

bre

**Weathertightness test to
BS 6375: Part 1: 2009 on
a Smart Systems Ltd
Visofold Panorama
outward opening
bifolding door**

Prepared for: Mr. M. Walford

Smart Systems Ltd

10 September 2010

Test report number 265170-2



0578

Tested on behalf of BRE by

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Date 10 September 2010

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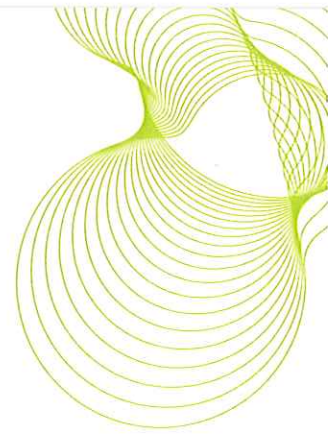
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1 Introduction

At the request of Mr. M. Walford of Smart Systems Ltd, Arnolds Way, Yatton, North Somerset, BS49 4UN, BRE issued proposal number 127554 on 13 July 2010. The proposal was accepted on 05 August and BRE tested a specimen door on 10 September 2010.

The tests to methods in BS 6375: Part 1: 2009, BS EN 1026¹, 1027² and 12211³ 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: 2009⁴ and BS EN's 12207⁵, 12208⁶, 12210⁷.

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 265170 in project number CV3986.

The tests were witnessed by:

Mr. M. Walford Smart Systems Ltd

Mr. D. White 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:

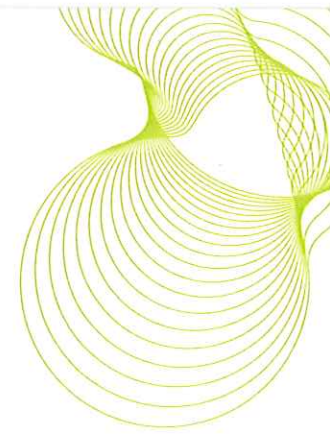
1. Air permeability to BS EN 1026: 2000; by application of a series of test air pressure differentials across the specimen with measurement of the air permeability of it at each pressure step. The maximum positive and negative pressure differential was 600 Pa reached in pressure steps of 50, 100, 150, 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 1050 Pa. Pressure (Pa)/time (min) steps were 0/15, 50/5, 100/5, 150/5, 200/5, 250/5, 300/5, 450/5, 600/5, 750/5, 900/5 and 1050/5.
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: $P1 = 1800$ Pa, $P2 = 900$ Pa and $P3 = 2700$ 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 door 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 14351-1:2006⁸ 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 an exposure category of 1800 (1800 Pa). The classifications set in BS 6375: Part 1: 2009 for an exposure category of 1800 are: Air permeability at Class 2/300 Pa or Classes 3 and 4 when tested to 600 Pa, watertightness at Class 5A/200 Pa and resistance to wind load at P1 1800 Pa, P2 900 Pa and P3 2700 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 Exxx 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.

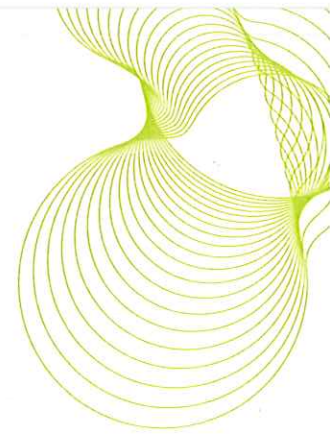
Resistance to wind load: BS EN 12210: 1999. The classification is based on a comparison of the resistance to wind loads of the test specimen when subjected to test pressures P1, P2 and P3. There are five classes; 1 up to 5 for P1 test pressures from 400 Pa to 2000 Pa. For specimens that are tested to P1 pressures exceeding 2000 Pa a class Exxxx is used. The xxxx 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 three outward opening bifold leafs. Reference: Smart Systems Ltd, 2704 wide mm x 2110 mm high Visofold Panorama bifold door.
- Glazing:** The door leafs are all internally glazed with insulating glass units with 4 mm thick toughened glass and a 20 mm air gap. Aluminium beads retain the glazing seals and the glazing.
- Seals:** The door frame carries a seal all around the opening toward the indoor edge. The door leafs have seals toward the outdoor edge. At each of the folding joints there are two seals. Each leaf has compression type and brush seals.
A sealant is applied to corner joints of the seals and other sealant is applied to the joints around the glazing beads.
- Hardware:** The left hand leaf (viewed from indoors) has a handle and key; these operate three Aliplast locking points and a latch. Each of the three locking points has a hook and straight bolt. Between the left hand and middle leafs there are four hinges. Between right hand and middle leafs there are also four hinges. The third hinge up has an integral pull handle. At each fold the top and bottom hinges also have integral trolley mechanisms. The right hand leaf has a handle at the left hand side that operates shoot bolts top and bottom.
- Fixings:** For these tests the specimen was fixed and sealed into a wood surround frame with screws at the top, bottom and sides.
- Detail:** In the bottom channel there are fifteen slots; three at each of five positions. In the underside of each bottom rail there is a pair of drainage holes and the nose of the sub-sill has drainage slots.
- Dimensions:** 2704 mm wide x 2110 mm high (overall). Area: 5.71 m²
Length of opening joint = 13.02 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 door was mounted in the BRE test rig 'G', to form one wall of a pressure box, with the outdoor face of the door enclosed in the box.

A single spray bar with six 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.

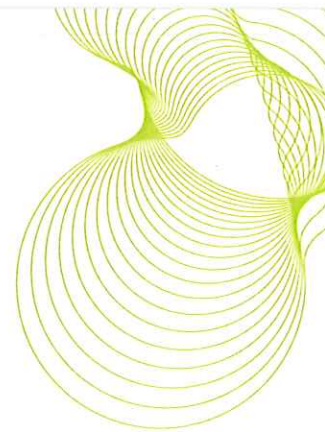
Transducers were mounted on independent supports to measure deflections of a frame member retaining an insulating glass unit. Deflections were measured on the span at the positions indicated in Figure 1.

6 Summary of test results

The test results are summarised in Table 1 below for an exposure category of 1800. Figures show detail of the door 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 2 to 300 Pa	Met the requirement of Class 3 based on the averages of readings in positive and negative tests	Class 5A at 200 Pa	Met & exceeded the require – ments. Class E1050 at 1050 Pa	Class 1800 P1 = 1800 Pa P2 = 900 Pa P3 = 2700 Pa	All met. Class 1800

Table 1. Summary of weathertightness test results



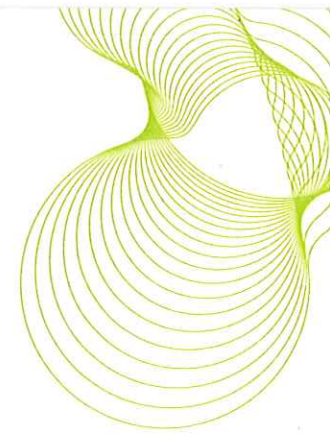
7 Conclusions

When the specimen Smart Systems Ltd, Visofold Panorama 2704 mm wide x 2110 mm high open outward bifold door was tested to the standards described herein it was found to be:

- Sufficiently airtight to attain Class 3 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 E1050 up to and at 1050 Pa thus **meeting and exceeding** the BS 6375: Part 1: 2009 requirements.
- Resistant to wind loads of ± 1800 Pa causing deflections less than $1/150$ of the span of a door leaf stile. Resistant to repeated pressure cycles of ± 900 Pa and able to sustain the corresponding safety test pressure of ± 2700 Pa. The overall classification for resistance to wind load is Class 1800 **meets** the requirements of Class A4 in 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. Weathertightness test results

Pressure differential Pa	Air flow through the specimen m ³ /h	Air flow per unit area of the specimen m ³ /h.m ²	Air flow per metre of opening joint m ³ /h.m
50	9.54	1.67	0.73
100	15.00	2.63	1.15
150	20.36	3.57	1.56
200	23.25	4.08	1.79
250	26.70	4.68	2.05
300	29.75	5.21	2.28
450	36.66	6.43	2.82
600	42.33	7.42	3.25

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

Pressure differential Pa	Air flow through the specimen m ³ /h	Air flow per unit area of the specimen m ³ /h.m ²	Air flow per metre of opening joint m ³ /h.m
50	10.46	1.83	0.80
100	16.83	2.95	1.29
150	23.44	4.11	1.80
200	28.33	4.97	2.18
250	35.42	6.21	2.72
300	43.58	7.64	3.35
450	72.49	12.71	5.57
600	94.83	16.62	7.28

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

Pressure differential Pa	Average air flow per unit area of the specimen m ³ /h.m ²	Average air flow per metre of opening joint m ³ /h.m
50	1.75	0.77
100	2.79	1.22
150	3.84	1.68
200	4.53	1.99
250	5.45	2.39
300	6.43	2.82
450	9.57	4.20
600	12.02	5.27

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

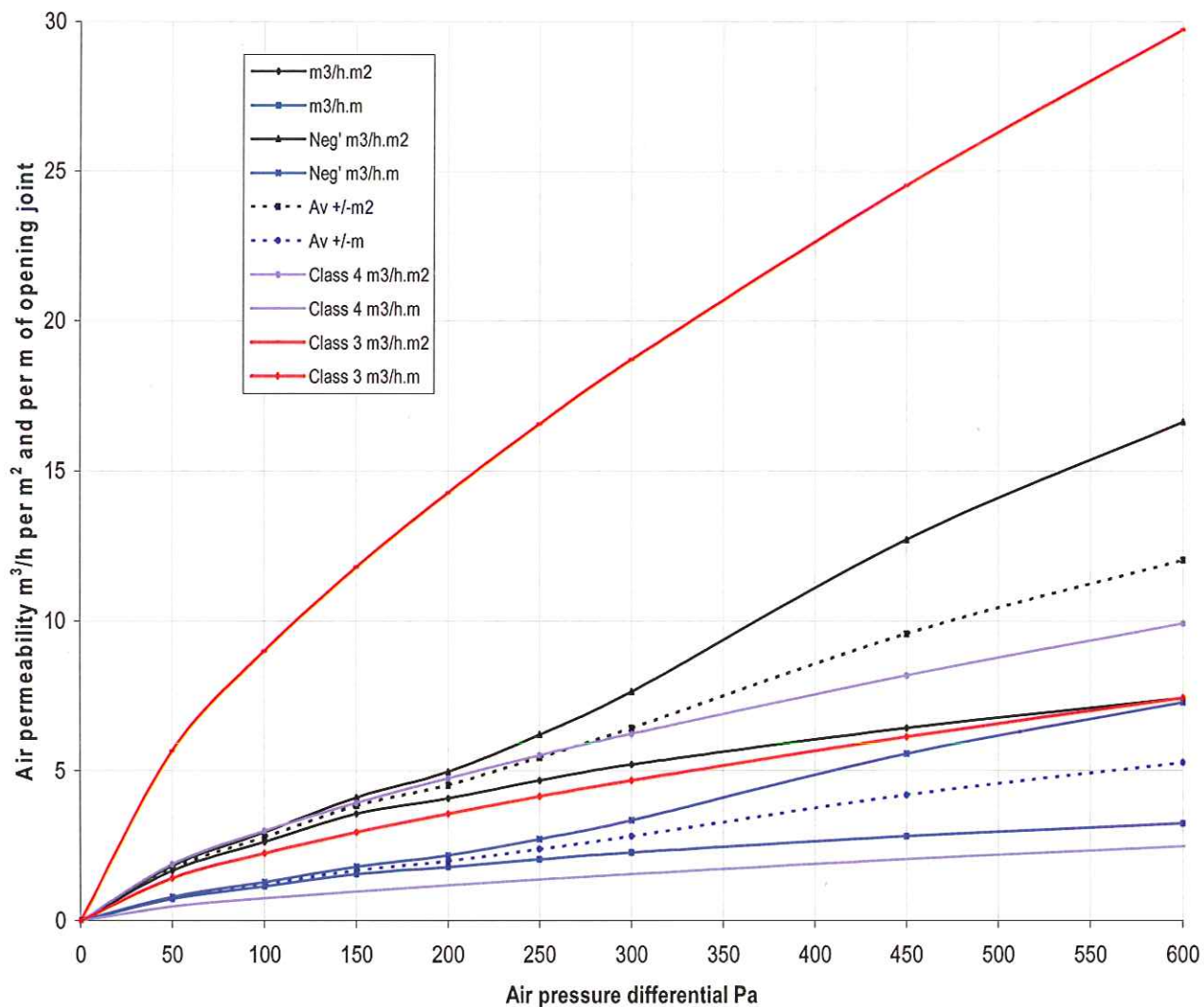
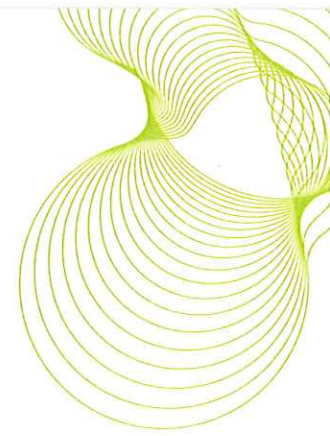


Figure A1. Air permeability under positive and negative air pressure; test results



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
750	5	Nil
900	5	Nil
1050	5	Nil

Test laboratory conditions: Air pressure 1009 mb. Relative humidity 66.8% at 19.1°C
Air temperature 19.1°C. Test chamber air temperature 19.0°C. Water temperature 18.5°C

Table A4. Watertightness test results

Resistance to wind load – Deflection test at ± 1800 Pa

Position deflection measured	Positive pressure P1 to +1800 Pa		Negative pressure P1 to - 1800 Pa	
	Deflection		Deflection	
	mm	defl./span	mm	defl./span
Left hand stile on the middle leaf	5.40	1/364	5.25	1/374

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 left hand stile in the resistance to wind load test at ±1800Pa.

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

Repeated pressure	Damage or functional defects
50 cycles to P2 at ± 900 Pa	None

Table A6. Damage or functional defects after repeated pressures to P2 at ± 900 Pa

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

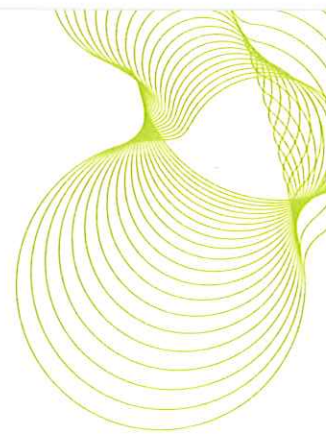
Pressure differential Pa	Air flow through the specimen m ³ /h	Air flow through the specimen as measured previously m ³ /h	Comparison to the air permeability measured previously (see Table A1)
50	9.61	9.54	After the test pressures P1 and P2 were applied the amounts of air flowing through the test specimen were not significantly different to those measured previously
100	15.08	15.00	
150	20.19	20.36	
200	22.51	23.25	
250	25.87	26.70	
300	28.35	29.75	
450	34.71	36.66	
600	41.08	42.33	

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 ³ /h	Air flow through the specimen as measured previously m ³ /h	Comparison to the air permeability measured previously (see Table A2)
50	9.61	10.46	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	15.75	16.83	
150	22.36	23.44	
200	27.33	28.33	
250	33.68	35.42	
300	42.17	43.58	
450	69.71	72.49	
600	91.96	94.83	

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 + 2700 Pa	No parts became detached and the test specimen remained closed

Table A9. Condition of the door after the safety test to P3 at ± 2700 Pa



Figure A1. Smart Systems Visofold Panorama open outward bifolding door in the BRE Test rig 'G'

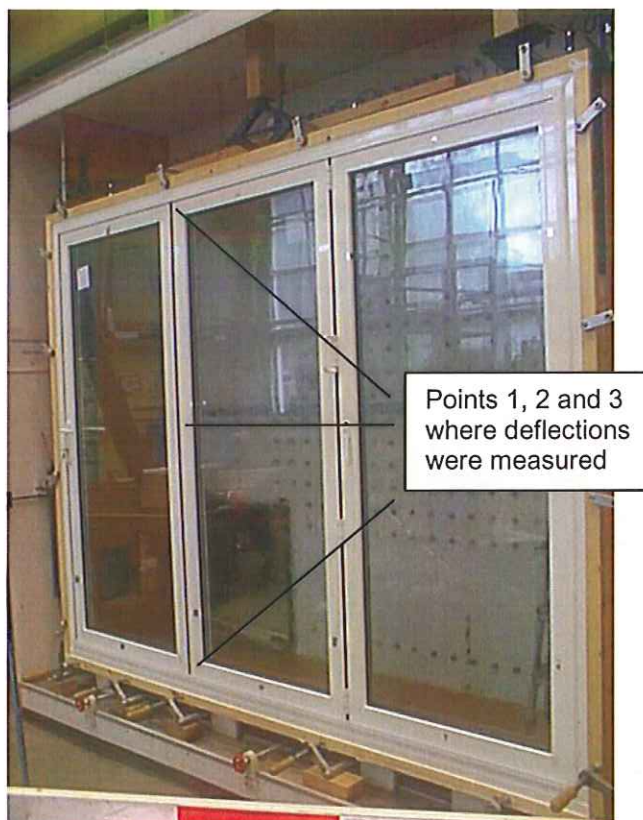


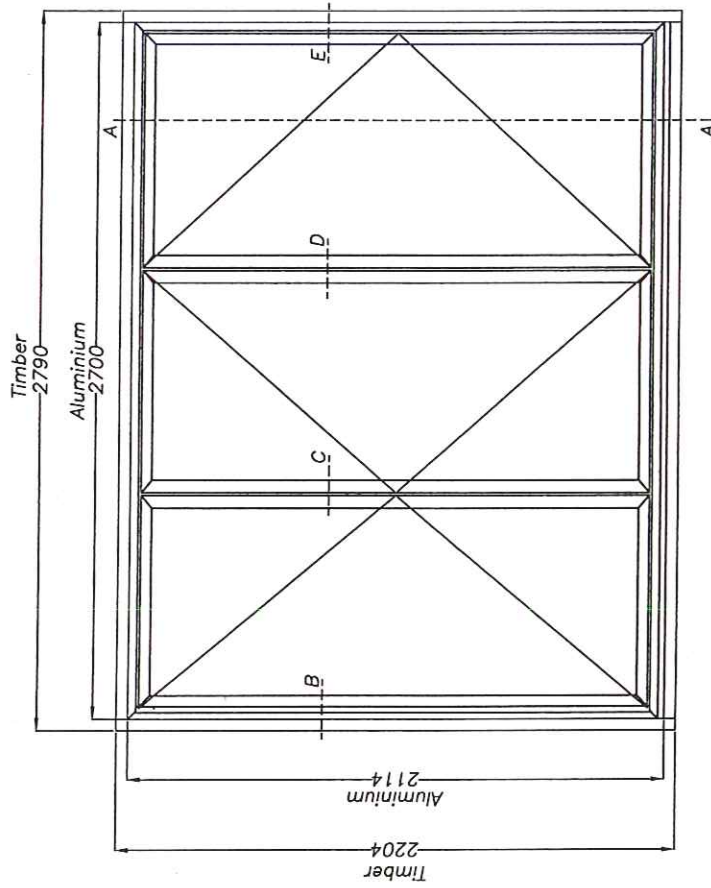
Figure A2. Smart System open outward bifolding door showing points where deflections were measured

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SCALE 1:20

TECHNICAL INFORMATION



DESCRIPTION

1No. 2790w x 2204h (including timber surround) thermally broken sliding/folding door for testing to BS6375. Fitted with multipoint lock to master leaf and shootbolts to folding leaf.
Glazed with 4/16/4 clear toughened double glazed units.

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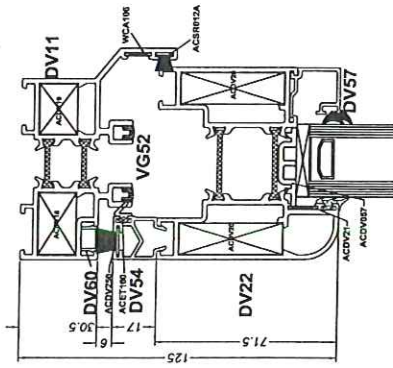
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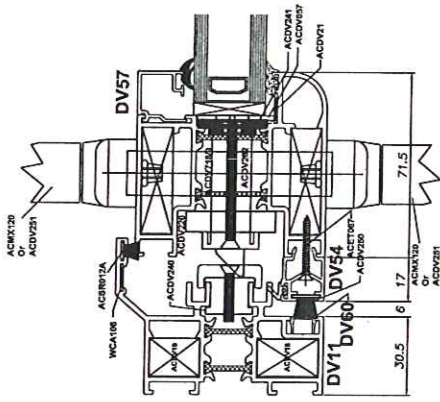
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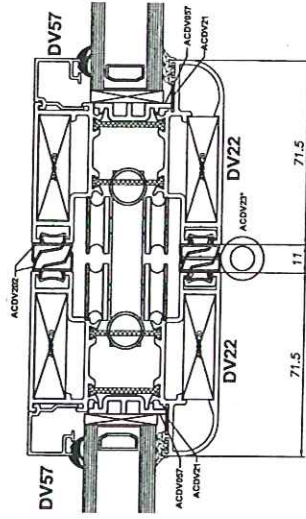
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DETAIL A



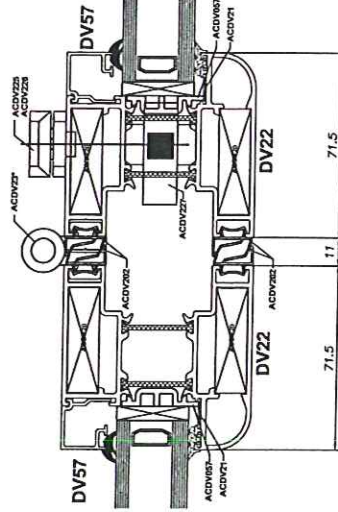
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DETAIL B



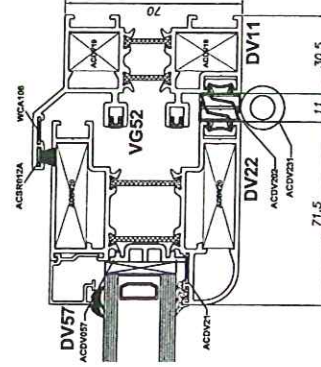
SCALE 1:2
DETAIL C



SCALE 1:2
DETAIL D



SCALE 1:2
DETAIL E



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