


Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		011-7S1490 F							
					Date issued		2016-10-26							
					Issued by		DIN CERTCO							
Licence holder		DIMAS SA Solar Energy Systems			Country		Greece							
Brand (optional)		-			Web		http://dimas-solar.gr/							
Street, Number		2nd km Argos - Nafplion			E-mail		info@dimas-solar.gr							
Postcode, City		21200, Argos			Tel		+30 +27510-29110 /-20920							
Collector Type					Flat plate collector, glazed									
Collector name					Power output per collector Gb = 850 W/m <sup>2</sup> ; Gd = 150 W/m <sup>2</sup> ; u = 3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	115 K				
					W	W	W	W	W	W				
ENERGY+ARGO 25					2.52	2 006	1 257	85	1 761	1 668	1 469	1 254	1 023	445
ENERGY+ARGO 23					2.24	1 893	1 183	85	1 565	1 482	1 306	1 115	910	395
ENERGY+ARGO 20					2.02	2 006	1 007	85	1 412	1 337	1 178	1 005	820	356
ENERGY+ARGO 19					1.96	1 503	1 305	85	1 370	1 297	1 143	975	796	346
ENERGY+ARGO 17					1.68	1 420	1 183	85	1 174	1 112	979	836	682	296
ENERGY+ARGO 15					1.51	1 503	1 007	85	1 055	999	880	752	613	266
Power output per m <sup>2</sup> gross area					699	662	583	498	406	176				
Performance parameters test method					Quasi dynamic									
Performance parameters (related to AG)					$\eta_{0,b}$	c1	c2	c3	c4	c6	Kd			
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					0.701	3.622	0.008	0.000	0.000	0.000	0.979			
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					$K_{\theta T, coll}$	1.00	0.99	0.98	0.96	0.94	0.88	0.78	0.45	0.00
Longitudinal					$K_{\theta L, coll}$	1.00	0.99	0.98	0.96	0.94	0.88	0.78	0.45	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					$(\vartheta_m - \vartheta_a)_{max}$		115	K						
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30^\circ\text{C}$ )					$\vartheta_{stg}$		200	°C						
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )					C/m <sup>2</sup>		17.941	kJ/(Km <sup>2</sup> )						
Maximum operating temperature					$\vartheta_{max, op}$		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)					10COL910/2 10COL911/2 10COL911Q/2			Dated		20.10.2016 20.10.2016 20.10.2016				
Comments of testing laboratory					Datashet version: 5.01, 2016-03-01									
This data sheet replaces the data sheet issued on 01.08.2013 The data sheet is issued on version 5.01 documented performance parameters are taken from 10COL910/2 (ENERGY+ARGO 15)					 <b>Forschungs- und Testzentrum für Solaranlagen</b> <small>Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 6, 70560 Stuttgart (Vaihingen)</small>									
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S1490 F</b>
	<b>Issued</b>	<b>2016-10-26</b>

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

Standard Locations Collector name	$\vartheta_m$	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
ENERGY+ARGO 25		2 856	2 004	1 303	2 138	1 459	915	1 580	1 017	612	1 728	1 105	654
ENERGY+ARGO 23		2 539	1 782	1 158	1 901	1 297	814	1 405	904	544	1 536	982	582
ENERGY+ARGO 20		2 290	1 607	1 044	1 714	1 170	734	1 267	815	491	1 385	886	524
ENERGY+ARGO 19		2 222	1 559	1 013	1 663	1 135	712	1 229	791	476	1 344	859	509
ENERGY+ARGO 17		1 904	1 336	869	1 425	973	610	1 054	678	408	1 152	737	436
ENERGY+ARGO 15		1 712	1 201	781	1 281	874	548	947	609	367	1 036	662	392
Annual output per m <sup>2</sup> gross area		1 133	795	517	848	579	363	627	404	243	686	439	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 $A_{sol}$	
ENERGY+ARGO 25	2.52	Collector efficiency ( $\eta_{col}$ )	54 %
ENERGY+ARGO 23	2.24	<i>Remark: Collector efficiency (<math>\eta_{col}</math>) 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 <math>\eta_{col}</math> is based on reference area (<math>A_{sol}</math>) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.</i>	
ENERGY+ARGO 20	2.02		
ENERGY+ARGO 19	1.96		
ENERGY+ARGO 17	1.68		
ENERGY+ARGO 15	1.51		
		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
		Zero-loss efficiency ( $\eta_0$ )	0.699 --
		First-order coefficient ( $a_1$ )	3.62 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.008 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0.94 --
<i>Remark: The data given in this section are related to collector reference area (<math>A_{sol}</math>) 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.</i>			