

Test report

Resistance to dynamical wind loads according to EN 16002:2018 –Determination of the resistance to wind load of mechanically fastened flexible sheets for roof waterproofing.

Project number:	20190312-219-1
Start date:	2019-03-12
Stop date:	2019-03-14
Report date	2019-03-14
Roof system:	Plastfoil ECO 1,5 mm 2,1 m
Membrane type:	Plastfoil ECO 1,5mm 2,1 m
Fastener type:	Wkret-met LINO 13 Ø50 mm Wkret-met WSR-T-4,8
Client:	KLIMAS SP.Z.O.O ul.Wincentego Witosa 135/137, Kuznica Kiedrzynska 42 - 233 MYKANÓW Poland
Contact:	Henryk Ziobro

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 Plastfoil ECO 1,5 mm 2,1m.

The purpose of the test was to determine the wind load capacity of the mechanical fastened roof system according to EN-16002:2018 and define a characteristic load according to the standard.

The installation and welding have 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 16002:2018 - 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 20180827.

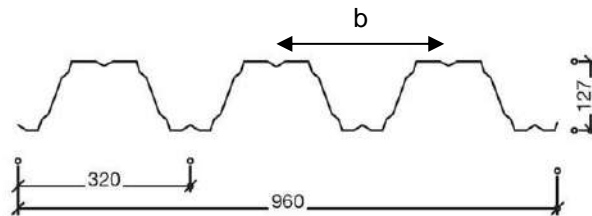


Wind load tester 4,90 m x 2,65 m

3. Test model

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

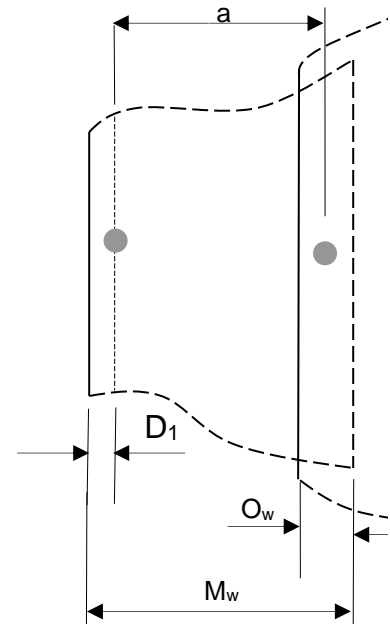
Substructure: Profiled steel deck Arcelor Mittal TP127
 Thickness 0,75 mm
 Yield strength 320 N/mm²



Thermal insulation: Rockwool Taurus
 Thickness 100 mm

Roof system:

Membrane:	Plastfoil ECO 1,5 mm 2,1 m
Membrane width (M _w):	2100,00 mm
Bonding method:	Overlap hot air welded 40 mm
Overlap width (O _w):	130,00 mm
Measure (a):	1970,00 mm
Washer type:	Wkret-met LINO 13 Ø50 mm
Fastener type:	Wkret-met WSR-T-4,8
Fixing pattern, fixed in the overlap (D ₁):	35,00 mm
Distance between fasteners (b):	320,00 mm



Temperature:
 Temperature during test was between +18°C and +21°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.
 A certificate of the steel substrate quality is given in annex E.

4. Results

At the failure cycle of $W_{\max 100\%}$ (theoretical load) the test was stopped. According to EN-16002:2018 the approved test result is $W_{\max 100\%}$ (theoretical load) for the fulfilled cycle prior the failed cycle, which results in:

$W_{\text{test}} =$	1500 N
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Failure mode

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

During buildup of load cycle 17 (1600 N) the membrane was ripped around the tube washers, this leading to that one of the fasteners in this fastener row was pulled out from the steel substrate. The previous load cycle 16 (1500) N is the approved test result for the system.

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

W_{test}	1500 N
C_a	0,94
C_d	0,9
ΔW_{char}	1269 N
W_{adm}	846 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 results are only related to the investigated samples, products and/or systems. 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.

Constructech Sweden AB is not liable for interpretations or conclusions that are made in consequence of the test results obtained.

Since sampling was not performed by Constructech Sweden AB, no judgement can be given with regards to the origin and representativeness of the samples.

Strängnäs 2019-03-14

Constructech Sweden AB



Fredrik Rundgren

Constructech Sweden AB



Sofie Rundgren

Annex A

Pictures from test sample









Pictures from test sample Description of failure

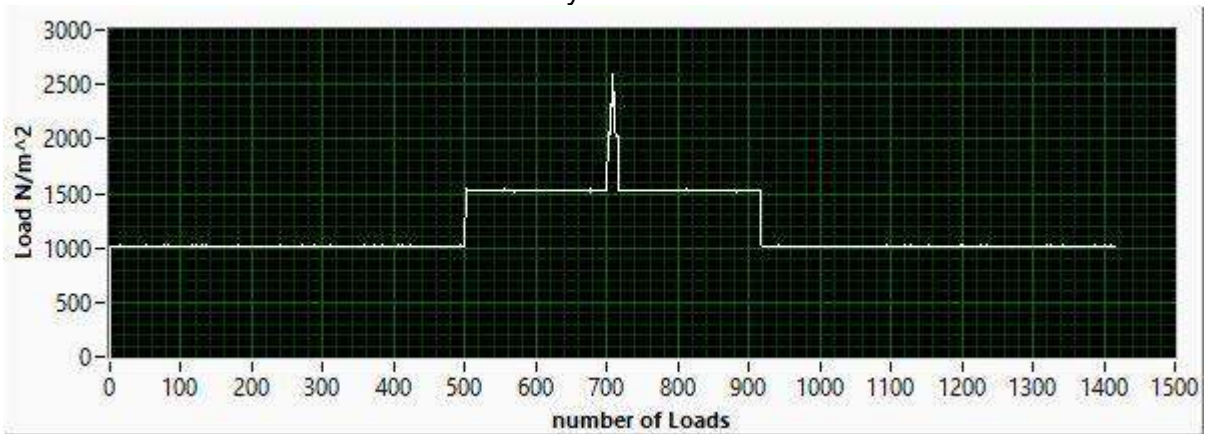




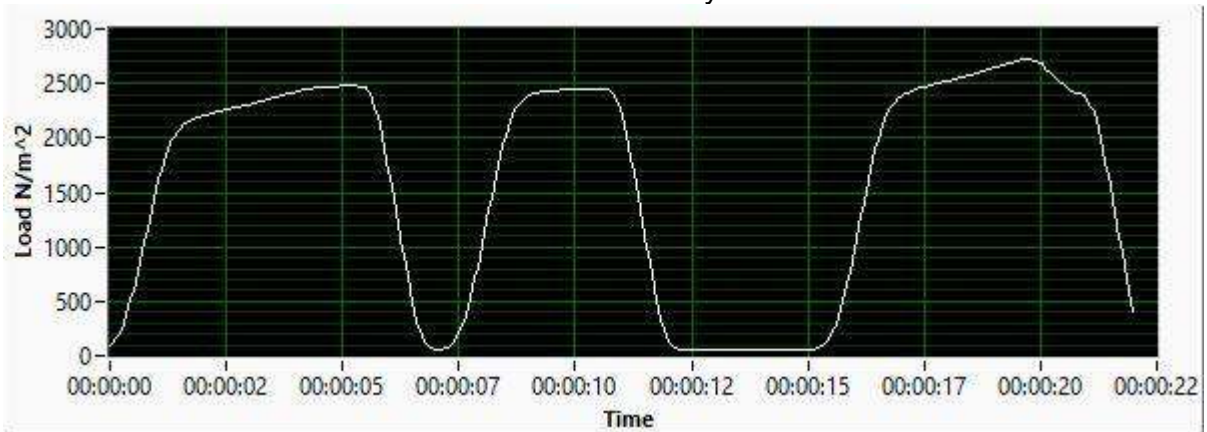


Annex B

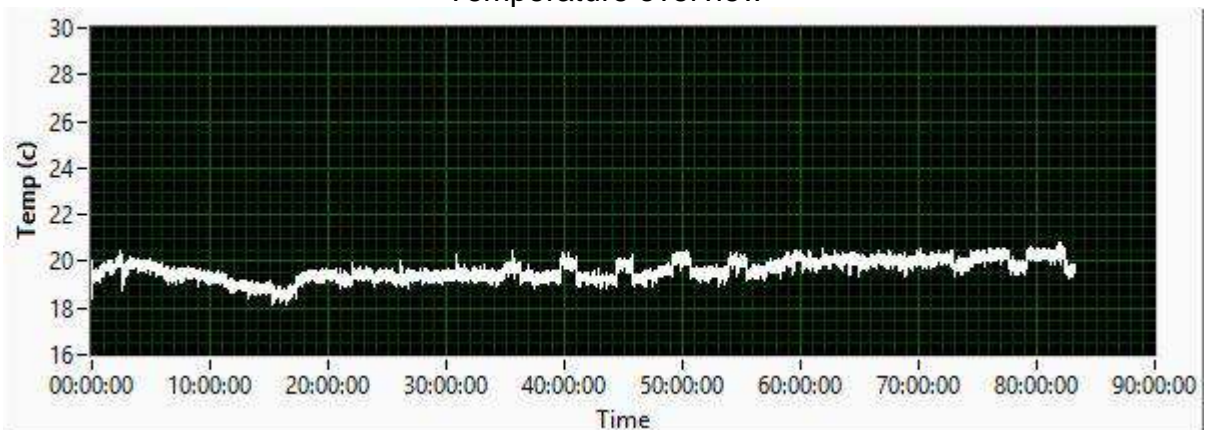
Graph over the loads in cycle W_{test}
Cycle 16



Load interval analysis



Temperature overview

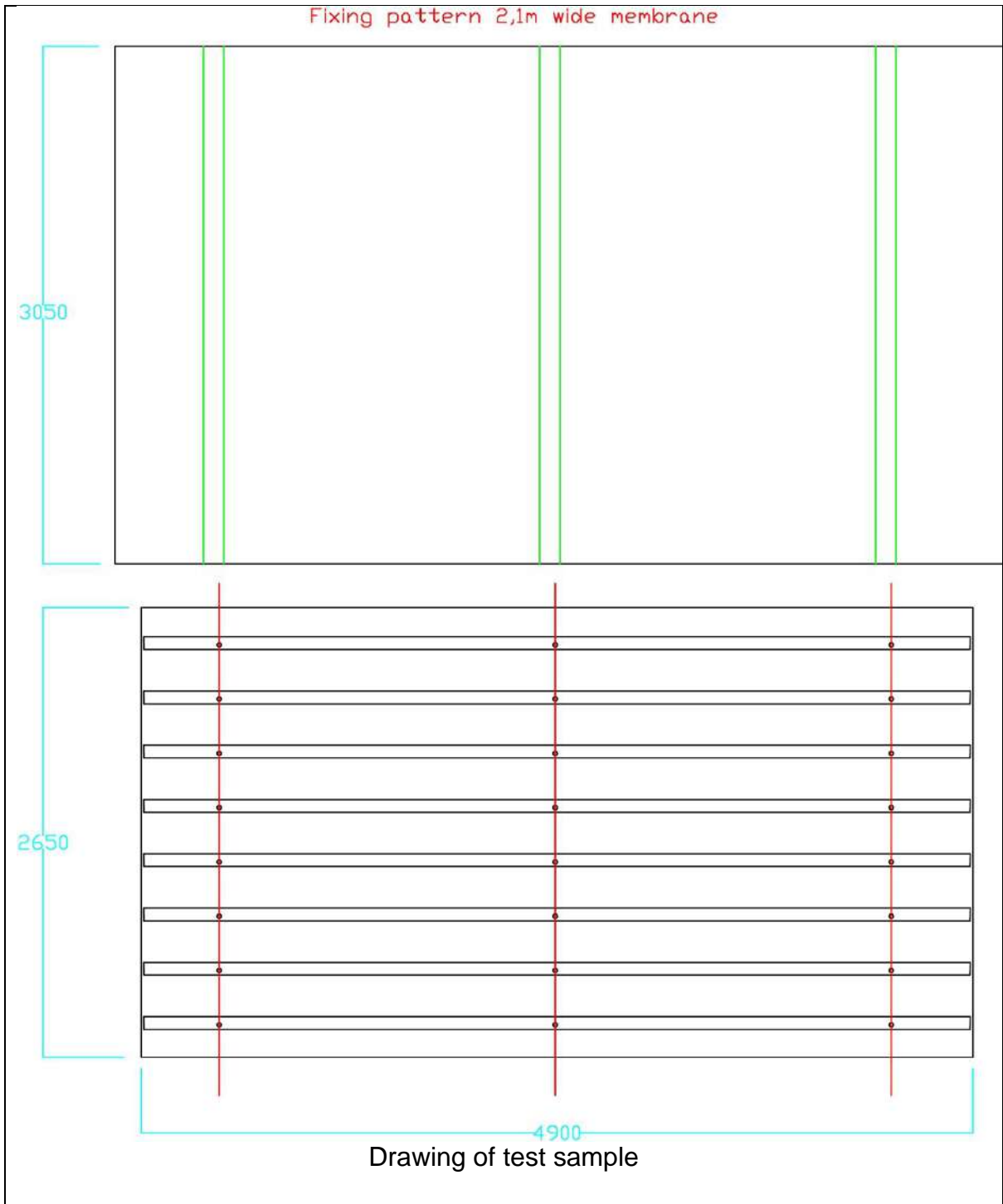


Annex C

$W_{test} = P_w \times A_i = (P_{lab} - P_{chamb.}) \times A_i$		
$W_{char} = W_{test} \times C_a \times C_d$		
$W_{adm} = W_{char} / \gamma_m$		
$W_{test} =$	maximum load in the cycle preceding the failure cycle	
$W_{char} =$	characteristic 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 (determined on national level)	

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

Annex D



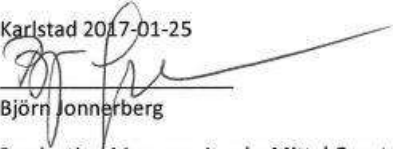
Annex E



To the attn. of Mr Fredrik Rundgren, Constructech Sweden AB

I hereby declare that the material TP127-960 ZM Evolution 0,75 mm delivered to Constructech Sweden AB, with reference coil batch nr: 15/125517/00-3.1 conforms to the standard and tolerances for steel S320.

Karlstad 2017-01-25



Björn Jonnerberg

Production Manager ArcelorMittal Construction Sverige AB

Annex F

List of versions and changes

Version	Changes made	Changes made by	Date of change	New version
1				