
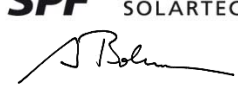


Annex to Solar Keymark Certificate - Summary of EN 12975-2 Test Results						Licence Number		011-7S440 R					
						Date issued		2017-03-21					
						Issued by							
Licence holder		AMK Collectra AG				Country		Switzerland					
Brand (optional)		--				Web		www.amk-collectra.ch					
Street, Number		Lagerstrasse 30				E-mail		info@amk-collectra.ch					
Postcode, City		CH-9470, Buchs				Tel		+41 0 81 750 17 17					
Collector Type						Evacuated tubular collector							
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 = 1000 W/m <sup>2</sup> ϑ <sub>m</sub> - ϑ <sub>a</sub>								
					0 K	10 K	30 K	50 K	70 K	130 K			
					W	W	W	W	W	W			
LBC 20	3.54	2'086	1'697	123	1'512	1'494	1'443	1'372	1'280	879			
LBC 15	2.66	2'086	1'279	123	1'075	1'063	1'027	976	910	625			
LBC 10	1.83	2'086	879	123	718	710	686	652	608	417			
Power output per m <sup>2</sup> gross area					427	422	408	388	361	248			
Performance parameters test method		Steady state - outdoor											
Performance parameters (aperture area)		η <sub>0,hem</sub>	a <sub>1</sub>	a <sub>2</sub>									
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )									
Test results		0.752	0.745	0.013									
Incidence angle modifier test method		Steady state - outdoor											
Bi-directional incidence angle modifiers		Yes											
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°		
Transversal		K <sub>GT, coll</sub>	1.01	1.05	1.15	1.30	1.55	1.56	1.46	1.14	0.00		
Longitudinal		K <sub>GL, coll</sub>	1.00	1.00	1.00	0.99	0.97	0.92	0.81	0.56	0.00		
Heat transfer medium for testing		Water-Glycole											
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		(ϑ <sub>m</sub> -ϑ <sub>a</sub> ) <sub>max</sub>	130	K									
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ϑ <sub>a</sub> = 30 °C)		ϑ <sub>stg</sub>	231	°C									
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )		C/m <sup>2</sup>	13.4	kJ/(Km <sup>2</sup> )									
Maximum operating temperature		ϑ <sub>max, op</sub>	--	°C									
Maximum operating pressure		p <sub>max, op</sub>	1000	kPa									
Testing laboratory		Fraunhofer ISE , PZTS				www.kollektortest.de							
Test report(s)		ktb-2009-8 / 2008-17-k				Dated		01.08.2009/02.07.2008					
Comments of testing laboratory						Datasheet version: 5.01, 2016-03-01							
--						 INSTITUT FÜR SOLARTECHNIK 							
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<b>Annex to Solar Keymark Certificate Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S440 R</b>
	<b>Issued</b>	<b>2017-03-21</b>

**Annual collector output in kWh/collector at mean fluid temperature  $\vartheta_m$ , based on EN 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
LBC 20		3'044	2'806	2'468	2'649	2'358	2'004	1'932	1'699	1'424	2'075	1'832	1'538
LBC 15		2'166	1'996	1'756	1'884	1'678	1'426	1'375	1'209	1'013	1'476	1'304	1'094
LBC 10		1'446	1'333	1'173	1'258	1'120	952	918	807	676	986	871	731
Annual output per m <sup>2</sup> aperture area		1'515	1'396	1'228	1'318	1'173	997	961	845	708	1'032	912	765
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 12975-2 under the following conditions:	
No valid climate reference class	--
Maximum tested positive load	1000 Pa
Maximum tested negative load	1000 Pa
Hail resistance using steel ball (maximum drop height)	m

**Energy Labelling Information**

	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
LBC 20	2.01	Collector efficiency ( $\eta_{col}$ )	70 %
LBC 15	1.43	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.	
LBC 10	0.96		
		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
		Zero-loss efficiency ( $\eta_0$ )	0.752 --
		First-order coefficient ( $a_1$ )	0.75 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.013 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	1.29 --
		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.	