

Summary of	EN12976-2	SOLAR SYSTEM test results	Licence Number	ICIM-CLS-000159-00
Annex to Solar KEYMARK Certificate			Issued	2019-02-28

Company	CORDIVARI S.r.l.	Country	ITALY	
Brand (optional)	STRATOS 4S HEAT CONTROL	Website	www.cordivari.it	
Street	INDUSTRIAL AREA OF PAGLIARE	E-mail	info@cordivari.it	
Postal Code	64020 MORRO D'ORO	Tel. / Fax	+39 085 804 01	

System classification

Application(s)	Hot water
Solar loop, circulation principle	Other
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	CORDIVARI S.r.l.			Company	CORDIVARI S.r.l.					
Keymark lic.no. if available	-			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							
1.77	1.77	2160	822	120	48	100	1700		-	-
2.27	2.27	2160	1048	180	72	100	1700		-	-

Solar loop controller		Solar loop fluid	
Keymark lic.no. if available		Recommended/required	Recommended
Company	Jiangsu Changseng Electric	Company	-
Name	Bimetalic	Name	water-glycol mixture 25%
Solar loop pump - power range	W to W	Freezing point	-20 °C

System family overview

Collector name	Number of collectors in each configuration for each store									
	120					180				
	Store name									
1.77	1									
2.27			1							

Testing Laboratory	Solar & other Energy Systems Laboratory
Website	www.solar.demokritos.gr/
Test report id. number	6100DE1, 6101DE1
Date of test report	2018-12-21

Comments of test lab	Integral collector storage type, both tested
	 N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503815 - Fax: +210 6541604 153 10 Ag. Paraskevi - Attiki - Greece

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Parameters for systems extrapolation (Annex D)

Collector of measured system		Storage tank of measured system	
$A_{ref} [m^2]$	0.00	Volume [l]	0
η_0	0.000	$A_{st} [m^2]$	0
$a_1 [W/Km^2]$	0.000	Piping	
$a_2 [W/Km^2]$	0.000		
IAM (50°)	0.000	$U_{loop,p}$	0.00

Parameters of system tested (ISO 9459-2)

Name of System Configuration Tested	I-O Diagram Parameters and Tank heat loss coefficient						
	$a_1 [1/m^2]$	$a_2 [MJ/K]$	$a_3 [MJ]$	$U_s [W/K]$			
	0.46	0.09	1.12	1.80			
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	11.94	11.91	10.62	1.6	1.98	1.92	2.14
0.2	10.39	10.46	9.21	1.7	1.80	1.73	1.94
0.3	8.43	8.75	8.21	1.8	1.63	1.57	1.76
0.4	7.58	7.84	7.42	1.9	1.48	1.42	1.61
0.5	6.77	6.96	6.73	2.0	1.35	1.30	1.46
0.6	6.03	6.16	6.08	2.1	1.23	1.18	1.33
0.7	5.36	5.44	5.48	2.2	1.13	1.08	1.22
0.8	4.77	4.80	4.93	2.3	1.03	0.98	1.11
0.9	4.24	4.25	4.44	2.4	0.95	0.90	1.02
1.0	3.79	3.76	3.99	2.5	0.87	0.83	0.93
1.1	3.37	3.34	3.58	2.6	0.80	0.76	0.86
1.2	3.02	2.98	3.22	2.7	0.74	0.70	0.79
1.3	2.71	2.66	2.90	2.8	0.70	0.65	0.73
1.4	2.44	2.38	2.62	2.9	0.66	0.60	0.67
1.5	2.20	2.13	2.37	3.0	0.61	0.56	0.62

Testing Laboratory	Solar & other Energy Systems Laboratory
Website	www.solar.demokritos.gr/
Test report id. number	6100DE1
Date of test report	2018-12-21
Test method	ISO 9459-2 (CSTG)

Comments of test lab	N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belessiotis Tel: +210 6503013 - Fax: +210 6544532 153 10 Ag. Paraskevi - Attiki - Greece
Parameters of system tested MODEL 120	

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Brand (optional)	STRATOS 4S HEAT CONTROL		Website	www.cordivari.it
Street	INDUSTRIAL AREA OF PAGLIARE		E-mail	info@cordivari.it
Postal Code	64020	MORRO D'ORO	Tel. / Fax	+39 085 804 01

Parameters for systems extrapolation (Annex D)

Collector of measured system		Storage tank of measured system	
A_{ref} [m ²]	0.00	Volume [l]	0
η_0	0.000	A_{bx} [m ²]	0
a_1 [W/Km ²]	0.000	Piping	
a_2 [W/Km ²]	0.000		
IAM (50°)	0.000	$U_{loop,p}$	0.00

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]
				0.75	0.13	1.42	2.60
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	11.06	10.30	10.04	1.6	1.92	2.01	1.97
0.2	10.22	9.65	9.17	1.7	1.75	1.81	1.78
0.3	8.90	8.69	8.48	1.8	1.57	1.65	1.63
0.4	8.03	7.89	7.83	1.9	1.41	1.50	1.45
0.5	7.18	7.08	7.10	2.0	1.27	1.37	1.30
0.6	6.39	6.30	6.40	2.1	1.14	1.26	1.17
0.7	5.65	5.58	5.74	2.2	1.03	1.17	1.06
0.8	4.99	4.93	5.12	2.3	0.93	1.08	0.95
0.9	4.40	4.35	4.55	2.4	0.85	1.00	0.86
1.0	3.88	3.84	4.03	2.5	0.78	0.94	0.86
1.1	3.43	3.40	3.57	2.6	0.71	0.88	0.86
1.2	3.03	3.02	3.16	2.7	0.64	0.83	0.86
1.3	2.68	2.69	2.80	2.8	0.59	0.78	0.86
1.4	2.38	2.40	2.48	2.9	0.54	0.74	0.86
1.5	2.12	2.19	2.21	3.0	0.50	0.70	0.86

Testing Laboratory	Solar & other Energy Systems Laboratory
Website	www.solar.demokritos.gr/
Test report id. number	6101DE1
Date of test report	2018-12-21
Test method	ISO 9459-2 (CSTG)

Comments of test lab	 N.C.S.R. "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr. Vassilis Belesiotis Tel: +210 6563915 - Fax: +210 6544569 153 10 Ag. Pareaskevi - Attiki - Greece
Parameters of system tested MODEL 180	

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Company	CORDIVARI S.r.l.		Country	ITALY									
Brand (optional)	STRATOS 4S HEAT CONTROL		Website	www.cordivari.it									
Street	INDUSTRIAL AREA OF PAGLIARE		E-mail	info@cordivari.it									
Postal Code	64020	MORRO D'ORO	Tel. / Fax	+39 085 804 01									
System family overview													
For each storage and collector size, give number of collectors													
Collector name	120	180											
1.77	1												
2.27		1											
Name of system configuration													
			Stratos 4S Heat Control 120										
Collector name	1.77	No. Collectors	1	Storage name									
Calculated annual results for "solar-only / preheat system"													
Location	Q_{d,sh}	Daily drawoff 80 				Daily drawoff 110 				Daily drawoff 140 			
		Q_{d,hw}	Q_L	Q_{par}	f_{sol}	Q_{d,hw}	Q_L	Q_{par}	f_{sol}	Q_{d,hw}	Q_L	Q_{par}	f_{sol}
	MJ/y	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%	MJ/y	MJ/y	MJ/y	%
Stockholm SE	4455	2044	0	46	6126	2213	0	36	7796	2279	0	29	
Würzburg DE	4272	2133	0	50	5874	2325	0	40	7476	2393	0	32	
Davos CH	4833	2836	0	59	6646	3007	0	45	8458	3095	0	37	
Athens GR	3320	2466	0	74	4565	2968	0	65	5810	3245	0	56	
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								
	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		600	kPa	Max. operating press. - tank side		500	kPa						
Testing Laboratory		Solar & other Energy Systems Laboratory											
Website		www.solar.demokritos.gr/											
Test report id. number		6100DE1											
Date of test report		2018-12-21											
Test method		ISO 9459-2 (CSTG)											
Comments of test lab													
Q _{par} = 0 because the controller is of the bimetallic type and the pump starts operating if the temperature of the fluid exceeds 90°C. The temperature during the performance test was always under 90°C.													
												N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belessiotis Tel: +210 6503615 - Fax: +210 6544502 153 1C Ag. Paraskevi - Attiki - 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

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Brand (optional)	STRATOS 4S HEAT CONTROL	Website	www.cordivari.it
Street	INDUSTRIAL AREA OF PAGLIARE	E-mail	info@cordivari.it
Postal Code	64020 MORRO D'ORO	Tel. / Fax	+39 085 804 01

System family overview

Collector name	For each storage and collector size, give number of collectors												
	120				180								
1.77	1												
2.27			1										

Name of system configuration	Stratos 4S Heat Control 180												
Collector name	2.27	No. Collectors	1	Storage name	180								

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	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		7796	3332	0	43	9467	3505	0	37	11138	3582	0	32
WürzburgDE		7476	3501	0	47	9078	3691	0	41	10680	3768	0	35
Davos CH		8458	4629	0	55	10271	4818	0	47	12084	4920	0	41
Athens GR		5810	4167	0	72	7055	4669	0	66	8300	5026	0	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/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	600	kPa	Max. operating press. - tank side	500	kPa
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Testing Laboratory	Solar & other Energy Systems Laboratory
Website	www.solar.demokritos.gr/
Test report id. number	6101DE1
Date of test report	2018-12-21
Test method	ISO 9459-2 (CSTG)

Comments of test lab	<p>Qpar = 0 because the controller is of the bimetallic type and the pump starts operating if the temperature of the fluid exceeds 90°C. The temperature during the performance test was always under 90°C.</p> <p>N.C.S.R "DEMOKRITOS" SOLAR ENERGY LABORATORY Head: Dr Vassilis Belesiotis Tel: +210 6503915 - Fax: +210 6544592 153 10 Ag. Paraskevi - Attiki - Greece</p>
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