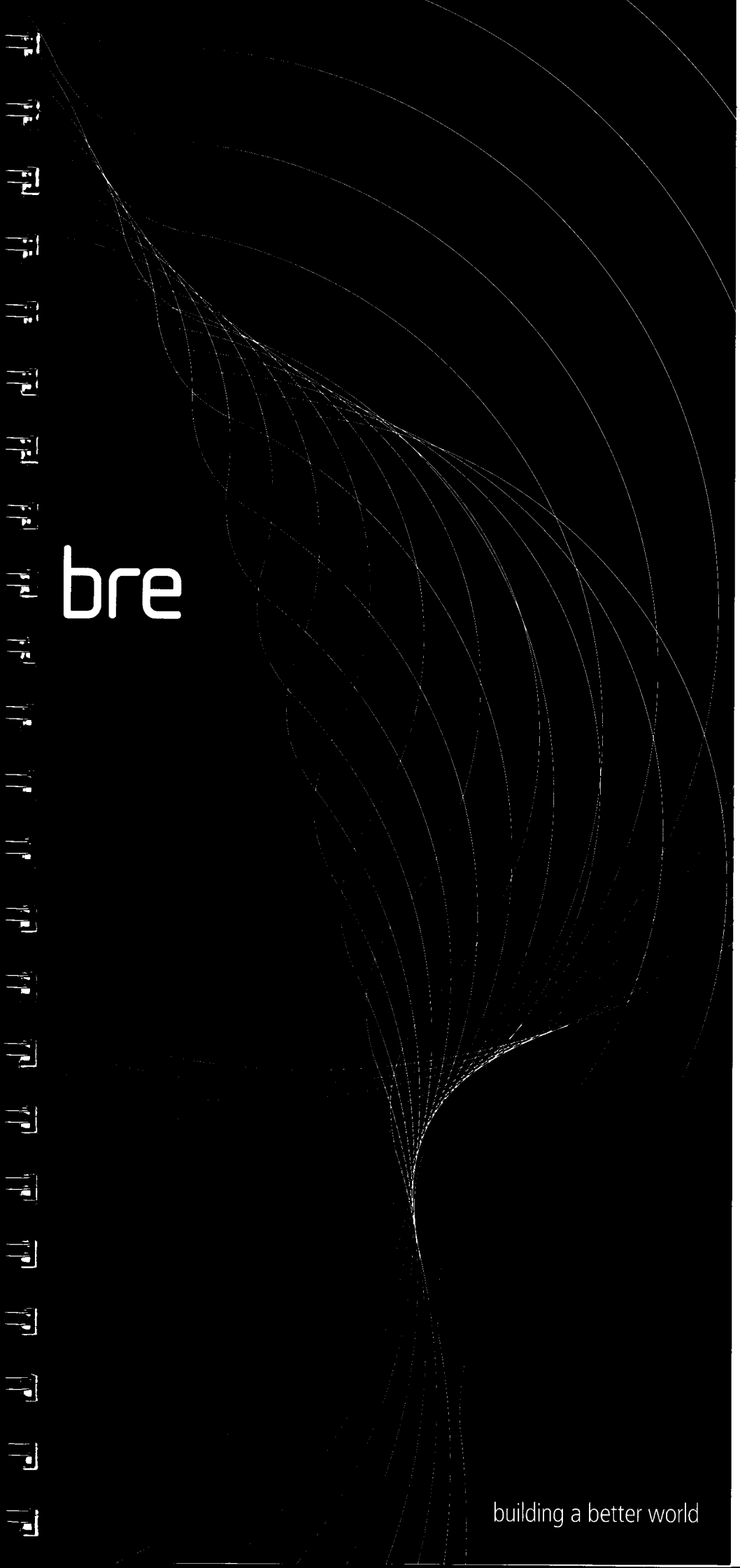

Weathertightness test on an AM Profiles Ltd Design 5 aluminium and wood framed window to BS 6375: Part 1: 2004

Prepared for: Mr R. Moreton

AM Profiles Ltd

08 May 2006

Test report number 229 098

UKAS TESTING

0578

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1 Introduction

At the request of Mr R. Moreton of AM Profiles Ltd, Hardwick View Road, Holmewood Industrial Estate, Holmewood, Chesterfield, Derbyshire, S42 5SA, BRE issued proposal 117217 dated 21 March 2006. The client accepted this on 28 March 2006 and the specimen was delivered on 21 April and BRE tested it on 26th April and 8th May.

The tests assess the weathertightness of the specimen window with respect to air permeability, watertightness and resistance to wind loads against the performance requirements specified in BS 6375: Part 1: 2004[1].

The tests on the window were carried out under the BRE Standard Terms and Conditions of Business and to the UKAS BRE Specific Procedures Series F, as part of BRE project number CV1032/Job Number 229098.

2 Details of tests carried out

The weathertightness test on the test specimen was carried out to the requirements of BS 6375: Part 1: 2004, BS EN's 1026[3], 1027[4] and 12211[5] for air permeability, watertightness and resistance to wind load.

BS 6375: Part 1: 2004 specifies that the air permeability test is performed under both positive and negative test pressures, the watertightness to test procedure A and that deflection of framing members be limited to 1/150 of their lengths. BS 6375: Part 1: 2004 and BS ENs 12207[6], 12208[7] and 12210[8] classify the weathertightness performance of completely assembled windows of any material after testing to the methods below.

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 window 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.

2. Watertightness to BS EN 1027: 2000; by applying specified amounts of water spray to the outside face of the specimen window 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 300 Pa. Pressure (Pa)/time (min) steps were 0/15, 50/5, 100/5, 150/5, 200/5, 250/5 and 300/5, 450/5, 600/5, 750/5, 900/5 and 1050/5 Pascals.

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 = 2000 Pa, P2 = 1000 Pa and P3 = 3000 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

The classifications given in BS 6375: Part 1: 2004 are those suitable for the UK selected from the forgoing standards. According to BS 6375: Part 1 for a window to be included in an exposure category the test pressures for air permeability, watertightness and resistance to wind shall be attained or exceeded. The window was tested to a UK exposure category of 2000 (Pa).

The classifications from BS 6375: Part 1: 2004 for a UK exposure category of 2000 and air permeability measured up to 600 Pa has air permeability at Class 3 or 4/600 Pa, watertightness at Class 5A/200 Pa and resistance to wind load at Class 5, P1 2000 Pa, P2 1000 Pa and P3 3000 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:	Currently, neither BS 6375: Part 1: 2004 or BS EN 12207: 1999 give guidance on how to classify the performance of windows when the air permeability under positive and negative pressures are significantly different. BRE's interpretation is that separate classifications are given for the performances under positive and negative test pressures respectively.

4 Test specimen

Type: Aluminium/wood framed window with a side hung and two different sized top hung opening lights and two fixed lights. Reference: AM Profiles Ltd Design 5 window 1350 mm high x 1900 mm wide. BRE ref. No. 229098/1

Glazing: The opening lights and one fixed light are glazed from the outdoor face with insulating glass units with 4 mm thick clear glass and a 20 mm air gap. Aluminium snap-on beads retain the exterior glazing seals and the glazing. The other fixed light is glazed form indoors with the same sized insulating glass unit as the other lights but has timber beads internally.

Seals: At each opening light there are compression type seals on the fixed window frame. These seals are butt jointed at the corners. On the opening lights at the outdoor edge of the sash frames there are brush pile seals with central plastic fins. Also, around each opening in the fixed window frame there are seals that bear against the edge of the opening light frames when they are closed.
The glazing seals are Neoprene type externally and a adhesive foam type internally.

Hardware: Each opening light has four espagnolette locking bolts at the handle side and PN projecting variable geometry friction stays with adjustable friction. Each opening light also has two interlocking claws at the hinge edge. The small top hung light has guide plates at each side.

Drainage: Below each opening light there are two drainage slots that drain to either the transoms or sub-sill. The transoms drain to the sub-sill via the front of the mullions. Each light has drainage at the outdoor bottom edge.

Dimensions: 1350 mm high x 1900 mm wide (overall). Area: 2.57 m²
Length of opening joints = 8.18 m

Individual sizes of lights: Large top hung light 1250 mm high x 550 mm wide, small top hung light and fixed light below 590 mm high x 565 mm wide each and side hung light and fixed light above, 590 mm high x 550 mm wide each.

Configuration: Figure 1 shows the inside face of the window

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 five 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. Figures show detail of the window and detailed results are given in Annex 1.

Tests	BS EN requirements		Test specimen performance	
	Max. test pressures Pa	Requirements	Test results	Classification
Air permeability	600	Max. air leakage rate at 600 Pa not to exceed: 9.91 $m^3/h.m^2$ in Cl.4 2.48 $m^3/h.m$ in Cl.4 Negative pressures	At 600 Pa: 0.34 $m^3/h.m^2$ 0.11 $m^3/h.m$ 9.90 $m^3/h.m^2$ 3.10 $m^3/h.m$	 Class 4 Class 4 Class 4 overall Class 4 Class 4 Class 4 overall
Watertightness	1050	No leaks up to and at 300 Pa – Class 7A	No leaks up to and at 1050Pa	Class E1050
Resistance to ± wind load	P1 = 2000 P2 = 1000 P3 = 3000	At P1 and P2: Deflection of frame member not to exceed 1/150 No visible failures. Remain functional. Increase in air perm' not greater than 20% of the max. permissible air perm' for the class attained in the 1st air perm' test At P3: No parts become detached and specimen remains closed	max. 1/385 on a stile at -2000 Pa No failures. Functions OK. No significant increases under ± test pressures Intact and remained closed	Classification of relative frontal deflection: Class C Classification of wind load: Class 5 Overall Classification for resistance to wind load: C5

Table 1. Summary of weathertightness test results

7 Conclusions

When the specimen AM Profile Ltd Design 5, 1350 mm x 1900 mm, window was tested to the standards described herein the results were:

1. Air permeability – Met Class 4 under positive and negative test pressures.
2. Watertightness – Exceeded Class 7A at 300 Pa and met Class E1050.
3. Resistant to wind loads of ±2000 Pa causing deflections less than 1/300 of the span of an opening light stile, resistant to repeated pressure cycles of ±1000 Pa and able to sustain the corresponding safety test pressure of ±3000 Pa. The overall classification for resistance to wind load is Class C5 as in BS EN 12210: 2000. This meets the class (Class 5) set in BS 6375.

8 References

1. BS 6375: Part 1: 2004. Performance of windows and windows – Classification for weathertightness and guidance on selection and specification
2. BS EN 1026: 2000. Windows and windows – Air permeability – Test method. British Standards Institution, London.
3. BS EN 1027: 2000. Windows and windows – Watertightness – Test method. British Standards Institution, London.
4. BS EN 12211: 2000. Windows and windows – Resistance to wind load – Test method. British Standards Institution, London.
5. BS EN 12207: 2000. Windows and windows – Air permeability - Classification. British Standards Institution, London.
6. BS EN 12208: 2000. Windows and windows – Watertightness - Classification. British Standards Institution, London.
7. BS EN 12210: 2000. Windows and windows – Resistance to wind load - Classification. British Standards Institution, London.

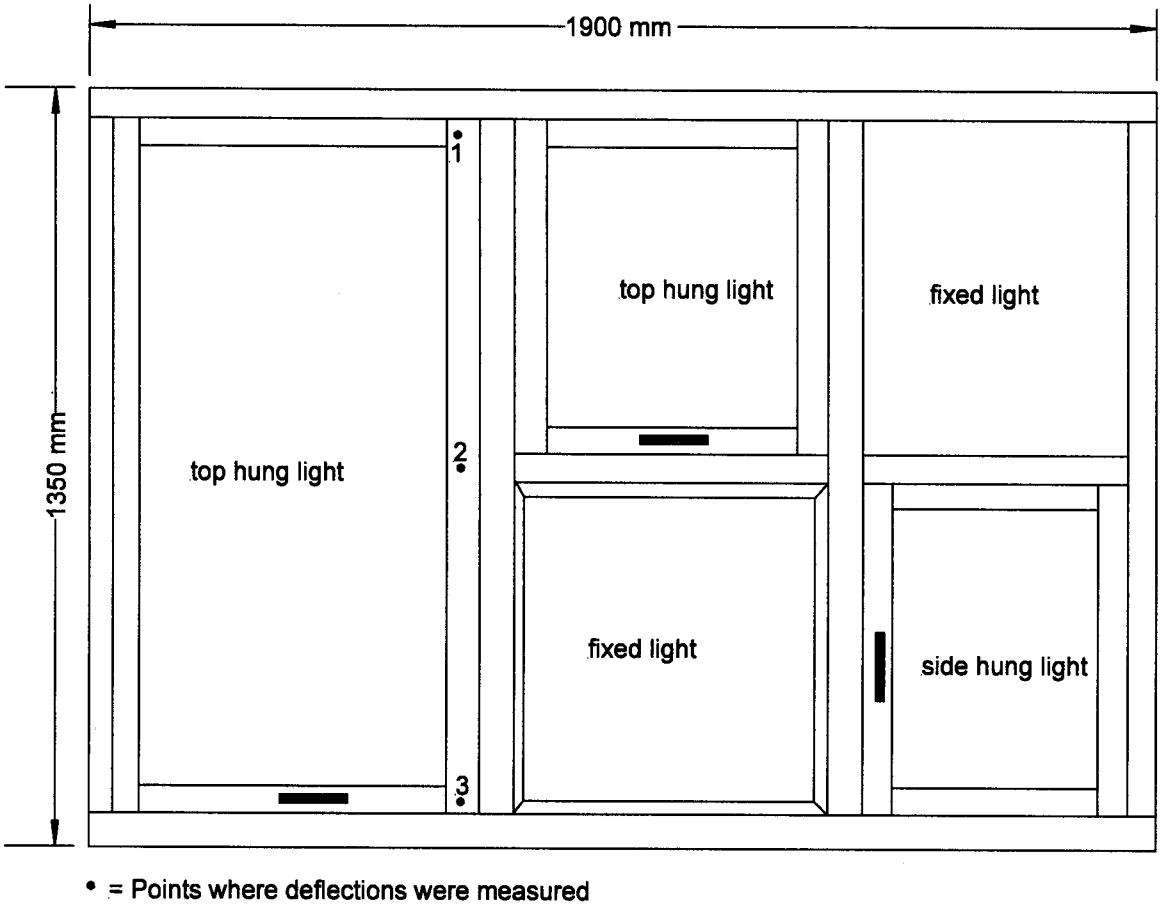

Figure 1. Outline sketch of the indoor face of the window showing points where deflections were measured.

ANNEX 1. Weathertightness test results

Air permeability test under positive air pressure

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	0.47	0.18	0.06
100	0.99	0.39	0.12
150	2.09	0.82	0.26
200	2.38	0.93	0.29
250	2.68	1.05	0.33
300	3.14	1.22	0.38
450	2.03	0.79	0.25
600	0.86	0.34	0.11

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

Air permeability test under negative air pressure

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	0.74	0.29	0.09
100	1.61	0.63	0.20
150	2.86	1.11	0.35
200	3.39	1.32	0.41
250	5.44	2.12	0.66
300	7.62	2.97	0.93
450	15.90	6.20	1.94
600	25.40	9.90	3.10

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

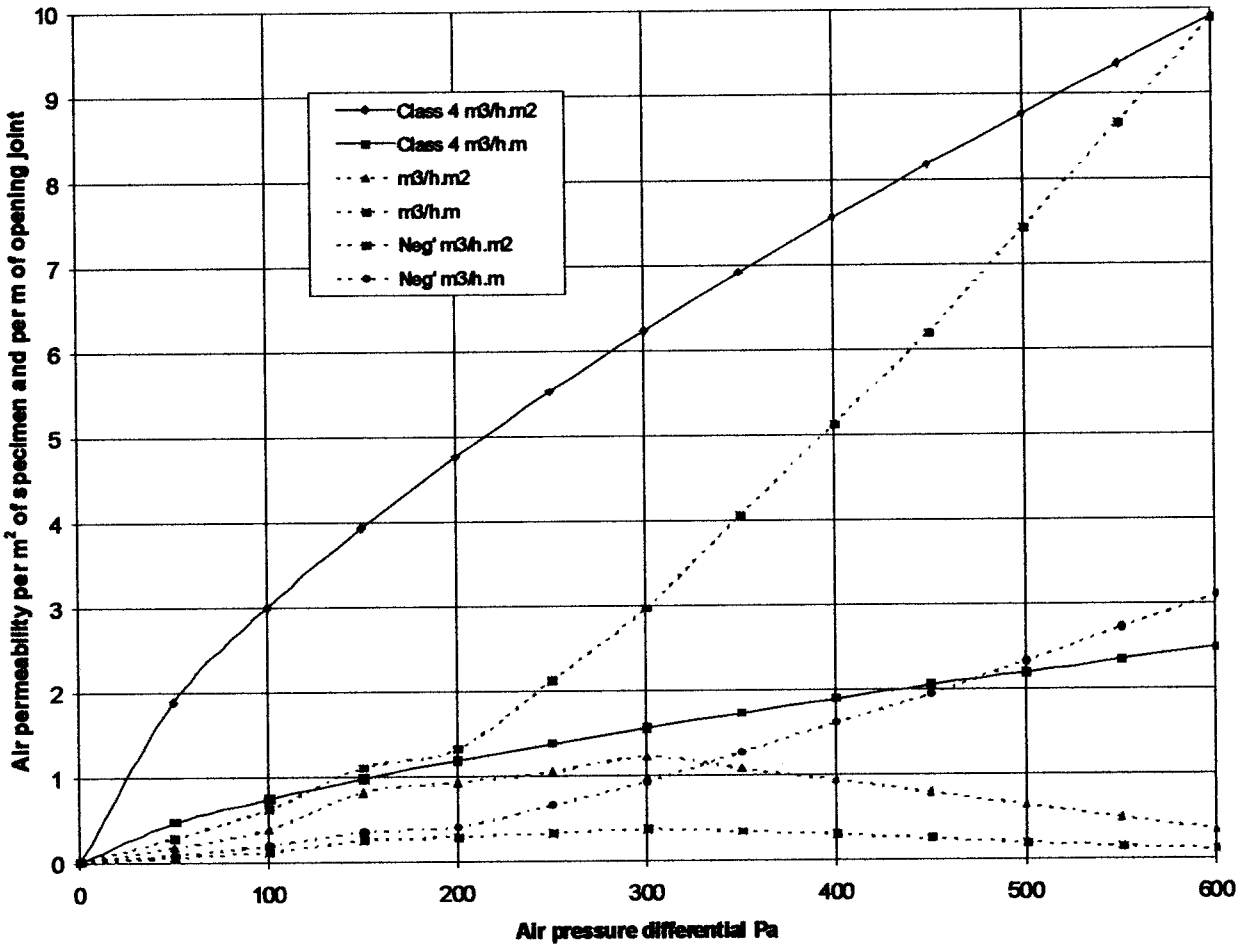

Figure A1. Air permeability under positive and negative air pressure; test results

Watertightness test

Pressure differential Pa	Duration Minutes	Water leaks
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 temperature 19.1°C. Pressure box air temperature 19.3°C Air pressure 1010 mb. Relative humidity 43.5% at 19.1°C

Table A3. Watertightness results

Resistance to wind load – Deflection test at ± 2000 Pa

Position deflection measured	Positive pressure P1 to +2000 Pa		Negative pressure P1 to - 2000 Pa	
	Deflection		Deflection	
	mm	defl./span	mm	defl./span
Mid height of right hand stile on large side hung light	2.53	1/494	3.25	1/385

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 A4. Deflections measured on an opening light stile in the resistance to wind load test at ± 2000 Pa.

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

Repeated pressure	Damage or functional defects
50 cycles to P2 at ±1000 Pa	None

Table A5. Damage or functional defects after repeated pressures to P2 at ±1000 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	Comparison to the air permeability measured previously (see Table A1)
50	0.48	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	1.06	
150	2.09	
200	2.39	
250	2.40	
300	3.04	
450	1.98	
600	0.80	

Table A6. 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	Comparison to the air permeability measured previously (see Table A2)
50	0.66	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	2.30	
150	2.93	
200	3.69	
250	5.70	
300	8.48	
450	15.95	
600	25.30	

Table A7. 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 + 3000 Pa	No parts became detached and the test window remained closed

Table A8. Condition of the window after the safety test to P3 at ±3000 Pa

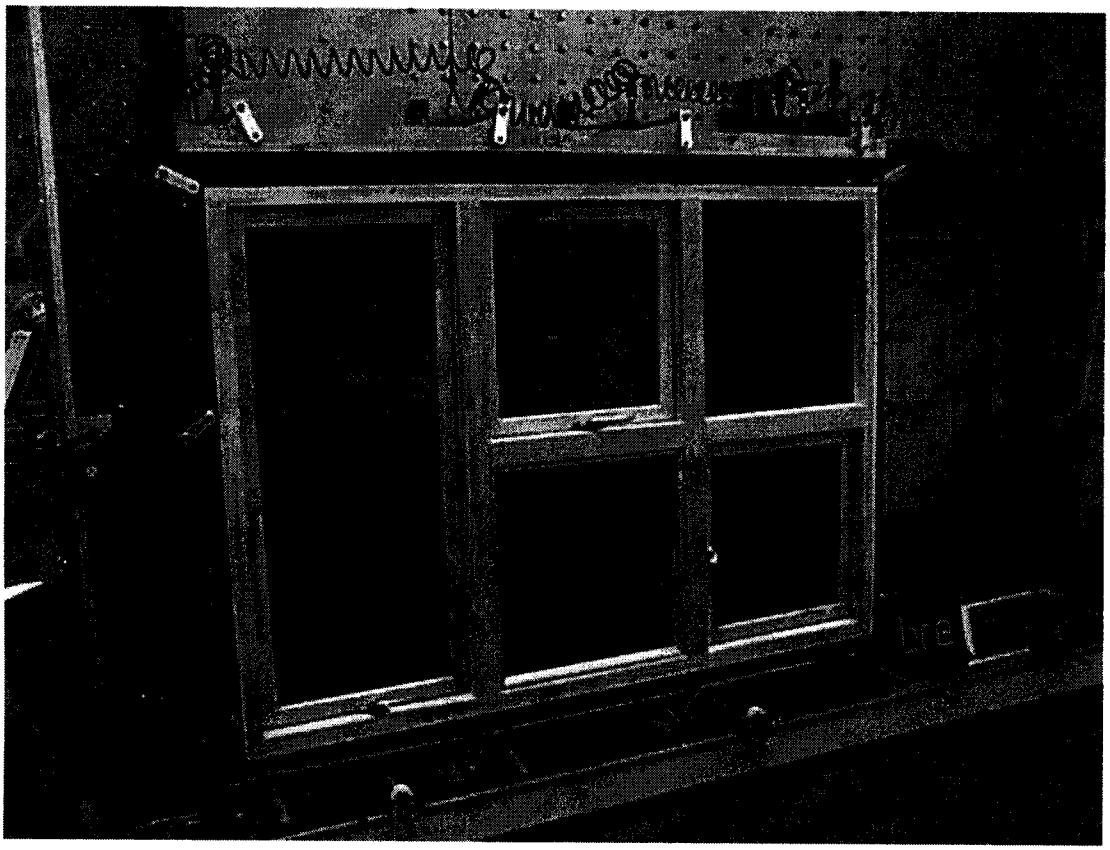

Figure A1. The AM Profile Design 5 test specimen mounted in the BRE test rig

Report ends