TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p.

Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate		Licence Number	TSU 002-10
		Issued	2015-11-16

Company holding the	Solar Tubes	Country	Macedonia
Brand (optional)		Website	www.solartubes.com.mk
Street, street number	Lece Koteski	E-mail	info@solartubes.com.mk
Postal Code / City, province	7500 Prilep	Tel/Fax	389 (0)48416414/(0)48421925

Collector Type (flat plate glazed/un-glazed; evacuate tubular)	Flat plate collector - glazed
Thermal / photo voltaic hybid collector? (PVT collector)	No
Integration in the roof possible ? (manufacturers declaration)	No

Collector name	Aperture area (Aa)	Gross length	Gross width	Gross height	Gross area (AG)	Power output per collector module G = 1000 W/m² Tm-Ta 0 K	10 K	30 K	50 K	70 K
	m²	mm	mm	mm	m²	W	W	W	W	W
FT-1.5 Cu/Al	1,33	1 468	1 010	90	1,50	1 008	942	807	668	524
FT-2 Cu/Al	1,78	1 970	1 010	90	2,00	1 349	1 261	1 080	894	701
FT-2.5 Cu/Al	2,24	1 948	1 245	90	2,50	1 698	1 587	1 359	1 124	883
FT-2.5 Cu/Al	2,24	2 468	997	90	2,50	1 698	1 587	1 359	1 124	883

Performance test method	Glazed liquid heating collector - steady state - outdoor									
Performance parameters related to aperture area	η0	a1	a2							
Units	-	W/(m²K)	W/(m²K²)							
Test results - Flow rate and fluid see note 1	0,758	4,920	0,004							

Bi-directional incidence angle modifiers?	No	*Kϑ values are obligatory for 50°.*								
Incidence angle modifiers Kθ(θ)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
	Kθ(θ)					0,94				0,00
Incidence angle modifier not bi-directional - leave fields blank										

Stagnation temperature - Weather conditions see note 2	Tstg	187	°C
Effective thermal capacity	ceff = C/Ag	8,2	kJ/(m²K)
Max. intende operation temperature - see note 3	Tmax,op	110	°C
Max. operation pressure - see note 3	pmax,op	1000	kPa

Pressure drop table - for a collector family, the values shall be for the module with highest ΔP per m² aperture area											
Flow rate	kg/(s m²)										
Pressure drop, ΔP	Pa										

Optional weather data	Location		Link
Testing Laboratory	Technický skúšobný ústav Piešťany, š.p.		
Website	www.tsu.eu		
Test report id. number	100700001/2/PQ, 100700001/2/P	Date of test report	03.11.2010, 08.11.2010

During the test GDIF/GTOT was always between	0,11	and	0,11	

Comments of testing laboratory:

Note 1	**Flow rate**	0,023	kg/(s m²)	**Fluid**	Water
Note 2	**Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C**				
Note 3	**Given by manufacturer**				

TECHNICKÝ SKÚŠOBNÝ ÚSTAV PIEŠŤANY, š.p. Krajinská cesta 2929/9 92101 PIEŠŤANY -316/3-

Datasheet version: 4.06, 2014-01-15

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Address: Krajinská cesta 2929/9, 92101 Piešťany, Slovak Republic
Phone: +421 33 79 57 111, Fax: +421 33 77 23 716, E-mail: sv@tsu.sk, web: www.tsu.eu

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	TSU 002-10
	Issued	16.11.2015

Annual collector output kWh/module

Collector name	Location and collector temperature (Tm)											
	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
FT-1.5 Cu/Al	1 591	1 032	618	1 142	729	425	852	507	283	930	545	300
FT-2 Cu/Al	2 129	1 381	827	1 528	975	569	1 140	679	379	1 245	730	401
FT-2.5 Cu/Al	2 679	1 737	1 041	1 923	1 227	716	1 434	854	477	1 566	918	505
FT-2.5 Cu/Al	2 679	1 737	1 041	1 923	1 227	716	1 434	854	477	1 566	918	505

Collector mounting: Fixed or tracking	Fixed; slope = latitude - 15° (rounded to nearest 5°)

Overview of locations

Location	Latitude °	Gtot kWh/m²	Ta °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°

Gtot	Annual total irradiation on collector plane	kWh/m²
Ta	Mean annual ambient air temperature	°C
Tm	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 (Tm). 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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Datasheet version: 4.06, 2014-01-15
ScenoCalc version: Ver. 4.06 (Jan, 2014)