

EVALUATION METHOD

No. 4 (2005)

TEST PROCEDURE FOR COATING AND JOINTING SYSTEMS FOR FLUSH FINISHED FIBRE CEMENT SHEET CLADDING



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1. Scope

This test method and reporting covers testing of coating and jointing systems for flush finished fibre cement sheet systems. It does not cover the durability or fixing of the fibre cement sheets. Fibre Cement sheets shall comply with AS/NZS 2908 Part 2. The flush-finished joints shall comprise a bedding compound and reinforcing tape.

Conformance with the requirements of this evaluation method satisfies the requirements of the New Zealand Building Code [NZBC] Acceptable Solution E2/AS1 Third Edition [June 2004] Section 9.7.10.2 (a).paragraph 9.7.10.2.

2. Apparatus and materials

Universal testing machine complying with ISO 7500-1:1999 [test procedures 5.1.3, 5.1.4, 5.3.3 and 5.3.4]

Heat rain apparatus as per AS/NZS 2908.2: 2000 [test procedure 5.2]

Conditioning chambers capable of maintaining -10 C, 30°C / 95% RH, 60°C / 75% RH and 10°C / 50% RH [test procedure 5.3]

Accelerated UV weathering chamber complying with either ASTM G154 or ASTM G155 [test procedure 5.4]

3. Test Specimens

The manufacturer or their approved applicator shall prepare test specimens in accordance with the technical instructions for the coating and jointing system. Samples shall be representative of the cladding system as made available in the market and be made from sheets of 7.5 mm minimum thickness. In cases where a manufacturer has identical boards with two or more thicknesses, the EM4 testing must be performed on the thinnest board. The results from these tests will be transferable to the thicker boards. For testing purposes, the coating colour must have a light reflectance value of 40%, regardless of gloss value.

3.1 Water Vapour Transmission Rate

[Specimen 1] Cut three coated fibre cement disc specimens [115 mm diameter] [Figure 1] from at least three coated fibre cement samples each with a minimum size of 600 mm x 600 mm.

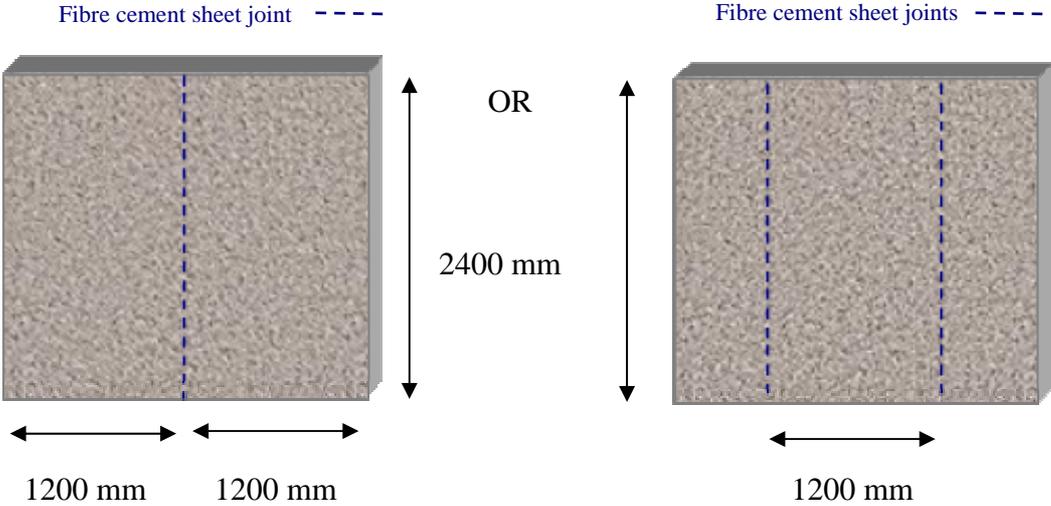
Figure 1



3.2 Heat / Rain Testing

[Specimen 2] Prepare one large-scale coated fibre cement specimen [2400 mm x 2400 mm] including at least one full fibre cement sheet [1200 mm x 2400 mm] and containing at least one vertical joint [Figure 2]. The test panel shall be typical of the actual product installed on site and effectively ready for sale. The panel shall be constructed with ex 100 x 50 timber framing with studs at 600 mm centres maximum, and dwangs at centres specified by the fibre cement manufacturer. The cladding is to be mounted flush with the edges of the panel and be fixed direct to frame with a 5 mm overhang at the base of the panel. For cavity installations, the fibre cement shall be installed over cavity battens at centres specified by E2/AS1 or the fibre cement manufacturer. Building wrap / wall underlay shall be omitted from the test panel to allow observation of the rear of the fibre cement sheet and joints.

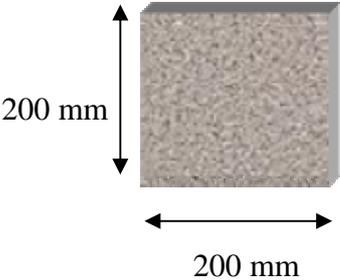
Figure 2



3.3 Static Head Testing

[Specimen 3] Cut ten coated fibre cement specimens [200 mm x 200 mm] [Figure 3] from coated fibre cement samples each with a minimum size of 600 mm x 600 mm.

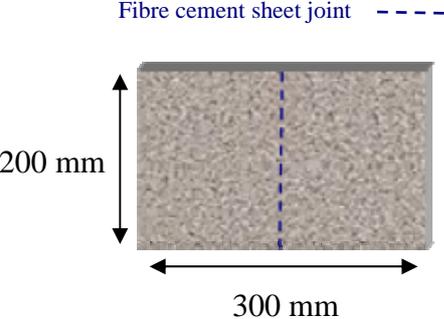
Figure 3



3.4 Coating Adhesion

[Specimen 4] Prepare at least five coated fibre cement specimens [300 mm x 200 mm] [Figure 4] containing the jointing system for tensile adhesion tests. To prevent damage during transportation, the samples shall be screw-fixed to a rigid backing board.

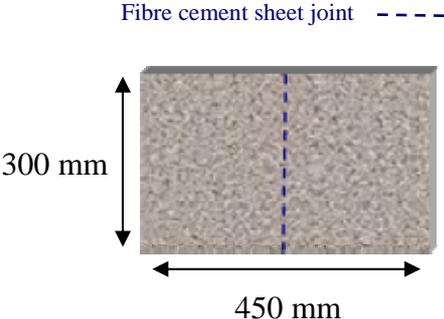
Figure 4



3.5 Tensile Strength Evaluation of Joint

[Specimen 5] Prepare at least ten coated fibre cement specimens containing the jointing system [450 mm x 300 mm] [Figure 5] for tensile strength evaluation tests. The joint shall be prepared in accordance with manufacturer’s instructions. To prevent damage during transportation, the samples shall be screw-fixed to a rigid backing board.

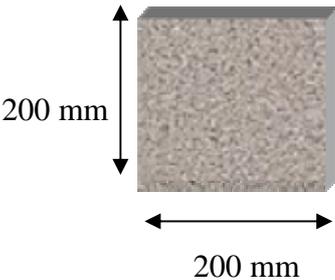
Figure 5



3.6 Accelerated UV Exposure Tests

[Specimen 6] Cut two coated fibre cement specimens [200 mm x 200 mm] [Figure 6] from coated fibre cement samples each with a minimum size of 600 mm x 600 mm.

Figure 6



4. Conditioning

All samples shall be conditioned at 23 ± 2 °C and $50 \pm 5\%$ RH for 7 days prior to testing.

5. Testing Procedure

5.1 Conditioned Samples

The following tests shall be performed on the conditioned specimens.

- 5.1.1** Determine the Water Vapour Transmission Rates [WVTR] of three coated fibre cement specimens [Specimens 1 - Figure 1] using the procedure of ASTM E96 using the wet cup method. The test conditions on the dry side shall be 23°C and 50% RH.

The condition of acceptance for direct-fix installations is that the corrected WVTR value for the coated specimens shall be greater than $35 \text{ g/m}^2 / 24 \text{ hrs}$. There are no conditions of acceptance requirements for coatings used on cavity-based installations only.

- 5.1.2** Evaluate the resistance to water penetration of the coating by Static Head tests [75 mm head] of three coated fibre cement specimens [Specimens 3 – Figure 3]. The method used shall be based on the CCMC 07102 Water Ponding Test or a modified AS/NZS 4548.5 water transmission resistance test, using a 100 mm diameter cylinder sealed to the surface of the coating system to prevent leakage. A 75 mm head shall be used for the test.

The condition of acceptance is that there shall be no loss of head of water or visible signs of moisture, such as water droplets or staining, on the underside face of the fibre cement sheets after 72 hours.

- 5.1.3** Evaluate both the adhesion of the coating and the jointing area on the fibre cement sheet by performing five tensile adhesion tests [based on ASTM C297] from at least two different coated fibre cement specimens [Specimens 4 – Figure 4].

The conditions of acceptance are that the failure mechanism shall be cohesive failure of the fibre cement sheet or the coating / jointing shall have a minimum adhesive strength of 250 kPa.

- 5.1.4** Measure the tensile strength in the plane of the joint of five coated fibre cement joint specimens [Specimens 5 – Figure 5], as specified in Section 3.5.

The conditions of acceptance are that the jointing system shall have a minimum peak tensile load of 2.0kN. The elongation at break shall also be recorded.

5.2 Large Scale Heat / Rain Exposure [Test method based on AS2908 Part 2]

Subject the large scale specimen [Specimen 2 – Figure 2] to 240 cycles of:

- 175 minutes heating period at a maximum surface temperature of 67 ± 2.5 °C [calibrated using a black panel temperature on the surface of the coating], followed by a 5 minute pause, then
- 175 minutes water spray period, which will provide complete wetting of the surface of the coated face, followed by a 5 minute pause

Perform the following examinations on the specimens after the heat rain exposure.

5.2.1 After the completion of 80 cycles the specimen shall be examined for leaks and the coating examined visually for evidence of defects such as cracking, checking, crazing, blistering or delamination in accordance AS 1580.481.1 [parts 7 – 10]. At the completion of the testing through the full 240 cycles, the coating and joint shall be examined visually and under 10 x magnification for evidence of defects.

The conditions of acceptance are that:

A. For acceptance for cavity installations

- i. After 80 cycles there shall be no evidence of water ingress on the reverse side of the test panel. In addition there shall be no signs of defects on the coating surface.*
- ii. After 240 cycles, the coating shall comply with the following:*
 - a. Degree of Checking – rating scale ≤ 2 [AS 1580.481.1.7]*
 - b. Degree of Cracking – rating scale ≤ 2 [AS 1580.481.1.8]*
 - c. Degree of Blistering – density rating scale ≤ 1 and size rating scale S1 [AS 1580.481.1.9]*
 - d. Degree of Flaking and Peeling – quantity rating scale ≤ 2 and size of flaking rating ≤ 2 [AS 1580.481.1.10]*
- iii. After 240 cycles any evidence of water ingress on the reverse side of the panel [restricted to minor staining of the fibre cement sheet and not significant water flow] is considered acceptable provided that the integrity of the joint has not been compromised. The integrity of the joint is considered to have been compromised if there is evidence of joint cracking, delamination, lack of adhesion to the fibre cement board, or any other similar failures.*

Although other observed changes in coating condition, such as degree of colour change, may be primarily aesthetic concerns, they shall be noted within the final report.

B. For acceptance for direct-fixed installations

- i. After 240 cycles there shall be no evidence of water ingress on the reverse side of the test panel.*
- ii. After 240 cycles, the coating shall comply with the following:*
 - a. Degree of Checking – rating scale ≤ 2 [AS 1580.481.1.7]*
 - b. Degree of Cracking – rating scale ≤ 2 [AS 1580.481.1.8]*

- c. *Degree of Blistering – density rating scale ≤ 1 and size rating scale S1 [AS 1580.481.1.9]*
- d. *Degree of Flaking and Peeling – quantity rating scale ≤ 2 and size of flaking rating ≤ 2 [AS 1580.481.1.10]*

Although other observed changes in coating condition, such as degree of colour change, may be primarily aesthetic concerns, they shall be noted within the final report.

C. A full acceptance for direct-fixed installations may qualify as a pass for cavity installations and the final report shall identify this

5.3 Temperature and Humidity Cycling

Subject the required specimens* to a cyclic testing regime to simulate the effect of fluctuations in temperature and humidity. The test shall comprise 75 cycles of the following:

- 2 hours at 30°C / 90 ± 5% RH
- 2 hours at 60°C / 75 ± 5% RH
- 2 hours at 10°C / 50 ± 5% RH
- 2 hours at -10°C / low RH

An alternative cyclic test regime that can be used if the capabilities of the environmental chamber are restricted comprises 30 cycles of the following:

- 6 hours at 30°C / 90 ± 5% RH
- 6 hours at 60°C / 75 ± 5% RH
- 6 hours at 10°C / 50 ± 5% RH
- 6 hours at -10°C / low RH

Perform the following four tests on specimens after the temperature and humidity cyclic exposure period.

* *At least three of specimen 3, at least five of specimen 4 and at least five of specimen 5 shall be subjected to the testing regime.*

5.3.1 At the completion of the testing the specimens shall be examined visually and under 10x magnification for evidence of defects such as cracking, checking, crazing, blistering or delamination in accordance AS 1580.481.1 [parts 7 – 10].

The condition of acceptance is that there shall be no signs of defects on the coating surface, and the coating shall comply with the following:

- iii. *Degree of Checking – rating scale ≤ 2 [AS 1580.481.1.7]*
- iv. *Degree of Cracking – rating scale ≤ 2 [AS 1580.481.1.8]*
- v. *Degree of Blistering – density rating scale ≤ 1 and size rating scale S1 [AS 1580.481.1.9]*
- vi. *Degree of Flaking and Peeling – quantity rating scale ≤ 2 and size of flaking rating ≤ 2 [AS 1580.481.1.10]*

Although other observed changes in coating condition, such as degree of colour change, may be primarily aesthetic concerns, they shall be noted within the final report.

- 5.3.2** Evaluate the resistance to water penetration of the coating by Static Head tests [75 mm head] of three coated fibre cement specimens [Specimens 3 – Figure 3]. The method used shall be based on the CCMC 07102 Water Ponding Test or a modified AS/NZS 4548.5 water transmission resistance test, using a 100 mm diameter cylinder sealed to the surface of the coating system to prevent leakage. A 75 mm head shall be used for the test.

The condition of acceptance is that there shall be no loss of head of water or visible signs of moisture, such as water droplets or staining, on the underside face of the fibre cement sheets after 72 hours.

- 5.3.3** Evaluate both the adhesion of the coating and the jointing area on the fibre cement sheet by performing five tensile adhesion tests [based on ASTM C297] from at least two different coated fibre cement specimens [Specimens 4 – Figure 4].

The conditions of acceptance are that the failure mechanism shall be cohesive failure of the fibre cement sheet and the results shall not be less than 80% of the control test results [Section 5.1.3].

- 5.3.4** Measure the tensile strength in the plane of the joint of five coated fibre cement joint specimens [Specimens 5 – Figure 5], as specified in Section 3.5.

The conditions of acceptance are that the jointing system shall have a minimum peak tensile load of 2.0kN and be no less than 75% of the control test results [Section 5.1.3]. The elongation at break shall also be recorded.

5.4 Accelerated UV Weathering

Subject one coated fibre cement specimen [Specimen 6 – Figure 6] to a cyclic testing regime of either:

- i.* UV radiation and water spray for 1500 light hours using the xenon arc UV lamp source, in accordance with ASTM G155 or,
- ii.* UV radiation and water condensation for 2000 light hours using the fluorescent UV [UVA] lamp source, in accordance with ASTM G154.

At the completion of the testing the coated specimen shall be examined visually and under 10x magnification for evidence of defects, such as cracking, checking, crazing, blistering or delamination and compared with non-exposed specimens.

The condition of acceptance is that there shall be no signs of defects on the coating surface, and the coating shall comply with the following:

- a. Degree of Checking – rating scale ≤ 2 [AS 1580.481.1.7]*
- b. Degree of Cracking – rating scale ≤ 2 [AS 1580.481.1.8]*

- c. *Degree of Blistering – density rating scale ≤ 1 and size rating scale S1 [AS 1580.481.1.9]*
- d. *Degree of Flaking and Peeling – quantity rating scale ≤ 2 and size of flaking rating ≤ 2 [AS 1580.481.1.10]*

Although other observed changes in coating condition, such as degree of colour change, may be primarily aesthetic concerns, they shall be noted within the final report.

In borderline cases, where the rating evaluation is ambiguous, static head tests [as per 5.1.2] and tensile adhesion tests [as per 5.1.3] on the exposed specimens shall be performed.

Topcoat paints already UV tested: - Where a topcoat of paint over the finish, as opposed to a pre-coloured texture coat, is required to provide weather protection, it shall be a latex exterior paint system complying with parts of 7, 8, 9 or 10 of AS3730. If it can be verified that the paint system is compliant with this standard and also has satisfactorily undergone similar UV testing regimes to those outlined within Section 5.4 herein, then the proposed system does not have to undergo the Accelerated UV Weathering test. The final Report shall identify these other UV testing regimes that have been accepted as part of the EM4 evaluation method.

6. Reporting

The report shall contain the following:

- Test date and report number
- Testing Agency and contact details
- Detailed specimen description and identification. All materials must be uniquely identified and not described generically. The information shall include specific details of the fibre-cement board, including rebate dimensions, primer, jointing compound, reinforcing mesh, mesh coat, coloured render, coating system etc
- The results of each test and all relevant observations on the behaviour or performance of the test samples with a summary of each test result as ‘acceptable’ or ‘unacceptable’.
- A summary statement of overall conformance or non-conformance.

Similar topcoat paints in a system: - Where a topcoat of paint over the textured finish is part of the weather protection for the whole system, then those paints that are verified to the satisfaction of the testing agency as having similar base formulations and properties and are manufactured by the same company would also be covered by the EM4 tests on one specific coating and jointing system. The final Report shall identify those topcoat paints that have been grouped together under one acceptance.

Similar textured finish coats in a system: - Where the applicant has various types of textured finish over a base coat plaster, or otherwise over a basecoat weather protection layer, that are part of the whole system, then those textured finishes that are verified to the satisfaction of the testing agency as having similar base formulations and properties and are manufactured by the same company would also be covered by the EM4 tests on one specific coating and jointing

system. The final Report shall identify those textured finishes that have been grouped together under one acceptance.

7. Referenced Documents

ASTM C297-94, Standard Test Method for Flatwise Tensile Strength of Sandwich Construction

ASTM D3285-99, Standard Test Method for Water Absorptiveness of Non-bibulous Paper and Paperboard (Cobb Test)

ASTM E96-00, Standard Test Methods for Water Vapor Transmission of Materials

ASTM G154-00, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Non-metallic Materials

ASTM G155-00, Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

AS/NZS 1580.481.1.7:1998, Exposed to Weathering - Degree of Checking

AS/NZS 1580.481.1.8:1998, Exposed to Weathering - Degree of Cracking

AS/NZS 1580.481.1.9:1998, Exposed to Weathering - Degree of Blistering

AS/NZS 1580.481.1.10:1998, Exposed to Weathering - Degree of Flaking

AS/NZS 2908.2: 2000, Cellulose-Cement Products - Flat Sheet

AS/NZS 4548.5: 1999, Guide to Long-life Coatings for Concrete and Masonry. Part 5: Guidelines to Methods of Test.

Canadian Construction Materials Centre (CCMC) Technical Guide for Sheathing, Membrane, Breather-type, 07102 / 07193, 1993, 1999.

ISO 7500-1:1999: Metallic Materials - Verification of Static Uniaxial Testing Machines - Part 1: Tension/Compression Testing Machines - Verification and Calibration of the Force-Measuring System

New Zealand Building Code [NZBC] Acceptable Solution E2/AS1 Third Edition [June 2004]