

Annex to Solar Keymark Certificate					Licence Number		PSK-006/2020							
					Date issued		2020-04-20							
					Issued by		CERTIF							
Licence holder		İSTEK YENİLENEBİLİR ENERJİ GÜN. EN. SİS. SAN. VE TİC. LTD. ŞTİ.					Country		Turkey					
Brand (optional)		ISTEK					Web		www.istek.com.tr					
Street, Number		ATATURK MAH. 31072 SOK. NO: 4/A					E-mail		info@info.info					
Postcode, City		33170 MEZITLI / MERSIN					Tel		+90 (324) 3583330					
Collector Type					Flat plate collector									
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> & u = 1.3 m/s $\vartheta_m - \vartheta_a$									
					0 K	10 K	30 K	50 K	70 K	100 K				
					m <sup>2</sup>	mm	mm	mm	W	W	W	W	W	W
ISTEK ST - T40/400					2.44	2,040	1,200	100	1,632	1,514	1,268	1,010	741	315
Power output per m <sup>2</sup> gross area					668	619	519	413	303	129				
Performance parameters test method		Quasi dynamic												
Performance parameters (related to A <sub>G</sub> )		$\eta_0, b$	a1	a2	a3	a4	a5	a6	a7	a8	Kd			
Units		-	W/(m <sup>2</sup> K)	W/(m <sup>2</sup> K <sup>2</sup> )	J/(m <sup>3</sup> K)	-	J/(m <sup>2</sup> K)	s/m	W/(m <sup>2</sup> K <sup>4</sup> )	W/(m <sup>2</sup> K <sup>4</sup> )	-			
Test results		0.672	4.790	0.006			9,600				0.959			
Incidence angle modifier test method		Quasi dynamic - outdoor												
Incidence angle modifier		Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°			
Transversal		K <sub>θT, coll</sub>	1.00	0.99	0.98	0.97	0.94	0.89	0.79	0.48	0.00			
Longitudinal		K <sub>θL, coll</sub>	1.00	0.99	0.98	0.97	0.94	0.89	0.79	0.48	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 during thermal performance test					( $\vartheta_m - \vartheta_a$ ) <sub>max</sub>	70	K							
Standard stagnation temperature (G = 1000 W/m <sup>2</sup> ; $\vartheta_a = 30$ °C)					$\vartheta_{stg}$	151	°C							
Maximum operating temperature					$\vartheta_{max, op}$	200	°C							
Maximum operating pressure					p <sub>max, op</sub>	600	kPa							
Testing laboratory		LNEG					www.lneg.pt							
Test report(s)		n. 10.V3/LES72017					Dated		15-7-2018					
Comments of testing laboratory					Datashet version: 6.1, 2019-09-26									
No comments					Stamp & signature of test lab									

<b>Annex to Solar Keymark Certificate</b> <b>Supplementary Information</b>	<b>Licence Number</b>	<b>PSK-006/2020</b>
	<b>Issued</b>	<b>2020-04-20</b>

Annual collector output in kWh/collector at mean fluid temperature $\vartheta_m$													
Collector name	Standard Locations	Athens			Davos			Stockholm			Würzburg		
	$\vartheta_m$	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C	25°C	50°C	75°C
ISTEK ST - T40/400	2,600	1,604	880	880	1,815	1,086	561	1,365	763	383	1,500	823	407
Annual output per m <sup>2</sup> gross area		1,064	656	360	743	444	229	558	312	157	614	337	167
Annual efficiency, $\eta_a$		60%	37%	20%	46%	27%	14%	48%	27%	13%	49%	27%	13%
Fixed or tracking collector		Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane		1765 kWh/m <sup>2</sup>			1630 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. 6.1 (September 2019). A detailed description of the calculations is available at <http://www.estif.org/solarkeymarknew/>

Additional Information	
Collector heat transfer medium	Water-Glycole
The collector is deemed to be suitable for roof integration	No
The collector was tested successfully under the following conditions:	
Climate class (A+, A, B or C)	B
G (W/m <sup>2</sup> ) >	900
$\vartheta_a$ (°C) >	15
$H_x$ (MJ/m <sup>2</sup> ) >	540
Maximum tested positive load	0 Pa
Maximum tested negative load	0 Pa
Hail resistance using steel ball (maximum drop height)	1.8 m
Additional collector attribute(s)	
<input type="checkbox"/> Using external power source(s) for normal operation	<input type="checkbox"/> Active or passive measure(s) for self-protection
<input type="checkbox"/> Co-generating thermal and electrical power	<input type="checkbox"/> Façade collector(s)

Energy Labelling Information		Additional Informative Technical Data	
	Reference Area, $A_{sol}$ (m <sup>2</sup> )	Hydraulic Designation Code	Aperture Area, $A_a$ (m <sup>2</sup> )
ISTEK ST - T40/400	2.44	10-VH-1234S-A:10,1875-C:26,1200	"[Aa]"

Data required for CDR (EU) No 811/2013 - Reference Area $A_{sol}$	Data required for CDR (EU) No 812/2013 - Reference Area $A_{sol}$
Collector efficiency ( $\eta_{col}$ )	47%
Zero-loss efficiency ( $\eta_0$ )	0.67
First-order coefficient ( $a_1$ )	4.79
Second-order coefficient ( $a_2$ )	0.006
Incidence angle modifier IAM (50°)	0.94

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 9806:2017.

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.