPF, CH-8640 Rapperswil
Website	www.spf.ch
Test report id. number	S273EN
Date of test report	2021-03-25
Test method	ISO 9459-5 (DST)

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

Version 4.5, 2017-10-24

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System family overview

Collector name	For each storage and collector size, give number of collectors			
	SOLAR ENAMELED TANK 150	SOLAR ENAMELED TANK 200	SOLAR ENAMELED TANK 300	
VN 2.2-2	1	1	2	

Name of system configuration	ZELIOS THERMO HF-2 150-1		
Collector name	VN 2.2-2	No. Collectors	1
		Storage name	SOLAR ENAMELED TANK 150

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	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	--	6150	3321	0	54	7821	3824	0	49	9492	4148	0	44
WürzburgDE	--	5897	3344	0	57	7506	3940	0	53	9114	4338	0	48
Davos CH	--	6654	4904	0	74	8483	5650	0	67	10281	6045	0	59
Athens GR	--	4573	3992	0	87	5834	4790	0	82	7064	5390	0	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
Ta,ave	°C	7,5	9,0	3,2	18,5
Tc,ave	°C	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	300	kPa	Max. operating press. - tank side	1.000	kPa
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Comments of test lab	
	 

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System family overview

Collector name	For each storage and collector size, give number of collectors			
	SOLAR ENAMELED TANK 150	SOLAR ENAMELED TANK 200	SOLAR ENAMELED TANK 300	
VN 2.2-2	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 HF-2 150-1	
Collector name	VN 2.2-2	No. Collectors	1	Storage name
				SOLAR ENAMELED TANK 150

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)	1542	2829	4468	5685	
Auxiliary heat contribution	Q _{nonsol}				section 5.9.3.6, see note 1
Average climate (kWh)	507	1415	2832	4008	Strasbourg
Cold climate (kWh)	763	1774	3243	4429	Helsinki
Hot climate (kWh)	182	855	2162	3320	Athens
Q _{aux} (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
Q _{elec} (kWh)					section 5.9.3.5, see note 1
Q _{fuel} (kWh)					section 5.9.3.5, see note 1
V ₄₀ , measured (l)					section 5.10.7, see note 1

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

Testing Laboratory	Institut für Solartechnik SPF, CH-8640 Rapperswil
Website	www.spf.ch
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System family overview

Collector name	For each storage and collector size, give number of collectors												
	SOLAR ENAMELED TANK 150			SOLAR ENAMELED TANK 200			SOLAR ENAMELED TANK 300						
VN 2.2-2	1			1			2						

Name of system configuration	ZELIOS THERMO HF-2 200-1				
Collector name	VN 2.2-2	No. Collectors	1	Storage name	SOLAR ENAMELED TANK 200

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	QL	Qpar	fsol	Qd,hw	QL	Qpar	fsol	Qd,hw	QL	Qpar	fsol
		MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%
Stockholm SE	--	9492	4006	0	42	11164	4276	0	38	13939	4502	0	32
WürzburgDE	--	9114	4202	0	46	10691	4533	0	42	13371	4800	0	36
Davos CH	--	10281	5798	0	56	12110	6152	0	51	15137	6418	0	42
Athens GR	--	7064	5291	0	75	8326	5861	0	70	10407	6546	0	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
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	300	kPa	Max. operating press. - tank side	1.000	kPa
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Testing Laboratory	Institut für Solartechnik SPF, CH-8640 Rapperswil
Website	www.spf.ch
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System family overview

Collector name	For each storage and collector size, give number of collectors			
	SOLAR ENAMELED TANK 150	SOLAR ENAMELED TANK 200	SOLAR ENAMELED TANK 300	
VN 2.2-2	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 HF-2 200-1		
Collector name	VN 2.2-2	No. Collectors	1
		Storage name	SOLAR ENAMELED TANK 200

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)	1542	2829	4468	5685	
Auxiliary heat contribution	Q _{nonsol}				section 5.9.3.6, see note 1
Average climate (kWh)	555	1429	2810	3963	Strasbourg
Cold climate (kWh)	813	1808	3252	4417	Helsinki
Hot climate (kWh)	219	835	2077	3189	Athens
Q _{aux} (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
Q _{elec} (kWh)					section 5.9.3.5, see note 1
Q _{fuel} (kWh)					section 5.9.3.5, see note 1
V ₄₀ , measured (l)					section 5.10.7, see note 1

Auxiliary thermostat setting	--	°C	Effective power of auxiliary heater	--	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 ENAMELED TANK 150			SOLAR ENAMELED TANK 200			SOLAR ENAMELED TANK 300								
VN 2.2-2	1			1			2								

Name of system configuration	ZELIOS THERMO HF-2 300-2				
Collector name	VN 2.2-2	No. Collectors	2	Storage name	SOLAR ENAMELED TANK 300

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	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	7067	0	51	16746	7737	0	46	22328	8507	0	38
WürzburgDE	--	13371	7207	0	54	16052	8042	0	50	21413	8951	0	42
Davos CH	--	15137	10475	0	69	18165	11462	0	63	24220	12255	0	51
Athens GR	--	10407	8752	0	84	12488	9928	0	80	16651	11622	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	
± 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	300	kPa	Max. operating press. - tank side	1.000	kPa
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System family overview

Collector name	For each storage and collector size, give number of collectors			
	SOLAR ENAMELED TANK 150	SOLAR ENAMELED TANK 200	SOLAR ENAMELED TANK 300	
VN 2.2-2	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 HF-2 300-2
Collector name	VN 2.2-2
No. Collectors	2
Storage name	SOLAR ENAMELED TANK 300

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)	1542	2829	4468	5685	
Auxiliary heat contribution	Q _{nonsol}				section 5.9.3.6, see note 1
Average climate (kWh)	365	914	1863	2797	Strasbourg
Cold climate (kWh)	649	1392	2533	3548	Helsinki
Hot climate (kWh)	72	323	916	1649	Athens
Q _{aux} (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
Q _{elec} (kWh)					section 5.9.3.5, see note 1
Q _{fuel} (kWh)					section 5.9.3.5, see note 1
V ₄₀ , measured (l)					section 5.10.7, see note 1

Auxiliary thermostat setting	--	°C	Effective power of auxiliary heater	--	kW
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