

Assessment Report

Document No.: (1202/139/19) – Lau of 26/05/2021

Customer: Elastotet SA
48° KM National Road Athens Lamia
19011 Avlona Attiki

Order date: 27/02/2019

Order received: 27/02/2019

Subject: Tests with a liquid applied waterproof roof membrane;
product name: "LASTOFLEX-PU" without interlining fabric

Test basis: ETAG 005: Guideline for European Technical Approval for
"liquid applied roof waterproofing kits"

Test material received: 15.03.2019

Sampling: made by the client

Test material marking: see section 1

Assessment period: 23/03/2019 until 21/05/2021

This Assessment Report consists of 3 pages, including the cover sheet and 7 annexes.



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1 Commission and material

By letter of 27 February 2019, Elastotet SA, 48° KM National Road Athens Lamia, 19011AVLONA Attiki-Greece, commissioned the Civil Engineering Materials Testing Institute (MPA BS) in Braunschweig to test a roof waterproofing system using liquid plastics in accordance with ETAG 005: "**Guideline for European Technical Approval for liquid applied waterproofing kits**". The product name is

"LASTOFLEX-PU" without interlining fabric.

To be able to carry out the required tests, MPA Braunschweig was supplied with the following material samples:

- 20 x 0.25 m² of free films of the "LASTOFLEX-PU" with a layer thickness of 1.17- 1.23 mm
- 4 x 0.25 m² of a free film produced at the lowest application temperature (3 °C surface temperature)
- 4 x 0.25 m² of a free film produced at the highest application temperature (40 °C surface temperature)
- System-coated substrates
- 3 paving slabs (30 x 30 cm²), coated with "LASTOFLEX-PU"
- 1 paving slab (30 x 30 cm²) coated with "LASTOFLEX-PU", which was coated with a second layer after a 24-hour interruption
- 3 steel plates (30 x 30 cm²), coated with "LASTOFLEX-PU"
- 1 paving slab, coated with "LASTOFLEX-PU" in a crack-bridging manner (crack width 1 mm)
- 1 paving slab, coated with "LASTOFLEX-PU" in a crack-bridging manner (zero joint)
- 500 ml of the liquid " LASTOFLEX-PU" component

The "LASTOFLEX-PU" waterproofing system is made from polyurethane without an interlining fabric. The minimum layer thickness is 1.20 mm.

2 Testing and Results

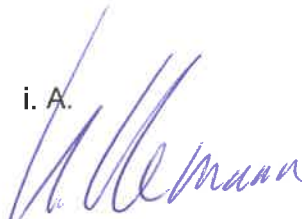
For testing the roof waterproofing system, reference was made to the specifications in the ETAG 005 "**Guideline for European Technical Approval of watertight covering kits**".

The test program was carried out on the basis of ETAG 005-1 (General) and the specific stipulations in ETAG 005-6 (material based on polyurethane).

The test results are presented in a tabulated form in the attached annexes, which also show the test conditions. The results show that the defined requirements are complied with:


- Durability W3
- Climate zone: S
- Load capacity: P1 (non-compressible substrate:
e.g. concrete/steel)
- Roof inclination: S1 to S4
- Lowest surface temperature: TL4
- Highest surface temperature: TH3

i. A.


Dr.-Ing. K. Herrmann
Head of Section



i. A.


N. Meyer-Laurien
Engineer/official in charge

Verification method in accordance with ETAG 005-1	Test conditions	Test results	Requirements
5.2.2 Reaction to fire	DIN EN ISO 11925-2 DIN EN 13501-1	class E	class E
5.3.1.1 Water vapour transmission properties	DIN EN 1931 23°C-0/75% RH Method: free film Number of specimens: 3 Thickness of dry coat: 1,20 mm	Water vapour diffusion current density $V = 15.4 \text{ [g/(m}^2 \cdot \text{d)]}$ Water vapour diffusion equivalent air layer thickness $S_d = 2.28 \text{ [m]}$ Diffusion resistance $\mu = 1900 \text{ [-]}$ $\mu_k = 1850 \text{ [-]}$ $\mu_G = 1950 \text{ [-]}$	-
5.3.1.2 Water tightness	TR-003: DIN EN 1928 Method A Test period 24 h Water column 1 m Number of specimens: 3	watertight	watertight
5.3.3.1 Resistance against wind load	TR-004: Indenter \varnothing 100 mm Load increase rate 100 N/sec. Number of specimens: 5	On concrete: $x = 1.46 \text{ N/mm}^2$ $g = 1.54 \text{ N/mm}^2$ $k = 1.37 \text{ N/mm}^2$ On galvanised steel plate: $x = 1.08 \text{ N/mm}^2$ $g = 1.22 \text{ N/mm}^2$ $k = 0.97 \text{ N/mm}^2$	$x \geq 0.05 \text{ N/mm}^2$ $x \geq 0.05 \text{ N/mm}^2$

Legend: x = mean value, k = lowest value g = highest value

Table: Characteristics of the "LASTOFLEX-PU" waterproofing system

Verification method in accordance with ETAG 005-1	Test conditions	Test results	Requirements
5.3.3.2 Resistance against mechanical damage as a result of dynamic and static indentation <ul style="list-style-type: none"> Impermeability to water in the loaded state 	<u>Load characteristics</u> <ul style="list-style-type: none"> Dynamic indentation acc. to TR-006 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) Number of specimens: 3 	Substrate: concrete P4: 6-mm indenter: tight	tight
	<u>Load characteristics</u> <ul style="list-style-type: none"> Static indentation acc. to TR-007 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) Number of specimens: 3 	Substrate: concrete P4: 250-N imposed load: tight	tight
5.3.3.3 Fatigue resistance	TR-008: Test temperature: -10°C Initial crack width: 1.0 mm Change in crack width: ± 1 mm No. of cycles: 1000 (W3) Test rate: 16 mm/h Number of specimens: 3	no cracks	no (incipient) cracks
5.3.3.4 Resistance against the effects of high and low surface temperatures	Low temperatures: <u>Load characteristics</u> <ul style="list-style-type: none"> Dynamic indentation acc. to TR-006 Substrate: steel plate 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) Number of specimens: 3 	Test temp.: -30°C (TL 4) P4: 6 mm indenter: tight	tight
	Extremely low temperatures: TR-013: Test temperature: -30°C Crack width: 1.5 mm Test rate: 0.5 mm/min Specimens: 3	watertight	watertight
	High temperatures: <u>Load characteristics</u> <ul style="list-style-type: none"> Static indentation acc. to TR-007 Substrate: steel plate 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) 	Test temp.: +90°C (TH 4) P4: 250-N imposed load: tight	According to ETAG 005, no test required for PUR

Legend: x = mean value, k = lowest value g = highest value

Table: Characteristics of the "LASTOFLEX-PU" waterproofing system

Verification method in accordance with ETAG 005-1	Test conditions	Test results	Requirements
<p>Resistance against the effects of aging</p> <p>5.3.3.5-1 Resistance against thermal aging</p>	<p>TR-011: 80°C/ 200 d</p> <p>Low temperature test: <u>Load characteristics</u></p> <ul style="list-style-type: none"> • Dynamic indentation acc. to TR-006 Substrate: steel plate • 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) • Number of specimens: 3 <p>Fatigue resistance in accordance with 5.3.3.3</p> <p>TR-008: Test temperature: -10°C Initial crack width: 1.0 mm Change in crack width: ± 1mm No. of cycles: 50 Test rate: 16 mm/h Number of specimens: 3</p> <p>Tension tests in accordance with DIN EN ISO 527</p> <ul style="list-style-type: none"> • Test rate: 200 mm/min • Specimen 1B • Number of specimens: 5 	<p>Test temp.: -30°C (TL 4) P4: 6 mm indenter: tight</p> <p>no cracks</p> <p>Tensile strength x = 3.91 MPa k = 3.23 MPa g = 4.68 MPa</p> <p>Strain at max. force x = 339 % k = 278 % g = 403 %</p> <p>→ No significant changes</p>	<p>tight</p> <p>no (incipient) cracks</p> <p>No significant changes in comparison with the condition when supplied</p>

Legend: x = mean value, k = lowest value g = highest value

Table: Characteristics of the "LASTOFLEX-PU" waterproofing system

Verification method in accordance with ETAG 005-1	Test conditions	Requirements	Requirements
<p>5.3.3.5-2 UV exposure in the presence of moisture</p>	<p>TR-010: 1000 MJ/m²</p> <p>Low temperature test: (-10 °C): <u>Load characteristics</u></p> <ul style="list-style-type: none"> • Dynamic indentation acc. to TR-006 Substrate: steel plate • 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) • Number of specimens: 3 <p>Tension tests in accordance with DIN EN ISO 527</p> <ul style="list-style-type: none"> • Test rate: 200 mm/min • Specimen 1B • Number of specimens: 5 	<p>P4: 6 mm indenter: tight</p> <p>Tensile strength</p> <p>x = 3.54 MPa k = 3.25 MPa g = 4.12 MPa</p> <p>Strain at max. force</p> <p>x = 231 % k = 200 % g = 280 %</p> <p>→ No significant changes</p>	<p>tight</p> <p>No significant changes in comparison with the condition when supplied</p>
<p>Resistance against the effects of aging</p> <p>5.3.3.5-3 Resistance against aging in water</p>	<p>TR-012: 60°C/ 90 d</p> <p>High temperature test: <u>Load characteristics</u></p> <ul style="list-style-type: none"> • Static indentation acc. to TR-007 Substrate: steel plate • 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) • Number of specimens: 3 <p>Resistance against wind load</p> <p>TR-004: Indenter Ø 100 mm Load increase rate 100 N/sec. Number of specimens: 5</p>	<p>Test temp.: +80°C (TH 3) P1: 70-N imposed load: tight</p> <p>On concrete: x = 1.25 N/mm² g = 1.32 N/mm² k = 1.20 N/mm²</p>	<p>tight</p> <p>x ≥ 0.05 N/mm²</p>

Legend: x = mean value, k = lowest value g = highest value

Table: Characteristics of the "LASTOFLEX-PU" waterproofing system

Verification method in accordance with ETAG 005-1	Test conditions	Requirements	Requirements
<p>5.7.1 Effects of deviations (fitness for use)</p>	<p><u>Load characteristics</u></p> <ul style="list-style-type: none"> • Dynamic indentation acc. to TR-006 • 24-hour exposure to a 0.1-metre water column (test method 5.3.1.2) • Number of specimens: 3 <p><u>Tension tests in accordance with DIN EN ISO 527</u></p> <ul style="list-style-type: none"> • Test rate: 200 mm/min • Specimen 1B • Number of specimens: 5 	<p><u>Film produced at + 3 °C</u></p> <p>Substrate: concrete P4: 6-mm indenter: tight</p> <p><u>Film produced at +40 °C</u></p> <p>Substrate: concrete P4: 6-mm indenter: tight</p> <p><u>Film produced at + 3 °C</u></p> <p>Tensile strength</p> <p>x = 3.31 MPa k = 2.65 MPa g = 3.52 MPa</p> <p>Strain at max. force</p> <p>x = 289 % k = 223 % g = 324 %</p> <p><u>Film produced at + 40 °C</u></p> <p>Tensile strength</p> <p>x = 3.10 MPa k = 2.74 MPa g = 3.64 MPa</p> <p>Strain at max. force</p> <p>x = 226 % k = 194 % g = 262 %</p> <p>→ No significant changes</p>	<p>tight</p> <p>tight</p> <p>No significant changes in comparison with the condition when supplied (see annex 5)</p>
<p>5.7.2 Effects on construction joints</p>	<p>Resistance against wind load</p> <p>TR-004: Indenter Ø 100 mm Load increase rate 100 N/sec. Number of specimens: 5</p>	<p>On concrete:</p> <p>x = 1.33 N/mm² k = 1.30 N/mm² g = 1.40 N/mm²</p>	<p>x ≥ 0.02 N/mm²</p>

Legend: x = mean value, k = lowest value g = highest value

Table: Characteristics of the "LASTOFLEX-PU" waterproofing system

Characteristics of the waterproofing system	Test conditions	Test results
Thickness	DIN EN 1849-2	<p>Sample condition when supplied: x = 1.17 mm k = 1.10 mm g = 1.23 mm</p> <p>Samples for static and dynamic indentation (free films): x = 1.20 mm k = 1.15 mm g = 1.24 mm</p> <p>Samples for fatigue resistance tests: x = 1.20 mm k = 1.17 mm g = 1.26 mm</p> <p>Samples for thermal aging tests: x = 1.21 mm k = 1.19 mm g = 1.23 mm</p> <p>Samples for UV aging tests: x = 1.25 mm k = 1.23 mm g = 1.27 mm</p> <p>Samples produced at + 3 min °C: x = 1.22 mm k = 1.21 mm g = 1.23 mm</p> <p>Samples produced at + 40 °C: x = 1.18 mm k = 1.04 mm g = 1.28 mm</p> <p>Samples for determination of the effects of construction joints: x = 2.31 mm k = 2.11 mm g = 2.48 mm</p>
Weight per unit area	EN 29073-1	<p>x = 1930 g/m² k = 1890 g/m² g = 1980 g/m²</p>
Reaction in the tension test	<p>DIN EN ISO 527 Specimen 1b Number of specimens: 5 v= 200 mm/min lo = 115 mm</p>	<p>Max. force x = 42.7 N/10 mm s = 3.00</p> <p>Tensile strength x = 3.75 MPa s = 0.16 k = 4.00 MPa g = 3.61 MPa</p> <p>Strain at max. force x = 218 % s = 10.0 k = 209 % g = 234 %</p>
Shore hardness	DIN 53505	<p>Shore A Median = 81 [-] Shore D Median = 23 [-]</p>

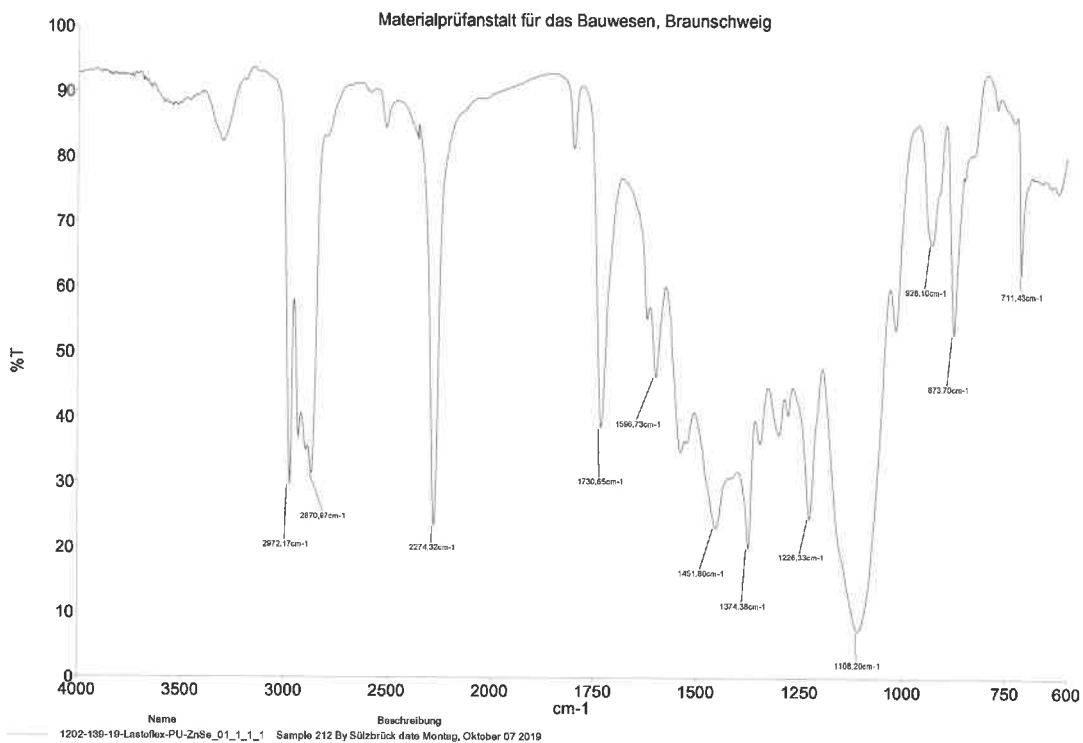
Legend: x = mean value s = ± standard deviation k = lowest value g = highest value

Table: Characteristics of the "LASTOFLEX-PU" waterproofing system

Characteristic of the liquid components	Test conditions	Test results
IR spectra	see below	see below
<p>The IR analyses were made with a Perkin-Elmer FTIR unit of type Spectrum 2000 Explorer, wave number range 4000 cm⁻¹ to 600 cm⁻¹. The sample quantity was selected so that the DIN 51451 requirements respecting extinction conditions were complied with. The spectra of the liquid components shown in Annex 7 are electronically smoothed. The original graphs are kept in the testing laboratory archives.</p>		

Legend: x = mean value

Table: Characteristic of the liquid component "LASTOFLEX-PU"



IR spectrum of the liquid component "LASTOFLEX-PU" (Batch 2019)