

Evidence of Performance

Air permeability, Watertightness, Resistance to wind load



Test Report

No. 12-001914-PR01

(PB-A01-02-en-01)

Client SAVOX d.o.o.
Johovac bb
75466 Milici
Bosnia-Herzegovina

Product Tilt and turn window

Designation System designation: IV 78mm Wood system

Performance-relevant product details Material: Wood

Overall dimensions (WxH) 1230 mm x 1480 mm

Special features

Basis

EN 14351-1:2006+A1:2010

Test standard/s:

EN 1026:2000-06
EN 1027:2000-06
EN 12046-1:2003-11
EN 12211:2000-06
EN 14609:2004-06

Correspond/s to the national standard/s (e.g. DIN EN)

Representation



Results

Air permeability according to EN 12207:1999-11



Class 4

Watertightness according to EN 12208:1999-11



Class E900

Resistance to wind load according to EN 12210:1999-11/AC:2002-08



Class C4 / B4

Instructions for use

The results obtained can be used by the manufacturer as the basis for the manufacturer ITT test report summary. Observe the specifications set out by the applicable product standard.

Validity

The data and results refer solely to the tested and described specimen. Classification remains valid as long as the product and the above basis remain unchanged. The results can be extrapolated under the manufacturer's own liability subject to observation of the relevant specifications set out by the applicable product standard. This test/evaluation does not allow any statement to be made on any further characteristics regarding performance and quality of the construction presented, in particular the effects of weathering and ageing were not taken into account.

Notes on publication

The ift-Guidance Sheet "Advertising with ift test documents" applies. The cover sheet can be used as an abstract.

The report contains a total of 20 pages.

ift Rosenheim

13.07.2012

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Building Components

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Deputy Head of Testing Department
Building Components



1. Object

1.1 Description of test specimen

Product	Tilt and turn window
Manufacturer	SAVOX d.o.o.
Date of manufacture	28.06.2012.
System	IV 78mm Wood system
Type of opening / Opening directions	Tilt and turn, DIN right inward opening
Frame material	Wood
Overall frame dimensions (W x H)	1230 mm x 1480 mm
Overall casement dimensions (W x H)	1158 mm x 1392 mm
Casement weight	48,7 kg
Frame member	Three-layer spruce elements 78/78 mm, further details are given in drawings
Frame connection	Tenon and mortice joints
Additional profile / Frame connection	Drip rail STEMESIEDER FS 24 48, with cover caps F 244850, clipped with 4 clips STEMESIEDER FSH 10
Casement member	Three-layer spruce elements 78/78 mm, further details are given in drawings
Frame connection	Tenon and mortice joints
Additional profile / Frame connection	Glazing bar 20 x 21 mm, mitre-cut, fastening with needles
Rebate design	
Rebate drainage	11 slots 5 mm x 30 mm in drip rail
Rebate seal	
External – Drip rail	
Material	Sealing material – TPE
Manufacturer	G.S. GEORG STEMESIEDER GmbH
Article number	FSD 001
Corner configuration	butt-cutt
Centre	
Material	Sealing material – TPE
Manufacturer	DEVENTER
Article number	S 7503a
Corner configuration	continuous, notched in corners, at top butt-jointed at centre and bonded
Internal	
Material	Sealing material – TPE
Manufacturer	DEVENTER
Article number	S 7503a
Corner configuration	continuous, notched in corners, at top butt-jointed at centre and bonded
Seal – Drip rail/Frame member	
Material	Sealing material – TPE
Manufacturer	G.S. GEORG STEMESIEDER GmbH
Article number	FSD 002A



Corner configuration	butt-cutt
Pressure equalisation	Without external gasket.
Infill	Insulating glass unit, configuration 4 / 12 / 4 / 12 / 4
Installation of infills	
Glazing gasket	
External	
Material	Sealing material - Silicon
Manufacturer	Adolf Würth GmbH & Co.
Article number	8923101
Corner configuration	continuous
Internal	
Material	Sealing material - Silicon
Manufacturer	Adolf Würth GmbH & Co.
Article number	8923101
Corner configuration	continuous
Vapour pressure equalisation	at bottom and at top 2 slots 5 mm x 14 mm per casement
Hardware	
Type / Manufacturer	Tilt and turn hardware, MACO Multi Trend
Hinges / Bearings	1 Tilt mechanism pivot 1 Corner pivot
Number of lockings	at bottom 2, at top 1, on hinge side 2, on lock side 3
max. locking distance	720 mm
Position of lockings	neutral

The description is based on information provided by the client and inspection of the test specimen at the ift (item designations / numbers as well as material specifications were provided by the client unless stated "*ift-checked*").

Test specimen representations are documented in the Annex "Representation of product/test specimen". The design details were examined solely on the basis of the characteristics / performance to be classified. The drawings are based on unchanged documentation provided by the client unless stated otherwise; the photographs were taken by the ift Rosenheim unless stated otherwise.

1.2 Sampling

The below sampling data were provided to the ift:

Sampling by: SAVOX d.o.o., Nebojsa Vujovic

Date: 01.04.2012

Verification: A sampling report has been provided to the ift.

Delivered on: 06.07.2012

ift-Pk-Number: 001



2. Procedure

2.1 Basis*) referring to methods

Testing

EN 1026:2000-06

Windows and doors - Air permeability - Test method

EN 1027:2000-06

Windows and doors - Watertightness - Test method

EN 12046-1:2003-11

Operating forces - Test method - Part 1: Windows

EN 12211:2000-06

Windows and doors - Resistance to wind load - Test method

EN 14609:2004-06

Windows - Determination of the resistance to static torsion

Classification / Evaluation

EN 12207:1999-11

Windows and doors - Air permeability - Classification

EN 12208:1999-11

Windows and doors - Watertightness - Classification

EN 12210:1999-11/AC:2002-08

Windows and doors - Resistance to wind load - Classification

EN 14351-1:2006+A1:2010

Windows and doors - Product standard, performance characteristics -
Part 1: Windows and external pedestrian doorsets without resistance to fire and/or
smoke leakage characteristics

*) and the equivalent national versions, e.g. DIN EN

2.2 Brief description of procedure

Air permeability - EN 1026

Prior to testing, the operating forces are determined as per EN 12046-1 for the release / locking operation of the hardware.

Air permeability is tested in accordance with EN 1026 and conducted in steps at negative pressure and positive pressure up to the maximum test pressure difference. Leakages of the test set-up are made visible using artificially generated fog and sealed using permanently resilient sealant. The test specimen is exposed to three pressure pulses $\Delta p_{\max} + 10\%$ or at least 500 Pa. This is followed by measurement of air permeability for the respective pressure steps.

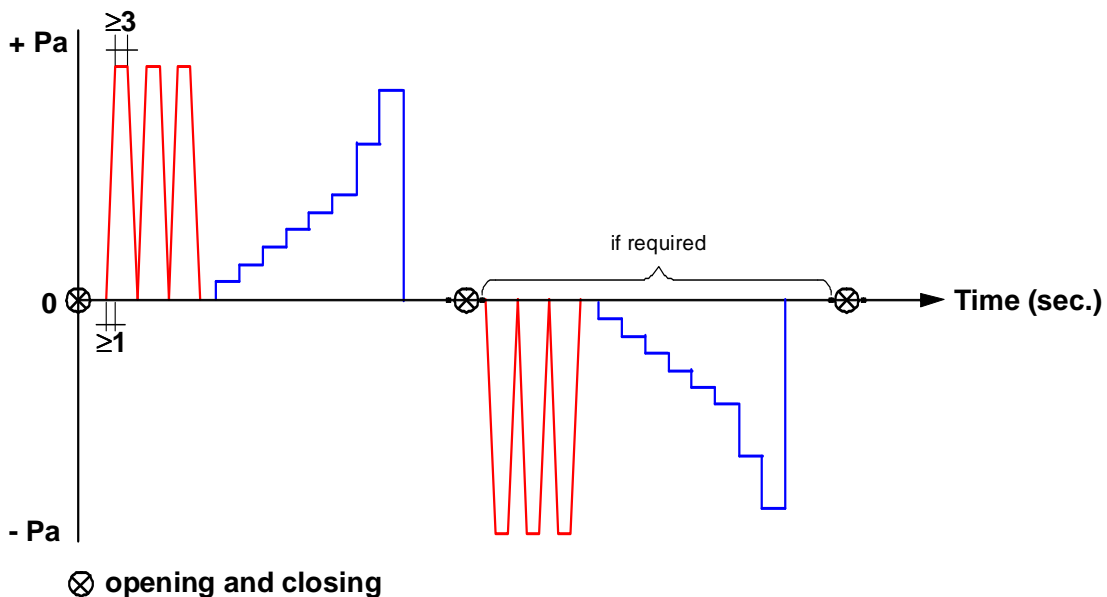


Illustration Test sequence for air permeability

Resistance to wind load - Deflection and alternating negative/positive pressures - EN 12211

Resistance to wind load is tested in accordance with EN 12211 and conducted in steps at negative pressure and positive pressure up to the test pressure p_1 . The test specimen is exposed to three pressure pulses $\Delta p_1 + 10\%$. This is followed by determination of the frontal deflection of test specimen for each pressure step when exposed to positive test pressure Δp_1 and negative test pressure Δp_1 . Then the test specimen is subjected to 50 cycles including negative and positive pressures of $\pm \Delta p_2 = \Delta p_1 - 50\%$.

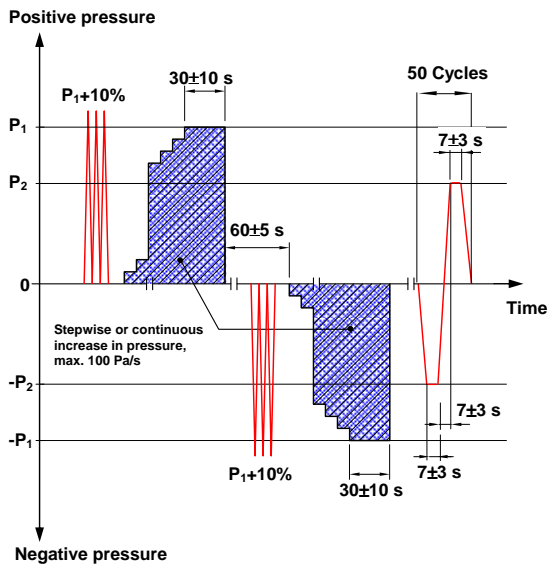


Illustration Test sequence for resistance to wind load

Air permeability – Repeat test - EN 1026

Following resistance to wind load test for p_1 (deflection) and p_2 (alternating positive/negative pressure), air permeability must not exceed by more than 20% the upper limit of the specified class as set out by EN 12207.

Watertightness - EN 1027

Watertightness is tested in accordance with EN 1027 up to the maximum test pressure difference. The external face of the test specimen is subjected to constant spraying of water by an upper row of nozzles at a flow rate of approx. 2 l/min per nozzle while increments of positive test pressure are applied at regular intervals. For test specimen exceeding 2.50 m in overall height, additional rows of nozzles are fixed at vertical intervals at 1.5 m below the top nozzle line. The water flow rate of the additional nozzle rows is approx. 1 l/min per nozzle.

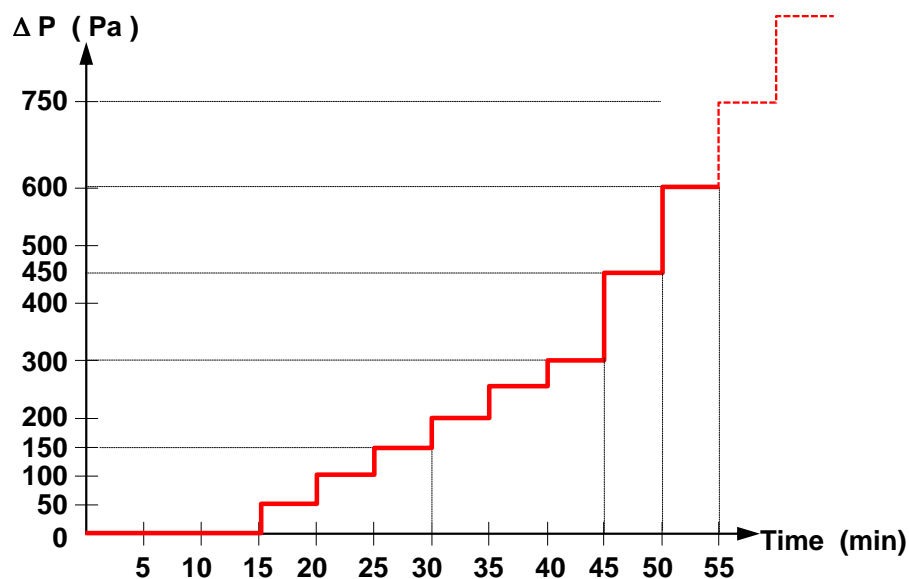


Illustration Test sequence for watertightness

Resistance to wind load – Safety test - EN 1211

The wind resistance test (safety test) is conducted at negative pressure and positive pressure in accordance with EN 12211 up to test pressure $\Delta p_3 = p_1 + 50\%$.

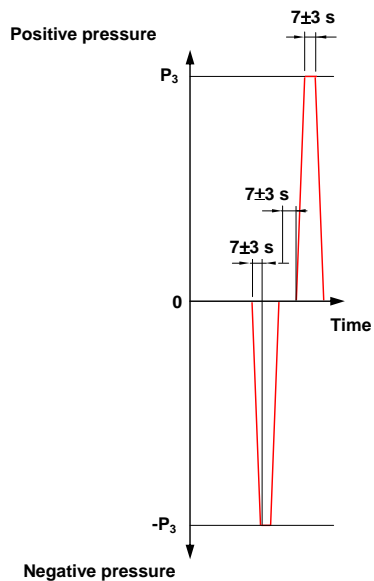


Illustration Test sequence for safety test

Load-bearing capacity of safety devices - EN 14609

Load-bearing capacity of safety devices is tested in accordance with EN 14609. The safety devices are subjected to individual loads of 350 N in the most unfavourable loading direction for 60 seconds. The load is applied pointwise. In deviation from EN 14609 the load can be applied directly to the safety device so as to test the most unfavourable load application to the stay bearing.

3. Detailed results

Performance data sheet

Specimen	Tilt and turn window		
Project No.	12-001914		
Client	SAVOX d.o.o.	Size of window frame	1230 x 1480 mm
System	IV 78mm Wood system	Size of active casement	1158 x 1392 mm
Frame material	Wood	Size of inactive casement	mm
Date of test	06.07.2012.	Area of test specimen	1,820 m ²
Tester	Mario Šimunović	Length of opening joints	5,100 m
Specimen No.	1	Casement weight	48,7 kg
Date of delivery	06.07.2012.	Temperature	29,8 °C
Date of manufacture	28.06.2012.	Air humidity	56 %
Attended by:	Nebojša Vujović, Slavko Šarac	Air pressure	1000 hPa

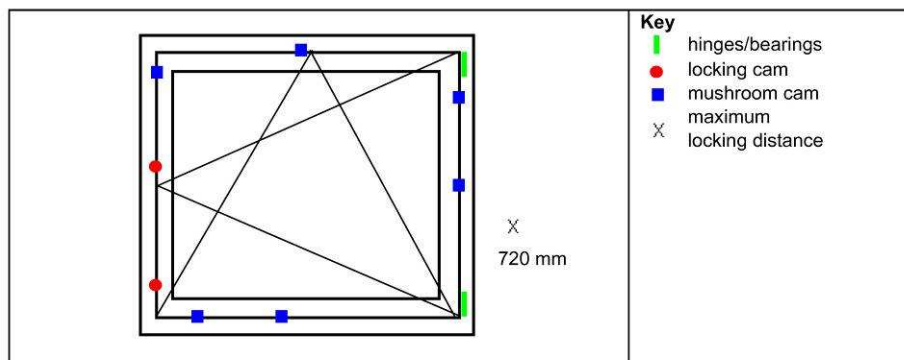


Figure 1 View of specimen

1 Operating forces - Test according to EN 12046

Table: Measurement of operating forces

Individual measured	1	2	3	Average value
in Nm	6,1	6,0	6,0	6,0

2 Air permeability - Test according to EN 1026

Table: Air permeability at positive wind pressure

Measured results at positive wind pressure	Pressure differential in Pa	50	100	150	200	250	300	450	600
		Flow rate (volume) m ³ /h	0,1	0,2	0,3	0,4	0,4	0,5	0,7
	Joint length-related m ³ /hm	0,03	0,04	0,06	0,07	0,09	0,09	0,13	0,17
	Overall area-related m ³ /hm ²	0,08	0,12	0,17	0,20	0,24	0,26	0,37	0,48

*) The measured values were below the 0,5m³/h leak flow volume of the displacement transducer. The precision of measurements is 0,1m³/h.

Table: Air permeability at negative wind pressure

Measured results at negative wind pressure	Pressure differential in Pa	50	100	150	200	250	300	450	600
		Flow rate (volume) m ³ /h	0,2	0,3	0,4	0,4	0,4	0,5	0,5
	Joint length-related m ³ /hm	0,05	0,05	0,07	0,07	0,08	0,09	0,10	0,12
	Overall area-related m ³ /hm ²	0,13	0,15	0,19	0,21	0,24	0,25	0,29	0,34

*) The measured values were below the 0,5m³/h leak flow volume of the displacement transducer. The precision of measurements is 0,1m³/h.

Table: Air permeability from average values from positive and negative wind pressures

Average value from positive and negative wind pressures	Pressure differential in Pa	50	100	150	200	250	300	450	600
		Flow rate (volume) m ³ /h	0,2	0,2	0,3	0,4	0,4	0,5	0,6
	Joint length-related m ³ /hm	0,04	0,05	0,06	0,07	0,09	0,09	0,12	0,15
	Overall area-related m ³ /hm ²	0,10	0,13	0,18	0,21	0,24	0,25	0,33	0,41

*) The measured values were below the 0,5m³/h leak flow volume of the displacement transducer. The precision of measurements is 0,1m³/h.

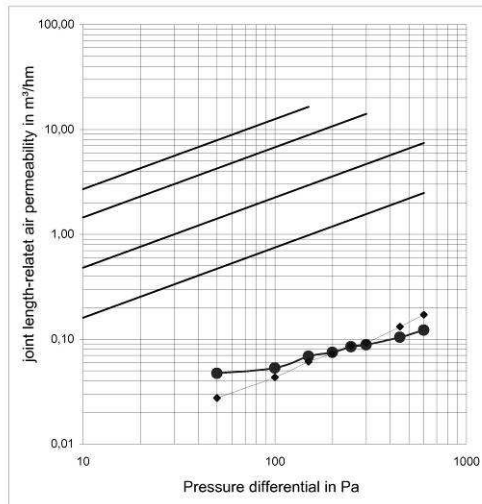


Diagram: Joint length-related air permeability (positive and negative wind pressures)

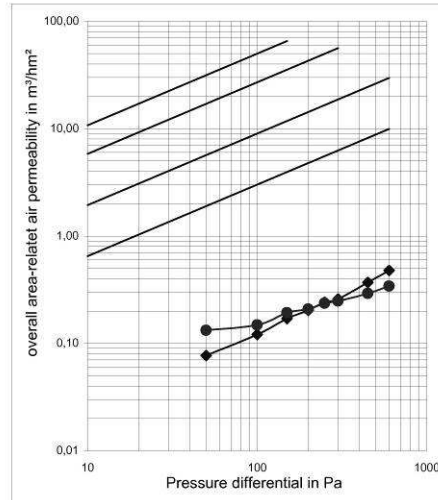


Diagram: Overall area-related air permeability (positive and negative wind pressures)

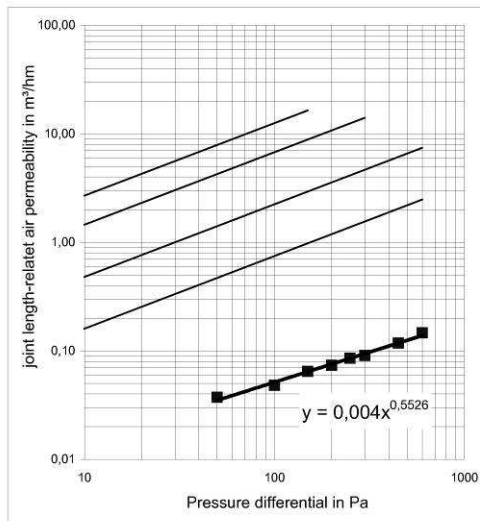


Diagram: Joint length-related air permeability (average value from positive and negative wind pressures)

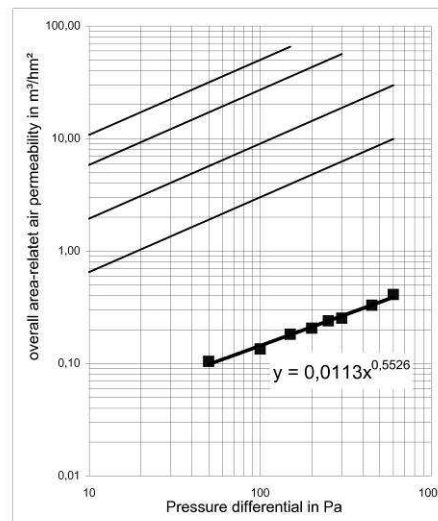


Diagram: Overall area-related air permeability (average value from positive and negative wind pressures)

Table: Measured results

Reference air permeability related to joint length	Q100 = 0,10 m³/hm
Reference air permeability related to overall area	Q100 = 0,14 m³/hm²

3 Resistance to wind load - Test according to EN 12211

3.1 Deflection under wind load

Maximum test pressure: \pm 1600 Pa 3 pressure pulses of 1760 Pa

Deflection was not measured because due to the perimeter locking and the existing locking distance no deformation of the frame members $> l/300$ is likely to occur at the specified wind loads. The test specimen was exposed to a load \pm 1600 Pa as specified by EN 12211.

3.2 Dynamic wind loads (negative / positive pressures)

Table: Pressure steps

p_2	Pa	200	400	600	800	1000
passed					√	

50 cycles at $p_2 \pm$ 800 Pa

No malfunctions were detected.

4 Repeat test of air permeability - Test according to EN 1026

Subsequent to the test of resistance to wind load by application of test pressures p_1 and p_2 , the upper limit of the achieved air permeability class must not be exceeded by more than 20% as set out by EN 12207 (Clause 2 of this test record).

The requirements were fulfilled.

5 Watertightness - Test according to EN 1027

No water penetration at up to 900 Pa detected.

3.3 Resistance to wind load - Test according to EN 12211 - Safety test

p_2	Pa	positive wind pressure					negative wind pressure				
		600	1200	1800	2400	3000	-600	-1200	-1800	-2400	-3000
passed					√					√	

Safety test passed at up to $p_3 \pm$ 2400 Pa passed.

6 Load-bearing capacity of safety devices

The testing of the safety device is carried out with a load of 350N for 60s.

No malfunctions were detected at the test specimen.

ift Rosenheim

06.07.2012.

Evidence of Performance

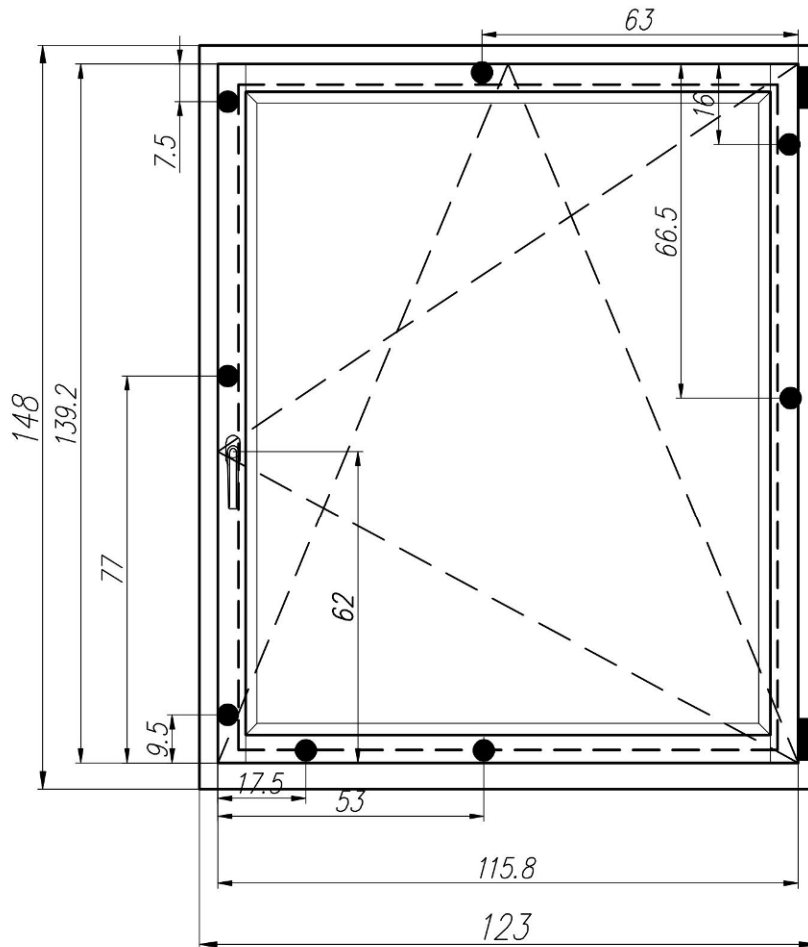
Air permeability, Watertightness, Resistance to wind load

Test Report 12-001914-PR01 (PB-A01-02-en-01) dated 13. Juli 2012

Client: SAVOX d.o.o., 75466 Milici (Bosnia-Herzegovina)



Single tilt and turn windows 1230x1480 mm IV 78 mm



▬ **Hinges**

● **Lockings**

Hardware used: MACO

Producer, type: Multi trend

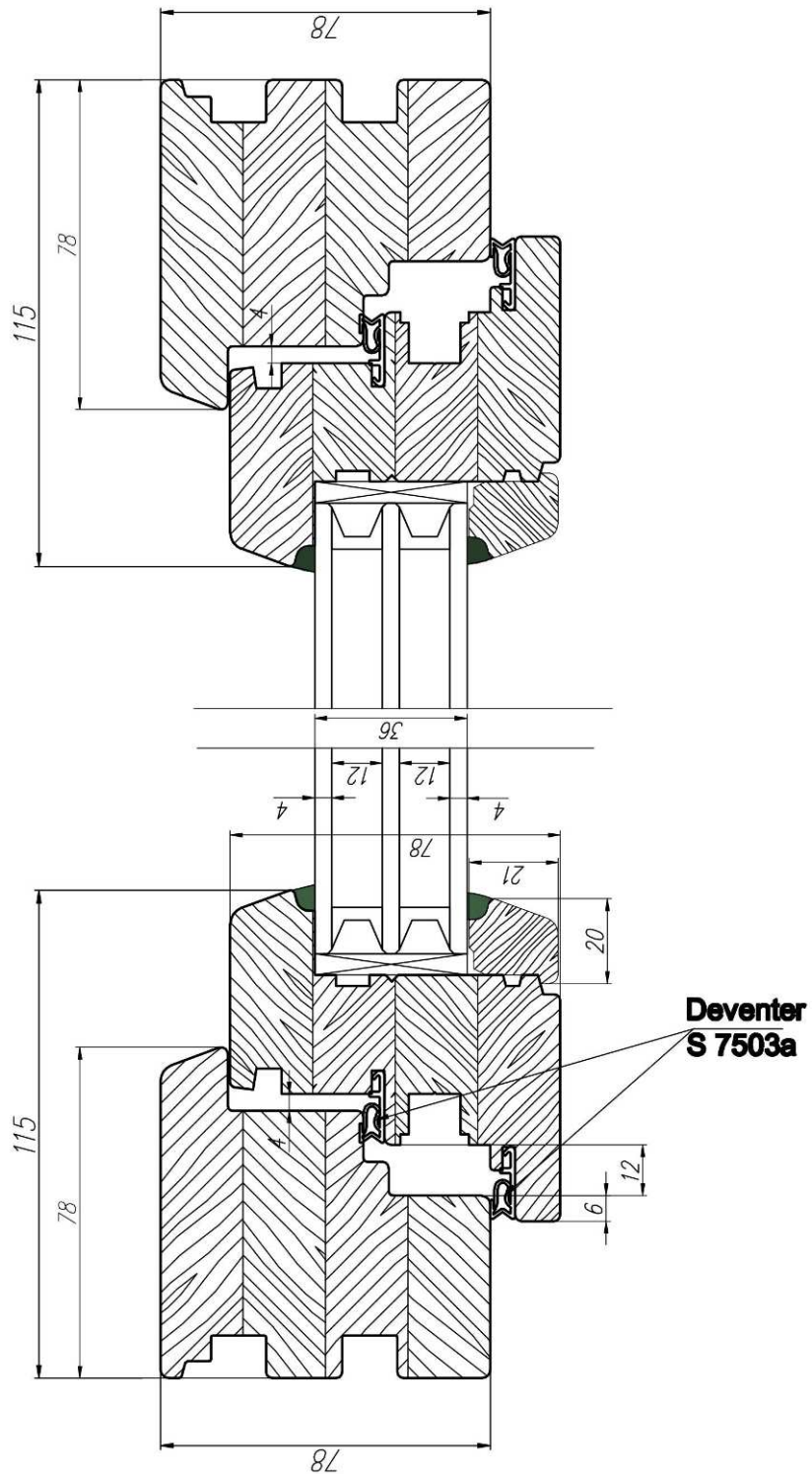
Drawing 1
Test specimen

Evidence of Performance

Air permeability, Watertightness, Resistance to wind load

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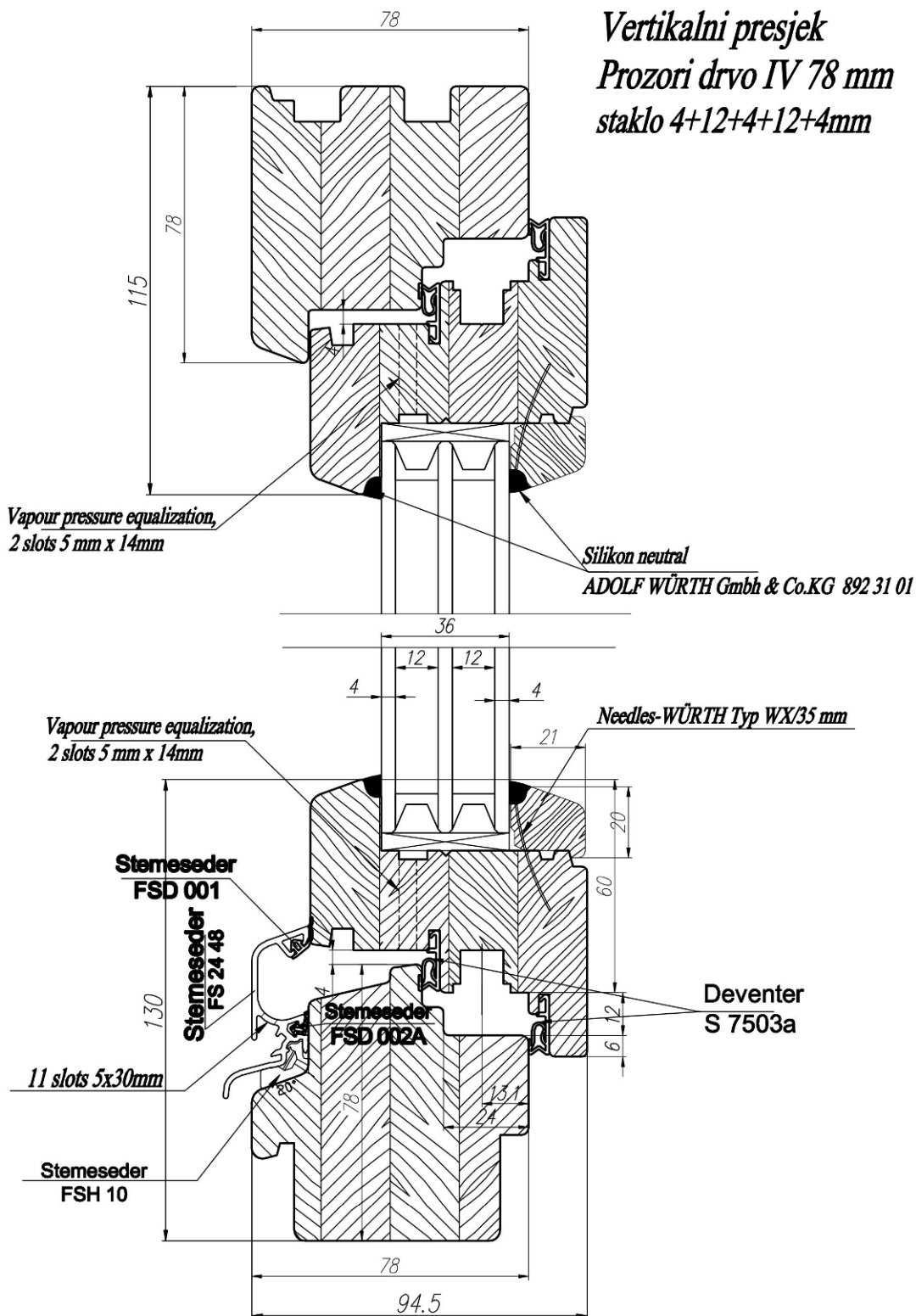
Drawing 2
Horizontal section

Evidence of Performance

Air permeability, Watertightness, Resistance to wind load

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Drawing 3
Vertical section

Evidence of Performance

Air permeability, Watertightness, Resistance to wind load

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Picture 1
View of test specimen on window test rig
Window closed



Picture 2
View of test specimen on window test rig
Window open



Picture 3
Rebate drainage



Picture 4
Rebate drainage



Picture 5
Rebate drainage



Picture 6
Rebate drainage

Evidence of Performance

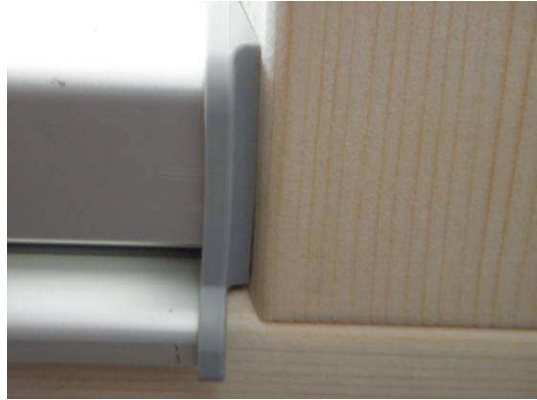
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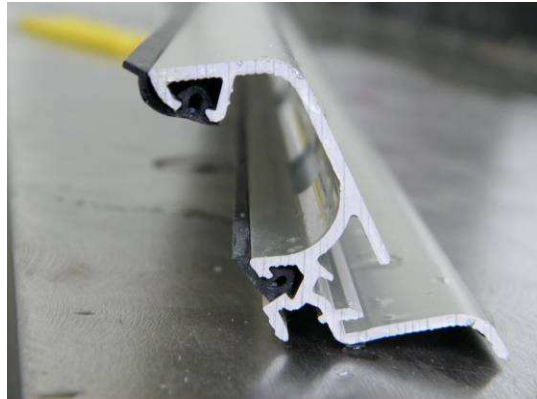
Picture 7
Drip rail, cover caps



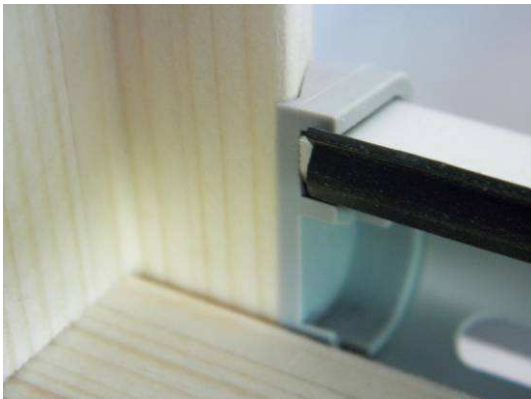
Picture 8
Drip rail, cover caps



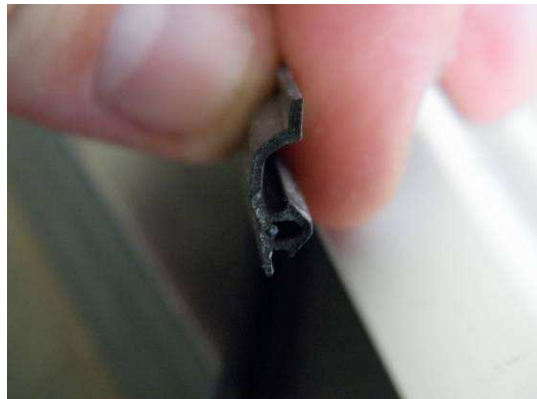
Picture 9
Drill inside cover caps



Picture 10
Drip rail



Picture 11
External rebate seal, drip rail,
corner configuration



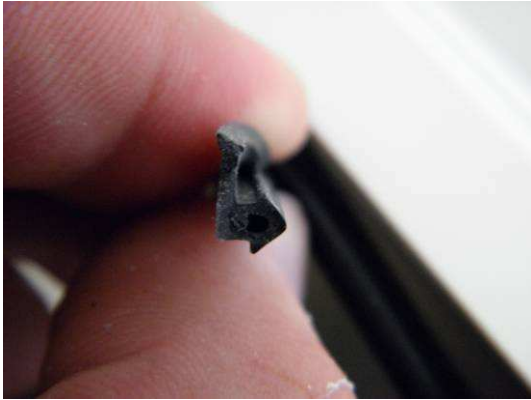
Picture 12
External rebate seal, drip rail

Evidence of Performance

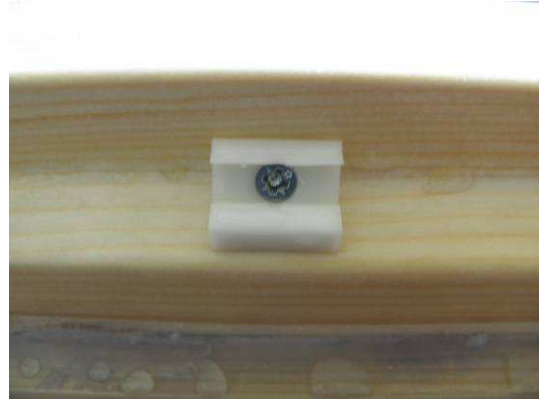
Air permeability, Watertightness, Resistance to wind load

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Client: SAVOX d.o.o., 75466 Milici (Bosnia-Herzegovina)



Picture 13
Seal – Drip rail/Frame member



Picture 14
Drip rail clips



Picture 15
Centre seal, corner configuration



Picture 16
Centre seal, sealant joint



Picture 17
Internal rebate seal, corner configuration



Picture 18
Internal rebate seal, sealant joint

Evidence of Performance

Air permeability, Watertightness, Resistance to wind load

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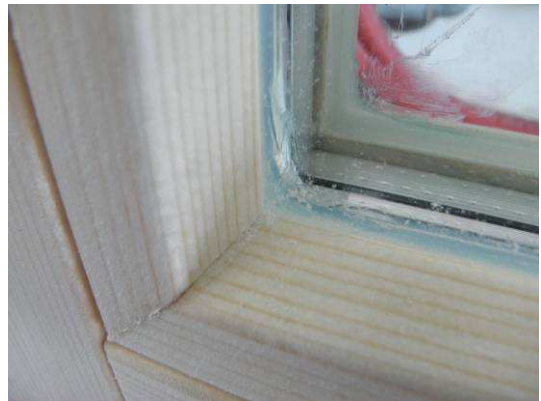
Picture 19
Centre seal



Picture 20
Internal rebate seal



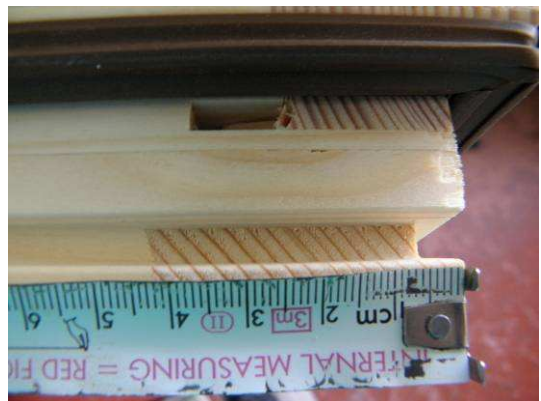
Picture 21
External glazing seal, corner configuration



Picture 22
Internal glazing seal, corner configuration



Picture 23
View of horizontal glazing rebate



Picture 24
Vapour pressure equalisation

Evidence of Performance

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Picture 25
Vapour pressure equalisation



Picture 26
Vapour pressure equalisation



Picture 27
Tilt mechanism pivot, internal view



Picture 28
Tilt mechanism pivot, rebate view



Picture 29
Corner pivot, internal view



Picture 30
Corner pivot, rebate view

Evidence of Performance

Air permeability, Watertightness, Resistance to wind load

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Picture 31
Locking situation, frame member / casement member 1



Picture 32
Locking situation, frame member / casement member 2



Picture 33
Locking situation, frame member / casement member 3



Picture 34
Locking situation, frame member / casement member 3