TÜVRheinland®
DIN CERTCO
Genau. Richtig.

Summary of EN 12975 Test Results, annex to Solar KEYMARK Certificate				Licence Number	011-7S472 R
				Issued	2016-03-14

Company holding the	S-Power Entwicklungs und Vertriebs GmbH		Country	Germany	
Brand (optional)	s-power		Website	www.s-power.de	
Street, street number	Industriestraße 24-27		E-mail	info@s-power.de	
Postal Code / City, province	49716	Meppen	Tel/Fax	+49	(0) 5931 88388-0/ -99

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

	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
Collector name	m²	mm	mm	mm	m²	W	W	W	W	W
s-power DF30-3000 TPS inside PowerPlus	3.05	2 192	2 245	88	**4.92**	2 367	2 306	2 172	2 023	1 859
s-power DF20-2000 TPS inside PowerPlus	2.03	2 192	1 495	88	**3.25**	1 575	1 534	1 445	1 346	1 237
s-power DF10-1000 TPS inside PowerPlus	1.02	2 192	745	88	**1.62**	791	771	726	676	622
s-power DF30-3000 TPS inside Power*	3.05	2 192	2 245	88	**4.92**	2 367	2 306	2 172	2 023	1 859
s-power DF20-2000 TPS inside Power*	2.03	2 192	1 495	88	**3.28**	1 575	1 534	1 445	1 346	1 237
s-power DF10-1000 TPS inside Power*	1.02	2 192	745	88	**1.63**	791	771	726	676	622

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	0.774	1.936	0.006	0.000	0.000	0.000	1.015		

Bi-directional incidence angle	Yes	*Kϑ values are obligatory for 50°.*								
Incidence angle modifiers Kθ(θT)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
transversal direction	Kθ(θT)	1.01	1.01	1.02	1.02	1.02	1.09	1.12		0.00
Incidence angle modifiers Kθ(θL)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
longitudinal direction	Kθ(θL)	1.00	1.00	0.99	0.98	0.97	0.94	0.88		0.00

Stagnation temperature - Weather conditions see note 2	Tstg	191.9	°C
Effective thermal capacity	ceff = C/Ag	12.87	kJ/(m²K)
Max. intende operation temperature - see note 3	Tmax,op	170	°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)	0.014	0.028	0.042	0.056	0.083	0.111	0.139	0.167	
Pressure drop, ΔP	Pa	509	1472	2890	4762	9870	16796	25540	36102	

Optional weather data	Location		Link	
Testing Laboratory	TÜV Rheinland Energie und Umwelt GmbH			
Website	www.tuv.com/st			
Test report id. number	21209370b_2400_spower; 21209370b_400_spower;	Date of test report	all 2011-01-24	

During the test GDIF/GTOT was always between	0.08	and	0.85

Comments of testing laboratory:

*The collector was tested with a black backside sheet to minimize backside reflectivity. The tested collector was build with the so called Narva power tube with backside coating **(PowerPlus)**. If the standard tube with only front side coating will be used **(Power)**, the output performance will be the same as for the **TPS inside PowerPlus** type tested with a black backside sheet. An additional thermal performance test with the collector **TPS inside PowerPlus** using a high efficiency backside reflector is given on page 3 and 4.

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

TÜVRheinland® Genau. Richtig.
TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Köln
stamp test lab

Datasheet version: 4.05, 2013-11-07

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S472 R
S-Power Entwicklungs und Vertriebs GmbH	Issued	14.03.2016

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
s-power DF30-3000 TPS inside PowerPlus	4 124	3 491	2 865	3 424	2 836	2 289	2 484	1 995	1 558	2 688	2 162	1 685
s-power DF20-2000 TPS inside PowerPlus	2 744	2 323	1 907	2 278	1 887	1 523	1 653	1 328	1 037	1 788	1 439	1 121
s-power DF10-1000 TPS inside PowerPlus	1 379	1 167	958	1 145	948	765	830	667	521	899	723	563
s-power DF30-3000 TPS inside Power	4 124	3 491	2 865	3 424	2 836	2 289	2 484	1 995	1 558	2 688	2 162	1 685
s-power DF20-2000 TPS inside Power	2 744	2 323	1 907	2 278	1 887	1 523	1 653	1 328	1 037	1 788	1 439	1 121
s-power DF10-1000 TPS inside Power	1 379	1 167	958	1 145	948	765	830	667	521	899	723	563

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/m
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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Brand (optional)	s-power	Website	www.s-power.de
Street, street number	Industriestraße 24-27	E-mail	info@s-power.de
Postal Code / City, province	49716 Meppen	Tel/Fax	+49 (0) 5931 88388-0/ -99

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

	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
Collector name	m²	mm	mm	mm	m²	W	W	W	W	W
s-power DF30-3000 TPS inside PowerPlus	4.39	2 192	2 245	88	**4.92**	2 570	2 504	2 366	2 222	2 070
s-power DF20-2000 TPS inside PowerPlus	2.93	2 192	1 495	88	**3.25**	1 715	1 671	1 579	1 483	1 382
s-power DF10-1000 TPS inside PowerPlus	1.46	2 192	745	88	**1.62**	855	833	787	739	689

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	0.559	1.485	0.002	0.000	0.000	0.000	1.314		

Bi-directional incidence angle	Yes	*Kϑ values are obligatory for 50°.*								
Incidence angle modifiers Kθ(θT)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
transversal direction	Kθ(θT)	1.35	1.17	1.25	1.20	1.22	1.15	0.83		0.00
Incidence angle modifiers Kθ(θL)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
longitudinal direction	Kθ(θL)	1.00	1.00	0.99	0.98	0.97	0.94	0.88		0.00

Stagnation temperature - Weather conditions see note 2	Tstg	191.9	°C
Effective thermal capacity	ceff = C/Ag	8.426	kJ/(m²K)
Max. intende operation temperature - see note 3	Tmax,op	170	°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	TÜV Rheinland Energie und Umwelt GmbH		
Website	www.tuv.com/st		
Test report id. number	21209370b_3000_spower; 21209370b_500_spower	Date of test report	all 2011-01-24

During the test GDIF/GTOT was always between	0.08	and	0.85

Comments of testing laboratory:

The collector **s-power DFX0-X000 TPS inside PowerPlus** could bei used with different back side reflector materials. This test was done with a high reflective planar mirror reflector to represent the maximum possible performance.

Note 1	**Flow rate**	0.028	kg/(s m²)	**Fluid**	Water
Note 2	**Irradiance, G = 1000 W/m²; Ambient temperature , Ta=30 °C**				
Note 3	**Given by manufacturer**				

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TÜV Rheinland Energie und Umwelt GmbH
Am Grauen Stein
51105 Köln
Staatlich geprüftes Prüflabor

Datasheet version: 4.05, 2013-11-07

Annual collector output based on EN 12975 Test Results, annex to Solar KEYMARK Certificate	Licence Number	011-7S472 R
S-Power Entwicklungs und Vertriebs GmbH	Issued	14.03.2016

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
s-power DF30-3000 TPS inside PowerPlus	5 231	4 559	3 926	4 426	3 809	3 250	3 192	2 667	2 215	3 458	2 893	2 399
s-power DF20-2000 TPS inside PowerPlus	3 491	3 043	2 620	2 954	2 543	2 169	2 131	1 780	1 478	2 308	1 931	1 601
s-power DF10-1000 TPS inside PowerPlus	1 740	1 516	1 306	1 472	1 267	1 081	1 062	887	737	1 150	962	798

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°
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Gtot	Annual total irradiation on collector plane	kWh/
Ta	Mean annual ambient air temperature	°C
Tm	Constant collector operating temperature (mean of in- and outlet temperatures)	°C

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