

<b>Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate</b>						<b>Licence Number</b>		<b>011-7S613 F</b>					
						<b>Issued</b>		<b>2015-01-22</b>					
<b>Company holding the</b>		<b>Daesung Finetec Co., Ltd.</b>				<b>Country</b>		<b>Korea</b>					
<b>Brand (optional)</b>						<b>Website</b>		<b>www.knsol.co.kr</b>					
<b>Street, street number</b>		<b>37 Junam-ro, 400 Beon-gil, Daesan-Myun,</b>				<b>E-mail</b>		<b>knmain@knsol.co.kr</b>					
<b>Postal Code / City, province</b>		<b>641-923</b>		<b>Changwon-si, Kyongnam</b>		<b>Tel/Fax</b>		<b>82 55-250-5400/55-252-7363</b>					
<b>Collector Type (flat plate glazed/un-glazed; evacuate tubular)</b>						<b>Flat plate collector - glazed</b>							
<b>Thermal / photo voltaic hybrid collector? (PVT collector)</b>						<b>No</b>							
<b>Integration in the roof possible ? (manufacturers declaration)</b>						<b>No</b>							
<b>Collector name</b>	<b>Aperture area (Aa)</b> m <sup>2</sup>	<b>Gross length</b> mm	<b>Gross width</b> mm	<b>Gross height</b> mm	<b>Gross area (AG)</b> m <sup>2</sup>	<b>Power output per collector module</b>							
						<b>G<sub>b</sub> = 850 W/m<sup>2</sup>; G<sub>d</sub> = 150 W/m<sup>2</sup></b>							
						<b>T<sub>m</sub>-T<sub>a</sub></b>							
						<b>0 K</b>	<b>10 K</b>	<b>30 K</b>	<b>50 K</b>	<b>70 K</b>			
						<b>W</b>	<b>W</b>	<b>W</b>	<b>W</b>	<b>W</b>			
<b>KNSC-003.1</b>	<b>1,91</b>	<b>2.010</b>	<b>1.010</b>	<b>89</b>	<b>2,03</b>	<b>1.381</b>	<b>1.300</b>	<b>1.129</b>	<b>944</b>	<b>746</b>			
<b>Performance test method</b>						<b>Liquid heating collector - quasi-dynamic - outdoor</b>							
<b>Performance parameters related to aperture area</b>						<b>η<sub>0b</sub></b>	<b>c<sub>1</sub></b>	<b>c<sub>2</sub></b>	<b>c<sub>3</sub></b>	<b>c<sub>4</sub></b>	<b>c<sub>6</sub></b>	<b>Kθ<sub>d</sub></b>	
<b>Units</b>						<b>-</b>	<b>W/(m<sup>2</sup>K)</b>	<b>W/(m<sup>2</sup>K<sup>2</sup>)</b>	<b>J/(m<sup>3</sup>K)</b>	<b>-</b>	<b>s/m</b>	<b>-</b>	
<b>Test results - Flow rate and fluid see note 1</b>						<b>0,723</b>	<b>4,139</b>	<b>0,009</b>	<b>0,000</b>	<b>0,000</b>	<b>1,000</b>		
<b>Bi-directional incidence angle modifiers?</b>						<b>Yes</b>							
						<i>Kθ values are obligatory for 50°.</i>							
<b>Incidence angle modifiers Kθ(θT) transversal direction</b>		<b>Angle</b>	<b>10°</b>	<b>20°</b>	<b>30°</b>	<b>40°</b>	<b>50°</b>	<b>60°</b>	<b>70°</b>	<b>80°</b>	<b>90°</b>		
		<b>Kθ(θT)</b>					<b>0,87</b>				<b>0,00</b>		
<b>Incidence angle modifiers Kθ(θL) longitudinal direction</b>		<b>Angle</b>	<b>10°</b>	<b>20°</b>	<b>30°</b>	<b>40°</b>	<b>50°</b>	<b>60°</b>	<b>70°</b>	<b>80°</b>	<b>90°</b>		
		<b>Kθ(θL)</b>					<b>0,89</b>				<b>0,00</b>		
<b>Stagnation temperature - Weather conditions see note 2</b>						<b>T<sub>stg</sub></b>		<b>175</b>			<b>°C</b>		
<b>Effective thermal capacity</b>						<b>ceff = C/Ag</b>		<b>9,88</b>			<b>kJ/(m<sup>2</sup>K)</b>		
<b>Max. intended operation temperature - see note 3</b>						<b>T<sub>max,op</sub></b>		<b>100</b>			<b>°C</b>		
<b>Max. operation pressure - see note 3</b>						<b>p<sub>max,op</sub></b>		<b>1000</b>			<b>kPa</b>		
<b>Pressure drop table - for a collector family, the values shall be for the module with highest ΔP per m<sup>2</sup> aperture area</b>													
<b>Flow rate</b>	<b>kg/(s m<sup>2</sup>)</b>	<b>0,003</b>	<b>0,007</b>	<b>0,010</b>	<b>0,013</b>	<b>0,017</b>	<b>0,020</b>	<b>0,023</b>	<b>0,027</b>	<b>0,030</b>	<b>0,033</b>		
<b>Pressure drop, ΔP</b>	<b>Pa</b>	<b>11</b>	<b>44</b>	<b>100</b>	<b>178</b>	<b>278</b>	<b>400</b>	<b>544</b>	<b>711</b>	<b>900</b>	<b>1111</b>		
<b>Optional weather data</b>		<b>Location</b>				<b>Link</b>							
<b>Testing Laboratory</b>		<b>TUV Immissionschutz und Energiesysteme</b>											
<b>Website</b>		<b>www.eco-tuv.de</b>											
<b>Test report id. number</b>						<b>21209798</b>			<b>Date of test report</b>			<b>2008.12.12</b>	
<b>During the test GDIF/GTOT was always between</b>		<b>0,07</b>	<b>and</b>	<b>0,85</b>									
<b>Comments of testing laboratory:</b>													
<b>Note 1</b>	<b>Flow rate</b>	<b>0,017</b>	<b>kg/(s m<sup>2</sup>)</b>	<b>Fluid</b>	<b>Water</b>								
<b>Note 2</b>	<b>Irradiance, G = 1000 W/m<sup>2</sup>; Ambient temperature, T<sub>a</sub> = 30 °C</b>												
<b>Note 3</b>	<b>Given by manufacturer</b>												
<b>Datasheet version: 4.06, 2014-01-15</b>													
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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	CERTNO-01C
	Issued	22.01.2015

Annual collector output kWh/module												
Collector name	Location and collector temperature (T <sub>m</sub> )											
	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
KNSC-003.1	2.109	1.395	837	1.529	979	557	1.136	684	382	1.254	748	405

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)
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Overview of locations				
Location	Latitude °	G <sub>tot</sub> kWh/m <sup>2</sup>	T <sub>a</sub> °C	Collector orientation or tracking mode
Athens	38	1.765	18,5	South, 25°
Davos	47	1.714	3,2	South, 30°
Stockholm	59	1.166	7,5	South, 45°
Würzburg	50	1.244	9,0	South, 35°

G <sub>tot</sub>	Annual total irradiation on collector plane	kWh/m <sup>2</sup>
T <sub>a</sub>	Mean annual ambient air temperature	°C
T <sub>m</sub>	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool ScenoCalc. The collector output is calculated hour by hour according to the efficiency parameters from the Keymark test using constant collector operating temperature (T<sub>m</sub>). A detailed description of the calculations is available at <http://www.sp.se/en/index/services/solar/ScenoCalc/Sidor/default.aspx>.

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