



Certificate no. **PSK – 011/2015**  
Certificado nº

**Name and address of certificate holder:**  
*Nome e morada do titular do certificado:*

OPENPLUS, Lda.  
Eco-Parque Empresarial, Rua de Canelas N.º 10  
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-011/2015  
(in annex)  
*Resumo dos resultados dos ensaios realizados segundo a norma EN 12975:  
Registo Nº PSK-011/2015 (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):*

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**This certificate is valid until:**  
*Este certificado é válido até:*

2018-04-07

**and supersedes certificate no:**  
*e substitui o certificado nº:*

PSK – 020/2013

**Date of issue:**  
*Data de emissão:*


2015-07-10



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*



|  |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |
|--|--|--|--------------------------|------------------------------------|--|---|------------------|--------------------------------|------------------|------------------|------|
| <b>Summary of EN 12975 Test Results,<br/>annex to Solar KEYMARK Certificate</b>  |  |  |                          |                                    |  | <b>Licence Number</b>   |                  | <b>PSK-011/2015</b>            |                  |                  |      |
|  |  |  |                          |                                    |  | <b>Issued</b>   |                  | <b>2015-07-10</b>              |                  |                  |      |
| <b>Company holding the</b>   |  | <b>OPENPLUS, lda</b>   |                          |                                    |  | <b>Country</b>  |                  | <b>Portugal</b>                |                  |                  |      |
| <b>Brand (optional)</b>  |  | <b>OPENPLUS ENERGY SYSTEMS</b>                                       |                          |                                    |  | <b>Website</b>  |                  | <b>www.openplus.pt</b>         |                  |                  |      |
| <b>Street, street number</b>   |  | <b>Eco-Parque Empresarial-Rua de Canelas 10</b>                      |                          |                                    |  | <b>E-mail</b>   |                  | <b>geral@openplus.pt</b>       |                  |                  |      |
| <b>Postal Code / City, province</b>  |  | <b>3860-529</b>  |                          | <b>Estarreja</b>                   |  | <b>Tel/Fax</b>  |                  | <b>351 234 811 450</b>         |                  |                  |      |
| <b>Collector Type (flat plate glazed/un-glazed; evacuate tubular)</b>  |  |  |                          |                                    |  | <b>Flat plate collector - glazed</b>  |                  |                                |                  |                  |      |
| <b>Thermal / photo voltaic hybrid collector? (PVT collector)</b>   |  |  |                          |                                    |  | <b>No</b>   |                  |                                |                  |                  |      |
| <b>Integration in the roof possible? (manufacturers declaration)</b>   |  |  |                          |                                    |  | <b>No</b>   |                  |                                |                  |                  |      |
| <b>Collector name</b>  | <b>Aperture area (Aa)</b><br>m <sup>2</sup>                                | <b>Gross length</b><br>mm  | <b>Gross width</b><br>mm | <b>Gross height</b><br>mm          | <b>Gross area (AG)</b><br>m <sup>2</sup> | <b>Power output per collector module</b><br>G = 1000 W/m <sup>2</sup><br>T <sub>m</sub> -T <sub>a</sub>   |                  |                                |                  |                  |      |
|  |  |  |                          |                                    |  | <b>0 K</b><br>W   | <b>10 K</b><br>W | <b>30 K</b><br>W               | <b>50 K</b><br>W | <b>70 K</b><br>W |      |
| OP-V4 AL   | 2,02   | 2.055  | 1.037                    | 68                                 | 2,13                                     | 1.480   | 1.386            | 1.188                          | 976              | 752              |      |
| OP-V4.3 AL   | 2,32   | 2.058  | 1.165                    | 68                                 | 2,40                                     | 1.704   | 1.595            | 1.367                          | 1.123            | 865              |      |
| OP-V4.5 AL   | 2,53   | 2.057  | 1.290                    | 68                                 | 2,65                                     | 1.854   | 1.736            | 1.487                          | 1.223            | 942              |      |
| OP-V6  | 1,90   | 1.930  | 1.040                    | 68                                 | 2,01                                     | 1.395   | 1.306            | 1.119                          | 920              | 708              |      |
| <b>Performance test method</b>   |  |  |                          |                                    |  | <b>Glazed liquid heating collector - steady state - indoor</b>  |                  |                                |                  |                  |      |
| <b>Performance parameters related to aperture</b>  |  | $\eta_0$   | a1                       | a2                                 |  |   |                  |                                |                  |                  |      |
| <b>Units</b>   |  | -  | W/(m <sup>2</sup> K)     | W/(m <sup>2</sup> K <sup>2</sup> ) |  |   |                  |                                |                  |                  |      |
| <b>Test results - Flow rate and fluid see note 1</b>   |  | 0,734  | 4,600                    | 0,008                              |  |   |                  |                                |                  |                  |      |
| <b>Bi-directional incidence angle</b>  |  | <b>No</b> <i>K<math>\theta</math> values are obligatory for 50°.</i> |                          |                                    |  |   |                  |                                |                  |                  |      |
| <b>Incidence angle modifiers K<math>\theta</math>(<math>\theta</math>)</b>   |  | Angle  | 10°                      | 20°                                | 30°                                      | 40°   | 50°              | 60°                            | 70°              | 80°              | 90°  |
|  |  | K $\theta$ ( $\theta$ )  |                          |                                    |  |   | 0,91             |                                |                  |                  | 0,00 |
| <b>Incidence angle modifier not bi-directional - leave fields blank</b>  |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |
| <b>Stagnation temperature - Weather conditions see note 2</b>  |  |  |                          |                                    |  | <b>Tstg</b>   |                  | <b>162,9 °C</b>                |                  |                  |      |
| <b>Effective thermal capacity</b>  |  |  |                          |                                    |  | <b>ceff = C/Ag</b>  |                  | <b>8,3 kJ/(m<sup>2</sup>K)</b> |                  |                  |      |
| <b>Max. intende operation temperature - see note 3</b>   |  |  |                          |                                    |  | <b>Tmax,op</b>  |                  | <b>°C</b>                      |                  |                  |      |
| <b>Max. operation pressure - see note 3</b>  |  |  |                          |                                    |  | <b>pmax,op</b>  |                  | <b>600 kPa</b>                 |                  |                  |      |
| <b>Pressure drop table - for a collector family, the values shall be for the module with highest <math>\Delta P</math> per m<sup>2</sup> aperture area</b>                         |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |
| <b>Flow rate</b>   | kg/(s m <sup>2</sup> )   | 0  | 45                       | 102                                | 159                                      | 216   | 273              | -                              | -                | -                | -    |
| <b>Pressure drop, <math>\Delta P</math></b>  | Pa   | 0  | 59                       | 186                                | 352                                      | 558   | 802              | -                              | -                | -                | -    |
| <b>Optional weather data</b>   |  | <b>Location</b>  |                          |                                    |  | <b>Link</b>   |                  |                                |                  |                  |      |
| <b>Testing Laboratory</b>  |  | <b>CTCV</b>  |                          |                                    |  |   |                  |                                |                  |                  |      |
| <b>Website</b>   |  | <b>www.ctcv.pt</b>   |                          |                                    |  |   |                  |                                |                  |                  |      |
| <b>Test report id. number</b>  |  | <b>001/15</b>  |                          |                                    |  | <b>Date of test report</b>  |                  | <b>2015-07-10</b>              |                  |                  |      |
| <b>During the test GDIF/GTOT was always between</b>  |  | -  | and                      | -                                  |  |   |                  |                                |                  |                  |      |
| <b>Comments of testing laboratory:</b>   |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |
| The performance test of OP-V6 was done under the EN ISO 9806 by CTCV.  |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |
| The test for the collectors OP-V4 AL, OP-V4.3 AL and OP-V4.5 AL were performed by LNEG   |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |
|  |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |
| <b>Note 1</b>  | <b>Flow rate</b>   | 0,020  | kg/(s m <sup>2</sup> )   | <b>Fluid</b>                       | <b>Water</b>                             |   |                  |                                |                  |                  |      |
| <b>Note 2</b>  | <b>Irradiance, G = 1000 W/m<sup>2</sup>; Ambient temperature, Ta=30 °C</b> |  |                          |                                    |  |   |                  |                                |                  |                  |      |
| <b>Note 3</b>  | <b>Given by manufacturer</b>   |  |                          |                                    |  |   |                  |                                |                  |                  |      |
|  |  |  |                          |                                    |  | <br>CENTRO TECNOLÓGICO DA CERÂMICA E DO VIDRO<br>LSE - Laboratório de Sistemas de Energia<br>Datasheet version: 4.06, 2014-01-15 |                  |                                |                  |                  |      |
| <b>CERTIF Associação para a Certificação</b><br>Rua Incá Afonso, 9F - 2810-237 Almada - Portugal<br>Tel: +351 212 586 940 / Fax: +351 212 586 959 / mail@certif.pt / www.certif.pt |  |  |                          |                                    |  |   |                  |                                |                  |                  |      |

