

Please find enclosed Amendment 8, effective 30 November 2018, to the Acceptable Solutions and Verification Methods for Clause E2 External Moisture of the New Zealand Building Code. The previous amendment to the E2 Acceptable Solutions and Verification Methods (Amendment 7) was in January 2017.

Section	Previous amendment	November 2018 Amendment 8
Title page	Remove document status and document history page 2A/2B	Replace with new document status and document history page 2A/2B
Contents	Remove page 5/6	Replace with new page 5/6
References	Remove page 13/14	Replace with new page 13/14
E2/VM1	Remove pages 21-24	Replace with new pages 21-24

Document Status

The most recent version of this document (Amendment 8), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 30 November 2018 and supersedes all previous versions of this document.

The previous version of this document (Amendment 7) will cease to have effect on 31 March 2019.

People using this document should check for amendments on a regular basis. The Ministry of Business, Innovation and Employment may amend any part of any Verification Method or Acceptable Solution at any time. Up-to-date versions of Verification Methods and Acceptable Solutions are available from www.building.govt.nz

E2: Document History			
	Date	Alterations	
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Third Edition	E2/VM1 effective from 1 July 2004	E2/AS1 effective from 1 February 2005	
Amendment 1 September 2004	E2/AS1 effective from 1 July 2005	p. 2 Document Status	
Reprinted incorporating Amendment 1		September 2004	
Amendment 2	Effective from 1 July 2005	p. 2 Document History, Document Status pp. 5-7, 9, 10 Contents pp. 13-16 References pp. 17-20 Definitions pp. 21-24 E2/VM1	pp. 25-43, 45-47, 49, 50, 55-57, 59-67, 69-89, 93-100, 102, 103, 105-107, 111-119, 121-125, 127-135, 138, 140-144, 146, 147, 149, 150, 153-155, 157, 163-169 E2/AS1 pp. 173, 174, 177, 178 Index
Erratum 1	Effective from 1 December 2005	p. 166 Table 23	
Amendment 3	21 June 2007	pp. 3 and 4, Building Code Clause E2	
Amendment 4	Effective from 1 May 2008 until 31 January 2012	p. 2 Document History, Document Status pp. 8 and 12 Contents pp. 13-14 References	pp. 171-180 E2/AS2 p. 181 Index
Amendment 5	1 August 2011	p. 2 Document History, Document Status pp. 5-12 Contents pp. 13-16A References pp. 17-20 Definitions pp. 21-24 E2/VM1	pp. 25-180 E2/AS1 pp. 183-184, 189-190 E2/AS2 p. 191 E2/AS3 pp. 193-204 Index
Errata 2	Effective from 24 December 2011 until 14 August 2014	p. 2 Document History, Document Status p. 9 Contents	pp. 29, 41, 43, 49, 55-57, 80, 81, 87, 91, 93, 94, 101, 106-108, 110-115, 117, 158, 160, 172, 176, 191 E2/AS1
Amendment 6	Effective from 14 February 2014 until 30 May 2017	p. 2A, Document History, Document Status p. 5, Contents pp. 13, 15, 16A References p. 17, Definitions	p. 23, E2/VM1 1.5.1, 1.5.2, 1.5.3 pp. 36, 68, 172, 175, 175 E2/AS1 4.3.4, 8.3.4.2, Tables 20, 21, 22
Amendment 7	Effective 1 January 2017 until 31 March 2019	p. 16A References	
Amendment 8	Effective 30 November 2018	p. 5 Contents p. 14 References	p. 21-23A E2/VM1 1.3, 1.3.1, 1.3.2, 1.3.2.1, 1.4.4.1, 1.4.5.1, 1.5, 1.6, 1.7
Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.			

Contents

	Page			
References	13	1.4	Specific design	26
Definitions	17	1.5	Qualifications	26
Verification Method E2/VM1	21	2.0	General	26
1.0 Cladding systems of buildings, including junctions with windows, doors and other penetrations	21	2.1	Weathertightness	26
1.1 General	21	2.2	Materials	26
1.2 Scope	21	2.3	Systems versus materials	26
A mend 8 Nov 2018		2.4	Cladding finish colours	26
1.3 Specimen details	21	2.5	Maintenance – general	27
1.3.1 Class 1	22	2.5.1	Regular maintenance	27
1.3.2 Class 2	22	3.0	Weathertightness Risk Factors	27
1.4 Test procedure	23	3.1	Establishing the risk	27
1.4.1 Preconditioning	23	3.1.1	Definitions of risk	27
1.4.2 Series 1 Static pressure water penetration	23	3.1.2	The risk score	27
Amend 2 Jul 2005		3.3	Wall claddings	28
1.4.3 Series 1 Cyclic pressure water penetration	23	3.4	Examples using the risk matrix	32
Amend 2 Jul 2005		3.4.1	Example 1	32
1.4.4 Series 2 'Water management testing'	23	3.4.2	Example 2	33
Amend 5 Aug 2011		3.4.3	Example 3	34
1.4.5 Series 3 'Wetwall test'	23	4.0	Flashings	35
1.5 Non-compliance	23	4.1	Materials for flashings	35
Amend 6 Feb 2014		4.2	Selection of flashing materials	35
1.6 Existing verification certificates as at 31 March 2019	23A	4.2.1	Environment	35
Amend 2 Jul 2005		4.2.2	Surrounding materials	36
1.7 Pro-forma for test details	23A	4.3	Acceptable flashing materials	36
2.0 Pitched roofing systems over a ventilated roof space of 15° pitch or more	23A	4.3.1	uPVC flashings	36
3.0 Skillion roofs and commercial and industrial roofing	23A	4.3.2	Aluminium flashings	36
Appendix 1: Pro forma	23B	4.3.3	Galvanized steel flashings	36
Acceptable Solution E2/AS1	25	4.3.4	Aluminium-zinc-magnesium (combinations) coated steel flashing to AS 1397	36
1.0 Scope	25	4.3.5	Stainless steel flashings	37
1.1 Construction included	25	4.3.6	Copper flashings	37
Amend 5 Aug 2011		4.3.7	Lead sheet flashings	37
1.1.1 Attached garages	25	4.3.8	Zinc sheet flashings	37
1.2 Construction excluded	25	4.3.9	Butyl rubber and EPDM flashings	37
1.2.1 Outbuildings	25	4.3.10	Bituminous flashings	37
1.2.2 Spread of flame	25			
Amend 2 Jul 2005				
1.2.3 Acoustics	25			
1.3 Provisions for snow	25			

4.3.11 Flexible flashing tape	37	8.1.2 Limitations	59
4.4 Fixings	37	8.1.3 Maintenance	59
4.5 Flashing requirements	37	8.1.4 Fixings	59
4.5.1 Edge treatments for flashings	37	8.1.5 Roof underlays	59
4.5.2 Metal flashing joints	38	8.1.6 Gutters general	60
4.6 Flashing overlaps and upstands	39	8.1.7 Roof penetrations	61
4.6.1 Overlap with roof claddings	39	8.2 Masonry Tiles	63
5.0 Roof/Wall Junctions	42	8.2.1 Materials	63
5.1 Apron flashings	42	8.2.2 General	63
5.2 Gutters, barges and fascias	44	8.2.3 Installation	63
5.3 Soffits	44	8.2.4 Flashings and fixings	63
6.0 Parapets	45	8.2.5 Anti-ponding boards	63
6.1 Limitations	45	8.2.6 Details and flashings	63
6.2 General	45	8.2.7 Penetrations	66
6.3 Capping materials	45	8.3 Pressed Metal Tiles	68
6.4 Metal cappings	47	8.3.1 Limitations	68
6.4.1 Parapet-to-wall junctions	48	8.3.2 Installation	68
6.5 Membrane cappings	48	8.3.3 Tiles	68
6.6 Integral surface cappings	48	8.3.4 Metal substrate	68
7.0 Decks and Pergolas	51	8.3.5 Roof pitch	68
7.1 Thresholds for decks	51	8.3.6 Underlay	69
7.1.1 Slatted decks	51	8.3.7 Fixings	69
7.1.2 Enclosed decks	51	8.3.8 Flashings	69
7.2 Attachment to building structure	51	8.3.9 Gutters, ridges, barges and fascias	72
7.2.1 Slatted timber decks to walls	51	8.3.10 Roof penetrations	72
7.2.2 Pergolas	52	8.4 Profiled Metal Roof Cladding	73
7.3 Level threshold	54	8.4.1 Limitations	73
7.3.1 Enclosed decks	54	8.4.2 General	73
7.3.2 Ground floor level access	54	8.4.3 Materials	73
7.4 Enclosed balustrades	57	8.4.4 Profiles	74
7.4.1 Deck drainage	57	8.4.5 Roof pitch	74
7.4.2 Balustrade-to-wall junctions	57	8.4.6 Structure	74
7.4.3 Balustrade-to-deck floor junction	57	8.4.7 Underlay	76
7.4.4 Metal cappings	57	8.4.8 Fixings: corrugated and trapezoidal	76
7.4.5 Stanchions	58	8.4.9 Fixings: trough profile	78
8.0 Roof Claddings	59	8.4.10 Allowance for expansion	78
8.1 General	59	8.4.11 Flashing requirements	78
8.1.1 Weathertightness	59		

Amend 5
Aug 2011Amend 2
Jul 2005Amend 5
Aug 2011

References

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in these Verification Methods and Acceptable Solutions (primary reference documents) must be the editions, along with their specific amendments, listed below. Where these primary reference documents refer to other Standards or documents (secondary reference documents), which in turn may also refer to other Standards or documents, and so on (lower-order reference documents), then the version in effect at the date of publication of these Verification Methods and Acceptable Solutions must be used.

Amend 4
May 2008Amend 6
Feb 2014Amend 6
Feb 2014

Standards New Zealand

Amend 5
Aug 2011

AS/NZS 1734: 1997 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate

Amends
2 and 5

AS/NZS 2269.0: 2008 Plywood – Structural

NZS 2295: 2006 Pliable, Permeable Building Membranes

Amend 6
Feb 2014

AS/NZS 2728: 2013 Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements

Amend 5
Aug 2011
Amend 6
Feb 2014

AS/NZS 2904: 1995 Damp-proof courses and flashings
Amend: 1

AS/NZS 2908: Cellulose-cement products
Part 2: 2000 Flat sheet

NZS 3602: 2003 Timber and wood-based products for use in building

NZS 3604: 2011 Timber framed buildings

Amend 5
Aug 2011

NZS 3617: 1979 Specification for profiles of weatherboards, fascia boards, and flooring

AS/NZS 4020: 2005 Testing of products for use in contact with drinking water

Amend 5
Aug 2011

Where quoted

AS1 4.3.2, 8.3.4.3,
8.4.3.3, 9.6.3.3

AS1 8.5.3,
9.3.6.1, 9.8.2

AS1 8.1.5, Table 23

AS1 4.2.1, 8.3.4.1,
8.3.4.2, 8.3.4.3,
8.4.3.1, 8.4.3.3, 9.6.3.1,
9.6.3.3, Table 20

AS1 4.3.10, 9.2.4

AS1 9.3.6.2, 9.5.2,
9.7.2

AS1 9.1.10, 9.4.2,
9.4.9, 9.7.3, 9.8.2,
10.2, Table 23

Definitions, VM1 1.1, 1.2,
AS1 1.1, 1.3, 4.1.3, 4.2.1,
7.2.1, 8.3.4.1, 8.4.3.1,
8.5.1, 9.1.3.1, 9.1.3.5,
9.2.1, 9.2.3, 9.2.7.1,
9.2.9, 9.3.2, 9.6.3.1,
Table 1, Table 2, Table 4,
Table 5, Table 6, Table 18,
Table 18A, Table 20
and Table 24
AS2 Figure 5.11 a) and b)

Amend 4
May 2008

AS1 9.4.1.1

AS1 8.1.1

		Where quoted
Amend 5 Aug 2011	NZS 4206: 1992 Concrete interlocking roofing tiles	AS1 8.2.1, 8.2.3
Amend 5 Aug 2011	NZS 4211: 2008 Specification for performance of windows	VM1 1.2, AS1 9.1.10
Amend 8 Nov 2018	<i>Amend: 1</i>	
	NZS 4217 Pressed metal tile roofs	AS1 8.3.3
	Part 1: 1980 Specification for roofing tiles and their accessories	
	Part 2: 1980 Code of practice for preparation of the structure and the laying and fixing of metal roofing tiles	
Amend 5 Aug 2011	SNZ HB 4236: 2002 Masonry veneer wall cladding	Definitions, AS1 Table 3
	NZS 4251: Solid plastering	
Amend 5 Aug 2011	Part 1: 2007 Cement plasters for walls, ceilings and soffits	AS1 9.3.2, 9.3.4.1, 9.3.4.2, 9.3.6.1, 9.3.6.2
	AS/NZS 4256 Plastic roof and wall cladding materials	AS1 4.3.1
	Part 2: 1994 Unplasticized polyvinyl chloride (uPVC) building sheets	
Amend 5 Aug 2011	AS/NZS 4284: 2008 Testing of Building Facades	VM1 1.1, 1.4, 1.4.2, 1.4.3, 1.4.4
	NZS 4298: 1998 Materials and workmanship for earth buildings	AS2 5.1.8, 9.7.2, Figure 4.1, Figure 9.2 a), b), c) and d)
	<i>Amend: 1</i>	
	NZS 4299: 1998 Earth buildings not requiring specific design	AS2 1.0, 1.1
	<i>Amend: 1</i>	
	NZS 4431: 1989 Code of practice for earth fill for residential development	AS2 Figure 4.1
	<i>Amend: 1</i>	
Amend 4 May 2008	AS/NZS 4534: 2006 Zinc and zinc/aluminium-alloy coatings on steel wire	AS1 9.1.8.5
Amend 5 Aug 2011	AS/NZS 4680: 2006 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles	AS1 9.9.4.1, Table 20
Amend 5 Aug 2011	AS/NZS 4858: 2004 Wet area membranes	AS1 9.7.7.1, 9.9.4.4, 9.9.10.1

Verification Method E2/VM1

1.0 Cladding systems of buildings, including junctions with windows, doors and other penetrations

1.1 General

This Verification Method is for determining compliance with NZBC E2.3.2 of *cladding systems* and associated window and door junctions only, for *buildings* of importance Levels 1 or 2 as described in Table 1.1(a) of NZS 3604.

The tests in this Verification Method shall be undertaken in a test facility with IANZ or equivalent accreditation for testing the *weathertightness* of *claddings* to the procedures of AS/NZS 4284, and as used to establish the performance criteria detailed in Paragraph 1.4 Test Procedures.

COMMENT:

The *weathertightness* testing of AS/NZS 4284 is modified in this Verification Method for generic domestic-oriented *cladding* because the Standard was developed primarily for testing specific, non-absorptive facades and curtain wall systems on high-rise commercial *buildings*.

1.2 Scope

1.2.1 The scope of this Verification Method shall be restricted to *buildings* that:

- a) are in accordance with the scope of Paragraph 1.0 of E2/AS1, and within the *wind zones* covered by Section 5 of NZS 3604, and
- b) have *claddings* that include a drained and vented cavity of nominal 20 mm minimum depth with minimum ventilation opening of 1000 mm²/m at the foot, including any *claddings* that require a rigid *wall underlay* in accordance with Paragraph 9.1.7.2 of E2/AS1, and
- c) include window and door units that are manufactured to comply with the relevant requirements of NZS 4211, and

- d) may include *buildings* based on (a), (b) and (c) above, but with specific engineering design frame elements of at least equivalent stiffness to the *framing* provisions defined in NZS 3604.

1.2.2 This Verification Method may also be used for individual *buildings* that comply with (a) to (d) above, and that are designed for a specific wind pressure up to a maximum ultimate limit state (ULS) of 2500 Pa.

COMMENT:

While the test specimens used for this Verification Method may include window and door units, it is only the junctions of these elements with other *cladding* elements that are assessed in the test.

1.3 Specimen details

The minimum size of the wall *cladding* specimen to be tested shall be 2.4 m x 2.4 m.

Any *cladding system* within an Extra High *wind zone* or subject to a specific design wind pressure up to ULS 2500 Pa that relies on this Verification Method shall have a rigid *underlay* installed in accordance with Paragraph 9.1.7 of E2/AS1. In either of these two circumstances, a rigid *underlay* is not necessary for the verification tests as a flexible *wall underlay* may suffice – unless the *cladding* to be tested specifically includes a rigid *underlay* as part of the *cladding system*, and its removal would compromise the structural fixings or support for the *cladding*.

COMMENT:

Testing a *cladding* with flexible *underlay*, but then verifying the *cladding* for use with rigid *underlay*, is allowed in order to make testing quicker and easier. It is expected that *cladding systems* with a cavity within the scope of E2/VM1 will perform better with a rigid *underlay* than with a flexible *underlay*, although this has not been proven.

For *cladding systems* intended to be available for use in multiple situations, including *cladding systems* for which a New Zealand supplier has commissioned the testing for the purposes of providing product assurance, Class 1 or Class 2 testing must be selected. Class 1 and Class 2 each include a mandatory

minimum set of details to be included in the specimen. If any of the mandatory details from Class 1 or Class 2 are omitted from the specimen, then E2/VM1 compliance to Class 1 or Class 2 cannot be claimed.

1.3.1 Class 1: *Cladding systems* where only vertical joints are required, and having no penetrations through the *cladding*.

Test specimens shall include vertical joints, internal and external corners of the external *wall* junctions, and footer and header termination systems.

1.3.2 Class 2: All *cladding systems* within the scope of this document that are not Class 1.

Testing is to include representative samples of penetrating *building elements* or joints to be used.

- a) Test specimens must include vertical and horizontal *control joints*, internal and external *wall* junctions, windows and/or doors, a *parapet* or *enclosed balustrade capping* with a *saddle flashing*, a 200 mm diameter pipe penetration, and footer and header termination systems.
- b) Test specimens may also include other details relevant to the use of the *cladding system* on the building, such as *scupper* penetrations, meter boxes, junctions with other *cladding systems* or *building elements*, and junctions where roof and *enclosed deck* terminations, *gutters*, or other features occur within walls (including within the sides of framed chimneys with *cladding*).

COMMENT:

Although only certain details are mandatory for inclusion within test specimens, the inclusion of other additional details could enable manufacturers, suppliers and specifiers who commission tests to demonstrate compliance for a wider range of situations than those which the mandatory details cover. Manufacturers, suppliers and specifiers should ensure that test specimens include all *cladding* details or junctions for which compliance with this Verification Method is intended to be demonstrated and claimed.

A 15 mm diameter round hole shall be formed in the internal *lining* below the window to simulate the effect of power points, light switches and other air leakage through the internal *lining*. Where a *cladding* specimen is larger than 2.4 m x 2.4 m, an additional 15 mm hole shall be added for each 7 m² of *cladding* area (or part thereof).

1.3.2.1 To allow the observation of any water penetration, one of the following options must be followed:

- a) For specimens that include a rigid *wall underlay*, adjacent to critical elements where visual access is required a proportion of the *underlay* shall be made using transparent material of sufficient structural capability and similar airtightness to the specified wall *lining* material, and able to resist the applied wind pressures. The proportion shall be at least 2%, but shall be small enough that it does not affect the ability of the specimen to represent the performance of the *underlay* within the *cladding system*; or
- b) For specimens that do not include a rigid *wall underlay*, adjacent to critical elements where visual access is required, the *wall underlay* shall be cut through and removed, or fastened back onto the *framing*, with a rigid transparent internal *lining* used to support the air pressure. It is required that between 2% and 100% of the area of the *wall underlay* (or equivalent) be so removed; or
- c) For specimens that include a flexible or a rigid *underlay*, small video cameras and/or borescopes shall be installed within the cavity to provide a clear view of all critical elements where visual access is required. Borescopes and cameras must be positioned clear of all junctions, and must be installed in a manner that does not affect the airtightness of the air barrier (rigid *underlay* or internal wall *lining*) or affect the path of any moisture that enters the cavity.

Amend 5
Aug 2011

Amend 8
Nov 2018

Amend 8
Nov 2018

Amend 8
Nov 2018

Amend 8
Nov 2018

Amend 5
Aug 2011

Amend 8
Nov 2018

COMMENT:

The use of borescopes and cameras requires care to achieve these requirements, but may be the most appropriate option in situations such as when other AS/NZS 4284 tests are to be performed on the same specimen, or to help resolve doubts about whether the replacement of a proportion of the *lining* or *underlay* with a transparent material will affect the performance of the *cladding*.

Amend 8
Nov 2018

1.4 Test procedure

The Verification Method shall consist of the extended water penetration test methodologies of AS/NZS 4284, following a preconditioning pressure loading exposure.

1.4.1 Preconditioning

Apply a preconditioning loading to the external face of the test sample for a period of 1 minute of positive pressure, followed by a period of 1 minute of negative pressure (suction). The loading shall be 1515 Pa.

COMMENT:

As the ventilated cavity is subjected to the same applied pressure, it is necessary that the material serving as the *air seal* is able to sustain the same applied loading.

Where the test wall is utilising a permeable *wall underlay* or *membrane*, the internal wall *lining* will be required to sustain the serviceability limit state (SLS) wind pressures.

1.4.2 Series 1 Static Pressure Water Penetration

The water penetration test by static pressure shall be conducted in accordance with Clause 8.5 of AS/NZS 4284 and at the maximum test pressure of 455 Pa.

1.4.3 Series 1 Cyclic Pressure Water Penetration

The water penetration test by cyclic pressure shall be conducted in accordance with Clause 8.6 of AS/NZS 4284 and to the cyclic pressure of 455 – 910 Pa at the prescribed Stage 3, with the Stage 1 and Stage 2 tests deleted.

1.4.4 Series 2 'Water Management Testing'

Paragraphs 1.4.2 and 1.4.3 shall be repeated, following the formation of 6 mm diameter holes through the *wetwall* as allowed in AS/NZS 4284 Clause 9.9 in at least 4 places, as noted below:

- a) Through the window/wall joint at 3/4 height of both window/door jambs,
- b) Immediately above the head *flashing*,
- c) Through the external sealing of the horizontal and vertical joints, and
- d) Above any other *wetwall* penetration detail.

The introduction of defects is intended to simulate the failure of the primary weather-defence/sealing. It must only penetrate to the plane of the back of the *wetwall* so the water management of the cavity can be assessed.

1.4.4.1 Immediately upon the conclusion of the Water Management Tests (within 30 minutes) (Paragraph 1.4.4), the layers behind the *wetwall* that support air pressure (including sealing in the window trim cavity) shall be removed, and any evidence of non-compliance (as defined in Paragraph 1.5) noted.

1.4.5 Series 3 'Wetwall Test'

1.4.5.1 Repeat Paragraph 1.4.2 with an air pressure of 50 Pa, applied across the *wetwall* only, for 15 minutes.

1.5 Non-compliance

1.5.1 Non-compliance shall be the presence of water (as defined in Paragraph 1.5.2), or evidence of any water, either:

- a) On the removed surfaces of the cavity after carrying out the tests in Paragraphs 1.4.2 and 1.4.3, and the subsequent 'water management' tests in Paragraph 1.4.4, and/or
- b) During or after the test in Paragraph 1.4.5.

1.5.2 Water which is able to penetrate to the back of the *wetwall* through introduced defects and joints shall be controlled. It may contact battens and other cavity surfaces,

Amend 5
Aug 2011

Amend 8
Nov 2018

Amend 8
Nov 2018

Amend 8
Nov 2018

Amend 5
Aug 2011

but no water shall be transferred to the plane of the *wall underlay*, cavity air sealing or structural *framing* due to a design or systemic failure. Water that may arrive on the *underlay* due to an 'isolated blemish' may be disregarded. No water may drip through an airspace within the cavity where it is possible for water to impact on a surface in the cavity and splash onto the *wall underlay*. However, any spattering of water into the cavity through the introduced defects shall be ignored.

During the *Wetwall* Test, water is allowed to spatter up from the footer *flashing*, provided it is not held above any cavity obstruction.

Amends
5 & 6

1.6 Existing verification certificates as at 31 March 2019

1.6.1 E2/VM1, included in E2 Acceptable Solutions and Verification Methods Amendment 8, is effective from 30 November 2018.

1.6.2 E2/VM1, included in E2 Acceptable Solutions and Verification Methods Amendments 5 - 7 remains effective (excluding transitional arrangements for E2/VM1 included in E2 Acceptable Solutions and Verification Methods Amendment 4 or earlier) for all *cladding systems* with verification certificates issued prior to 31 March 2019 provided that any verification certificates issued under E2/VM1 from 31 March 2019 must be under E2 Acceptable Solutions and Verification Methods Amendment 8.

Amend 8
Nov 2018Amends
5 & 6Amend 8
Nov 2018

1.7 Pro-forma for test details

The pro forma attached as Appendix 1 to this Verification Method may be used to provide specifiers with a summary of test details and results.

Amend 5
Aug 2011

2.0 Pitched roofing systems over a ventilated roof space of 15° pitch or more

2.1 AS 4046 Part 9 provides a Verification Method for determining compliance with NZBC E2.3.2 of any tiled roofing system of 15° pitch or more above a *roof space* (i.e. not a skillion *roof*). Compliance is based on comparison of performance with a control roofing system described in the Standard. Compliance is achieved where the water penetration is less than, or equal to, the control sample. This test is also a Verification Method for other ventilated roofing systems or skylights with a pitch of 15° or more above a *roof space*.

3.0 Skillion roofs and commercial and industrial roofing

3.1 No specific method has been adopted for verifying compliance of skillion *roofs* or commercial or industrial roofing with NZBC E2.3.2.

Amend 5
Aug 2011

Appendix 1: Pro forma

Test results shall be expressed in the following tabulated format within the usual Test Report of the particular test laboratory.

Amend 5
Aug 2011

Series 1: Static Water Penetration

Test pressure 455 Pa
Duration 15 minutes

Amend 5
Aug 2011

Series 1: Cyclic Water Penetration

Test pressure 455–910 Pa
Duration 5 minutes

Amend 5
Aug 2011

**Series 2: Water Management Tests
Static Water Penetration**

Test pressure 455 Pa
Duration 15 minutes

Amend 5
Aug 2011

**Series 2: Water Management Tests
Cyclic Water Penetration**

Test pressure 455–910 Pa
Duration 5 minutes

Amend 5
Aug 2011

Series 3: Wetwall Test Static Water Penetration

Test pressure 50 Pa
Duration 15 minutes

Additional water penetration requirements:

Comments:

