


<b>Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results</b>					<b>Licence Number</b>		<b>011-7S2878 F</b>							
					<b>Date issued</b>		<b>2018-09-12</b>							
					<b>Issued by</b>		<b>DIN CERTCO</b>							
<b>Licence holder</b>	<b>THINKTECH</b>				<b>Country</b>	<b>Portugal</b>								
<b>Brand (optional)</b>					<b>Web</b>	<b>www.thinktech.pt</b>								
<b>Street, Number</b>	<b>Estrada da Moita Negra, 453</b>				<b>E-mail</b>	<b>geral@thinktech.pt</b>								
<b>Postcode, City</b>	<b>2495-326 Boleiros - Fátima</b>				<b>Tel</b>	<b>+351</b>	<b>249 530 550</b>							
<b>Collector Type</b>					<b>Flat plate collector, glazed</b>									
<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> ϑ <sub>m</sub> - ϑ <sub>a</sub>									
					0 K W	10 K W	30 K W	50 K W	70 K W	100 K W				
<b>THK 25 H</b>	2.59	1 243	2 081	96	1 805	1 715	1 519	1 303	1 066	671				
<b>THK 25 V</b>	2.59	2 081	1 243	96	1 805	1 715	1 519	1 303	1 066	671				
<b>Power output per m<sup>2</sup> gross area</b>					<b>697</b>	<b>662</b>	<b>587</b>	<b>503</b>	<b>412</b>	<b>259</b>				
<b>Performance parameters test method</b>					<b>Steady state - indoor</b>									
<b>Performance parameters (related to A<sub>G</sub>)</b>					η <sub>0,hem</sub>	a <sub>1</sub>	a <sub>2</sub>							
<b>Units</b>					-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )							
<b>Test results</b>					<b>0.697</b>	<b>3.378</b>	<b>0.010</b>							
<b>Incidence angle modifier test method</b>					<b>Quasi dynamic - outdoor</b>									
<b>Bi-directional incidence angle modifiers</b>					<b>No</b>									
<b>Incidence angle modifier</b>					Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
<b>Transversal</b>					K <sub>θT, coll</sub>	-	-	-	-	0.94	-	-	-	0.00
<b>Longitudinal</b>					K <sub>θL, coll</sub>	-	-	-	-	0.94	-	-	-	0.00
<b>Heat transfer medium for testing</b>					<b>Water-Glycole</b>									
<b>Flow rate for testing (per gross area, A<sub>G</sub>)</b>					dm/dt	0.018	kg/(sm <sup>2</sup> )							
<b>Maximum temperature difference for thermal performance calculations</b>					(ϑ <sub>m</sub> -ϑ <sub>a</sub> ) <sub>max</sub>	100	K							
<b>Standard stagnation temperature (G = 1000 W/m<sup>2</sup>; ϑ<sub>a</sub> = 30 °C)</b>					ϑ <sub>stg</sub>	196	°C							
<b>Effective thermal capacity, incl. fluid (per gross area, A<sub>G</sub>)</b>					C/m <sup>2</sup>	8.75	kJ/(Km <sup>2</sup> )							
<b>Maximum operating temperature</b>					ϑ <sub>max, op</sub>	n.a.	°C							
<b>Maximum operating pressure</b>					p <sub>max, op</sub>	100	kPa							
<b>Testing laboratory</b>					<b>TZS, ITW University Stuttgart</b>									
<b>Test report(s)</b>					<b>www.itw.uni-stuttgart.de</b>									
					<b>Dated</b>	<b>12.09.2018</b>								
						<b>12.09.2018</b>								
						<b>12.09.2018</b>								
<b>Comments of testing laboratory</b>					<b>Datasheet version: 5.01, 2016-03-01</b>									
Documented dimensions and performance parameters are taken from 18COLP20401123105OEM01 (THK 25 H)					 <b>TZS</b> Forschungs- und Testzentrum für Solaranlagen <small>Institut für Thermodynamik und Wärmetechnik      Universität Stuttgart      Pfaffenwaldring 8, 70550 Stuttgart (Vaihingen)</small>									
<b>DIN CERTCO • Alboinstraße 56 • 12103 Berlin, Germany</b> <b>Tel: +49 30 7562-1131 • Fax: +49 30 7562-1141 • E-Mail: info@dincertco.de • www.dincertco.de</b>														

<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>011-7S2878 F</b>
	<b>Issued</b>	<b>2018-09-12</b>

Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$ , based on 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
THK 25 H		2 880	2 045	1 340	2 179	1 505	951	1 607	1 047	636	1 746	1 132	676
THK 25 V		2 880	2 045	1 340	2 179	1 505	951	1 607	1 047	636	1 746	1 132	676
Annual output per m <sup>2</sup> gross area		1 112	790	517	841	581	367	620	404	246	674	437	261
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	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	2842	Pa
Maximum tested negative load	2808	Pa
Hail resistance using steel ball (maximum drop height)	n.a.	m

Energy Labelling Information			
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	
THK 25H	2.59	Collector efficiency ( $\eta_{col}$ )	55 %
THK 25 V	2.59	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 ( $\eta_0$ )	0.697 --
		First-order coefficient ( $a_1$ )	3.38 W/(m <sup>2</sup> K)
		Second-order coefficient ( $a_2$ )	0.010 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.	