




TEST REPORT

| SQM_392_2019 |

EFFICIENCY DETERMINATION ON THE PRODUCT "PLATIO 4.6 SYSTEM", OF THE COMPANY "INNOVATÍV TÉRBUKOLATFEJLESZTŐ KFT." IN THE CONDITION "AS IS" AND AFTER CICLES OF ARTIFICIAL AGEING

PLACE AND DATE OF ISSUE:	Faenza, 25/02/2020
COMPANY:	Innovatív Térburkolatfejlesztő Kft.
ADDRESS:	4080 Hajdúnánás, Jókai utca 64 - Hungary
TYPE OF PRODUCT:	<i>Paving integrated systems for external uses</i>
STANDARD APPLIED:	I.O.P
DATE OF RECEIPT IN LABORATORY:	30/10/2019
TESTS EXECUTED:	January - May 2020
TEST EXECUTED BY:	CertiMaC, Faenza

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Test executed	Written	Approved
I.E. Germano Pederzoli 	_Eng. Simone Bandini_ 	_Eng. Luca Laghi_ 
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1 Introduction

This test report describes:

Efficiency determination of the photovoltaic modules on the samples “as is” and after artificial aging by means of:

- *Freeze/Thaw cycles*
- *De-icing salts cycles*
- *Heat-Rain cycles*

carried out on a kind of product sent to the CertiMaC Laboratory in Faenza, by the company Innovatív Térburkolatfejlesztő Kft (Ref. 2-a, 2-b).

Artificial ageing has been executed according to Ref. 2-c,d,e, then the efficiency of the panels has been determined according to an Internal Operating Protocol described below.

2 References

- a. Estimate: ref. n. 19307/lab on 22/10/2019.
- b. Order confirmation: e-mail on 22/10/2019.
- c. Test Report: SQM_389_2019. DETERMINATION OF FROST RESISTANCE (EN 10545-12) ON THE PRODUCT “PLATIO 4.6 SYSTEM”, OF THE COMPANY “Innovatív Térburkolatfejlesztő Kft.” (Standard UNI EN ISO 10545-12. P. Ceramic Tiles. Determination of frost resistance)
- d. Test Report: SQM_390_2019. DETERMINATION OF FREEZE/THAW RESISTANCE WITH DE-ICING SALT (EN 1339- Annex D) ON THE PRODUCT “PLATIO 4.6 SYSTEM”, OF THE COMPANY “Innovatív Térburkolatfejlesztő Kft.” (Standard UNI EN 1339. Concrete paving flags. Requirements and test methods. Annex D: Determination of freeze/thaw resistance with de-icing salt)
- e. Test Report: SQM_391_2019. DETERMINATION OF HEAT/RAIN RESISTANCE (ETAG 004) ON THE PRODUCT “PLATIO 4.6 SYSTEM”, OF THE COMPANY “Innovatív Térburkolatfejlesztő Kft.” ETAG 004:2013. Guideline for European technical approval of external thermal insulation. Composite systems (ETICS) with rendering. 5. Methods of verification. Par. 5.1.3.2.1 Hygrothermal behavior.

3 Test object

Test has been executed on paving blocks with an integrated photovoltaic system, named:

- PLATIO 4.6 SYSTEM

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with size approximately of 34 x 34 x 6,5 cm³. The specimens were selected from a sampling sent to the laboratory by the Customer on 30/10/2019.

4 Conditioning

- Five (5) samples were tested "as is" [named Ref.]
- Ten (10) samples were conditioned according to Ref. 2-c (*Freeze/Thaw cycles*) [named F&T]
- Three (3) samples were conditioned according to Ref. 2-d (*De-iceing salts cycles*) [named DS]
- Five (5) samples were conditioned according to Ref. 2-e (*Heat-Rain cycles*) [named HR]

5 Test procedure

After conditioning (according to the corresponding artificial aging cycles, reported in paragraph 4), on each sample (both conditioned and "as is") the current and the voltage generated by the photovoltaic panel inside the tiles was measured by means of a digital multimeter (HIOKI DT4281). The purpose of the test is to verify whether the artificial aging causes a decrease in the panel performance and efficiency.

All the measures were executed on the same sunny day, with an irradiance of 689 W/m² and a temperature (measured directly in contact with the panel surface, by means of a thermocouple and a hole drilled in the centre of the surface glass) variable between 39 and 42 °C. All the measurements were carried out and completed within an hour, in order to ensure, as much as possible, the constancy of the sun radiation.

In table 1 the values of current, voltage, power ($P=I \cdot V$), for each sample, are reported. The variation between the electrical power values of the samples "as is" and the conditioned ones was also calculated.

Sample	V [V]	I [A]	P [W]	P [W] (mean value)	Variation [%] (vs ref. mean)	Variation [%] (mean value)
ref-1	2,65	8,32	22,06	21,58		
ref-2	2,62	8,26	21,65			
ref-3	2,61	8,15	21,25			
ref-4	2,63	8,34	21,92			
ref-5	2,61	8,06	21,03			
DS-1	2,65	7,83	20,75	20,86	-3,85	-3,34
DS-2	2,59	8,03	20,76		-3,82	
DS-3	2,53	8,33	21,07		-2,35	
F&T-1	2,63	7,95	20,87	21,00	-3,30	-2,69
F&T-2	2,56	7,80	19,95		-7,55	
F&T-3	2,59	7,71	19,98		-7,44	
F&T-4	2,62	7,90	20,71		-4,02	

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F&T-5	2,65	8,02	21,21		-1,71	
F&T-6	2,61	8,14	21,25		-1,52	
F&T-7	2,65	8,31	21,98		1,85	
F&T-8	2,62	8,14	21,31		-1,25	
F&T-9	2,61	7,98	20,80		-3,64	
F&T-10	2,63	8,33	21,93		1,63	
HR-1	2,63	8,14	21,44	21,35	-0,65	-1,09
HR-2	2,65	8,28	21,98		1,82	
HR-3	2,62	7,89	20,69		-4,14	
HR-4	2,63	8,13	21,37		-0,96	
HR-5	2,60	8,17	21,26		-1,50	

Tab. 1 Measured values and variation % between conditioned samples and reference ones

6 Conclusions

The cycles of artificial aging do not seem to have clearly influenced the performance of the panels. The average values of the variation always remain very low for all the conditioning methods (< 3,5%). The most evident single variances are found as a result of the freeze/thaw cycles (7,44-7,55%), must likely due to a greater number of samples, and maybe those panels had a lower performance even before ageing; the mean value however remains below 3%.

7 Distribution List

ENEA	Archives	1 copy
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