

Test report

Test of resistance to wind uplift according to the Guideline for European technical approval of systems of mechanically fastened flexible roof waterproofing membranes, ETAG-006 chapter 5.1.4.1 (edition March 2000).

Project number:	201107061013460001-3
Report date:	2011-08-17
Roof system:	Protan SE 1,2mm
Membrane type:	Protan SE 1,2mm 1,0m wide
Fastener type:	ROKS-80 Barbed plate Ø50mm FBD 4,8x70mm
Client:	Protan AS P.O. Box 420 Brakerøya NO-3002 Drammen Norway
Contact:	Hege Gunnerud

Chief of controlling and testing Fredrik Rundgren

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1. Introduction

Constructech Sweden AB has, on request of the client, carried out windload testing of the Roof system Protan SE 1,2mm width 1,0m.

The purpose of the testing was to determine the windload capacity of the mechanical fastened roof system according to ETAG-006 5.1.4.1 and define a design 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 wind uplift has been carried out according to the Guideline for European technical approval of systems of mechanically fastened flexible roof waterproofing membranes. ETAG-006 chapter 5.1.4.1 (edition March 2000)

Wind load tester size: 6,0 x 1,60m

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.

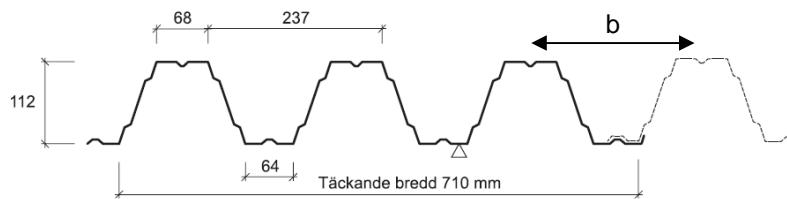


Wind load tester 6,0m x 1,60m

3. Test model

Test model dimensions: 6,0m x 1,60m

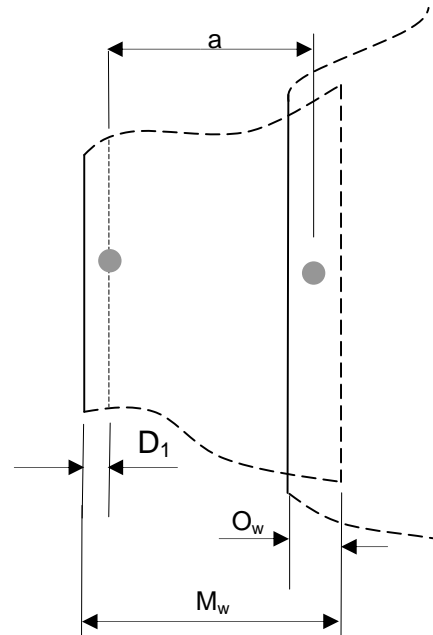
Substructure: Profiled steel deck Ruuki GA 108-65, thickness 0,85mm
Yield strength 350 N/mm²



Thermal insulation: Rockwool Hardrock, thickness 100mm

Roof system:

Membrane:	Protan SE 1,2mm width 1,0m
Membrane width (M _w):	1000,00
Bonding method:	Hot air welded 40mm
Overlap width (O _w):	120,00
Measure (a):	880,00
Washer type:	ROKS-80 Barbed plate 50mm
Fastener type:	FBD 4,8x70mm
Fixing pattern, fixed in the overlap (D ₁):	40,00
Distance between fasteners (b):	237,00



Temperature:

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

A photo report of the build up 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 ETAG 006 the approved test result is $W_{\max 100\%}$ (theoretical load) for the fulfilled cycle prior the failed cycle, which results in:

$W_{\text{test}} =$	1200 N
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Failure mode

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

The sleeves were torn out of the membrane during cycle 14 (1300N), see pictures. The tubes were permanent deformed as showed at picture 3. No weld seams were open; some seams were delaminated to 40 - 45%. More than 2 cm welded area were still intact from the original 4 cm weld width.

The design value is calculated according to the formula in [annex C](#) and the results for this test are as follows:

W_{test}	1200N
C_a	0,983
C_d	1,0
γ_m	1,5
W_{adm}	786N

A graph of the loads in load cycle, W_{test} , is given in [Annex B](#)

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 2011-08-17

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Annex A

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Pictures from test sample

Picture 1



Picture 2



Annex A

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Pictures from test sample Description of failure

Picture 1



Picture 2



Annex A

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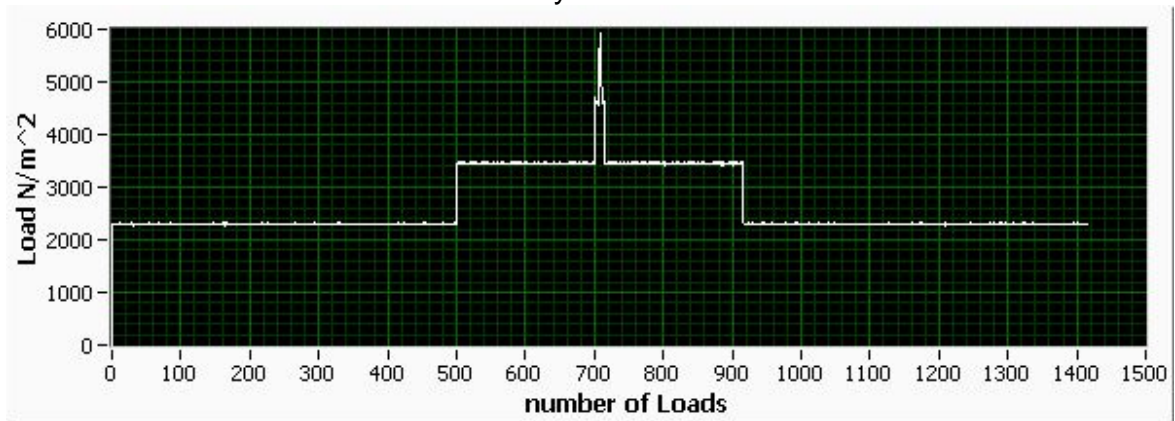
Picture 3



Annex B

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Graph over the loads in cycle W_{test}
Cycle 13



Annex C

$W_{test} = P_w \times A_i = (P_{lab} - P_{chamb.}) \times A_i$		
$W_{corr.} = W_{test} \times C_a \times C_d$		
$W_{adm} = W_{corr.} / \gamma_m$		
$W_{test} =$	maximum load in the cycle preceding the failure cycle	
$W_{corr.} =$	corrected load taking into account the correction factors C_a and C_d	
$W_{adm} =$	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	

Annex D
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