Technical Report

Title	**Weathertightness testing an Argeton Rainscreen system of terracotta**
Report Number & Date of Issue	N950/07/13946/REV01 16 OCTOBER, 2007

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Abstract

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1. INTRODUCTION

This report describes tests carried out at the Taylor Woodrow Technology Centre at the request of Telling Architectural Limited, Primrose Avenue, Fordhouses, Wolverhampton, West Midlands, WV10 8AW.

The test sample consisted of an Argeton Rainscreen system of terracotta manufactured by Telling.

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 on the 11th and 12th September 2007 and were to determine the weathertightness of the test sample. The test methods were in accordance with the CWCT Standard Test Methods for building envelopes, 2005, for:

Watertightness – dynamic pressure

Wind resistance – serviceability & safety.

The sample was also subjected to the following non UKAS accredited tests in accordance with the Taylor Woodrow Quality System:

Impact resistance. (BS 8200)

Seismic movement. (AAMA 501.4-00)

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.

2. DESCRIPTION OF TEST SAMPLE

2.1 GENERAL ARRANGEMENT

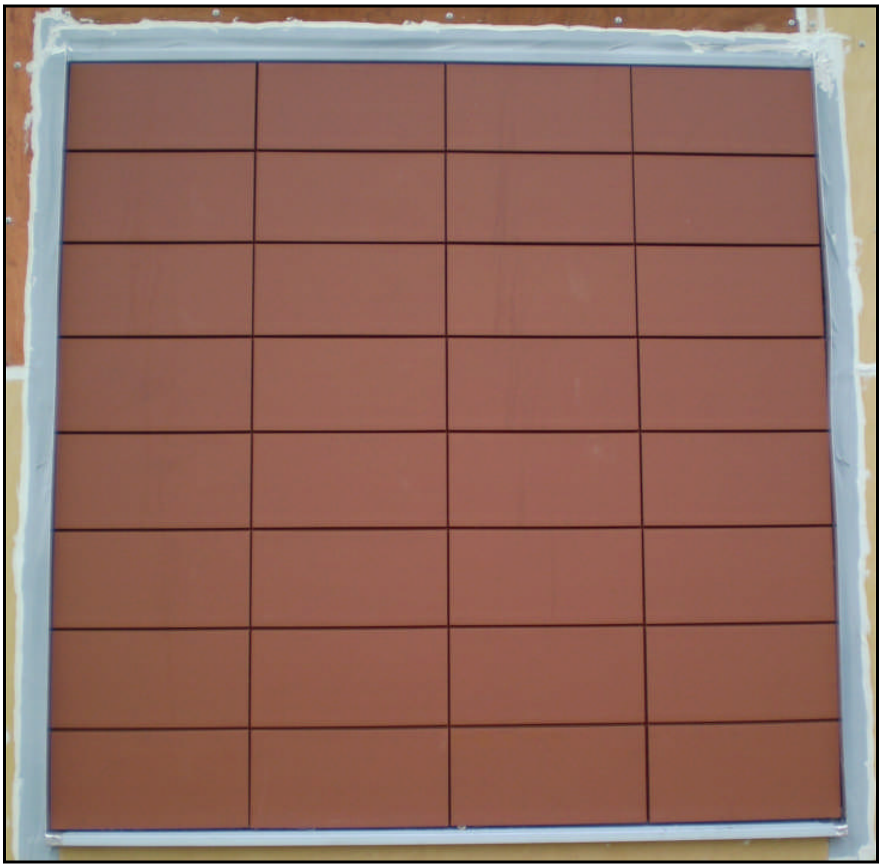
The sample was as shown in the photo below and the drawings included as an appendix to this report.

The tiles measured 600 mm wide by 300 mm high and were supported by vertical rails at 600 mm centres.

The aluminium rainscreen carrier frame was secured to the backing wall framework with 2 coarse thread self drilling Tek screws at each fixing position.

PHOTO 00013

TEST SAMPLE ELEVATION



2.2 CONTROLLED DISMANTLING

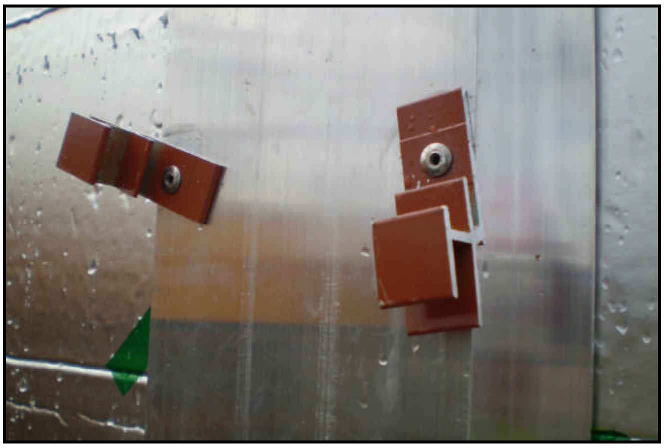
During the dismantling of the sample no discrepancies from the drawings were found.

PHOTO 20027

VERTICAL SUPPORT RAILS

PHOTO 20028

TILE SUPPORT CLIPS

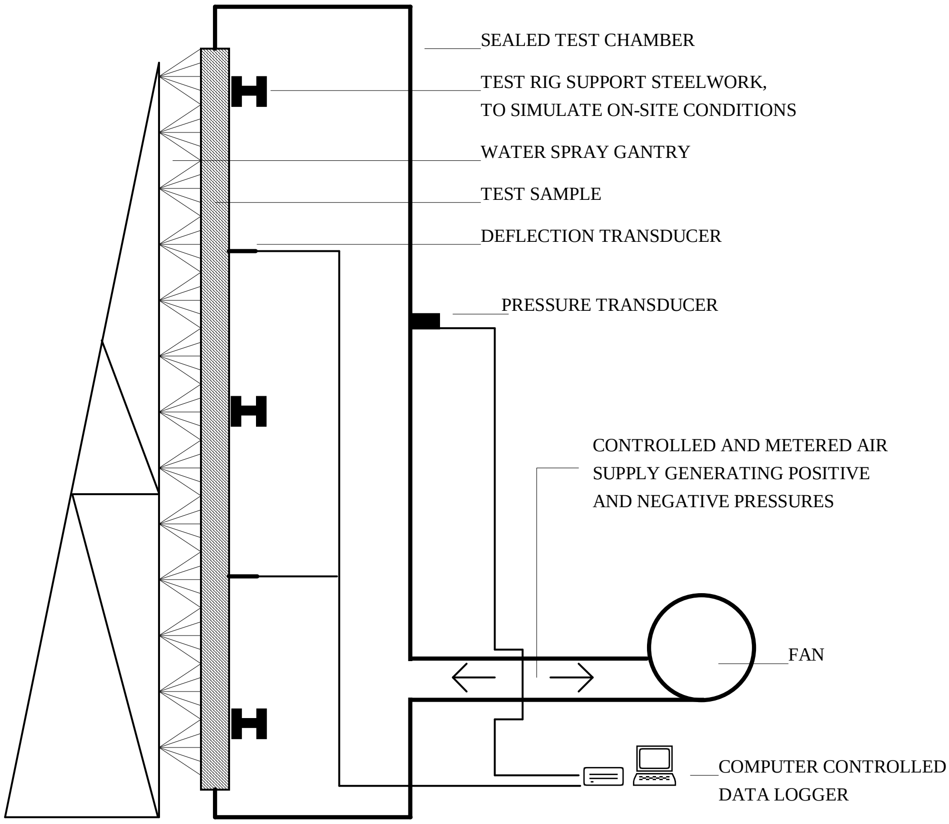


3. TEST RIG GENERAL ARRANGEMENT

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 Telling 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) Wind resistance – serviceability

(2) Wind resistance – safety

(3) Watertightness – dynamic

(4) Impact resistance

(5) Seismic movement

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, 8 and 9.

TABLE 1

Date	Test number	Test description	Result
11 September 2007	1	Wind resistance – serviceability	Pass
11 September 2007	2	Wind resistance – safety	Pass
12 September 2007	3	Watertightness – dynamic	Pass
12 September 2007	4	Impact resistance	Pass
12 September 2007	5	Seismic movement	Pass

TABLE 2

Test	Standard	Classification / Declared value
Wind resistance	CWCT	2400 pascals

6. WIND RESISTANCE 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 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 2.

6.1.3 Temperature

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

6.1.4 General

Holes were introduced in the backing wall and insulation to enable the pressure to reach the tiles. During these tests the joints between the tiles were taped over.

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

6.3.1 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.

The test was then repeated using a negative pressure of -1200 pascals.

6.3.2 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.

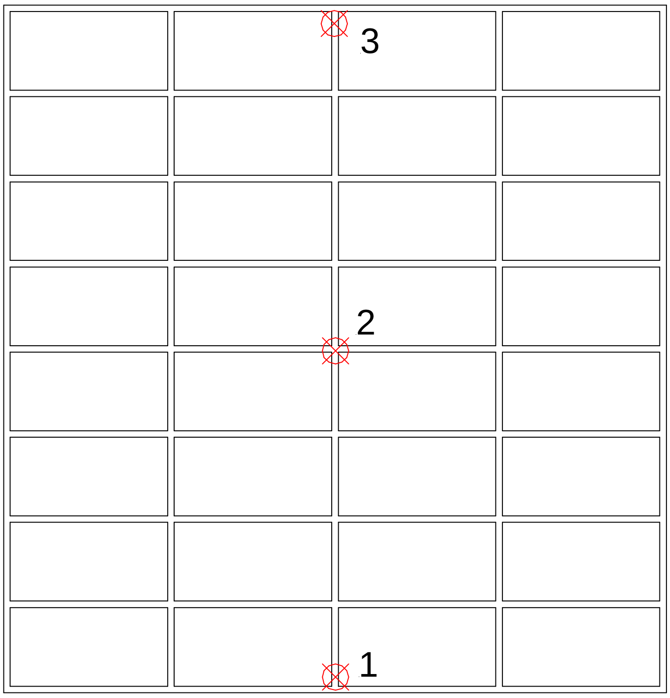
Any damage or functional defects were recorded.

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

FIGURE 2

DEFLECTION GAUGE LOCATIONS

External View



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6.4 PASS/FAIL CRITERIA

6.4.1 Calculation of permissible deflection

Gauge number	Member	Span (L) (mm)	Permissible deflection (mm)	Permissible residual deformation
2	Vertical support rail	2400	L/200 = 12.0	1 mm

6.5 RESULTS

Test 1 (serviceability) Date: 11 September 2007

The deflections measured during the wind resistance test, at the positions shown in Figure 2, are shown in Tables 4 and 5.

Summary Table:

Gauge number	Member	Pressure differential (Pa)	Measured deflection (mm)	Residual deformation (mm)
2	Vertical support rail	2440 -2417	6.4 -7.1	0.1 -0.7

No damage to the test sample was observed.

Ambient temperature = 20°C
Chamber temperature = 22°C

Test 2 (safety) Date: 11 September 2007

The deflections measured during the structural safety test, at the positions shown in Figure 2, are shown in Table 6.

No damage to the sample was observed.

Ambient temperature = 20°C
Chamber temperature = 22°C

TABLE 4

WIND RESISTANCE – POSITIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	609	**1181**	**1780**	**2440**	**Residual**
1	0.8	1.5	2.2	2.8	0.1
2	3.7	6.3	8.6	10.6	0.2
3	3.0	4.0	4.8	5.5	0.1
2 *	1.8	3.5	5.1	6.4	0.1

* Mid-span reading adjusted between end support readings

TABLE 5

WIND RESISTANCE – NEGATIVE **SERVICEABILITY** TEST RESULTS

Position	Pressure (pascals) / Deflection (mm)				
	-621	**-1228**	**-1855**	**-2417**	**Residual**
1	-0.9	-2.0	-3.6	-5.3	-0.4
2	-2.8	-5.7	-8.8	-11.8	-0.9
3	-1.0	-2.0	-3.0	-4.1	-0.2
2 *	-1.9	-3.7	-5.5	-7.1	-0.7

* Mid-span reading adjusted between end support readings

TABLE 6

WIND RESISTANCE - **SAFETY** TEST RESULTS

Position	**Pressure (pascals) / Deflection (mm)**			
	3588	**Residual**	**-3582**	**Residual**
1	4.3	0.4	-8.1	-0.6
2	14.6	0.5	-16.6	-1.1
3	6.6	0.2	-6.2	-0.8
2 *	9.1	0.2	-9.5	-0.4

* Mid-span reading adjusted between end support readings

7. WATERTIGHTNESS TESTING

7.1 INSTRUMENTATION

7.1.1 Water Flow

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

7.1.2 Temperature

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

7.2 FAN

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

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.

7.4 PROCEDURE

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 a pressure differential of 600 pascals. These conditions were maintained for 15 minutes. Throughout the test the inside of the sample was examined for water penetration.

7.5 PASS/FAIL CRITERIA

There shall be no water penetration to the internal face of the sample throughout testing.

7.6 RESULTS

Test 3 Date: 12 September 2007

No water penetration was observed throughout the test.

Chamber temperature= 12°C
Ambient temperature = 9°C
Water temperature = 14°C

8. IMPACT TESTING

8.1 IMPACTOR

8.1.1 Soft body

The soft body impactor comprised a canvas spherical/conical bag 400 mm in diameter filled with 3 mm diameter glass spheres with a total mass of approximately 50 kg suspended from a cord at least 3 m long.

8.1.2 Hard body

The hard body impactor was a solid steel ball of 50 mm or 62.5 mm diameter and approximate mass of 0.5 kg or 1.0 kg.

8.2 PROCEDURE (BS 8200)

8.2.1 Soft body

The impactor almost touched the face of the sample when at rest. It was swung in a pendular movement to hit the sample normal to its face. The test was performed at the locations shown in Figure 3. The impact energies were 120, 350 and 500 Nm.

8.2.2 Hard body

The impactor almost touched the face of the sample when at rest. It was swung in a pendular movement to hit the sample normal to its face. The test was performed at the locations shown in Figure 3. The impact energies were 3, 6 and 10 Nm.

8.3 PASS/FAIL CRITERIA

8.3.1 At impact energies for retention of performance

There shall be no failure, significant damage to surface finish or significant indentation.

8.3.2 At impact energies for safety

The structural safety of the building shall not be put at risk, no parts shall be made liable to fall or to cause serious injury to people inside or outside the building. The soft body impactor shall not pass through the wall. Damage to the finish and permanent deformation on the far side of the wall may occur.

8.4 RESULTS

Test 4 Date: 12 September 2007

Location 1.

120 Nm soft body. No damage to the sample was observed.

Location 2.

120 and 350 Nm soft body. No damage to the sample was observed.

500 Nm. The impact cracked the top of the tiles below. The tiles remained secure. See photo 20018.

Location 3.

120, 350 and 500 Nm soft body. No damage to the sample was observed.

Location 4.

500 Nm soft body. No damage to the sample was observed.

Location 5.

500 Nm soft body. No damage to the sample was observed.

6 Nm hard body. No damage to the sample was observed.

Location 6.

3 Nm hard body. No damage to the sample was observed.

Location 7.

10 Nm hard body. The tile cracked but remained secure. See photo 20025.

Ambient temperature = 13°C

FIGURE 3

IMPACT TEST LOACTIONS

External View

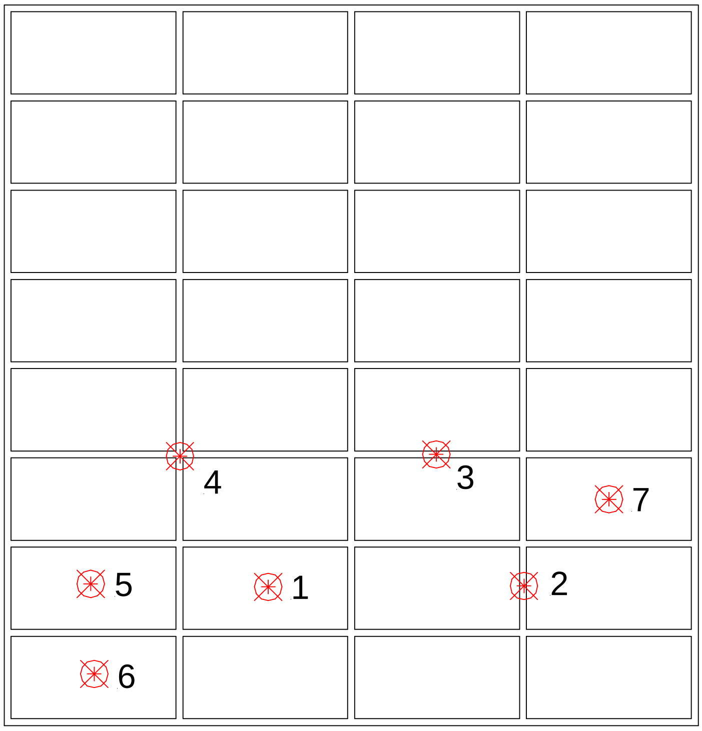

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PHOTO 20018

LOCATION 2 IMPACT

PHOTO 20025

LOCATION 7 IMPACT

9. SEISMIC MOVEMENT

9.1 PROCEDURE (AAMA 501.4-00)

Seismic serviceability.

The top horizontal support beam was moved sideways by 24 mm in each direction three times.

Seismic safety

The test was then repeated once in each direction but the movement was increased to 36 mm.

9.2 RESULTS

Test 5 Date: 12 September 2007

No damage to the sample was observed.

Ambient temperature = 15°C

10. APPENDIX - DRAWINGS

The following 14 unnumbered pages are copies of Telling Architectural Aluminium drawings numbered:

L001,

L002,

L003,

L004,

M001,

M002,

M003,

M004,

M005,

M006,

M007,

M008,

M009 rev A,

M010.

END OF REPORT

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