



Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results					Licence Number		<b>011-7S2782 P</b>							
					Date issued		<b>2017-07-20</b>							
					Issued by		TÜV Rheinland Energy GmbH							
Licence holder		<b>SOLAIRE 2G S.A.S</b>			Country		France							
Brand (optional)		DualSun			Web		http://www.dualsun.fr							
Street, Number		2 rue Marc Donadille			E-mail		info@dualsun.fr							
Postcode, City		CS 80001 - 13013 Marseille			Tel		+33 (0)9 52 03 59 57							
Collector Type					Flat plate collector, unglazed									
Collector name					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 = 1 m/s ∅ <sub>m</sub> - ∅ <sub>a</sub>									
					0 K	10 K	30 K	50 K	70 K	40 K				
					m <sup>2</sup>	mm	mm	mm	W	W	W	W	W	W
225M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
230M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
235M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
240M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
245M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
250M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
<b>255M - 60 - 2BBPI</b>					<b>1.65</b>	<b>1 677</b>	<b>990</b>	<b>45</b>	<b>707</b>	<b>556</b>	<b>256</b>	<b>0</b>	<b>0</b>	<b>105</b>
260M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
265M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
270M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
275M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
280M - 60 - 2BBPI					1.65	1 677	990	45	707	556	256	0	0	105
Power output per m <sup>2</sup> gross area									428	337	155	0	0	64
Performance parameters test method					Quasi dynamic									
Performance parameters (related to AG)					η <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					0.475	7.411	0.000	1.700	0.437	0.003	1.000			
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>θT, coll</sub>	1.00	1.00	0.99	0.99	0.98	0.96	0.92		0.00
Longitudinal					K <sub>θL, coll</sub>	1.00	1.00	0.99	0.99	0.98	0.96	0.92		0.00
Heat transfer medium for testing					Water									
Flow rate for testing (per gross area, A <sub>G</sub> )					dm/dt	0.030	kg/(sm <sup>2</sup> )							
Maximum temperature difference for thermal performance calculations					(∅ <sub>m</sub> -∅ <sub>a</sub> ) <sub>max</sub>	40	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ∅ <sub>a</sub> = 30 °C)					∅ <sub>stg</sub>	80	°C							
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )					C/m <sup>2</sup>	42.2	kJ/(Km <sup>2</sup> )							
Maximum operating temperature					∅ <sub>max, op</sub>	80	°C							
Maximum operating pressure					p <sub>max, op</sub>	120	kPa							
Testing laboratory					TÜV Rheinland Energy GmbH			www.tuv.com/solarpower						
Test report(s)					21236476.001r1			Dated		20.01.2017				
Comments of testing laboratory					Datashet version: 5.01, 2016-03-01									
Thermal performance parameters are given for the PV-module working with max. electrical power output ('MPP mode'). As Scenocalc is not operating proper with Steady state for uncovered collectors, the quasi-dynmic test results had been used for Scenocalc calculatuion.					 Genau. Richtig.  TÜV Rheinland Energy GmbH Am Grauen Stein 51105 Köln									
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**Annual collector output in kWh/collector at mean fluid temperature  $\vartheta_m$ , based on EN ISO 9806:2013 test results**

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
Collector name													
225M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
230M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
235M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
240M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
245M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
250M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
255M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
260M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
265M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
270M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
275M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0
280M - 60 - 2BBPI		942	124	2	388	25		350	34		406	47	0

Annual output per m <sup>2</sup> gross area	571	75	1	235	15		212	21		246	29	0
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	Yes	
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)	A	--
Maximum tested positive load	5400	Pa
Maximum tested negative load	2400	Pa
Hail resistance using steel ball (maximum drop height)	25	m

**Energy Labelling Information**

	Reference Area, A <sub>sol</sub> (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area A <sub>sol</sub>	
225M - 60 - 2BBPI	1.65	Collector efficiency ( $\eta_{col}$ )	0 %
230M - 60 - 2BBPI	1.65	<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 (A<sub>sol</sub>) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.</i>	
235M - 60 - 2BBPI	1.65		
240M - 60 - 2BBPI	1.65		
245M - 60 - 2BBPI	1.65		
250M - 60 - 2BBPI	1.65		
255M - 60 - 2BBPI	1.65		
260M - 60 - 2BBPI	1.65		
265M - 60 - 2BBPI	1.65	Data required for CDR (EU) No 812/2013 - Reference Area A <sub>sol</sub>	
270M - 60 - 2BBPI	1.65	Zero-loss efficiency ( $\eta_0$ )	0.475 --
275M - 60 - 2BBPI	1.65	First-order coefficient (a <sub>1</sub> )	12.51 W/(m <sup>2</sup> K)
280M - 60 - 2BBPI	1.65	Second-order coefficient (a <sub>2</sub> )	0.000 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0.98 --
<i>Remark: The data given in this section are related to collector reference area (A<sub>sol</sub>) 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>			