


<b>Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results</b>					<b>Licence Number</b>		<b>011-7S2824 F</b>				
					<b>Date issued</b>		<b>2018-02-01</b>				
					<b>Issued by</b>		<b>DIN CERTCO</b>				
<b>Licence holder</b>	<b>Bural Solar San. Ve Tic. Ltd. Sti.</b>				<b>Country</b>	Turkey					
<b>Brand (optional)</b>	-				<b>Web</b>	http://www.bural.com.tr					
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<b>Postcode, City</b>	38070 Melikgazi Kayseri				<b>Tel</b>	+90 352 225 71 01					
<b>Collector Type</b>					Flat plate collector, glazed						
<b>Collector name</b>	<b>Gross area (A<sub>G</sub>)</b> m <sup>2</sup>	<b>Gross length</b> mm	<b>Gross width</b> mm	<b>Gross height</b> mm	<b>Power output per collector</b> 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	108 K W	
HP180	1.76	1 916	916	92	1 252	1 192	1 060	916	760	427	
HP200	2.00	1 961	1 021	92	1 423	1 354	1 205	1 041	863	486	
HP210	2.07	1 761	1 176	92	1 473	1 401	1 247	1 078	894	503	
HP230	2.31	1 961	1 176	92	1 644	1 564	1 392	1 203	997	561	
HP240	2.39	1 961	1 221	92	1 701	1 618	1 440	1 244	1 032	581	
HP270	2.66	2 261	1 176	92	1 893	1 801	1 603	1 385	1 148	646	
<b>Power output per m<sup>2</sup> gross area</b>					712	677	602	521	432	243	
<b>Performance parameters test method</b>		Quasi dynamic									
<b>Performance parameters (related to A<sub>G</sub>)</b>		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>			
<b>Units</b>		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	s/m	-			
<b>Test results</b>		0.713	3.368	0.009	0.000	0.000	0.000	0.987			
<b>Incidence angle modifier test method</b>		Quasi dynamic - outdoor									
<b>Bi-directional incidence angle modifiers</b>		No									
<b>Incidence angle modifier</b>		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
<b>Transversal</b>		K <sub>θT, coll</sub>	1.00	1.00	0.99	0.98	0.92	0.74	0.50	0.25	0.00
<b>Longitudinal</b>		K <sub>θL, coll</sub>	1.00	1.00	0.99	0.98	0.92	0.74	0.50	0.25	0.00
<b>Heat transfer medium for testing</b>					Water						
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>					dm/dt	0.020	kg/(sm <sup>2</sup> )				
<b>Maximum temperature difference for thermal performance calculations</b>					(∅ <sub>m</sub> -∅ <sub>a</sub> ) <sub>max</sub>	108	K				
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; ∅<sub>a</sub> = 30 °C)</b>					∅ <sub>stg</sub>	201	°C				
<b>Effective thermal capacity, incl. fluid (per gross area, A<sub>G</sub>)</b>					C/m <sup>2</sup>	13.38	kJ/(Km <sup>2</sup> )				
<b>Maximum operating temperature</b>					∅ <sub>max, op</sub>	100	°C				
<b>Maximum operating pressure</b>					p <sub>max, op</sub>	1000	kPa				
<b>Testing laboratory</b>		TZS, ITW University Stuttgart			www.itw.uni-stuttgart.de						
<b>Test report(s)</b>		17COL1400 17COL1401 17COL1401Q			<b>Dated</b>		11.01.2018 11.01.2018 11.01.2018				
<b>Comments of testing laboratory</b>					Datashet version: 5.01, 2016-03-01						
This data sheet replaces the data sheet issued 22.01.2018. Documented performance parameters are taken from test report 17COL1401 (HP270). The values related to 2.49m <sup>2</sup> aperture area are: eta <sub>0a</sub> = 0.762; c <sub>1a</sub> =3.598; c <sub>2a</sub> =0.010.					 <b>Forschungs- und Testzentrum für Solaranlagen</b> Institut für Thermodynamik und Wärmetechnik Universität Stuttgart Pfaffenwaldring 8, 70569 Stuttgart (Vaihingen)						
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<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S2824 F</b>
	<b>Issued</b>	<b>2018-02-01</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
HP180		2 022	1 457	976	1 545	1 085	709	1 128	750	470	1 235	815	503
HP200		2 298	1 655	1 110	1 756	1 233	805	1 282	852	534	1 403	926	572
HP210		2 378	1 713	1 148	1 817	1 276	833	1 327	882	552	1 453	959	592
HP230		2 654	1 912	1 282	2 028	1 424	930	1 481	984	616	1 621	1 070	660
HP240		2 746	1 978	1 326	2 098	1 473	962	1 532	1 018	638	1 677	1 107	683
HP270		3 056	2 202	1 476	2 335	1 640	1 071	1 705	1 133	710	1 867	1 232	760
Annual output per m <sup>2</sup> gross area		1 149	828	555	878	617	403	641	426	267	702	463	286
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	Yes	
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	2750	Pa
Maximum tested negative load	2500	Pa
Hail resistance using steel ball (maximum drop height)	2	m

**Energy Labelling Information**

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
HP180	1.76	Collector efficiency ( $\eta_{col}$ )	56 %
HP200	2.00	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.	
HP210	2.07		
HP230	2.31		
HP240	2.39		
HP270	2.66		
		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
		Zero-loss efficiency ( $\eta_0$ )	0.712 --
		First-order coefficient ( $a_1$ )	3.37 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.009 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.			