




Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results						Licence Number		011-7S2572 F			
						Date issued		2017-07-12			
						Issued by		DINCERTCO			
Licence holder	TISUN GmbH					Country	AUSTRIA				
Brand (optional)	--					Web	http://www.tisun.com				
Street, Number	Stockach 100					E-mail	office@tisun.com				
Postcode, City	A-6306 Söll					Tel	+43 53333 201 0 / 201 699				
Collector Type						Flat plate collector, glazed					
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 <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>						
					0 K W	10 K W	30 K W	50 K W	70 K W	56 K W	
PFM-S Harfe 2,01 m <sup>2</sup>	2,01	1.702	1.182	60	1.403	1.328	1.162	973	761	911	
Power output per m <sup>2</sup> gross area					698	661	578	484	379	453	
Performance parameters test method						Steady state - indoor					
Performance parameters (related to A <sub>G</sub> )		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		0,698	3,583	0,014							
Incidence angle modifier test method						Steady state - 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>					0,94				0,00
Longitudinal		K <sub>θL, coll</sub>					0,94				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						(ϑ <sub>m</sub> -ϑ <sub>a</sub> ) <sub>max</sub>	56	K			
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; ϑ <sub>a</sub> = 30 °C)						ϑ <sub>stg</sub>	206,5	°C			
Effective thermal capacity, incl. fluid (per gross area, A <sub>G</sub> )						C/m <sup>2</sup>	4,816	kJ/(Km <sup>2</sup> )			
Maximum operating temperature						ϑ <sub>max, op</sub>	130	°C			
Maximum operating pressure						p <sub>max, op</sub>	1000	kPa			
Testing laboratory						Fundación CENER-CIEMAT					
Test report(s)						30.3047.0-1-1 30.3047.0-2-1 30.3047.0					
						http://www.cener.com					
						Dated					
						14/11/2016					
Comments of testing laboratory						Datashet version: 5.01, 2016-03-01					
--											
DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de											

Annex to Solar Keymark Certificate Supplementary Information	Licence Number	011-7S2572 F
	Issued	2017-07-12

Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$ , based on ISO 9806:2013 test results													
Collector name	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
PFM-S Harfe 2,01 m2		2.231	1.537	948	1.664	1.102	643	1.232	771	435	1.341	833	462
Annual output per m <sup>2</sup> gross area		1.110	765	471	828	548	320	613	384	217	667	414	230
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	3000	Pa
Maximum tested negative load	3000	Pa
Hail resistance using ice balls (diameter)	35	mm

Energy Labelling Information			
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
PFM-S Harfe 2,01 m2	2,01	Collector efficiency ( $\eta_{col}$ )	53 %
		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 ( $\eta_0$ )	0,698 --
		First-order coefficient ( $a_1$ )	3,58 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0,014 W/(m <sup>2</sup> K <sup>2</sup> )
		Incidence angle modifier IAM (50°)	0,94 --
		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.	