Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S2398 F
	Issued	2014-10-06

Company holding the	TISUN GmbH	**Country**	Österreich
Brand (optional)		**Website**	www.tisun.at
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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)	Yes

Collector name	Aperture area (Aa)	Gross length	Gross width	Gross height	Gross area (Ag)	Power output per collector module Gb = 850 W/m²; Gd = 150 W/m² Tm-Ta 0 K	10 K	30 K	50 K	70 K
	m²	mm	mm	mm	m²	W	W	W	W	W
PFM-W 3,30	3.15	1 182	2 802	62	**3.32**	2 506	2 362	2 061	1 743	1 407

Performance test method	Liquid heating collector - quasi-dynamic - outdoor								
Performance parameters related to aperture area	η0b	c1	c2	c3	c4	c6	Kθd		
Units	-	W/(m²K)	W/(m²K²)	J/(m³K)	-	s/m	-		
Test results - *Flow rate and fluid see note 1*	0.80	4.491	0.007	0.000	0.000	0.000	0.962		

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)	1.00	0.99	0.97	0.95	0.91	0.84	0.68	0.22	0.00
Incidence angle modifier not bi-directional - leave fields blank										

Stagnation temperature - *Weather conditions see note 2*	T_{stg}	185	°C
Effective thermal capacity	$c_{eff} = C/A_g$	8.703	kJ/(m²K)
Max. intende operation temperature - *see note 3*	$T_{max,op}$	-	°C
Max. operation pressure - *see note 3*	$p_{max,op}$	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	TZS, ITW Universtät Stuttgart			
Website	http://www.itw.uni-stuttgart.de			
Test report id. number	14COL1217, 14COL1216Q	**Date of test report**	2014-10-06, 2014-09-25	

During the test G_{DIF}/G_{TOT} was always between 0 and 1

Comments of testing laboratory:

Note 1	**Flow rate**	0.020	kg/(s m²)	**Fluid**	Water
Note 2	**Irradiance, G = 1000 W/m²; Ambient temperature , T_a=30 °C**				
Note 3	**Given by manufacturer**				

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Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S2398 F
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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
PFM-W 3,30	3 978	2 707	1 710	2 931	1 950	1 193	2 170	1 359	800	2 377	1 472	851

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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ScenoCalc version: Ver. 4.06 (Jan, 2014)