


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results						Licence Number		<b>011-7S2855 F</b>						
						Date issued		<b>2018-05-23</b>						
						Issued by		<b>DIN CERTCO</b>						
Licence holder		<b>LATO S.A.</b>				Country		Greece						
Brand (optional)						Web		www.lato.com.gr						
Street, Number		15 klm Thesaloniki - Edesa				E-mail		info@lato.com.gr						
Postcode, City		57011 Gerifa				Tel		+30 2 310 710 151						
Collector Type						Flat plate collector, glazed								
Collector name					Gross area (A <sub>G</sub> ) m <sup>2</sup>	Gross length mm	Gross width mm	Gross height mm	Power output per collector G <sub>b</sub> = 850 W/m <sup>2</sup> ; G <sub>d</sub> = 150 W/m <sup>2</sup> ; u = 3 m/s ̑ <sub>m</sub> - ̑ <sub>a</sub>					
									0 K W	10 K W	30 K W	50 K W	70 K W	112 K W
HELIOS 17					2.53	2 008	1 258	85	1 734	1 643	1 450	1 243	1 022	512
HELIOS 16					2.24	1 893	1 183	85	1 537	1 456	1 285	1 102	906	454
HELIOS 15					2.02	2 006	1 007	85	1 386	1 314	1 159	994	817	409
HELIOS 14					1.96	1 503	1 305	85	1 346	1 275	1 126	965	794	398
HELIOS 12					1.68	1 420	1 183	85	1 153	1 092	964	827	680	340
HELIOS 10					1.51	1 501	1 007	85	1 037	983	868	744	612	306
HELIOS 21					2.93	2 007	1 458	85	2 008	1 903	1 680	1 440	1 184	593
HELIOS 18					2.67	2 260	1 183	85	1 835	1 738	1 535	1 316	1 082	542
Power output per m <sup>2</sup> gross area									686	650	574	492	405	203
Performance parameters test method		Quasi dynamic												
Performance parameters (related to AG)		̑ <sub>0,b</sub>	c <sub>1</sub>	c <sub>2</sub>	c <sub>3</sub>	c <sub>4</sub>	c <sub>6</sub>	K <sub>d</sub>						
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	s/m	-						
Test results		0.687	3.534	0.007	0.000	0.000	0.000	0.993						
Incidence angle modifier test method		Quasi dynamic - outdoor												
Bi-directional incidence angle modifiers		No												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub>GT, coll</sub>	1.00	0.99	0.98	0.96	0.92	0.86	0.73	0.34	0.00			
Longitudinal		K <sub>GL, coll</sub>	1.00	0.99	0.98	0.96	0.92	0.86	0.73	0.34	0.00			
Heat transfer medium for testing		Water												
Flow rate for testing (per gross area, A <sub>G</sub> )		dm/dt	0.020		kg/(sm <sup>2</sup> )									
Maximum temperature difference for thermal performance calculations		(̑ <sub>m</sub> -̑ <sub>a</sub> ) <sub>max</sub>	112		K									
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ̑ <sub>a</sub> = 30 °C)		̑ <sub>stg</sub>	199		°C									
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )		C/m <sup>2</sup>	11.515		kJ/(Km <sup>2</sup> )									
Maximum operating temperature		̑ <sub>max, op</sub>	n.a.		°C									
Maximum operating pressure		p <sub>max, op</sub>	1600		kPa									
Testing laboratory		TZS, ITW University Stuttgart				www.itw.uni-stuttgart.de								
Test report(s)		10COL933/3OEM20 10COL934/3OEM20 10COL934Q/3OEM20				Dated		23.05.2018 23.05.2018 23.05.2018						
Comments of testing laboratory		Datashet version: 5.01, 2016-03-01												
Documented performance parameters are taken from test report 10COL933/3OEM20 (HELIOS 10)		 Forschungs- und Testzentrum für Solaranlagen Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70560 Stuttgart (Vaihingen)												
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S2855 F</b>
	<b>Issued</b>	<b>2018-05-23</b>

**Annual collector output in kWh/collector at mean fluid temperature  $\vartheta_m$ , based on ISO 9806:2013 test results**

Collector name	Standard Locations $\vartheta_m$	Athens			Davos			Stockholm			Würzburg		
		25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
HELIOS 17		2 810	1 981	1 300	2 108	1 448	921	1 556	1 008	615	1 704	1 096	658
HELIOS 16		2 492	1 756	1 153	1 869	1 284	816	1 379	894	545	1 510	972	583
HELIOS 15		2 247	1 584	1 040	1 686	1 158	736	1 244	806	492	1 362	877	526
HELIOS 14		2 182	1 538	1 010	1 637	1 124	715	1 208	783	477	1 323	851	511
HELIOS 12		1 869	1 317	865	1 402	963	612	1 035	671	409	1 133	729	438
HELIOS 10		1 682	1 185	778	1 261	866	551	931	603	368	1 019	656	394
HELIOS 21		3 256	2 295	1 506	2 442	1 677	1 067	1 802	1 168	712	1 973	1 270	762
HELIOS 18		2 975	2 097	1 376	2 231	1 533	975	1 647	1 067	651	1 803	1 161	696


Annual output per m<sup>2</sup> gross area      1 113    784    515    835    573    365    616    399    243    674    434    260

Fixed or tracking collector      Fixed (slope = latitude - 15°; rounded to nearest 5°)

Annual irradiation on collector plane      1765 kWh/m<sup>2</sup>      1714 kWh/m<sup>2</sup>      1166 kWh/m<sup>2</sup>      1244 kWh/m<sup>2</sup>

Mean annual ambient air temperature      18.5°C      3.2°C      7.5°C      9.0°C

Collector orientation or tracking mode      South, 25°      South, 30°      South, 45°      South, 35°

The collector is operated at constant temperature  $\vartheta_m$  (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 5.01 (March 2016). A detailed description of the calculations is available at [www.solarkeymark.org/scenocalc](http://www.solarkeymark.org/scenocalc)

**Additional Information**

Collector heat transfer medium	Water-Glycole	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	B	--
Maximum tested positive load	2500	Pa
Maximum tested negative load	2250	Pa
Hail resistance using steel ball (maximum drop height)	n.a.	m

**Energy Labelling Information**

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
HELIOS 17	2.53	Collector efficiency ( $\eta_{col}$ )	53 %
HELIOS 16	2.24	Remark: Collector efficiency ( $\eta_{col}$ ) is defined in CDR (EU) No 811/2013 as collector efficiency of the solar collector at a temperature difference between the solar collector and the surrounding air of 40 K and a global solar irradiance of 1000 W/m <sup>2</sup> , expressed in % and rounded to the nearest integer. Deviating from the regulation $\eta_{col}$ is based on reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.	
HELIOS 15	2.02		
HELIOS 14	1.96		
HELIOS 12	1.68		
HELIOS 10	1.51		
HELIOS 21	2.93		
HELIOS 18	2.67		
		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
		Zero-loss efficiency ( $\eta_0$ )	0.686 --
		First-order coefficient ( $a_1$ )	3.53 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.007 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0.92 --
Remark: The data given in this section are related to collector reference area ( $A_{sol}$ ) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806. Consistent data sets for either aperture or gross area can be used in calculations like in the regulation 811 and 812 and simulation programs.			