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**TEST REPORT № NL-0766/C/LL-219/K/08/1a**

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Light Partitions and Glazing Laboratory

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CUSTOMER Reynaers Polska Sp. z o.o.  
05-500 Piaseczno  
ul. Okulickiego 12

OBJECT OF TESTS Double row window with tilt and turn casement  
made of Reynaers CS77 aluminium profiles

Accepted for testing: 16.10.2008 with the protocol NL-0766/C/LL-219/K/08/Not/1  
in accordance with the procedure no. 18.

Test period: 16.10.2008 to 20.10.2008

#### TEST METHODS:

##### Initial type testing (ITT) – AoC system 3

PN-EN 1026:2001 Windows and doors – Air permeability – Test method.

PN-EN 1027:2001 Windows and doors – Watertightness – Test method

PN-EN 12211:2001 Windows and doors – Resistance to wind load - Test method.

PN-EN 14351-1:2006 p. 4.8 Windows and doors – Product standard, performance characteristics  
– Part 1: Windows and external pedestrian doorsets without resistance to  
fire and/or smoke leakage characteristics

##### Additional properties

PN-EN 12046-1:2005 Operating forces – Test method – Part 1: Windows

PN-EN 14609:2006 Windows – Determination of the resistance to static torsion

PN-EN 14608:2006 Windows – Determination of the resistance to racking

Test procedure LL-20 Windows and french windows. Visual inspection, dimensions

The test equipment used comply with the above-mentioned standards

## 1 The scope of tests

The scope of initial type testing covered the verification of:

- air permeability,
- watertightness,
- resistance to wind load,
- load-bearing capacity of safety devices,

The scope of additional tests covered the verification of:

- operating forces,
- resistance to static torsion,
- resistance to racking.

Personnel executing the test:

Daniel Kuna

## 2 Test specimen (identification)

The object of the tests was the double row window with tilt and turn casement, external dimensions S x H = 2500 x 2550 mm – 1 element assembled in 2008.

The information about sampling of the specimen by right of Reynaers's sampling report:

**Manufacturer:** Reynaers Polska Sp. z o.o., 05-500 Piaseczno, ul. Okulickiego 12

**Place of sampling:** Reynaers Polska Training Centre, 05-500 Piaseczno,  
ul. Okulickiego 12

**Number of samples:** 1

**Description of the sample:** double row window, dimensions S x H = 2500 x 2550 mm made of Reynaers CS77 aluminium profiles, with tilt and turn casement inside opened,

**Date of sampling:** October 2008

### Used materials

The scheme of the window and components (profiles, weather stripping) are shown on figures 1 and 2.

Window infilling consisted of 6-12-6 insulating glass unit.

Hardware

- tilt and turn casement – Fapim Galipius 2

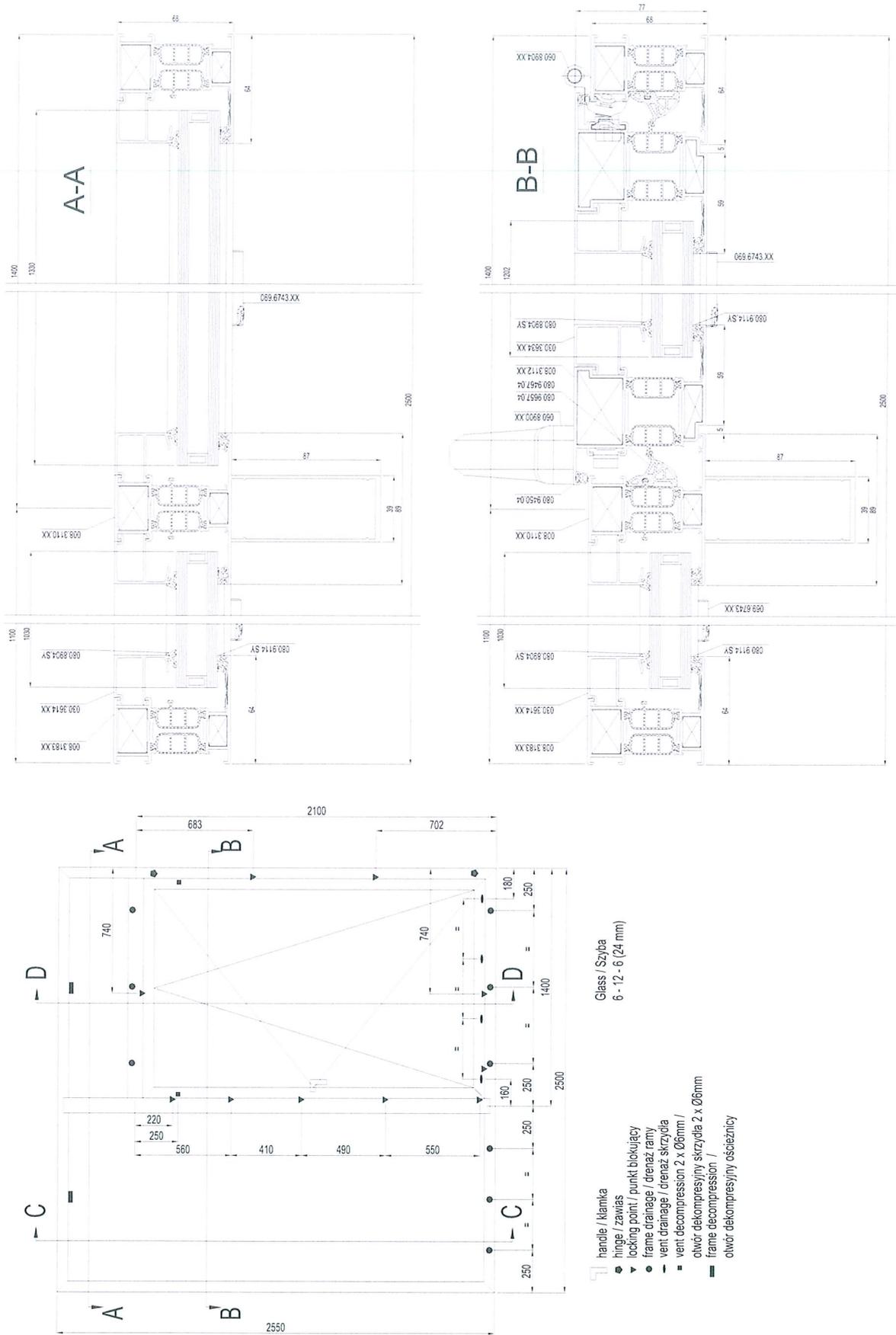


Fig. 1 Scheme and cross-sections of testing window; locking points

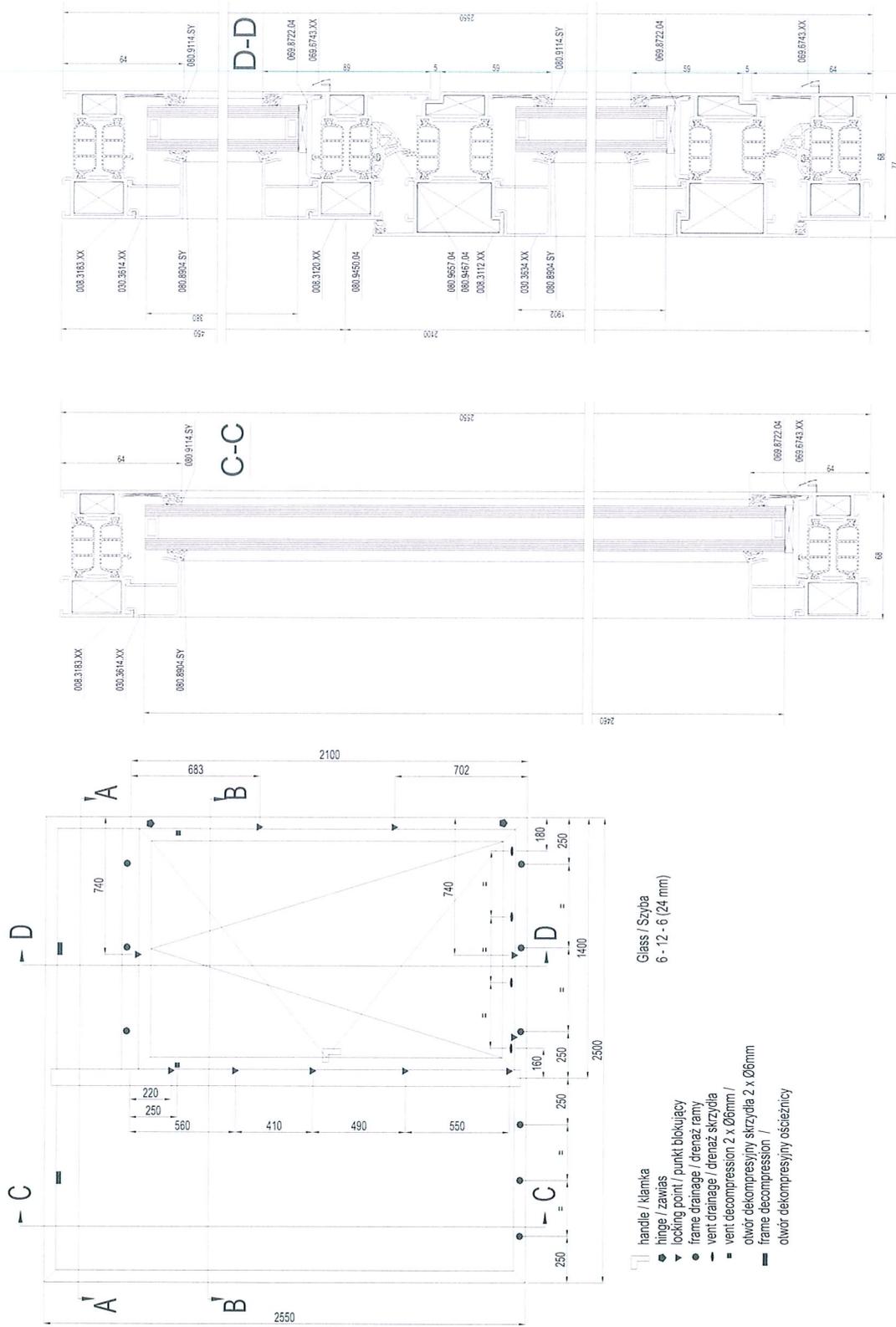


Fig. 2 Scheme and cross-sections of testing window; locking points

### 3 The methods and results

#### 3.1 Operating forces

The test was carried out in accordance with the PN-EN 12046-1:2004

The motion of the casement on opening and closing was smooth, without the casement slowing down or catching on other elements of the window.

Test results have been presented in table no. 1.

**Tab. 1 Operating forces**

Casement	Measurement	Rate of load, N		
		disengagement of hardware	the force need to start motion of the casement	full engagement of closing and locking hardware
tilt and turn	1	55,40	2,50	59,90
	2	55,15	2,50	60,45
	average	55,28	2,50	60,18
the arm of force, cm		10	-	10

PN-EN 13115:2002 classification

Class 1

#### 3.2 Air permeability (before the test of resistance to wind load)

The test was carried out in accordance with the PN-EN 1026: 2001.

specimen area	6,4 m <sup>2</sup>	joint length	16,1 m	temp.	21 °C	humidity	48%	atm. pressure	993hPa
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**Tab. 2 Air permeability double row window 1 positive test pressure**

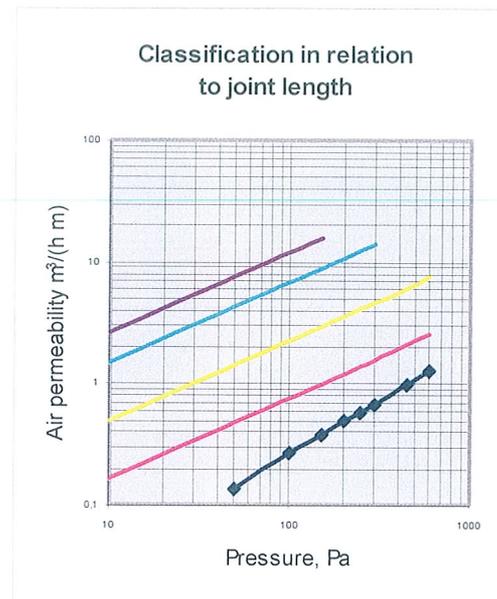
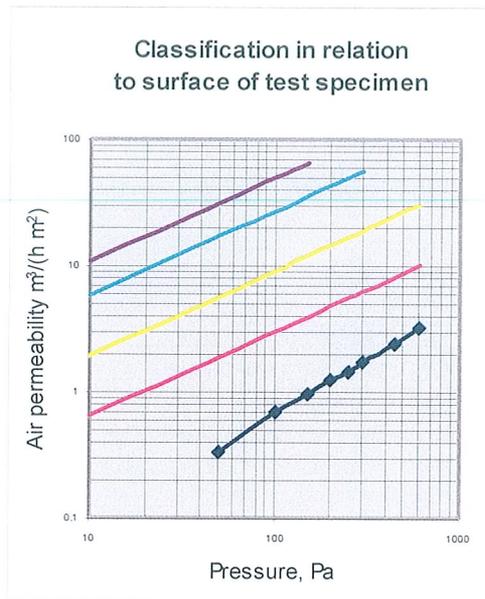
Air flow		Value of air permeability at pressure, Pa							
		50	100	150	200	250	300	450	600
overall	m <sup>3</sup> /h	2,3	4,7	6,7	8,8	10,7	12,9	20,3	28,7
in relation to joint length	m <sup>3</sup> /hm	0,14	0,29	0,42	0,55	0,66	0,80	1,26	1,78
in relation to surface	m <sup>3</sup> /hm <sup>2</sup>	0,36	0,74	1,05	1,38	1,68	2,02	3,18	4,50
air inf. coefficient , a	m <sup>3</sup> /(mhdaPa) <sup>2/3</sup>	0,05	0,06	0,07	0,07	0,08	0,08	0,10	0,12

**Tab. 3 Air permeability double row window 1 negative test pressure**

Air flow		Value of air permeability at pressure, Pa							
		50	100	150	200	250	300	450	600
overall	m <sup>3</sup> /h	2,0	4,1	5,6	6,9	8,0	8,8	10,9	13,0
in relation to joint length	m <sup>3</sup> /hm	0,12	0,25	0,35	0,43	0,50	0,55	0,68	0,81
in relation to surface	m <sup>3</sup> /hm <sup>2</sup>	0,31	0,64	0,88	1,08	1,25	1,38	1,71	2,04
air inf. coefficient , a	m <sup>3</sup> /(mhdaPa) <sup>2/3</sup>	0,04	0,05	0,06	0,06	0,06	0,06	0,05	0,05

**Tab. 4 Air permeability double row window 1 numerical average**

Air flow		Value of air permeability at pressure, Pa							
		50	100	150	200	250	300	450	600
overall	m <sup>3</sup> /h	2,2	4,4	6,2	7,9	9,4	10,9	15,6	20,9
in relation to joint length	m <sup>3</sup> /hm	0,13	0,27	0,38	0,49	0,58	0,67	0,97	1,30
in relation to surface	m <sup>3</sup> /hm <sup>2</sup>	0,34	0,69	0,96	1,23	1,47	1,70	2,45	3,27
air inf. coefficient , a	m <sup>3</sup> /(mhdaPa) <sup>2/3</sup>	0,07							



Classification in relation to joint length	Class 4
Classification in relation surface of test specimen	Class 4
<b>PN-EN 12207:2001 overall classification</b>	<b>Class 4</b>

### 3.3 Watertightness

The test was carried out in accordance with the PN-EN 1027: 2001, method 1A. Test results have been presented in table no. 5.

Tab. 5 Watertightness

Pressure, Pa	Testing time, mm	Remarks and observations	Pressure, Pa	Testing time, mm	Remarks and observations
0	15	no leakage	250	5	no leakage
50	5	no leakage	300	5	no leakage
100	5	no leakage	450	5	no leakage
150	5	no leakage	600	5	no leakage
200	5	no leakage	-	-	-

<b>PN-EN 12208:2001 classification</b>	<b>Class 9A</b>
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### 3.4 Resistance to wind load

The test was carried out in accordance with the PN-EN 12211:2001

#### Measurement of deflection with P1

The spacing of measurement points is presented in drawing no. 3.

**Tab. 6 Window displacement values - pressure**

Load	Displacement values at measurement points, mm					
	transom bar			mullion		
[Pa]	1	2	3	4	5	6
0	0,0	0,0	0,0	0,0	0,0	0,0
200	0,1	0,5	0,4	0,1	0,8	0,2
400	0,2	1,3	1,3	0,4	1,8	0,5
600	0,4	1,8	1,9	0,8	2,5	0,8
800	0,6	2,6	2,5	1,0	3,8	1,1
1000	0,8	3,2	3,3	1,3	4,9	1,5
1200	1,0	3,9	4,0	1,7	6,0	1,7
1400	1,1	4,6	4,7	1,9	7,2	1,9
1600	1,2	5,3	5,4	2,2	8,4	2,2
0	0,1	0,2	0,1	0,2	0,3	0,1
Class C4						

**Tab. 7 Window displacement values - suction**

Load	Displacement values at measurement points, mm					
	transom bar			mullion		
[Pa]	1	2	3	4	5	6
0	0,0	0,0	0,0	0,0	0,0	0,0
200	0,1	0,6	0,6	0,2	0,5	0,3
400	0,3	1,2	1,5	0,8	1,8	0,7
600	0,6	2,2	2,4	1,2	2,6	1,3
800	0,8	2,7	2,6	1,5	2,9	1,5
1000	1,0	3,0	3,1	1,7	5,0	1,8
1200	1,2	3,8	4,1	2,0	6,1	2,0
1400	1,3	5,3	5,4	2,3	7,3	2,3
1600	1,5	5,5	5,8	2,6	8,5	2,6
0	0,2	0,4	0,5	0,4	0,5	0,2
Class C4						

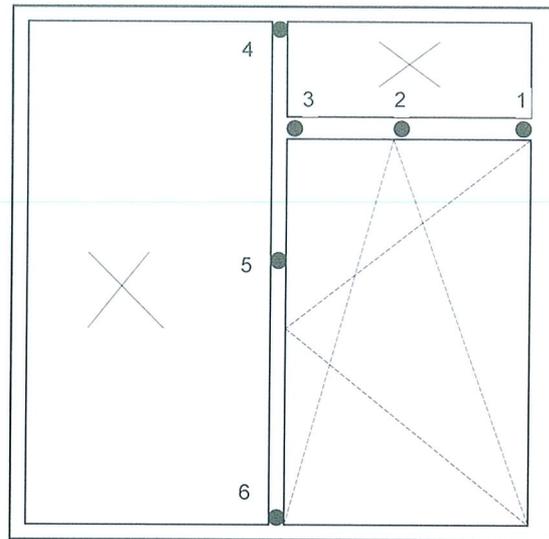


Fig. 3 Spacing of measurement points

**Repeated load P2**

The window was loaded with 50 pressure/suction cycles at  $\pm 800$  Pa. After test no visible changes were observed.

**Safety test P3**

The window was subjected to a brief safety test pressure of 2400 Pa and suction of 2400 Pa. After test no visible changes were observed.

**3.5 Air permeability (after the test of resistance to wind load)**

The test was carried out in accordance with the PN-EN 1026:2001.

specimen area	6,4 m <sup>2</sup>	joint length	16,1 m	temp.	21 °C	humidity	48%	atm. pressure	993hPa
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**Tab. 8 Air permeability double row window 1 positive test pressure**

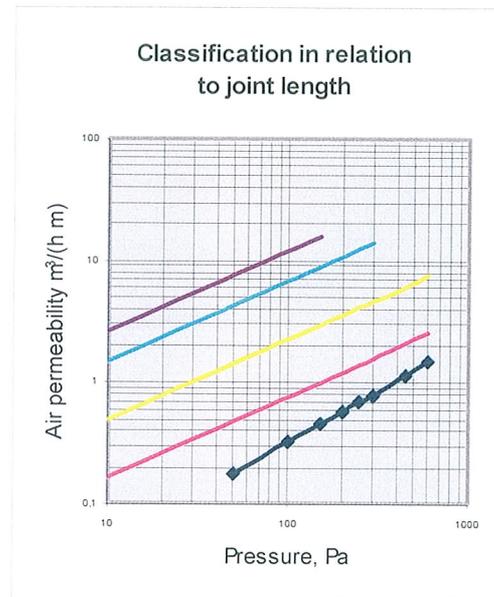
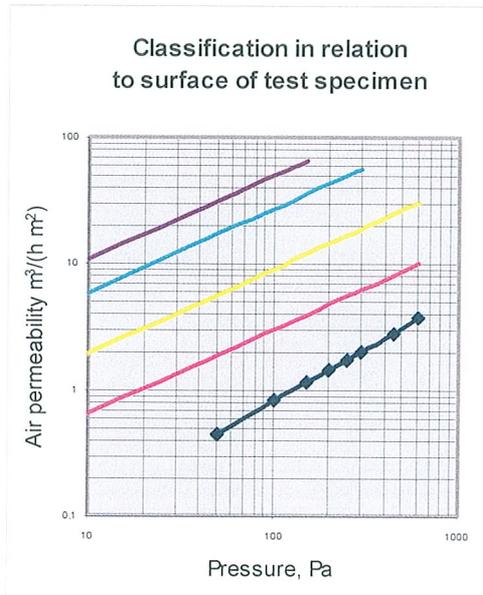
Air flow		Value of air permeability at pressure, Pa							
		50	100	150	200	250	300	450	600
overall	m <sup>3</sup> /h	2,6	5,5	8,2	10,8	13,5	16,1	25,1	34,8
in relation to joint length	m <sup>3</sup> /hm	0,16	0,34	0,51	0,67	0,84	1,00	1,56	2,16
in relation to surface	m <sup>3</sup> /hm <sup>2</sup>	0,41	0,86	1,29	1,69	2,12	2,52	3,93	5,45
air inf. coefficient , a	m <sup>3</sup> /(mhdaPa) <sup>2/3</sup>	0,06	0,07	0,08	0,09	0,10	0,10	0,12	0,14

**Tab. 9 Air permeability double row window 1 negative test pressure**

Air flow		Value of air permeability at pressure, Pa							
		50	100	150	200	250	300	450	600
overall	m <sup>3</sup> /h	3,1	5,1	6,7	7,7	8,6	9,1	11,0	13,1
in relation to joint length	m <sup>3</sup> /hm	0,19	0,32	0,42	0,48	0,53	0,57	0,68	0,81
in relation to surface	m <sup>3</sup> /hm <sup>2</sup>	0,49	0,80	1,05	1,21	1,35	1,43	1,72	2,05
air inf. coefficient , a	m <sup>3</sup> /(mhdaPa) <sup>2/3</sup>	0,07	0,07	0,07	0,06	0,06	0,06	0,05	0,05

Tab. 10 Air permeability double row window 1 numerical average

Air flow		Value of air permeability at pressure, Pa							
		50	100	150	200	250	300	450	600
overall	m <sup>3</sup> /h	2,9	5,3	7,5	9,3	11,1	12,6	18,1	24,0
in relation to joint length	m <sup>3</sup> /hm	0,18	0,33	0,46	0,57	0,69	0,78	1,12	1,49
in relation to surface	m <sup>3</sup> /hm <sup>2</sup>	0,45	0,83	1,17	1,45	1,73	1,97	2,83	3,75
air inf. coefficient, a	m <sup>3</sup> /(mhdaPa) <sup>2/3</sup>	0,08							



Classification in relation to joint length	Class 4
Classification in relation surface of test specimen	Class 4
<b>PN-EN 12207:2001 overall classification</b>	<b>Class 4</b>

### 3.6 Load-bearing capacity of safety devices

The test was carried out in accordance with the PN-EN 14351-1:2006 and PN-EN 14609:2005. The casement was loaded with the force 350 N by 60s in turned position (locked by restrictor).

- deformation at 350 N ( $a_1 - a_0$ ) = 62,94 mm
- residual deformation ( $a_2 - a_0$ ) = 0,99 mm

After test no visible changes were observed.

### 3.7 Determination of the resistance to racking

The test was carried out in accordance with the PN-EN 14608:2006.  
Test results have been presented in table no. 11.

**Tab. 11 Determination of the resistance to racking**

Casement	Deformation, mm			Maximum def. mm	Residual def. mm
	a <sub>0</sub>	a <sub>1</sub>	a <sub>2</sub>	a <sub>1</sub> -a <sub>0</sub>	a <sub>2</sub> -a <sub>0</sub>
turn	0,00	2,98	0,39	2,98	0,39
tilt	0,00	2,49	0,25	2,49	0,25
<b>The load 800 N</b>					

### 3.8 Determination of the resistance to static torsion

The test was carried out in accordance with the PN-EN 14609:2006.  
Test results have been presented in table no. 12.

**Tab. 12 Determination of the resistance to static torsion**

Casement	Deformation, mm			Maximum def. mm	Residual def. mm
	a <sub>0</sub>	a <sub>1</sub>	a <sub>2</sub>	a <sub>1</sub> -a <sub>0</sub>	a <sub>2</sub> -a <sub>0</sub>
turn	0,00	61,20	2,15	61,20	2,15
tilt	0,00	65,45	2,31	65,45	2,31
<b>The load 350 N</b>					

### 3.9 Operating forces (after mechanical strength test)

The test was carried out in accordance with the PN-EN 12046-1:2005.  
Test results have been presented in table no. 13.

**Tab. 13 Operating forces**

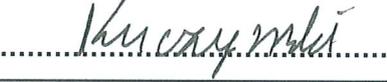
Casement	Measur ement	Rate of load, N		
		disengagement of hardware	the force need to start motion of the casement	full engagement of closing and locking hardware
tilt and turn	1	68,50	2,55	72,10
	2	68,85	2,55	72,80
	średnio	68,68	2,55	72,45
the arm of force, cm		10	-	10

## 4 Classification

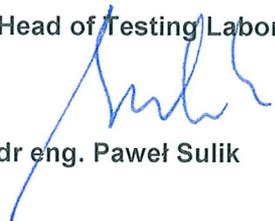
On the base of test results the classification is presented in table no. 14.

**Tab. 14 Classification of the testing window**

Properties	Classification	Classification standards
Air permeability	class 4	PN-EN 12207:2001
Watertightness	class 9A	PN-EN 12208:2001
Resistance to wind load	class C4	PN-EN 12210:2001
Load-bearing capacity of safety devices	pass	PN-EN 14351-1:2006
Operating forces	class 1	PN-EN 13115:2002
Determination of the resistance to static torsion	class 4	PN-EN 13115:2002
Determination of the resistance to racking	class 4	PN-EN 13115:2002

Responsible for the test: <i>dr eng. Krzysztof Kuczyński</i>  .....	Authorizing Person <i>mgr eng. Irena Kotwica</i>  .....
Warsaw <i>31.10.2008</i> ✓	
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Head of Testing Laboratory LL

  
 dr eng. Paweł Sulik