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# Report No. FT-R1005

## Testing of James Hardie NZ ExoTec façade panel top hat rainscreen façade system in accordance with AS/NZS 4284:2008 'Testing of building facades', plus extension.

**Project:** Generic ExoTec façade panel rainscreen system

**Client:** James Hardie NZ

**Specifier:** James Hardie NZ

**Sample designer:** James Hardie NZ

**Manufacturer** James Hardie NZ

**Installer:** Steve Cleary (Builder)

**Test dates:** 8-9 May 2017

**Test Schedule** The test order specified in AS/NZS 4284:2008 was followed, with preliminary testing on 8th May 2017 and the balance of the testing completed on 8th and 9th May 2017.

**Persons present:**

John Burgess, (IANZ authorised signatory), Singh Kamboj, (Technical manager, James Hardie NZ) and part time - Steve Cleary (SC Interiors), Josh Burg (Technical manager, JH Research Australia)

**Test facility:** Façade testing NZ Ltd,
127 Park Rd
Miramar
Wellington

**IANZ accredited testing officer:** John Burgess

IANZ accreditation number for testing 1259, including AS/NZS 4284.

Note: The "Test Request' has been attached as Appendix 10.2.

Tested by: John Burgess, IANZ Signatory    Checked by: Darryl Scott

*Figure 1: Sample under construction for testing showing dry-side*

# 1. Summary

The James Hardie NZ Exotec façade panel top hat rainscreen test sample was subjected to tests from the AS/NZS 4284:2008 testing suite, and had the following results.

## 1.1. Preliminary tests

Pass – air and water

### 1.1.1. Serviceability deflection test

Pass – studs showed minor deflections

## 1.2. Air infiltration test

Indeterminate at positive pressure (See discussion later)
Fail at negative pressure

## 1.3. Static Water penetration test

Pass – at 1050 Pa

## 1.4. Cyclic water penetration test

Pass – at between 525 and 2,100 Pa

## 1.5. Ultimate limit state pressure test

Pass – at +5.0 kPa and -5.0 kPa

# 2. Contents

# 3. Figures

# 4. Tables



*Figure 2: RH Top of sample from wet side*

*Figure 3: Lower LHS of sample from wet side*

*Figure 4: LH Top of sample from wet side, under construction*

*Figure 5: Lower RHS of sample from wet side*

# 5. Notation

The reference numbers from the AS/NZS 4284:2008 ‘Testing of building facades’ document are used in the following from this point onwards, for ease of reference.

# 6. Apparatus

The James Hardie ExoTec Top Hat Rainscreen Façade system was tested using the FTNZ test facility.

# 7. Sample

## 7.1. Orientation

The orientation of all elements is typically recorded in this report as viewed from the outside of the test booth (dry side), being the inside of the façade when constructed. The inside of the test booth has the outside (wet side) of the façade.

## 7.2. Sample Description

The test arrangement consisted of a single storey test sample comprising the ExoTec façade panel system. The sample was approximately 3500 mm high and 4400 mm wide. The system was built on a 140 x 45 mm SG8 timber stud frame at 400 mm centres with nogs at 800 mm centres. A window of 765 x 1200mm, and a 600 x 400 mm return detail was included, clad in 6mm James Hardie RAB board, with ‘Top Hat’ metal rails fixed vertically down the system between nog lines – not on the studs. A horizontal expansion joint was included at 2700 mm above the footer, including an Aluminium 'T' socket.

Differences between the drawings provided and the system as built included:

- the PVC "H" mould to the RAB board was overlaid with Protecto Superstick flashing tape to ensure airtightness of the test chamber.
- The ExoTec Top Hat base mould was used at the footer, with WANZ support bar and head flashing used at the window opening.

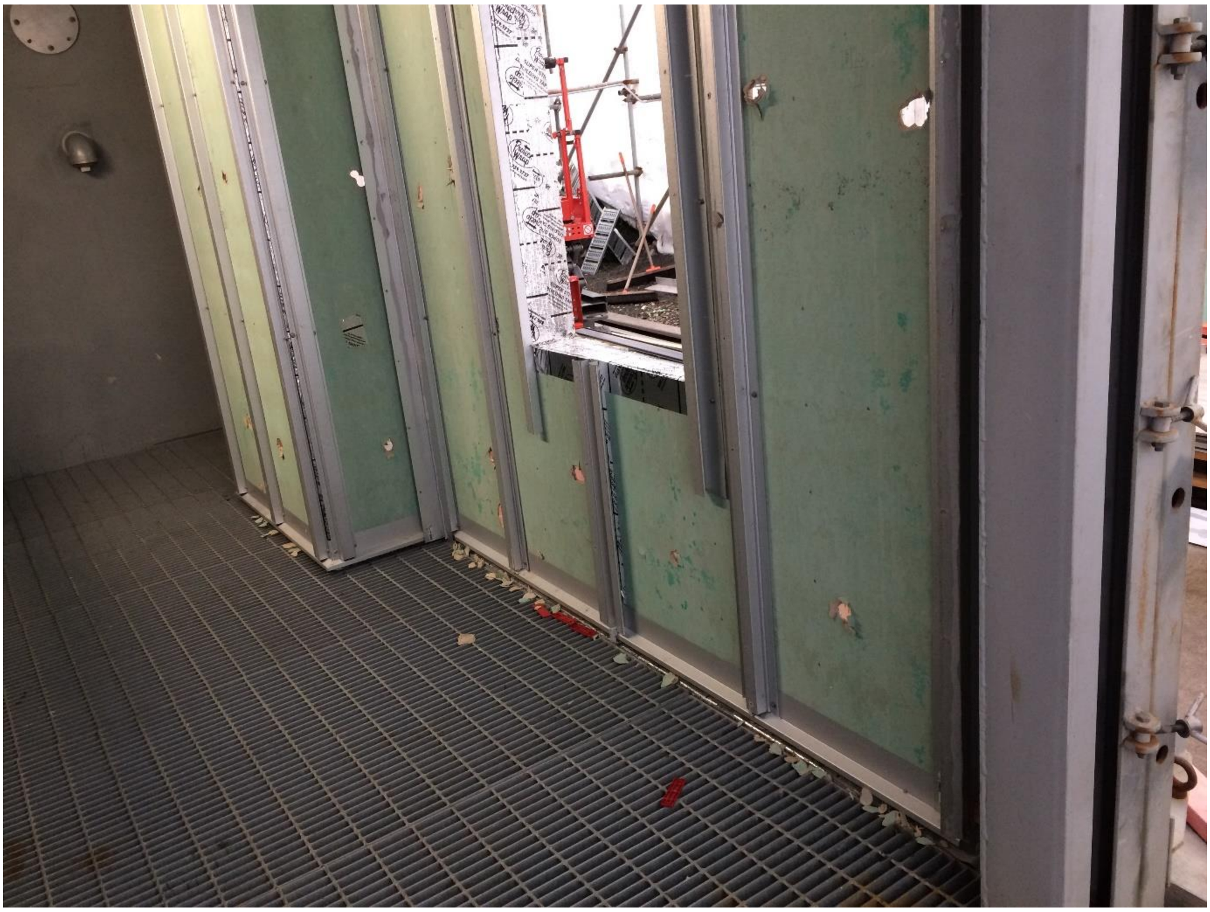

*Figure 6: Top hat sections on wet side of cladding, with cladding removed and holes in RAB board during disassembly.*

## 7.3. Modifications to the sample

Modification to the details were noted during testing, and changes were made to the drawings, as shown in the Appendix, and include:

- Foundation (Detail A)
- Vertical joint (Detail B)
- Internal corner (Detail C)
- External corner (Detail D)
- Window (head, jamb and sill) details (Details E, F, G)
- Horizontal joint (Detail H))

### 7.3.1. Modifications During Preliminary Testing

During preliminary cyclic water testing at 750 Pa a significant volume of water was seen on the dry side of the RAB board, leaking from the horizontal joint at the top of the sample. This was fixed with a batten and tape, and by adding a section of plywood ceiling to cover the top of the 'return' section of the cladding.

### 7.3.2. Modifications During AS/NZS 4284:2008 Testing

During the negative SLS deflection test, a batten holding the flexible butyl rubber at the foot, blew off when testing at -3500 Pa. This was replaced with a new section of batten and several screws, and testing resumed.

### 7.3.3. Modifications following AS/NZS 4284:2008 Testing

Holes were punched in the RAB board to establish an air pressure across the cladding, to allow a modification of the wetwall test of the E2/VM1 testing to be undertaken.

# 8. Procedure

Note: the same clause numbers have been used as in AS/NZS 4284 for ease of reference in the below.

## 8.1. Test Sequence

The tests were performed using the testing procedures of AS/NZS 4284:2008 in the cladding test facilities of Façade Testing NZ Ltd (FTNZ), Park Rd, Miramar, Wellington.

## 8.2. Preliminary Tests

The tests in clauses 8.2.2, 8.2.3 and 8.2.4 were conducted before the structural test.

### 8.2.1. Smoke Test

A smoke machine was used to identify air leakage sources in the sample following completion of the RAB board but prior to installation of ExoTec façade panel system. Where identified, air leakage sources were sealed prior to completion of the cladding erection.

### 8.2.2. Static Pressure

The client agreed to undertake the preliminary tests with a reduced SLS of 2 kPa for initial pressure, 750 Pa (0.3 x 2.5 kPa for static water), and then use the intended SLS of 3.5 kPa for standard testing. The test sample was subjected to the positive and negative SLS design wind pressures for 10 seconds. Air pressures of +2.1 kPa and -2.0 kPa were applied to the test sample. See Figure 7.

### 8.2.3. Water

Preliminary water tests were conducted under static and cyclic pressures, as per clauses 8.5 and 8.6. Air pressures were 750 Pa for static water testing, and were 750, 1000 and 1500 for the cyclic water testing.

*Figure 7: Water sprays on during static water test*

## 8.3. Structural test at serviceability limit state (SLS)

### 8.3.1. Structural test pressures

Following preliminary testing which used an SLS of 2000 Pa, the SLS test pressures of ±3.5 kPa were used, although the first set pressure used was 3.0 kPa, not 3.5 kPa.

### 8.3.2. Location of the displacement transducers

Following agreement with the client, six displacement transducers were set to record deflection of the two studs that were expected to give the largest deflections - beside the window on the LHS, and in the free wall on the RHS, as shown in Figure 8.

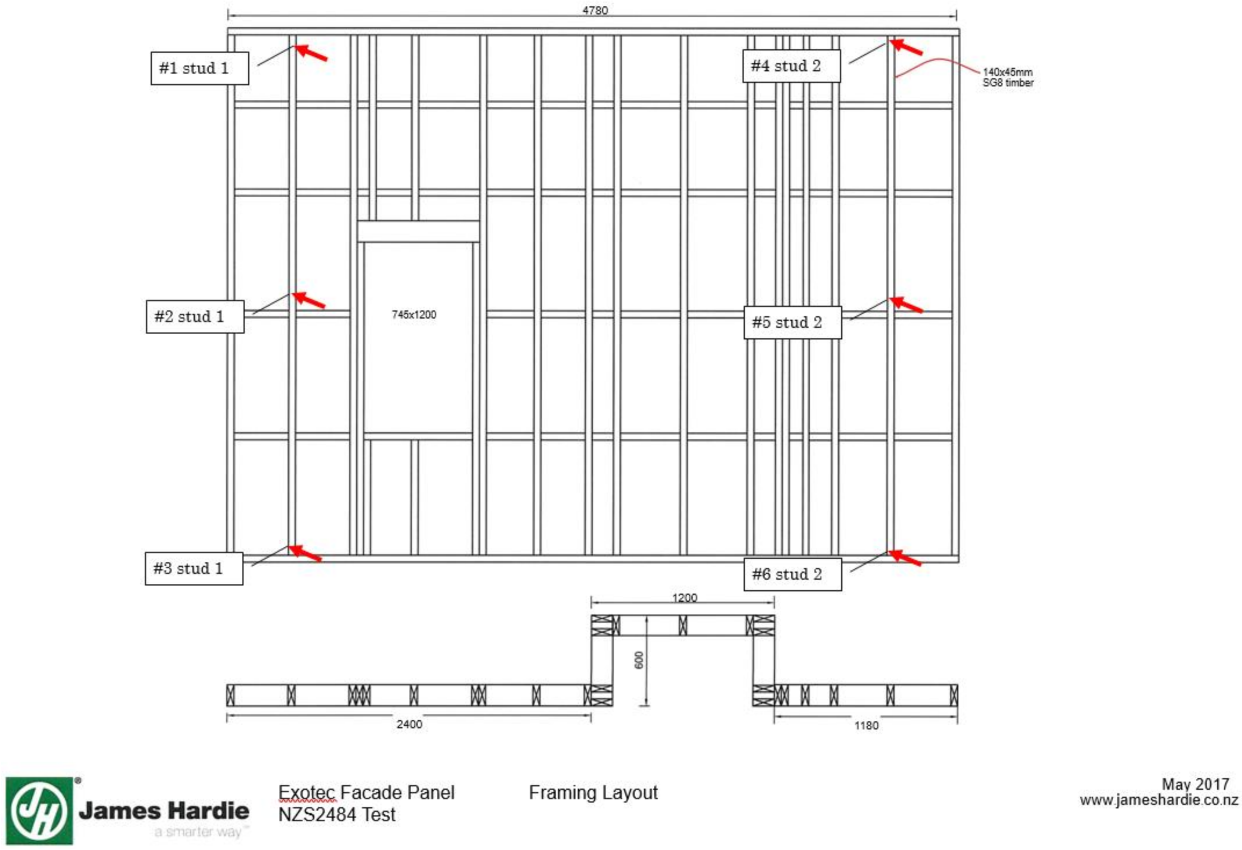


*Figure 8: Location of displacement transducers on studs 1 and 2*

*Figure 9: Photos of displacement transducers on stud beside window (Stud 1)*

*Figure 10: Photos of transducers on stud in field of wall (Stud 2)*

### 8.3.3. Pressure loading sequence

The pressure loading sequence, (as per AS/NZS 4284) was requested by the client as ramping up in five steps, being 20%, 40%, 60%, 80% and 100%, before continuing with the ramp down, and negative pressures, as in Fig 1 of AS/NZS 4284: 2008.

## 8.4. Air Infiltration

The air infiltration test pressure of +/- 150 Pa was used. The test process involved measuring the sum of the booth leakage and the sample together.

## 8.5. Water Penetration by Static pressure

The water penetration test pressure of 1050 Pa was nominated by the specifier.

## 8.6. Water penetration test by cyclic pressure

The three stages of cyclic water penetration were nominated as follows:

Stage 1: 525 - 1050 Pa

Stage 2: 700 – 1400 Pa

Stage 3: 1050 – 2100 Pa

## 8.7. BMU restraint test

A BMU restraint test was not requested as part of the AS/NZS 4284:2008 test procedure.

## 8.8. Structural test at ultimate limit state (ULS)

The test pressures of +5.0 kPa, and -5.0 kPa were applied to the sample.

## 8.9. Seismic test

Seismic displacement values of ±18 mm for SLS and ±30mm ULS were agreed with the client.

*Figure 11: Top right hand corner of sample connected to the seismic ram via steel plates and bolts through the framing.*

# 9. Results

## 9.1. Preliminary water tests (AS/NZS 4284:2008 Part a)

The performance requirements below, are as per the request of the client.

| Preliminary static water test | | | |
|---|---|---|---|
| Stage | Air pressure (Pa) | Duration | Result |
| | 0 | 5 minutes | No water leaks |
| 1 | 750 | 15 minutes | No water leaks |
| 2 | 0 | 5 minutes | No water leaks |

*Table 1: Preliminary static water test*

| Preliminary cyclic water test | | | |
|---|---|---|---|
| Phase | Air pressure (Pa) | Duration | Result |
| | 0 | 5 minutes | No water leaks |
| 1 | 375-750 | 5 minutes | No water leaks |
| 2 | 500-1000 | 5 minutes | No water leaks |
| 3 | 750-1500 | 5 minutes | No water leaks |

*Table 2: Preliminary cyclic water test pressures*

## 9.2. Structural test at serviceability limit state (SLS) (AS/NZS 4284:2008 Part b)

| Displacement at transducer | | | | |
|---|---|---|---|---|
| Transducer Number | Transducer Location | Span (mm) | Max pos displacement (mm) | Max neg displacement (mm) |
| 1 | Stud 1 top | 3510 | 9.43 | -12.21 |
| 2 | Stud 1 mid | 3510 | 21.24 | -21.26 |
| 3 | Stud 1 lower | 3510 | 28.62 | -20.48 |
| 4 | Stud 2 top | 3510 | 6.79 | -8.29 |
| 5 | Stud 2 mid | 3510 | 6.87 | -8.27 |
| 6 | Stud 2 lower | 3510 | 13.38 | -17.72 |

*Table 3: Summary of maximum transducer deflections in serviceability limit state testing*

The gross deflections of the studs at each of the locations shown in Figure 8, and the photos (Figure 9 and Figure 10) are summarised in Table 3, (maximum values shown), with net deflections of the members shown in Table 4. The gross individual transducer readings for all transducers and zero table are in the Appendix.

Note: The two values of N/A in Table 4 are due to transducer two running out of travel, which was discovered after the conclusion of the testing.

Transducer 2 was re-set during testing. See the Appendix for explanation.

| Deflection of studs | | | | |
|---|---|---|---|---|
| | Stud #1 | | Stud #2 | |
| Pressure (Pa) | Net Deflection (mm) | Defl/Span | Net Deflection (mm) | Defl/Span |
| 0 | 0.00 | 0.0000 | 0.00 | 0.0000 |
| 3000 | 10.51 | 0.0033 | 6.19 | 0.0020 |
| 0 | 0.09 | 0.0000 | -0.01 | 0.0000 |
| 700 | 2.19 | 0.0007 | 1.24 | 0.0004 |
| 1400 | 4.70 | 0.0015 | 2.68 | 0.0009 |
| 2100 | 7.51 | 0.0024 | 4.34 | 0.0014 |
| 2800 | 10.10 | 0.0032 | 5.92 | 0.0019 |
| 3500 | 13.18 | 0.0042 | 7.73 | 0.0025 |
| 0 | 0.06 | 0.0000 | 0.03 | 0.0000 |
| 3500 | 13.28 | 0.0042 | 7.79 | 0.0025 |
| 2800 | 11.39 | 0.0036 | 6.59 | 0.0021 |
| 2100 | 9.12 | 0.0029 | 5.18 | 0.0016 |
| 1400 | 6.38 | 0.0020 | 3.64 | 0.0012 |
| 700 | 3.31 | 0.0011 | 1.89 | 0.0006 |
| 0 | 0.16 | 0.0001 | 0.11 | 0.0000 |
| -3500 | N/A | N/A | -10.94 | -0.0035 |
| 0 | -3.00 | -0.0010 | -2.40 | -0.0008 |
| -700 | -5.63 | -0.0018 | -4.01 | -0.0013 |
| -1400 | -8.15 | -0.0026 | -5.57 | -0.0018 |
| -2100 | -11.03 | -0.0035 | -7.41 | -0.0024 |
| -2800 | N/A | N/A | -9.23 | -0.0029 |
| -3500 | -15.49 | -0.0049 | -11.14 | -0.0035 |
| 0 | -3.00 | -0.0010 | -2.66 | -0.0008 |
| -3500 | -15.53 | -0.0049 | -11.17 | -0.0036 |
| -2800 | -13.36 | -0.0043 | -9.93 | -0.0032 |
| -2100 | -11.05 | -0.0035 | -8.54 | -0.0027 |
| -1400 | -8.31 | -0.0026 | -6.87 | -0.0022 |
| -700 | -5.24 | -0.0017 | -4.90 | -0.0016 |
| 0 | -2.87 | -0.0009 | -2.75 | -0.0009 |
| 3500 | 15.21 | 0.0048 | 12.05 | 0.0038 |
| 0 | 0.81 | 0.0003 | -0.32 | -0.0001 |

*Table 4: Deflections of studs and deflection/span results for transducers*

## 9.3. Air infiltration (AS/NZS 4284:2008 Part c)

This test was undertaken to determine the airtightness of the sample.

The airtightness of interest was the cladding.

Overall area: 18.4 $m^2$
Allowable leakage, at 1.6 $l/m^2.s$ 29.4 l/s

| Airtightness measurements @ 150 Pa ΔP | | |
|---|---|---|
| | Positive pressure (infiltration) l/s | Negative pressure (exfiltration) l/s |
| Measured (booth + sample) | 29.4 ± 0.6 | 33.5 ± 0.7 |
| Calculated sample | < 29 l/s | < 34 l/s |

*Table 5: Air tightness leakage results*

The airtightness of the 'sample plus booth' in the positive pressure scenario was within the experimental error of measurement. Therefore, a compliance statement cannot be made conclusively for air infiltration. While there was considerable air leaking around the perimeter of the sample, the airtightness of the system is largely dependent upon the airtightness of the RAB board. Hence, effort was not expended to find and seal these leaks, or to blank off the sample area to find the base leakage of the booth and perimeter seal.

The exfiltration of air from the sample under negative pressure exceeded the allowable leakage, but was not of concern as discussed above.

## 9.4. Water penetration (AS/NZS 4284:2008 Part d)

### 9.4.1. Static pressure water penetration

The results of the static water tests, as per clause 8.5 are shown below.

| Static water test | | | |
|---|---|---|---|
| Stage | Air pressure (Pa) | Duration | Result |
| 0 | 0 | 5 minutes | No water leaks |
| 1 | 1050 | 15 minutes | No water leaks |
| 2 | 0 | 5 minutes | No water leaks |

*Table 6 Static water leakage results*

There were no water leaks, meeting the requirement of the standard.

### 9.4.2. Cyclic pressure water penetration

| Cyclic water test | | | |
|---|---|---|---|
| Phase | Air pressure (Pa) | Duration | Result |
| | 0 | 5 minutes | No water leaks |
| 1 | 525 – 1050 | 5 minutes | No water leaks |
| 2 | 700 – 1040 | 5 minutes | No water leaks |
| 3 | 1050 – 2100 | 5 minutes | No water leaks |

*Table 7: Cyclic water test results*

There were no water leaks, meeting the requirement of the standard.

## 9.5. Seismic test at serviceability limit displacement (AS/NZS 4284:2008 Part e)

The seismic displacement test from clause 8.9 of AS/NZS 4284 was performed. The test displacement was generated with the ram mounted at the top of the sample, in the plane of the façade. The displacement, d, number of cycles, n, and period, T, were as shown in Table 8.

The displacements were achieved using the seismic ram applying load to the top ribbon plate. Changes in the movement joint location and width were not recorded.

| Seismic deflection parameters (SLS) | | | |
|---|---|---|---|
| Distance (d ± x mm) | Cycles (n) | Period (T, seconds) | Pause at mid-point and ends (sec) |
| 18 ± 1 mm | 10 | 10 mm/sec | 10 |
| 20 ± 2 mm | 10 | 10 mm/sec | 10 |

*Table 8: Parameters for seismic deflections*

The seismic deflection testing at ±20 mm was undertaken straight after the SLS seismic deflection of ±18 mm, and resulted in a fine crack occurring at the head of the window. The cyclic water penetration test was performed following the seismic test with the results as follows.

| Cyclic water test | | | |
|---|---|---|---|
| Phase | Air pressure (Pa) | Duration | Result |
| | 0 | 5 minutes | No water leaks |
| 1 | 525 – 1050 | 5 minutes | No water leaks |
| 2 | 700 – 1040 | 5 minutes | No water leaks |
| 3 | 1050 – 2100 | 5 minutes | Dampness on back of RAB board around crack in RAB board. No water leakage. |

*Table 9: Post SLS seismic test water test pressures*

## 9.6. BMU restraint test

Not requested.

## 9.7. Structural test at ultimate limit state air pressure (AS/NZS 4284:2008 Part g)

| Ultimate Limit State (ULS) air pressure test | |
|---|---|
| Air pressure (Pa) | Result |
| +5000 | OK |
| - 5000 | OK |

*Table 10: Ultimate limit state air pressure results*

There was no permanent distortion or collapse during the ULS air pressure test.

## 9.8. Ultimate limit state seismic test (AS/NZS 4284:2008 Part h)

| ULS seismic deflections | | | |
|---|---|---|---|
| Distance (± x mm) | Cycles (n) | Period (T, seconds) | Pause at ends (sec) |
| 30 mm | 10 | Approx. 10 sec, with 3-4 sec between end points | 10 |

*Table 11: Ultimate limit state seismic test parameters*

There was minor damage to the RAB board from the end of the window head flashing where the RAB board cracked for an approximate distance of 200 mm. See photo in Figure 12. This extended and widened the crack first noticed following the ±20 mm seismic displacement.

*Figure 12: Crack in RAB board following ULS seismic testing on system*

Following the completion of the AS/NZS 4284 tests, further testing was undertaken as noted in the Appendix. This is outside the scope of the IANZ Accreditation, but provides information about the weathertightness of the cladding panels.

| | |
|---|---|
| Prepared By: | Checked By: |
| John Burgess | Darryl Scott |
| IANZ-accredited test engineer | Manager Façade Testing NZ Ltd |

# 10. Appendices

## 10.1. Serviceability deflections

| Displacements | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2a | 2b | 2 (Generated) | 3 | 4 | 5 | 6 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3000 | 7.52 | 16.8 | | 16.8 | 5.06 | 5.41 | 10.6 | 3.42 |
| 0 | 0.18 | 0.27 | | 0.27 | 0.18 | 0.2 | 0.16 | 0.13 |
| 700 | 1.64 | 3.56 | | 3.56 | 1.11 | 1.16 | 2.18 | 0.73 |
| 1400 | 3.4 | 7.55 | | 7.55 | 2.3 | 2.33 | 4.61 | 1.53 |
| 2100 | 5.57 | 12.14 | | 12.14 | 3.7 | 3.95 | 7.57 | 2.51 |
| 2800 | 7.26 | 16.16 | | 16.16 | 4.87 | 5.26 | 10.2 | 3.3 |
| 3500 | 9.22 | 21.02 | | 21.02 | 6.46 | 6.83 | 13.28 | 4.28 |
| 0 | 0.12 | 0.26 | | 0.26 | 0.29 | 0.27 | 0.24 | 0.15 |
| 3500 | 9.29 | 21.24 | | 21.24 | 6.63 | 6.87 | 13.38 | 4.31 |
| 2800 | 8.29 | 18.44 | | 18.44 | 5.82 | 6.07 | 11.51 | 3.77 |
| 2100 | 6.99 | 15.02 | | 15.02 | 4.81 | 5.06 | 9.28 | 3.14 |
| 1400 | 5.21 | 10.78 | | 10.78 | 3.59 | 3.54 | 6.55 | 2.29 |
| 700 | 3 | 5.86 | | 5.86 | 2.11 | 2.19 | 3.63 | 1.3 |
| 0 | 0.28 | 0.54 | | 0.54 | 0.48 | 0.39 | 0.43 | 0.25 |
| -3500 | -12.02 | -21.26 | | -21.26 | -8.04 | -7.98 | -17.24 | -4.63 |
| 0 | -3.28 | -5.61 | 0.94 | -5.61 | -1.94 | -2.43 | -4.22 | -1.21 |
| -700 | -5.78 | -10.16 | | -10.16 | -3.28 | -3.64 | -6.74 | -1.83 |
| -1400 | -7.32 | -14.01 | | -14.01 | -4.41 | -4.66 | -9.1 | -2.41 |
| -2100 | -8.98 | -18.38 | | -18.38 | -5.72 | -5.82 | -11.9 | -3.17 |
| -2800 | -10.59 | -21.21 | -15.91 | -21.21 | -7 | -7 | -14.69 | -3.93 |
| -3500 | -12.21 | | -20.41 | -25.71 | -8.24 | -8.26 | -17.68 | -4.83 |
| 0 | -3.49 | | -0.53 | -5.83 | -2.17 | -2.65 | -4.66 | -1.35 |
| -3500 | -12.21 | | -20.48 | -25.78 | -8.29 | -8.27 | -17.72 | -4.83 |
| -2800 | -11.18 | | -17.41 | -22.71 | -7.52 | -7.43 | -15.82 | -4.35 |
| -2100 | -9.88 | | -13.96 | -19.26 | -6.55 | -6.48 | -13.65 | -3.74 |
| -1400 | -8.31 | | -9.81 | -15.11 | -5.3 | -5.33 | -11.03 | -2.99 |
| -700 | -6.53 | | -5.15 | -10.45 | -3.9 | -4.13 | -8.06 | -2.2 |
| 0 | -3.51 | | -0.42 | -5.72 | -2.2 | -2.65 | -4.75 | -1.35 |
| 3500 | 9.43 | | 28.62 | 23.32 | 6.79 | 6.82 | 13.34 | -4.23 |
| 0 | -0.27 | | 6.02 | 0.72 | 0.09 | -0.06 | -0.4 | -0.1 |
| Max pos | 9.43 | 21.24 | 28.62 | 23.32 | 6.79 | 6.87 | 13.38 | 4.31 |
| Max neg | -12.21 | -21.26 | -20.48 | -25.78 | -8.29 | -8.27 | -17.72 | -4.83 |

*Figure 13: Displacements of transducers*

Note: Transducer 2 left the surface of the stud during the negative pressure application at 3500 Pa. It is possible that the transducer was also beyond its range at -2800 Pa, so these values have been recorded here, but noted as ‘not applicable’ in the body of the report. The transducer was reset, and results recorded as 2b. The column marked “2 Generated” are the readings offset by the difference between the readings of transducer 2 before and after being re-set. Testing was continued from this point.

| Zero table | | |
|---|---|---|
| Zeroes | Stud 1 | Stud 2 |
| Z1 | 0.09 | -0.01 |
| Z2 | 0.06 | 0.03 |
| Z3 | 0.16 | 0.11 |
| Z4 | -3.00 | -2.40 |
| Z5 | -3.00 | -2.66 |
| Z6 | -2.87 | -2.75 |
| Z7 | 0.81 | -0.32 |

*Figure 14: Zero table results from transducers*

Successive member displacements can be seen in the Zero table above, and did not exceed the ±3 mm allowed for structural framing members.

## 10.2. Test Request

**TEST REQUEST FORM**

Project: Exutec Facade Panel Test-4284/2008

Client: James Hardie NZ

Specifier:

Sample designer/manufacturer: James Hardie NZ

Installer: steve cleary

Date(s) of test requested: Mid June 2017 or earlier

Test schedule required: (Cross out those Sections not required—a, b, c, d and g are mandatory to claim compliance with this Standard, AS/NZS 4284.)

| | | |
|---|---|---|
| a—Preliminary | b—Structural at SLS | c—Air infiltration |
| d—Water at static and cyclic | e—Seismic at SLS with water | f—BMU restraint test |
| g—Strength at ULS | h—Seismic at ULS | i—Seal degradation |

General description of test sample

Drawings of the test sample attached? Y/~~N~~

Certificate of Identification attached? Y/N

**Information to be submitted a minimum of 48 hours prior to testing:**

1. A set of scale drawings and specifications for the test sample showing:
   a) An inside elevation.
   b) Full sized or dimensioned cross sections through the facade with components suitability identified by material, die number or similar.
   c) Position of any viewing panels for water testing
   d) All significant dimensions.
   e) Glass thickness, type and condition.
   f) Gaskets, glazing methods, sash and joint sealing methods.
   g) Sealant types used and their locations.
   h) Hardware fitted (hinges, stays, catches etc.).
   i) A number assigned to each panel and light whether opening or fixed where the quantity of lights makes it difficult to describe location.
   j) A reference number or description for identification of the unit.

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## SPECIFIC TEST REQUIREMENTS

| Section | Test Name | Clause | Required parameters |
|---|---|---|---|
| a | Preliminary test | 8.2.1 | 1 kPa SLS @ ±2.5kPa for prelim (0.75kPa static water) |
| | SLS pressure | 8.2.2/8.3 | SLS(+) = 3.5kPa |
| | | | SLS(–) = 3.5kPa |
| | Water static | 8.2.3/8.5 | Static water test pressure = 1.05 K Pa |
| | Water—Cyclic | 8.2.3/8.6 | Cyclic test pressure Stage 1 = 0.5 K Pa to 1 kPa |
| | | 8.2.3/8.6 | Cyclic test pressure Stage 2 = 0.7K Pa to 1.5kPa |
| | | 8.2.3/8.6 | Cyclic test pressure Stage 3 = 1.05KPa to 2.0kPa |
| | | | Full test water pressure |
| b | Structural test at SLS | 8.3.2 | Location of transducers noted on drawings? Y/N ~~Y~~ NO See over |
| | | 8.3.3 | Pressure steps? |
| | | | Max. displacement? = ~~20~~ 14 mm |

| Members or panels | Deflection/span limit ratio |
|---|---|
| EXOTEC PANEL | Span/250 |
| TOP HAT SECTION | Span/250. |
| | |
| | |

| Section | Test Name | | | |
|---|---|---|---|---|
| c | Air infiltration test | Test pressure | (+) = 150 Pa | |
| | | | (–) = 150 Pa | |
| | | Air infiltration limit = 1.6 (l/m²s) | | |
| d | Water test (static and cyclic) | Pressure (Pa) | Duration (mins) | Duration and spray intensity |
| | | | | 15 min, 0.05 L/m² s |
| 750 Pa | Static | As Per 8.5 (a) above | | 5 min, 0.05 L/m² s |
| 0.375 – 750 | Cyclic 1 | | | 5 min, 0.05 L/m² s |
| 500 – 1 kPa | Cyclic 2 | | | 5 min, 0.05 l/m²s |
| 750 – 1.5 kPa | Cyclic 3 | | | |

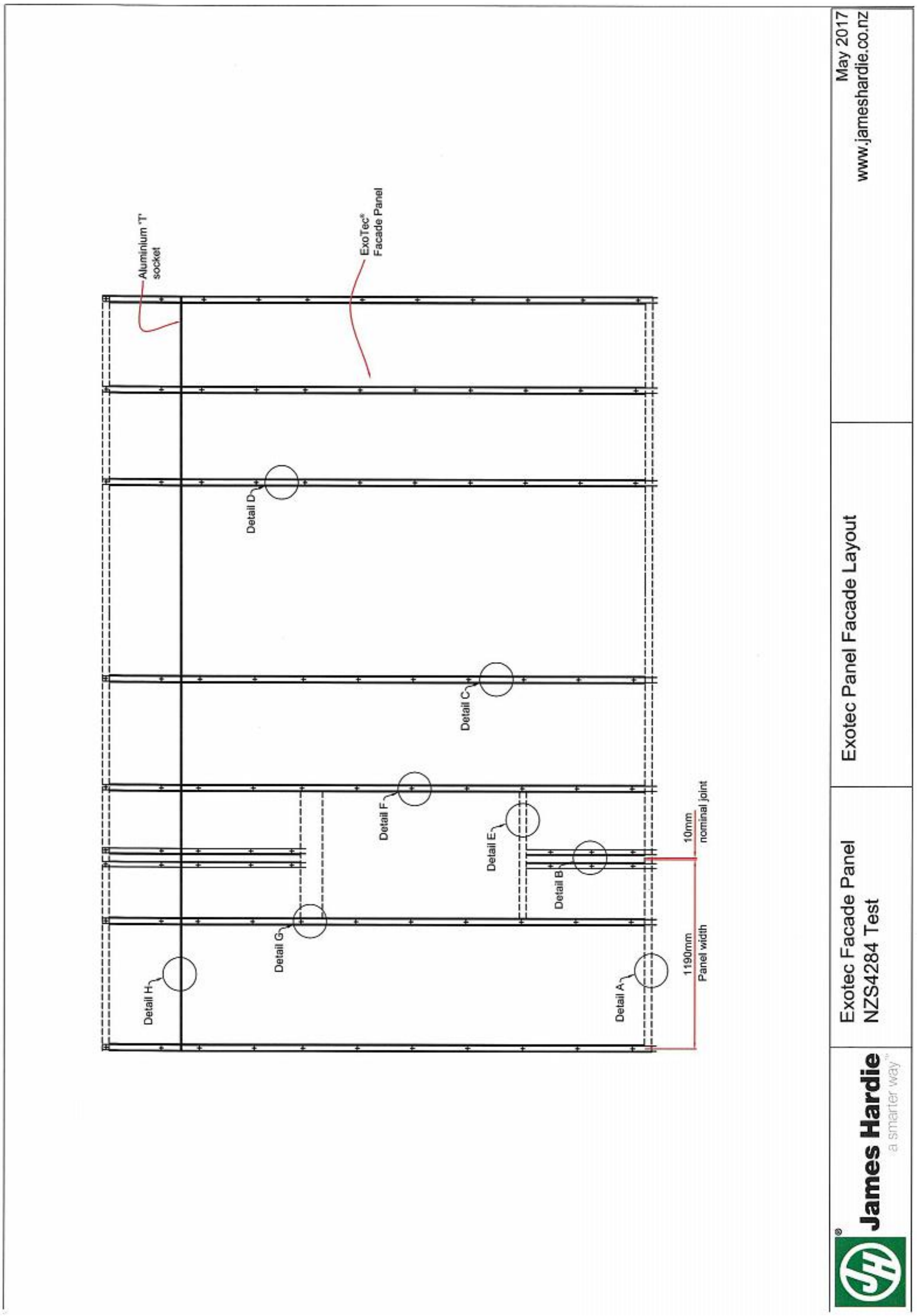
Preliminary water test pressures

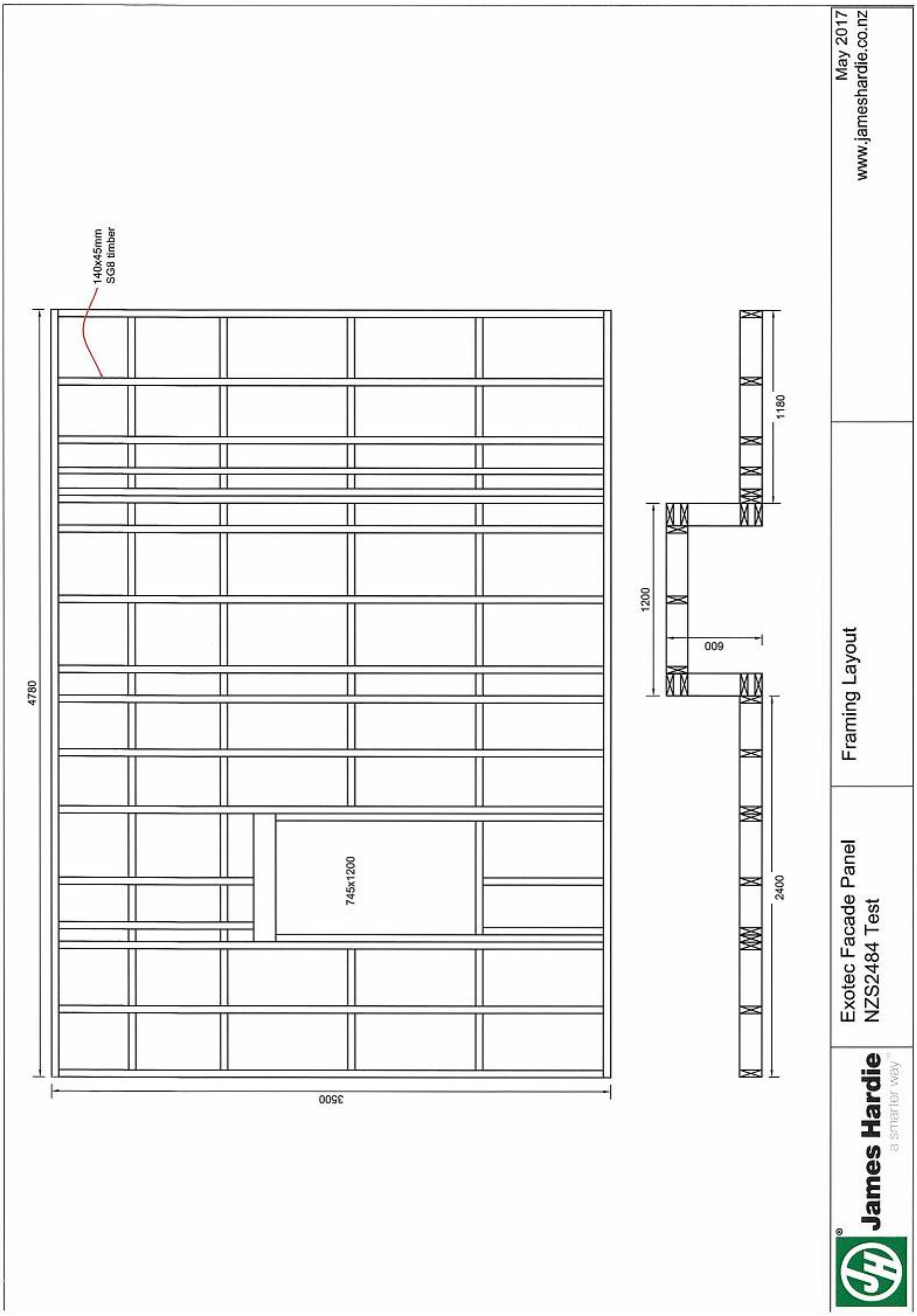
| Section | Test Name | |
|---|---|---|
| | Additional water penetration requirements? | |
| e | Seismic at SLS | (Water test repeated after) |
| | Support beam movement allowed = | ~~±15mm~~ ±20mm |
| | Number of cycles = | 10 cycles |
| | Frequency of movement = | |
| f | BMU restraint | Test load across face of sample = kN |
| | | Test load perpendicular to sample = kN |
| g | Strength at ULS | Test pressure (+) = 5 K Pa |
| | | (–) = 5 K Pa |
| h | Seismic at ULS | |
| | Support beam movement allowed = | ±30 mm |
| | Number of cycles = | 10 |
| | Frequency of movement = | Hz |
| i | Seal degradation | 10% air seal removal? Y/N |
| | Describe seals to be altered | Window Seals |

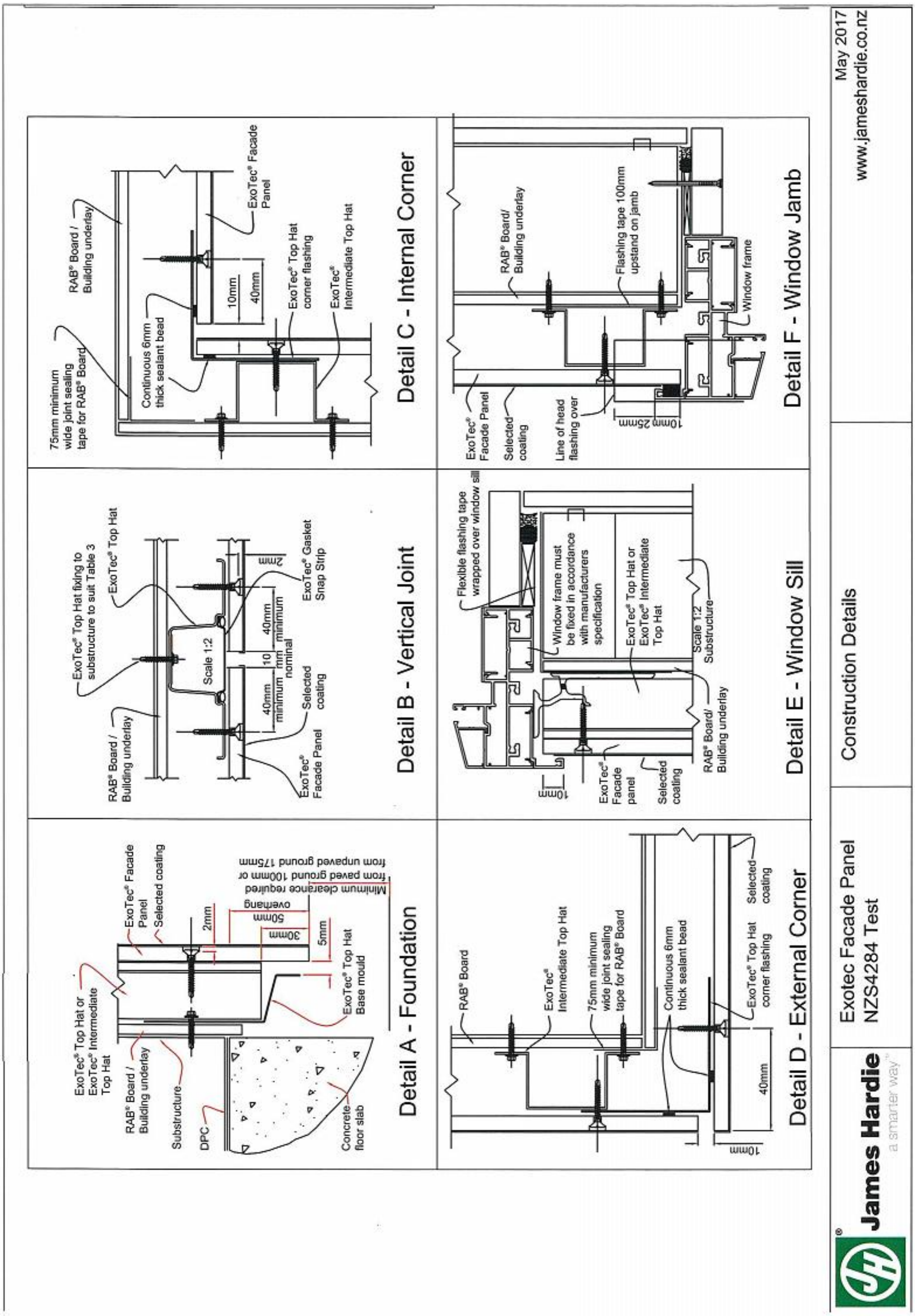


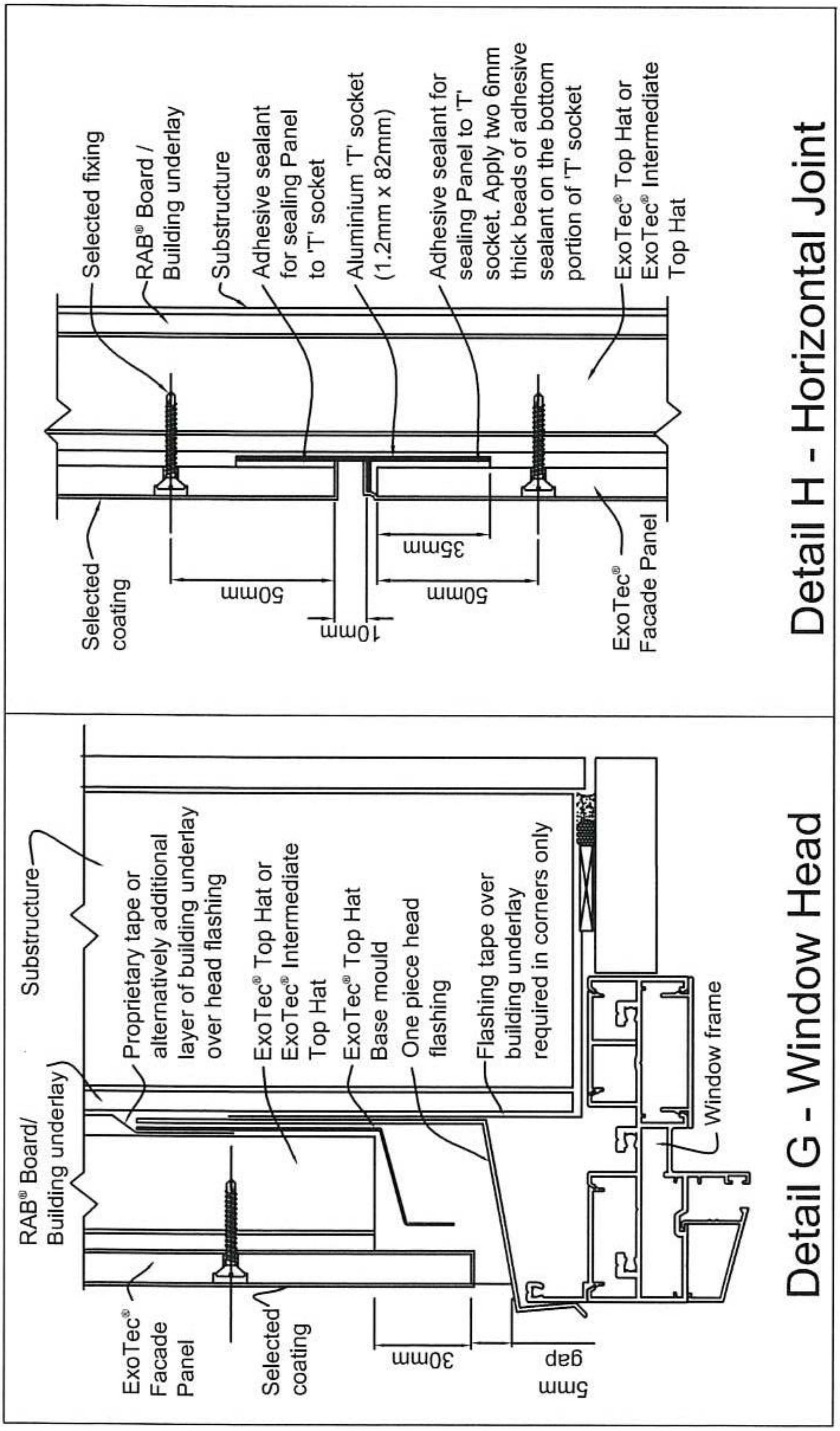
*Figure 15: Test request form – annotated and agreed*

## 10.3. Drawings




140x45mm
SG8 timber
4780
3500
745x1200
1180
1200
600
2400
May 2017
www.jameshardie.co.nz
Framing Layout
Exotec Facade Panel
NZS2484 Test
James Hardie
a smarter way


Detail A - Foundation
Detail B - Vertical Joint
Detail C - Internal Corner
Detail D - External Corner
Detail E - Window Sill
Detail F - Window Jamb
James Hardie
a smarter way
Exotec Facade Panel
NZS4284 Test
Construction Details
May 2017
www.jameshardie.co.nz


Selected fixing
RAB® Board / Building underlay
Substructure
Adhesive sealant for sealing Panel to 'T' socket
Aluminium 'T' socket (1.2mm x 82mm)
Adhesive sealant for sealing Panel to 'T' socket. Apply two 6mm thick beads of adhesive sealant on the bottom portion of 'T' socket
ExoTec® Top Hat or ExoTec® Intermediate Top Hat
Selected coating
50mm
10mm
35mm
50mm
ExoTec® Facade Panel
Detail H - Horizontal Joint
RAB® Board/ Building underlay
Substructure
Proprietary tape or alternatively additional layer of building underlay over head flashing
ExoTec® Top Hat or ExoTec® Intermediate Top Hat
ExoTec® Top Hat Base mould
One piece head flashing
Flashing tape over building underlay required in corners only
Window frame
ExoTec® Facade Panel
Selected coating
30mm
5mm gap
Detail G - Window Head

## 10.4. Further testing

Following the completion of the AS/NZS 4284 testing, holes were formed in each of the stud cavities through the RAB board. This was undertaken in an attempt to reduce the air pressure held by the RAB board to about half the air pressure drop across the sample. The hope was that about half the air pressure would be held across the cladding, and about half across the RAB board for this test.

BRANZ is currently developing the WeatherPlus test for mid-rise commercial buildings and proposing that the 50 Pa air pressure from the E2/VM1 test be raised to a 70 Pa air pressure test. Hence, the static "Wetwall" test from E2/VM1 was undertaken with a 150 Pa pressure difference across the system.

Results showed that the crack from the LHS of the window head flashing (at 1) allowed some seepage of water through the RAB board. Water seeped through the joint between the stud and the bottom plate at (2), and water spattered up from the footer flashing at points 3, 4 and 5.

Point 6 had water that was dripping down inside the metal top hat batten, coming out through the defect in the RAB board. This water was contained, and did not spatter on the back of the RAB board.

The test would have passed this section of the extended E2/VM1 'WeatherPlus' test, since all this water was managed appropriately.

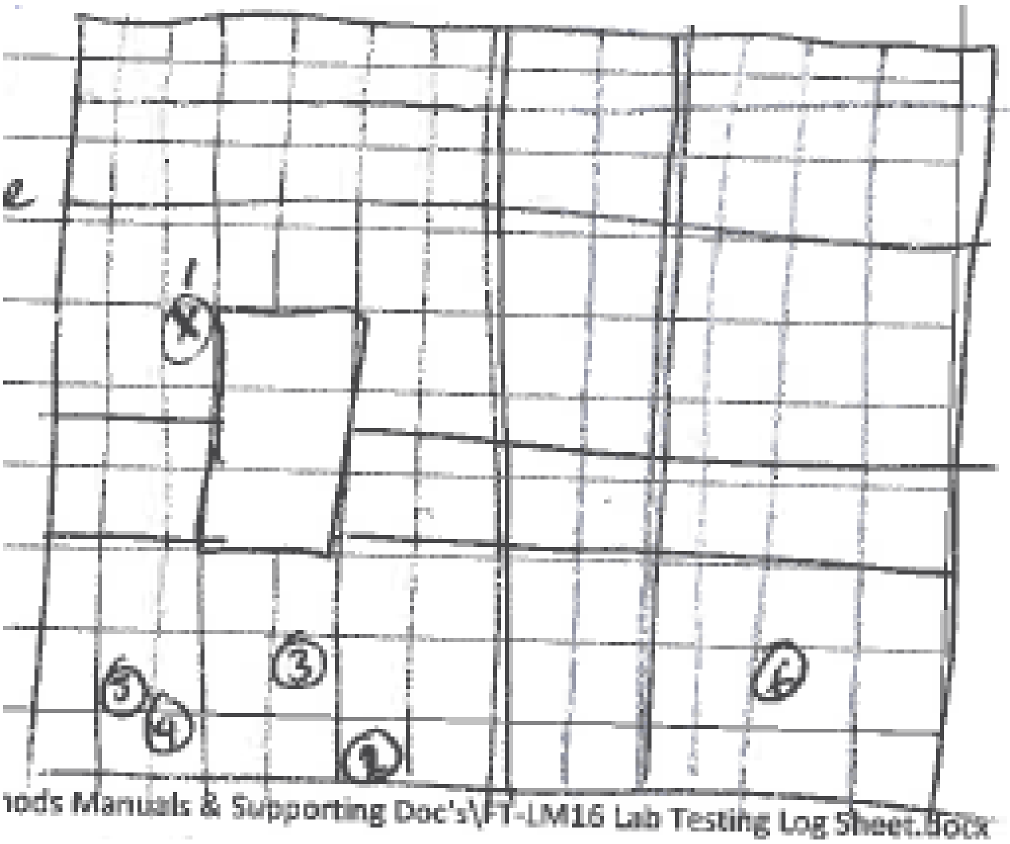



*Figure 16: Sketch of water leak locations during the extended E2/VM1 'WeatherPLus' test.*

*Figure 17: View from wet side of RAB board after removal of cladding, showing holes made in RAB board, and the damp patch from water seeping through the crack emanating from the head flashing.*