CERTIFIKAT

Solar Keymark Certificate
No. SP SC0722-15

Holder/Issued to

Company: 2-improve Energy
Address: Symon spiersweg 7D10 1506 RZ Zaandam, The Netherlands

Product name and description

Vacuum tube thermal solar collectors. For technical information see Appendix (2 pages).

Models:	**Prisma Pro 8**	**Prisma Pro 9**	**Prisma Pro 10**	**Prisma Pro 12**
	Prisma Pro 14	**Prisma Pro 15**	**Prisma Pro 16**	**Prisma Pro 18**
	Prisma Pro 20	**Prisma Pro 21**	**Prisma Pro 22**	**Prisma Pro 24**

Certificate

The product is found to comply with the requirements in EN 12975-1:2006+A1:2010 and the Specific CEN Keymark Scheme Rules for Solar Thermal Products, and are based on test results according to EN 12975-2:2006.

Marking

Products conforming to this certificate shall be marked in accordance with the requirements in the Specific CEN Keymark Scheme Rules for Solar Thermal Products. The marking shall, together with the Keymark logo, show the identification code of the empowered certification body (SP Technical Research Institute of Sweden, No. 012), also see CEN-CENELEC Internal Regulations Part 4 Certification, Annex A.

Validity

This certificate is valid until 2019-01-20 provided that the conditions in the Solar Keymark Rules are fulfilled and the standard or rules are not modified significantly. The validity of the certificate can be checked in the database, see Solar Keymark website http://www.solarkeymark.org

Miscellaneous

The manufacturer's factory production control procedures are under surveillance by the responsibility of SP. This is the first version of this certificate.

Borås, Sweden 2015-10-30

SP Technical Research Institute of Sweden
Certification

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SWEDAC ACKREDITERING
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ISO/IEC 17065

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Empowered Certification Body No. 012: SP Certification, Sweden
For more information of Solar Keymark visit: www.solarkeymar.org
This certificate may not be reproduced other than in full, except with the prior written approval by SP. SP Certification rules SPCR402 applies.

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Annex to Solar Keymark Certificate

Licence Number	SP SC0722-15
Issued	2015-10-30

Summary of EN 12975-2 Test Results

Company holding the	2-improve Energy		Country	Netherlands
Brand (optional)	Prisma Pro		Website	http://prisma-pro.nl
Street, street number	Symon spiersweg 7D10		E-mail	info@Prisma-pro.nl
Postal Code / City, province	1506 RZ	Zaandam	Tel/Fax	+31 75-6703958

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

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
Prisma Pro 8	1.41	1 917	910	133	**1.74**	939	917	870	816	758
Prisma Pro 9	1.59	1 917	1 020	133	**1.96**	1 064	1 039	985	925	858
Prisma Pro 10	1.78	1 917	1 130	133	**2.17**	1 190	1 162	1 102	1 034	960
Prisma Pro 12	2.16	1 917	1 350	133	**2.59**	1 440	1 407	1 334	1 252	1 162
Prisma Pro 14	2.53	1 917	1 570	133	**3.01**	1 691	1 652	1 566	1 470	1 364
Prisma Pro 15	2.72	1 917	1 680	133	**3.22**	1 816	1 774	1 681	1 578	1 464
Prisma Pro 16	2.91	1 917	1 790	133	**3.43**	1 941	1 896	1 798	1 688	1 566
Prisma Pro 18	3.28	1 917	2 010	133	**3.85**	2 192	2 141	2 030	1 905	1 768
Prisma Pro 20	3.66	1 917	2 230	133	**4.28**	2 442	2 386	2 262	2 123	1 970
Prisma Pro 21	3.84	1 917	2 340	133	**4.49**	2 568	2 508	2 378	2 232	2 071
Prisma Pro 22	4.03	1 917	2 450	133	**4.70**	2 693	2 630	2 494	2 341	2 172
Prisma Pro 24	4.41	1 917	2 670	133	**5.12**	2 943	2 875	2 726	2 559	2 374

Performance test method	Glazed liquid heating collector - steady state - outdoor								
Performance parameters related to aperture	η0	a1	a2						
Units	-	W/(m²K)	W/(m²K²)						
Test results - Flow rate and fluid see note 1	0.668	1.496	0.005						

Bi-directional incidence angle modifiers?	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)		1.03		1.05		1.18			0.00
Incidence angle modifiers Kθ(θL)	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
longitudinal direction	Kθ(θL)					0.95				0.00

Stagnation temperature - Weather conditions see note 2	Tstg	275.6	°C
Effective thermal capacity	ceff = C/Ag	3.17	kJ/(m²K)
Max. intende operation temperature - see note 3	Tmax,op	120	°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)	0.005	0.011	0.018	0.024	0.030
Pressure drop, ΔP	Pa	20	110	270	484	721

Optional weather data	Location		Link

Testing Laboratory	Intertek Testing Services Shenzhen Ltd. Guangzhou Branch		
Website	www.intertek.com		
Test report id. number	150824106GZU-001	Date of test report	2015-09-06

During the test GDIF/GTOT was always between 0.07 and 0.12

Comments of testing laboratory:

The "negative pressure test of the collector" according to EN 12975-2:2006,5.9.2 was not performed.

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				

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Datasheet version: 4.06, 2014-01-15

Annex to Solar Keymark Certificate

Annual collector output based on EN 12975-2 Test Results, annex to Solar KEYMARK Certificate	Licence Number	SP SC0722-15
	Issued	2015-10-30

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
Prisma Pro 8	1 598	1 372	1 147	1 345	1 134	937	969	793	637	1 043	855	683
Prisma Pro 9	1 810	1 554	1 300	1 524	1 285	1 061	1 098	899	721	1 182	968	773
Prisma Pro 10	2 024	1 738	1 453	1 704	1 437	1 186	1 227	1 005	806	1 321	1 083	865
Prisma Pro 12	2 450	2 103	1 759	2 062	1 739	1 436	1 486	1 217	976	1 599	1 311	1 047
Prisma Pro 14	2 876	2 469	2 065	2 421	2 042	1 686	1 744	1 428	1 146	1 877	1 539	1 229
Prisma Pro 15	3 089	2 652	2 218	2 600	2 192	1 811	1 873	1 534	1 231	2 016	1 652	1 320
Prisma Pro 16	3 303	2 835	2 371	2 780	2 344	1 936	2 002	1 640	1 316	2 155	1 767	1 411
Prisma Pro 18	3 729	3 201	2 677	3 139	2 647	2 186	2 261	1 852	1 486	2 434	1 995	1 593
Prisma Pro 20	4 155	3 567	2 983	3 497	2 949	2 436	2 519	2 063	1 655	2 712	2 223	1 775
Prisma Pro 21	4 369	3 750	3 137	3 677	3 101	2 561	2 649	2 169	1 741	2 851	2 337	1 866
Prisma Pro 22	4 581	3 933	3 289	3 856	3 252	2 685	2 777	2 275	1 825	2 990	2 451	1 957
Prisma Pro 24	5 007	4 298	3 595	4 215	3 554	2 935	3 036	2 486	1 995	3 268	2 679	2 139

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)