



Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results						Licence Number		<b>011-7S1871 F</b>							
						Date issued		<b>2017-04-26</b>							
						Issued by		TÜV Rheinland Energy GmbH							
Licence holder		<b>Liebi LNC AG</b>				Country		Swiss							
Brand (optional)						Web		www.liebi-heizungen.ch							
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Postcode, City		3753 Oey-Diemtigen				Tel		+41 (0)33 681 27-81							
Collector Type						Flat plate collector, glazed									
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> ϑ <sub>m</sub> - ϑ <sub>a</sub>									
						Gross area (A <sub>G</sub> ) m <sup>2</sup>	Gross length mm	Gross width mm	Gross height mm	0 K W	10 K W	30 K W	50 K W	70 K W	90 K W
<b>LNC/HAR</b>						2.20	2 099	1 050	122	1 569	1 499	1 347	1 178	994	794
Power output per m <sup>2</sup> gross area						712	680	611	535	451	360				
Performance parameters test method						Steady state - indoor									
Performance parameters (related to AG)						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						0.712	3.096	0.009							
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>					0.92				0.00
Longitudinal						K <sub>θL, coll</sub>					0.92				0.00
Heat transfer medium for testing						Water									
Flow rate for testing (per gross area, A <sub>G</sub> )						dm/dt	0.050	kg/(sm <sup>2</sup> )							
Maximum temperature difference for thermal performance calculations						(ϑ <sub>m</sub> -ϑ <sub>a</sub> ) <sub>max</sub>	90	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ϑ <sub>a</sub> = 30 °C)						ϑ <sub>stg</sub>	200	°C							
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )						C/m <sup>2</sup>	15.93	kJ/(Km <sup>2</sup> )							
Maximum operating temperature						ϑ <sub>max, op</sub>	205	°C							
Maximum operating pressure						p <sub>max, op</sub>	1000	kPa							
Testing laboratory						TÜV Rheinland Energy GmbH									
Test report(s)						www.tuv.com/solarpower									
2.04.01243.1.0-1-LT (AIT; Thermal Performance) 2.04.01243.1.0-1-QT (AIT; Reliability) 06COL470/1OEM06 (ITW; document evaluation))						Dated		16.03.2015							
								16.03.2015							
								06.03.2012							
Comments of testing laboratory						Datasheet version: 5.01, 2016-03-01									
The values related to 2.02 m <sup>2</sup> aperture area are: eta0a=0.776; a1a=3.372; a2a=0.010. TÜV Rheinland Energy GmbH is not responsible for the test reports and the results issued by AIT Austrian Institute of Technology or ITW.						 Genau. Richtig.  TÜV Rheinland Energy GmbH Am Grauen Stein 51105 Köln									
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	<b>Issued</b>	<b>2017-04-26</b>

Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$ , based on EN ISO 9806:2013 test results													
Standard Locations		Athens			Davos			Stockholm			Würzburg		
Collector name	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
LNC/HAR		2 468	1 809	1 242	1 904	1 365	914	1 394	947	608	1 511	1 020	645
Annual output per m <sup>2</sup> gross area		1 120	821	563	864	619	415	632	430	276	686	463	293
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 <a href="http://www.solarkeymark.org/scenocalc">www.solarkeymark.org/scenocalc</a>													

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	1500	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 $A_{sol}$	
LNC/HAR	2.20	Collector efficiency ( $\eta_{col}$ )	57 %
		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.	
		Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$	
		Zero-loss efficiency ( $\eta_0$ )	0.712 --
		First-order coefficient ( $a_1$ )	3.10 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.	