Weathertightness test to BS 6375: Part 1: 2004 on a Smart Systems Ltd Alitherm 47 window

Prepared for: Mr. Mark Walford

Smart Systems Ltd

10 September 2006

Test report number 231960

UKAS TESTING

0578

Tested by

Name	Malcolm Pound
Position	Laboratory Manager and Senior Consultant
Date	07 September 2006
Signature	M.C. Pound

Prepared by

Name	Malcolm Pound
Position	Laboratory Manager and Senior Consultant
Date	10 September 2006
Signature	M.C Pound

Approved on behalf of BRE

Name	Dr. P. Blackmore
Position	Associate Director of Centre for Materials and Engineering
Date	20-9-06
Signature	P Blackmore

BRE
Garston
WD25 9XX
T + 44 (0) 1923 664000
F + 44 (0) 1923 664010
E enquiries@bre.co.uk
www.bre.co.uk

BRE is not UKAS accredited to make opinions and interpretation. Any opinions and interpretations included as part of this report are clearly marked as such.

UKAS TESTING
0578

This report may only be distributed in its entirety and in accordance with the terms and conditions of the contract. Test results relate only to the items tested. BRE has no responsibility for the design, materials, workmanship or performance of the product or items tested. This report does not constitute an approval, certification or endorsement of the product tested.

This report is made on behalf of BRE. By receiving the report and action on it, the client – or any third party relying on it – accepts that no individual is personally liable in contract, tort or breach of statutory duty (including negligence).

© Building Research Establishment Ltd 2006

1 Introduction

At the request of Mr. M. Walford of Smart Systems Ltd, Arnolds Way, Yatton, North Somerset, BS49 4UN, BRE issued proposal number 118 323 on 23 August 2006. The proposal was accepted on 29 August 2006 and BRE tested a specimen window on 7 September 2006.

The tests to methods in BS 6375: Part 1: 2004, BS EN 1026[1], 1027[2] and 12211[3] measure the weathertightness of the specimen window in terms of air permeability, watertightness and resistance to wind load respectively. Classification of the results is based on BS 6375: Part 1: 2004[4] and BS EN 12207[5], 12208[6], 12210[7].

The tests on the specimen window were carried out under the BRE Standard Terms and Conditions of Business and to the UKAS BRE Specific Procedures Series F, as BRE Job number 231960 in project number CV1291.

© Building Research Establishment Ltd 2006

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, 1027 and 12211 for air permeability, watertightness and resistance to wind load.

BS 6375: Part 1: 2004 classifies the results for products in the UK. It also specifies that the air permeability test is performed under both positive and negative test pressures, water tightness test method A is used and that deflections measured during the resistance to wind 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 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 Pascals.

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 1200 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, 1050/5 and 1200/5.

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.

© Building Research Establishment Ltd 2006

3 Classification of results

According to BS 6375: Part 1: 2004 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 classifications given in BS 6375 are those suitable for the UK selected from the forgoing standards. The window was tested to a UK exposure category of 2400 (Pa).

The classifications from BS 6375: Part 1: 2004 for a UK exposure category of 2400 has air permeability at Class 2/300 Pa, watertightness at Class 7A/300 Pa and resistance to wind load at Class E2400, P1 2400 Pa, P2 1200 Pa and P3 3600 Pa. BS ENs 12207, 12208 and 12210 also classify the weathertightness performance of completely assembled windows of any material after testing to the methods referred to in Section 2.

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 is significantly different. BRE's interpretation is that separate classifications are given for the performances under positive and negative test pressures respectively.

© Building Research Establishment Ltd 2006

4 Test specimen

The general details about the test specimen supplied by Smart Systems Ltd for these tests are given below:

Type: Aluminium frame members with side and top hung opening lights and a fixed light.
Reference: Smart Systems Ltd 1200 mm x 1600 mm Alitherm 47 window.

Glazing: The three lights are all glazed from the outdoor face with insulating glass units with 4 mm thick toughened glass and a 16 mm air gap. Aluminium beads retain the glazing seals and the glazing.

Seals: The window frame carries a compression type seal, bonded at the corners and the opening light frames have a compression type seal continuous at the corners with a joint mid way along the bottom run. The glazing seals are Neoprene, mitred and bonded at the corners.

Hardware: Each opening light has a lockable operating handle that operates two espagnolette bolts and two shoot bolts per light. The opening lights are hung on Securistyle variable geometry friction stays.

Fixings: For these tests the specimen window was fixed and sealed into a wood surround frame with screws; four at top, bottom and sides.

Detail: The sill and bottom rails both have drain points. Three in the sill are connected to holes in the underside of the nose of the sub sill outside.
The window frame members are painted white.

Dimensions: 1208 mm high x 1610 mm wide (overall). Area: 1.95 m²
Length of opening joint = 5.71 m

© Building Research Establishment Ltd 2006

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 four 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.

© Building Research Establishment Ltd 2006

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.

BS or BS EN	Air permeability		Watertightness		Resistance to wind loads	
	Requirements	**Results**	**Requirement**	**Results**	**Requirements**	**Results**
BS 6375	Class 4 to 600 Pa	**Met** the requirements of Class 4 for positive and negative tests	Class 7A at 300 Pa	**Met** the require – ments. Class E1200 Pa	P1 = 2400 Pa P2 = 1200 Pa P3 = 3600 Pa	**All met.** Class E2400

Table 1. Summary of weathertightness test results

© Building Research Establishment Ltd 2006

7 Conclusions

When the specimen Smart Systems Ltd 1200 mm x 1600 mm Alitherm 47 window was tested to the standards described herein it was found to be:

- Sufficiently airtight to attain Class 4 under positive and negative test pressures thus **meeting and exceeding** the BS 6375: Part 1: 2004 requirements.
- Resistant to water penetration using method 1A to Class E1200 at 1200 Pa thus **meeting and exceeding** the BS 6375: Part 1: 2004 requirements.
- Resistant to wind loads of ±2400 Pa causing deflections less than 1/150 of the span of a sash stile. Resistant to repeated pressure cycles of ±1200 Pa and able to sustain the corresponding safety test pressure of ±3600 Pa. The overall classification for resistance to wind load is Class E2400. **Meets** the requirements of BS 6375: Part 1: 2004

8 References

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

© Building Research Establishment Ltd 2006

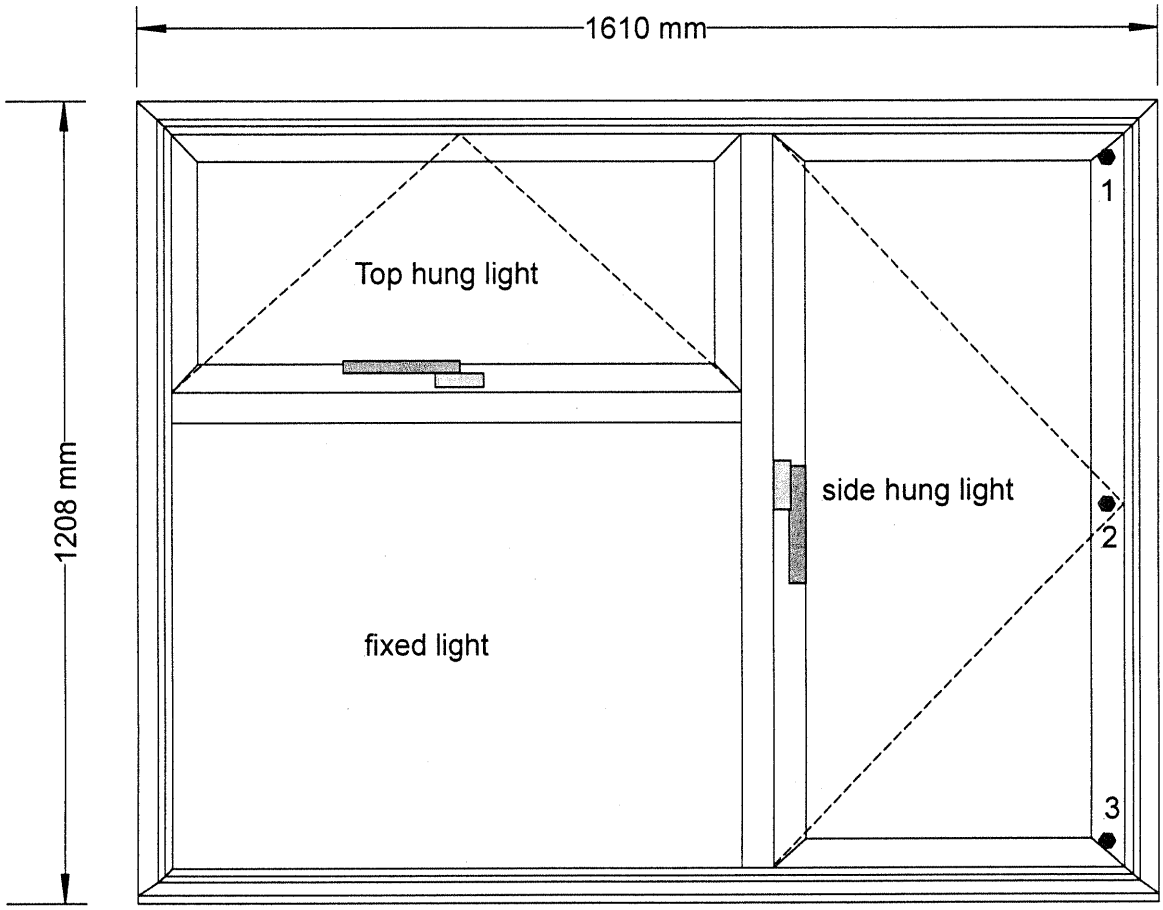

Figure 1. Outline sketch of the inside face of the window showing positions of deflection measurement points on a stile of the sash

© Building Research Establishment Ltd 2006

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	0.01	0.00	0.00
100	0.02	0.01	0.00
150	0.03	0.02	0.01
200	0.04	0.02	0.01
250	0.06	0.03	0.01
300	0.08	0.04	0.01
450	0.09	0.05	0.02
600	0.10	0.05	0.02

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	0.00	0.00	0.00
100	0.06	0.03	0.01
150	0.08	0.04	0.01
200	0.10	0.05	0.02
250	0.13	0.07	0.02
300	0.15	0.08	0.03
450	0.22	0.11	0.04
600	0.34	0.17	0.06

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

© Building Research Establishment Ltd 2006

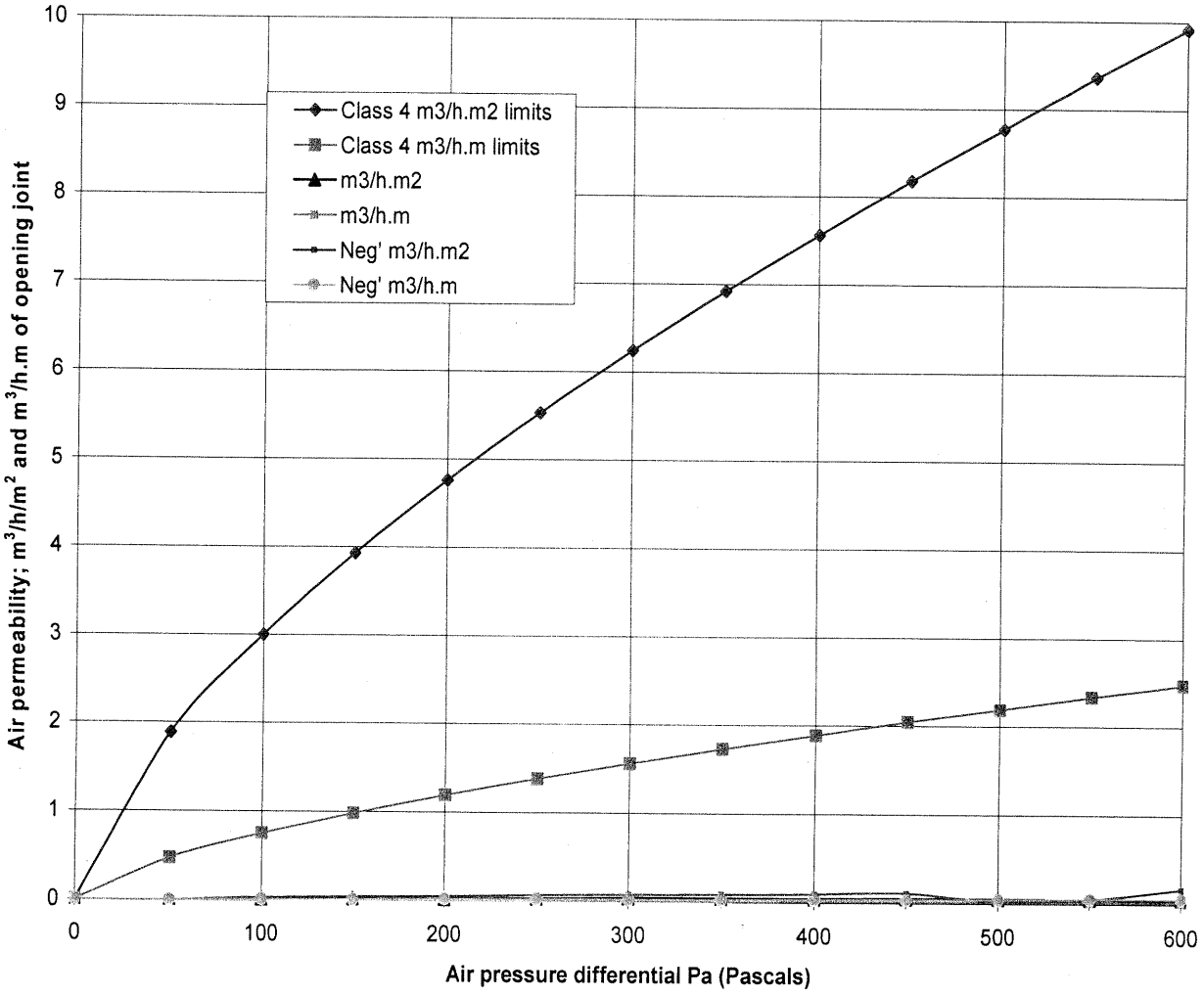

Figure A1. Air permeability under positive and negative air pressure; test results

© Building Research Establishment Ltd 2006

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
1200	5	Nil

Test laboratory conditions: Air temperature 21.9°C. Test chamber air temperature 20.9°C Air pressure 1011mb. Relative humidity 51.3% at 21.9°C. Water temperature 20.5°C

Table A3. 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 bottom opening light stile	0.56	1/1929	1.54	1/701

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 ± 2400 Pa.

© Building Research Establishment Ltd 2006

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

Repeated pressure	Damage or functional defects
50 cycles to P2 at ±1200 Pa	None

Table A5. Damage or functional defects after repeated pressures to P2 at ±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 m³/h	Comparison to the air permeability measured previously (see Table A1)
50	0.01	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	0.03	
150	0.04	
200	0.04	
250	0.05	
300	0.05	
450	0.06	
600	0.07	

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 m³/h	Comparison to the air permeability measured previously (see Table A2)
50	0.01	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	0.08	
150	0.09	
200	0.10	
250	0.16	
300	0.17	
450	0.25	
600	0.38	

Table A7. Second air permeability test results under negative air pressures

© Building Research Establishment Ltd 2006

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 window remained closed

Table A8. Condition of the window after the safety test to P3 at ±3600 Pa

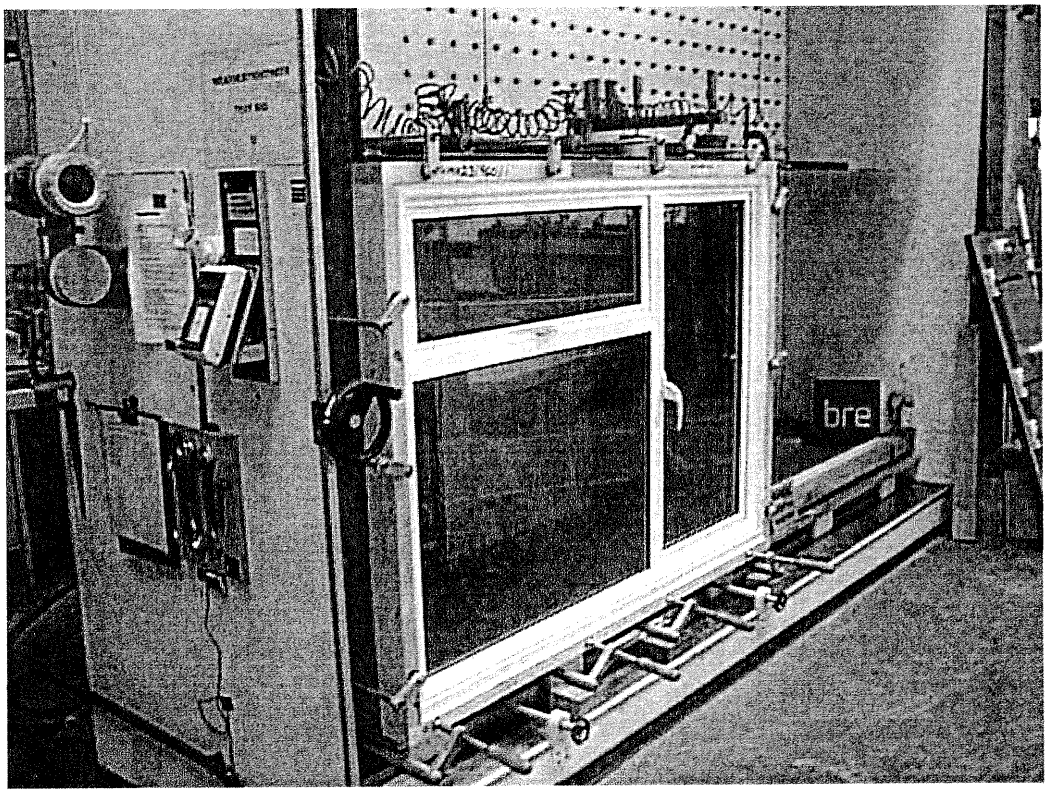

Figure 1. The Smart Systems Alitherm 47 window specimen in BRE Test rig 'G'

==========REPORT ENDS==========

© Building Research Establishment Ltd 2006