

bre

**Weathertightness test to  
BS 6375: Part 1: 2009 on  
a Smart Systems Ltd  
Parallel opening window**

Prepared for: Mr. Chris White

Smart Systems Ltd

10 May 2010

Test report number 262759



0578

building a better world

**Tested on behalf of BRE by**

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Name Malcolm Pound  
Position Laboratory Manager and Senior Consultant, Actions, Building Technology  
Date 10 May 2010

Signature *M. C. Pound*

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Name Malcolm Pound  
Position Laboratory Manager and Senior Consultant, Actions, Building Technology  
Date 11 May 2010

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**Approved on behalf of BRE**

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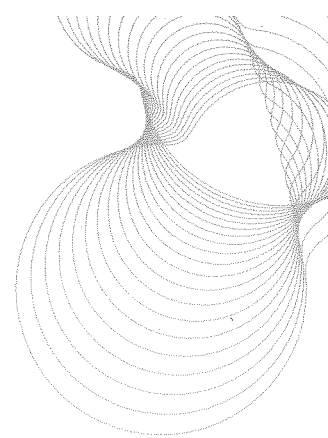
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## 1 Introduction

At the request of Mr. C. White of Smart Systems Ltd, Arnolds Way, Yatton, North Somerset, BS49 4UN, BRE issued proposal number 127066 on 27 April 2010. The proposal was accepted on 05 May and BRE tested a specimen window on 10 May 2010.

The tests to methods in BS 6375: Part 1: 2009, BS EN 1026<sup>1</sup>, 1027<sup>2</sup> and 12211<sup>3</sup> measure the weathertightness of the specimen in terms of air permeability, watertightness and resistance to wind load respectively. Classification of the results is based on BS 6375: Part 1: 2009<sup>4</sup> and BS EN 12207<sup>5</sup>, 12208<sup>6</sup>, 12210<sup>7</sup>.

The tests on the specimen were carried out under the BRE Standard Terms and Conditions of Business for testing and to the UKAS BRE Specific Procedures Series F, as BRE Job number 262759 in project number CV3808.

The tests were witnessed by:

Mr. C. White                      Smart Systems Ltd

Mr. M. Carroll                    Smart Systems Ltd

## 2 Details of tests carried out

BS 6375: Part 1: 2009 specifies that the air permeability test is performed under both positive and negative test pressures and that the average of the measurements defines the results. It also specifies that water tightness test method A is used and that deflections measured during the resistance to wind load test do not exceed 1/150 of the span. The weathertightness test comprised of three parts in the sequence:

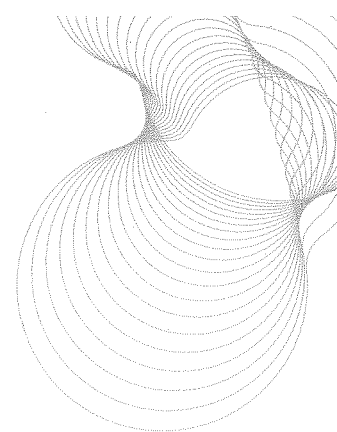
1. Air permeability to BS EN 1026: 2000; by application of a series of test air pressure differentials across the specimen with measurement of the air permeability of it at each pressure step. The maximum positive and negative pressure differential was 600 Pa reached in pressure steps of 50, 100, 150, 200, 250, 300, 450 and 600 Pa.
2. Watertightness to BS EN 1027: 2000; by applying specified amounts of water spray to the outside face of the specimen while incrementally increasing the air pressure differential across it. The test pressure, time and position of any water penetration are recorded. The maximum positive air pressure differential was 600 Pa. Pressure (Pa)/time (min) steps were 0/15, 50/5, 100/5, 150/5, 200/5, 250/5, 300/5, 450/5 and 600/5.
3. Resistance to wind load to BS EN 12211: 2000; by application of a series of positive and negative test air pressures. Measurements and inspections are made to assess relative frontal deflection and resistance to damage from wind loads.

The resistance to wind load test includes a deflection test, a repeated pressure test and operational test, an air permeability test and finally a safety test. For the purpose of the resistance to wind load test three test pressures are defined:

- P1 applied to measure the deflections of parts of the test specimen.
- P2 50 cycles of pulsating pressure to assess performance under repeated wind loads.
- P3 applied to assess the safety of the test specimen under extreme conditions.

The values of P1, P2 and P3 are related as follows:  $P2 = 0.5P1$ ,  $P3 = 1.5P1$ .  
For these tests the values are: P1 = 2400 Pa, P2 = 1200 Pa and P3 = 3600 Pa.

**Note:** The repeat air permeability test is an integral part of the resistance to wind load test and its significance is as an indicator of damage that may occur during that test.



### 3 Classification of results

BS 6375: Part 1: 2009 classifies the results for products in the UK. For a window to be included in an exposure category the appropriate test pressures for air permeability, watertightness and resistance to wind shall be attained or exceeded. The relevant product standard BS EN 14351-1:2006<sup>8</sup> also states that classification of air permeability is based on the averages of the positive and negative air leakage values at each pressure step.

The specimen was tested to a UK exposure category of 2000+ (2400 Pa). The classifications set in BS 6375: Part 1: 2009 for a UK exposure category of 2000+ for windows are: Air permeability at Class 2/300 Pa or Classes 3 and 4 when tested to 600 Pa, watertightness at Class 7A/300 Pa and resistance to wind load at Class AE at P1 2400 Pa, P2 1200 Pa and P3 3600 Pa.

The BS EN classifications are explained below:

**Air permeability:** BS EN 12207: 1999. The classification is based on a comparison of the air permeability of the test specimen related to both overall area and length of opening joint. There are four classes; Class 4 is applicable to the most airtight specimens while Class 1 describes those with most air leakage. To meet any class the measured air permeability of the specimen must not exceed the upper limit at any test pressure step in that class.

**Watertightness:** BS EN 12208: 2000. The classification is based on a comparison of the watertightness of the test specimen related to test pressures and duration of the test. There are nine classes; 1A/1B up to 9A for test pressures from 0 Pa to 600 Pa. For specimens that remain watertight over 600 Pa for 5 minutes a class E<sub>xxx</sub> is used. The xxx is the maximum test pressure e.g. 750 Pa. To meet any class the specimen must remain watertight for 5 minutes up to and at the test pressure set for that class.

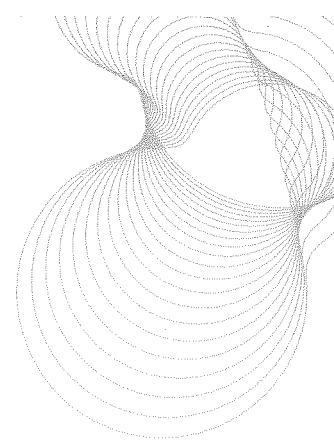
**Resistance to wind load:** BS EN 12210: 1999. The classification is based on a comparison of the resistance to wind loads of the test specimen when subjected to test pressures P1, P2 and P3. There are five classes; 1 up to 5 for P1 test pressures from 400 Pa to 2000 Pa. For specimens that are tested to P1 pressures exceeding 2000 Pa a class E<sub>xxxx</sub> is used. The xxx is the actual test pressure P1 used e.g. 2400 Pa. To achieve any class the resistance of the specimen to wind load must meet all the requirements for that class.

**Note:** This report has results for air permeability under positive and negative test pressures and a graph showing the average air permeability for them at each pressure step.

## 4 Test specimen

The general details about the test specimen supplied by Smart Systems Ltd for these tests are given below and in drawings in the Annex of this report

- Type:** Aluminium frame members with one parallel open outward light. Reference: Smart Systems Ltd 1098 wide mm high x 1200 mm wide Parallel opening window.
- Glazing:** The opening light is internally glazed with an insulating glass unit with 4 mm thick toughened glass and a 20 mm air gap. Aluminium beads retain the glazing seals and the glazing.
- Seals:** On the opening light frame there is a compression type seal. On the corresponding parts of the window frame there is a compression seal. Both seals are continuous at the corners with a bonded butt joint on their top horizontal run. The glazing seals are neoprene with bonded corner joints.
- A sealant is applied to corner joints of the seals and other sealant is applied to the joints between glazing beads.
- Hardware:** Two lockable handles (one on each frame stile) each operate a central locking bolt, two espagnolette bolts and shoot bolts top and bottom of each stile.
- The light is hung on six Securistyle parallel hinges; Two at each side and two at the top.
- Fixings:** For these tests the specimen was fixed and sealed into a wood surround frame with three wood screws at the top, bottom and sides.
- Detail:** There is a weather moulding above the top most opening joint fixed to the window frame across the full width of the frame.
- There are two drainage slots with hoods in the bottom rail of the opening light and two in the sill. There are four slots in the top surface of the sill below the opening light.
- Dimensions:** 1098 mm wide x 1200 mm wide (overall). Area: 1.32 m<sup>2</sup>  
Length of opening joint = 4.20 m



## 5 Test rig and preparatory procedures

The test specimen was conditioned for at least 4 hours within temperature and humidity ranges specified in the test standards of 10°C to 30°C and 25% to 75% RH respectively.

The water temperature in the watertightness test was within the specified range of 4°C to 30°C.

The window was mounted in the BRE test rig 'G', to form one wall of a pressure box, with the outdoor face of the window enclosed in the box.

A single spray bar with three full circular cone nozzles was mounted in the pressure box to apply water to the outside face of the specimen at the rate of 2 L/min per nozzle in accordance with BS EN 1027 spraying method 1A.

Transducers were mounted on independent supports to measure deflections of a frame member retaining an insulating glass unit. Deflections were measured on the span at the positions indicated in Figure 1.

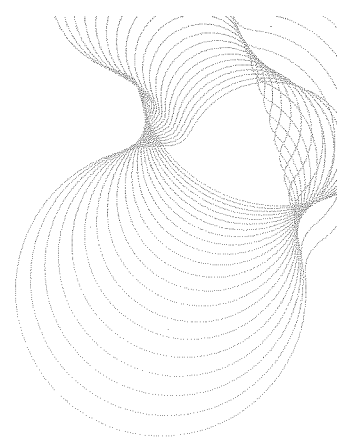
## 6 Summary of test results

The test results are summarised in Table 1 below for a UK exposure category of 2000+. Figures show detail of the window and detailed results are given in Annex 1.

BS or BS EN	Air permeability		Watertightness		Resistance to wind loads	
	Requirements	Results	Requirement	Results	Requirements	Results
BS 6375	Class 3 or 4 to 600 Pa	<b>Met</b> the requirement of Class 4 based on the averages of readings in positive and negative tests	Class 7A at 300 Pa	<b>Met &amp; exceeded</b> the require – ments. Class 9A at 600 Pa	Class AE2400  P1 = 2400 Pa P2 = 1200 Pa P3 = 3600 Pa	<b>All met.</b> Class AE2400

**Table 1. Summary of weathertightness test results**





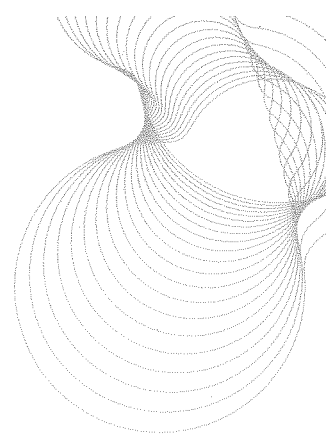
## 7 Conclusions

When the specimen Smart Systems Ltd 1098 mm x 1200 mm Parallel opening light window was tested to the standards described herein it was found to be:

- Sufficiently airtight to attain Class 4 when the averages of the readings under positive and negative test pressures were considered, thus **meeting** the BS 6375: Part 1: 2009 requirements.
- Resistant to water penetration using method 1A to Class 9A up to and at 600 Pa thus **meeting and exceeding** the BS 6375: Part 1: 2009 requirements.
- Resistant to wind loads of  $\pm 2400$  Pa causing deflections less than 1/150 of the span of a window frame stile. Resistant to repeated pressure cycles of  $\pm 1200$  Pa and able to sustain the corresponding safety test pressure of  $\pm 3600$  Pa. The overall classification for resistance to wind load is Class AE2400 **meets** the requirements of BS 6375: Part 1: 2009.

## 8 References

1. BS EN 1026: 2000. Windows and doors – Air permeability – Test method. British Standards Institution, London.
2. BS EN 1027: 2000. Windows and doors – Watertightness – Test method. British Standards Institution, London.
3. BS EN 12211: 2000. Windows and doors – Resistance to wind load – Test method. British Standards Institution, London.
4. BS 6375: Part 1: 2009. Performance of windows and doors – Classification for weathertightness and guidance on selection and specification
5. BS EN 12207: 2000. Windows and doors – Air permeability - Classification. British Standards Institution, London.
6. BS EN 12208: 2000. Windows and doors – Watertightness - Classification. British Standards Institution, London.
7. BS EN 12210: 2000. Windows and doors – Resistance to wind load - Classification. British Standards Institution, London.
8. BS EN 14351-1:2006 Windows and doors – Product standard. British Standards Institution, London



**ANNEX 1. Weather-tightness test results**

Pressure differential Pa	Air flow through the specimen m <sup>3</sup> /h	Air flow per unit area of the specimen m <sup>3</sup> /h.m <sup>2</sup>	Air flow per metre of opening joint m <sup>3</sup> /h.m
50	0.16	0.12	0.04
100	0.50	0.38	0.12
150	0.69	0.52	0.16
200	0.79	0.60	0.19
250	0.94	0.71	0.22
300	1.38	1.05	0.33
450	1.42	1.08	0.34
600	1.45	1.10	0.35

**Table A1. Air permeability under positive air pressure; test results**

Pressure differential Pa	Air flow through the specimen m <sup>3</sup> /h	Air flow per unit area of the specimen m <sup>3</sup> /h.m <sup>2</sup>	Air flow per metre of opening joint m <sup>3</sup> /h.m
50	0.25	0.19	0.06
100	0.41	0.31	0.10
150	0.71	0.54	0.17
200	0.79	0.60	0.19
250	0.80	0.61	0.19
300	1.25	0.95	0.30
450	1.45	1.10	0.35
600	1.55	1.17	0.37

**Table A2. Air permeability under negative air pressure; test results**

Pressure differential Pa	Average air flow per unit area of the specimen m <sup>3</sup> /h.m <sup>2</sup>	Average air flow per metre of opening joint m <sup>3</sup> /h.m
50	0.16	0.05
100	0.35	0.11
150	0.53	0.17
200	0.60	0.19
250	0.66	0.21
300	1.00	0.32
450	1.09	0.35
600	1.14	0.36

**Table A3. Averages of air permeabilities under positive and negative air pressures; test results**

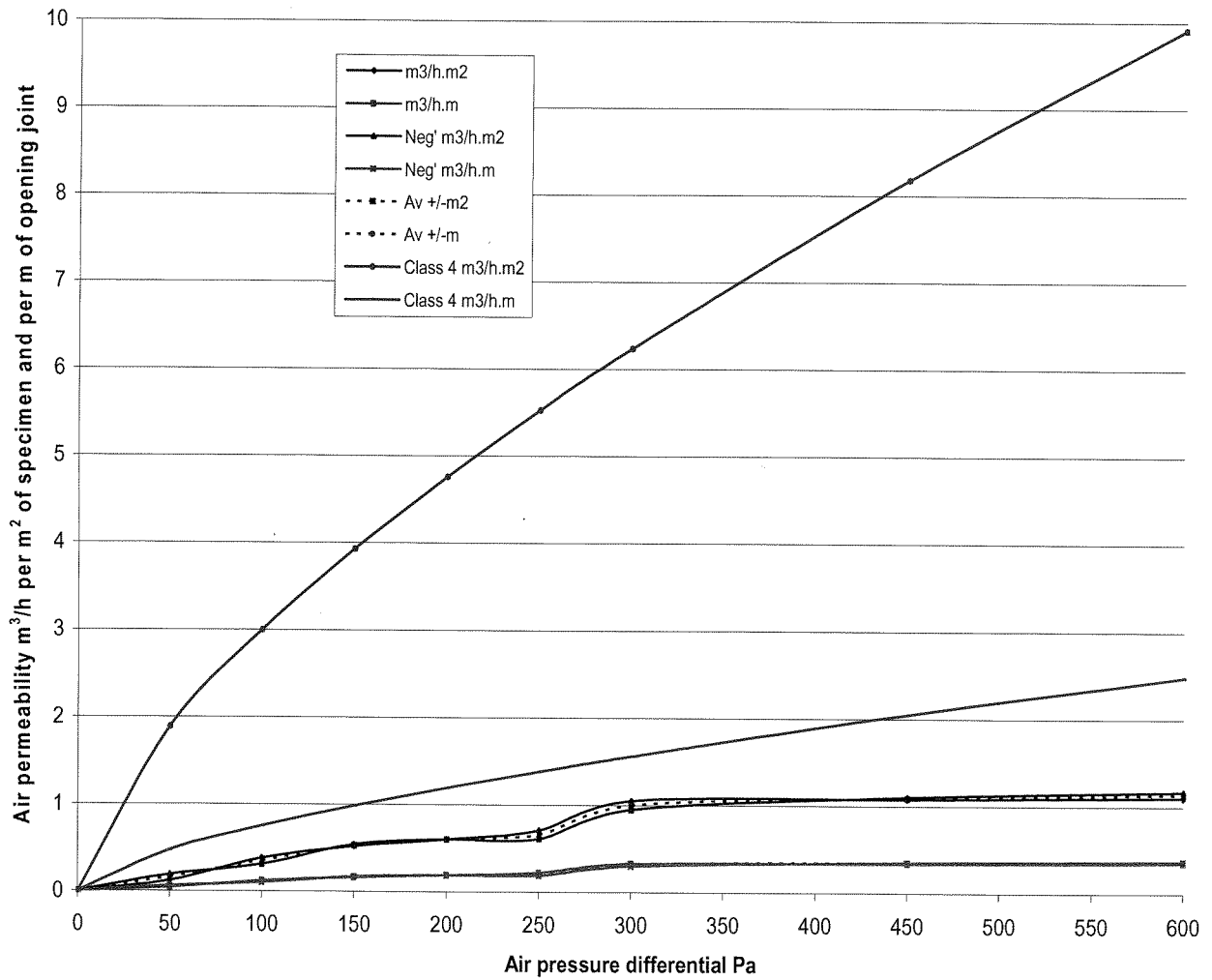
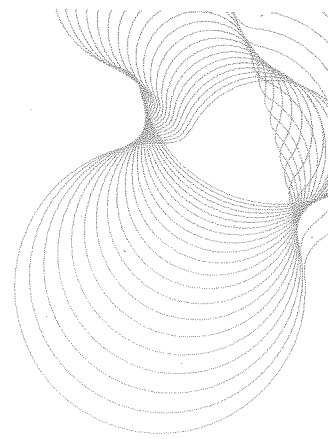


Figure A1. Air permeability under positive and negative air pressure; test results



**Watertightness test**

Pressure differential Pa	Duration	Water leaks
	Minutes	
0	15	Nil
50	5	Nil
100	5	Nil
150	5	Nil
200	5	Nil
250	5	Nil
300	5	Nil
450	5	Nil
600	5	Nil

Test laboratory conditions: Air pressure 1002 mb. Relative humidity 32.8% at 19.1°C  
Air temperature 19.1°C. Test chamber air temperature 18.9°C. Water temperature 17.4°C

**Table A4. Watertightness test results**

**Resistance to wind load – Deflection test at ± 2400 Pa**

Position deflection measured	Positive pressure P1 to +2400 Pa		Negative pressure P1 to - 2400 Pa	
	Deflection		Deflection	
	mm	defl./span	mm	defl./span
Mid height of right hand side stile on opening light	0.50	1/2200	0.51	1/2157

**Note:** The deflection at the mid-point of a member is measured relative to its ends, e.g. with reference to Figure 1: Deflection at the mid-point = deflection at the mid-point – average of deflections at the two ends of the same member.

**Table A5. Deflections measured on right hand stile in the resistance to wind load test at ±2400Pa.**

**Resistance to wind load – Repeated pressure test including the second air permeability test**

Repeated pressure	Damage or functional defects
50 cycles to P2 at $\pm 1200$ Pa	None

**Table A6. Damage or functional defects after repeated pressures to P2 at  $\pm 1200$  Pa**

**Second air permeability test under positive air pressures (part of resistance to wind load test)**

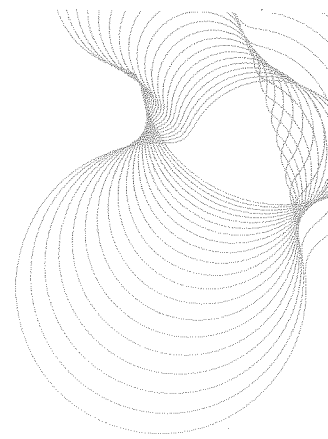
Pressure differential Pa	Air flow through the specimen m <sup>3</sup> /h	Air flow through the specimen as measured previously m <sup>3</sup> /h	Comparison to the air permeability measured previously (see Table A1)
50	0.17	0.16	After the test pressures P1 and P2 were applied the amounts of air flowing through the test specimen were not significantly different to those measured previously
100	0.57	0.50	
150	0.78	0.69	
200	1.13	0.79	
250	1.03	0.94	
300	1.44	1.38	
450	2.08	1.42	
600	2.11	1.45	

**Table A7. Second air permeability test results under positive air pressures**

**Second air permeability test under negative air pressures (part of resistance to wind load test)**

Pressure differential Pa	Air flow through the specimen m <sup>3</sup> /h	Air flow through the specimen as measured previously m <sup>3</sup> /h	Comparison to the air permeability measured previously (see Table A2)
50	0.29	0.25	After the test pressures P1 and P2 were applied the amounts of air flowing through the test specimen were not significantly different to those measured previously
100	0.55	0.41	
150	0.78	0.71	
200	1.13	0.79	
250	0.93	0.80	
300	1.39	1.25	
450	1.85	1.45	
600	2.47	1.55	

**Table A8. Second air permeability test results under negative air pressures**



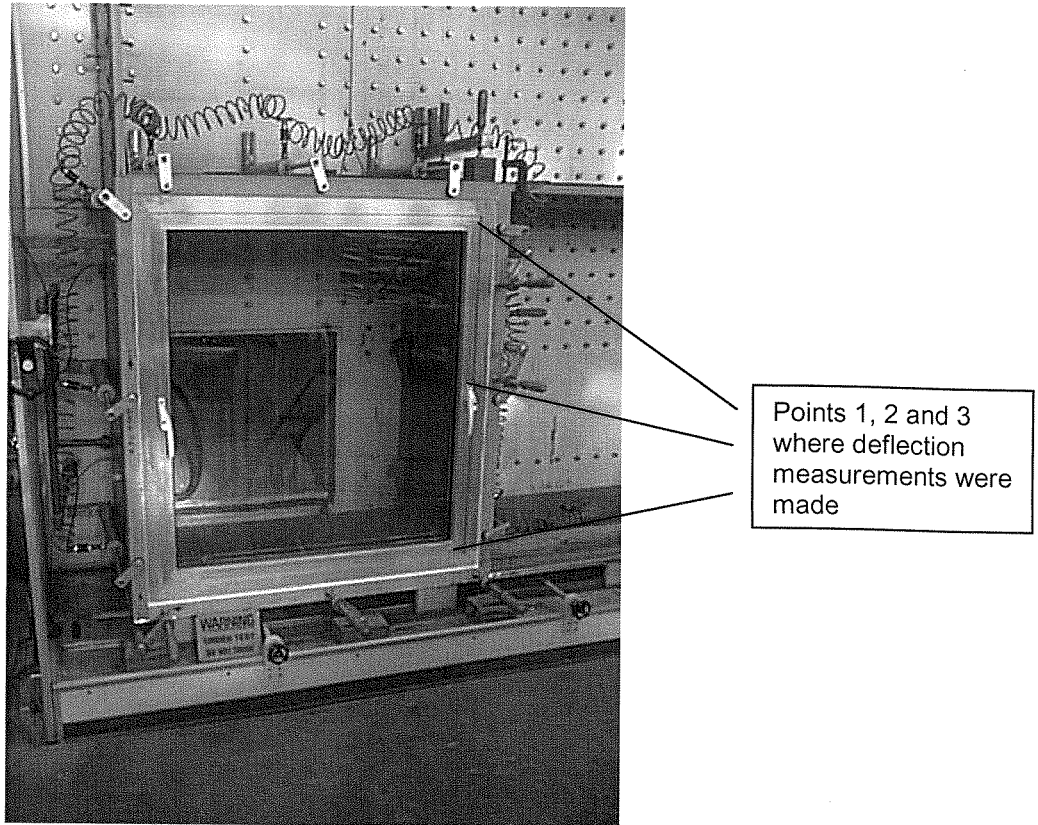
**Resistance to wind load - Safety test**

Safety test	Condition after test
One pressure pulse to pressure: P3 at – then + 3600 Pa	No parts became detached and the test specimen remained closed

**Table A9. Condition of the window after the safety test to P3 at  $\pm 3600$  Pa**



**Figure 1. The Smart Systems Parallel opening window with one opening light in the BRE Test rig 'G'**



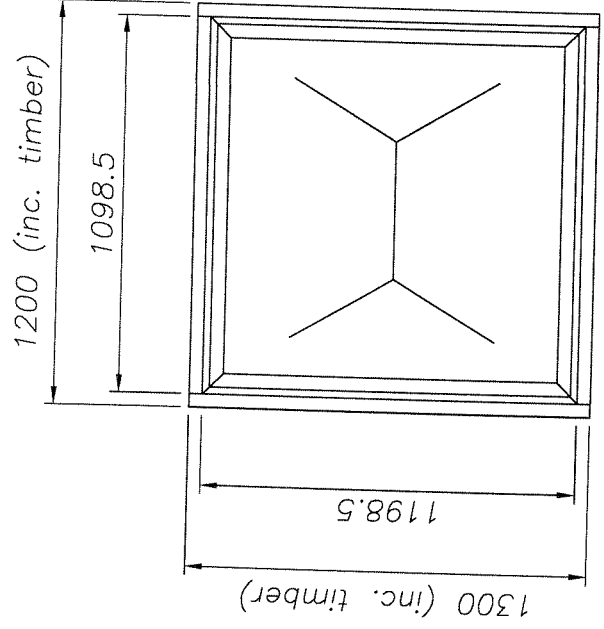
**Figure 2. The Smart System Parallel opening window showing points where deflections were measured**

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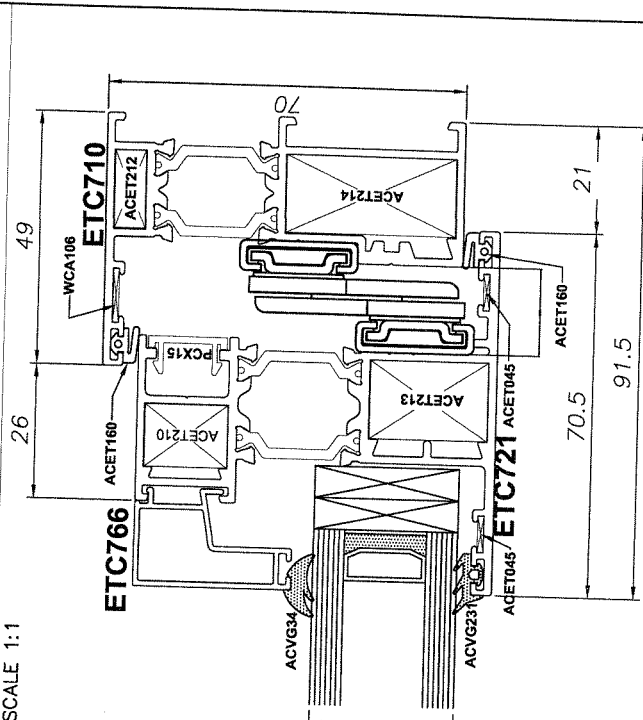
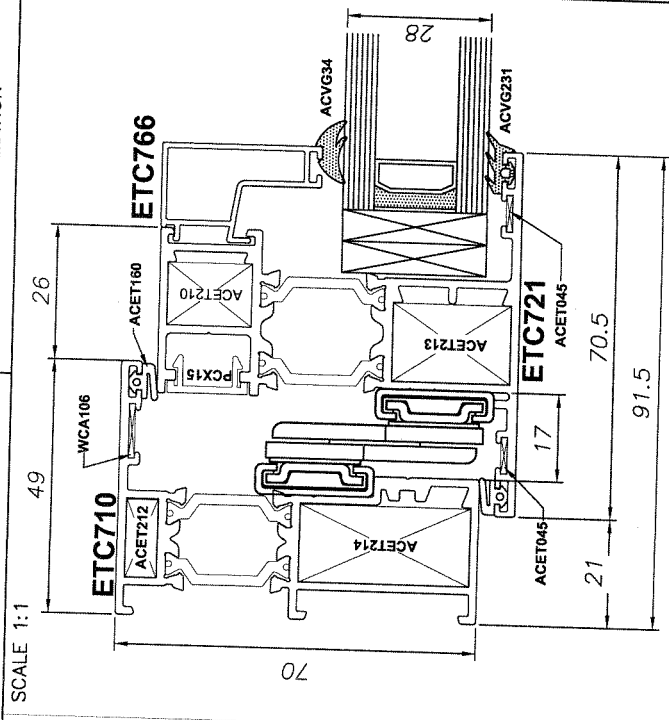
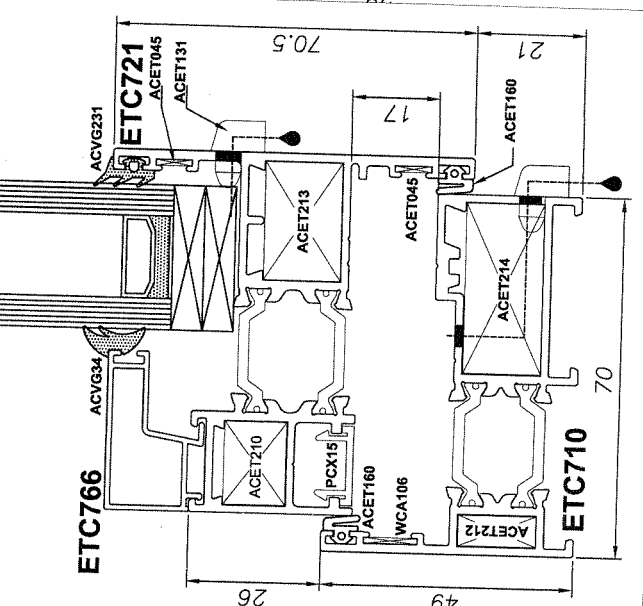
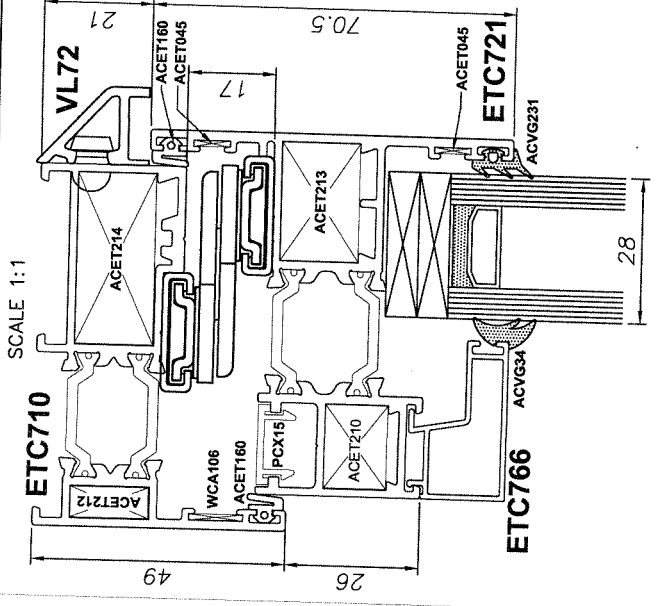


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SCALE NTS



TECHNICAL INFORMATION



**DESCRIPTION**

1No. 1200w x 1300h (inc timber) thermally broken Parallel opening window for testing to BS6375.  
 Locking: 2No. Saracen multi-point locking operated by ACET165handles.  
 Hinges: 3No. Securistyle Parallel window hinges.  
 Glass: 4mm Clear Float / 20mm Air Space / 4mm Clear Float

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