

IAN BENNIE AND ASSOCIATES
TEST REPORT NO. 5004S1
GENERIC SYSTEM TESTING
TERRAÇADE TL CLADDING SYSTEM
PROTOTYPE TEST to AS/NZS 4284:1995
for The Austral Brick Company

January 2006



Registered Laboratory No. 2371



IAN BENNIE & ASSOCIATES PTY. LTD.

Building Performance Testing

ACN : 007 133 253



Registered
Laboratory
No. 2371

TEST REPORT NUMBER 5004S1

Test Client: The Austral Brick Company

Project: Terraçade TL Cladding System.

Background

Ian Bennie and Associates were engaged by The Austral Brick Company to conduct Investigative Water Penetration and Strength tests on a sample of Terraçade TL Cladding System. The client's consultant, Connell Mott MacDonald, specified all test pressures and parameters.

Water penetration tests were conducted both with and without a "FrameShield 100" breathable membrane installed. Negative structural deflection and ultimate load tests were conducted with the full loads applied to the façade tiles.

Sample Identification

A sample installation of Terraçade TL Cladding System, measuring 3000 mm in height x 2400 mm in width. The Terraçade top hat sections were fixed to horizontal steel purlins at 600 mm centres with a 450 mm span at the top of the sample. Three alternative vertical tile joints were included for evaluation. Details of the sample condition for the tests are given in Connell Mott MacDonald Drawings No 2082-SK-01/02, 2082-D-01/02, 02/02, 03/02 and 04/02 that are given in Appendix B. The sample was installed and tested at Ian Bennie & Associates' laboratory in Melbourne.

Test Methods

Investigative Water Penetration and Strength tests were conducted generally in accordance with the procedures and performance requirements of Australian Standard AS/NZS 4284:1995, Testing of building facades, as detailed in Appendix A. Specific test methodologies, configurations and parameters are detailed in the individual sections below.

Test Date(s): 9 and 10 November 2005.

Water Penetration Test with "FrameShield 100" membrane

Sample configuration and Test Methodology

As the Terraçade TL Cladding System consists of only external open jointed tiles, an internal air barrier was required for the tests. Sheets of clear 10 mm acrylic were used for this purpose and they were installed and sealed on the indoor side of the sample. This enable clear viewing of the entire indoor surface of the cladding system.

The internal acrylic sheets were fitted with a gate valve so that the air infiltration rate through the sample could be set prior to commencing the water test. The gate valve was adjusted so the air infiltration rate was 1.0 l/s.m² at 150 Pa which is the maximum allowed by the Standard. The valve remained in that position during the water penetration test.

Measurement of the air infiltration was conducted in accordance with Clause 7.4 of Australian Standard AS/NZS 4284:1995. Air flow rate measurements were carried out with a NATA certified orifice plate flowmeter using pressure transducers calibrated against a NATA certified manometer. The accuracy of the flow rate may be taken as ± 0.04 L/m².s.

The water test was conducted in accordance with Clauses 7.5 and 7.6 of AS/NZS 4284:1995. The full sequence of test pressures was as follows:

Pressure (Pa)		Duration
0		5 minutes
300	static	15 minutes
0	(no water)	5 minutes
150 - 300	cyclic	5 minutes
0		2 minutes
300 - 600	cyclic	5 minutes
0		2 minutes
460-920	cyclic	5 minutes
0		2 minutes
540-1080	cyclic	5 minutes
0		2 minutes
600-1200	cyclic	5 minutes
0	(no water)	5 minutes

Simulated rain conditions were provided by use of water sprays located 1 metre away from the outdoor face of the test sample. Water flow rate to the sprays was measured with a NATA certified flow meter to an accuracy of 2% and was maintained at a level of 0.05 l/s.m² over the test area throughout the test. Water application was maintained continuously and water was observed to evenly cover the exterior face of the test sample.

Observations

No water penetrated to the indoor side of the "FrameShield 100" membrane during any stage of the tests.

Water Penetration Test without membrane

Sample configuration and Test Methodology

The breathable membrane was removed from the sample prior to commencement of the test. All other details were as per the test with the membrane installed.

Observations

Water penetration was observed in 4 locations during the tests:

- 1/ Zero Pa Step: Water was observed running down the inside of the top hat behind the vertical tile joint with the aluminium channel. Some of this water splashed onto the horizontal purlins. This leak continued to occur at all subsequent pressure stages of the test.
- 2/ Zero Pa Step: Water was observed penetrating through many of the horizontal tile joints but the water remained on the back of the tiles and ran down to the sill. These leaks were notably worse in the bottom five rows of the of tiles than those above. These leaks continued to occur at all subsequent pressure stages of the test.
- 3/ Zero Pa Step: A significant quantity of water was observed splashing up under the under the bottom of the bottom tiles. This splashing caused a lot of water to accumulate on the outside surface of the acrylic sheet, some as high as 350mm above the sill. These leaks continued to occur at all subsequent pressure stages of the test.
- 4/ 300 Pa Step: Water was observed running down the inside of the top hat behind the vertical tile joint with the silicon seal. Some of this water splashed onto the horizontal purlins. This leak continued to occur at all subsequent pressure stages of the test.

There was no apparent increase in the rate of water penetration through any of the locations during any of the pressure stages after the 300 Pa stage.

Structural Deflection Test

Sample configuration and Test Methodology

As the Terraçade TL Cladding System consists of external open jointed tiles, a layer of plastic film was installed immediately behind the tiles for the test. This film was placed to the outdoor side of the top hat sections and small cuts allowed the clips to penetrate without affecting the engagement of the tiles on the clips. The internal acrylic sheets were removed for the structural test.

Test Readings and Observations

Figure 1 shows the 6 measurement locations used to record the displacements under load of the top hat section. Table 1 gives deflection/span ratios for each span measured at each test pressure.

The greatest deflection recorded was Span:3067 at negative 1540 Pa.

Ultimate Load Proof Test

Sample configuration and Test Methodology

Only negative wind loading was nominated for testing. Details were the same as for the Structural test.

Observations

The sample was incrementally loaded up to negative 2400 Pa and the sample sustained this load for the 10 second test duration without any sign of collapse. Approximately three seconds later, the tile at the top left of the sample (viewed from indoors) released from the clips and fell to the floor fracturing into many pieces. The exact mode of the failure could not be determined however the top hat clips appeared to be undamaged.

Ultimate Load Proof Test with Anti-lift Blocks

Sample configuration and Test Methodology

Details were the same as for the previous test except that additional packing blocks were installed between the top row of tiles and the perimeter of the test chamber. Two blocks were installed above each tile, one at each end. These blocks were intended to prevent the top tiles from lifting off the clips during the test.

Observations

The sample was incrementally loaded up to negative 2900 Pa and the sample sustained the load for the 10 second test duration without any sign of collapse. When the test load was being re-applied for the next pressure increment, many of the tiles down the left side of the sample released from the clips but these did not include the two top tiles. The release occurred at a pressure of approximately negative 2940 Pa. Inspection after the test revealed many of the top hat clips were bent and it is likely this was the mode of the failure.

Report Distribution:

Ian Bennie & Associates..... 3
The Austral Brick Company..... PDF + 2



A handwritten signature in black ink, appearing to read 'D. Dubout'.

Derek Dubout 12 January 2006
Authorised NATA Signatory

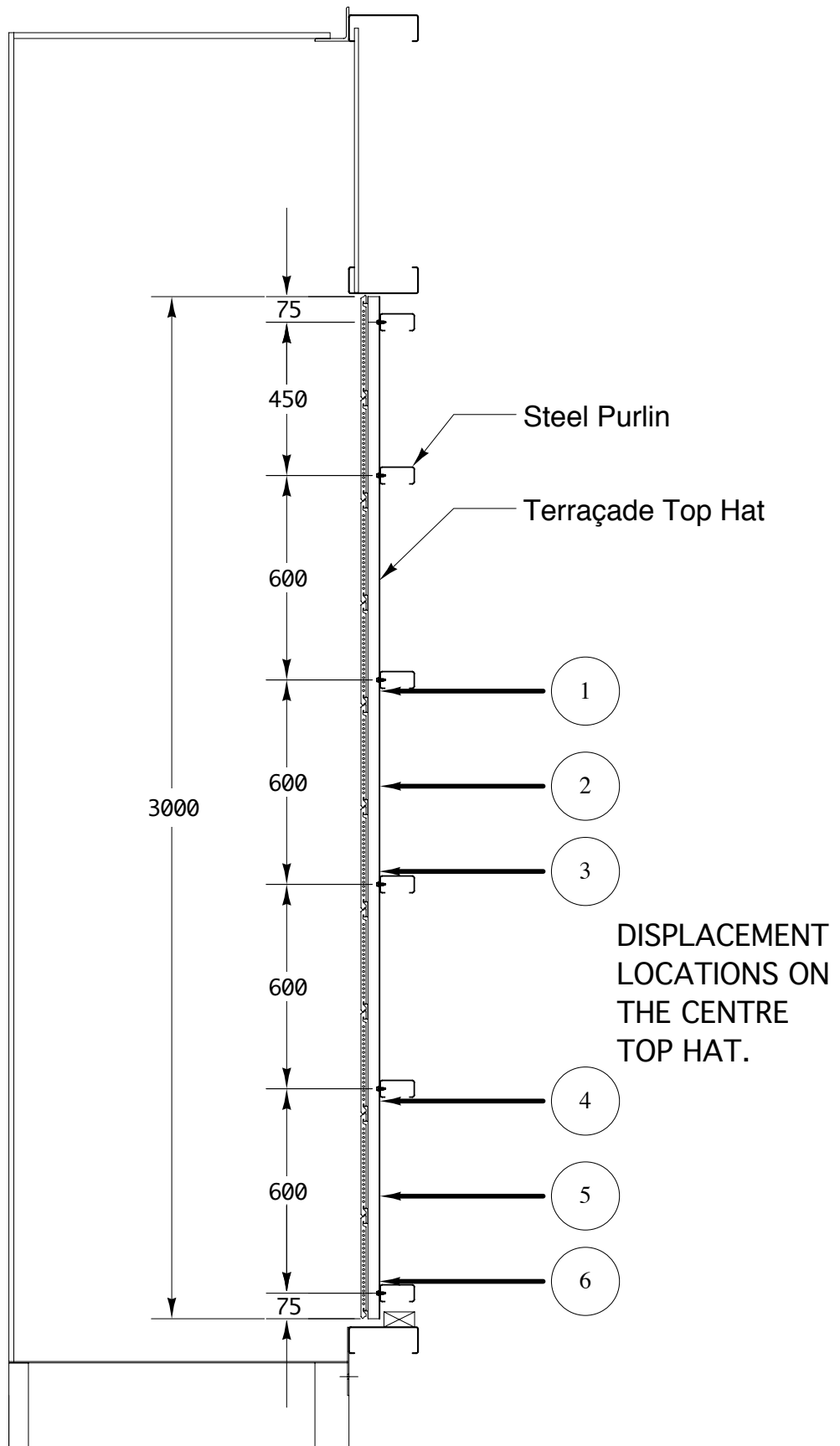


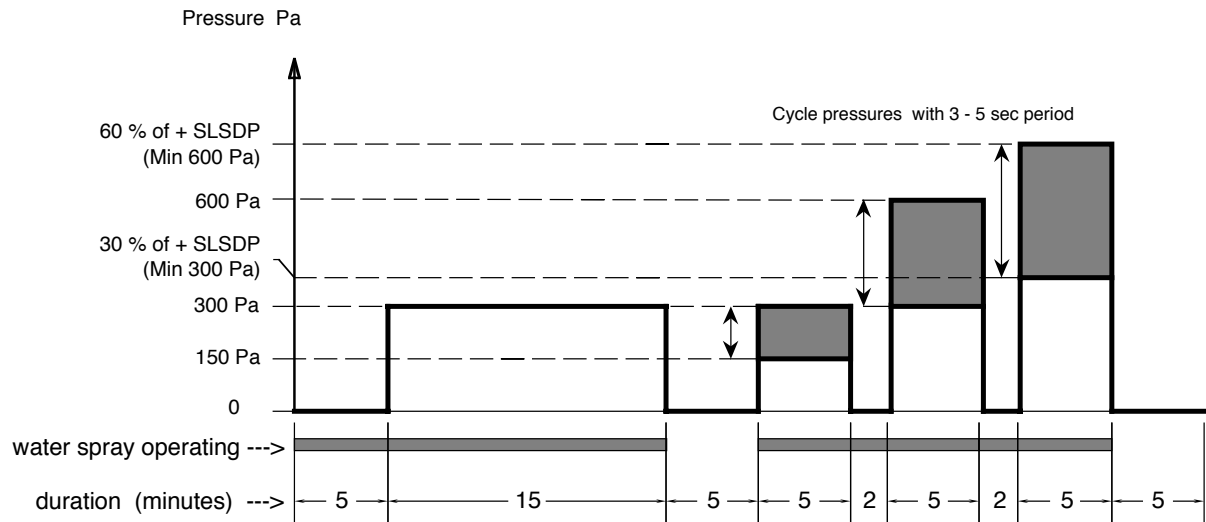
Figure 1. Displacement measurement locations.

Table 1
STRUCTURAL PERFORMANCE

DATAFILE 619		TEST NUMBER 1			DATE : 10/11/2005		
MEMBER	PRESSURE (kPa)	DISPLACEMENTS (rounded to 0.1 mm)			BENDING DEFLECTION (rounded to 0.01 mm) DC - $\frac{D1+D2}{2}$ DEF (mm)	SPAN L (mm)	SDR L/DEF
		LEFT OR TOP D1 (mm)	CENTRE DC (mm)	RIGHT OR BOTTOM D2 (mm)			
1,2,3	CENTRE TOP HAT - MIDDLE SPAN						
	-0.31	-1.0	-1.0	-1.1	-0.03	540	-19028
	-0.61	-2.4	-2.5	-2.5	-0.05		-11380
	-0.93	-4.0	-4.2	-4.1	-0.14		-3859
	-1.22	-5.4	-5.6	-5.5	-0.14		-3911
	-1.54	-6.8	-7.0	-7.0	-0.18		-3067
	-1.54	-6.9	-7.1	-7.0	-0.17		-3089
	-1.22	-5.9	-6.0	-6.0	-0.11		-4995
	-0.92	-4.6	-4.7	-4.7	-0.11		-4748
	-0.61	-3.2	-3.2	-3.2	-0.03		-19325
-0.31	-1.6	-1.7	-1.7	-0.06	-8378		
4,5,6	CENTRE TOP HAT - BOTTOM SPAN						
	-0.31	-1.1	-1.0	-0.9	0.00	540	183443
	-0.61	-2.4	-2.2	-1.9	-0.04		-13062
	-0.93	-3.8	-3.4	-2.9	-0.06		-8837
	-1.22	-5.1	-4.5	-3.9	-0.01		-38840
	-1.54	-6.4	-5.7	-4.9	-0.08		-6742
	-1.54	-6.5	-5.8	-5.0	-0.05		-11216
	-1.22	-5.4	-4.8	-4.1	-0.06		-8447
	-0.92	-4.2	-3.7	-3.2	-0.04		-14955
	-0.61	-2.9	-2.5	-2.2	0.01		47799
-0.31	-1.5	-1.3	-1.2	0.03	15580		

4 Water Penetration Tests - continued

Water penetration test sequence



Pass / Fail criteria : No leaks under static and cyclic pressure.

For both the static and cyclic water tests, a leak is considered to occur when one or more of the following occur:

- water appears on any inside surface of the facade and is visible from an occupied space.
- uncontrolled water appears on the inside face of the facade
- water appears that is likely to wet insulation, fixtures and finishes
- Water appears in other locations specified as unacceptable by the purchaser.

5 Proof Test

Test Parameters

Test pressures: Positive and negative ultimate limit state pressures for a period of not less than **10 seconds** each.

Pass / Fail criteria:

“Under proof there shall be no collapse of the test sample. Collapse shall mean any one or any combination of the following:

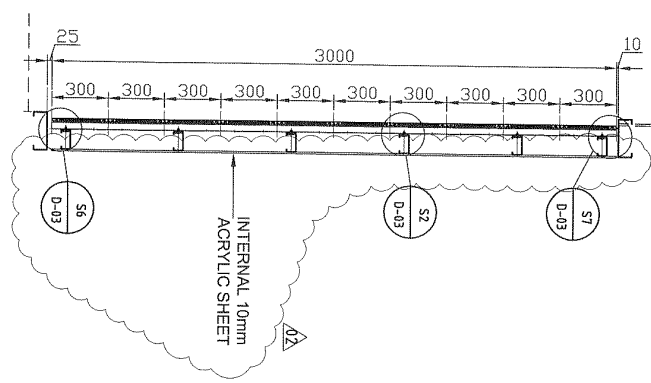
- Dislodgement of any glass.
- Dislodgement of any framing member, facade panel or part thereof..
- Failure of any fixings that connect the facade to the building structure, such that the test sample is unstable.
- The failure of any stop, locking device, fastener or support which would allow an opening light to come open.

6 Retesting - if required

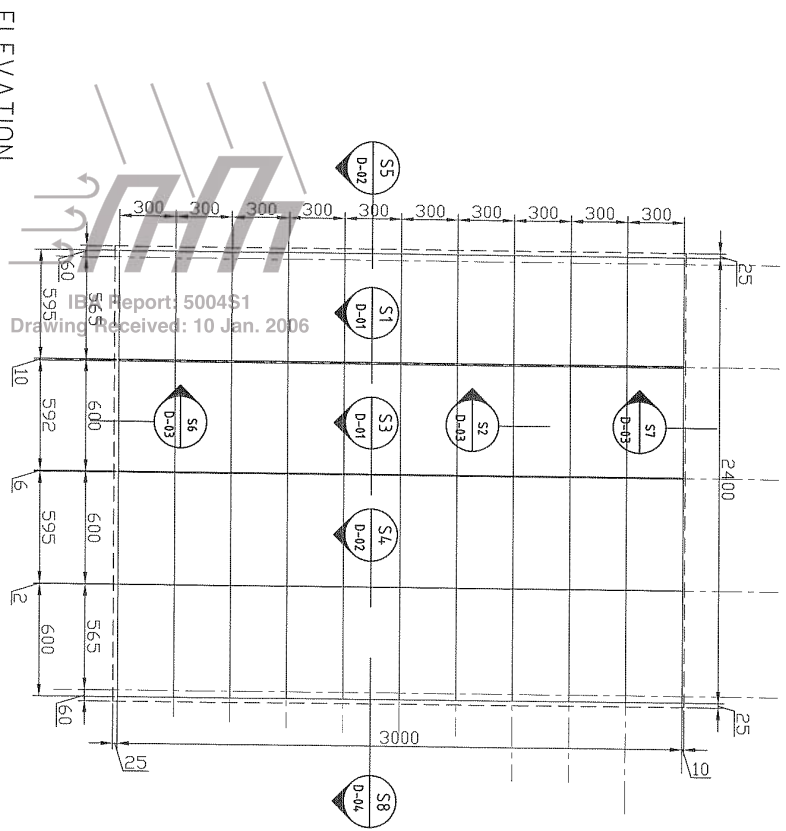
Test Parameters

Preload pressures: Positive and negative serviceability limit state pressures for a period of **2 minutes** each.

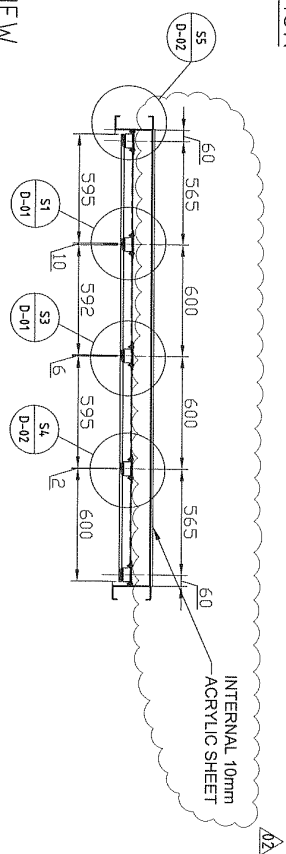
If the sample requires modification to enable it to pass either the air infiltration or water penetration tests then both test shall be repeated in full.



SECTION
SCALE 1:25

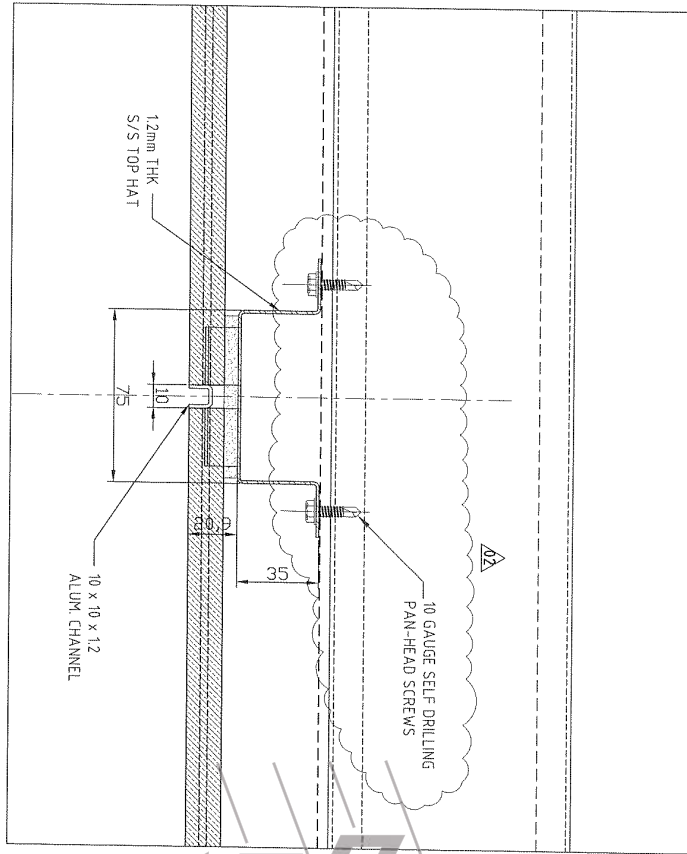


ELEVATION
SCALE 1:25

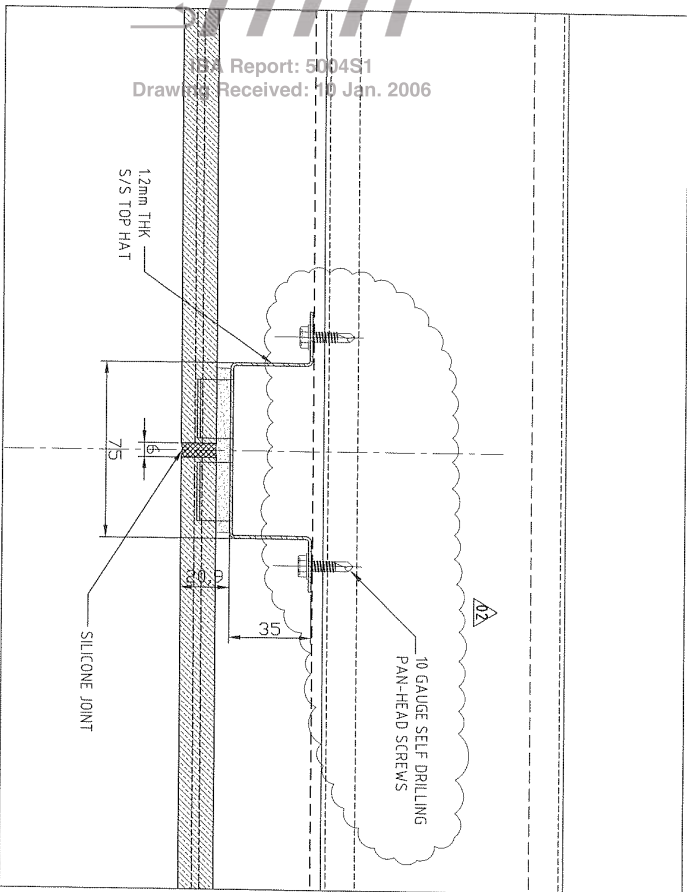


PLAN VIEW
SCALE 1:25

Connell Motit MacDonald Building the future 110 Murray Road (PO Box 5283) Newtown Bldg New South Wales 2205 Australia Email: connell@connellmotit.com.au Phone: (02) 9387 1000		Client AUSTRAL BRICKS		Project TERRACADE TL CLADDING SYSTEM		Drawing Title MOCK-UP ELEVATIONS		Project No. 2082-01-FO	
Drawing No. 2082-SK-01		Scale 1 : 25		Sheet Size A3		Rev. 02		Date 10 Jan 2006	
Issued For ISSUE FOR TEST REPORT		Checked LL		Signed LL		Date 10 Jan 2006		Drawing No. 2082-SK-01	
Issued For ISSUE FOR APPROVAL		Checked LL		Signed LL		Date 10 Jan 2006		Drawing No. 2082-SK-01	



DETAIL S-1
SCALE 1:2



DETAIL S-3
SCALE 1:2

IBA Report: 5004S1
Drawing Received: 10 Jan. 2006

No.	Date	Revision	By	Appr.
02	10/21/06	ISSUED FOR TEST REPORT	LL	DLK
01	24/07/06	ISSUED FOR APPROVAL	LL	DLK

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Client: **AUSTRAL BRICKS**

Project: **TERRACADE TL CLADDING SYSTEM**

Drawn	Signed	Date
LL		
Checked	Signed	Date
GW		
Verified	Signed	Date
Approved	Signed	Date

Drawing Title: **MOCK-UP DETAILS**

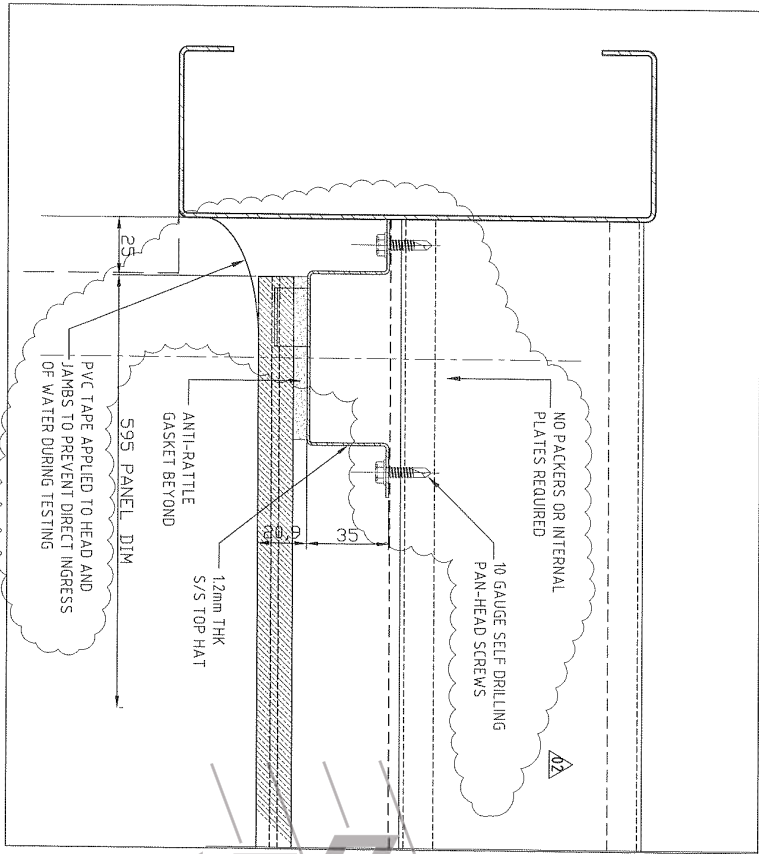
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Scale: **1 : 2**

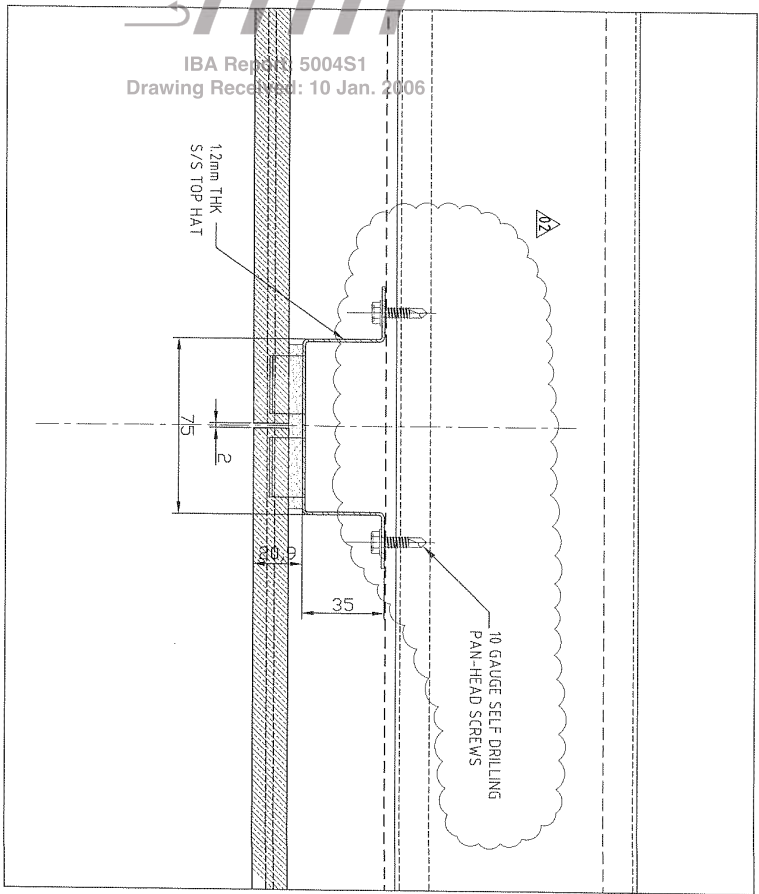
Sheet Size: **A3**

Drawing No: **2082-D-01**

Rev: **02**



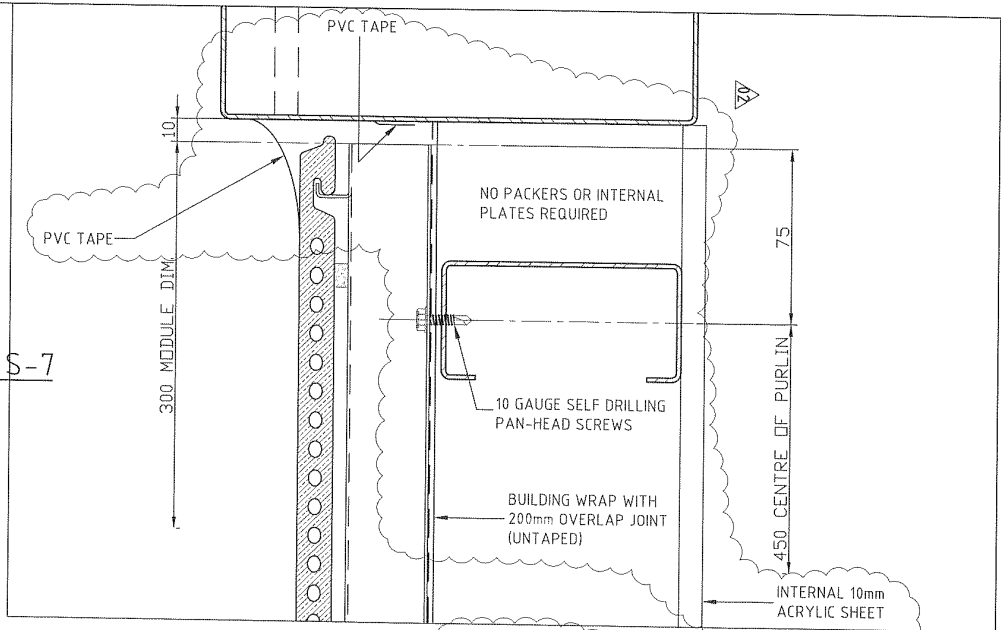
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SCALE 1:25



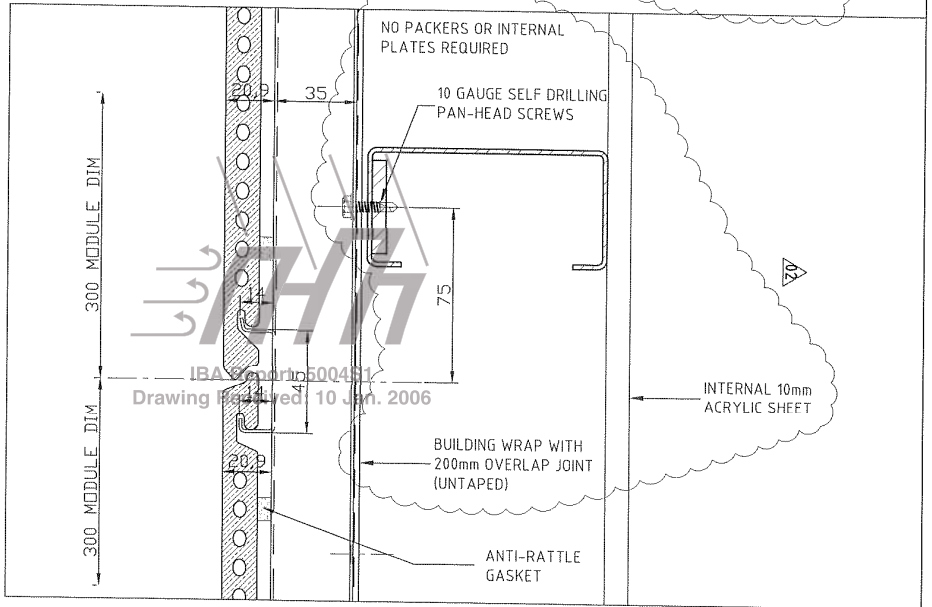
DETAIL S-4
SCALE 1:25

Cornell Mott MacDonald <i>...building the future</i> <small> Cornell Mott MacDonald Pty Ltd 11th Floor, 111 Market Street, Sydney, NSW 2000 Tel: +61 2 9230 6000 Fax: +61 2 9230 6001 Email: info@cornellmott.com.au </small>		Client	AUSTRAL BRICKS		Project	TERRACADE TL CLADDING SYSTEM		Drawing Title MOCK-UP DETAILS	Project No. 2082-01-FO
No. 02 01/24/2008 ISSUED FOR TEST REPORT	Date 01/24/2008	Drawn DML	Checked GJM	Approved GJM	Date 01/24/2008	Date 01/24/2008	Date 01/24/2008	Scale 1 : 2	Sheet Size A3
IBA Report No: 5004S1 Drawing Received: 10 Jan. 2006									
Project No. 2082-01-FO Drawing No. 2082-D-02 Rev. 02									

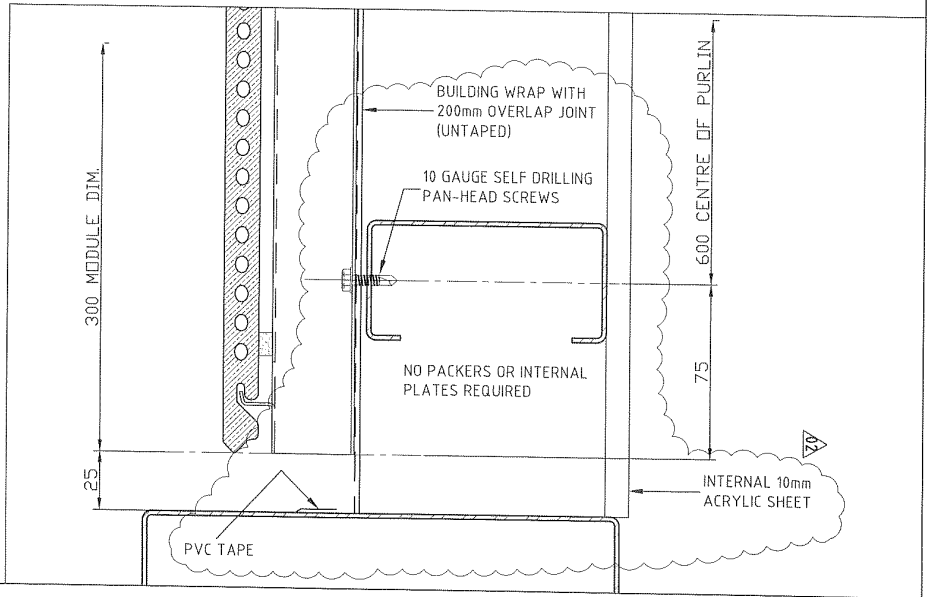
DETAIL S-7
SCALE 1:2



DETAIL S-2
SCALE 1:2



DETAIL S-6
SCALE 1:2



01	DATE	DESCRIPTION	BY	CHK
02	18.01.06	ISSUED FOR TEST REPORT	DL	DL
03	18.01.06	REVISED FOR APPROVAL	DL	DL

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AUSTRAL BRICKS

TERRACADE TL CLADDING SYSTEM

Drawn	Checked	Approved
LL	LL	LL
Signed	Signed	Signed
Date	Date	Date

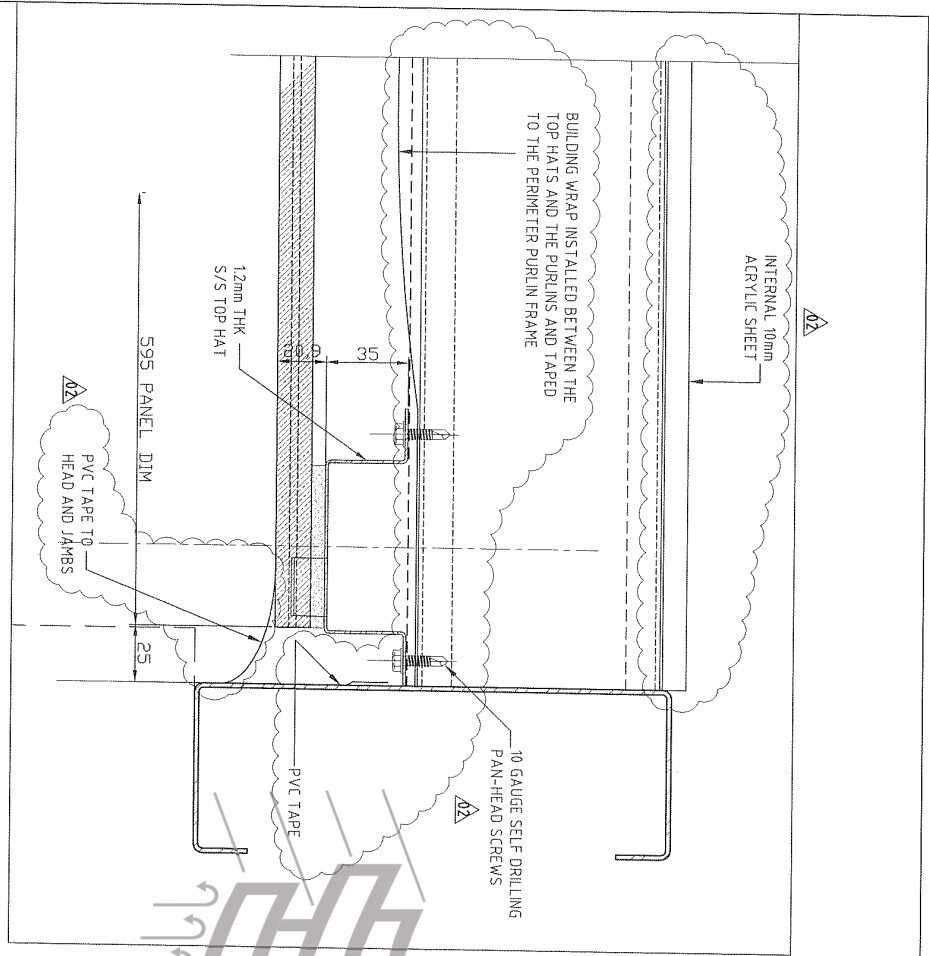
MOCK-UP DETAILS

Project No: **2082-01-FO**

Scale: **1:2**

Sheet No: **A3**

Drawing No: **2082-D-03**



DETAIL S-8
SCALE 1:2



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02	10/1/06	ISSUED FOR TEST REPORT	DLK	DLK					
03	10/1/06	ISSUED FOR APPROVAL	DLK	DLK					

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Client: **AUSTRAL BRICKS**

Project: **TERRACADE TL CLADDING SYSTEM**

Drawn	Checked	Reviewed	Approved
LL	LL	GW	GW
Signed	Signed	Signed	Signed
Date	Date	Date	Date

Drawing Title: **MOCK-UP DETAILS**

Project No:	2082-01-FO
Scale:	1 : 2
Sheet No:	A3
Drawing No:	2082-D-04
Rev:	02