Certificado

Certificate no.
Certificado nº **PSK – 002/2018**

Name and address of certificate holder: *Nome e morada do titular do certificado:*	OPENPLUS, Lda. Rua de Canelas, Nº10 3860-529 Estarreja Portugal
Product: *Produto:*	Thermal Solar Collector *Coletor Solar Térmico*
Type references: *Referências:*	OP-V6, OP-V4 AL, OP-V4.3 Al and/ *e* OP-V4.5 Al
Trademark(s): *Marca(s) comercial(is):*	OPENPLUS ENERGY SYSTEMS
Technical characteristics: *Características técnicas:*	Summary of EN 12975 Test Results: Registration No. PSK–002/2018 (in annex) *Resumo dos resultados dos ensaios realizados segundo a norma EN 12975: Registo Nº PSK-002/2018 (em anexo)*
This product is in conformity with: *Este produto está em conformidade com:*	EN 12975-1:2006+A1:2010, EN 12975-2:2006

and with the Specific Keymark Scheme Rules for Solar Thermal Products
e com as Regras Particulares do CEN Keymark Scheme para Produtos Solares Térmicos.

Test report(s) ref. / Issued by: *Relatório(s) de ensaios nº(s) / Emitido(s) por:*	001/15/ CTCV, 17.V2/LES/2011 and/ *e* 4.V2/LES/2013/ LNEG
Additional information (if any): *Informação adicional (se existir):*	-----
This certificate is valid until: *Este certificado é válido até:*	2021-12-31
and supersedes certificate no: *e substitui o certificado nº:*	-----
Date of issue: *Data de emissão:*	2018-04-06

Francisco Barroca
General Manager / *Diretor Geral*

This Certificate includes one Annex with 2 (two) pages
Este Certificado é constituído por um Anexo com 2 (duas) páginas

Annex to Solar Keymark Certificate - Summary of EN ISO 9806:2013 Test Results	Licence Number	PSK-002/2018
	Date issued	2018-04-06
	Issued by	CERTIF

Licence holder	OPENPLUS, lda	Country	Portugal
Brand (optional)	OPENPLUS ENERGY SYSTEMS	Web	www.openplus.pt
Street, Number	Eco-Parque Empresarial-Rua de Canelas 10	E-mail	geral@openplus.pt
Postcode, City	3860-529 Estarreja	Tel	+351 234811450

Collector Type	Flat plate collector, glazed

Collector name	Gross area (A_G)	Gross length	Gross width	Gross height	Power output per collector Gb = 850 W/m²; Gd = 150 W/m² ϑm - ϑa					
					0 K	10 K	30 K	50 K	70 K	50 K
	m²	mm	mm	mm	W	W	W	W	W	W
OP-V4 AL	2,13	2.055	1.037	68	1.564	1.464	1.255	1.031	794	1.029
OP-V4.3 AL	2,40	2.058	1.165	68	1.760	1.648	1.412	1.161	894	1.157
OP-V4.5 AL	2,65	2.057	1.290	68	1.947	1.823	1.562	1.284	989	1.280
OP-V6	2,01	1.930	1.040	68	1.475	1.381	1.183	973	749	970
Power output per m² gross area					734	687	589	484	373	483

Performance parameters test method	Steady state - indoor								
Performance parameters (related to AG)	η0,hem	a1	a2						
Units	-	W/(m²K)	W/(m²K²)						
Test results	0,734	4,600	0,008						

Incidence angle modifier test method		Steady state - indoor								
Bi-directional incidence angle modifiers	No									
Incidence angle modifier	Angle	10°	20°	30°	40°	50°	60°	70°	80°	90°
Transversal	$K_{\theta T\,coll}$					0,91				0,00
Longitudinal	$K_{\theta L\,coll}$					0,91				0,00

Heat transfer medium for testing		Water	
Flow rate for testing (per gross area, A_G)	dm/dt	0,020	kg/(sm²)
Maximum temperature difference for thermal performance calculations	$(\vartheta_m-\vartheta_a)_{max}$	50,25	K
Standard stagnation temperature (G = 1000 W/m²; ϑ_a = 30 °C)	ϑ_{stg}	162,9	°C
Effective thermal capacity, incl. fluid (per gross area, A_G)	C/m²	8,3	kJ/(Km²)
Maximum operating temperature	$\vartheta_{max\,op}$	-	°C
Maximum operating pressure	$p_{max\,op}$	600	kPa

Testing laboratory	CTCV	www.ctcv.pt	
Test report(s)	001/15	Dated	10-07-2015

Comments of testing laboratory	Datasheet version: 5.01, 2016-03-01
The performance test of OP-V6 was done under the EN ISO 9806 by CTCV. *The test for the colectors OP-V4 AL, OP-V4.3 AL and OP-V4.5 AL were performed by LNEG*	CTCV - LSE CENTRO TECNOLÓGICO DA CERÂMICA E DO VIDRO LSE - Laboratório de Sistemas de Energia

Annex to Solar Keymark Certificate	Licence Number	PSK-002/2018
Supplementary Information	Issued	2018-04-06

Annual collector output in kWh/collector at mean fluid temperature ϑ_m, based on ISO 9806:2013 test results

Standard Locations	Athens			Davos			Stockholm			Würzburg		
Collector name ϑ_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
OP-V4 AL	2.402	1.549	906	1.729	1.092	615	1.285	762	414	1.402	815	436
OP-V4.3 AL	2.703	1.743	1.020	1.946	1.229	692	1.446	857	466	1.577	917	491
OP-V4.5 AL	2.990	1.928	1.128	2.153	1.360	765	1.600	948	516	1.745	1.015	543
OP-V6	2.265	1.461	855	1.631	1.030	580	1.212	718	391	1.322	769	411
Annual output per m² gross area	1.127	727	425	811	513	288	603	357	194	658	383	205
Fixed or tracking collector	Fixed (slope = latitude - 15°; rounded to nearest 5°)											
Annual irradiation on collector plane	1765 kWh/m²			1714 kWh/m²			1166 kWh/m²			1244 kWh/m²		
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 ϑm (mean of in- and outlet temperatures). The calculation of the annual collector performance is performed with the official Solar Keymark spreadsheet tool Scenocalc Ver. 5.01 (March 2016). A detailed description of the calculations is available at www.solarkeymark.org/scenocalc

Additional Information

Collector heat transfer medium	Water	
Hybrid Thermal and Photo Voltaic collector	No	
The collector is deemed to be suitable for roof integration	No	
The collector was tested successfully according to EN ISO 9806:2013 under the following conditions:		
Climate class (A, B or C)	C	--
Maximum tested positive load	1333	Pa
Maximum tested negative load	889	Pa
Hail resistance using steel ball (maximum drop height)	-	m

Energy Labelling Information

	Reference Area, A_{col} (m²)
OP-V4 AL	2,13
OP-V4.3 AL	2,40
OP-V4.5 AL	2,65
OP-V6	2,01

Data required for CDR (EU) No 811/2013 - Reference Area A_{sol}		
Collector efficiency (η_{col})	54	%

Remark: Collector efficiency (η_{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/m², expressed in % and rounded to the nearest integer. Deviating from the regulation η_{col} is based on reference area (A_{sol}) which is aperture area for values according to EN 12975-2 or gross area for ISO 9806:2013.

Data required for CDR (EU) No 812/2013 - Reference Area A_{sol}		
Zero-loss efficiency (η_0)	0,734	--
First-order coefficient (a_1)	4,60	W/(m²K)
Second-order coefficient (a_2)	0,008	W/(m²K²)
Incidence angle modifier IAM (50°)	0,91	--

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.

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