Weathertightness testing of a sample of Smart Systems Curtain Walling

Report No. N950/08/14087

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Technical Report

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Abstract

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CONTENTS

1. INTRODUCTION

This report describes tests carried out at the Taylor Woodrow Technology Centre at the request of Smart Systems Limited, North End Road, Yatton, Somerset, BS49 4AW.

The test sample consisted of a sample of curtain walling manufactured by Smart Systems Limited.

Taylor Woodrow is accredited by the United Kingdom Accreditation Service as UKAS Testing Laboratory No.0057 and is also approved with Lloyds Register of Quality Assurance for ad-hoc in-service inspections and tests to ISO 9001 2000.

The tests were carried out during January through June 2008 and were to determine the weathertightness of the test sample. The test methods, as amended by the project specification, were generally in accordance with the CWCT Standard Test Methods for building envelopes, 2005, for:

Air permeability.

Watertightness – static pressure, dynamic pressure and hose.

Wind resistance – serviceability & safety.

The testing was carried out in accordance with Taylor Woodrow Method Statement C2601/MS rev 0.

This test report relates only to the actual sample as tested and described herein.

The results are valid only for the conditions under which the tests were conducted.

The tests were witnessed wholly or in part by:

Mark Walford	-	Smart Systems Limited
Dan White	-	Smart System Limited
Chris White	-	Smart System Limited
Alan Keiller	-	CWCT

2. DESCRIPTION OF TEST SAMPLE

2.1 GENERAL ARRANGEMENT

The sample was as shown in the photo below and the drawings included as an appendix to this report. For details of any remedial work carried out refer to Section 7.

PHOTO 5080047

TEST SAMPLE ELEVATION

2.2 CONTROLLED DISMANTLING

During the dismantling of the sample no water penetration or discrepancies from the drawings were found.

PHOTO 5080047

FIXING BRACKET

PHOTO 6230069

BASE OF MULLION

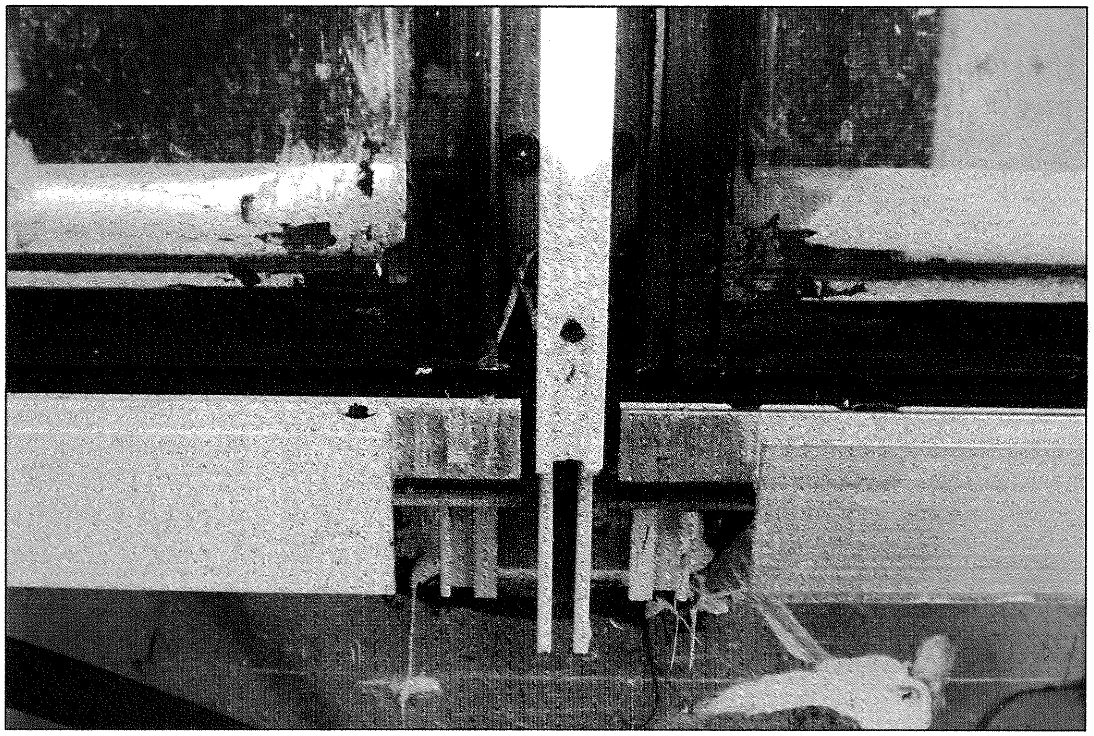


PHOTO 6230072a

PRESSURE PLATES

PHOTO 6230078a

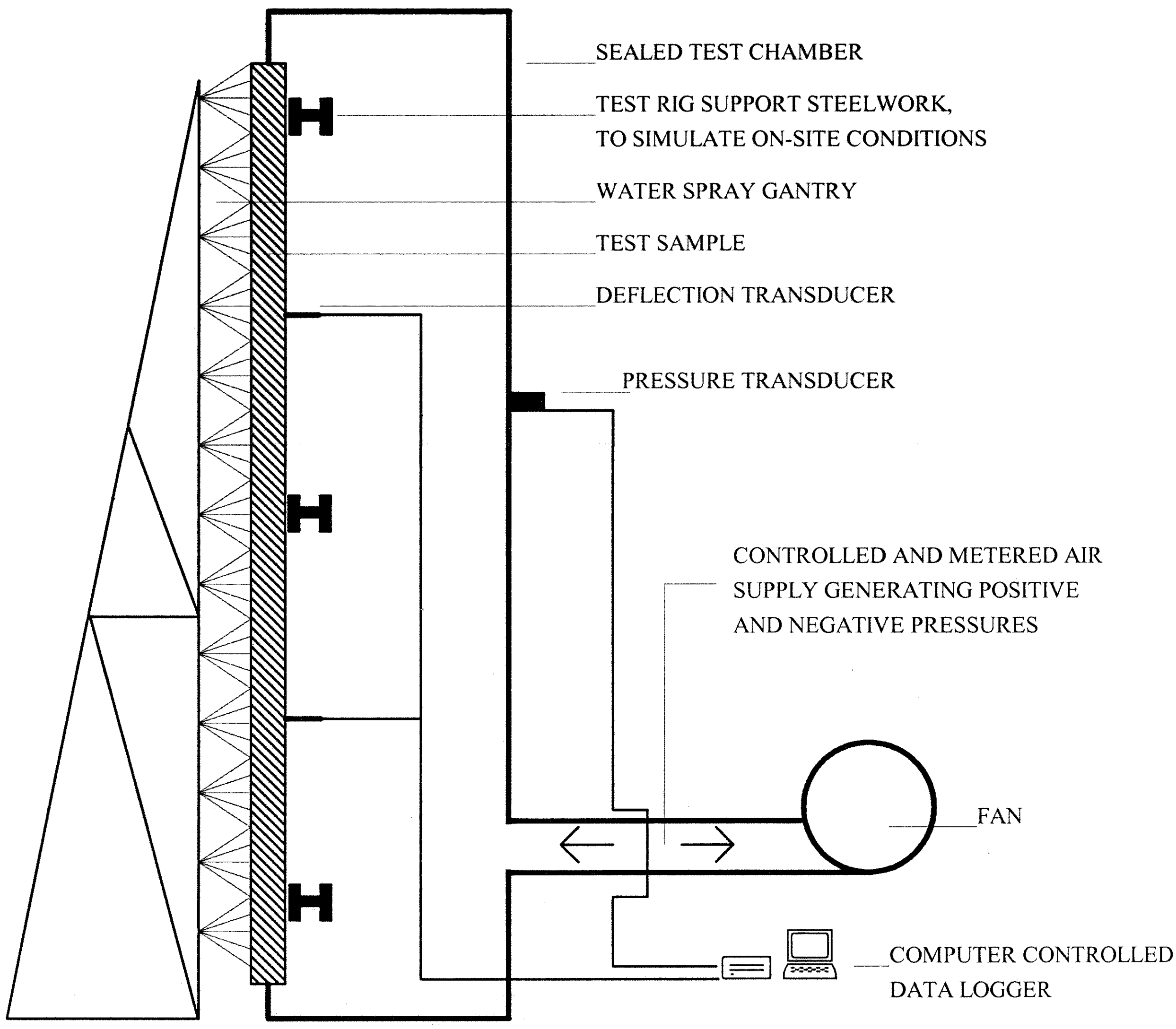
GLAZING GASKET

3. TEST RIG GENERAL ARRANGEMENT

The test sample was mounted on a rigid test rig with support steelwork designed to simulate the on-site/project conditions. The test rig comprised a well sealed chamber, fabricated from steel and plywood. A door was provided to allow access to the chamber. Representatives of Smart Systems installed the sample on the test rig. See Figure 1.

FIGURE 1

TYPICAL TEST RIG GENERAL ARRANGEMENT



SECTION THROUGH TEST RIG

4. TEST SEQUENCE

The test sequence was as follows:

(1) Air permeability

(2) Watertightness – static

(3) Wind resistance – serviceability

(4) Air permeability

(5) Watertightness – static

(6) Watertightness – dynamic

(7) Watertightness – hose

(8) Wind resistance – safety

Prior to starting the formal test sequence above, pre-testing using the static pressure watertightness test procedure (2) was carried out. See the relevant sections of this report for details.

5. SUMMARY AND CLASSIFICATION OF TEST RESULTS

The following summarises the results of the tests carried out. For full details refer to Sections 6, 7 and 8.

TABLE 1

Date	Test number	Test description	Result
25 April 2008	2	Watertightness – static	Fail
8 May 2008	1	Air permeability	Pass
8 May 2008	2	Watertightness – static	Pass
8 May 2008	3	Wind resistance – serviceability	Pass
8 May 2008	4	Air permeability	Pass
8 May 2008	5	Watertightness – static	Fail
22 May 2008	1	Air permeability	Pass
22 May 2008	2	Watertightness – static	Pass
22 May 2008	3	Wind resistance – serviceability	Pass*
22 May 2008	4	Air permeability	Pass
22 May 2008	5	Watertightness – static	Pass
29 May 2008	6	Watertightness – dynamic	Pass
29 May 2008	7	Watertightness – hose	Pass
29 May 2008	8	Wind resistance – safety	Fail
14 June 2008	8	Wind resistance – safety	Fail
18 June 2008	8	Wind resistance – safety	Pass

* See section 8.5

TABLE 2

Test	Standard	Classification / Declared value
Air permeability	CWCT	A4
Watertightness	CWCT	R7
Wind resistance	CWCT	2400 pascals

6. AIR PERMEABILITY TESTING

6.1 INSTRUMENTATION

6.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

6.1.2 Air Flow

A laminar flow element mounted in the air system ductwork was used with a pressure transducer to measure the air flow into the chamber. This device was capable of measuring airflow through the sample to within 2%.

6.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

6.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

6.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

6.3 PROCEDURE

Three positive pressure pulses of 1200 pascals were applied to prepare the test sample.

The opening vent was then opened and locked closed five times.

The average air permeability was determined by measuring the rate of air flow through the chamber whilst subjecting the sample to positive pressure differentials of 50, 100, 150, 200, 300, 450 and 600 pascals. Each pressure increment was held for at least 10 seconds.

Extraneous leakage through the test chamber and the joints between the chamber and the test sample was determined by sealing the sample with polythene sheeting and adhesive tape and measuring the air flow at the pressures given above.

The test was then repeated with only the opening vent section sealed and then with the complete sample unsealed; the difference between the readings being the rate of air flow through the vent and whole sample respectively.

6.4 PASS/FAIL CRITERIA

The permissible air flow rate, Q_o, at peak test pressure, p_o, could not exceed:

1.5 m^3 per hour per m^2 for fixed panels, and
2.0 m^3 per hour per m length of joint between the fixed frame and the frame enclosing the opening light when viewed from outside for opening lights.

At intermediate pressures, p_n, flow rates, Q_n, were calculated using $Q_n = Q_o(p_n/p_o)^{2/3}$

The area of the sample was 59.1 m^2.

Length of openable joints was 6.2 m.

Note: The above permissible air flow rates are for infiltration.

6.5 RESULTS

TABLE 3

TEST 1 **Date: 8 May 2008**

Pressure differential (pascals)	Measured air flow through sample			
	INFILTRATION		EXFILTRATION	
	Opening vent (m^3/hour/m)	Fixed panels (m^3/hour/m^2)	Opening vent (m^3/hour/m)	Fixed panels (m^3/hour/m^2)
50	0.08	0.10	-1.31	-0.02
100	0.05	0.21	-1.79	-0.06
150	0.32	0.17	-3.03	-0.15
200	0.05	0.24	-4.05	-0.21
300	0.19	0.25	-5.13	-0.46
450	0.05	0.39	-6.60	-0.89
600	0.19	0.39	-10.13	-1.05
Temperatures	Ambient = 15°C Chamber = 13°C			

The results are shown graphically in Figures 2 and 3.

For test 4 carried out on 8 May 2008 no significant increase in overall air flow was measured.

TABLE 4

<u>TEST 1</u> **Date: 22 May 2008**

Pressure differential (pascals)	Measured air flow through sample			
	INFILTRATION		EXFILTRATION	
	Opening vent (m^3/hour/m)	Fixed panels (m^3/hour/m^2)	Opening vent (m^3/hour/m)	Fixed panels (m^3/hour/m^2)
50	0.13	0.22	-0.15	-0.13
100	0.05	0.26	-0.27	-0.18
150	0.16	0.33	-0.95	-0.24
200	0.37	0.32	-0.82	-0.29
300	0.48	0.38	-0.94	-0.47
450	0.42	0.46	-1.71	-0.61
600	0.56	0.52	-1.90	-0.79
Temperatures	Ambient = 23°C Chamber = 26°C			

The results are shown graphically in Figure 4 and 5.

TABLE 5

TEST 4 **Date: 22 May 2008**

Pressure differential (pascals)	Measured air flow through sample			
	INFILTRATION		EXFILTRATION	
	Opening vent (m^3/hour/m)	Fixed panels (m^3/hour/m^2)	Opening vent (m^3/hour/m)	Fixed panels (m^3/hour/m^2)
50	0.13	0.13	-0.18	-0.15
100	0.15	0.24	-0.23	-0.21
150	0.11	0.30	-0.31	-0.28
200	0.13	0.26	-0.58	-0.33
300	0.45	0.42	-1.02	-0.47
450	0.45	0.45	-1.39	-0.67
600	0.58	0.55	-1.63	-0.84
Temperatures	Ambient = 24°C Chamber = 28°C			

The results are shown graphically in Figures 4 and 5.

FIGURE 2

Fixed panels - air infiltration test results

8 May 2008

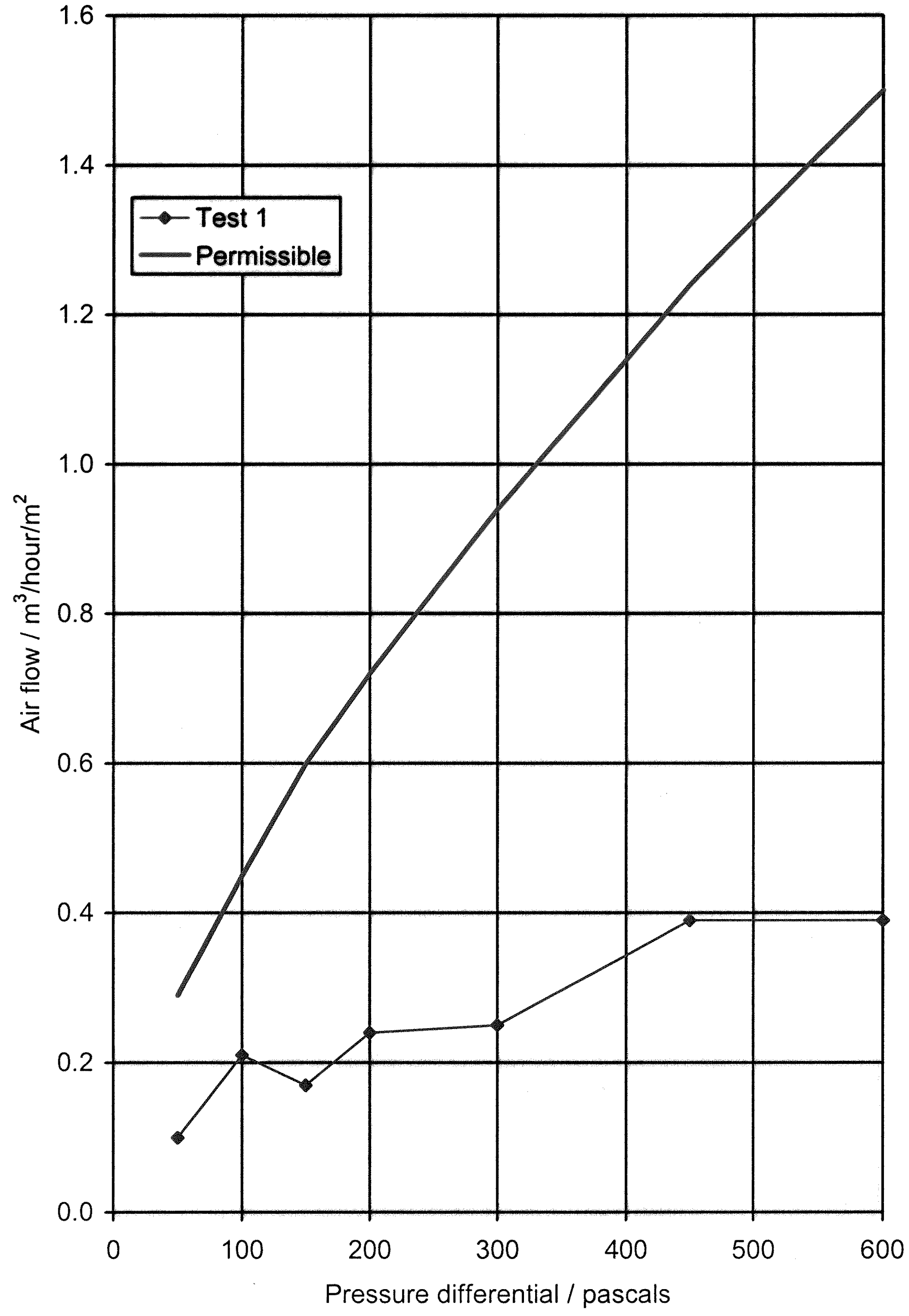


FIGURE 3

Opening vent - air infiltration test results

8 May 2008

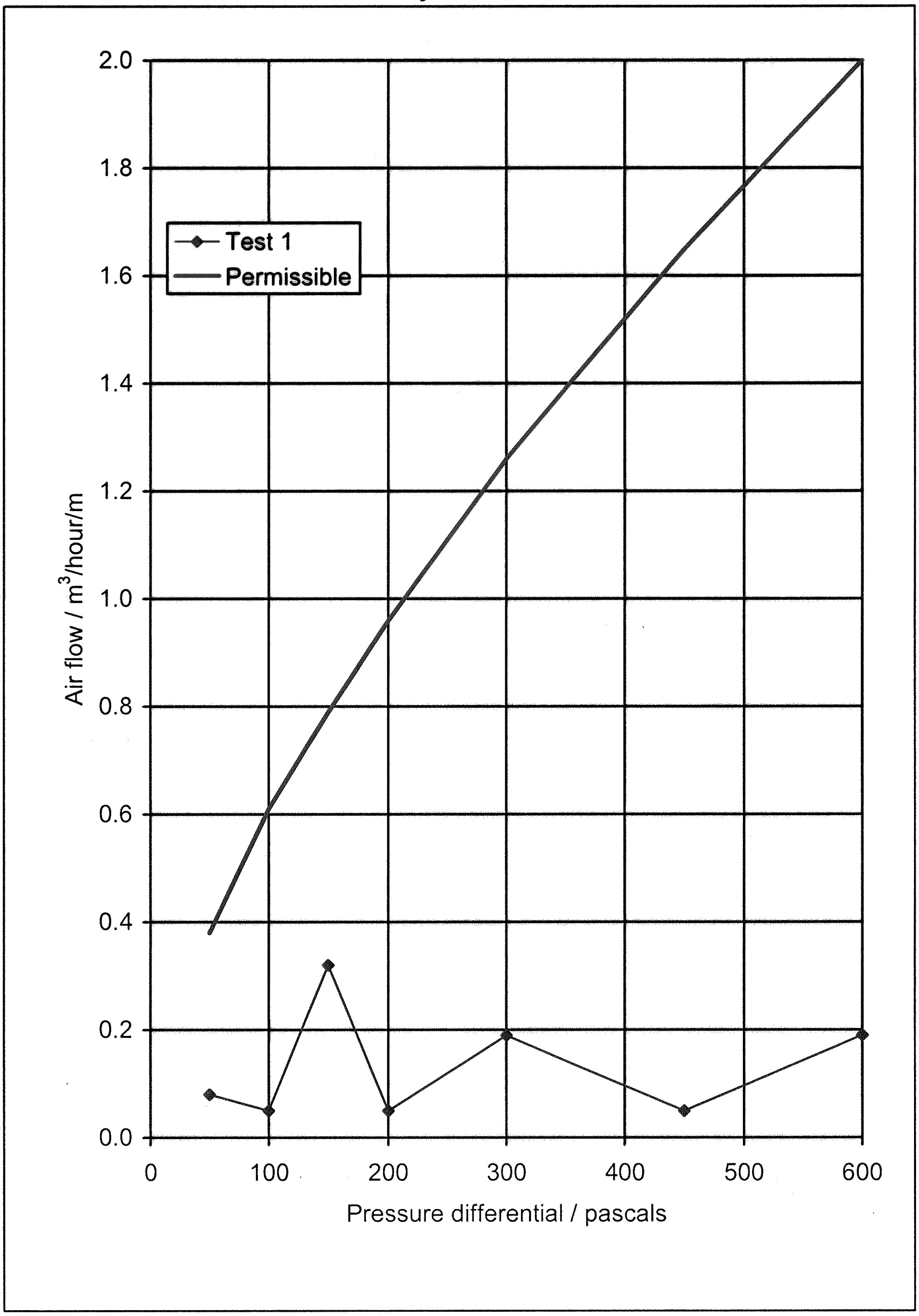


FIGURE 4

Fixed panels - air infiltration test results

22 May 2008

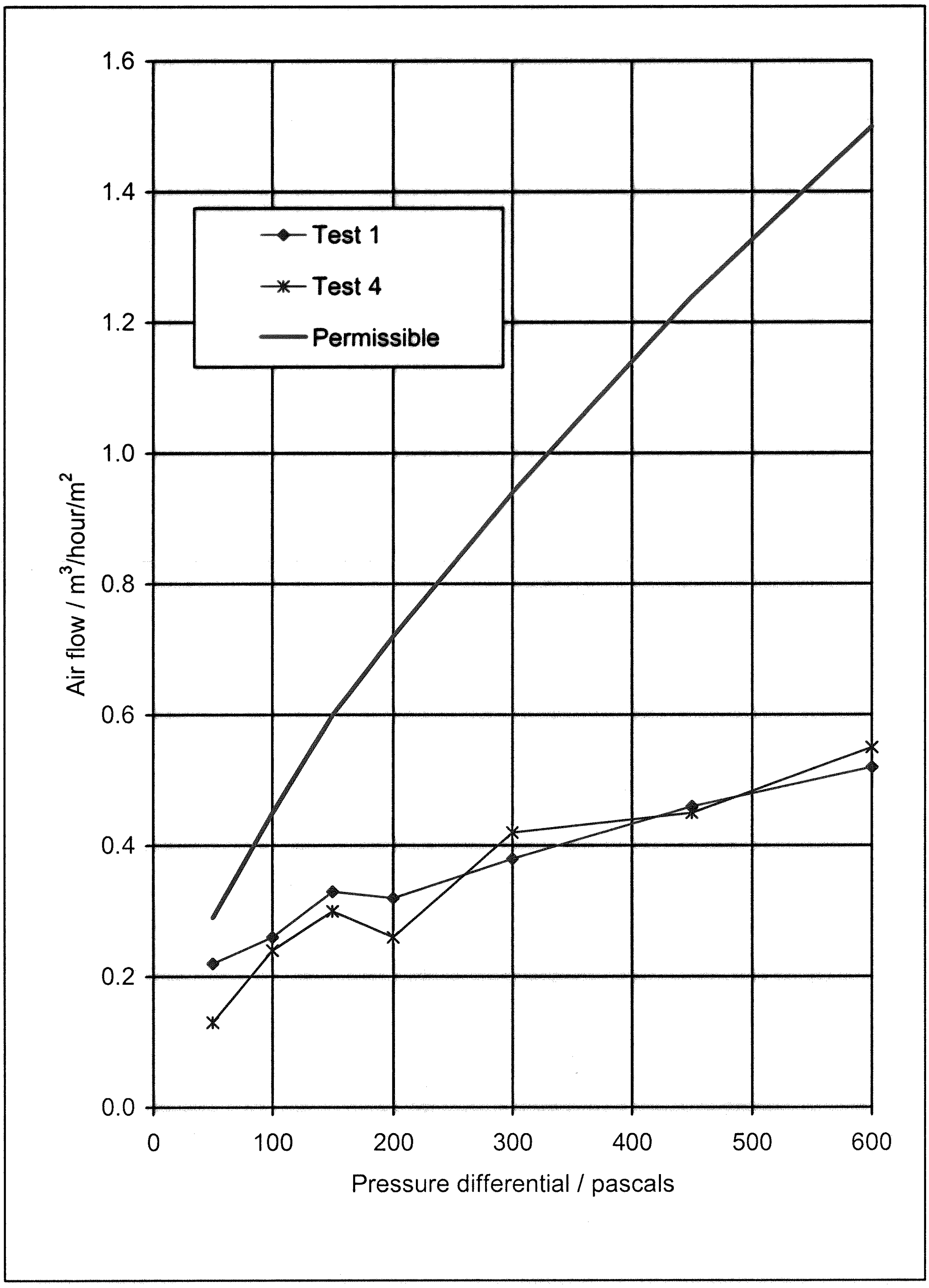
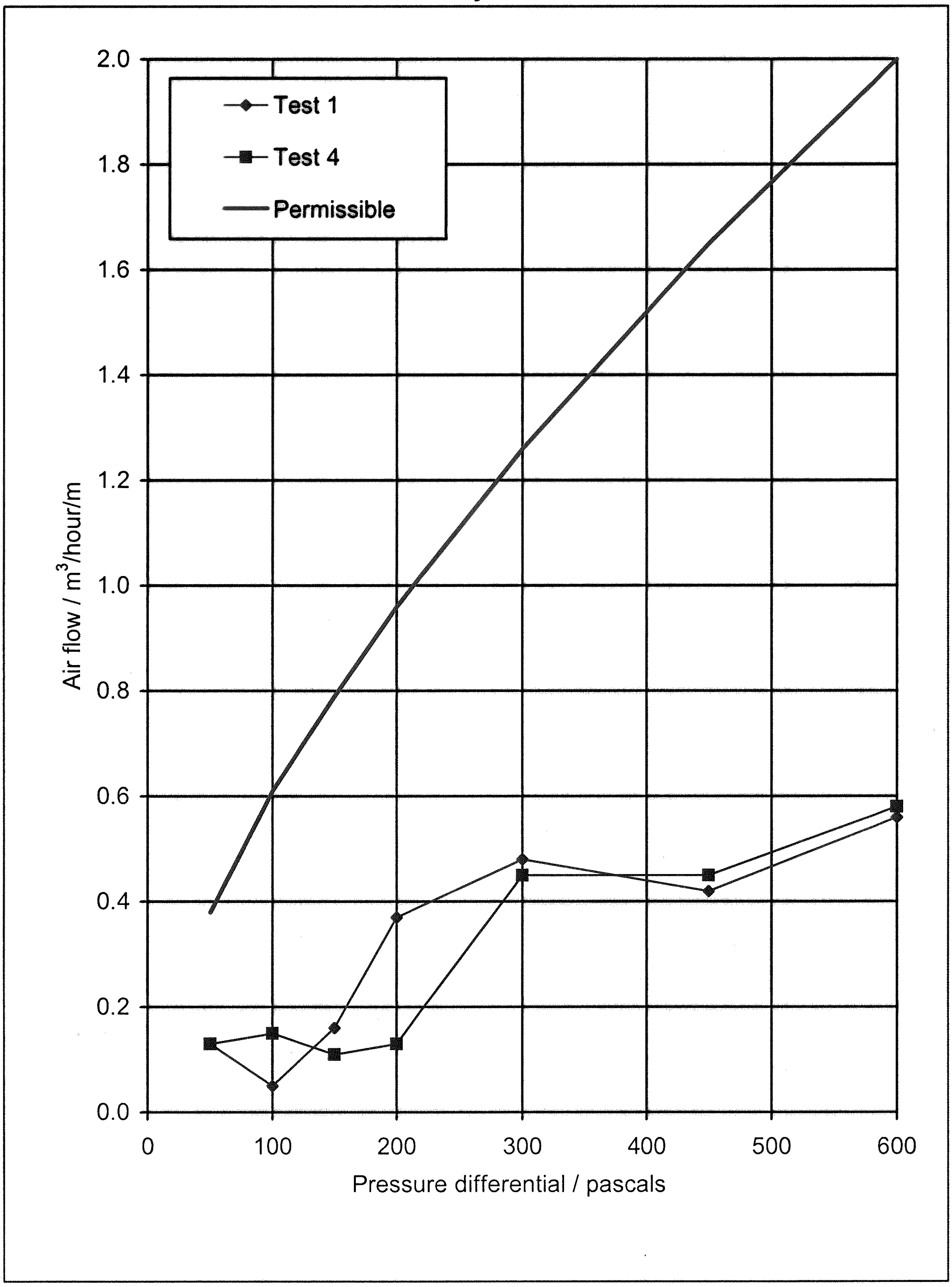


FIGURE 5

Opening vent - air infiltration test results

22 May 2008



7. WATERTIGHTNESS TESTING

7.1 INSTRUMENTATION

7.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

7.1.2 Water Flow

An in-line water flow meter was used to measure water supplied to the spray gantry to within 5%.

7.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air and water temperatures to within 1°C.

7.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

7.2 FAN

7.2.1 Static Pressure Testing

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

7.2.2 Dynamic Pressure Testing

A wind generator was mounted adjacent to the external face of the sample and used to create positive pressure differentials during dynamic testing. The wind generator comprised a piston type aero-engine fitted with 4 m diameter contra-rotating propellers.

7.3 WATER SPRAY

7.3.1 Spray Gantry

The water spray system comprised nozzles spaced on a uniform grid not more than 700 mm apart and mounted approximately 400 mm from the face of the sample. The nozzles provided a full-cone pattern with a spray angle between 90° and 120°. The spray system delivered water uniformly against the exterior surface of the sample.

7.3.2 Hose test

The water was applied using a brass nozzle that produced a full-cone of water droplets with a nominal spray angle of 30°. The nozzle was used with a ¾" hose and provided with a control valve and a pressure gauge between the valve and nozzle.

7.4 PROCEDURE

7.4.1 Watertightness – static

Three positive pressure pulses of 1200 pascals were applied to prepare the test sample.

The opening vent was then opened and locked closed five times.

Water was sprayed onto the sample using the method described above at a rate of at least 3.4 litres/m^2/minute for 15 minutes at zero pressure differential. With the water spray continuing the pressure differential across the sample was then increased in increments of: 50, 100, 150, 200, 300, 450 and 600 pascals, each held for 5 minutes.

Throughout the test the interior face of the sample was examined for water penetration.

7.4.2 Watertightness – dynamic

Water was sprayed onto the sample using the method described above at a flow rate of at least 3.4 litres/m^2/minute.

The aero-engine was used to subject the sample to wind of sufficient velocity to produce average deflections in the principle framing members equal to those produced by a static pressure differential of 600 pascals. Suction was applied to the inside of the specimen to achieve the required test deflections but was limited to 25% of the peak static pressure. These conditions were maintained for 15 minutes. Throughout the test the inside of the sample was examined for water penetration.

7.4.3 Watertightness – hose

Working from the exterior, the selected area was wetted progressing from the lowest horizontal joint, then the intersecting vertical joints, then the next horizontal joint above, etc. The water was directed at the joint and perpendicular to the face of the sample. The nozzle was moved slowly back and forth above the joint at a distance of 0.3 metres from it for a period of 5 minutes for each 1.5 metres of joint. Shorter or slightly longer joints were tested pro rata. The water flow to the nozzle was adjusted to produce 22, ±2 litres per minute when the water pressure at the nozzle inlet was 220, ±20 kPa.

Throughout the test the interior face of the sample was examined for water penetration. The joints tested are shown in Figure 6.

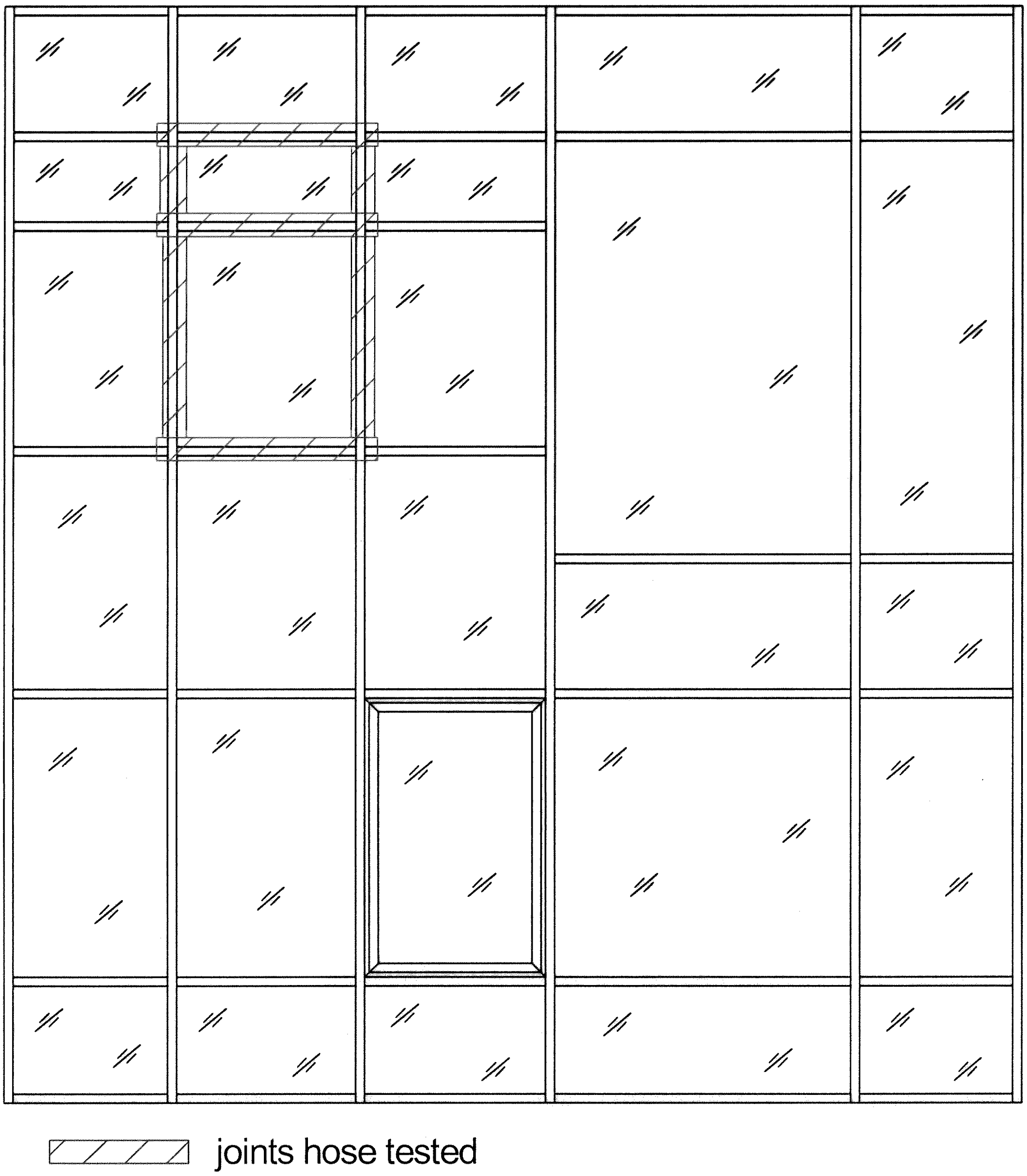
7.5 PASS/FAIL CRITERIA

There shall be no water penetration to the internal face of the sample throughout testing. At the completion of the test there shall be no standing water in locations intended to remain dry.

FIGURE 6

HOSE TEST LOCATIONS

External View



7.6 RESULTS

Test 2 (Static pressure) Date: 25 April 2008

Water leakage was observed during the test as described below and shown in Figure 7.

After 4½ minutes at a pressure differential of 450 pascals, steady dripping was observed from bottom of intruder vent frame at location 1. Dripping continued through 600 pascals.

Chamber temperature= 16°C
Ambient temperature = 13°C
Water temperature = 11°C

Remedial work

The following remedial work was carried out by Smart Systems:

The casement vent insert was inspected; the leak appeared to be coming from between the reversing profile and the outer frame. This joint was resealed and additional ventilation holes at the top of the reversing profile to aid the drainage.

Test 2 (Static pressure) Date: 8 May 2008

No water penetration was observed throughout the test.

Chamber temperature= 25°C
Ambient temperature = 21°C
Water temperature = 14°C

Test 5 (Static pressure) Date: 8 May 2008

Water leakage was observed during the test as described below and shown in Figure 7.

After 4 minutes at a pressure differential of 600 pascals, a pool of water was observed in the glazing gasket corner at location 2. One minute later, a drop of water also appeared in the glazing gasket corner at location 3.

Chamber temperature= 24°C
Ambient temperature = 21°C
Water temperature = 13°C

Remedial work

The following remedial work was carried out by Smart Systems:

Caps and pressure plates were removed from outside. At the point where the leaks occurred the inside gasket was reinserted over the transom pins and the corners were resealed and the cover caps refitted. A new vent was installed. Two cockspur handles were fitted to vent.

Test 2 (Static pressure) Date: 22 May 2008

No water penetration was observed throughout the test.

Chamber temperature= 25°C
Ambient temperature = 21°C
Water temperature = 14°C

Test 5 (Static pressure) Date: 22 May 2008

No water penetration was observed throughout the test.

Chamber temperature= 25°C
Ambient temperature = 24°C
Water temperature = 14°C

Test 6 (Dynamic pressure) Date: 29 May 2008

No water penetration was observed throughout the test.

Chamber temperature= 21°C
Ambient temperature = 19°C
Water temperature = 12°C

Test 7 (Hose) Date: 29 May 2008

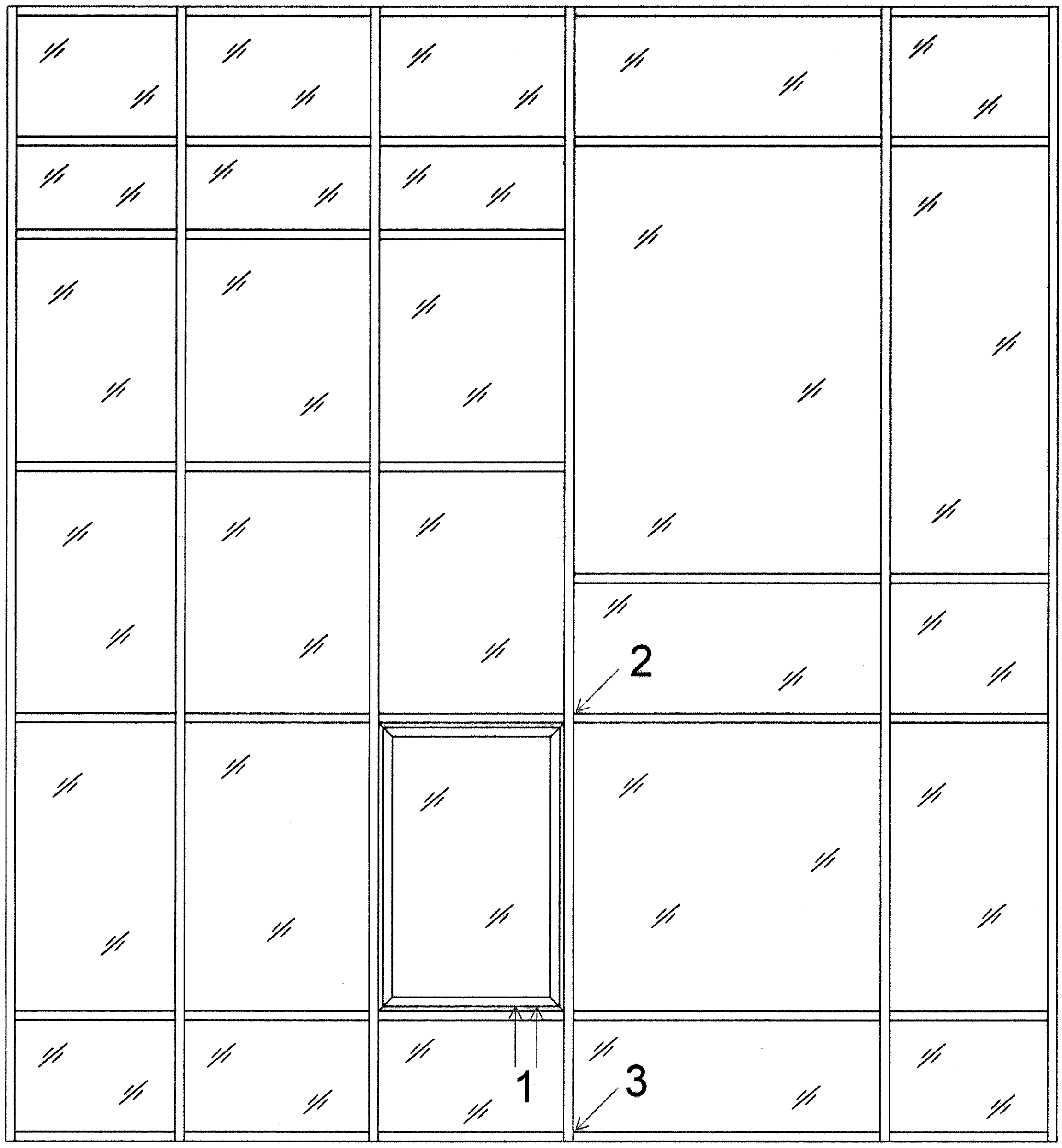
No water penetration was observed throughout the test.

Chamber temperature= 21°C
Ambient temperature = 19°C
Water temperature = 12°C

FIGURE 7

WATER LEAKAGE LOCATIONS

External view



8. WIND RESISTANCE TESTING

8.1 INSTRUMENTATION

8.1.1 Pressure

One static pressure tapping was provided to measure the chamber pressure and was located so that the readings were unaffected by the velocity of the air supply into or out of the chamber.

A pressure transducer, capable of measuring rapid changes in pressure to within 2% was used to measure the differential pressure across the sample.

8.1.2 Deflection

Displacement transducers were used to measure the deflection of principle framing members to an accuracy of 0.1 mm. The gauges were set normal to the sample framework at mid-span and as near to the supports of the members as possible and installed in such a way that the measurements were not influenced by the application of pressure or other loading to the sample. The gauges were located at the positions shown in Figure 8.

8.1.3 Temperature

Platinum resistance thermometers (PRT) were used to measure air temperatures to within 1°C.

8.1.4 General

Electronic instrument measurements were scanned by a computer controlled data logger, which also processed and stored the results.

All measuring instruments and relevant test equipment were calibrated and traceable to national standards.

8.2 FAN

The air supply system comprised a variable speed centrifugal fan and associated ducting and control valves to create positive and negative static pressure differentials. The fan provided essentially constant air flow at the fixed pressure for the period required by the tests and was capable of pressurising at a rate of approximately 600 pascals in one second.

8.3 PROCEDURE

8.3.1 Wind Resistance – serviceability

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 2400 pascals to 0. The pressure was increased in four equal increments each maintained for 15 ±5 seconds. Displacement readings were taken at each increment. Residual deformations were measured on the pressure returning to zero.

Any damage or functional defects were recorded. Operable components were opened and closed five times and any change in ease of operation noted.

The test was then repeated using a negative pressure of -2400 pascals.

8.3.2 Wind Resistance – safety

Three positive pressure differential pulses of 1200 pascals were applied to prepare the sample. The displacement transducers were then zeroed.

The sample was subjected to one positive pressure differential pulse from 0 to 3600 pascals to 0. The pressure was increased as rapidly as possible but not in less than 1 second and maintained for 15 ±5 seconds. Displacement readings were taken at peak pressure. Residual deformations were measured on the pressure returning to zero.

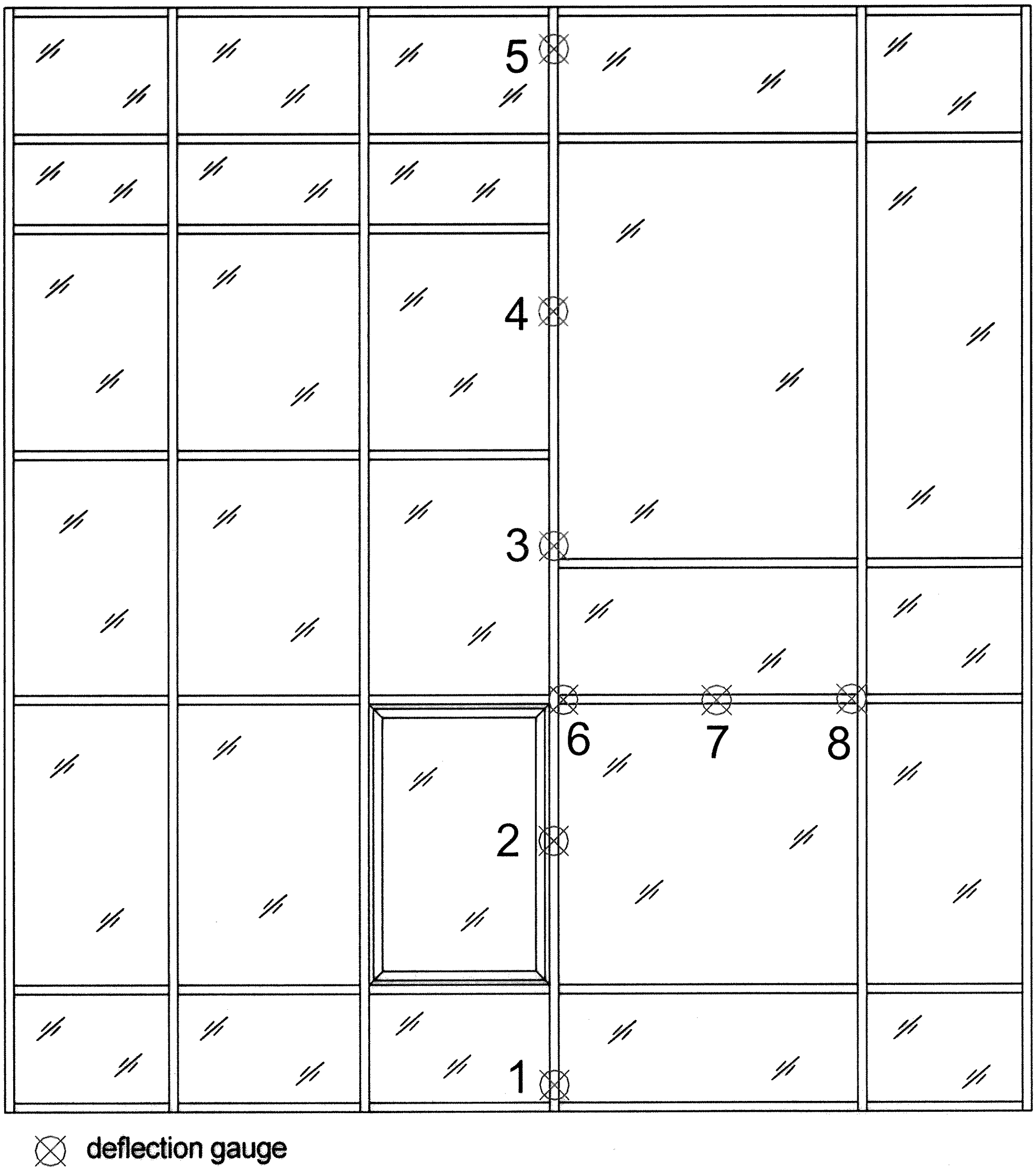
Any damage or functional defects were recorded.

The test was then repeated using a negative pressure of –3600 pascals.

FIGURE 8

DEFLECTION GAUGE LOCATIONS

External View



8.4 PASS/FAIL CRITERIA

8.4.1 Calculation of permissible deflection

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
2	Mullion	3900	L/300+5mm = 18.0mm	1 mm
4	Mullion	3700	L/300 = 17.3mm	1 mm
7	Transom	2000	L/175 = 11.4mm	1 mm

8.5 RESULTS

Test 3 (serviceability) Date: 8 May 2008

The deflections measured during the wind resistance test, at the positions shown in Figure 8, are shown in Tables 6 and 7.

Note: Vent was tapped up to achieve the pressure. High residual readings were recorded at location 4 (upper mullion) due to the joint in mullion.

Summary Table:

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
2	Mullion	2412	5.4	0.1
		-2405	-6.1	0.7
4	Mullion	2412	11.5	-0.2
		-2405	-4.7	-1.2
7	Transom	2412	4.0	-0.1
		-2405	-0.2	-0.1

No damage to the test sample was observed.

Ambient temperature =20°C
Chamber temperature = 18°C

Test 3 (serviceability) Date: 22 May 2008

The deflections measured during the wind resistance test, at the positions shown in Figure 8, are shown in Tables 8 and 9.

Summary Table:

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
2	Mullion	2406 -2394	5.5 -4.1	0.4 0.6
4	Mullion	2406 -2394	12.4 -14.0	-0.3 0.1
7	Transom	2406 -2394	4.0 -3.9	-0.1 0.0

No damage to the test sample was observed.

Ambient temperature = 24°C
Chamber temperature = 27°C

Test 8 (safety) Date: 29 May 2008

The deflections measured during the structural safety test, at the positions shown in Figure 8, are shown in Table 10.

At a negative pressure differential of -3400 pascals, the largest glass unit and the right hand unit next to it blew out.

Ambient temperature = 19°C
Chamber temperature = 23°C

Remedial work

The following remedial work was carried out by Smart Systems:

The glass units were replaced with new glass units.

Re-Test 8 (safety) Date: 14 June 2008

At a negative pressure differential of -2500 pascals, the pressure plate on the right-hand side of the large unit came lose.

Ambient temperature = 11°C
Chamber temperature = 14°C

Remedial work

The following remedial work was carried out by Smart Systems:

The screws and pressure plate were replaced with new screws, into new holes in the thermal break.

Re-Test 8 (safety) Date: 18 June 2008

The deflections measured during the structural safety test, at the positions shown in Figure 8, are shown in Table 11.

No damage to the test sample was observed.

Ambient temperature = 18°C
Chamber temperature = 21°C

TABLE 6

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Date: 8 May 2008

Position	**Pressure (pascals) / Deflection (mm)**				
	600	**1201**	**1817**	**2412**	**Residual**
1	0.2	0.4	0.6	0.8	0.0
2	1.6	3.3	4.7	6.1	0.2
3	0.1	0.2	0.3	0.4	0.0
4	3.4	6.9	9.5	11.9	-0.2
5	0.1	0.2	0.3	0.4	0.0
6	1.1	2.1	3.0	3.8	0.1
7	2.0	4.2	6.2	8.1	0.0
8	1.1	2.2	3.3	4.3	-0.1
2 *	1.5	3.0	4.3	5.4	0.1
4 *	3.3	6.7	9.2	11.5	-0.2
7 *	0.9	2.0	3.0	4.0	-0.1

* Mid-span reading adjusted between end support readings

TABLE 7

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Date: 8 May 2008

Position	Pressure (pascals) / Deflection (mm)				
	-599	**-1224**	**-1811**	**-2405**	**Residual**
1	-1.0	-1.3	-1.6	-1.8	0.0
2	-1.8	-3.5	-4.8	-6.3	0.1
3	-0.2	-0.5	-1.4	-2.5	-1.0
4	-4.1	-7.9	-12.6	-17.5	-2.2
5	-0.2	-0.3	-0.8	-1.3	-0.6
6	-1.1	-2.2	-3.2	-4.3	-0.1
7	-1.9	-4.1	-6.4	-8.5	-0.3
8	-0.8	-1.9	-3.3	-4.3	-0.5
2 *	-1.2	-2.6	-3.4	-4.1	-0.5
4 *	-3.9	-7.5	-11.5	-15.6	-1.5
7 *	-1.0	-2.1	-3.1	-4.2	0.0

* Mid-span reading adjusted between end support readings

TABLE 8

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Date: 22 May 2008

Position	**Pressure (pascals) / Deflection (mm)**				
	600	**1201**	**1817**	**2412**	**Residual**
1	0.2	0.4	0.6	0.8	0.0
2	1.6	3.3	4.7	6.1	0.2
3	0.1	0.2	0.3	0.4	0.0
4	3.4	6.9	9.5	11.9	-0.2
5	0.1	0.2	0.3	0.4	0.0
6	1.1	2.1	3.0	3.8	0.1
7	2.0	4.2	6.2	8.1	0.0
8	1.1	2.2	3.3	4.3	-0.1
2 *	1.5	3.0	4.3	5.4	0.1
4 *	3.3	6.7	9.2	11.5	-0.2
7 *	0.9	2.0	3.0	4.0	-0.1

* Mid-span reading adjusted between end support readings

TABLE 9

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Date: 22 May 2008

Position	**Pressure (pascals) / Deflection (mm)**				
	-599	**-1224**	**-1811**	**-2405**	**Residual**
1	-1.0	-1.3	-1.6	-1.8	0.0
2	-1.8	-3.5	-4.8	-6.3	0.1
3	-0.2	-0.5	-1.4	-2.5	-1.0
4	-4.1	-7.9	-12.6	-17.5	-2.2
5	-0.2	-0.3	-0.8	-1.3	-0.6
6	-1.1	-2.2	-3.2	-4.3	-0.1
7	-1.9	-4.1	-6.4	-8.5	-0.3
8	-0.8	-1.9	-3.3	-4.3	-0.5
2 *	-1.2	-2.6	-3.4	-4.1	-0.5
4 *	-3.9	-7.5	-11.5	-15.6	-1.5
7 *	-1.0	-2.1	-3.1	-4.2	0.0

* Mid-span reading adjusted between end support readings

TABLE 10

WIND RESISTANCE - **SAFETY** TEST RESULTS

Date: 29 May 2008

Position	Pressure (pascals) / Deflection (mm)			
	3601	Residual	-3082	Residual
1	1.4	-0.2	-2.1	0.7
2	9.4	0.5	-7.8	0.2
3	0.9	0.2	-2.4	-1.7
4	18.8	1.0	-20.0	-3.2
5	1.3	0.6	-1.4	-0.6
6	5.8	0.4	-5.1	0.1
7	12.3	0.6	-10.3	-0.5
8	6.7	0.7	-5.0	-1.0
2 *	8.2	0.5	-5.5	0.2
5 *	17.7	0.6	-18.1	-2.5
7 *	6.1	0.0	-5.2	0.0

* Mid-span reading adjusted between end support readings

TABLE 11

WIND RESISTANCE - **SAFETY** TEST RESULTS

Date: 18 June 2008

Position	Pressure (pascals) / Deflection (mm)			
	3601	Residual	-3595	Residual
1	1.4	-0.2	-2.3	-0.4
2	9.4	0.5	-7.9	0.4
3	0.9	0.2	-2.7	-0.3
4	18.8	1.0	-22.1	0.3
5	1.3	0.6	-1.4	0.0
6	5.8	0.4	-5.6	0.3
7	12.3	0.6	-11.2	0.0
8	6.7	0.7	-5.6	0.1
2 *	8.2	0.5	-5.4	0.7
5 *	17.7	0.6	-20.1	0.5
7 *	6.1	0.0	-5.6	-0.1

* Mid-span reading adjusted between end support readings

9. APPENDIX - DRAWINGS

The following 7 unnumbered pages are copies of Smart Systems drawings numbered:

MCO1/rev 2,

MCO2/rev 2,

MCO3/rev 2,

MCO4/rev 2,

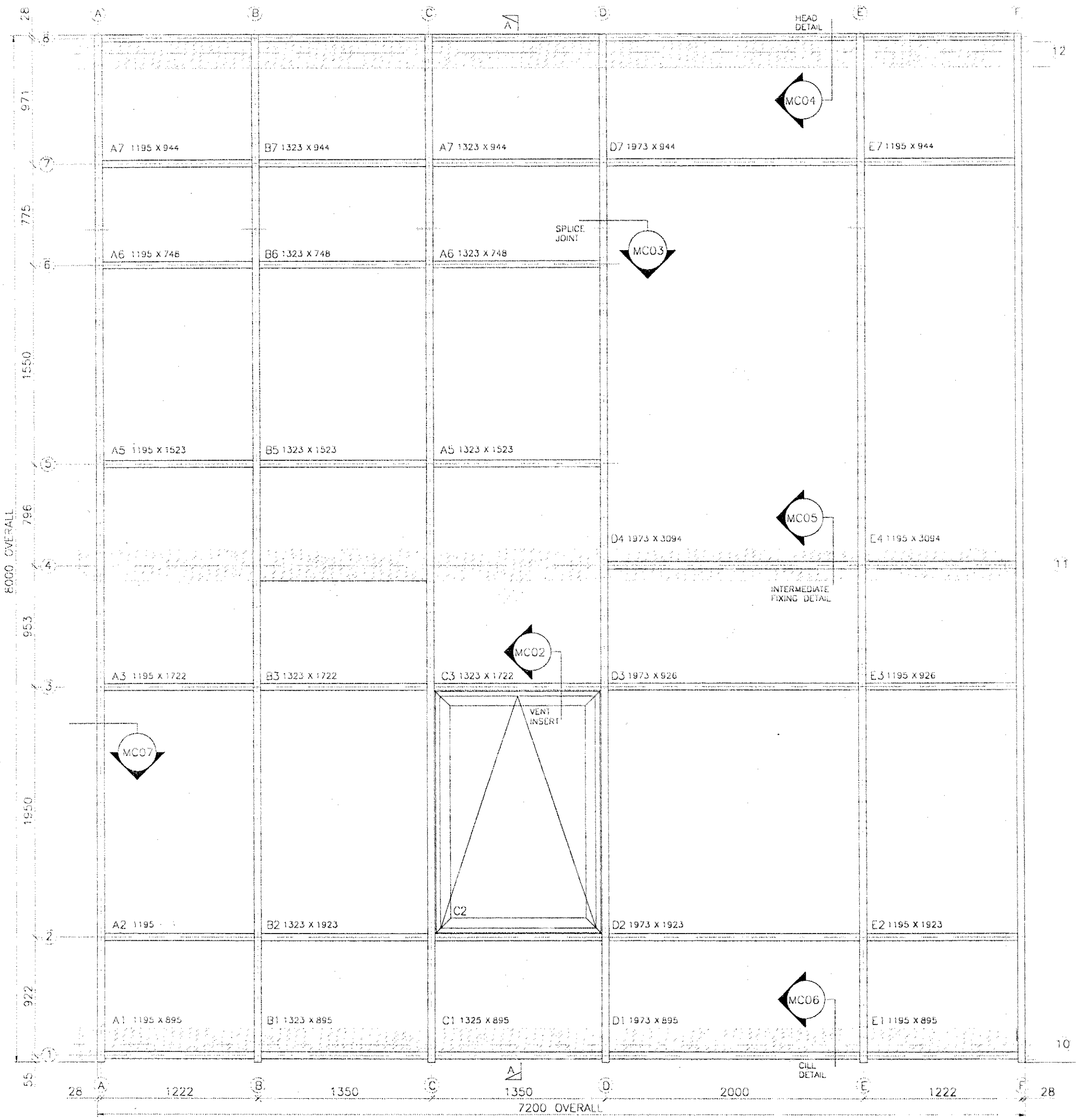
MCO5/rev 2,

MCO6/rev 2,

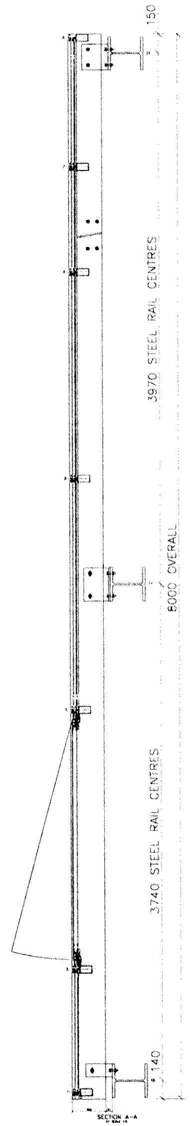
MCO7/rev 2.

END OF REPORT

DO NOT SCALE: IF IN DOUBT - ASK



SCREEN ELEVATION
A1 SCALE 1:20



SECTION A–A
A1 SCALE 1:20

NOTES
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SCREEN TO BE SMARTS MC WALL
MC018 129mm MULLIONS
MC232 100mm TRANSOM
3. POLYESTER POWDER COATED TO BS6496 FINISH COLOUR KL9010 GLOSS
4. CASEMENT WINDOW INSERT REFER TO DRG No. MC02

No.	DRAWING TITLE
MC01	ELEVATION
MC02	VENT INSERT DETAILS
MC03	SPLICE JOINT DETAILS
MC04	HEAD DETAIL
MC05	INTERMEDIATE FIXING
MC06	CILL DETAIL
MC07	JAMB DETAIL

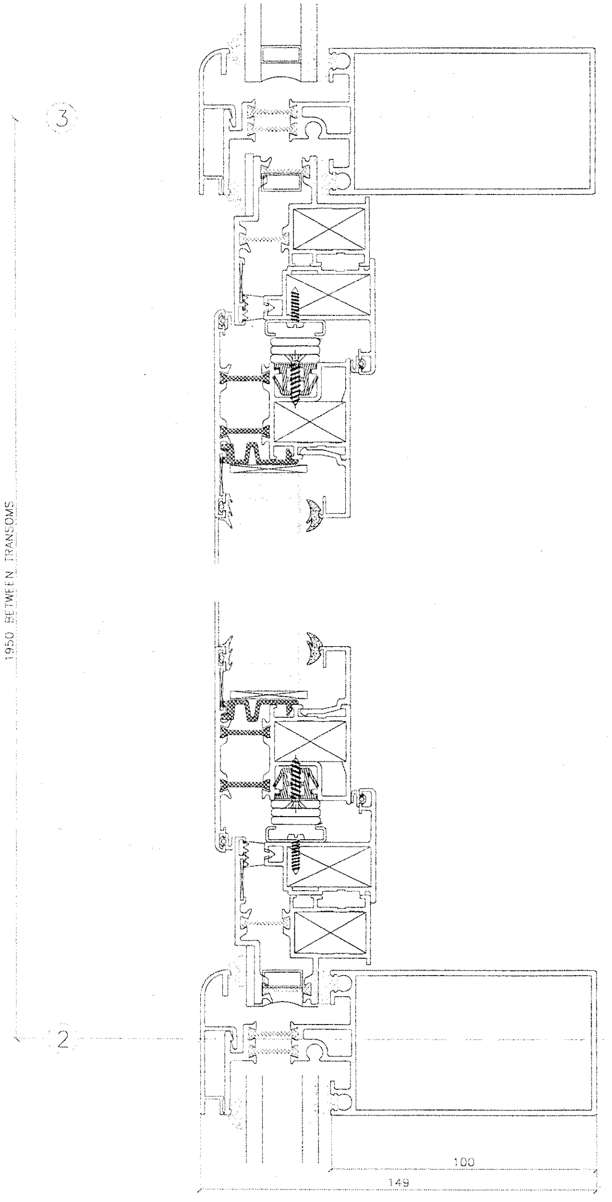
USED ON:	
MTL:	ALUMINIUM ALLOY
FINISH:	
REV:	REV2 30/06/2008

smart architectural aluminium

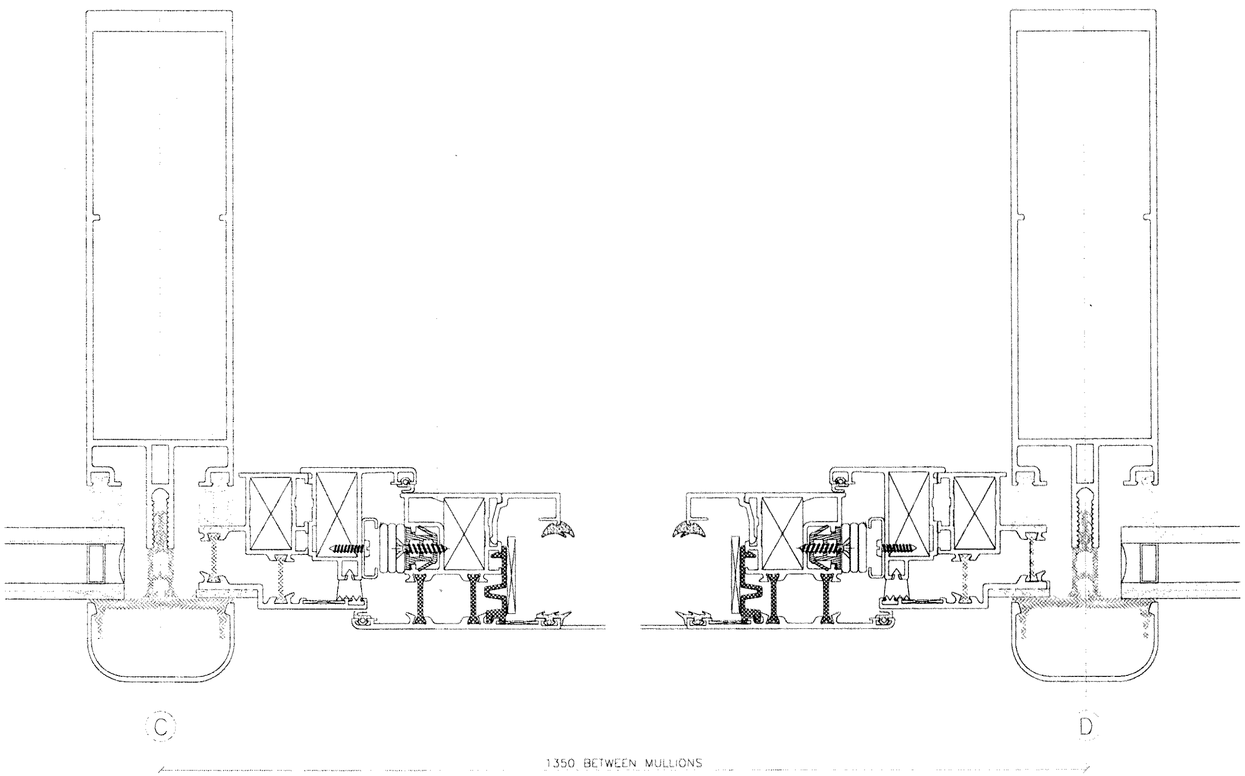
DRAWN BY	A.MURRAY
CHECKED	A.MURRAY
APPROVED	–
PROJECT No.	TG001
CLIENT	–
	DIMENSIONS IN MILLIMETRES

THIRD ANGLE PROJECTION
TITLE: ELEVATION
MC Wall – CWCT Test
CUSTOMER –
DATE 28.04.08
SCALE Varies
SHEET 1 OF 1
DRAWING NUMBER MC01
SIZE A1
REVISION 1

DO NOT SCALE: IF IN DOUBT - ASK



INTRUDER WINDOW
A1 SCALE 1:1



NOTES

1 ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

2 TOP HUNG CASEMENT WINDOWS:
SMART SYSTEMS VISOLINE AND INTRUDER PROFILES
ESPAGNOLETTE MULTIPONT AND COCKSPUR LOCKING
VL17: OUTERFRAME
IN045: REVERSING PROFILES
IN122: SASH

3 POLYESTER POWDER COATED TO BS6496
FINISH COLOUR KL9010 GLOSS WHITE

USED ON:		THIRD ANGLE PROJECTION	
MTL:	ALUMINIUM ALLOY	TITLE: VENT INSERT DETAILS MC Wall - CWCT Test	
FINISH:		CUSTOMER	-
REV:	REV2 30/06/2008	DATE 28.04.08	DRAWING NUMBER MC02
DRAWN BY: A.MURRAY	PROJECT No. TC001	A1 SCALE Varies	A1
CHECKED A.MURRAY	CLIENT -	SHEET 1 OF 1	1
APPROVED -	DIMENSIONS IN MILLIMETRES		

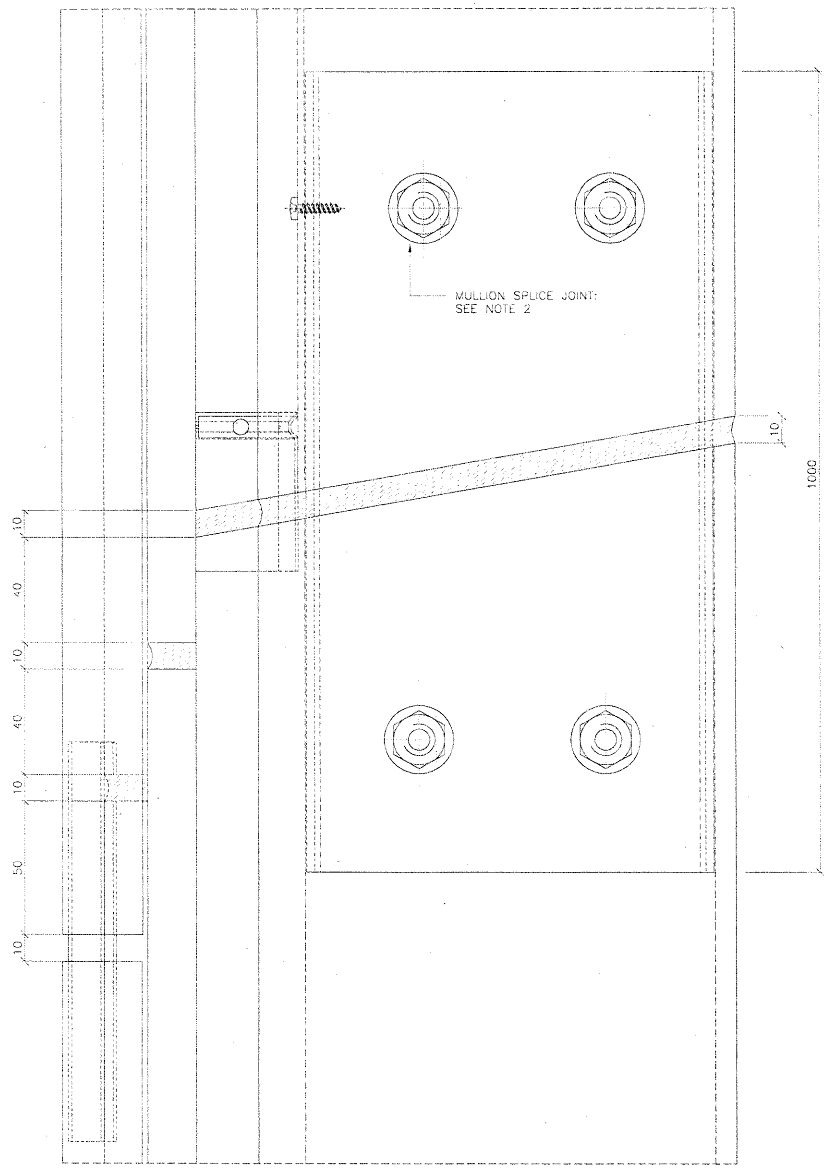
smart architectural aluminium

DO NOT SCALE: IF IN DOUBT - ASK

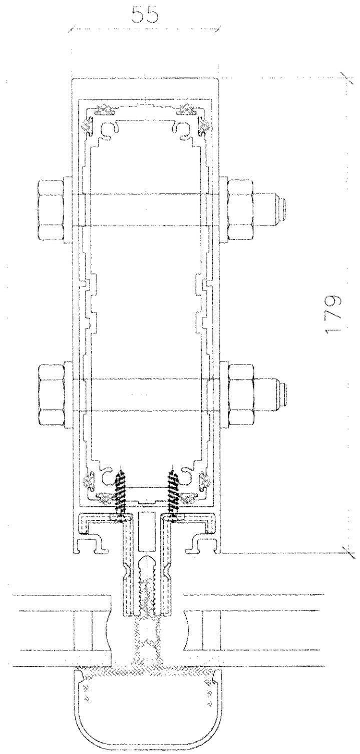
NOTES

1 ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

2 SPLICE JOINT BETWEEN MULLIONS:
10mm EXPANSION JOINT
ACMC049 COUPLING SECTION
M12x100 ST.STEEL HEX HEAD BOLT
M12 ST.STEEL HEX NY-LOCK NUT
M12 ST.STEEL FLAT WASHERS
MULLION SITE DRILLED 10.5MM DIA



MULLION SPLICE JOINT
A1 SCALE 1:1



MULLION ARRANGEMENT
SCALE 1:2

USED ON:	
MTL:	ALUMINIUM ALLOY
FINISH:	
REV:	REV2 30/06/2008

smart architectural aluminium

THIRD ANGLE PROJECTION

TITLE: SPLICE JOINT DETAIL MC WALL - CWCT Test

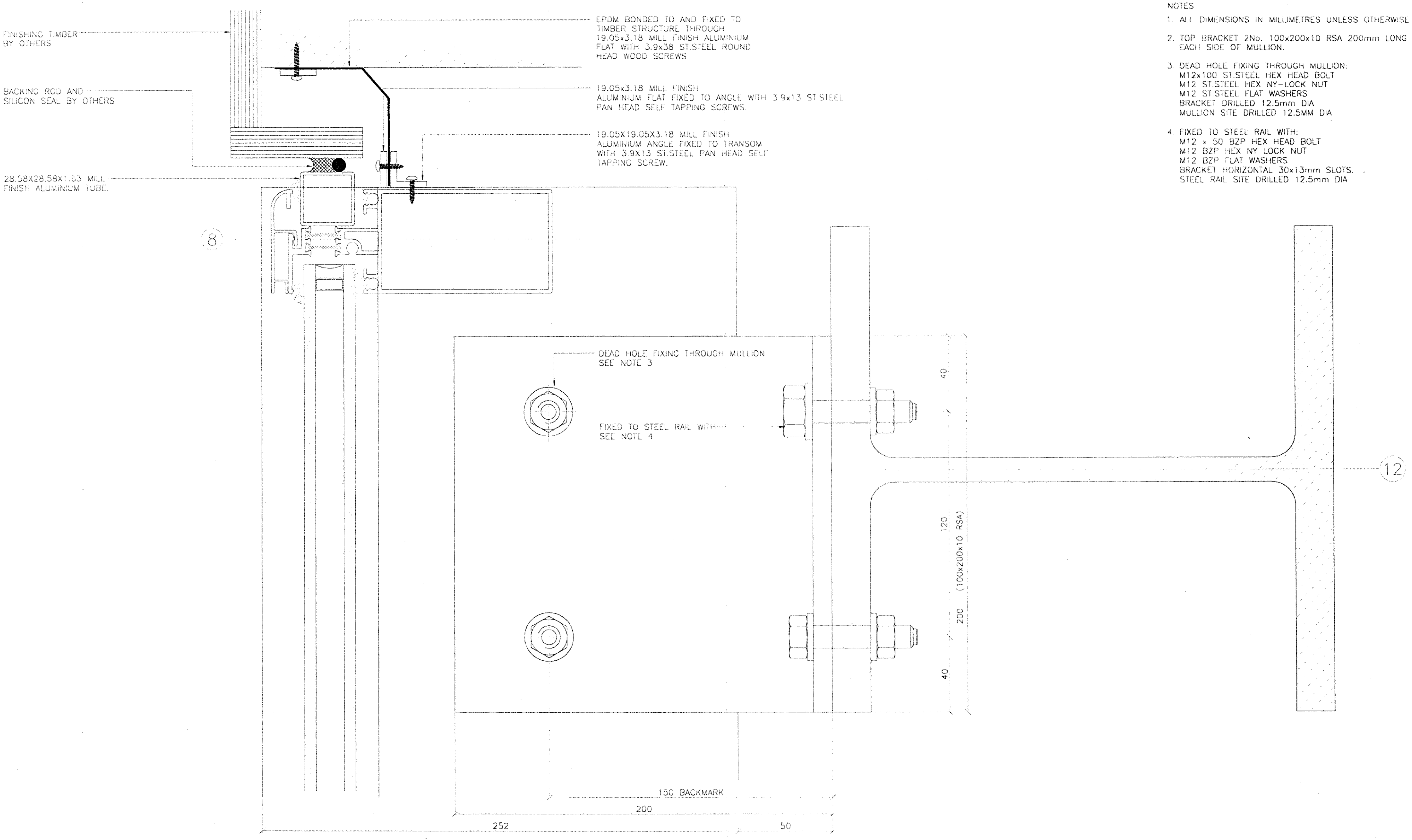
CUSTOMER: -

DRAWN BY: A.MURRAY	PROJECT No: TG001	DATE: 28.04.08	DRAWING NUMBER: MC03
CHECKED: A.MURRAY	CLIENT: -	A1 SCALE: Varies	SIZE: A1
APPROVED: -	DIMENSIONS IN MILLIMETRES	SHEET 1 OF 1	REVISION: 1

DO NOT SCALE: IF IN DOUBT – ASK

NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. TOP BRACKET 2No. 100x200x10 RSA 200mm LONG EACH SIDE OF MULLION.
3. DEAD HOLE FIXING THROUGH MULLION:
   M12x100 ST.STEEL HEX HEAD BOLT
   M12 ST.STEEL HEX NY-LOCK NUT
   M12 ST.STEEL FLAT WASHERS
   BRACKET DRILLED 12.5mm DIA
   MULLION SITE DRILLED 12.5MM DIA
4. FIXED TO STEEL RAIL WITH:
   M12 x 50 BZP HEX HEAD BOLT
   M12 BZP HEX NY LOCK NUT
   M12 BZP FLAT WASHERS
   BRACKET HORIZONTAL 30x13mm SLOTS.
   STEEL RAIL SITE DRILLED 12.5mm DIA



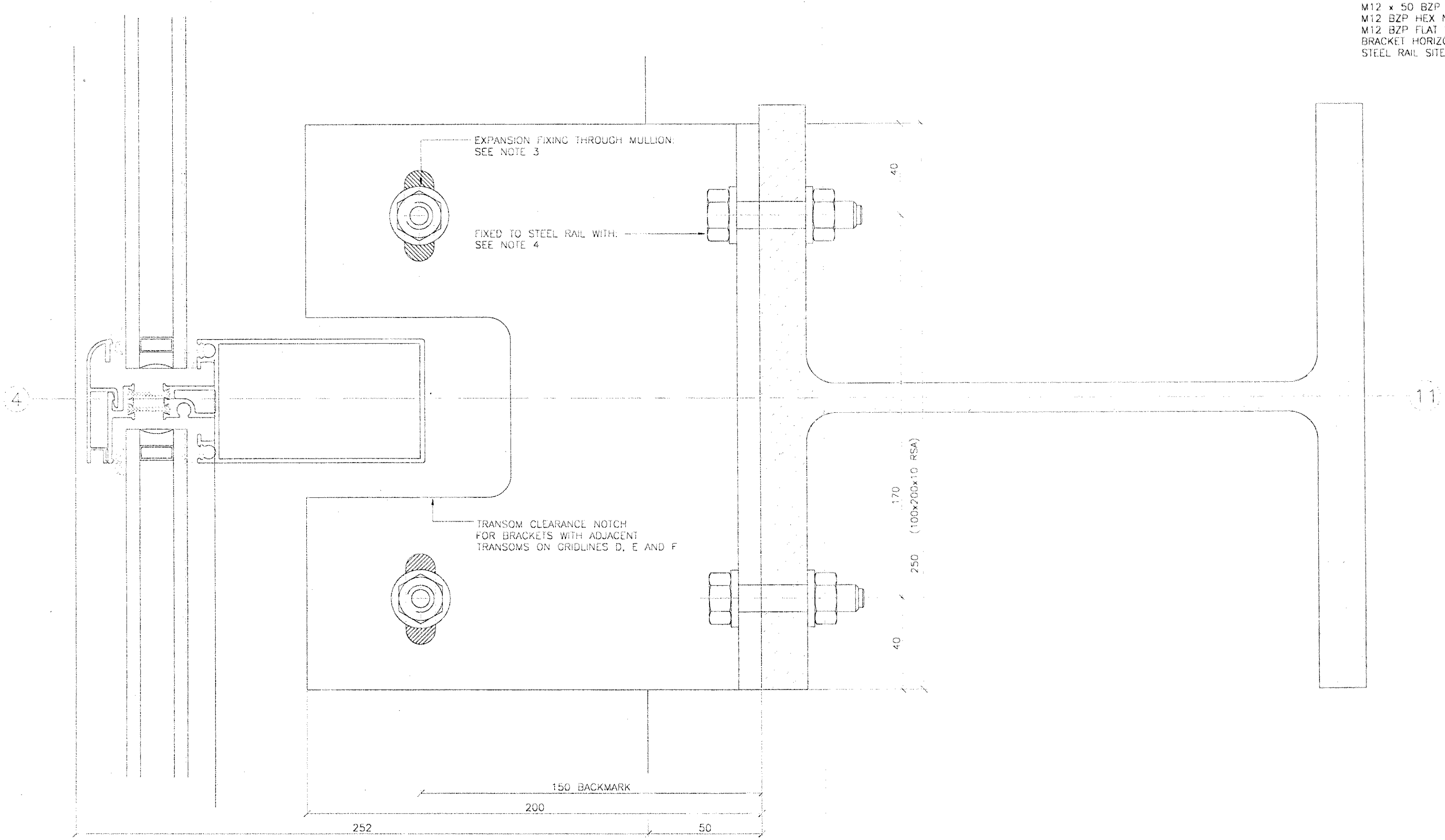
HEAD FIXING DETAIL
A1 SCALE 1:1

USED ON		smart architectural aluminium	THIRD ANGLE PROJECTION	
M/L	ALUMINIUM ALLOY		TITLE HEAD DETAIL MC Wall – CWCT Test	
FINISH			CUSTOMER –	
REV.	REV2 30/06/2008	DRAWN BY A.MURRAY / PROJECT No. TG001	DATE 28.04.08 / DRAWING NUMBER MC04	SIZE A1
		CHECKED A.MURRAY / CLIENT –	A1 SCALE Varies	
		APPROVED – / DIMENSIONS IN MILLIMETRES	SHEET 1 OF 1	REVISION 1

DO NOT SCALE IF IN DOUBT ASK

NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. INTERMEDIATE FIXING 2No. 100x200x10 RSA 250mm LONG EACH SIDE OF MULLION.
3. EXPANSION FIXING THROUGH MULLION:
   M12x100 ST.STEEL HEX HEAD BOLT
   M12 ST.STEEL HEX NY-LOCK NUT
   M12 ST.STEEL FLAT WASHERS
   BRACKET VERTICAL 30mm x 13MM SLOT
   MULLION SITE DRILLED 12.5MM DIA.
4. FIXED TO STEEL RAIL WITH:
   M12 x 50 BZP HEX HEAD BOLT
   M12 BZP HEX NY LOCK NUT
   M12 BZP FLAT WASHERS
   BRACKET HORIZONTAL 30x13mm SLOTS
   STEEL RAIL SITE DRILLED 12.5mm DIA.

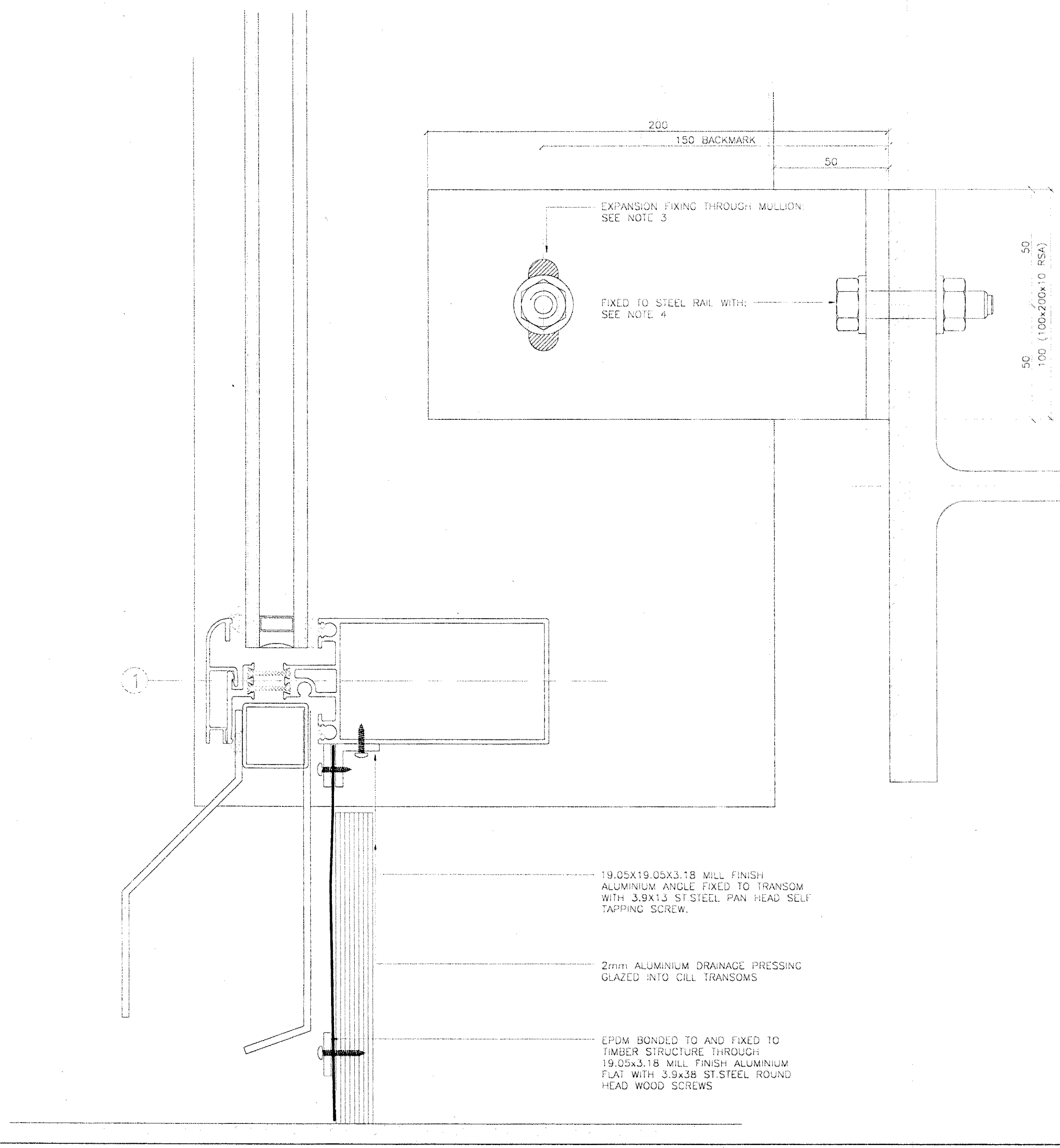


INTERMEDIATE FIXING DETAIL

A1 SCALE 1:1

USED ON:		smart architectural aluminium	THIRD ANGLE PROJECTION	
MAT:	ALUMINIUM ALLOY		TITLE: INTERMEDIATE FIXING DETAIL MC Wall - CWCT Test	
FINISH:			CUSTOMER	-
REV:	REV2 30/06/2008			
DRAWN BY: A.MURRAY	PROJECT No.: TG001	DATE: 28.04.08	DRAWING NUMBER: MC05	SIZE: A1
CHECKED: A.MURRAY	CLIENT: -	A1 SCALE: Varies		ISSUE: 1
APPROVED: -	DIMENSIONS IN MILLIMETRES	SHEET 1 OF 1		

DO NOT SCALE: IF IN DOUBT ASK

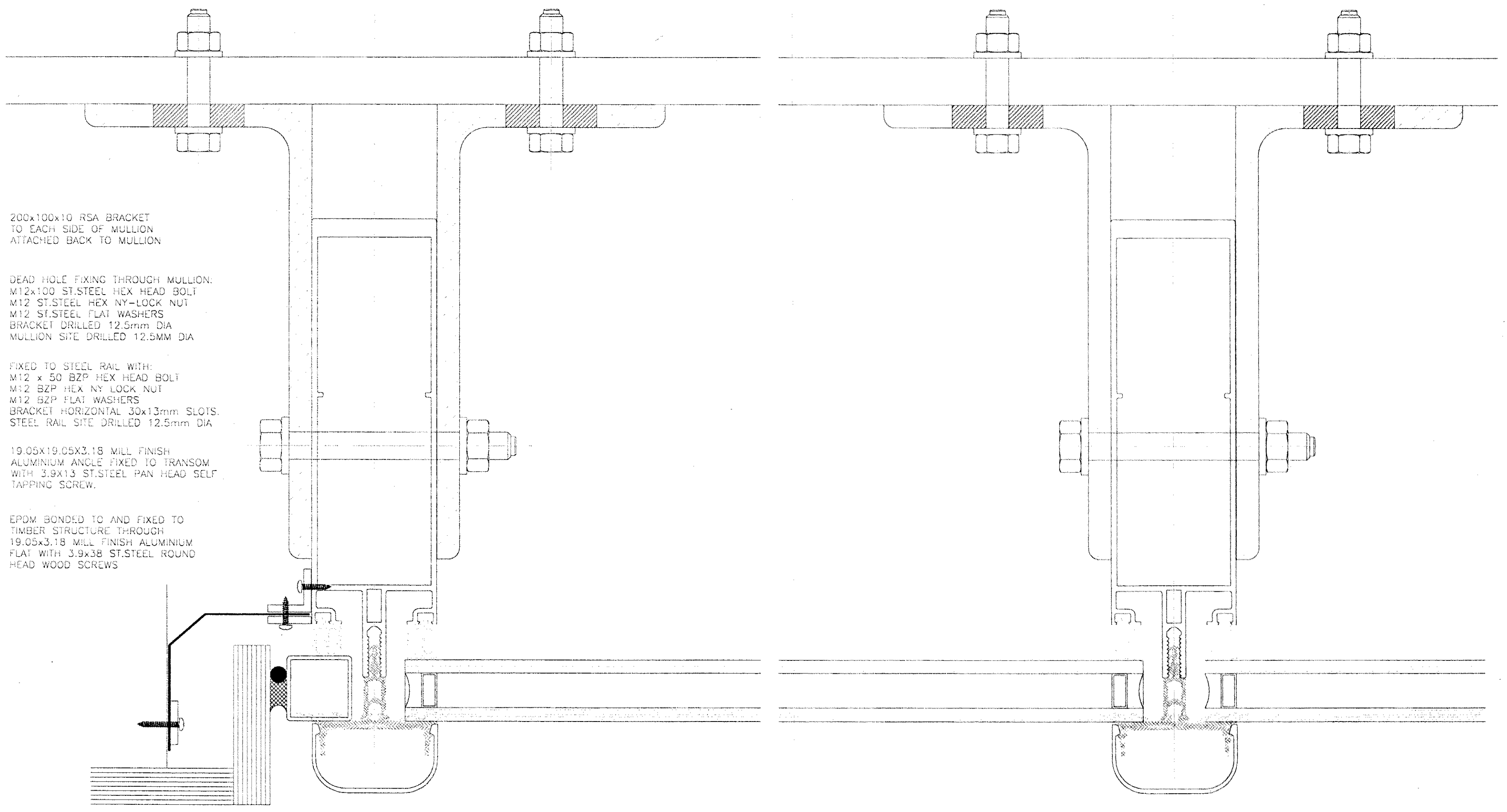


NOTES

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. CILL FIXING 2No. 100x200x10 RSA 100mm LONG EACH SIDE OF MULLION.
3. EXPANSION FIXING THROUGH MULLION
   M12x100 ST.STEEL HEX HEAD BOLT
   M12 ST.STEEL HEX NY-LOCK NUT
   M12 ST.STEEL FLAT WASHERS
   BRACKET VERTICAL 30mm x 13MM SLOT
   MULLION SITE DRILLED 12.5MM DIA.
4. FIXED TO STEEL RAIL WITH:
   M12 x 50 BZP HEX HEAD BOLT
   M12 BZP HEX NY LOCK NUT
   M12 BZP FLAT WASHERS
   BRACKET HORIZONTAL 30x13mm SLOTS
   STEEL RAIL SITE DRILLED 12.5mm DIA.

USED ON:		smart architectural aluminium	THIRD ANGLE PROJECTION
MTL:	ALUMINIUM ALLOY		TITLE CILL DETAIL MC Wall – CWCT Test
FINISH:			CUSTOMER –
REV:	REV2 30/06/2008	DRAWN BY A.MURRAY; PROJECT No. TG001	DATE 28.04.08
		CHECKED A.MURRAY; CLIENT –	AT SCALE Varies; DRAWING NUMBER MC06; SIZE A1
		APPROVED –; DIMENSIONS IN MILLIMETRES	SHEET 1 OF 1; REVISION 1

DO NOT SCALE: IF IN DOUBT - ASK



USED ON:
MTL: ALUMINIUM ALLOY
FINISH:
REV: REV2 30/06/2008

smart
architectural aluminium

DRAWN BY A.MURRAY | PROJECT No. TC001
CHECKED A.MURRAY | CLIENT –
APPROVED – | DIMENSIONS IN MILLIMETRES

THIRD ANGLE PROJECTION

TITLE: JAMB DETAIL
MC Wall – CWCT Test

CUSTOMER –
DATE 28.04.08
A1 SCALE Varies
SHEET 1 OF 1
DRAWING NUMBER MC07
A1
1

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