




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

NOTE: Results contained in the present test report are exclusively referred to the samples subjected to the tests described hereafter. Moreover, this report is for the exclusive use of the Customer, within the limits set by mandatory legislation and cannot be reproduced, totally or partially (in digital or paper form), without a written approval of the Laboratory.

Test executed	Written	Approved
<u>_I.E. Germano Pederzoli_</u> 	<u>_Eng. Simone Bandini_</u> 	<u>_Eng. Luca Laghi_</u> 
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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·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
CertiMaC	Archives	1 copy
Customer	Innovatív Térburkolatfejlesztő Kft	1 copy

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