

Test report

Resistance to dynamical wind loads according to EN 16002:2010 –Determination of the resistance to wind load of mechanically fastened flexible sheets for roof waterproofing.

| | |
|-----------------|---|
| Project number: | 20160831-120-7 |
| Report date: | 2016-09-13 |
| Roof system: | TechnoNicol Two-layer system |
| Membrane type: | Base: TechnoElast FIX EPM Cap: TechnoElast EKP |
| Fastener type: | TechnoNicol plastic tube Ø50 TechnoNicol Roofing Screw Ø4,8 Ph2 |
| Client: | LLC TechnoNICOL - Construction Systems Gilyarovskogo str. 47 page 5 129110 Moscow Russian Federation |
| Contact: | Sergey Gavrilov |

Chief of controlling and testing Fredrik Rundgren

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1. Introduction

Constructech Sweden AB has, on request of the client, carried out wind load testing of the Roof system Base: TechnoElast FIX EPM Cap: TechnoElast EKP . The purpose of the test was to determine the wind load capacity of the mechanical fastened roof system according to EN-16002:2010 and define a characteristic load according to the standard.

The installation and welding has been carried out by the client in cooperation with Constructech's test engineer. The installation has been carried out according to the general installation guide for the membrane system.

2. Investigation – Wind load tester

The investigation of the resistance to dynamical wind loads has been performed according to EN 16002:2010 - Determination of the resistance to wind load of mechanically fastened flexible sheets for roof waterproofing.

The test result of the wind uplift test has been interpreted according to the European directive ETAG 006:2000/Amended:2012 - Guideline for the European Technical Approval of systems of mechanically fastened flexible roof waterproofing membranes.

Wind load tester size: 4,90 m x 2,65 m.

Pitch $0\pm 2^\circ$

The wind load tester fulfills the requirements according to the standard. The pressure load cells have been calibrated in line with Constructech's quality management routines. Last calibration performed 2016-06-16

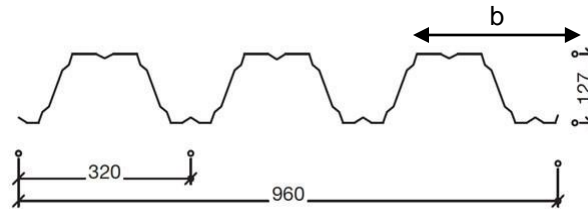


Wind load tester 4,90 m x 2,65 m

3. Test model

Test model dimensions: 4,90 m x 2,65 m

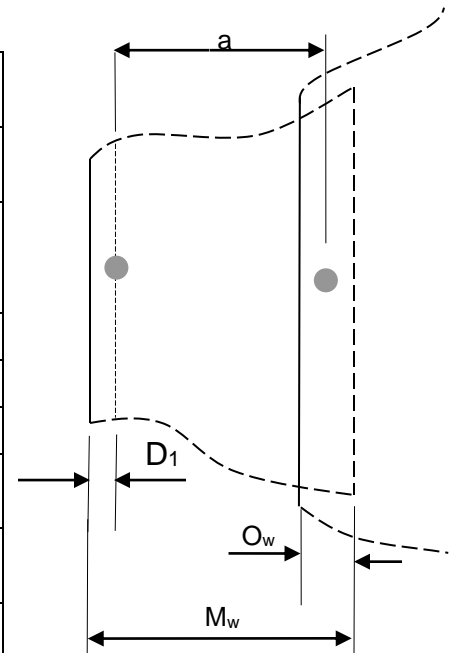
Substructure: Profiled steel deck Arcelor Mittal TP127
Thickness 0,75 mm
Yield strength 350 N/mm²



Thermal insulation: Paroc ROS30 +Paroc ROB80 Mineral Wool
Thickness 100 mm

Roof system:

| | |
|---|--|
| Membrane: | Base: TechnoElast FIX EPM Cap: TechnoElast EKP |
| Membrane width (M _w): | 1000,00 |
| Bonding method: | Overlap of base fully torched. Cap fully torched to base |
| Overlap width (O _w): | 100,00 |
| Measure (a): | 900,00 |
| Washer type: | TechnoNicol tube Ø50 |
| Fastener type: | TechnoNicol roofing Screw Ø4,8 |
| Fixing pattern, fixed in the overlap (D ₁): | 45,00 |
| Distance between fasteners (b): | 320,00 |



Temperature:
Temperature during test was between +24°C and +26°C.

A photo report of the buildup and the failure mode is given in annex A.
A drawing of the test model is given in annex D.

4. Results

At the failure cycle of $W_{\max 100\%}$ (theoretical load) the test was stopped. According to EN-16002:2010 the approved test result is $W_{\max 100\%}$ (theoretical load) for the fulfilled cycle prior the failed cycle, which results in:

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|---------------------|--------|
| $W_{\text{test}} =$ | 1000 N |
|---------------------|--------|

Failure mode

Below you will find a short description of the failure mode:

At the peak load of cycle 12 (1100N) the fasteners were pulled out from the deck. No indication of delamination in overlap seam.

The characteristic value is calculated according to the formula in annex C and the results for this test are as follows:

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|--------------------------|--------|
| W_{test} | 1000 N |
| C_a | 1,0 |
| C_d | 1,0 |
| ΔW_{char} | 1000 N |
| W_{adm} | 667 N |

A graph of the loads in load cycle, W_{test} , is given in annex B

Note: ΔW_{char} is the characteristic value and not the design value, see annex C.

$W_{\text{adm}} = W_{\text{char}}/\gamma_m$ is the design value. (ETAG 006:2000/Amended:2012: $\gamma_m=1,5$)

Remark

The indicated test data are valid under test conditions only. A successful application under other than the reported test conditions are not proven with this test report. It shall be emphasized that this investigation is only an indication at a given moment of the properties of the investigated material and does not provide information on the scope of the variations over course of time.

Strängnäs 2016-09-13

Constructech Sweden AB

A handwritten signature in blue ink, appearing to read 'Fredrik Rundgren', written over a faint circular stamp.

Fredrik Rundgren

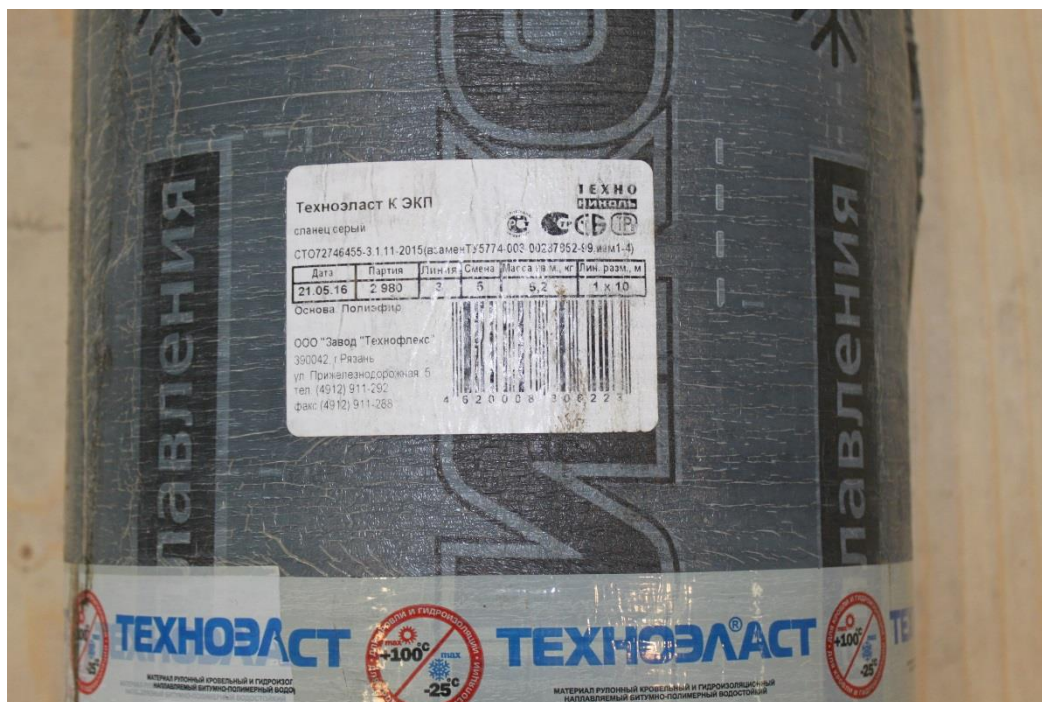
Constructech Sweden AB

A handwritten signature in blue ink, appearing to read 'Sofie Rundgren', written over a faint circular stamp.

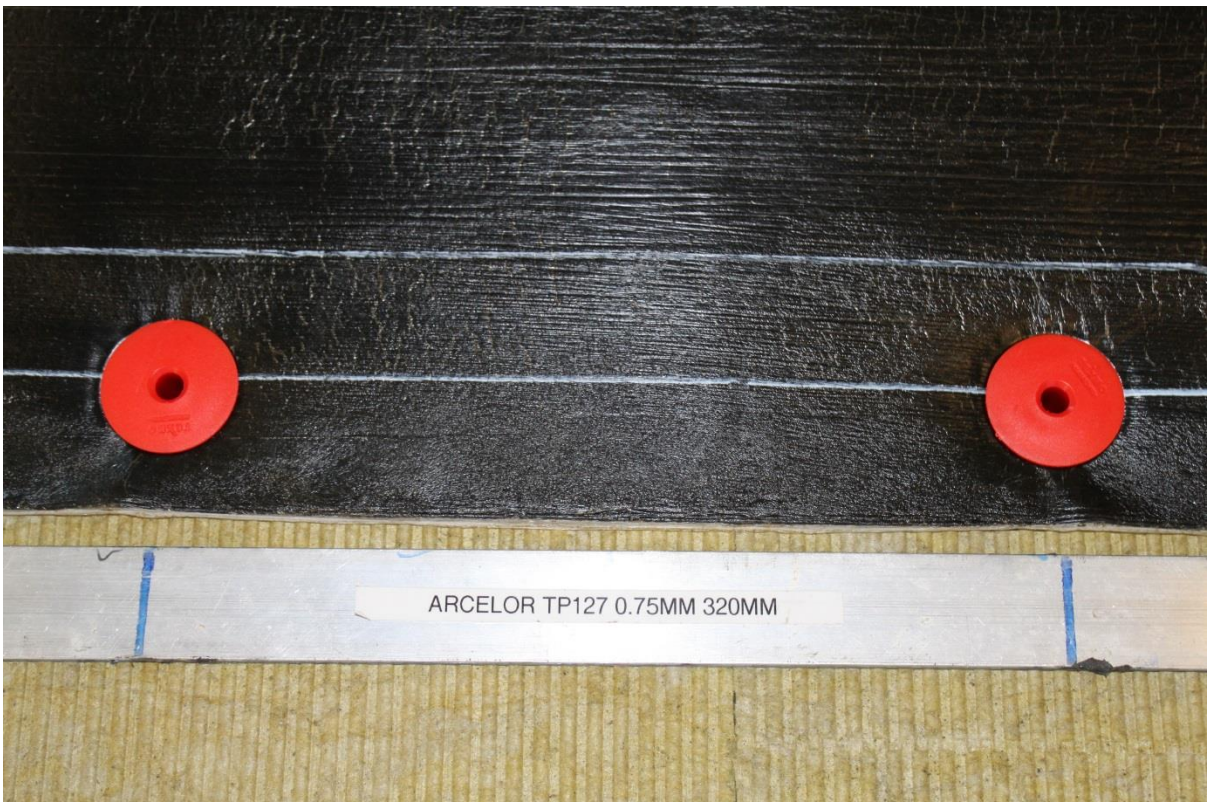
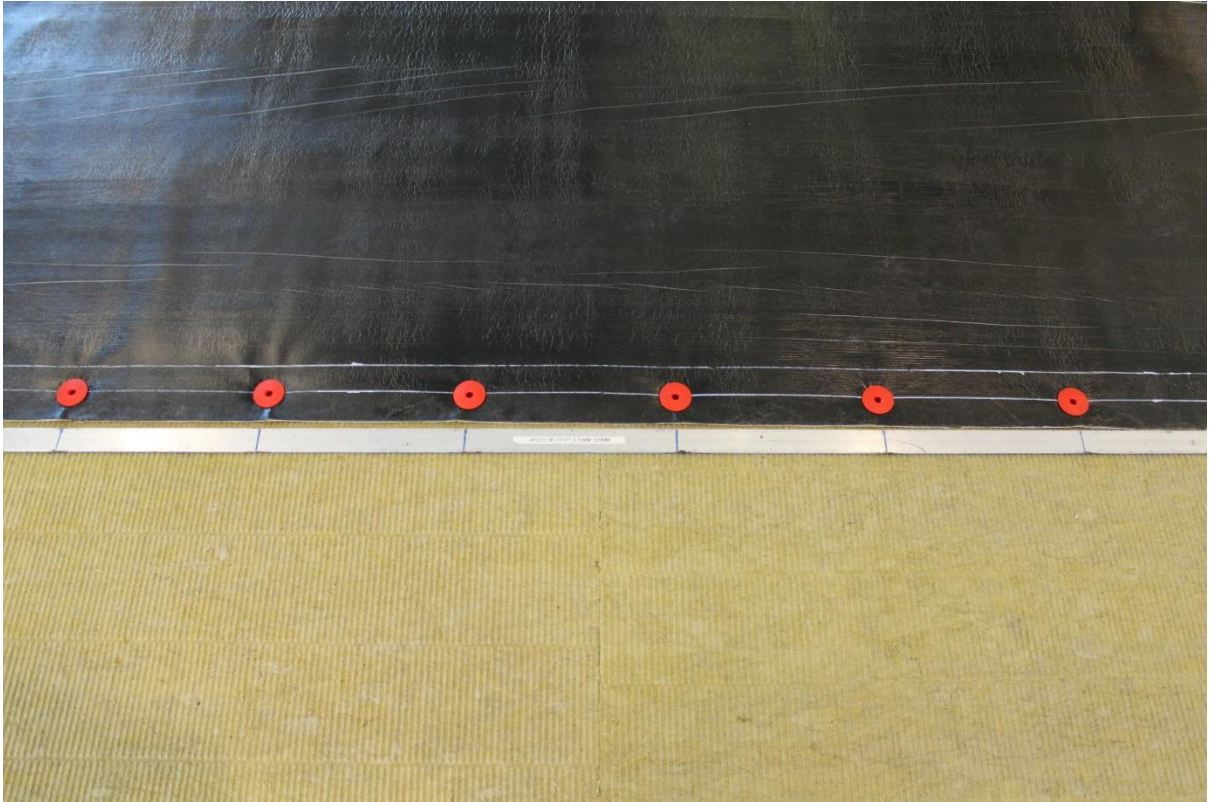
Sofie Rundgren

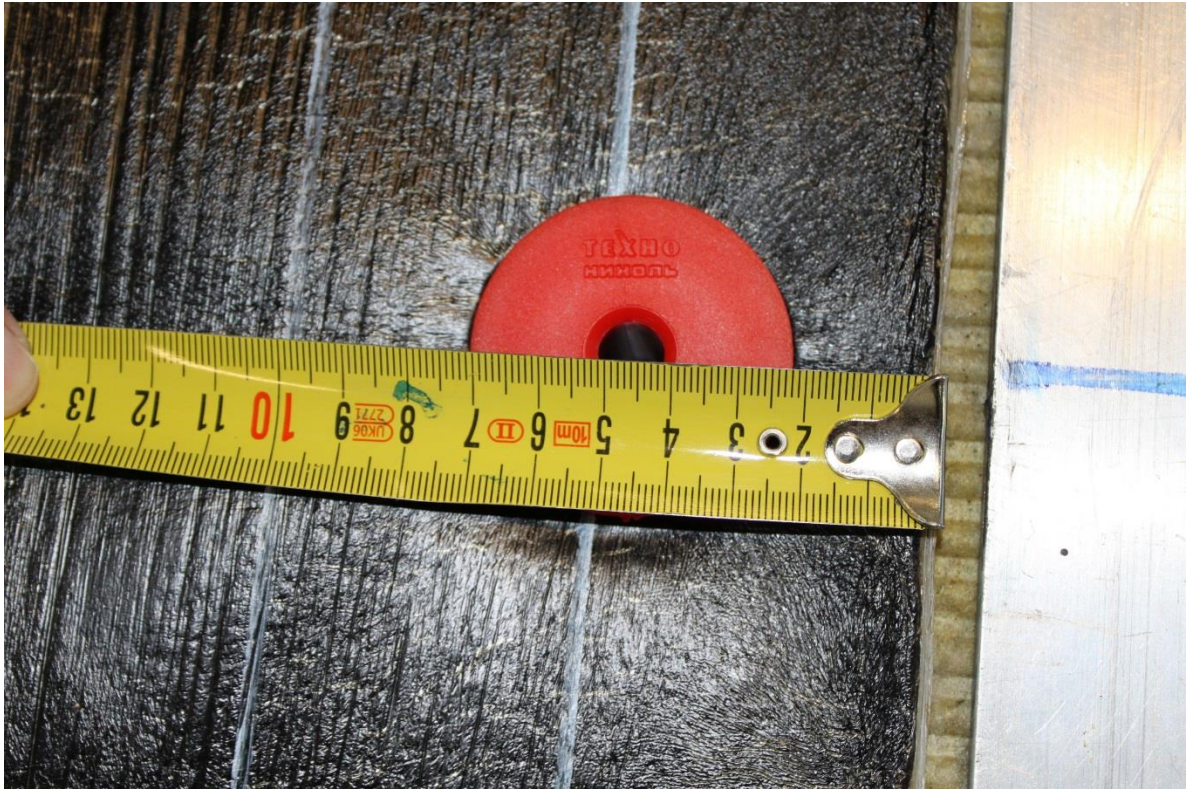
Annex A

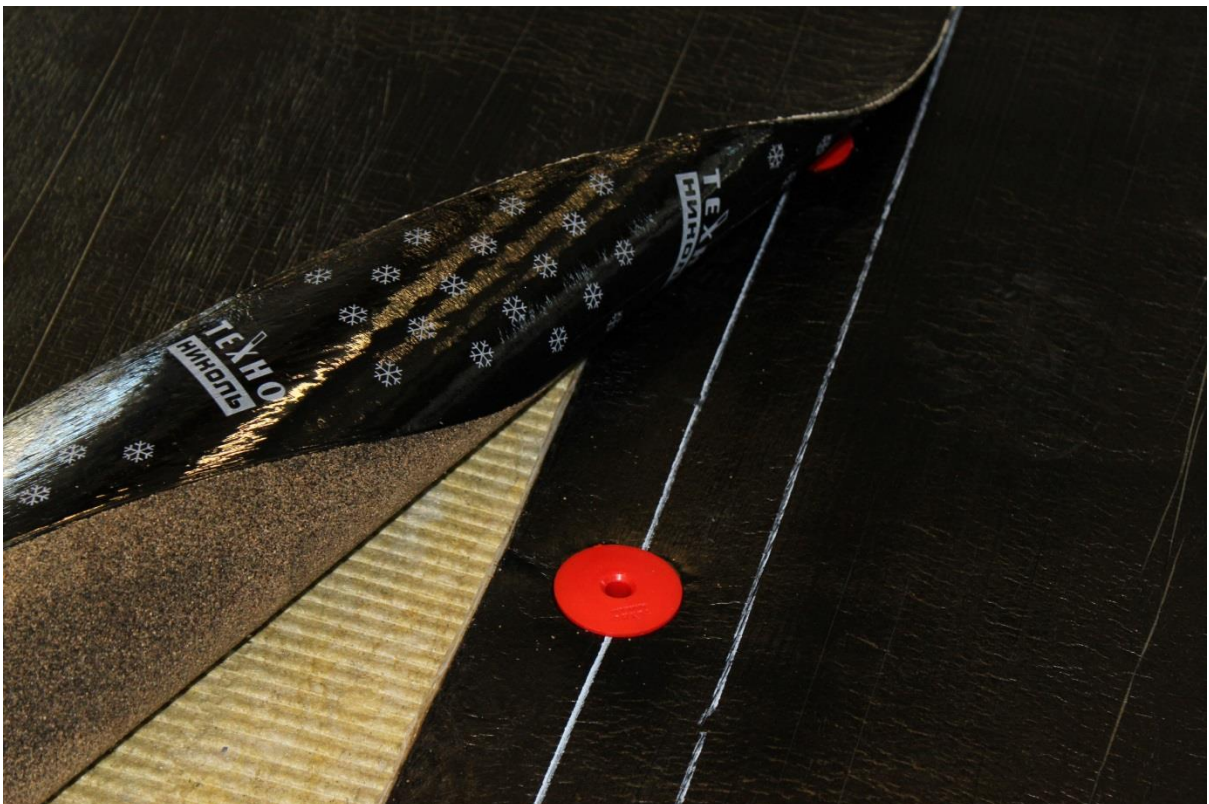
Pictures from test sample

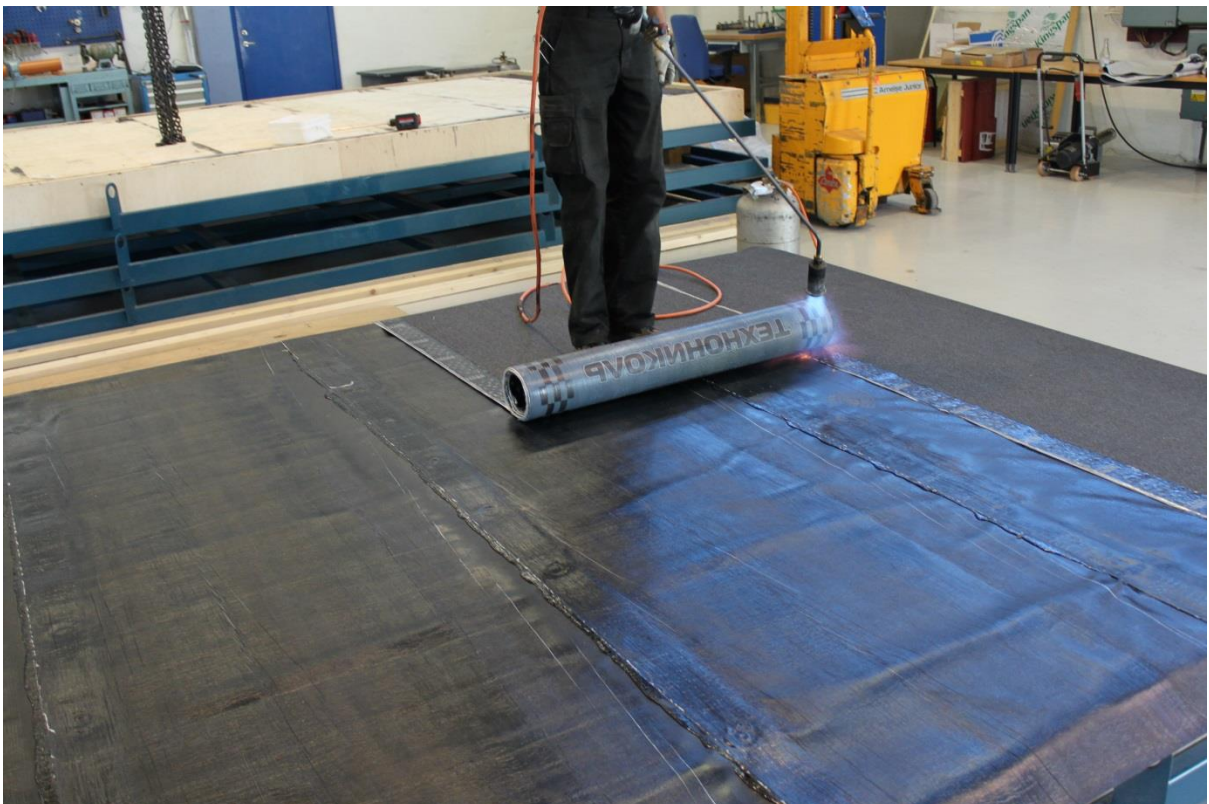


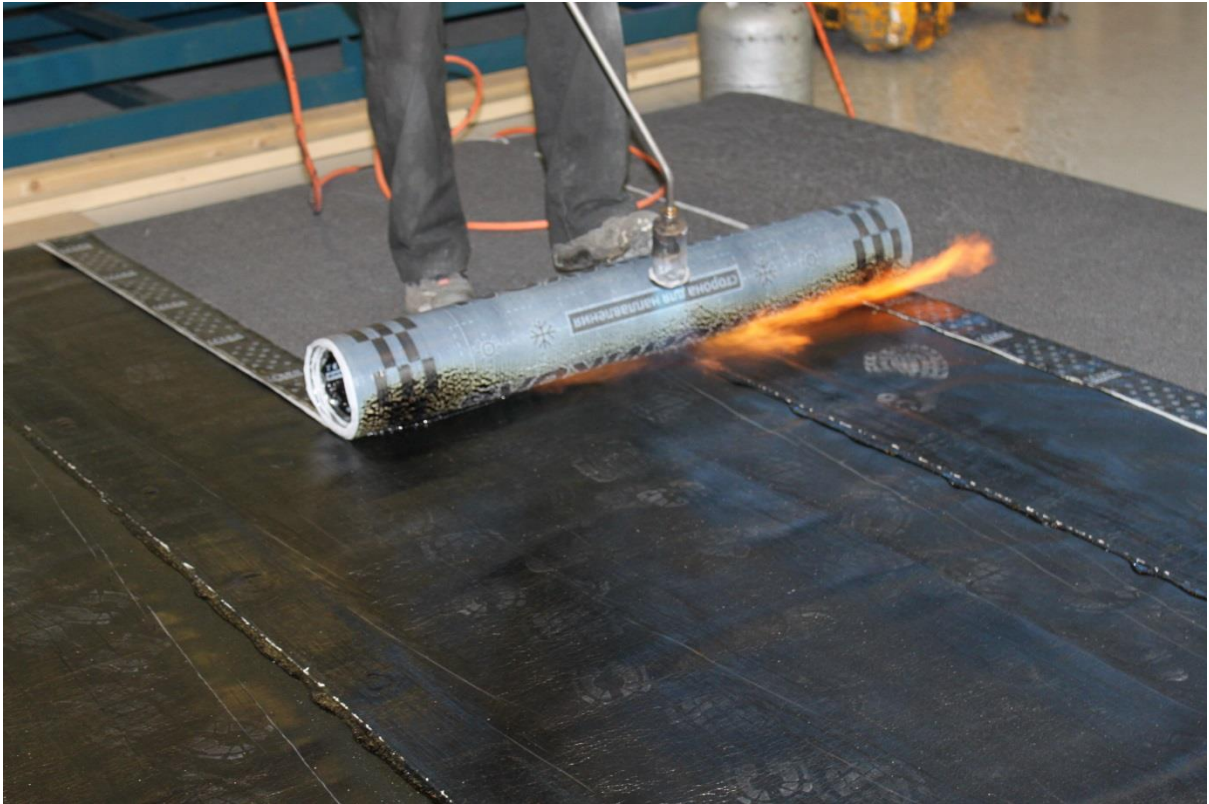




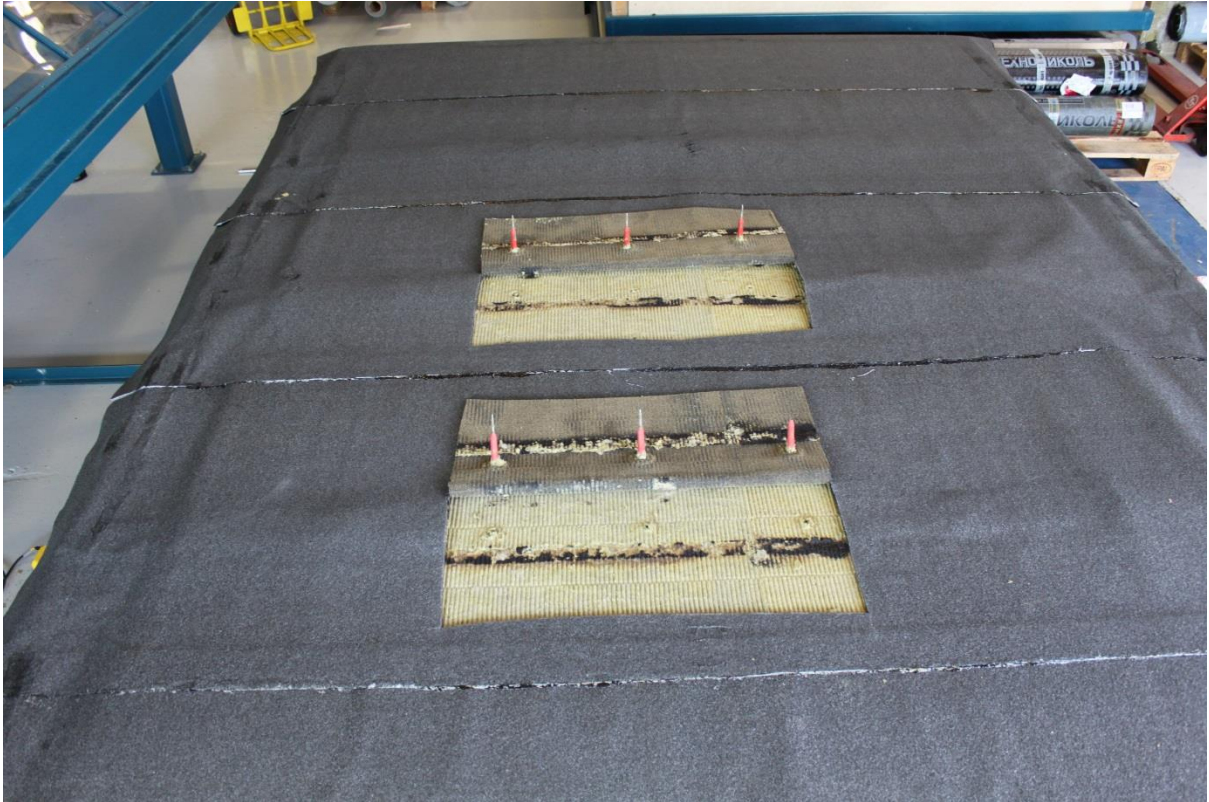


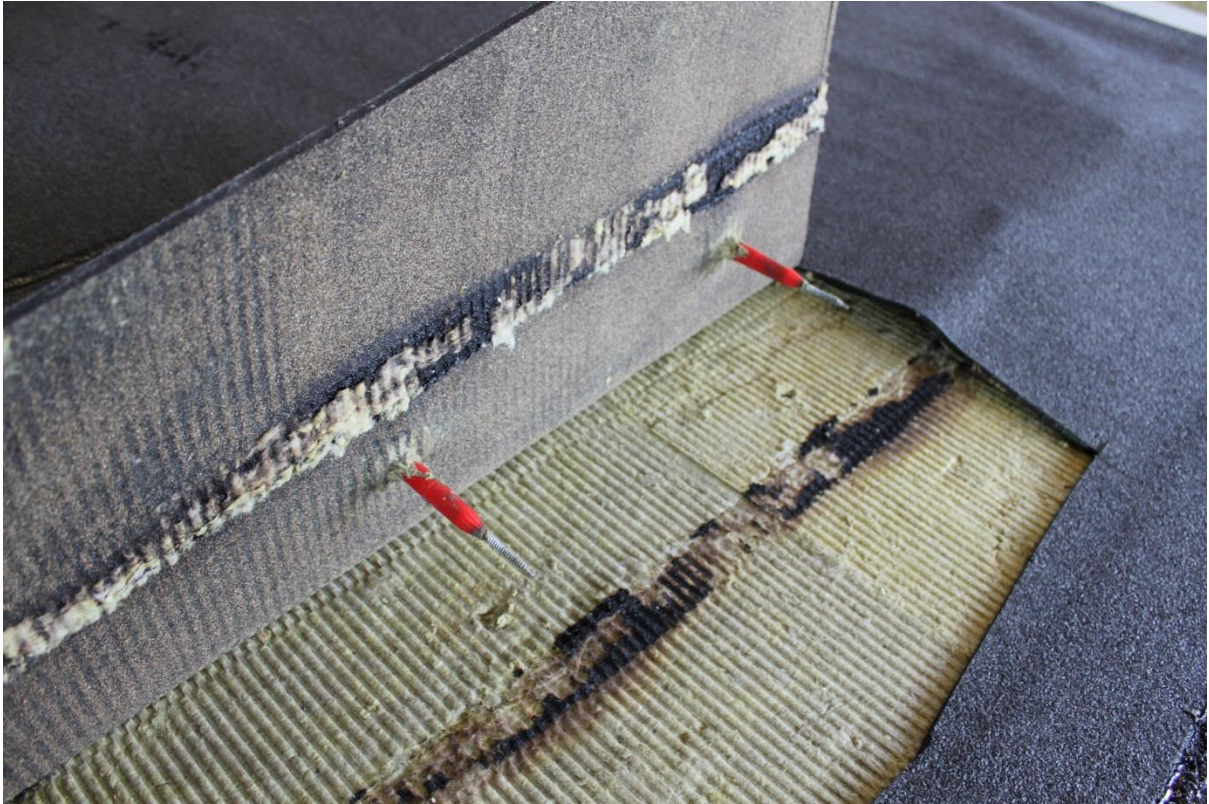






Pictures from test sample Description of failure

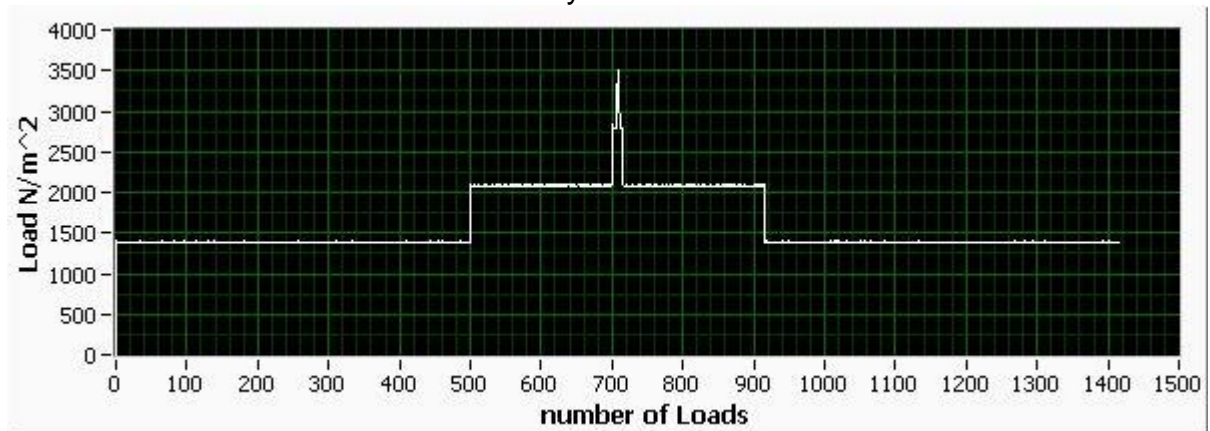






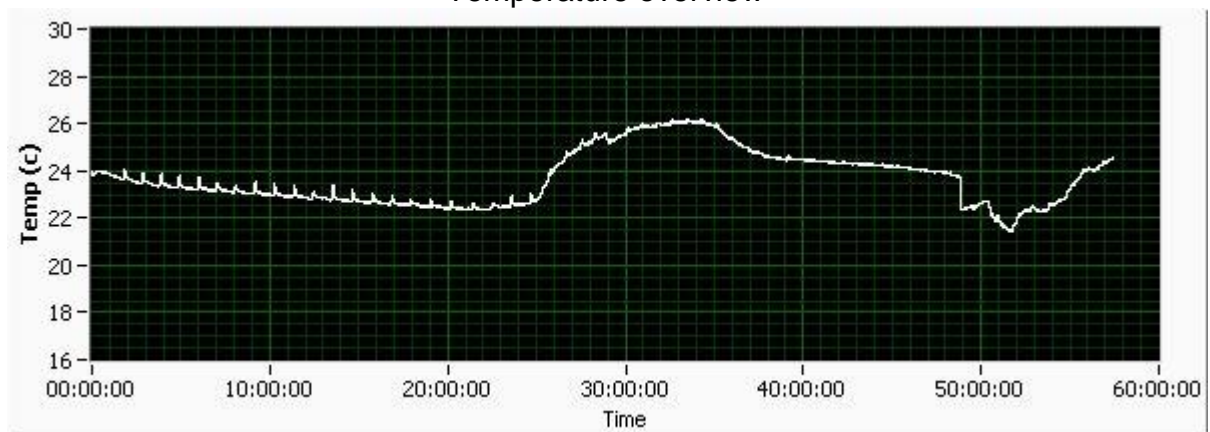
Annex B

Graph over the loads in cycle W_{test}
Cycle 11



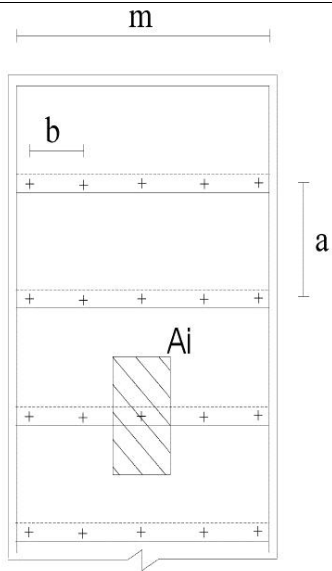
Load interval analysis

Temperature overview



Annex C

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|--|--|
| $W_{\text{test}} = P_w \times A_i = (P_{\text{lab}} - P_{\text{chamb.}}) \times A_i$ | |
| $W_{\text{char}} = W_{\text{test}} \times C_a \times C_d$ | |
| $W_{\text{adm}} = W_{\text{char}} / \gamma_m$ | |
| $W_{\text{test}} =$ | maximum load in the cycle preceding the failure cycle |
| $W_{\text{char}} =$ | characteristic load taking into account the correction factors C_a and C_d |
| $W_{\text{adm}} =$ | admissible(design) load for the wind uplift resistance (N per fasteners) |
| $C_a =$ | a geometric factor allowing for the difference between the deformation of the waterproof covering in the test and the real deformation for the membrane on a complete roof |
| $C_d =$ | a statistical factor allowing for the reduction in the probability of failure of one fastener, due to the reduced number of fasteners in the test system |
| $\gamma_m =$ | material correction factor (determined on national level) |



The diagram illustrates a rectangular test area with a width labeled 'm' and a height labeled 'a'. A central square area is labeled 'Ai' and is shaded with diagonal lines. The diagram shows a grid of fasteners, represented by '+' signs, arranged in a 5x5 pattern. A horizontal dimension 'b' is indicated at the top left, representing the width of the central square area 'Ai'.

Note: $W_{adm} = W_{char} / \gamma_m$ is the design value and shall be used when performing wind load calculations.

Annex D

