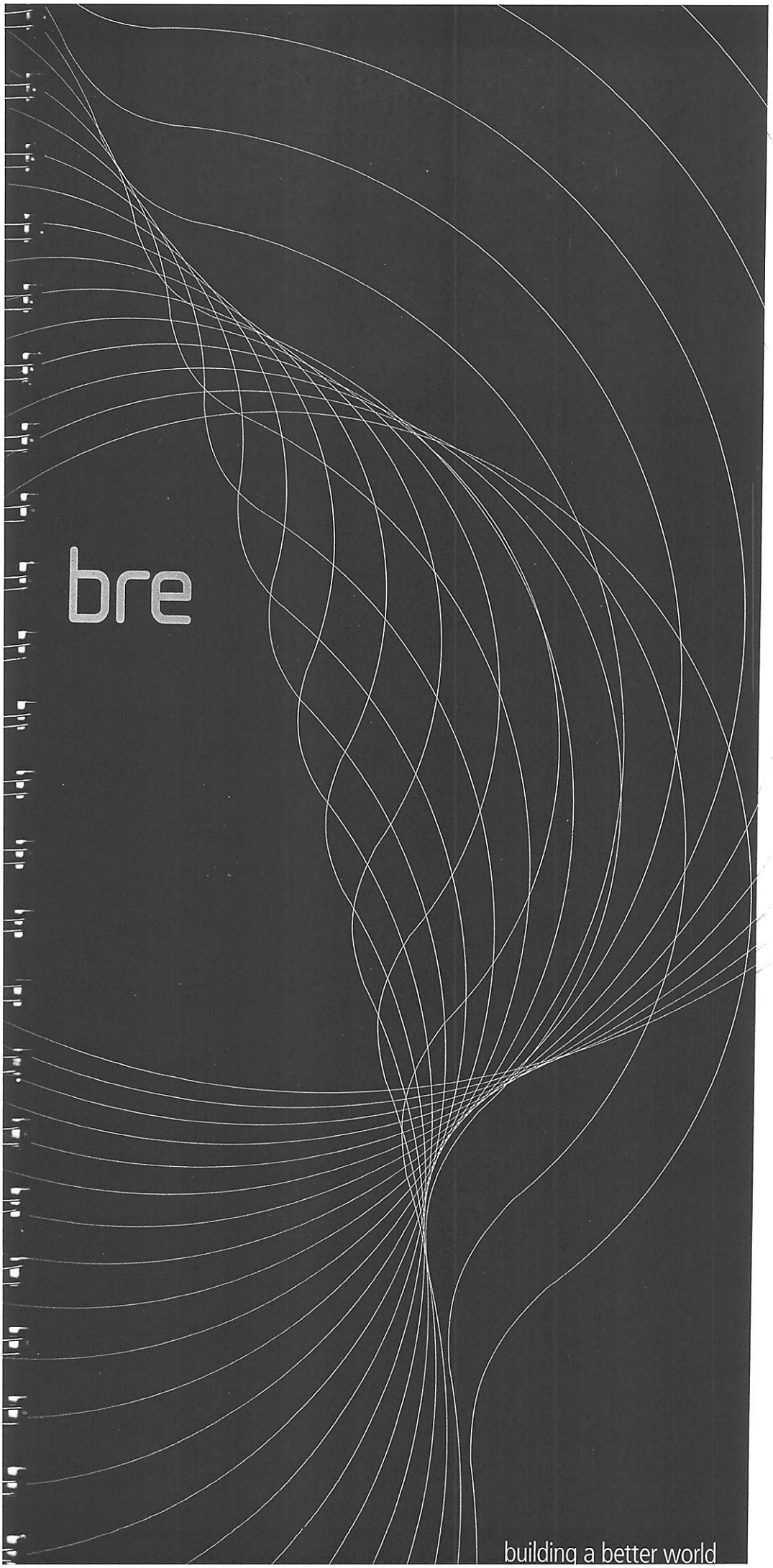

Air permeability tests on a Naturalight Systems Ltd glazed rooflight, 1734 mm wide x 2036 mm long.

Prepared for:
Mr. S. Johnston

Naturalight Systems Ltd

04 April 2009

Test report number 252249

Air permeability tests on a Naturalight Systems Ltd glazed rooflight, 1734 mm wide x 2036 mm long

Tested on behalf of BRE by

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Date	25 March 2009
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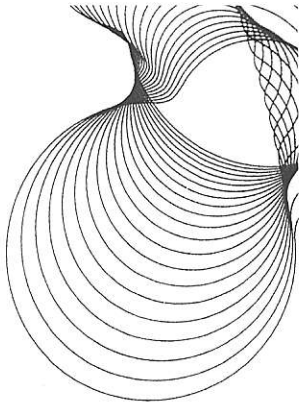


1 Introduction

At the request of Mr. S. Johnston, Naturalight Systems Ltd, Accessory House, Barrington Industrial Estate, Bedlington, Northumberland, NE22 7DQ, BRE issued proposal 124467 dated 13 March 2009. The client accepted this on 18 March and BRE tested a specimen glazed rooflight for air permeability on 25 March 2009.

The tests are based on methods in BS EN 12153[1] and measure the air permeability of the specimen rooflight. The results are expressed in m^3/h per test pressure increment as an overall leakage rate, leakage rate per m^2 of the external surface area and per metre length of fixed joints.

The air permeability test results were compared to the Building Regulations Part L2A 'reasonable limit' of 10 $m^3/h.m^2$ at 50 Pa and to the limits required for curtain walling.

The tests were carried out by Mr. M. C. Pound under the BRE Standard Terms and Conditions of Business as job number 252249, part of project number CV2943.

2 Details of air permeability tests carried out

The air permeability test was carried out based on the methods in *BS EN 12153: 2000 Curtain walling – Air permeability – Test method*, an air permeability test method for curtain walling. The client had indicated that the rooflight under test had features similar to and based on curtain walling practice.

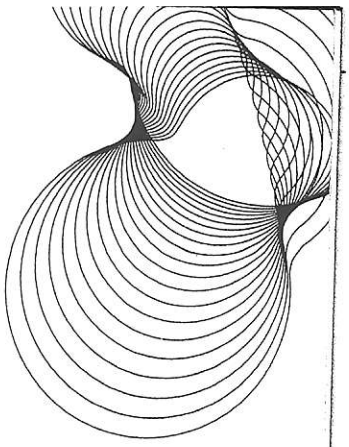
Air permeability to BS EN 12153 is by application of a series of test air pressure differentials across the specimen with measurement of the air permeability of it at each pressure step. The maximum positive and negative pressure differential was 600 Pa reached in pressure steps of 25, 50, 100, 150, 200, 250, 300, 450 and 600 Pascals (Pa).

The air permeability test is performed first under a series of positive test pressures and then repeated under negative test pressures.

3 Evaluation of results

Evaluation of the air permeability results was by comparison of them to the 'reasonable limit' of 10 $m^3/h.m^2$ at 50 Pa in *Building Regulations 2000 Conservation of fuel and power, Approved document L2A – Design limits for envelope standards, Clause 39 Air permeability.*

Comparison was also made to the air permeability requirements for curtain walling.



4 Test specimen

The general details about the glazed rooflight test specimen supplied by Naturalight Systems Ltd for these tests are below and drawings and photographs are given in the annex to this report:

Type: Rooflight with two non-opening glazed panels in an aluminium frame
Reference: Naturalight Systems Ltd glazed rooflight

Glazing: The light is glazed externally with insulating glass units that have 6 mm thick clear, toughened glass outdoors, a 12 mm air gap and 6.4 mm thick clear, 'k' laminated glass indoors. The glazing is retained against glazing seals on box section bars by screw on aluminium pressure plates with glazing seals. The pressure plates at three sides of the glazing have snap-on aluminium cover plates.

Seals: There are glazing seals around all of the glazing and sealant seals where the upstand joins the glazing bars. The bottom joint at one end of the glass has two rows of seals against the indoor face of the glass.

Fixings: For these tests the specimen was mounted onto a test rig against foam rubber seals around the perimeter and retained there with air and mechanical clamps.

Dimensions: 1734 mm wide x 2033 mm wide x 100 mm high (upstand) (overall).

The total area of the outdoor face is 5.32 m²

Length of fixed joints = 21.6 m

5 Test rig and preparatory procedures

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

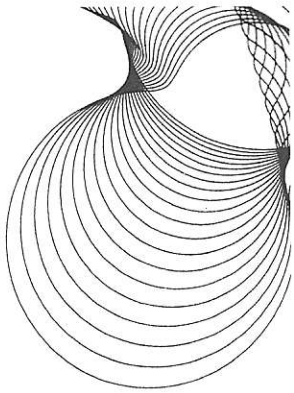
The test specimen was mounted vertically onto the BRE test rig to form a test chamber, with the indoor face of the specimen enclosed in that chamber.

Air was either pumped into or out of the test chamber, via an air pump, to generate either positive or negative test pressures. A calibrated manometer measures the differential air pressure in the test chamber and in the laboratory via a tapping and connecting pipe.

6 Information – Air permeability performance criteria

Building Regulations Approved document L2A 'reasonable limit' of 10 $m^3/h.m^2$ at 50 Pa.

BS EN 12152: 2002 Curtain walling – Air permeability - Performance requirements and classification. The maximum test pressure used in these tests was + and – 600 Pa. The corresponding class for curtain walling based on overall area when tested to 600 Pa is Class A4. Other classes at maximum test pressures of 150, 300 and 450 Pa are A1, A2 and A3 respectively. Up to and at these test pressures air permeability must not exceed 1.5 $m^3/h.m^2$ of overall area and based on air permeability per metre of fixed joint length the air leakage rate must not exceed 0.5 $m^3/h.m$ of fixed joint.



7 Summary of test results

The test results are summarised in Table 1 below. Figures showing details of the roof light and detailed results are given in the annex to this report.

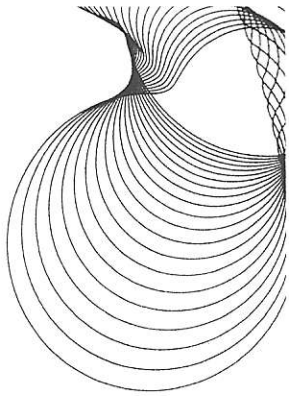
Air permeability	
Requirements	**Results**
Building regulations **10 $m^3/h.m^2$ at 50 Pa**	Overall area of the external face of the rooflight specimen is 5.32 m^2 0.66 $m^3/h.m^2$ at 50 Pa 1.46 $m^3/h.m^2$ at -50 Pa **Met** the requirement under positive and negative test pressures
BS 12152 for curtain walling at +/- 600 Pa, Class A4 **1.5 $m^3/h.m^2$ of overall area** **0.5 $m^3/h.m$ of fixed joint**	Fixed joint length at the external face of the rooflight specimen is 21.6 m 0.20 $m^3/h.m^2$ at 600 Pa. 18.56 $m^3/h.m^2$ at -600 Pa 0.05 $m^3/h.m$ at 600 Pa 4.57 $m^3/h.m$ at -600 Pa Meets Class A4 under positive test pressures only.
Notes:	Air permeability was greater under negative test pressures. The bottom most joint on the rooflight has no pressure plate. The glass there is supported on two rows of seals on the indoor face. Under the action of negative test pressures the glass lifts reducing the compression of the seals at the bottom joint and hence allowing more air to leak passed the seals there. The converse occurs under the action of positive test pressures.

Table 1. Summary of air permeability test results

8 Conclusions

When the specimen Naturalight Systems Ltd glazed rooflight with upstand described herein was tested to the method in this report it was found to be:

- Sufficiently airtight to meet the Building regulations air permeability requirement at 50 Pa under positive and negative test pressures.
- Sufficiently airtight to meet the air permeability requirements for curtain walling for Class A4 under positive test pressures only.
- Does not meet air permeability requirements for curtain walling for Class A1 under negative test pressures.
- Air leakage between glass and seals at the bottom joint is significant under negative test pressures.



ANNEX. Air permeability test results

Air permeability test under positive air pressure

Pressure differential Pa	Air flow through the specimen m³/h	Air flow per unit area of the specimen m³/h.m²	Air flow per metre of opening joint m³/h.m
25	3.07	0.58	0.14
50	3.53	0.66	0.16
100	3.58	0.67	0.17
150	3.36	0.63	0.16
200	0.98	0.18	0.05
250	0.01	0.00	0.00
300	0.22	0.04	0.01
450	0.15	0.03	0.01
600	1.05	0.20	0.05

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 m³/h	Air flow per unit area of the specimen m³/h.m²	Air flow per metre of opening joint m³/h.m
25	3.81	0.72	0.18
50	7.77	1.46	0.36
100	17.22	3.24	0.80
150	26.80	5.04	1.24
200	33.73	6.34	1.56
250	42.18	7.93	1.95
300	50.33	9.46	2.33
450	75.43	14.18	3.49
600	98.73	18.56	4.57

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

Pressure differential Pa	Average air flow per unit area of the specimen m³/h.m²	Average air flow per metre of opening joint m³/h.m
25	0.65	0.16
50	1.06	0.26
100	1.96	0.49
150	2.84	0.70
200	3.26	0.81
250	3.97	0.96
300	4.75	1.17
450	7.11	1.75
600	9.38	2.31

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

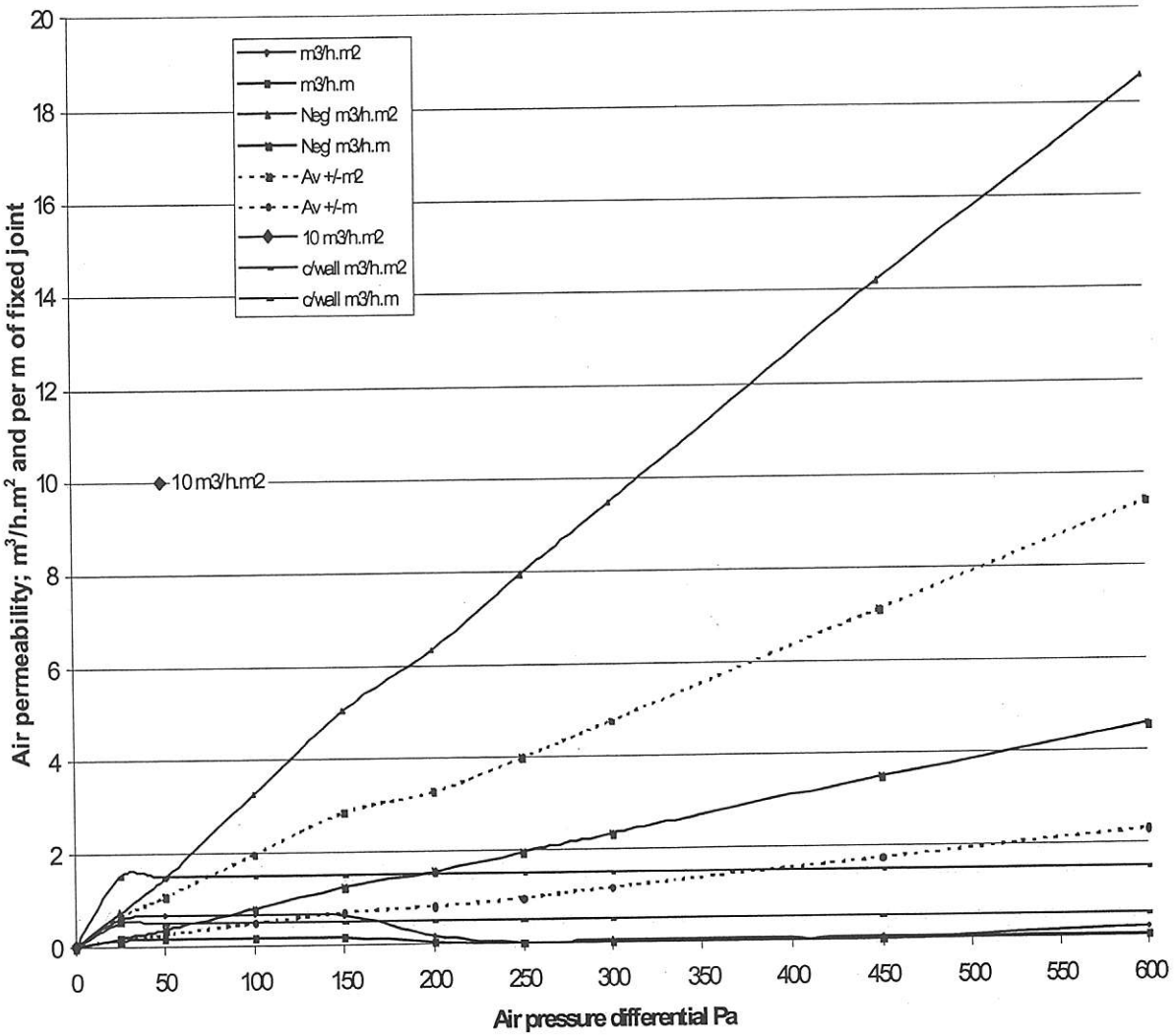


Figure A1. Air permeability per m² and per m of fixed joint under positive and negative air pressures and showing the averages of positive and negative air permeability measurements