WINTECH

WINDOW AND CLADDING
TESTING & LABORATORY
SERVICES

Technical Report

Report No R1570

UKAS TESTING
2223

Clement Windows Group Ltd

Forest House

West Bromwich Road

Walsall

West Midlands

WS5 4AN

Project

Cast 3 Rooflight System Test

Project Ref. 06/1118/WEL

8th March 2007

WINTECH ENGINEERING LIMITED, HALESFIELD 2, TELFORD, TF7 4QH, ENGLAND.
TEL: +44 (0) 1952 586580 FAX: +44 (0) 1952 586585 E-mail: testing@wintech-group.co.uk Web: www.wintech-engineering.com

Testing Conducted by:	Wintech Engineering Ltd Halesfield 2 Telford Shropshire TF7 4QH
Test Conducted at:	Above Address
Test Conducted for:	Clement Windows Group Ltd Forest House West Bromwich Road Walsall West Midlands WS5 4AN
Standard Specified:	BS 6375 pt 1: 2004, BS EN 1026: 2000, BS EN 12207: 2002, BS EN 1027:2000, BS EN 12208:2000, BS EN 12211:2000 BS EN 12210:1999, as per Method Statement; PSR/M1224/06/1118, dated 20th September 2006
Project No:	06/1118/WEL
Date of Test Sequence:	19th December 2006
Product Tested:	Clement Cast 3 Rooflight
Tests Performed:	As Listed in Section 5 – Test Procedures
Testing Conducted by:	D Price R W Withers

Report Compiled by:

A Peace
Technical Administrator

Technical Approval:
(Authorising Signatory)

R W Withers
Quality & Technical Manager

Contents

1. INTRODUCTION

This report describes tests conducted at the test laboratory of Wintech Engineering Ltd to a roof light sample on behalf of Clement Windows Group Ltd.

The test sequence was conducted on the 19th December 2006 in order to determine the weather tightness of the sample with respect to air permeability, water penetration and wind resistance. The test methods were generally in accordance with the following standards as requested by Clement Windows Group Ltd.

Performance of windows-Classification for Weather tightness guidance on selection and specification	BS 6375 pt 1: 2004
Windows & Doors - Air permeability test method	BS EN 1026: 2000
Windows & Doors - Air permeability classification	BS EN 12207: 2002
Windows & Doors - Watertightness test method	BS EN 1027: 2000
Windows & Doors - Watertightness classification	BS EN 12208: 2000
Windows & Doors - Wind resistance test method	BS EN 12211: 2000
Windows & Doors - Wind resistance classification	BS EN 12210: 1999

Testing was conducted in accordance with Method Statement PSR/M1224/06/1118, dated 20th September 2006, by Wintech Engineering Ltd.

Wintech Engineering Ltd is accredited by the United Kingdom Accreditation Service as UKAS Testing Laboratory No. 2223.

The test sample was supplied fixed to a timber sub-frame by Clement Windows Group Ltd and was mounted onto the test chamber by Wintech Engineering Ltd.

2. SUMMARY OF TEST RESULTS

The following summarises the results of testing carried out, in accordance with the relevant testing & classification standards;

Classification according to individual standards

	Test Method & Classification Standard	Test Pressure	Overall Classification
Air Permeability	BS EN 1026: 2000 BS EN 12207: 2000	600 Pa (Positive)	Class 3
		600 Pa (Negative)	N/A
Watertightness	BS EN 1027: 2000 BS EN 12208: 2000	600 Pa	Class 9A
Wind Resistance	BS EN 12211: 2000 BS EN 12210: 2000	P1: 2000 Pa P2: 1000 Pa P3: 3000 Pa	Class C5

More comprehensive details are reported in Section 6.

These results are valid only for the conditions under which the test was conducted

All measurement devices, instruments and other relevant equipment were calibrated and traceable to National Standards.

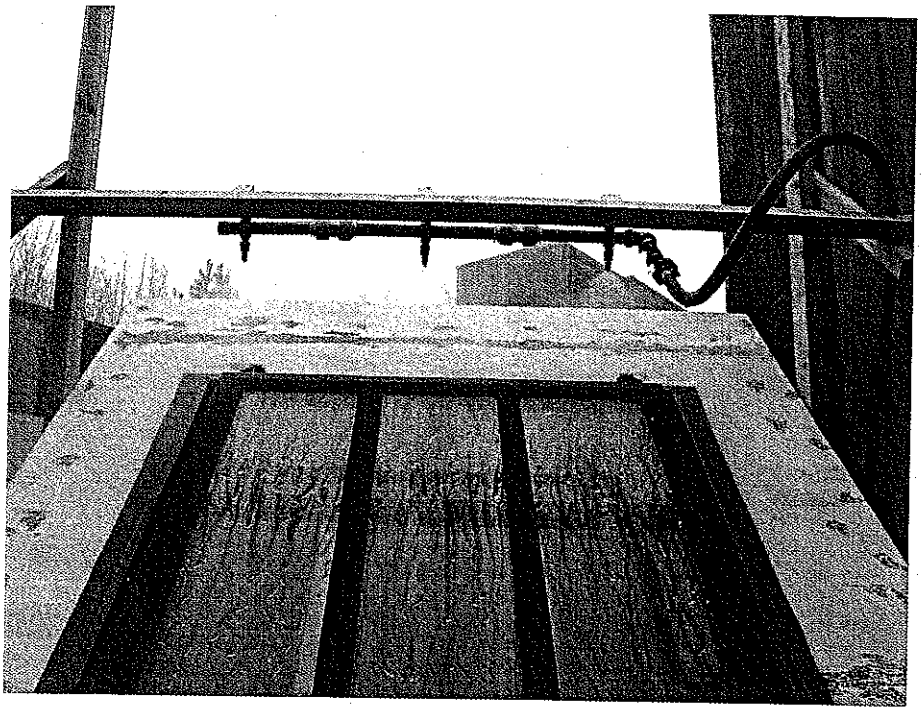
3. DESCRIPTION OF TEST SAMPLE

NAME OF SYSTEM:	Double glazed steel roof light Window system
MANUFACTURED BY:	Clement Windows S.R.L STR Zootehniei Fn Com. Paulesti, Jud Prahova Romainia, 107400
SAMPLE SIZE:	818 mm Wide x 1169 mm High
JOINING METHOD:	Mitred and Fully welded.
DRAWINGS:	2 no. Drawings attached
GLASS MAKE UP & THICKNESS:	Glazed with 24mm TGI sealed unit, Having stepped bottom edge using aluminium bead, glazing tape & silicone sealant. Outer – 4mm Toughened Float (Stepped area protected with black film to outer surface) Inner – 4mm Toughened Low 'E' (Stepped back at bottom by 55mm) Cavity – 16mm Argon Filled (Standard colour spacer bar)
GASKETS:	Draught Gasket 'A'
HARDWARE USED:	Hung on pair welded hinges, fitted welded mounting plates to frame & vent to accommodate vent operator type B1001
DRAINAGE:	Gravity
SEALANTS USED:	Silicone Sealant U9
SYSTEM:	Rooflight manufactured from 3.5 mm thick M.S. sheet curb pressings & 3 mm thick M.S. sheet vent pressings Mounted at an angle of 40° from the horizontal

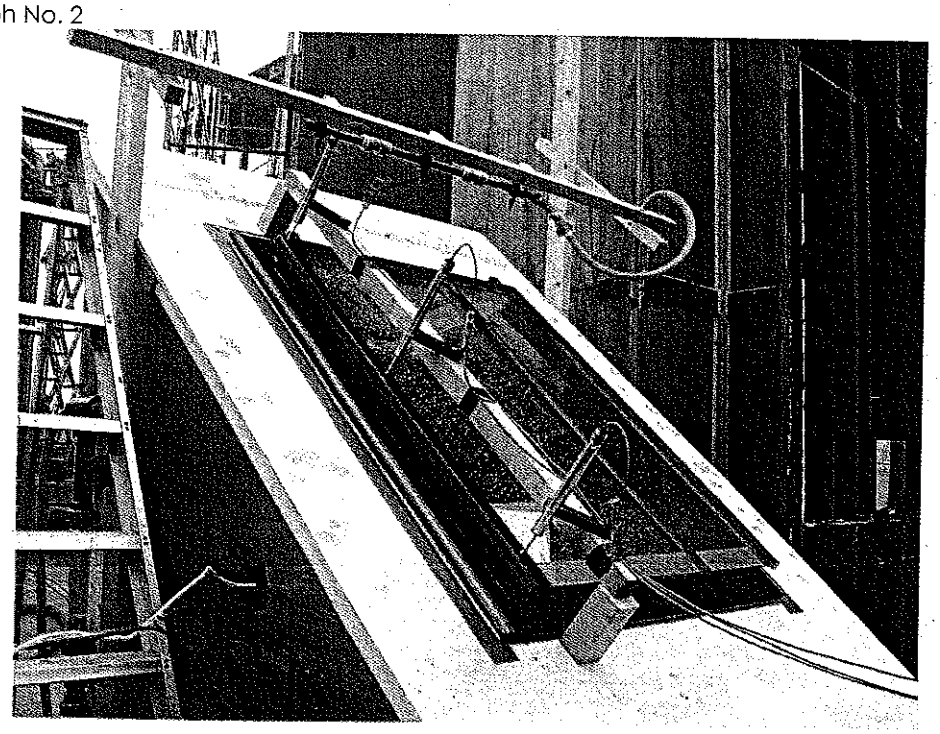
Sample information provided by Clement Windows. Drawings in Appendix A.

Test Sample during Testing

Photograph No. 1



Photograph No. 2



4. TEST ARRANGEMENT

4.1 TEST CHAMBER

The test chamber shall comprise of a well-sealed chamber constructed from plywood, timber and steel and shall be of sufficient strength and rigidity to withstand the test pressures likely to be imposed on it during testing.

A roof light specimen, supplied for testing in accordance with the relevant British and European Standards, was mounted onto the test chamber at an angle of 40° from the horizontal, with the same conditions of attachment and support, and same degree of restraint to lateral and vertical movement as in the expected on-site installation.

Representatives of Clement Windows installed the sample onto the test chamber.

4.2 INSTRUMENTATION

4.2.1 Static Pressure

A liquid manometer capable of measuring rapid changes in pressure to an accuracy within ±5%, was used to measure the pressure differential across the sample.

4.2.2 Air Flow

An air flow meter, mounted in the air system ducting was used to measure the airflow required to obtain pressures within the test chamber. The system has the capability of measuring airflow through the sample to an accuracy of ± 5%.

4.2.3 Water Flow

An in line flow meter, mounted in the spray bar water supply system, was used to measure water flow to the test sample to an accuracy of 10% (as required by BS EN 1027: 2000).

4.2.4 Deflection

Digital linear measurement devices with an accuracy of 0.1 mm will be used to measure deflection of the sample. These measurement devices will be positioned at characteristic points stated in the specification and mounted in such a way that any measurement will not be influenced by the application of any pressures or loading to the sample.

4.2.5 Temperature & Humidity

A digital data logger capable of measuring temperature with an accuracy of ± 1°C and humidity with an accuracy of ± 5 %Rh will be used.

4.2.6 Atmospheric Pressure

A digital barometer was used to take atmospheric pressure readings ± 1Kpa.

4.2.7 Relative Humidity

An environmental conditions data logger was used for relative humidity readings with an accuracy within ± 5%.

4.3 PRESSURE GENERATION

4.3.1 Static Air Pressure

The air supply system comprised of a centrifugal fan assembly and associated ducting and control valves and was used to create both positive and negative static pressure differentials. The fan provided a constant airflow at the required pressure and period required for the tests.

Note: References are made to both positive and negative pressures in this document, it should be noted that in these instances, positive pressure is when pressure on the weather face of the sample is greater than that on the inside face and vice versa.

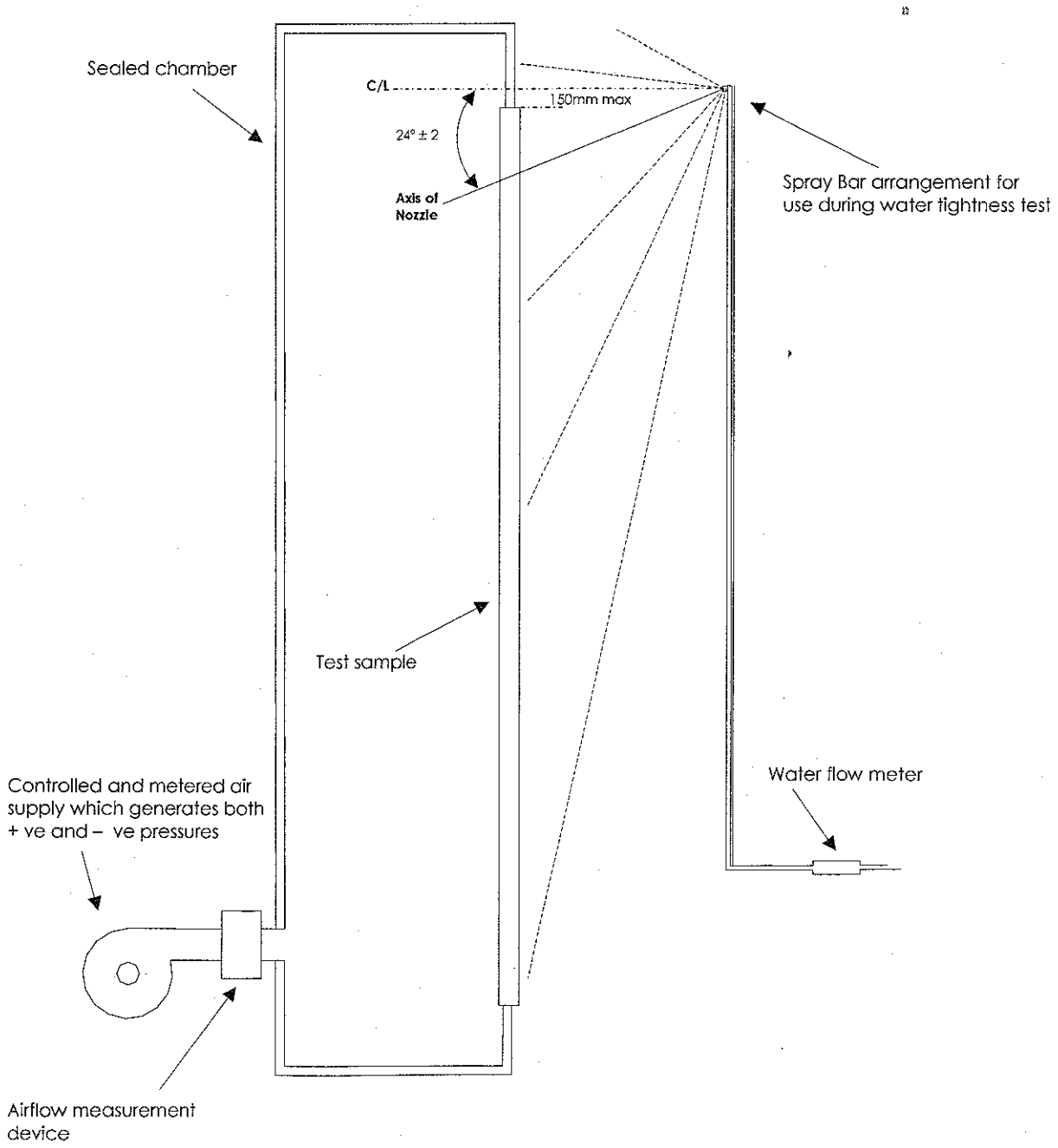
4.4 WATER SPRAY & ARRANGEMENT

The spray nozzles have a circular full cone spray pattern and a spray angle of 120° (+0°/–10°) at working pressure of 2 – 3 bar and a flow rate of 2 litres/min (± 0.2 litres/min) per nozzle. The nozzles were spaced at 400 mm (± 10mm) along the axis of the spraybar and the nozzles were arranged so that the lateral distance between the outer edge of the surround and the outermost nozzles was not greater than 50mm and did not exceed 250mm.

The nozzle line was located not more than 150mm above the topmost horizontal joint line of any moving frame or the glazing line of any fixed glazing, in order to provide complete wetting of the adjacent horizontal frame member(s). The nozzle line was also located at a distance of 250mm (+10mm/- 0mm) from the external face of the specimen as defined by the outermost external joint plane of moving parts or the glazing plane of fixed parts.

Figure 1

GENERAL ARRANGEMENT OF TEST CHAMBER



5. TEST PROCEDURES

5.1 SEQUENCE OF TESTING

1a. Air Permeability – Infiltration
1b. Air Permeability – Exfiltration
2. Watertightness
3. Wind Resistance, P1
4. Wind Resistance, P2
5a. Repeat Air Permeability – Infiltration
5b. Repeat Air Permeability – Exfiltration
6. Wind Resistance, P3

Note: BS 6375 Pt 1:2004 requires that the test sample be conditioned prior to testing for at least 4 hours at between 10 – 30°C & 25 – 75% RH, and that these conditions should be maintained throughout testing. However, as the testing was conducted outside it was not possible to control these conditions before or during the test.

5.2 AIR PERMEABILITY

5.2.1 Infiltration

Three (3) preparatory pulses of **660 Pa (110% of peak test pressure)** positive pressure were applied to the test sample and any opening lights opened and closed at least once.

The test results were determined by measuring the rate of air flow through the test chamber whilst subjecting the sample to positive pressure differentials as follows: **50, 100, 150, 200, 250, 300, 450 and 600 Pa**, each step being held for at least 10 seconds.

Leakage through the test chamber and joints between the chamber and test sample was determined by sealing the sample with adhesive tape and polythene sheeting and measuring the air flows at the above pressures. The preparation pulses and test sequence were then repeated with the sample unsealed and the difference between readings being the air leakage through the test sample.

5.2.2 Exfiltration

Three (3) preparatory pulses of **660 Pa (110% of peak test pressure)** negative pressure were applied to the test sample and any opening lights opened and closed at least once.

The test results were determined by measuring the rate of air flow through the test chamber whilst subjecting the sample to positive pressure differentials as follows: **50, 100, 150, 200, 250, 300, 450 and 600 Pa**, each step being held for at least 10 seconds.

Leakage through the test chamber and joints between the chamber and test sample was determined by sealing the sample with adhesive tape and polythene sheeting and measuring the air flows at the above pressures. The preparation pulses and test sequence were then repeated with the sample unsealed and the difference between readings being the air leakage through the test sample.

5.4 WATERTIGHTNESS

Any opening lights were opened and closed at least once before testing. Water was then sprayed on to the sample as per section 4.4, for 15 minutes at **0 Pa**. The water spray continued and the pressure was increased in the following increments: **50, 100, 150, 200, 250, 300, 450 and 600 Pa**, each stage being held for 5 minutes.

The interior face of the sample was continuously monitored for water ingress throughout the test.

5.5 WIND RESISTANCE

Note: Following each of the following tests, the sample was inspected for permanent deformation or damage.

5.5.1 Wind Resistance to Pressure P1 (Serviceability)

Three (3) pressure pulses were applied to the test sample equal to **2200 Pa (Pressure P1 + 10%)** positive pressure and each peak held for at least 3 seconds. After returning to zero (0) pressure, all sensors were then zeroed.

Peak test pressure **2000 Pa (Pressure P1)** was applied at a rate not exceeding 100 Pa/sec, either incrementally or continuously. Once the peak pressure was reached, it was maintained for a period of 30 seconds, and the required frontal deflections were recorded. The pressure was then reduced to 0 Pa, at a rate not greater than 100 Pa/sec, and the residual deformation was recorded within 60 ± 5 secs of returning to 0 Pa.

The test was then repeated at negative pressure.

5.5.2 Wind Resistance to Pressure P2

The sample was subjected to 50 cycles including negative & positive pressures.

The first step was at a test pressure of **1200 Pa (Pressure P2 = P1 x 0.5)** negative pressure and followed by **1200 Pa** positive pressure, as was the last of the sequence of 50 cycles. The time in which the variation from
Pressure P2 (negative) to Pressure P2 (positive) and the reverse was 7 secs (± 3 secs), with each peak being maintained for 7 secs (± 3 secs).

Following completion of the required 50 cycles, all moving parts of the test sample were opened and closed and note was taken of any damage or defects.

5.5.3 Wind Resistance to Pressure P3 (Safety)

The safety test consisted of one (1) cycle of a negative and positive test pressures, with the peak test pressure being **3600 Pa (Pressure P3 = P1 x 1.5)** and negative test pressure applied first.

The time in which the variation from 0 Pa to Pressure P3 (negative) and back to 0 Pa was 7 secs (± 3 secs) between each stage, with the peak being maintained for 7 secs (± 3 secs).

Positive test pressure was applied following a 7 secs (± 3 secs) rest at 0 Pa. Variation from 0 Pa to Pressure P3 (positive) and back to 0 Pa was the same duration as for the Pressure P3 (negative) test.

Once the test was completed, the sample was checked to determine whether it had remained closed and any if any parts of the sample which had become detached.

6. TEST RESULTS

6.1 AIR PERMEABILITY

Overall area of test sample = 1.67m²
Length of opening joints of test sample = 4.12 m

Note: **All test results were adjusted to standard atmospheric conditions using the equation given in BS EN 1026: 2000, as required by that standard.**

6.1.1 Allowable Air Permeability

6.1.1.1 Infiltration (Positive Pressure)

Class	Allowable air permeability @ 100 Pa ($m^3/h/m^2$)
0	*Not Tested*
1	50
2	27
3	9
4	3

Class	Allowable air permeability @ 100 Pa ($m^3/h/m$)
0	*Not Tested*
1	12.50
2	6.75
3	2.25
4	0.75

The required air permeability figures for all additional pressure steps in all classifications were calculated using the equation given in BS EN 1026: 2000 and method statement PSR/M1224/06/1118.

The air permeability after tests 3 & 4 (Wind Resistance P1 & P2) shall not exceed the upper limits of the claimed air permeability class by more than 20%.

6.1.1.2 Exfiltration (Negative Pressure)

According to BS EN 12207 Air Permeability - Exfiltration testing is optional, but in BS 6375 pt 1:2004 it is a mandatory test. However, there are no performance requirements contained within either standard for this test. The test results for exfiltration testing have been reported using the same criteria as that of Infiltration testing in this report.

6.1.2 Air Leakage Classifications

6.1.2.1 Infiltration

Total Area	Classification
Test 1a	3
Test 5a	3
Overall	**3**

Length of Joint	Classification
Test 1a	3
Test 5a	3
Overall	**3**

6.1.3 Tests 1a & 5a – Air Permeability – Infiltration

	Test No. 1a	Test No. 5a
Temperature °C	10.0	**6.8**
Humidity %RH	70.8	**95.9**
Atmos. Pressure KPa	102.1	102.2

6.1.3.1 Overall Area

Pressure Differential (Pa)	Air Permeability Rate ($m^3/hr/m^2$)	
	Test No 1a	Test No 5a
50	1.56	2.62
100	3.00	3.25
150	3.93	4.25
200	4.69	4.81
250	5.06	5.37
300	5.81	6.06

6.1.3.2 Length of Joint

Pressure Differential (Pa)	Air Permeability Rate ($m^3/hr/m$)	
	Test No 1a	Test No 5a
50	0.63	1.06
100	1.22	1.32
150	1.60	1.72
200	1.90	1.95
250	2.05	2.18
300	2.36	2.46

Figure 2

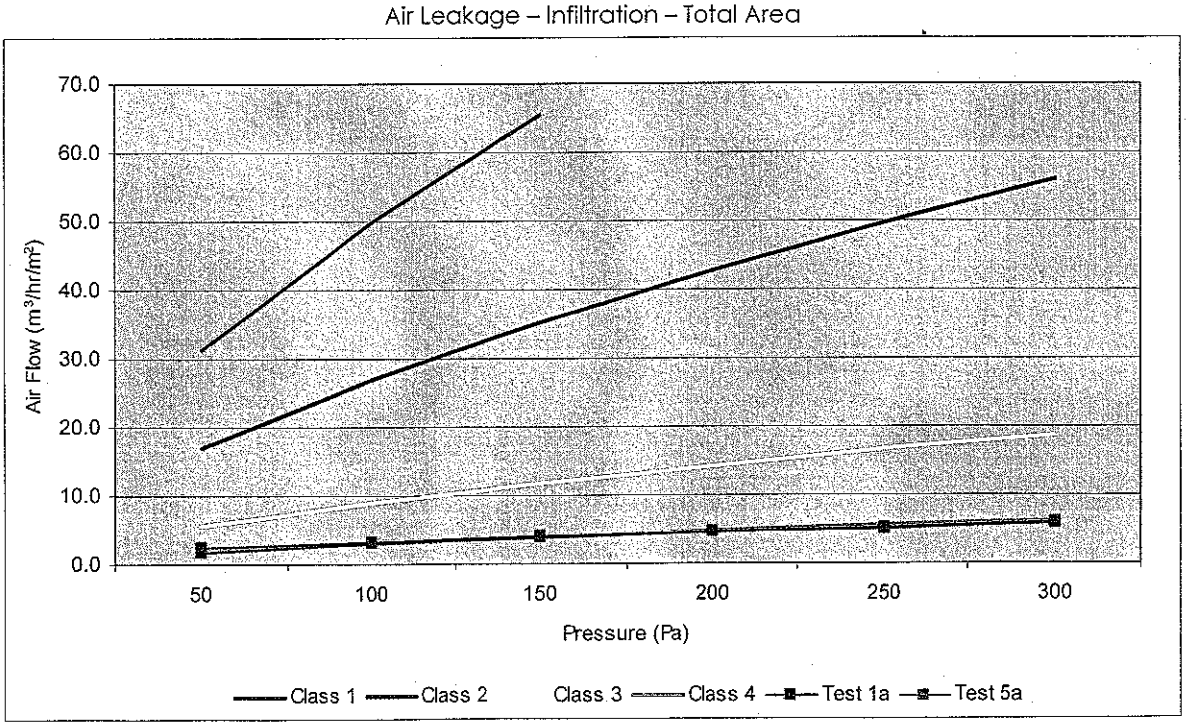
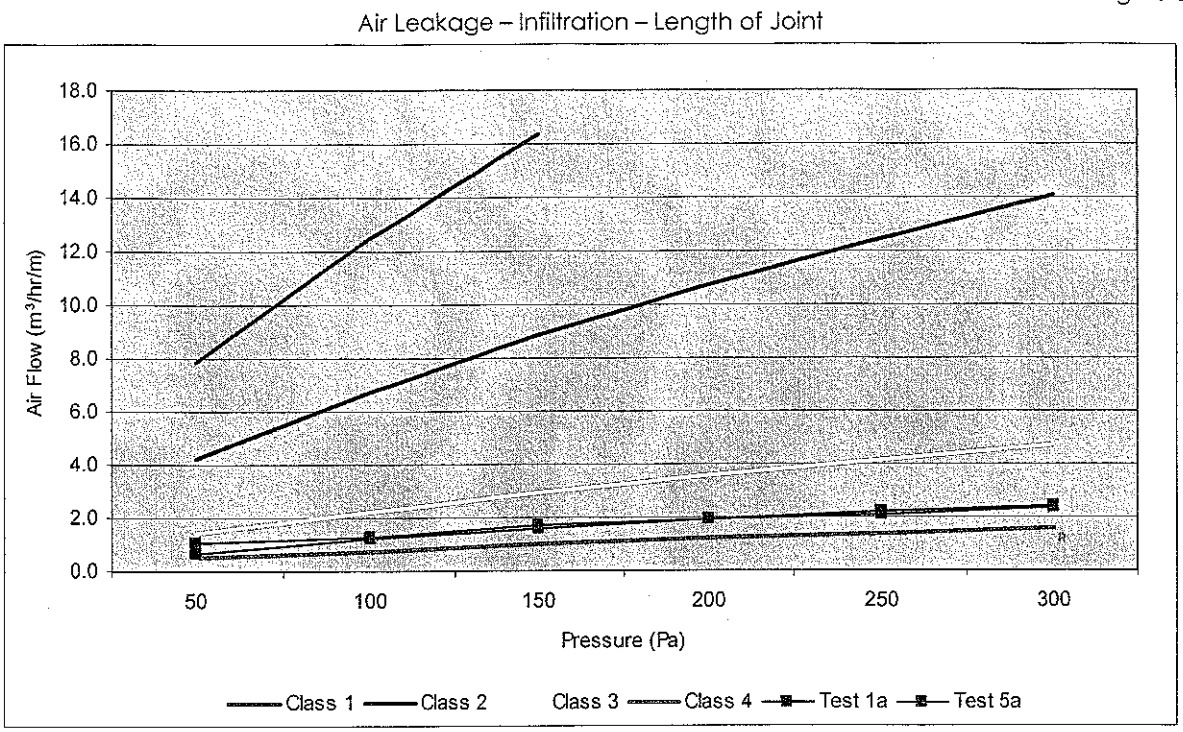


Figure 3



Tests 1b & 5b – Air Permeability – Exfiltration

	Test No. 1b	Test No. 5b
Temperature °C	10.0	**6.8**
Humidity %RH	70.8	**95.9**
Atmos. Pressure KPa	102.1	102.2

6.1.4.1 Overall Area

Pressure Differential (Pa)	Air Permeability Rate	
	Test No 1b (m³/hr/m²)	Test No 5 b (m³/hr/m²)
50	0.69	2.87
100	1.75	4.21
150	2.75	6.31
200	3.94	7.65
250	5.06	9.57
300	6.63	11.48

6.1.4.2 Length of Joint

Pressure Differential (Pa)	Air Permeability Rate	
	Test No 1b (m³/hr/m²)	Test No 5b (m³/hr/m²)
50	0.28	1.16
100	0.71	1.71
150	1.12	2.56
200	1.60	3.10
250	2.05	3.88
300	2.69	4.65

Figure 4

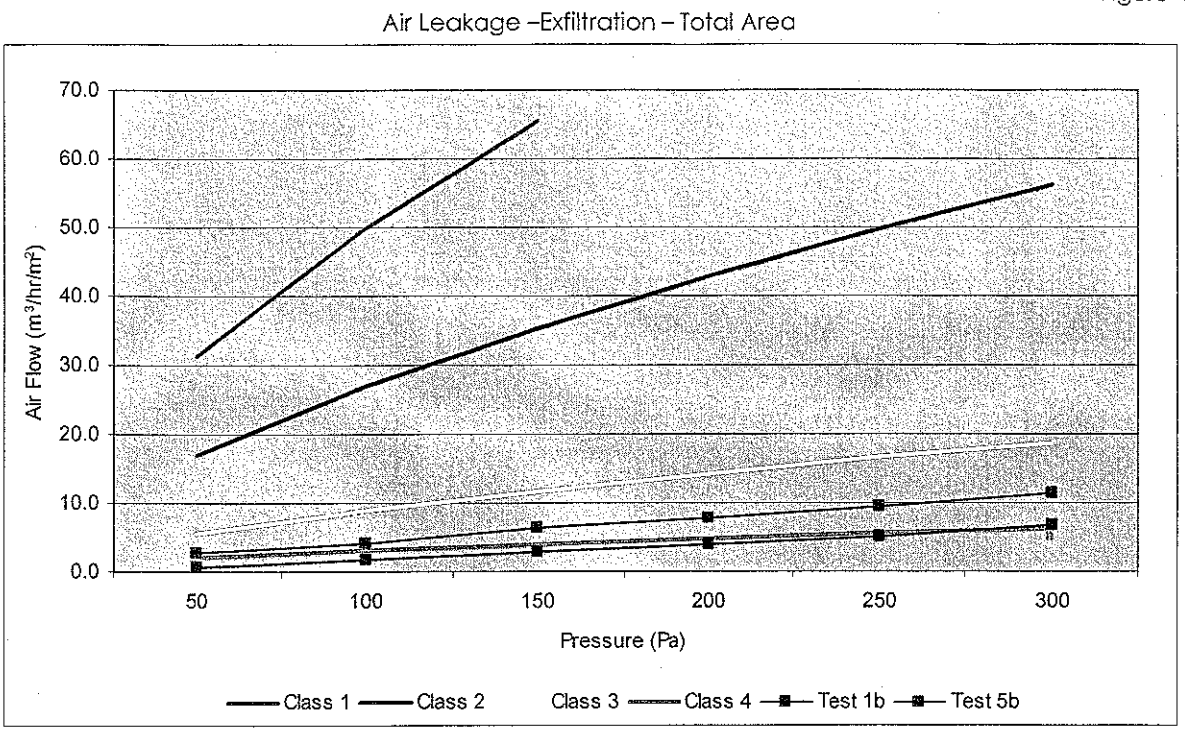
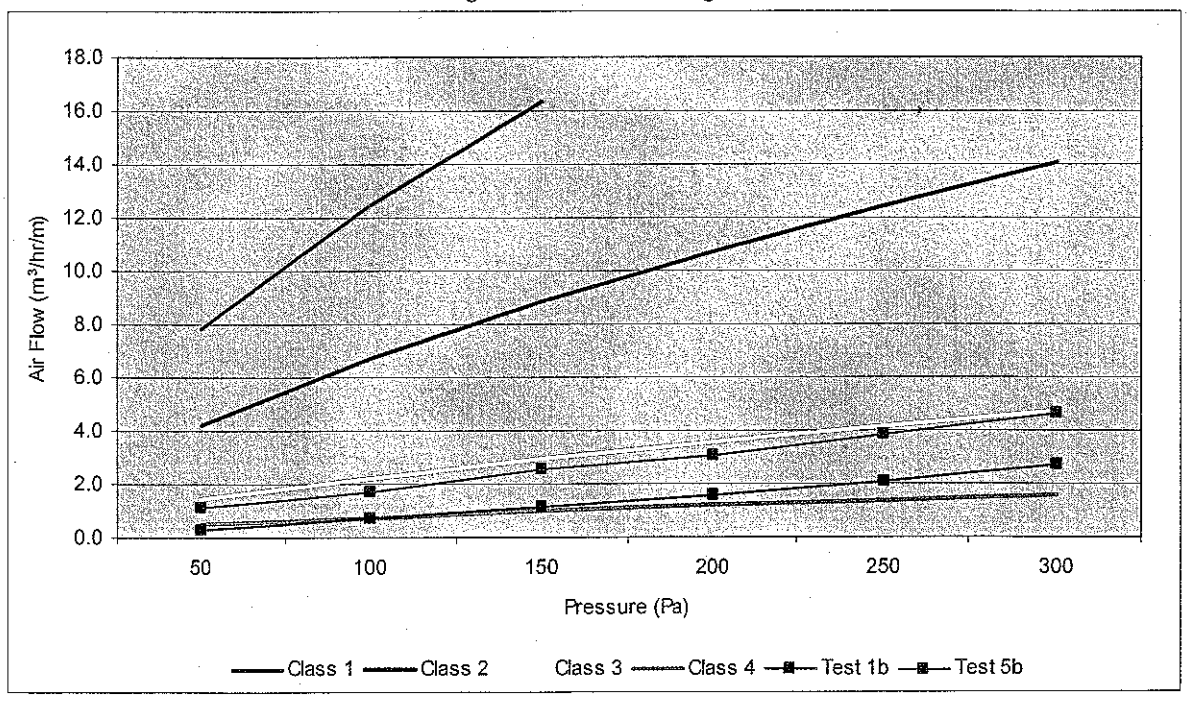


Figure 5



6.2 WATERTIGHTNESS TESTING

6.2.1 Test 2 – Watertightness under Static Pressure

6.2.1.1 Reference Classification of Watertightness

Test Pressure (Pa)	Classification	Specifications
-	0	*No Requirement*
0	1A	Water spray for 15 mins
50	2A	As class 1 + 5 mins
100	3A	As class 2 + 5 mins
150	4A	As class 3 + 5 mins
200	5A	As class 4 + 5 mins
250	6A	As class 5 + 5 mins
300	7A	As class 6 + 5 mins
450	8A	As class 7 + 5 mins
600	9A	As class 8 + 5 mins
>600	Exxxx	Above 600 Pa, in steps of 150 Pa – each step 5 mins.

6.2.1.2 Watertightness Classification

	Classification
Test 2	9A

6.2.1.3 Test Conditions

Temperature °C	10.1
Water Temperature °C	14.8
Humidity %RH	72.0
Atmos. Pressure KPa	102.1

6.2.1.4 Observations

Air Pressure (Pa)	Comments / Observations
0 x 15 minutes	No Leakage
50 x 5 minutes	No Leakage
100 x 5 minutes	No Leakage
150 x 5 minutes	No Leakage
200 x 5 minutes	No Leakage
250 x 5 minutes	No Leakage
300 x 5 minutes	No Leakage
450 x 5 minutes	No Leakage
600 x 5 minutes	No Leakage

6.3 WIND RESISTANCE

6.3.1 Reference Classifications of Wind Resistance

6.3.1.1 Classification of Design Wind Load and Associated Test Pressures

Class	Test pressures (Pa)		
	P1	P2	P3
0	*Not Tested*		
1	400	200	600
2	800	400	1200
3	1200	600	1800
4	1600	800	2400
5	**2000**	**1000**	**3000**
Exxxx	xxxx	xxxx (P1 x 0.5)	xxxx (P1 x 1.5)

Note: Specimens tested with wind loads above class 5 are classification Exxxx, where xxxx is the actual test pressure P1.

6.3.1.2 Classification of Relative Frontal Deflection

Class	Relative Frontal Deflection	Calculated Allowable Frontal Deflection
A	< Length/150	8.13 mm
B	<Length/200	6.10 mm
C	<Length/300	4.07 mm

6.3.1.3 Resistance to Wind Load Classification

Wind Load Class	Relative Frontal Deflection Class		
	A	**B**	**C**
1	A1	B1	C1
2	A2	B2	C2
3	A3	B3	C3
4	A4	B4	C4
5	A5	B5	C5
Exxxx	AExxxx	BExxxx	CExxxx

6.3.2 Test 3 – Wind Resistance, P1

6.3.2.1 Wind Resistance, P1 – Classification

	Classification
Test 3a - Positive	C5
Test 3b - Negative	C5

6.3.2.2 Wind Resistance, P1 – Test Conditions

Temperature °C	10.1

Measured length of Vertical Sash Member = 1220 mm

The displacement probes were positioned as shown in Figure 6.

6.3.2.3 Wind Resistance, P1 – Results

Positive Pressure (Pa)	Results
0	-0.02
2003	-0.39
Residuals Immediately following test	-0.03

Calculation of Deflection – Positive
Maximum recorded deflection = 0.69 mm
Maximum deflection ratio = 1220/0.39 = 3128.21 = **L/3128**

Negative Pressure (Pa)	Results
0	-0.01
2001	1.12
Residuals Immediately following test	0.03

Calculation of Deflection – Negative
Maximum recorded deflection = 1.12 mm
Maximum deflection ratio = 1220/1.12 = 1089.29 = **L/1089**

6.3.3 Test 4 – Wind Resistance, P2

Test Pressure: **1000 Pa**

6.3.3.1 Wind Resistance, P2 – Observations

Following test 4 – Wind Resistance, P2, after 50 cycles at both positive and negative pressure testing, an inspection of the sample showed no evidence of any permanent deformation or damage and the window continued to function correctly.

6.3.4 Test 6 – Wind Resistance, P3 (Safety)

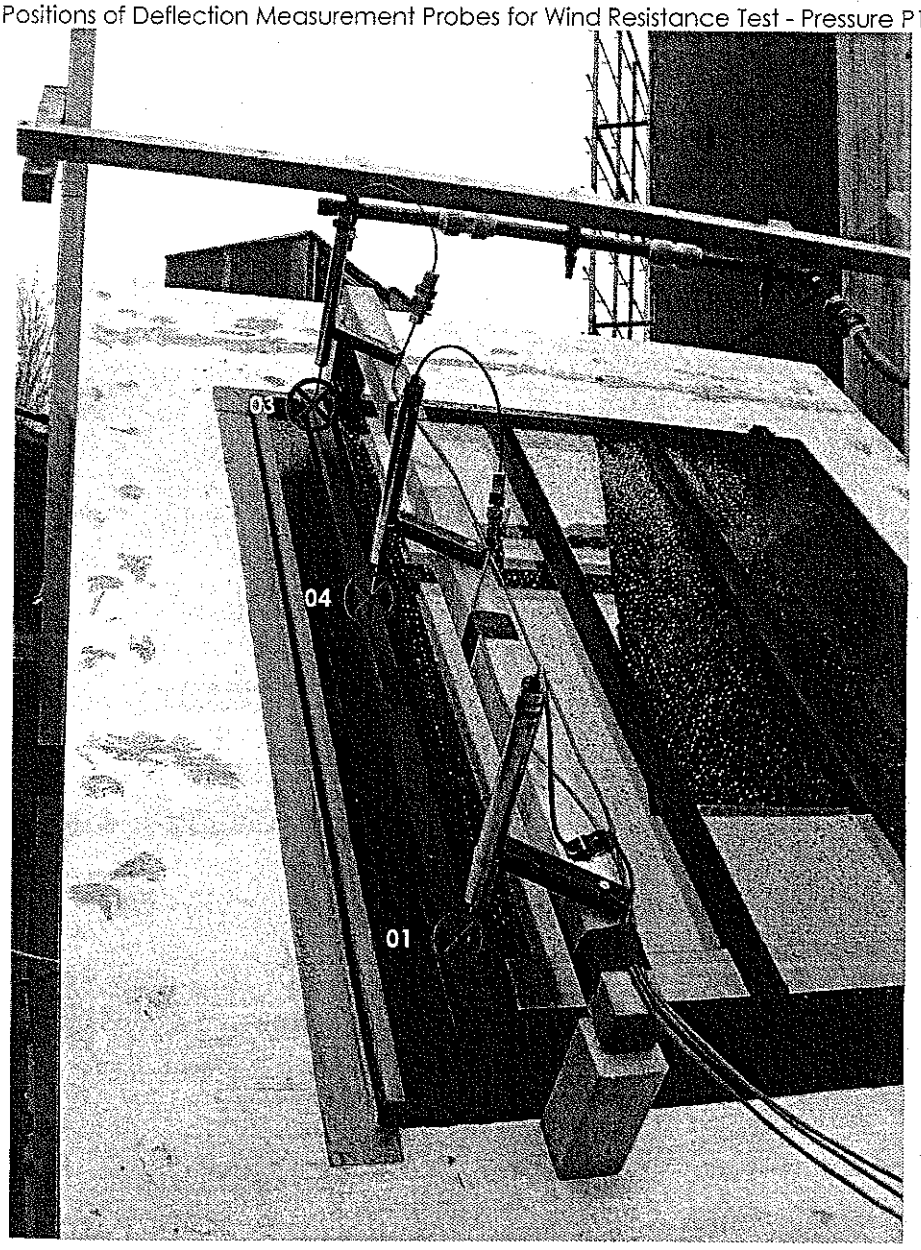
Test Pressure: **3000 Pa**

6.3.4.1 Wind Resistance, P3 (Safety) – Observations

Following test 6 – Wind Resistance, P3, after both positive and negative pressure testing, an inspection of the sample showed no evidence of any permanent deformation or damage and the window continued to function correctly.

Figure 6

Positions of Deflection Measurement Probes for Wind Resistance Test - Pressure P1



APPENDIX A

System Drawings

Drawing Title	Drawing No.	Revision	Date
Double Glazed Steel Rooflight Roof Tile Application Section Thro' Horizontal.	D-CRPM/03	C	April 2006
Double Glazed Steel Rooflight Roof Tile Application Section Thro' Slope.	D-CRPM/04	C	April 2006

NOTES

SYSTEM
ROOFLIGHT MANUFACTURED FROM 3·5mm THICK M.S. SHEET CURB PRESSINGS & 3mm THICK M.S. SHEET VENT PRESSINGS.

CORNERS MITRED & FULLY WELDED.

FINISH
POLYZINC 770 AFTER ALL FABRICATION.

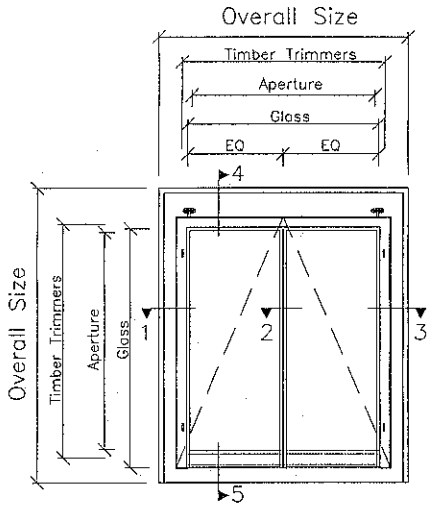
POLYESTER POWDER COAT FINISHED RAL 9005 MATT (black).

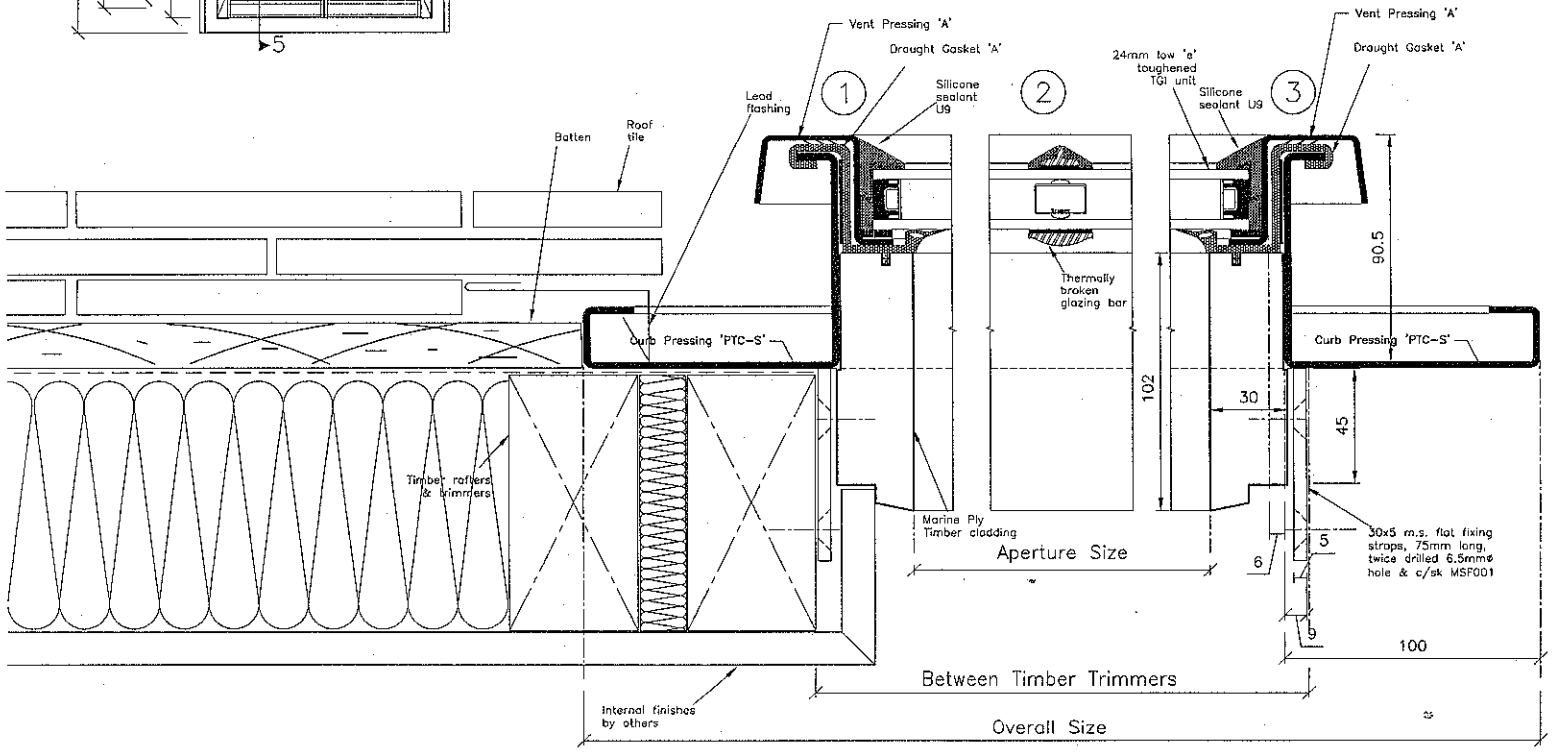
HARDWARE & ATTACHMENTS
HUNG ON PAIR WELDED HINGES, FITTED WELDED MOUNTING PLATES TO FRAME & VENT TO ACCOMMODATE VENT OPERATOR.

GLAZING
GLAZED WITH 24mm TGI SEALED UNIT, HAVING STEPPED BOTTOM EDGE, USING ALUMINIUM BEAD, GLAZING TAPE & SILICONE SEALANT

OUTER – 4mm TOUGHENED FLOAT (STEPPED AREA PROTECTED WITH LEAD FLASHING TO OUTER SURFACE)
INNER – 4mm TOUGHENED LOW 'E' (STEPPED BACK AT BOTTOM BY 55mm)
CAVITY – 16mm ARGON FILLED – STANDARD COLOUR SPACER BAR.

GENERAL





DIM CHART	Overall Size W x H	Aperture Size W x H	Between Timber Trimmers W x H
Type N3	818 x 1169	560 x 861	638 x 921

DATE	REV	COMMENTS
08/08/06	C	General revisions & corrections
28/06/06	B	General revisions to details
25/04/06	A	Details updated

REVISIONS

FOR INFORMATION

Drawing Title
DOUBLE GLAZED STEEL ROOFLIGHT
ROOF TILE APPLICATION
SECTION THRO' HORIZONTAL

Project/Site

Contractor/Client
ROOFLIGHT DEPT

Architect

Surveyor/Agent

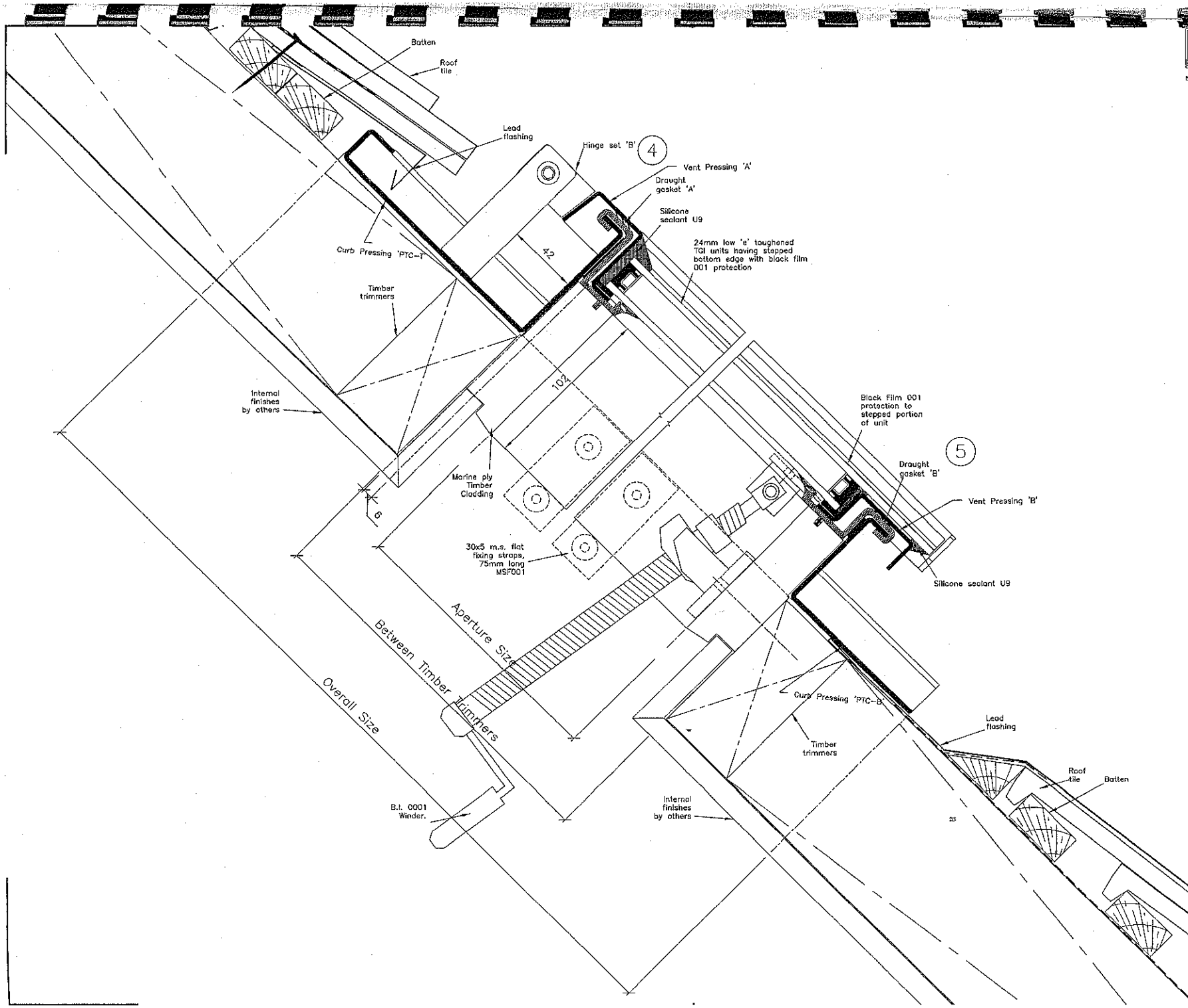
Scale @ A1: DETAIL F.S. – ELEV'S 1:10

Date: APRIL 2006 | **Drawn By:**

CLEMENT
Steel Windows Ltd
Clement House Haslemere Surrey GU27 1HR
Tel: 01428 643393 Fax: 01428 644436

Drawing No. D–CRPM/03 | **Revision** C

NOTES



DATE	REV	COMMENTS
08/08/06	C	General revisions & corrections
26/06/06	B	General revisions to details
25/04/06	A	Details updated

REVISIONS

FOR INFORMATION

Drawing Title
DOUBLE GLAZED STEEL ROOFLIGHT
ROOF TILE APPLICATION
SECTION THRO' SLOPE

Project/Site

Contractor/Client
ROOFLIGHT DEPT

Architect

Surveyor/Agent

Scale @ A1: DETAIL F.S.

Date: APRIL 2006 | Drawn By:

CLEMENT
Steel Windows Ltd
Clement House Haslemere Surrey GU27 1HR
Tel: 01428 643393 Fax: 01428 644436

Drawing No.	Revision
D-CRPM/04	C