Acceptable Solutions and Verification Methods

For New Zealand Building Code Clause E2 External Moisture
Status of Verification Methods and Acceptable Solutions

Verification Methods and Acceptable Solutions are prepared by the Ministry of Business, Innovation and Employment in accordance with section 22 of the Building Act 2004. Verification Methods and Acceptable Solutions are for use in establishing compliance with the New Zealand Building Code.

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Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Verification Methods and Acceptable Solutions and explains alternative methods of achieving compliance. Defined words (italicised in the text) and classified uses are explained in Clauses A1 and A2 of the Building Code and in the Definitions at the start of this document.

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**Document Status**

The most recent version of this document (Amendment 7), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 1 January 2017 and supersedes all previous versions of this document.

The previous version of this document (Amendment 6) will cease to have effect on 30 May 2017.

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

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New Zealand Building Code Clause E2 External Moisture

This Clause is extracted from the New Zealand Building Code contained in the First Schedule of the Building Regulations 1992.

Clause E2—External moisture

Provisions

Objective

E2.1 The objective of this provision is to safeguard people from illness or injury that could result from external moisture entering the building.

Functional requirement

E2.2 Buildings must be constructed to provide adequate resistance to penetration by, and the accumulation of, moisture from the outside.

Performance

E2.3.1 Roofs must shed precipitated moisture. In locations subject to snowfalls, roofs must also shed melted snow.

E2.3.2 Roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to building elements, or both.

E2.3.3 Walls, floors, and structural elements in contact with, or in close proximity to, the ground must not absorb or transmit moisture in quantities that could cause undue dampness, damage to building elements, or both.

E2.3.4 Building elements susceptible to damage must be protected from the adverse effects of moisture entering the space below suspended floors.

E2.3.5 Concealed spaces and cavities in buildings must be constructed in a way that prevents external moisture being accumulated or transferred and causing condensation, fungal growth, or the degradation of building elements.

Limits on application

Requirement E2.2 does not apply to buildings (for example, certain bus shelters, and certain buildings used for horticulture or for equipment for washing motor vehicles automatically) if moisture from the outside penetrating them, or accumulating within them, or both, is unlikely to impair significantly all or any of their amenity, durability, and stability.
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Figure 113: Flush-finished external corners for fibre cement sheet

Figure 114: Soffits for flush-finished fibre cement sheet

Figure 115: Windows and doors for direct fixed fibre cement sheet

Figure 116: Windows and doors for fibre cement sheet and flush-finished fibre cement on cavity

Figure 117: Enclosed balustrade to wall for fibre cement sheet

Figure 119: Battened joints for plywood sheet

Figure 121: Horizontal joints for plywood sheet

Figure 122: External corners for plywood sheet

Figure 123: Internal corners for plywood sheet

Figure 124: Control joints for EIFS

Figure 125: Bottom of cladding for EIFS

Figure 126: Penetration for EIFS

Figure 127: Window and door corner flashing for EIFS

Figure 128: Windows and doors in EIFS

Figure 129: Enclosed balustrade-to-wall junction for EIFS

Figure 130: Parapet with metal capping for EIFS

Figure 9.2: Head details

A) Timber joinery with timber-framed wall insert

B) Aluminium joinery with timber-framed wall insert

C) Timber joinery with timber lintel

D) Aluminium joinery with timber lintel

Figure 9.3: Jamb details

A) Timber joinery

B) Aluminium joinery

Figure 9.4: Sill details

A) Timber joinery with brick or tile sill

B) Aluminium joinery with brick or tile sill

C) Timber joinery with concrete sill

D) Aluminium joinery with concrete sill

Figures – E2/AS2

Figure 4.1: Footing dimensions and general details

Figure 5.11: Soffit to wall junction

A) Flat soffit

B) Angled soffit

Figure 5.12: Timber-framed gable to earth wall
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.

**Standards New Zealand**

- AS/NZS 1734: 1997 Aluminium and aluminium alloys – Flat sheet, coiled sheet and plate
- AS/NZS 2269.0: 2008 Plywood – Structural
- NZS 2295: 2006 Pliable, Permeable Building Membranes
- AS/NZS 2728: 2013 Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements
- AS/NZS 2904: 1995 Damp-proof courses and flashings
- NZS 3602: 2003 Timber and wood-based products for use in building
- NZS 3604: 2011 Timber framed buildings
- 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

**Where quoted**

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- AS1 8.5.3, 9.3.6.1, 9.8.2
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NZS 4211: 2008 Specification for performance of windows
NZS 4217 Pressed metal tile roofs
  Part 2: 1980 Code of practice for preparation of the structure and
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SNZ HB 4236: 2002 Masonry veneer wall cladding
NZS 4251: Solid plastering
  Part 1: 2007 Cement plasters for walls, ceilings and soffits
AS/NZS 4256 Plastic roof and wall cladding materials
  Part 2: 1994 Unplasticized polyvinyl chloride (uPVC) building sheets
AS/NZS 4284: 2008 Testing of Building Facades
NZS 4298: 1998 Materials and workmanship for earth buildings
  Amend: 1
NZS 4299: 1998 Earth buildings not requiring specific design
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  Amend: 1
AS/NZS 4534: 2006 Zinc and zinc/aluminium-alloy coatings on steel wire
AS/NZS 4680: 2006 Hot-dip galvanized (zinc) coatings on fabricated
  ferrous articles
AS/NZS 4858: 2004 Wet area membranes

AS1 8.2.1, 8.2.3
VM1 1.2, AS1 9.1.10
AS1 8.3.3
Definitions,
AS1 Table 3
AS1 9.3.2, 9.3.4.1,
  9.3.4.2, 9.3.6.1, 9.3.6.2
AS1 4.3.1
VM1 1.1, 1.4, 1.4.2,
  1.4.3, 1.4.4
AS2 5.1.8, 9.7.2,
  Figure 4.1, Figure 9.2
  a), b), c) and d)
AS2 1.0, 1.1
AS2 Figure 4.1
AS1 9.1.8.5
AS1 9.9.4.1,
  Table 20
AS1 9.7.7.1, 9.9.4.4,
  9.9.10.1
Standards Australia

AS 1366  Rigid cellular plastics sheets for thermal insulation

AS 1397: 2011 Continuous hot-dip metallic coated steel sheet and strip
  – Coatings of zinc and zinc alloyed with aluminium and magnesium
    Amend: 1

AS 1566: 1997 Copper and copper alloys – Rolled flat products

AS 1804: 1976 Soft lead sheet and strip

AS 2049: 2002 Roof tiles

AS 2050: 2002 Installation of roof tiles

AS 3566  Self-drilling screws for the building and construction industries
  Part 2: 2002 Corrosion resistance

AS 3730  Guide to the properties of paints for buildings
  Amend 5

BS 6538: 1987 Air permeance of paper and board
  Part 3: 1987 Method for determination of air permeance using the Garley apparatus

BS EN 988: 1997 Zinc and zinc alloys. Specification for rolled flat products for building

Where quoted

AS1 9.9.3.1
AS1 9.9.3.1
AS1 4.3.4, Table 20
AS1 4.3.6
AS1 4.3.7
AS1 8.2.1
AS1 8.2.3
AS1 8.4.8, 8.4.9, 9.6.6, Table 20
AS1 9.3.7, 9.4.9, 9.5.6, 9.7.3.1, 9.7.4, 9.8.9, 9.9.3, 9.9.6.3
VM1 2.1, AS1 8.2.3
AS1 Table 23
AS1 4.3.8
### American Society for Testing and Materials

<table>
<thead>
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<tbody>
<tr>
<td>ASTM D6134: 2007 Standard Specification for Vulcanised Rubber Sheets Used in Waterproofing Systems</td>
<td>AS1 4.3.9, 8.5.4</td>
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<tr>
<td>ASTM E96: 2005 Standard Test Methods for Water Vapour Transmission of Materials</td>
<td>AS1 Table 23</td>
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<td>ASTM E104: 2002 Standard Practice for Maintaining Constant Relative Humidity by Means of Aqueous Solutions</td>
<td>AS1 10.3.2</td>
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### Building Research Association of New Zealand

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<tr>
<td>BRANZ Bulletin 330: 1995 Thin flooring materials – 2 Preparation and laying. Appendix 1</td>
<td>AS1 10.3.2</td>
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<td>BRANZ EM 4: 2005 Evaluation method for jointing systems for flush finished fibre cement sheet</td>
<td>AS1 9.7.4, 9.7.10.2</td>
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<tr>
<td>BRANZ EM 5: 2005 Evaluation method for adhesives and seam tapes for butyl and EPDM rubber membranes</td>
<td>AS1 8.5.4</td>
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<td>BRANZ EM 6: 2010 Evaluation method for window and door support mechanisms or bars</td>
<td>AS1 9.1.10.5</td>
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<tr>
<td>BRANZ Bulletin 411: 2001 Recommended timber cladding profiles</td>
<td>AS1 9.4.1.1</td>
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</tbody>
</table>
## SCION

Measurement of moisture content of wood

### Other Organisations

**Federal Specification** Elastomeric type, cold applied single component Standard for caulking, sealing, and glazing in buildings, TT-S-00230C building areas (plazas, decks, pavements), and other structures


ICBO Evaluation Acceptance criteria for flashing materials Services Inc AC148

ISO 9223: 1992 Corrosion of metals and alloys; corrosivity of atmospheres; classification

ISO 11600: 2002 Building Construction – Jointing products Classification and requirements for sealants 9.5.3.2, 9.6.7, 9.9.3,


New Zealand Metal Roof and Wall Cladding Code of Practice: 2008 New Zealand Metal Roofing Manufacturers Inc.

### Cement & Concrete Association of New Zealand

CCANZ – CP01: 2014 Code of Practice for weathertight concrete and concrete masonry construction, incorporating errata 1, January 2015

### Where quoted

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<tr>
<td>AS1 10.3.1</td>
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<td>AS1 4.3, 4.5.1, 4.5.2, 8.1.6.2, 8.3.1, 8.4.1, 8.4.12, 8.4.14, 8.4.15, 8.4.16.2, 8.4.17</td>
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<tr>
<td>AS3 1.0</td>
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Air seal
A continuous seal fitted between a window or door reveal and the surrounding wall framing to prevent the flow of air into the interior of the building.

Anti-ponding board
A board laid under the lowest row of concrete and clay roof tiles and supports the roof underlay. The board is sloped to ensure moisture under the tiles is directed to the exterior of the roof.

Apron flashing
A near flat or sloping flashing with a vertical upstand, used at junctions between roofs and walls.

Attached garage
A garage that shares a common wall or walls with a habitable building, and is enclosed by roof and wall claddings that are continuous with the habitable part of the building.

Base metal thickness (BMT)
The thickness of the bare or base metal before any subsequent coating, such as galvanizing.

Bird's beak
A double fold applied to the edge of a horizontal metal flashing to stiffen the edge and to assist in deflecting moisture away from the cladding system below. Refer also Kick-out and Drip edge.

Butt flashing
A preformed wall flashing, used to flash windows and corners on horizontal profiled metal wall cladding.

Cantilevered deck
A deck where no support is provided at the outer extremities of the deck.

Capping
A flashing formed to cover the top of an enclosed balustrade or parapet. Also known as a coping.

Cavity batten
A vertical packing member used to create a drained cavity as part of a cladding system.

Cavity wall
A term used to describe a wall that incorporates a drained cavity.

Cavity spacer
A short block used to provide intermittent support for fixings or pipe penetrations through a drained cavity, while not interrupting drainage within the cavity.

Cladding
The exterior weather-resistant surface of a building. Includes any supporting substrate and, if applicable, surface treatment.

Cladding system
The outside or exterior weather-resistant surface of a building; including roof cladding and roof underlays, wall cladding and wall underlays, and cavity components, rooflights, windows, doors and all penetrations, flashings, seals, joints and junctions.

Control joint
A joint designed to prevent damage by accommodating movement. See also Expansion joint.

Damp-proof course (DPC)
A strip of durable vapour barrier placed between building elements to prevent the passage of moisture from one element to another.
Damp-proof membrane (DPM) A sheet material, coating or vapour barrier, having a low water vapour transmission, and used to minimise water and water vapour penetration into buildings. Usually applied against concrete in contact with the ground. (Also known as a concrete underlay.)

Deck An open platform projecting from an exterior wall of a building and supported by framing. A deck may be over enclosed internal spaces, or may be open underneath. Refer also Enclosed deck. Also known as a balcony.

Direct fixed A term used to describe a wall cladding attached directly to the wall framing, without the use of a drained cavity.

Dormer or dormer window A framed structure that projects from a sloping roof, and has a window at its outer end.

Drained cavity A cavity space, immediately behind a wall cladding, that has vents at the base of the wall. Also known as a drained and vented cavity and referred to in this Acceptable Solution as a cavity or drained cavity.

A drained cavity assists drying by allowing water which occasionally penetrates the wall cladding system to drain to the exterior of the building, and any remaining moisture to dry by evaporation. Where this Acceptable Solution requires a nominal 20 mm drained cavity, the depth shall be between limits of 18 mm and 25 mm.

For definition of masonry veneer cavity refer to SNZ HB 4236.

Drip edge Fold(s) applied to the edge of a horizontal metal flashing to deflect moisture away from the cladding system below. Refer also Bird’s beak and Kick-out.

Dwang A short (usually horizontal) member fixed between framing timbers. Also known as nogging.

Eaves That part of the roof construction, including cladding, fascia and eaves gutter (spouting), that extends beyond the exterior face of the wall.

EIFS (Exterior Insulation and Finish System). A polystyrene sheet-based cladding system that uses mesh reinforced polymer-modified cement-based or polymer-based plaster base coats and a protective top coating.

Electrolytic corrosion Galvanic corrosion commonly resulting from the contact of two dissimilar metals when an electrolyte such as water is present.

Enclosed balustrade A timber-framed barrier with cladding across all exposed faces. Refer also Parapet.

Enclosed deck A deck, whether over an interior or exterior space, that has an impermeable upper surface and is closed on the underside. May also be known as a balcony.

Envelope complexity The categorisation of the complexity of the total building envelope into one of four classes, depending on the particular features of the building as specified in this Acceptable Solution.

EPDM (Ethylene Propylene Diene Monomer) A thermosetting synthetic rubber used as a resilient part of a sealing washer, or as a roof membrane.

Expansion joint A joint designed to prevent damage by accommodating movement. See also Control joint.

External wall Any vertical exterior face of a building consisting of primary and/or secondary elements intended to provide protection against the outdoor environment.

Finished ground level (FGL) The level of the ground against any part of a building after all backfilling and/or landscaping and/or surface paving has been completed.

Flexible flashing tape A flexible self-adhesive waterproof tape. Usually used as an accessory for wall underlays, to seal corners and intersections.
Flush-finished The description of a cladding and joints system which relies on a protective coating applied to the face of the cladding to prevent the penetration of water.

Framing Timber members to which lining, cladding, flooring, or decking is attached; or which are depended upon for supporting the structure, or for resisting forces applied to it.

Hem A flat fold, not completely closed, applied to the edge of a metal flashing.

Hidden gutter A gutter located within the boundaries of the roof framing. Hidden gutters may also be known as secret gutters or internal gutters. See also Valley gutters.

Hook An open fold applied to the edge of a metal flashing.

Kick-out A single fold applied to the edge of a horizontal metal flashing to deflect moisture away from the cladding system below. Refer also Bird’s beak.

Lining The rigid sheet covering for a wall, ceiling or other interior surface.

Masonry tiles Clay or concrete tile roof cladding.

Masonry veneer Clay or concrete block veneer cladding.

Membrane A non-metallic material, usually synthetic, used as a fully supported roof cladding, deck surface or, in conjunction with other claddings, as gutters or flashings.

NZBC New Zealand Building Code.

Parallel flashing A roof flashing that runs along the roof slope, parallel to the roof cladding profile. Also known as a longitudinal flashing.

Parapet A timber-framed wall that extends above the level of the roof cladding. Refer also Enclosed balustrade.

Purlin A horizontal member laid to span across rafters or trusses, and to which the roof cladding is attached.

Rafter A framing timber, normally parallel to the slope of the roof, providing support for sarking, purlins or roof cladding.

Risk matrix A table that allows the calculation of a risk score by the allocation and summing of scores for a range of design and location factors applying to a specific building design.

Risk score An aggregated numerical score for a proposed building as defined by this Acceptable Solution. The risk score is determined by completion of the risk matrix.

Roof That part of a building having its upper surface exposed to the outside and at an angle of 60° or less to the horizontal.

Roof underlay An absorbent permeable building paper that absorbs or collects condensation or water in association with roof cladding performance.

Saddle flashing A flashing used to weatherproof the junction between a horizontal and vertical surface.

Scupper An opening in a parapet or enclosed balustrade to allow water to drain into a rainwater head.

Sill support bar A bar or mechanism complying with EM6, E2/VM1 tests, and Clause B2 of the Building Code, and used to support the weight of aluminium window and door joinery that is installed over drained cavities.

Soft edge A compatible soft edging seamed onto flashings to provide closure to profiled cladding.

Specific design Design and detailing for compliance with the Building Code, of a proposed part or parts of a building which are not shown in this Acceptable Solution.
Stanchion A connecting device, fixed into the structure of a building, that provides support for handrails, aerials and similar structures.

Stopend A turn-up at the upper edge of profiled metal cladding, or at the end of gutters and some types of flashings.

COMMENT: A stopend assists the control of moisture by ensuring any moisture reaching the edge of the roofing is deflected from further entry.

Storey That portion of a building included between the upper surface of any floor and the upper surface of the floor immediately above, except the top storey shall be that portion of a building included between the upper surface of the topmost floor and the ceiling or roof above.

Stucco A wall cladding system formed from reinforced solid plaster over a rigid or non-rigid backing.

Stud A vertical framing timber.

Transverse flashing A roof flashing that runs across the roof slope, at right angles to the roof cladding profile.

Trapezoidal A type of profiled metal cladding with symmetrical or asymmetrical crests, with troughs between the crests.

Trough profile A type of profiled metal cladding comprising vertical ribs with flat, or lightly profiled pans between the ribs. Also known as ribbed, secret fixed or tray profile.

Underlay The material used behind a roof or wall cladding. Refer Wall underlay and Roof underlay.

Valley gutter A gutter running down the valley formed by the intersection of two pitched roof surfaces.

Wall refer External wall.

Wall underlay A building paper, synthetic material or rigid sheathing used as part of the wall cladding system to assist the control of moisture by ensuring moisture which occasionally penetrates the wall cladding is directed back to the exterior of the building.

Waterproof and waterproofing The complete and total resistance of a building element to the ingress of any moisture.

Weathertightness and weathertight Terms used to describe the resistance of a building to the weather.

Weathertightness is a state where water is prevented from entering and accumulating behind the cladding in amounts that can cause undue dampness or damage to the building elements.

COMMENT: The term weathertightness is not necessarily the same as waterproof.

However, a weathertight building, even under severe weather conditions, is expected to limit moisture ingress to inconsequential amounts, insufficient to cause undue dampness inside buildings and damage to building elements. Moisture that may occasionally enter is able to harmlessly escape or evaporate.

Wetwall The exterior cladding on a wall with a drained cavity.

Wind zone Categorisation of wind force experienced on a particular site as determined in NZS 3604, Section 5.

COMMENT: Maximum ultimate limit state speeds are:

- Low wind zone = wind speed of 32 m/s
- Medium wind zone = wind speed of 37 m/s
- High wind zone = wind speed of 44 m/s
- Very high wind zone = wind speed of 50 m/s
- Extra high wind zone = wind speed of 55 m/s.

Specific design is required for wind speeds greater than 55 m/s.
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 air barrier as part of the specified system.

If the cladding system is never to be used with building elements penetrating the exterior surface walls, then the specimen shall include the details from Class 1. In all other cases, specimens with the details of Class 2 shall be tested, where the classes are described below:

Class 1: Cladding systems where only vertical joints are required, and having no penetrations through the cladding. Testing shall include vertical joints, internal and external corners of the external wall junctions, and footer and header termination systems.

Class 2: All other cladding systems to be used within the scope of this document.
Testing is to include representative samples of penetrating building elements or joints, and including vertical and horizontal control joints, internal and external wall junctions, windows and/or doors, electrical meter boxes, balcony drainage and parapet flashings, and footer and header termination systems, plus any other relevant details.

To allow the observation of any water penetration, a proportion of the internal wall lining shall be made using transparent material of sufficient structural capability and similar airtightness to resist the applied wind pressures. Adjacent to critical elements where visual access is required, the wall underlay shall be cut through and fastened back onto the framing, with the transparent internal lining fully sealing the internal perimeter of the observation opening. It is required that at least 2% of the area of the wall underlay (or equivalent) be so removed. 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.

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 1.4.5.3) noted.
1.4.5 Series 3 'Wetwall Test'

1.4.5.1 Repeat Paragraph 1.4.3 with an air pressure of 50 Pa, applied across the wetwall only, for 15 minutes.

1.4.5.2 Non-compliance shall be the presence of water (as defined in Paragraph 1.4.5.3) after carrying out the tests in Paragraphs 1.4.2 and 1.4.3, and the subsequent 'water management' tests (or evidence of any water) on the removed surfaces of the cavity.

1.4.5.3 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, 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 air-space within the cavity where it is possible for water to impact on a surface in the cavity and splash onto the wall underlay. However, the 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.

1.5 Verification Certificates

Verification certificates issued after 30 June 2013 must meet the current Verification Method E2/VM1.

1.6 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.

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.
Appendix 1: Pro forma
Test results shall be expressed in the following tabulated format within the usual Test Report of the particular test laboratory.

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<th>Series 1: Static Water Penetration</th>
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<tr>
<td>Test pressure 455–910 Pa</td>
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<td>Test pressure 455 Pa</td>
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<tr>
<td>Cyclic Water Penetration</td>
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<td>Duration 15 minutes</td>
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Additional water penetration requirements:

Comments:
1.0 Scope

This Acceptable Solution covers the weathertightness of the building envelope. Notes shown under ‘COMMENT’, occurring throughout this document are for guidance purposes only and do not form part of this Acceptable Solution.

1.1 Construction included

The scope of this Acceptable Solution is limited to the materials, products and processes contained herein, for buildings within the scope of NZS 3604, and:

a) Up to 3 storeys with a height measured from lowest ground level adjacent to the building to the highest point of the roof (except for chimneys, aerials and the like) of 10 m or less, and

b) With floor plan area limited only by seismic and structural control joints, and

c) External walls that are vertical, and roofs that are 60º or less above the horizontal.

Where buildings are based on NZS 3604, but require specific engineering design input, the framing shall be of at least equivalent stiffness to the framing provisions of NZS 3604.

COMMENT:
The floor plan limitations of NZS 3604 may be exceeded up to the point that specific design is required to accommodate seismic or wind movement. Beyond that point, specific design is required to demonstrate compliance with Clause E2 of the Building Code.

Claddings also required to perform as bracing must comply with NZS 3604. Where a drained cavity is used, specific testing can be used to demonstrate that a cladding on cavity battens can provide the required bracing resistance.

1.1.1 Attached garages

Attached garages that are integral with the weathertightness envelope of the building are included within the scope of this Acceptable Solution. Refer to Paragraph 9.1.3.4.

1.2 Construction excluded

1.2.1 Outbuildings

Outbuildings, such as stand-alone garages and other structures that are unlined, are outside the scope of this Acceptable Solution.

COMMENT:
Details contained in this Acceptable Solution can be used for outbuildings and unlined structures, but the requirements may be in excess of the minimum required by the Building Code.

This is particularly the case in regard to unlined and uninsulated buildings, where a drained cavity is unlikely to be necessary. However, care must be taken, as some weathertight details depend on the presence of an internal lining to provide pressure equalisation behind the cladding.

1.2.2 Spread of flame

Buildings with drained cavities and spread-of-flame requirements, as specified in NZBC Clauses, are outside the scope of this Acceptable Solution. Cavities in such circumstances must be specifically designed for both weathertightness and spread of flame.

COMMENT:
Options could include the provision of a fire rated wall behind the battens, or breaking the cavity at each floor and providing a cavity flashing and fire stop at each level.

1.2.3 Acoustics

Buildings with drained cavities and acoustic requirements, as specified in NZBC Clause G6, are outside the scope of this Acceptable Solution.

COMMENT:
Cavities in such circumstances must be specifically designed for both weathertightness and acoustic performance.

1.3 Provisions for snow

Specific design for preventing the ingress of snow melt water is required when the open ground snow load $S_{op}$, as defined in NZS 3604, exceeds 1.0 kPa, and the roof is constructed in a way that is likely to cause a build-up of snow.
COMMENT:
Hidden gutters, parapets and skylights are examples of features within a roof design that are likely to cause a build-up of snow.

1.4 Specific design

Buildings, components or junction details not included or shown in this Acceptable Solution require specific design.

1.5 Qualifications

COMMENT:
An understanding of the proper methods of design and installation and the importance of the correct construction sequence is essential if an NZBC compliant building is to be achieved. Adequate training by those designing and applying particular products and claddings is therefore highly recommended.

The design, installation and alteration of claddings will be ‘restricted work’ under the licensed building practitioner scheme, due to take effect in 2012. Until then, the use of licensed designers, builders and installers is optional. It is important that product suppliers, manufacturers and NZ agents (for imported products) ensure those handling and applying their products are adequately trained to do so, and that site managers oversee the correct integration of adjoining building elements to achieve a complete weathering system.

2.0 General

2.1 Weathertightness

Cladding systems shall meet the requirements of NZBC E2.2 to E2.3.7, and the provisions of this Acceptable Solution are acceptable means of achieving this.

COMMENT:
Most manufacturers provide technical literature for their cladding materials and systems that include recommendations for design and installation. Manufacturers’ recommendations may include information additional to that shown in this Acceptable Solution.

However, some additional work, such as extra fixings that penetrate flashings, can lead to details that need to be considered in terms of specific design. Additional or alternative details may be required that need supporting documentation or testing to demonstrate compliance in regard to weathertightness.

2.2 Materials

Materials used to construct the building envelope shall be:

a) In accordance with the durability requirements of NZBC B2,

b) Suitable for their end-use, location and environment as shown in Table 20, and

c) Compatible with adjoining materials as shown in Table 21 and Table 22.

2.3 Systems versus materials

All building products shall be considered as part of a system, even if the components of that system are provided from different sources. Materials used to construct the building envelope shall be designed as a complete cladding system rather than as separate items.

COMMENT:
It is important that the compatibility and durability of the combination of materials is able to be demonstrated for any given application.

2.4 Cladding finish colours

Finish colours for flush-finished fibre cement sheet and EIFS shall have a reflectivity of 40% or more when measured in accordance with ASTM C1549.

COMMENT:
Dark colours cause claddings to reach higher temperatures, which results in more thermal expansion and a greater risk of cracking of joints in monolithic wall claddings. Risks of cracking are also associated with dark colours on painted timber wall claddings and trim. Expansion of metal roofing and flashings are affected by dark colours.

Colour cards from some coating manufacturers may include reflectance values.
2.5 Maintenance – general

Maintenance shall be carried out as necessary to achieve the required durability of materials, components and junctions.

The extent and nature of necessary maintenance is dependent on the:

a) Type of cladding or components used,
b) Position of cladding or components on the building,
c) Geographical location of the building, and
d) Specific site conditions.

COMMENT:
A deterioration in the appearance of the surface of a cladding does not necessarily relate to a deterioration in the weathertightness of the cladding.

2.5.1 Regular maintenance

Regular maintenance of a building will include:

a) Washing exterior surfaces,
b) Inspecting surfaces and junctions, and repairing or replacing items when necessary, in order to preserve the weathertightness of the building.
c) Maintaining clearances between cladding and external ground or paving as per Paragraph 9.1.3.
d) Maintaining minimum 35 mm clearances between roofing and membrane decking, and wall cladding above.
e) Maintaining finish coatings especially for stucco, EIFS and fibre cement claddings.

COMMENT:
Washing by rain removes most accumulated atmospheric contaminants, but sheltered areas, such as walls directly below eaves, are protected from the direct effects of rain and require regular manual washing.

Some heavily textured surfaces will not be as effectively washed by rain as smoother surfaces, so will require more regular manual washing.

However, it is important that high pressure water is not directed at sensitive junctions such as window surrounds and other flashings. Great care must be taken to avoid water being driven past anti-capillary gaps and flashings into the wall cavities.

3.0 Weathertightness Risk Factors

COMMENT:
Analysis of inspection reports from leaking buildings shows that a high incidence of leaks is associated with junctions within, and penetrations through, the building envelope. It also shows serious problems are more commonly associated with claddings that have limited capacity to drain and dry out any water that gets behind them, when a leak occurs.

This Acceptable Solution addresses these problems in two ways:

a) By providing details for common junctions and penetrations of the building envelope, and
b) By classifying buildings within the scope of this document into risk categories, and requiring different cladding solutions depending on the risk score.

Using the risk assessment, risk factors can be identified and changes may be made to a design to lower the risk score.

3.1 Establishing the risk

A risk assessment of the proposed design shall be carried out using a building envelope risk matrix. This allows the risks related to various features to be aggregated, resulting in a risk score for the design.

Figure 1 shows the process that shall be followed in order to assess the risk.

3.1.1 Definitions of risk

Table 1 sets out the definitions of risk levels relating to the location and design features of the building.

3.1.2 The risk score

Table 2 sets out the risk matrix that shall be used to define the risk score for a building within the scope of this Acceptable Solution.

A risk score is calculated for each external face of the building. Claddings are then selected from Table 3 according to the risk scores, or the highest risk score may be used for all walls.
3.3 Wall claddings

The following wall cladding systems are covered in this Acceptable Solution:

a) Masonry veneer Paragraph 9.2
b) Stucco Paragraph 9.3
c) Timber weatherboards Paragraph 9.4
d) Fibre cement weatherboards Paragraph 9.5
e) Profiled metal wall claddings Paragraph 9.6
f) Fibre cement sheet Paragraph 9.7
g) Plywood sheet Paragraph 9.8
h) EIFS Paragraph 9.9.

Other wall claddings are outside the scope of this Acceptable Solution.

Assess the drawings for each external face to determine the risk score for each risk factor. These are:

- Wind zone
- Number of storeys
- Roof/wall intersection design
- Eaves width
- Envelope complexity
- Deck design

Refer Table 1.

Complete the “Building envelope risk matrix” (Table 2) for each face of the building.

It is possible for different elevations to have different risk scores.

Consult Table 3: Suitable wall claddings to determine what cladding types are recommended with the risk score for each face.

The cladding selected must be appropriate for the score on that face, but can be beyond the minimum required (i.e. cladding suitable for a higher score can be used).
<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Score(5)</th>
<th>Risk severity</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A: Wind zone</strong></td>
<td></td>
<td></td>
<td><strong>Low risk</strong> Low wind zone as described by NZS 3604</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Low</td>
<td>Low wind zone as described by NZS 3604</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>High</td>
<td>High wind zone as described by NZS 3604</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Very high</td>
<td>Very High wind zone as described by NZS 3604</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Extra high</td>
<td>Extra High wind zone as described in NZS 3604 (4)</td>
</tr>
<tr>
<td><strong>B: Number of storeys</strong></td>
<td></td>
<td></td>
<td><strong>Low risk</strong> One storey</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Low</td>
<td>One storey</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Medium</td>
<td>Two storeys in part</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>High</td>
<td>Two storeys</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Very high</td>
<td>More than two storeys</td>
</tr>
<tr>
<td><strong>C: Roof/wall junctions</strong></td>
<td></td>
<td></td>
<td><strong>Low risk</strong> Roof to wall intersection fully protected (e.g. hip and gable roof with eaves)</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Low</td>
<td>Roof to wall intersection fully protected (e.g. hip and gable roof with eaves)</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Medium</td>
<td>Roof to wall intersection partly exposed (e.g. hip and gable roof with no eaves)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>High</td>
<td>Roof to wall intersection fully exposed (e.g. parapets, enclosed balustrades or eaves at greater than 90° to vertical with soffit lining)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Very high</td>
<td>Roof elements finishing within the boundaries formed by the exterior walls (e.g. lower ends of aprons, chimneys, dormers etc)</td>
</tr>
<tr>
<td><strong>D: Eaves width</strong></td>
<td></td>
<td></td>
<td><strong>Low risk</strong> Greater than 600 mm for single storey</td>
</tr>
<tr>
<td>(1)(2)</td>
<td>0</td>
<td>Low</td>
<td>Greater than 600 mm for single storey</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Medium</td>
<td>451–600 mm for single storey, or over 600 mm for two storey</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>High</td>
<td>101–450 mm for single storey, or 451–600 mm for two storey, or greater than 600 mm above two storey</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Very high</td>
<td>0–100 mm for single storey, or 0–450 mm for two storey, or less than 600 mm above two storey</td>
</tr>
<tr>
<td><strong>E: Envelope complexity</strong></td>
<td></td>
<td></td>
<td><strong>Low risk</strong> Simple rectangular, L, T or boomerang shape, with single cladding type</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>Low</td>
<td>Simple rectangular, L, T or boomerang shape, with single cladding type</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Medium</td>
<td>Moderately complex, angular or curved shapes (e.g. Y or arrowhead) with no more than two cladding types</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>High</td>
<td>Complex, angular or curved shapes (e.g. Y or arrowhead) with multiple cladding types</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Very high</td>
<td>As for High risk, but with junctions not covered in C or F of this table (e.g. box windows, pergolas, multi-storey re-entrant shapes etc)</td>
</tr>
<tr>
<td><strong>F: Decks</strong></td>
<td></td>
<td></td>
<td><strong>Low risk</strong> None, timber slat deck or porch at ground floor level</td>
</tr>
<tr>
<td>(3)</td>
<td>0</td>
<td>Low</td>
<td>None, timber slat deck or porch at ground floor level</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Medium</td>
<td>Fully covered in plan by roof, or timber slat deck attached at first or second floor level</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>High</td>
<td>Enclosed deck exposed in plan or cantilevered at first floor level</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Very high</td>
<td>Enclosed deck exposed in plan or cantilevered at second floor level or above</td>
</tr>
</tbody>
</table>

**NOTES:**

(1) *Eaves width* measured horizontally from external face of wall cladding to outer edge of overhang, including fascias and external gutters/spoutings.

(2) Balustrades and *parapets* count as 0 mm *eaves*.

(3) The term *deck* includes balconies, as described in the Definitions.

(4) *Buildings* in Extra High *wind zones* require rigid *underlays* and drained *cavities*, refer to Table 3.

(5) Refer also to Table 2.
Table 2: Building envelope risk scores
Paragraph 3.1.2, Figure 1

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
<th>VERY HIGH (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind zone (per NZS 3604)(1)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number of storeys</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Roof/wall intersection design</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Eaves width</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Envelope complexity</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Deck design</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
</tbody>
</table>

(Enter the appropriate risk severity score for each risk factor in the score columns. Transfer these figures across to the right-hand column. Finally, add up the figures in the right-hand column to get the total risk score.)

Total risk score for use in Table 3:

NOTE: (1) For buildings in Extra High wind zones, refer to Tables 1 and 3 for rigid underlay and drained cavity requirements.
Table 3: Suitable wall claddings

<table>
<thead>
<tr>
<th>Risk Score from Table 2</th>
<th>Suitable wall claddings(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct fixed to framing</td>
<td>Over nominal 20 mm drained cavity</td>
</tr>
<tr>
<td>0 – 6</td>
<td>Claddings on parapets, enclosed balustrades, and in Extra High wind zones shall be installed over drained cavities.(5)(6)</td>
</tr>
<tr>
<td>a) Timber weatherboards – all types</td>
<td>a) Masonry veneer (2)</td>
</tr>
<tr>
<td>b) Fibre cement weatherboards</td>
<td>b) Stucco</td>
</tr>
<tr>
<td>c) Vertical profiled metal – corrugated and symmetrical trapezoidal (3)</td>
<td>c) Horizontal profiled metal (3) – corrugated and trapezoidal only</td>
</tr>
<tr>
<td>d) Fibre cement sheet (4) (Jointed finish)</td>
<td>d) Fibre cement – flush-finished</td>
</tr>
<tr>
<td>e) Plywood sheet</td>
<td>e) EIFS</td>
</tr>
<tr>
<td>7 – 12</td>
<td>Masonry veneer (2)</td>
</tr>
<tr>
<td>a) Bevel-back timber weatherboards</td>
<td>a) Masonry veneer (2)</td>
</tr>
<tr>
<td>b) Vertical timber board and batten</td>
<td>b) Stucco</td>
</tr>
<tr>
<td>c) Vertical profiled metal – corrugated only(3)(6)</td>
<td>c) Horizontal profiled metal – corrugated and trapezoidal only</td>
</tr>
<tr>
<td>13 – 20</td>
<td>d) Rusticated weatherboards</td>
</tr>
<tr>
<td>a) Vertical profiled metal – corrugated only(3)(6)</td>
<td>e) Fibre cement weatherboards</td>
</tr>
<tr>
<td>20</td>
<td>f) Fibre cement sheet – flush and jointed finish</td>
</tr>
<tr>
<td>a) Redesign the building to achieve a lower score, or</td>
<td>g) Plywood sheet</td>
</tr>
<tr>
<td>b) Specific design</td>
<td>h) EIFS</td>
</tr>
<tr>
<td>– The design may need changing to reduce the risk</td>
<td>i) Bevel-back weatherboards</td>
</tr>
<tr>
<td>– The building consent authority may require more comprehensive details and documentation providing evidence of weathertightness</td>
<td></td>
</tr>
<tr>
<td>– The building consent authority, designer or owner may require more inspections</td>
<td></td>
</tr>
<tr>
<td>– A third party audit of the design may be required</td>
<td></td>
</tr>
</tbody>
</table>

NOTES: (1) The wall claddings in this table are limited to those covered in this Acceptable Solution.
(2) Traditional masonry veneer as per SNZ HB 4236, with minimum 40 mm cavity.
(3) Refer Figure 38 for profiles.
(4) Except stucco over a fibre cement backing.
(5) Claddings in Extra High wind zones require rigid underlays – refer to Paragraph 9.1.7.2
(6) Direct fix vertical corrugated steel is included as cavity construction.
3.4 Examples using the risk matrix

Paragraphs 3.4.1 to 3.4.3 provide examples that show a range of building styles. The completion of the risk matrix for each design is shown, together with the choice of wall claddings the risk scores indicate.

COMMENT:
The examples have been selected to show a range of design complexities, features and materials. Refer also to Guide to the Risk Matrix.

3.4.1 Example 1

The first example illustrates the use of the risk matrix for a simple traditionally-styled building.

Figure 2: Risk matrix example 1

The house in this example is a simple single storey L shape and is considered low risk in terms of envelope complexity.

The eaves are 500 mm wide, and the site is in a High wind zone.

The covered porch is at ground level and so is considered low risk.

For this example, the calculations have been done for the south elevation, and this face scores as very low risk. A similar risk score would result for all elevations of this building.

3.4.1.1 Cladding options

As all faces score low, cladding options from Table 3 are:

a) Direct fixed claddings:
   i) Timber weatherboards – all types shown
   ii) Fibre cement weatherboards
   iii) Vertical profiled metal – corrugated and symmetrical trapezoidal only
   iv) Fibre cement sheet – not flush-finished
   v) Plywood sheet

b) Wall cladding with a nominal 20 mm drained cavity (note: claddings in Extra High wind zones require rigid underlays):
   i) Masonry veneer
   ii) Stucco
   iii) Horizontal profiled metal – corrugated and trapezoidal only
   iv) Fibre cement – flush-finished
   v) EIFS.

Table 4: Risk matrix example 1 – south face

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
<th>VERY HIGH</th>
<th>Subtotals for each risk factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind zone (per NZS 3604)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Number of storeys</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Roof/wall intersection design</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Eaves width</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Envelope complexity</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Deck design</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Total risk score: 2
3.4.2 Example 2

The second example illustrates the use of the risk matrix for a moderately complex building.

**COMMENT:**

Overall the house in this example is still a relatively simple design with a single cladding type. It would be considered to be medium risk in terms of envelope complexity.

The lean-to style room on the ground floor is quite simple but does introduce a roof-to-wall intersection which requires the correct flashing and particular care with the kick-out at the west end of the junction. This would make this factor very high risk.

The timber deck, itself low risk, connects to the house at the first floor level, and so is considered to be medium risk. Any leaks at the connection points have an opportunity to enter the wall below.

The eaves are less than 450 mm wide, and the site is in a High wind zone.

The calculations have been done for the south elevation. The other elevations of this building score lower because they are simpler.

The west elevation still has the deck connection and scores 7. Cladding options would be the same as for the south face.

The east elevation scores 6 and the north elevation scores 5, so these have more cladding options.

**Table 5: Risk matrix example 2 – south elevation**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
<th>VERY HIGH</th>
<th>Subtotals for each risk factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind zone (per NZS 3604)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Number of storeys</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Roof/wall intersection design</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Eaves width</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Envelope complexity</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Deck design</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total risk score:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>12</strong></td>
</tr>
</tbody>
</table>

3.4.2.1 Cladding options – south and west elevations

Cladding options from Table 3, are:

a) Direct fixed claddings:
   i) Bevel-back weatherboards
   ii) Vertical board and batten weatherboards
   iii) Vertical corrugated metal, and

b) Wall cladding with a nominal 20 mm drained cavity:
   i) Masonry veneer (with 40 mm cavity)
   ii) Stucco
   iii) Horizontal profiled metal – corrugated and trapezoidal only
   iv) Rusticated weatherboards
   v) Fibre cement weatherboards
   vi) Fibre cement sheet
   vii) Plywood sheet
   viii) EIFS.
3.4.2.2 Cladding options – north and east elevations

Cladding options from Table 3, for east and north faces, are:

a) Direct fixed claddings:
   i) Timber weatherboards – all types
   ii) Fibre cement weatherboards
   iii) Vertical profiled metal – corrugated and symmetrical trapezoidal only

b) Wall cladding with a nominal 20 mm drained cavity:
   i) Masonry veneer (with 40 mm cavity)
   ii) Stucco
   iii) Horizontal profiled metal – corrugated and trapezoidal only.

3.4.3 Example 3

The third example illustrates the use of the risk matrix for a complex building.

COMMENT:

The combination of features present on the south elevation results in a very high risk score. The presence of a parapet at the roof, decks, enclosed balustrade-to-wall junctions and pergola connections all contribute to this risk. The site is in a High wind zone.

The risk score is sufficiently high that the south elevation would require specific design, or redesign to lower the risk.

Specific design may result in the building consent authority possibly:

a) Needing more details to be provided,
b) Requiring more inspections during construction,
c) Requiring a third party audit of the design.

The east and west elevations also score very highly at 18-20, and would require a cladding with a cavity such as vertical profiled steel, masonry veneer or any other cladding with a nominal 20 mm drained cavity.

The north elevation scores 14, so would require the use of the same cladding option as the east and west elevations.

---

### Table 6: Risk matrix example 3 – south elevation

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>LOW</th>
<th>MEDIUM</th>
<th>HIGH</th>
<th>VERY HIGH</th>
<th>Subtotals for each risk factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wind zone (per NZS 3604)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of storeys</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Roof/wall intersection design</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Eaves width</td>
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<td>1</td>
<td>2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Envelope complexity</td>
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<td>1</td>
<td>3</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Deck design</td>
<td>0</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

**Total risk score:** 22
3.4.3.1 Cladding options – south elevation
As the south face scores over 20, it will require:

a) Specific design, or
b) Redesigning the proposal to reduce the risk, so reducing the risk score.

3.4.3.2 Cladding options – other elevations
As the other faces score from 14 to 20, cladding options from Table 3 are:

a) Direct fixed claddings:
   i) Vertical corrugated metal, and
b) Wall cladding with a nominal 20 mm drained cavity:
   i) Masonry veneer (with 40 mm cavity)
   ii) Stucco
   iii) Horizontal profiled metal – corrugated and trapezoidal only
   iv) Rusticated weatherboards
   v) Fibre cement weatherboards
   vi) Fibre cement sheet
   vii) Plywood sheet
   viii) EIFS
   ix) Bevel-back weatherboards.

4.0 Flashings

4.1 Materials for flashings
Acceptable materials for flashing junctions and penetrations are described in Paragraph 4.3.

4.2 Selection of flashing materials
Flashing materials shall take into account the following factors:

a) The requirements of NZBC Clause B2 Durability,
b) The environment where the building is located,
c) The specific conditions of use, and
d) Consideration of the surrounding materials.

COMMENT:
Generally, the durability requirements for flashings specified in B2 are:

a) 50 years, where flashings are:
   i) completely hidden behind claddings such as masonry veneer, or
   ii) not accessible,
b) 15 years, where flashings are:
   i) exposed, partially exposed, or
   ii) accessible.

Two part flashings allow replacement of the flashing without cladding alteration.

An example of a two part flashing is shown in Figure 7.

4.2.1 Environment
Flashing materials shall be selected according to the relevant exposure conditions as defined in Table 20 to minimise corrosion.

COMMENT:
The exposure zone in which a building is located can affect the durability of flashings.

Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3604, require specific design.

Exposure zones are based on AS/NZS 2728. AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.
4.2.2 Surrounding materials
Metals which are in contact in locations where they will become wet, or where water can flow over metals or certain plastics onto another metal, shall be selected in accordance with Table 21 and Table 22.

Uncoated metals shall not be used where carbon deposits or chemical contaminants may accumulate.

COMMENT:
Undesirable effects can occur when some materials are in contact with each other. Examples are corrosion of metals, stress cracking of plastics and staining of glass. Carbon deposits such as soot will cause accelerated corrosion of damp uncoated metal.

4.3 Acceptable flashing materials
Tables 20, 21 and 22 shall be used to assess suitability of flashing materials for the required durability.

COMMENT:
Additional guidance on flashing materials can be found in the New Zealand Metal Roof and Wall Cladding Code of Practice.

4.3.1 uPVC flashings
uPVC flashings shall be a minimum of 0.75 mm thick.

uPVC flashings shall comply with the requirements of the following Clauses of AS/NZS 4256: Part 2:

a) Clause 9.2 Impact resistance,
b) Clause 9.3 Tensile strength, and
c) Clause 9.4 Colourfastness and impact resistance following ultraviolet light exposure.

Where uPVC flashings are exposed to the weather, they shall also comply with Section 8 of AS/NZS 4256: Part 2.

uPVC flashings shall have a finish colour with a reflectance of 40% or more, as outlined in Paragraph 2.4.

COMMENT:
Manufacturers of uPVC flashings which have a proven performance in use may be able to show compliance with NZBC Clause B2 Durability as detailed in B2/VM1.

4.3.2 Aluminium flashings
Aluminium flashings shall be a minimum thickness of 0.7 mm, and formed from 5000 series in accordance with AS/NZS 1734.

4.3.3 Galvanized steel flashings
Galvanized steel flashings shall:

a) have a BMT of 0.55 mm minimum
b) be grade G550, or G300 for rolled or crimped flashings
c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

4.3.4 Aluminium-zinc-magnesium (combinations) coated steel flashings to AS 1397
Aluminium-zinc-magnesium coated steel shall:

a) have a BMT of 0.55 mm minimum
b) be grade G550, or G300 for curved or crimped flashings
c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

4.3.5 Stainless steel flashings
Stainless steel flashings shall be:

a) Minimum thickness of 0.45 mm, and
b) 304 or 316 stainless steel in accordance with Table 1 of ISO/TS 15510.
4.3.6 Copper flashings
Copper flashings shall be:
   a) A minimum thickness of 0.5 mm,
   b) In compliance with AS 1566, and
   c) Alloy, designation C11000 or C12200.

4.3.7 Lead sheet flashings
Lead sheet flashings shall:
   a) Comply with AS 1804, and
   b) Have a minimum unit mass of 17 kg/m².

4.3.8 Zinc sheet flashings
Zinc sheet flashings shall only be used in accordance with Tables 20, 21 and 22.
Zinc sheet flashings shall be:
   a) A minimum thickness of 0.7 mm, and
   b) In compliance with BS EN 988.

4.3.9 Butyl rubber and EPDM flashings
Butyl rubber flashings shall only be used in accordance with Tables 20, 21 and 22.
Butyl rubber and EPDM flashings shall be a minimum thickness of 1.0 mm, and shall comply with the following parts of Table 1 in ASTM D6134:
   a) Tensile strength,
   b) Elongation,
   c) Water absorption,
   d) Water vapour permeance, and
   e) Heat aging followed by:
      i) tensile strength
      ii) elongation.

4.3.10 Bituminous flashings
Bituminous flashings shall only be used in accordance with Table 20.
Flashings made from bitumen-impregnated material shall:
   a) Comply with AS/NZS 2904, and
   b) Be used only in fully concealed applications.

4.3.11 Flexible flashing tape
Flexible flashing tape shall comply with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148, shall be compatible with adjacent building wall underlay or roof underlay, and be used only in fully concealed applications.

4.4 Fixings
Fixings of metal flashings shall comply with Tables 20, 21 and 22.
Exposed flashings such as barge and ridge flashings are to be fixed along both edges.

COMMENT:
Fixings that penetrate flashings should be avoided where possible.

4.5 Flashing requirements
All flashings shall have expansion joints where required in Paragraph 4.5.2 to provide for thermal expansion.
Flashings are required to shed or divert water at sensitive areas of the building cladding.
These include at:
   a) The building periphery, except where gutters are present,
   b) Changes of direction in cladding materials,
   c) Intersections between cladding materials or with other buildings, and
   d) Roof or wall penetrations, including windows, doors and other penetrations.

4.5.1 Edge treatments for flashings
Flashings shall be to the dimensions shown throughout this Acceptable Solution.
Exposed bottom edges of flashings shall be folded to a kick-out or a bird’s beak as shown in Figure 5.
For Low, Medium, High and Very High wind zones, flashing upstands shall have either:
1) A hem or hook to Figure 5, with upstand dimensions as shown throughout the document, or
2) No hooks or hems, and flashing upstand dimensions increased by 25 mm beyond those shown.
For Extra High wind zones, hooks and hems shall be used, and flashing upstand dimensions increased by 25 mm beyond those shown in Table 7 or elsewhere in the document.

COMMENT:
Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for further edge treatments.
4.5.2 Metal flashing joints

Where metal flashings require to be joined, the method shall be as shown in Figure 6. Joins of metal flashings shall have the following features:

a) Rivets used for joining and sealing laps shall be spaced at a maximum of 50 mm centres, and be:
   i) compatible with the flashing material as per Table 21 and Table 22, and
   ii) sealed against moisture, or
   iii) of a sealing type or blind rivet,

b) Expansion joints shall be provided for joined flashings with a combined length exceeding:
   i) 12 metres for light coloured steel and stainless steel. 8 metres for dark coloured steel,
   ii) 8 metres for copper,
   iii) 8 metres for aluminium.

c) Where both ends of a flashing are constrained, allowance shall be made for expansion,

d) Where necessary, expansion joints shall be formed as shown in Figure 6, with:
   i) minimum 200 mm laps, and
   ii) sliding clips at both sides of the lap,

e) When using uncoated galvanized steel, zinc, stainless steel or copper flashings, joints shall be riveted or soldered as described in the New Zealand Metal Roof and Wall Cladding Code of Practice,

f) When using uncoated or coated lead flashings, maximum continuous lengths shall be 1300 mm for 17 kg or 1500 mm for 20 kg lead. Where the pitch of the flashing is greater than 15° at the join, the lap at the join shall be 100 mm minimum.
Where the pitch of the flashing is 15° or less at the join, the lap at the join shall be 200 mm minimum and the flashing underneath the lap shall have a hook at the edge.

g) Lap joins on other metal flashings shall be sealed using a neutral cure silicone sealant in conjunction with mechanical fasteners. The sealant shall comply with:

i) Type F, Class 20LM or 25LM of ISO 11600, or

ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

COMMENT:
Further information may be found in the New Zealand Metal Roof and Wall Cladding Code of Practice for joints in metal flashings.

4.6 Flashing overlaps and upstands

Overlaps and upstands to flashings shall be as specified in this paragraph and Table 7, unless specifically shown otherwise. Refer to Paragraph 8.1 to Paragraph 9.9 for requirements for specific claddings.

Flashing edges, with hooks, hems, kick-outs and bird's beaks shall be as required in Table 7 and Paragraph 4.5.1.

Where a turn-down to the cover flashing for profiled metal claddings is required, use:

a) A soft edge flashing for corrugated profiles, or

b) A notched turn-down or soft edge flashing for trapezoidal profiles with rib height not exceeding 30 mm and/or rib centres not exceeding 200 mm, or

c) A notched turn-down for trapezoidal profiles with rib height exceeding 30 mm and/or rib centres exceeding 200 mm, or

d) A notched turn-down for trough profiles.

Where a notched turn-down is used there shall be a gap between the edge of the flashing and the pan of the roof cladding. The gap shall be a maximum of 5 mm.

4.6.1 Overlap with roof claddings

4.6.1.1 Apron flashing cover over metal roofing

a) Transverse flashing:
Refer to Figure 7 for example of use. The apron shall have:

i) for notched turn-downs, a gap between the flashing and the pan of the roof cladding. The gap shall be a maximum of 5 mm, and

ii) a minimum effective cover to roof cladding, excluding any soft edge or turn-down to the flashing, as shown in Table 7.

b) Parallel flashing:
Refer to Figure 48 for example of use. The apron shall:

i) be dimensioned to suit the roof cladding profile,

ii) for profiled metal roof cladding, cover at least two crests, (turned-up edge to full crest height constitutes a crest), and

iii) for profiled metal roof cladding, overhang flashing a minimum 10 mm clear of crest and maximum 5 mm clear of trough as shown in Figure 47.

4.6.1.2 Ridges and hips

Refer to Figure 46 for example of use.

a) For notched turn-downs of the flashing leave a gap between the flashing and the roof cladding. The gap shall be a maximum of 5 mm.

b) There shall be a minimum effective cover to roof cladding, excluding any soft edge or turn-down to the flashing, in accordance with Table 7.

4.6.1.3 Change in metal roof pitches

Refer to Figure 44 for example of use.

a) There shall be a minimum effective lap under roof cladding in accordance with Table 7, with a hem at upper edge.

b) The apron cover over the roof cladding shall be in accordance with Table 7.
4.6.1.4 Roof- or deck-to-wall junctions

Refer to Figure 7 for example of use.

a) There shall be a total minimum upstand height of 110 mm, in accordance with Table 7, comprising a minimum:
   i) overlap cover of cladding to the flashing upstand of 75 mm, and
   ii) 35 mm clearance from bottom of the wall cladding to roof cladding or finished deck material.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>All (1)</th>
<th>Situation 1 (2) minimum mm</th>
<th>Situation 2 (3) minimum mm</th>
<th>Situation 3 (3a) minimum mm</th>
<th>Figure reference (as example)</th>
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<tbody>
<tr>
<td>Aprons: general</td>
<td>Transverse flashing over roofing</td>
<td></td>
<td>130 (4)</td>
<td>200 (4)</td>
<td>200 mm</td>
<td>Figure 7 and Figure 44 (X values)</td>
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<td></td>
<td>Parallel flashing over roofing</td>
<td></td>
<td></td>
<td>Two crests, finish in next trough – refer 4.6.1.1b</td>
<td></td>
<td>Figures 47, 48 (Y values)</td>
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<td>Ridges/ hips</td>
<td>Transverse flashing over roofing</td>
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<td></td>
<td></td>
<td>Refer Aprons: general</td>
<td>Figures 43, 45b, 46</td>
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<tr>
<td>Changes in roof pitches</td>
<td>Upper lap under roofing</td>
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<td>250 mm min.</td>
<td>Not permitted</td>
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<td>Figure 44</td>
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<tr>
<td></td>
<td>Transverse flashing over roofing</td>
<td></td>
<td></td>
<td></td>
<td>Refer Aprons: general</td>
<td></td>
</tr>
<tr>
<td>Barges</td>
<td>Overlap to barge board</td>
<td></td>
<td>50 (8)</td>
<td>70 (8)</td>
<td>90 mm</td>
<td>Figure 47 (Z values)</td>
</tr>
<tr>
<td>Cappings</td>
<td>Overlaps to cladding</td>
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<td>50 (8)</td>
<td>70 (8)</td>
<td>90 mm</td>
<td>Figure 10 (Z values)</td>
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<td>Slope to top: parapet and balustrade – metal capping</td>
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<td>5° min.</td>
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<td>Figures 10, 11, 12, 130</td>
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<td>Slope to balustrade – flush-finished EIFS and fibre cement(5)</td>
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<td>10° min.</td>
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<td>Figures 117, 129, 130</td>
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<tr>
<td>Roof or Deck to Wall – See membranes below</td>
<td>Overlaps to roofing</td>
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<td></td>
<td>Refer Aprons: general</td>
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<tr>
<td></td>
<td>Lap under cladding above</td>
<td></td>
<td>75 mm min.</td>
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<td>Figures 7, 26, 30, 35, 37, 44, 48, 50</td>
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<td>Clearance below cladding</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>Total upstand</td>
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<td></td>
<td></td>
<td></td>
<td>110 mm min.</td>
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### Membrane roofs and decks

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<th>Type</th>
<th>Description</th>
<th>Situation 1 (2) minimum mm</th>
<th>Situation 2 (3) minimum mm</th>
<th>Situation 3 (3a) minimum mm</th>
<th>Figure reference (as example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows</td>
<td>Window flange clearance for direct fixed claddings and ply or fibre cement on cavities</td>
<td>5 mm</td>
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<td>Eg. Figure 81</td>
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<tr>
<td></td>
<td>Cover to window/door jamb flange</td>
<td>10 mm (7) min.</td>
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<td></td>
<td>Eg. Figure 81c</td>
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<td></td>
<td>Cover to window/door sill flange</td>
<td>8 mm (7) min.</td>
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<td></td>
<td>Eg. Figure 81c</td>
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<tr>
<td>Sills</td>
<td>Sill flashing slope (6)</td>
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<td></td>
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<td>Flat (6)</td>
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<tr>
<td>Heads</td>
<td>Head flashing slope</td>
<td>15° min.</td>
<td></td>
<td></td>
<td>Eg. Figure 81a</td>
</tr>
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<td></td>
<td>Lap under cladding above</td>
<td>35 mm min.</td>
<td>60 mm</td>
<td></td>
<td>Eg. Figure 81a</td>
</tr>
<tr>
<td></td>
<td>Anti-capillary gap to cladding</td>
<td>5 mm</td>
<td></td>
<td></td>
<td>Eg. Figure 81a</td>
</tr>
<tr>
<td></td>
<td><strong>Total upstand</strong></td>
<td><strong>40 mm min.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corners</td>
<td>Corner flashings (1)</td>
<td>50 mm x 50 mm minimum</td>
<td>75 x 75 mm</td>
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<td>Eg. Figure 79</td>
</tr>
<tr>
<td>Inter-storey junctions</td>
<td>Junction flashing: slope</td>
<td>15° min.</td>
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<tr>
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<td>Lap over cladding below (1)</td>
<td>35 mm min.</td>
<td>60 mm</td>
<td></td>
<td>Figure 70</td>
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<td>Lap under cladding above</td>
<td>35 mm min.</td>
<td>60 mm</td>
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<tr>
<td></td>
<td>Clearance under cladding</td>
<td>5 mm min.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total upstand</strong></td>
<td><strong>40 mm min.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NOTES:

1. Unless otherwise dimensioned in details.
2. **Situation 1:** Low, Medium, High wind zones, where roof pitch \( \geq 10^\circ \) (X or Z values)
3. **Situation 2:** All roof pitches in Very High wind zones, Low, Medium and High wind zones where roof pitch \( \leq 10^\circ \). (X or Z values)
4. (3a)**Situation 3:** For all roof pitches in Extra High wind zone.
5. (4) Excluding any soft edge or turn-down to roofing.
6. (5) For buildings other than housing, slope shall be as per F4/AS1.
7. (6) For direct fixed window/doors, unless shown. Sill flashing must extend past the condensation channel. Ensure sill flashings are not installed with backwards slope.
8. (7) Excluding drip edge.
9. (8) Excluding drip edge.
4.6.1.5 Barges
Refer to Figure 47 for example of use.

a) There shall be a minimum effective overlap to the barge board, excluding the drip edge to the flashing, in accordance with Table 7.
b) The apron cover over the roof cladding shall be as for Paragraph 4.6.1.1.

4.6.1.6 Window and door heads
Refer to Figures 71 and 81 for example of use.

a) Slopes and covers of flashings at window and door heads shall comply with Table 7.
b) Overlap cover of cladding to the flashing upstand and clearance from the bottom of the cladding to top of head flashing slope shall be in accordance with Table 7.
c) Details for door heads shall be based on those applying to windows.

4.6.1.7 Inter-storey junctions
Refer to Paragraph 9.1.9.4 and Figure 70.

a) Minimum slopes and covers of flashings shall be in accordance with Table 7.
b) Overlap cover of the cladding to the flashing upstand, and clearance from the bottom of the cladding to top of the slope of the head flashing, shall be in accordance with Table 7.

5.0 Roof/Wall Junctions

5.1 Apron flashings
Refer Paragraph 4.3 for acceptable apron flashing materials.

All roof-to-wall junctions shall be made weathertight by using an apron flashing as outlined in Paragraph 4.6.1.1, and shown in Figure 7, that:

a) Provides a minimum lap under the wall cladding of 75 mm in accordance with Table 7, except that:
   i) pressed metal tiles shall have a flashing fitted to achieve the minimum required overlap of wall cladding, as shown in Figure 35,
b) For profiled metal, incorporates *stopends* at the upper end of the *roof cladding* as per Paragraph 8.4.13,

c) Provides a minimum clearance from the *wall cladding* to the roofing in accordance with Table 7, and

d) Extends over the roofing by a minimum cover in accordance with Paragraph 4.6.1.1 and Table 7, depending on the:

i) wind zone and,

ii) pitch of the roof.

**COMMENT:**

40 mm is the maximum upturn achievable with pressed metal tiles, meaning that a *flashing* is required.

Details for specific *wall cladding systems* are given in Paragraph 9.0.

Where the roof finishes within the length of an adjacent wall, a *kick-out* or *stopend* as detailed in Figure 8B shall be provided to direct water out from the *wall cladding* onto the *roof cladding* and gutter.
5.2 Gutters, barges and fascias

Where eaves gutters/spoutings, barges or fascias terminate against claddings, these shall be installed after the wall cladding, and after any protective finishes have been applied.

Eaves gutters/spouting, barges and fascias shall terminate so as to leave a gap of 10 mm from the finished wall cladding as shown in Figure 8B.

COMMENT:
It is important to ensure the wall cladding behind eaves gutters/spoutings, barges and fascias is protected by the surface coating to prevent moisture penetration through the unsealed cladding.

5.3 Soffits

Eaves shall be enclosed by installing soffit linings direct fixed to framing and comprising minimum 4.5 mm fibre cement sheet, or 7 mm H3 plywood, with joints, fixings and finishes as shown in Paragraphs 9.7 and 9.8. Soffit linings shall be finished to fascias, barges and wall claddings as outlined in Figure 8A generally, or Figure 114 for flush finished fibre cement. Wall underlays shall not be required behind soffit linings.
6.0 Parapets

Parapets require a \textit{drained cavity for claddings} except for vertical corrugated steel as outlined in Table 3. Refer also to Paragraph 7.4 Enclosed balustrades.

\textbf{COMMENT:}
Vertical corrugated profiled metal is considered to have drainage capabilities the equivalent of \textit{drained cavities}.

6.1 Limitations

This Acceptable Solution does not cover \textit{parapet cappings} that use \textit{stucco, EIFS and flush-finished} fibre cement materials.

6.2 General

Parapets shall be \textit{constructed} as shown in Figure 10, and shall comply with the following requirements:

a) Timber for \textit{framing} and \textit{cavity battens} shall comply with B2/AS1,

b) Sloped packers under \textit{cappings} shall be polystyrene or timber treated to B2/AS1, or minimum 9 mm H3 plywood on packers, and

c) \textit{Framing} shall be fully enclosed with \textit{wall underlay} or \textit{roof underlay}, in accordance with Table 23 for the specific \textit{cladding}.

d) \textit{Claddings} shall be installed over a cavity in accordance with Paragraph 9.1.8.

Details for specific \textit{wall cladding systems} are given in Paragraph 9.0.

Specific requirements for \textit{enclosed balustrades} are given in Paragraph 7.4.

6.3 Capping materials

Parapets shall be capped with metal, butyl or \textit{EPDM membrane}. \textit{Cappings} shall comply with the requirements of Paragraph 4.0.
Figure 9: General capping joints for parapets and enclosed balustrades
Paragraphs 6.3, 6.4, 7.4.4, 9.8.7, 9.9 and 10.2

NOTE: Capping joints and fixings - refer Paragraph 4.5.2 and Figure 9

5° min. slope (1:12)

Z - refer Table 7

Kick-out or bird’s beak drip edge both sides - refer text

(a) PARAPET FLASHING

50 mm min. overlap both sides

Sealant or compressible strip

Cap flashing to be face screwed to structure

Line of soaker flashing below

5° min. slope

(b) PARAPET FLASHING SOAKER JOINT

3-5 mm

Minimum sealant bead before compression

Screw fixing or rivet to vertical face

Soaker flashing over parapet/ balustrade framing

(c) SECTION A - A THROUGH SOAKER FLASHING

Sealant under overlap member

Blind rivets through sealant to join flashing

Fall for raked flashings only

5° min. slope (1:12)

Under-capping C

Fall for raked flashings only

Face screw to structure

100 mm min. overlap of cap flashing

(d) PARAPET FLASHING OVERLAP JOINT

(e) CAPPING FLASHING AT EXTERNAL CORNER OF PARAPET

Cap flashing to be face screwed to structure, holes oversized to allow for expansion

Line of soaker flashing below

5° min. slope

(f) PREFORMED CORNER SOAKER

200 mm min.

Flashing A

Screw fixing

Flashing B

Flashing B positioned between flashing A and under-capping C. Cut-out around screw fixing in A

(g) PARAPET FLASHING EXPANSION JOINT

Amend 2
Jul 2005

Amend 5
Aug 2011
6.4 Metal cappings

Metal cappings installed over parapets and enclosed balustrades, shall be as outlined in Paragraphs 6.0 and 7.4, and comply with the following requirements:

a) Tops of cappings shall be free of any penetrations,

b) Slope of top shall be 5° (1:12) minimum,

c) The cover at the sides of the capping shall be in accordance with Table 7,

d) All cappings shall have drip edges. The details shown in Figure 5 are acceptable minimum drip edges for parapets,

e) Cappings shall be separated from underlying timber by roof underlay as shown in Figure 10,

f) Lengths of capping shall be joined as shown in Figure 9 (b) or Figure 9 (d),

g) External corners of cappings shall be as shown in Figure 9 (e),

h) Expansion joints shall be provided for joined cappings with a combined length exceeding:
i) 12 metres for light coloured steel and stainless steel, 8 metres for dark coloured steel
ii) 8 metres for copper
iii) 8 metres for aluminium.

Where both ends of a capping are constrained, allowance shall be made for expansion, and

Where necessary, expansion joints shall be formed as shown in Figure 9 (g), and with:

i) minimum 200 mm laps
ii) sliding clips at both sides of the lap.

Any textured coating application, except for the finished coat, over flush-finished cladding shall be completed prior to the installation of metal cappings.

6.4.1 Parapet-to-wall junctions

Junctions of parapets to walls shall be flashed to direct water clear of the outside face of the cladding system, using a saddle flashing as shown in Figure 11 and Figure 12.

Parapets that are continuous and in-plane with adjacent wall surfaces are outside the scope of this Acceptable Solution. An offset in wall line between parapet and adjacent wall is required as in Figures 11 and 12.

COMMENT:

Reports on leaky buildings show these junctions have been prone to leakage and care must be taken to detail and build them correctly.

In-plane junctions require specific design of flashing arrangements.

6.5 Membrane cappings

Butyl rubber and EPDM cappings shall be in accordance with Paragraph 4.3.9, and comply with the following requirements:

a) Tops of membrane cappings shall be free of any penetrations, and shall have a minimum slope of 10\(^o\) (1:6),
b) Sides of membrane cappings shall overlap the wall claddings as outlined in Table 7, and
c) Joints shall be in accordance with Paragraph 8.5.5.2.

6.6 Integral surface cappings

Cappings formed by using stucco, EIFS and flush-finished fibre cement materials shall not be used for parapets, (but may be used for enclosed balustrades as described in Paragraph 7.4).

COMMENT:

The tops to parapets are considered to be more risky locations than the tops to enclosed balustrades, as they are less accessible for inspection and regular maintenance.
Figure 11: Parapet/enclosed balustrade-to-wall junctions – plan section
Paragraphs 6.4.1, 7.4.2, 7.4.4.1 and 7.4.4.2, Figures 10, 12, 117, 129 and 130

NOTE: (1) Refer Figure 12 for saddle flashing and capping to wall junction.
(2) Plan section is through balustrade or parapet framing, below capping packer.

Window trimming stud
Wall framing 40 mm min.
Parapet or balustrade wall underlay lapped around corner
Wall underlay

Cladding fixing clear of flashing
Drain formed in corner
150 mm minimum to face of window or door jamb stud

50x50 mm corner flashings
Line of sloping H3 ply or polystyrene packer above
Cavity battens
Wall underlay
Parapet or balustrade wall framing
Figure 12: General junction of parapet and enclosed balustrade to wall
Paragraphs 6.4.1, 7.4.2, 7.4.4.1, 7.4.4.2 and 9.9.10.1, Figures 10, 12, 117, 129 and 130

(a) SADDLE FLASHING

Flexible flashing tape dressed up and securely adhered to wall underlay at rear of cavity
Flexible flashing tape dressed min. 50 mm down face of battens

NOTE:
(1) The junction is weatherproofed by the saddle flashing which is positioned at the front of the cavity as shown in (c).
(2) The flexible flashing tape over the sloped capping packer is intended to drain only moisture from within the drained cavity above, and to direct it into the adjacent continuous cavity.
(Refer Figure 11 for plan section.
(3) Separation layer of underlay between sloped timber capping and capping flashing omitted for clarity.

(b) STAGE 1 FLEXIBLE FLASHING INSTALLATION

(c) STAGE 2 SADDLE FLASHING INSTALLATION
7.0 Decks and Pergolas

Timber used to construct decks, enclosed balustrades and other attachments such as pergolas shall comply with B2/AS1.

7.1 Thresholds for decks

The vertical separation between the opening threshold level and the upper surface of the deck shall be as shown in Figure 14.

Opening threshold level may be at or above floor level.

7.1.1 Slatted decks

The level of the upper surface of the slatted deck:

a) Shall be a minimum of 50 mm below the threshold level for cantilevered decks as shown in Figures 14(b) and 16, or

b) May be at the same level as the threshold for non-cantilevered decks that are formed as shown in Figure 14(c).

For slatted decks, a minimum gap of 12 mm shall be provided between the exterior wall and the adjacent decking slat.

7.1.2 Enclosed decks

This Acceptable Solution is limited to enclosed decks with a maximum area of 40 m².

For enclosed decks, the vertical separation between the opening threshold level and the upper surface of the finished deck surface shall be a minimum of 100 mm.

7.2 Attachment to building structure

7.2.1 Slatted timber decks to walls

Junctions of slatted timber decks with walls shall be made weathertight as shown in Figures 15 and 16.

Fixings for stringers shall be in accordance with NZS 3604.

COMMENT:
Separating decks from buildings reduces the risk of water penetration into the framing.
Wall claddings that rely on surface coatings to reduce water absorption shall be sealed on outer faces and edges prior to fixing the stringers.

7.2.1.1 Cantilevered decks

Cantilevered decks shall have the junction with the exterior wall made weathertight as shown in Figure 16. Cladding shall be sealed to the saddle flashing.

7.2.2 Pergolas

Connections of other structures, such as pergolas, shall have the junction with the exterior wall made weathertight by using the deck framing connections shown in Figure 15.
Figure 16: Junction with wall for cantilevered timber deck

Paragraphs 7.1, 7.2.1.1, 7.3.1 and Figure 14

NOTE:

(1) Building wrap at back of cavity shall be taped around joist penetrations.
(2) The back of the saddle flashing shall be positioned behind the cladding.
(3) Saddle flashing terminates over inter-storey flashing.
7.3 Level thresholds
Where provision for level access is required, this shall be provided as shown in Figure 17A and Figure 17B.

7.3.1 Enclosed decks
Where provision for level access is required for an enclosed deck, this shall be provided in Figure 17A. The underlying membrane deck surface shall be made weathertight as described in Paragraph 8.5.

7.3.1.1 Removable surfaces
Raised removable surfaces of tiles, pavers or timber shall be provided over the underlying weathertight enclosed deck surface for cleaning and maintenance, as shown in Figure 17A. A minimum gap of 12 mm shall be provided against the wall or balustrade cladding.

7.3.1.2 Timber removable surface
Timber decking shall be over framing supported off the deck membrane as shown in Figure 17A, with spacing in accordance with B2/AS1.

No fixings shall penetrate the underlying deck membrane.

COMMENT:
Tiled boards or structural pavers sitting on proprietary supports can be adjusted according to level changes in the underlying deck surface.

The pavers or tiled boards are spaced to allow free drainage and the ability to lift the top surface off when necessary.

The timber option allows access by fixing the timber decking with stainless steel screws, so they may be removed when necessary.

7.3.2 Ground floor level access
Where provision for level access is required, this may be provided as shown in Figure 17B, with exterior paving or decking that complies with the access route requirements of D1/AS1.

7.3.2.1 Concrete slab
Where provision for level access is required from a concrete floor slab to exterior paving, this shall be as shown in Figure 17B with:

a) A channel, together with drainage provisions, across the door opening, with:
   i) the width to suit capacity in accordance with E1/AS1,
   ii) a minimum depth of 150 mm,
   iii) a maximum length of 3700 mm, and
   iv) 1:200 minimum fall along length of channel towards a drainage outlet,

b) Grating, in accordance with Tables 21 and 22, over the channel, that:
   i) is supported independently of the door frame,
   ii) is removable to allow access for cleaning,
   iii) is specifically designed to accommodate imposed loads,
   iv) has gaps sized to prevent the wheels of wheel chairs or mobility aids entering or being trapped, and
   v) has a continuous gap of 12 mm minimum from door frame and wall cladding.

COMMENT:
The grating support must be specifically detailed to suit the condition of the building and site.

c) Exterior paving that:
   i) has a minimum fall of 1:40 away from the channel for a minimum distance of 1 m,
   ii) together with the surrounding paving and ground levels, complies with drainage requirements of E1/AS1.

7.3.2.2 Timber floor
Where provision for level access is required from a timber floor structure to the exterior, this may be provided as shown in Figure 17B, with clearances in accordance with Paragraph 9.1.3.
NOTE:
(1) For use for framed, above ground enclosed decks with membrane surfaces.
(2) Care must be taken to ensure that no fixings or sharp edges penetrate the weather tight membrane deck surface.
(3) Refer also to Paragraph 8.5.

Figure 17A: Level thresholds for enclosed decks

Paragraphs 7.3, 8.5.1 and Figure 17B

(a) TILE/PAVING

Turn-up membrane 100 mm min. at trimmer studs
Tapered reveal to suit
Air seal
Floor finishes

Floor structure
Sill support bar, pre-fill fixation holes with silicon sealant

Door joinery
Tiles on support layer decking panels or structural paving slabs

(b) DECKING

Line of cladding beyond

Turn-up membrane 100 mm min. at trimmer studs
Tapered reveal to suit
Air seal
Floor finishes

Floor structure
Sill support bar, pre-fill fixation holes with silicon sealant

Line of cladding beyond

Door joinery
Decking screw fixed or panellised for removal and access

H3.2 framing
Deck membrane extended under sill reveal

H3.2 timber blocks on isolation pad
NOTE:
(1) Detail (a) is suitable for use with concrete floor slabs - refer Paragraph 7.3.2.1 for requirements.
(2) Detail (b) is suitable for use with timber floors. It may also be adapted for timber decks on upper storeys as per Paragraph 7.1.1 b), or for enclosed decks, with removable panels or decking as shown in Figure 17A.
(3) Both details may be adapted for inward or outward opening doors.
(4) Exposure to wind-driven rain must be specifically taken into account when using these details, and shelter to doors and joinery provided where local conditions warrant.

### (a) CONCRETE SLAB
- Turn-up flashing tape 100 mm min. at trimmer studs
- Air seal
- Floor finishes
- Floor structure
- Flashing tape
- Sill support bar to suit specific cladding situation
- Line of cladding beyond
- Drainage channel, fall along length
- Channel cover support brackets to specific design
- 150 mm min.

### (b) TIMBER FLOOR
- Turn-up flashing tape 100 mm min. at trimmer studs
- Air seal
- Floor finishes
- Packer
- Timber floor
- Sill support bar
- Wall underlay
- Door joinery (outward opening)
- Timber deck structure
- Flashing tape
- Drained cavity
- 12 mm

NOTE: 'A' to be the minimum dimension to maintain clearance from the bottom of the door to finished floor or deck, to manufacturer's requirements, and to keep sill upstand height to less than 20 mm.
Figure 17C: Door sills for cavity construction
Paragraph 9.1.10.5, Figures 73C, 85, 86, 91, 99, 116 and 128

(a) CONCRETE SLAB

(b) TIMBER FLOOR
Figure 17D: Door sills for direct fix
Paragraph 9.1.10.5, Figures 81, 82, 83, 84, 90, 95 and 115

- Turn-up flashing tape 100 mm min. against trimmer studs
- Frame block
- Sill tray to Paragraph 9.1.10.5 c) with 8 mm min. upstand and sloped end dam.
- Flashing to extend back past last line of aluminium profile
- Line of cladding beyond
- Flashing tape

(a) CONCRETE SLAB

- Turn-up flashing tape 100 mm min. at trimmer studs
- Door joinery
- Sill tray to Paragraph 9.1.10.5 c) with 8 mm min. upstand and sloped end dam.
- Flashing to extend back past last line of aluminium profile
- Frame block
- Air seal
- Timber trim
- Floor finishes
- Timber floor
- Packer to suit
- Wall underlay
- Cladding

(b) TIMBER FLOOR
7.4 Enclosed balustrades

Enclosed balustrades require a drained cavity for claddings, except for vertical corrugated steel, as outlined in Table 3, and shall be detailed as required for parapets described in Paragraphs 6 and 9.1.8 and Figures 10, 11 and 12. Details for specific cladding systems are given in Paragraph 9.0. Enclosed balustrade cappings for EIFS and flush finished fibre cement may include flush finishes as outlined in Paragraphs 9.7.7 and 9.9.10.

COMMENT: Reports on leaky buildings show these junctions have been prone to leakage and care must be taken in detailing and building them correctly.

7.4.1 Deck drainage

For decks with enclosed balustrades, provision for drainage shall be in accordance with Paragraph 8.5.6 and Paragraph 8.5.10.

7.4.2 Balustrade-to-wall junctions

Enclosed balustrade-to-wall junctions shall be flashed to direct water clear of the outside face of the cladding system using a saddle flashing as shown in Figures 11 and 12.

COMMENT: Reports on leaky buildings show these junctions have been prone to leakage and care must be taken in detailing and building them correctly.

7.4.3 Balustrade-to-deck floor junction

The junction of the enclosed balustrade with the floor of the enclosed deck shall be made weathertight as shown in Figure 18. Junctions with wall claddings shall be as shown in Figure 62.

7.4.4 Metal cappings

Metal cappings to enclosed balustrades shall have dimensions as outlined in Table 7. Metal cappings shall have the same requirements as outlined for parapets in Paragraph 6.4, with the exception of the:

a) Slope to the top of the capping, for buildings other than housing to be as in F4/AS1,

b) Drip edges are required to both sides of the capping. The drip edge to the deck side of the capping shall be a bird’s beak as shown in Figure 5.

COMMENT: A bird’s beak drip edge will avoid danger of injury resulting from the sharp edge of a kick-out.

Figure 18: Enclosed balustrade – bottom of cladding

Paragraphs 7.4.3, 9.1.3, Figures 56, 62, 63 and 64
### 7.4.5 Stanchions

*Stanchions* for *handrails*, signs, television aerials or similar structures shall be side-fixed through the *cladding system* into *framing*, as shown in Figure 19. These fixings are not included for *stucco*, *EIFS* or profiled metal in this Acceptable Solution.

Fixing shall be to vertical surfaces only. The sealant shall be compatible with the washer.

![Figure 19: Stanchion fixing](image)

**Figure 19: Stanchion fixing**

Paragraph 7.4.5

**NOTE:** Z = variable according to *wind zone* – refer Table 7.
8.0 Roof Claddings

8.1 General

8.1.1 Weathertightness

*Roof claddings* shall meet the requirements of NZBC E2.2, and be specified and *constructed* in accordance with the provisions of Paragraph 8.1.2 to Paragraph 8.5.

**COMMENT:**
For roofs used to collect water for human consumption, refer AS/NZS 4020.

8.1.2 Limitations

The following roof cladding systems are covered in this Acceptable Solution:

a) Masonry tiles Paragraph 8.2
b) Pressed metal tiles Paragraph 8.3
c) Profiled metal roof claddings Paragraph 8.4
d) Membrane roofing Paragraph 8.5.

Other roof claddings are beyond the scope of this Acceptable Solution.

8.1.3 Maintenance

Maintenance of claddings shall be carried out as necessary to achieve the expected *durability* of the materials – refer to Paragraph 2.5.

**COMMENT:**
A deterioration in the appearance of the coating of the metal does not necessarily relate to a deterioration in the weathertightness of the roof cladding.

Care should be taken to avoid post-installation damage to the cladding when accessing the roof. Additional support is required around roof-mounted units such as air-conditioners to avoid roof distortion.

8.1.3.1 Projecting eaves

Soffits and verges of all projecting eaves shall be closed in. Refer to Paragraph 5.3 for details.

8.1.4 Fixings

Fixings shall be as specified in Paragraph 8.2 to Paragraph 8.5.

Materials for fixing roof claddings and flashings, where necessary, shall be selected from Tables 20, 21 and 22 to minimise corrosion.

**COMMENT:**
The use of stainless steel fixings is not recommended by steel manufacturers for use with coated steel in severe marine and industrial environments, as they are considered to cause deterioration.

8.1.5 Roof underlays

*Roof underlays* shall be to Table 23 and NZS 2295, and be either:

- R1 heavy weight kraft, or
- R2 self supporting kraft.

**Underlays** shall:

- Layed with minimum numbers of laps
- Lapped at all side and end laps by minimum 150 mm
- Run horizontally for roof pitches below 10°
- Run horizontally or vertically for roof pitches above 10°
- Have *anti-ponding boards* at lower edges of masonry tiles, refer Figure 25(b) and Paragraph 8.2.5.

8.1.5.1 Underlay support

Prevent sagging of roof underlay by either:

- For R1 underlays, fully support with a corrosion resistant material
- For R2 self supporting underlays, laid to maximum 1.2 metre span between adjacent supports

**COMMENT:**
Solvent in freshly LOSP-treated timber can affect bitumen in underlays. Any solvent should be allowed to evaporate before the roof underlay is installed.
8.1.6 Gutters general

Gutters, downpipes and spreaders, including eaves gutters/spoutings are required for the drainage of roof water, and shall:

a) Be to the minimum dimensions shown in this Acceptable Solution, or calculated to E1/AS1, whichever is the greater

b) If a gutter depth is reduced to allow entry of a valley gutter, the reduced depth must be used to calculate the capacity of the gutter

c) For internal, valley, and hidden gutters, have no fixings in gutter bottoms or sides, and be continuously supported on H1.2 minimum treated timber gutter boards or H3 ply which is separated from metal by roof underlay strip.

Eaves gutters/spoutings shall:

d) Be to any of the materials outlined for flashings in Paragraph 4.1 except 4.3.9, 4.3.10 and 4.3.11

e) Have a minimum cross sectional area of 2500 mm²

f) Be designed to overflow water to the outside.

Downpipes shall:

g) Be formed from any of the materials outlined for flashings in Paragraph 4.1 except 4.3.9, 4.3.10 and 4.3.11

h) Upper roofs shall drain via downpipes directly to ground level where possible, or

i) Where discharging to a lower roof, be fitted with a spreader as detailed in Figure 20

j) Have a maximum catchment area of 25 m² if discharging on to a lower roof area.

Spreaders shall:

k) Be to any of the materials outlined for flashings in Paragraph 4.1 except 4.3.9, 4.3.10 and 4.3.11

l) Be to Figure 20 and not be used on masonry tile roofs unless a roof underlay is installed

m) Discharge directed away from roofing laps and clear of roof penetrations.

COMMENT:

Design calculations for a specific roof may allow larger catchment areas per spreader to be used.

The alternative to a spreader is to direct an upper level downpipe into a rainwater head.

The ends of spreaders should be blocked off where a sideways flow of water is against laps in roof claddings.

8.1.6.1 Internal gutters

Internal gutters shall:

a) Be formed with continuous butyl or EPDM strip complying with Paragraph 4.3.9, with no cross-joints in the gutter, or aluminium, copper, stainless steel, or zinc sheet to Paragraph 4.3, with joints that are welded

b) Where butyl or EPDM, be minimum 1.5 mm membrane thickness, or 1.0 mm thickness for gutters less than 1 metre wide

c) Have a minimum slope of 1:100

d) Be constructed to at least the minimum dimensions shown in Figure 52, or the capacity calculated to E1/AS1 plus an additional freeboard depth of 20 mm minimum.
For roofs other than membrane roofs:
e) Discharge into a rainwater head as shown in Figure 63 (a) and (b), or
f) Discharge to an internal outlet to Figure 64 (b) or (c) with overflows provided by either:
   i) a second outlet to a rainwater head, or
   ii) an overflow as shown in Figure 63(c), and positioned below the level of any potential overflow into the building.

For internal gutters and membrane roofing, refer to Paragraph 8.5.

8.1.6.2 Valley gutters and hidden gutters

Valley gutters and hidden gutters shall be constructed as shown in Figures 50 and 51 for the applicable roof cladding (except for membrane roofing) and:

a) Not change direction in plan
b) Have a minimum underlap to roof cladding as specified in Figures 27, 37, 50, and 51 for the relevant roof cladding

c) Be formed from any of the materials outlined for flashings in Paragraph 4.3 except 4.3.10 and 4.3.11
d) Be fixed at upper ends only, and be secured with a purpose-made clip system for the remaining length to enable expansion/contraction along the length of the gutter
e) Discharge into an internal gutter or eaves spouting.

In addition:

f) Have minimum slopes of 8° for hidden gutters, and to Table 8 for valley gutters
g) Hidden gutters receive no discharge from downpipes or spreaders
h) Spreaders not discharge directly into a valley gutter
i) Valley gutters be minimum 250 mm wide where receiving run off from spreaders.

### Table 8: Maximum catchment areas for valley gutters

<table>
<thead>
<tr>
<th>Gutter width</th>
<th>Maximum catchment area</th>
<th>Minimum roof pitch</th>
</tr>
</thead>
<tbody>
<tr>
<td>250 mm</td>
<td>25 m²</td>
<td>8°</td>
</tr>
<tr>
<td>160 mm to 249 mm</td>
<td>16 m²</td>
<td>12.5°</td>
</tr>
</tbody>
</table>

**NOTE:** Catchment areas are limited to:
(1) Gutters in accordance with Paragraph 8.1.6.2.
(2) Rainfall intensity with average recurrence interval (ARI) no greater than 200 mm per hour.

**COMMENT:**

Gutters for lower-pitched roofs, or for catchment areas other than those shown in Table 8, require specific design. Additional information may be found in the New Zealand Metal Roof and Wall Cladding Code of Practice.

8.1.7 Roof penetrations

**Roof penetrations shall be made weathertight** in accordance with Paragraph 8.2 to Paragraph 8.5.

Where roof penetrations are required for large openings such as roof lights and chimneys, this Acceptable Solution is limited to the following requirements:

a) The edge of roofing penetrations over 200 mm wide shall be supported in either direction with additional framing as shown in Figure 21, and
b) For the catchment area of the roof above the penetration as shown in Figure 22, the roof length shall be limited to:
   i) for profiled metal roofing, Table 17
   ii) for other roof claddings, the areas shown in Table 9.

**COMMENT:**

Flashings for roof penetrations not included in this Acceptable Solution require specific design.

For pipe penetrations, refer to details for the roof cladding material used.

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**DEPARTMENT OF BUILDING AND HOUSING**

1 August 2011

**EXTERNAL MOISTURE**

**Acceptable Solution E2/AS1**

1 August 2011

Amend 5 Aug 2011
**Table 9:** Maximum catchment areas above penetrations
Paragraph 8.1.7 and Figure 22

<table>
<thead>
<tr>
<th>Penetration width</th>
<th>Maximum roof length above penetrations in metres</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 to 1200 mm</td>
<td>4 m</td>
</tr>
<tr>
<td>600 to 800 mm</td>
<td>6 m</td>
</tr>
<tr>
<td>400 to 600 mm</td>
<td>8 m</td>
</tr>
<tr>
<td>0 to 400 mm</td>
<td>10 m</td>
</tr>
</tbody>
</table>

**NOTE:** Refer to Table 17 for profiled metal roofing.

---

**Figure 21:** Penetration support
Paragraphs 8.1.7 and 8.4.17

**Figure 22:** Catchment area for penetrations
Paragraphs 8.1.6, 8.1.7, Tables 9 and 17

**NOTE:**
(1) Profiled metal roofing - refer Table 17 for maximum roof lengths above penetrations.
(2) Other roof cladding - refer Table 9 for maximum roof lengths above penetrations.
8.2 Masonry Tiles

8.2.1 Materials
Concrete tiles shall meet the requirements of NZS 4206 or AS 2049. Clay tiles shall meet the requirements of AS 2049.

8.2.1.1 Tile profiles
For the purposes of this paragraph, tiles shall be divided into three types as listed below:

a) Type I: Double profile tiles having two distinct watercourses with a minimum watercourse depth of 18 mm,
b) Type II: Single profile tiles having one watercourse depth of a minimum of 25 mm, or
c) Type III: Tiles not fitting the Type I or Type II categories, and includes flat tiles and those resembling slates, shakes and shingles.

8.2.2 General

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

8.2.3 Installation
Masonry tile roof cladding shall be installed in accordance with NZS 4206 or AS 2050 onto minimum H1.2 treated timber battens, except the minimum pitch shall be as specified in Table 10. Where required in AS 2050 and Table 20, underlay shall comply with Table 23.

Fixing and fixing patterns shall be to NZS 4206, with the exception that nails shall penetrate a minimum of 35 mm into timber battens, and the minimum pitches and roof underlay shall be as described in Table 10 and Table 23.

Use 304 or 316 stainless steel fixings for corrosion zones B, C, D and E, or hot dip galvanised fixings at 450 g/m² for Zone B and Zone C. Refer to Table 20 for corrosion zones.

Table 10: Minimum pitches for masonry tiles
Paragraph 8.2.3, Figure 25

<table>
<thead>
<tr>
<th>Tile material</th>
<th>Profile type</th>
<th>With underlay (1/2)</th>
<th>Without underlay (1/2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete tiles (to rafter length 4.5 m)</td>
<td>Type I</td>
<td>15°</td>
<td>20°</td>
</tr>
<tr>
<td>Type II</td>
<td>20°</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Type III</td>
<td>25°</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Clay tiles (to rafter length 4.5 m)</td>
<td>Type I</td>
<td>20°</td>
<td>25°</td>
</tr>
<tr>
<td>Type II</td>
<td>20°</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>Type III</td>
<td>25°</td>
<td>–</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: (1) Increase pitch by 1° per additional 0.5 metres of rafter length over 4.5 m.
(2) Roof underlay is required for any roof receiving discharge from a spreader, or for roofs in wind zone Very High or Extra High.

COMMENT:
Rafter length, tile profile and wind zone all affect the allowable minimum pitch of a tile roof. Rafters longer than in Table 10 may require the addition of underlay.

Manufacturers may have specific profiles that are suitable for pitches lower than those shown in Table 10, but these are outside the scope of this Acceptable Solution.

Where masonry tiles have been shown to comply with the dynamic weathertightness test requirements of AS 4046: Part 9, a lower pitch may be used providing it is not less than 15°.

8.2.4 Flashings and fixings
Materials for flashings, gutters and fixings shall be in accordance with Paragraph 4.0, and:

a) Be selected from Table 20 to minimise corrosion, and

b) Be compatible with mortar and bedding in accordance with Table 21 and Table 22.

8.2.5 Anti-ponding boards
Masonry tile roofs with underlays shall have anti-ponding boards installed to Figure 25.

Where anti-ponding boards are used, these shall be set to a minimum fall of 5° (1:12), and shall be treated minimum H1.2 for solid timber and H3 for plywood.

8.2.6 Details and flashings
Hips, ridges, valleys and barges shall be made weathertight by using flashings and seals as shown in Figure 23 to Figure 28.
**Figure 23:** Masonry tile ridge
Paragraph 8.2.6

- Ridge tiles
- Mortar bedding with weep holes at the pan of each tile
- Underlay where required

**Figure 24:** Barge for masonry tile
Paragraph 8.2.6

- Barge tile
- Mortar bedding
- Tile
- Batten
- Underlay where required
- Outtrigger
- Eaves lining
- Cladding
- Wall underlay
NOTE: (1) Anti-ponding boards required for tile roofs with underlays.
(2) Refer Table 10 for tile types and roof pitches requiring roof underlays.

Figure 25: Timber fascia eaves for masonry tile
Paragraphs 8.1.5 and 8.2.5

(a) WITHOUT UNDERLAY

(b) WITH UNDERLAY

Figure 26: Apron details for masonry tile
Paragraph 8.2.6

(a) PARALLEL FLASHING

(b) TRANSVERSE FLASHING
8.2.7 Penetrations

Penetrations shall be flashed as shown in Figure 29 to Figure 31.

Holes in tiles for pipe penetrations shall be machine-cut to minimise the size of the hole.
Figure 30: Abutment at framed penetration for masonry tile
Paragraph 8.2.7, Table 9 and Figure 31

Figure 31: Flashing to framed penetration for masonry tile
Paragraph 8.2.7, Table 9 and Figure 30
8.3 Pressed Metal Tiles

8.3.1 Limitations
This Acceptable Solution is limited to pressed metal tile roofs.

COMMENT:
Additional guidance on pressed metal tiles can be found in the New Zealand Metal Roof and Wall Cladding Code of Practice.

8.3.2 Installation

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

8.3.3 Tiles and accessories
Tiles and their accessories shall meet the requirements of NZS 4217.

8.3.4 Metal substrate

8.3.4.1 Choice of metal

COMMENT:
The exposure zone in which a building is located can affect the durability of flashings.

Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3804, require specific design.

Exposure zones are based on AS/NZS 2728. AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

8.3.4.2 Steel
Steel for the manufacture of pressed metal tile and flashing systems shall:

a) have a base metal thickness (BMT) of 0.39 mm minimum,

b) be grade G300 or G250,

c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

Paint coatings may include factory-applied finishes complying with AS/NZS 2728, or factory-painted or bonded resin and chip finishes of minimum 15 year durability.

8.3.4.3 Aluminium
Aluminium for the manufacture of pressed metal tiles and flashing systems shall comply with AS/NZS 1734, and shall:

a) Have a base metal thickness (BMT) of 0.7 mm minimum,

b) Be minimum 5000 series,

c) For pre-painted aluminium, have a factory-applied finish complying with AS/NZS 2728.

8.3.5 Roof pitch

General approximations of profile types for standard profile and shake or shingle profile metal roof tiles are shown in Figure 32.

The minimum roof pitches for metal tiles where rafter length does not exceed 12 m shall be limited to:

a) 12° (1:4.75) for profiles resembling standard profiles, and

b) 15° (1:3.75) for profiles resembling shingle or shake profiles.

Where rafter length exceeds 12 m, increase minimum pitch by 1° per additional 0.5 m.

Figure 32: Metal tile profiles
Paragraph 8.3.5

(a) STANDARD PROFILE

Profile depth = 25 mm

(b) SHAKE OR SHINGLE PROFILE

Profile depth = ± 20 mm
COMMENT:
Panels are available in a wide range of profiles. Where manufacturers have more stringent requirements, these should be followed to optimise performance and to avoid invalidating guarantees.

8.3.6 Underlay
All metal tile roofing shall have a roof underlay installed. Roof underlay shall be to Table 23. Refer to Paragraph 8.1.5 for installation details. If LOSP-treated timber is used, roof underlay shall not be applied until the LOSP solvent has been allowed to evaporate.

COMMENT:
Solvent in freshly LOSP-treated timber can affect bitumen in underlays. Any solvent should be allowed to evaporate before the roof underlay is installed.

8.3.7 Fixings
Pressed metal tiles shall be fixed as shown in Figure 33, with:

a) 50 x 2.8 mm hot-dipped galvanized painted flat-head annular-grooved nails. For fixings through the top of the tiles, use neoprene washers containing no more than 15% by weight carbon black content, with

b) Four fixings per sheet through:
   i) the turn-down of the tiles for the body of the roof, and
   ii) the top of the profile slope for sheets at the eaves, avoiding the weather channel of the tiles.

8.3.8 Flashings
The roof shall be flashed at all boundaries, except at the discharge to a gutter, using the details shown in Figure 34 to Figure 37. Metal flashings are generally supplied by the metal tile manufacturer, and shall comply with Paragraph 8.3.4.2 and Table 7, unless specifically shown otherwise in the details.

COMMENT:
Metal tile manufacturers supply pre-folded or formed accessories and recommendations for their installation.
Figure 34: Ridge or hip flashings for metal tile
Paragraphs 8.3.3 and 8.3.8

(a) RIDGE OR HIP

- Ridge tile cut and bent to form upstand
- Minimum upstand at ridge 40 mm
- Fixing
- Underlay turned up at ridge
- Mitre, lap and seal the ridge capping at all junctions

(b) RIDGE OR HIP ALTERNATIVE

- Barrel or angled ridge
- Minimum cover of ridge tile 35 mm at any point
- Fixing through upstand
- Minimum upstand on ridge tile 40 mm
- Underlay

(c) RIDGE TO HIP FLASHING ALTERNATIVE

- Preformed ridge capping
- Lapped and sealed joint

NOTE: For alternative ridge profiles, ridge to hip capping must be preformed to suit profile.

Figure 35: Apron flashings for metal tile
Paragraphs 8.3.3 and 8.3.8

(a) PARALLEL APRON FLASHING

- Cladding and wall underlay
- Over-flashing
- Minimum upstand of verge tile 40 mm
- Minimum cover of over-flashing 35 mm
- Line of framing
- Verge tiles
- Underlay

(b) TRANSVERSE APRON FLASHING

- Cladding and wall underlay
- Over-flashing
- Underlay carried up face of framing behind upstand Flashing
- Minimum upstand of tile 40 mm, minimum cover of over-flashing 35 mm
- Line of framing
- Line of framing

Amend 2 Jul 2006
Amend 5 Aug 2011
NOTE: If alternative barge flashing profiles are used, these profiles must achieve equivalent covers.

Underlay under battens

Underlay pressed over battens and fascia at eaves

Min. overhang at closest point of the tile 40 mm

Selected fascia & gutter system (a) EAVE

Barge flashing minimum cover over turn up 25 mm at any point

Tile edge turned up minimum 40 mm

Eaves lining Barge board or cladding (b) BARGE

Figure 36: Eaves and barge for metal tile
Paragraphs 8.3.3 and 8.3.8

Figure 37: Hidden and valley gutter flashings for metal tile
Paragraphs 8.1.6.2, 8.3.3, 8.3.8, Figure 51

NOTE: (1) Refer to Table 8 for maximum catchment areas for valley gutters.
(2) Minimum width of valley gutter may reduce to 160 mm, providing roof catchment area is in accordance with Table 8. In this case, minimum dimensions as shown, shall apply.

Wall underlay carried over flashing

Exterior wall cladding

Selected roofing profile

Min. gap 35 mm

Min. cover 75 mm

Over flashing with hem to upper edge

Verge tiles turned down into gutter

Underlay carried over edge of gutter

25 mm gutter support boards cut between rafters and fixed to stop end batten

Underlay separating timber and gutter

Fully supported hidden gutter

Gutter width refer Figure 51

(a) PARALLEL HIDDEN GUTTER

(b) VALLEY GUTTER

NOTE:
Where gutter finishes within the length of the wall, step lower part of gutter out to 10 mm past the cladding line, while maintaining required clearances, to allow the gutter to feed into the lower eaves gutter.
8.3.9 Gutters, ridges, barges and fascias

Gutters, ridges, barges and fascias shall be as shown in Figures 34–37.

Refer to Paragraph 5.2 for termination of *roofs* against *wall claddings*.

8.3.10 Roof penetrations

Pipe penetrations shall be flashed using *EPDM flashings* similar to that shown for masonry tiles, Figure 29.

**COMMENT:**

Use purpose-made preformed rooflights and ventilators supplied by the manufacturer of the tiles where available.
8.4 Profiled Metal Roof Cladding

8.4.1 Limitations

This Acceptable Solution is limited to the following types of profiled metal roof cladding:

a) Profiled as outlined in Paragraph 8.4.4,
b) Valley gutters that do not change direction in plan,
c) Not curved, and
d) With sheets no more than 18 metres long.

COMMENT:
If curved profiled metal sheet is used, the radius of the curve may affect durability. Specific design is required, and manufacturers and the New Zealand Metal Roof and Wall Cladding Code of Practice should be consulted for recommendations.

8.4.2 General

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

8.4.3 Materials

8.4.3.1 Choice of metal

Metal roof cladding and flashings shall be selected according to the exposure conditions in Table 20 as defined in:

a) NZS 3604, or
b) AS/NZS 2728.

COMMENT:
A deterioration in the appearance of the coating of the metal does not necessarily relate to a deterioration in the weathertightness of the roof cladding.

8.4.3.2 Steel

Materials for the manufacture of profiled steel roof cladding shall:

a) have a BMT of 0.4 mm minimum
b) be grade G550, or G300 for rolled, crimped, or trough profile roofing
c) be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

8.4.3.3 Aluminium

Aluminium for the manufacture of profiled aluminium roofing shall comply with AS/NZS 1734, and be a minimum:

a) Base metal thickness (BMT) of 0.7 mm,
b) 5000 series.

Pre-painted aluminium roofing shall have a factory-applied finish complying with AS/NZS 2728.

COMMENT:
Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3604, require specific design.

Exposure zones are based on AS/NZS 2728. AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.
8.4.4 Profiles
Profiles covered in this Acceptable Solution are shown in Figure 38, and consist of:

a) **Corrugated** – curved with a crest height of 16.5 mm minimum,

b) **Trapezoidal** – symmetrical or asymmetrical with a minimum crest height of 19 mm, and for asymmetrical a flat or lightly profiled pan width of 210 mm maximum between crests, and

c) **Trough profile** – with vertical ribs at a minimum height of 38 mm, and flat or lightly profiled pans of 210 mm maximum between crests.

![Figure 38: Profiled metal profiles](image)

**NOTE:** Tables 11 to 13 have limited profile requirements for given roofing spans.

- **Corrugated Profile**: Minimum profile depth = 16.5 mm
- **Trapezoidal Profile (Symmetrical)**: Minimum profile depth = 19 mm
- **Trapezoidal Profile (Asymmetrical)**: Minimum profile depth = 19 mm
- **Tray may be profiled**
- **Trough Profile**: Minimum profile depth = 38 mm

8.4.5 Roof pitch
For roofs up to 18 metres in length without end laps, pitches shall be:

a) Corrugated – not less than 8° (1:7).

b) **Trapezoidal** – not less than:
   i) 4° (1:14) where the crest height is less than 27 mm, or
   ii) 3° (1:20) where the crest height is 27 mm or higher.

c) **Trough profile** – not less than 3° (1:20).

**COMMENT:**
For roofs over 18 metres in length refer to the manufacturer for minimum pitch requirements. Where manufacturers have more stringent requirements, these should be followed to optimise performance and to avoid invalidating guarantees.

8.4.6 Structure
The maximum span and fixing patterns of profiled metal roof cladding between purlins to comply with this Acceptable Solution are given in Table 11, Table 12 or Table 13, 14 and 15. Spans shown are for steel with BMT, grade and profile as specified in each Table.

**COMMENT:**
For purlin sizes, spacing and fixing, refer to NZS 3604. Additional support will be required around roof-mounted services such as air-conditioning in order to avoid roof distortion.
Table 11: Steel corrugate profiled roofing – 0.4 mm BMT and minimum profile height 16.5 mm
Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

<table>
<thead>
<tr>
<th>Purlin spacings (metres)</th>
<th>Wind zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low and Medium</td>
</tr>
<tr>
<td>End span</td>
<td>Intermediate span</td>
</tr>
<tr>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>0.8</td>
<td>1.2</td>
</tr>
</tbody>
</table>

**NOTE:** C1 fixing pattern is – Hit 1, miss 1...
C2 fixing pattern is – Hit 1, miss 1, hit 1, miss 2...

Table 12: Steel corrugate profiled roofing – 0.55 mm BMT with minimum profile height 16.5 mm
Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

<table>
<thead>
<tr>
<th>Purlin spacings (metres)</th>
<th>Wind zones</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low and Medium</td>
</tr>
<tr>
<td>End span</td>
<td>Intermediate span</td>
</tr>
<tr>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>1.15</td>
<td>1.6</td>
</tr>
</tbody>
</table>

**NOTE:** C2 fixing pattern is – Hit 1, miss 1, hit 1, miss 2...
C3 fixing pattern is – Hit 1, miss 2, hit 1, miss 3...
COMMENT:

It is recommended that access to the roof is limited to within 100 mm of purlin lines to avoid damaging the roof cladding.

Table 13: Steel trough profile roofing – 0.55 mm BMT with profile height 46 mm minimum, and pan width 210 mm maximum

<table>
<thead>
<tr>
<th>Maximum span of roof cladding mm</th>
<th>End span</th>
<th>Intermediate span</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100</td>
<td>1600</td>
<td></td>
</tr>
</tbody>
</table>

NOTE: (1) Trough profile with 0.4 mm BMT steel is excluded from this Acceptable Solution

(2) For profile heights and pan widths outside this range, refer to supplier’s literature for fixing patterns and spans

8.4.7 Underlay

All profiled metal long-run roofing shall have a roof underlay installed to Table 23. See Paragraph 8.1.5 for installation details.

8.4.8 Fixings: corrugated and trapezoidal

Fixings shall be as shown in Tables 11, 12, 14 and 15, and shall be a minimum 12-gauge screw, as shown in Figure 39, which complies with Class 4 of AS 3566: Part 2.

COMMENT:

Screw fixing is recommended for metal roofing as there is less likelihood of the fixing ‘backing out’ than with a nail.

The spacing requirements for fixings are conservative, and a specific design may produce a more optimum spacing, especially with the use of load-spreading washers. Consult roofing manufacturers for information.

8.4.8.1 Fixing requirements

Fixings shall:

a) Be fixed through crests,

b) Penetrate purlins by a minimum of 40 mm for nail fixings and 30 mm for screw fixings,

c) Include sealing washers of:
   i) neoprene (having a carbon black content of 15% or less by weight),
   ii) profiled washer and EPDM washer where required to allow for expansion of the profiled metal roof cladding.

Figure 39: Corrugated and trapezoidal fixings and sheet lap

Paragraphs 8.4.8, 9.6.6, Tables 20, 22 and 24
### Table 14: Steel Trapezoidal Profiled Roofing – 0.4mm BMT and Profile Height 27mm Minimum, and Minimum 5-Rib Profiles

Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

<table>
<thead>
<tr>
<th>Purlin spacings (metres)</th>
<th>Wind zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>End span</td>
<td>Intermediate span</td>
</tr>
<tr>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>1.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

**NOTE:**
- T1 fixing pattern is – Fix every crest...
- T2 fixing pattern is – Hit 1, miss 1...
- SED Specific Engineering Design
- (1) For profile heights and pan widths outside this range, refer to supplier’s literature for fixing patterns and spans

### Table 15: Steel Trapezoidal Profiled Roofing – 0.55mm BMT, Profile Height 27mm Minimum, and Minimum 5-Rib Profiles

Maximum spans and fixing patterns. Refer to Paragraph 8.4.6

<table>
<thead>
<tr>
<th>Purlin spacings (metres)</th>
<th>Wind zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>End span</td>
<td>Intermediate span</td>
</tr>
<tr>
<td>0.4</td>
<td>0.6</td>
</tr>
<tr>
<td>0.6</td>
<td>0.9</td>
</tr>
<tr>
<td>0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>1.2</td>
<td>1.8</td>
</tr>
</tbody>
</table>

**NOTE:**
- T1 fixing pattern is – Fix every crest...
- T2 fixing pattern is – Hit 1, miss 1...
- (1) For profile heights and pan widths outside this range, refer to supplier’s literature for fixing patterns and spans
8.4.9 Fixings: trough profile
Clip fixings for trough profiles and spans as shown in Table 13 shall be as shown in Figure 40, and shall:

a) Have a minimum BMT of 0.9 mm
b) Be a minimum width of 30 mm
c) Be made from a material compatible with the cladding, refer to Tables 20 and 21
d) Have clips fastened with a minimum of two 10-gauge by 30 mm waferhead hot-dipped galvanised screws which comply with Class 3 of AS 3566: Part 2.

Where Table 16 requires profiled washers, allowance shall be made for expansion by:

a) Fixing the top 50% (closest to the ridge) with conventional fixings, and
b) Fixing the lower 50% with sealing washers fixed over profiled washers as shown in Figure 39, and:
   i) using oversized holes, and
   ii) positioning fixing in centre of hole.

<table>
<thead>
<tr>
<th>Material</th>
<th>&lt; 8 m</th>
<th>8-12 m</th>
<th>12-18 m</th>
<th>&gt;18 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>NSR</td>
<td>Profiled washers</td>
<td>Profiled washers</td>
<td>SD</td>
</tr>
<tr>
<td>Aluminium</td>
<td>Oversized holes</td>
<td>Profiled washers</td>
<td>SD</td>
<td>SD</td>
</tr>
<tr>
<td>SD – Requires specific design</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSR – No special requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.4.10 Allowance for expansion
Allowance shall be made for expansion of corrugated and trapezoidal roof cladding as shown in Table 16.

8.4.11 Flashing requirements
The roofing shall be flashed at all boundaries to comply with the following:

a) At edges discharging to gutters with eaves flashings where required in Figure 45(a)
b) Soft edge to cover flashings complying with Paragraph 4.6. Refer to Figure 41 for example of use and Tables 21 and 22.
c) Notched turn-downs to cover flashings shall comply with Paragraph 4.6. Refer to Figure 42 for example of use.
d) Materials for flashings shall be compatible with the roof cladding material as per Table 21 and Table 22, and shall be in accordance with Paragraph 4.3.
e) Provide expansion joints in accordance with Paragraph 4.5.2.

8.4.11.1 Fixing flashings
a) When fixing flashings to the structure, use screws as for roofing (see Paragraph 8.4.8).
b) When fixing flashings to other flashings or to roofing use:
   i) for galvanized steel, 4 mm diameter monel metal or stainless steel rivets, where compatible as per Table 21,
   ii) for aluminium-zinc coated steel, 4 mm diameter aluminium rivets,
   iii) for aluminium, 4 mm diameter aluminium rivets.

COMMENT:
The use of stainless steel fixings is not recommended by steel manufacturers for use with coated steel, in severe marine and industrial environments, as they are considered to cause deterioration.

c) Flashing joins, including expansion joints where required, shall be in accordance with Paragraph 4.5.2 and as shown in Figure 6.

d) Where end-laps are required in flashings, form these as shown in Figure 6 and, before joining the two parts, apply an 8 mm diameter bead of neutral cure sealant complying with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

8.4.12 Flashing details
The roof shall be flashed using details shown below:

a) Ridge to hip as shown in Figure 43,

b) Apron flashing and change in pitch as shown in Figure 44,

c) Eaves and roof/wall ridge as shown in Figure 45,

d) Eaves flashing as in Figure 45(a) required for all roofs under 10º pitch and soffit widths less than 100 mm,

e) Ridge and hip as shown in Figure 46,

f) Barge flashings as shown in Figure 47,

g) Apron flashing – parallel flashing to profile as shown in Figure 48.
COMMENT:
Reduced cover for barge and apron flashings may be applicable for specifically designed roofs in low wind zones.

Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for additional guidance on ridge to hip flashings.

NOTE: Flashing cover varies according to wind zone – refer Table 7. For other ridge to hip flashings refer to New Zealand Metal Roofing and Wall Cladding Code of Practice.

Ridge flashing

Butyl under-flashing to ridge and hip flashings

Hip flashing

Flashing edge to suit roofing profile

Pop rivet and sealant joints to junctions of ridge and hip flashings

Flashing edge to suit roofing profile

Paragraphs 4.5, 8.4.11, 8.4.12, Table 7

Figure 43: Ridge to hip flashings

Figure 44: Apron flashing and change in pitch for profiled metal

Paragraphs 4.5, 8.4.11, 8.4.12, Table 7

NOTE: X = variable according to wind zone – refer Table 7.

Hem along top edge of flashing

Upper roof underlay lapped over flashing

Wall underlay over apron upstand

Hem to flashing edge

Min. gap 35mm

Min. cover 70mm

110mm min. total

(a) CHANGE IN PITCH

(b) APRON FLASHING
**Figure 45:** Eaves and roof/wall ridge for profiled metal

Paragraphs 4.5, 8.4.11, 8.4.12, Table 7

Eave flashing required where all of the following conditions are met:
- Roof slope less than or equal to 10°, and
- soffit width less than or equal to 100 mm, and
- wind zones are Very High or Extra High

- 125 mm

- 35 mm min. overlap

- Selected fascia & gutter system

*100 mm or less - refer eaves flashing note above

(a) EAVE

(b) ROOF / WALL RIDGE

**Figure 46:** Ridge and hip flashings for profiled metal

Paragraphs 4.4, 4.5, 8.4.11, 8.4.12, Table 7

(a) CORRUGATED PROFILE

(b) TRAPEZOIDAL PROFILE
Figure 47: Barge flashings for profiled metal
Paragraphs 8.4.11, 8.4.12, Table 7

(a) CORRUGATED PROFILE
- Barge flashing to cover two full crests
- Screw fixing
- Eave soffit

(b) TRAPEZOIDAL PROFILE
- Barge flashing
- Screw fixing
- Eave soffit

(c) TROUGH PROFILE
- Barge flashing
- Screw fixing
- Eave soffit

Acceptable Solution E2/AS1
Figure 48: Parallel apron flashings for profiled metal
Paragraphs  8.4.11, 8.4.12, Table 7

(a) CORRUGATED PROFILE
Cladding with wall underlay over flashing
5 mm max. gap
Underlay

(b) TRAPEZOIDAL PROFILE
Cladding with wall underlay over flashing
5 mm max. gap
Fixing through rib
Underlay

(c) TROUGH PROFILE
Cladding with wall underlay over flashing
5 mm max. gap
Underlay
8.4.13 Stopends
The top ends of profiled metal roof cladding shall have stopends as shown in Figure 49 for trapezoidal and trough profile metal roof cladding, where:

a) The roof pitch is less than 25°, or

b) The building is in a High/Very High/Extra High wind zone.

8.4.14 Turn-downs at gutters
The lower ends of trapezoidal and trough profile roofing shall be turned down at gutters, where the roof pitch is less than 10°.

The turn-down shall be 30° from the plane of the sheet.

**COMMENT:** Specific tools are available and should be used to turn up or turn down ends. Care should be taken to ensure the sheet does not split.

Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for guidance on methods.

8.4.15 Profile closure
Preformed compressible seals shall not be used at the eaves.

**COMMENT:** Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for guidance.

8.4.16 Hidden, valley and internal gutters
Hidden, valley and internal gutters shall be in accordance with Paragraph 8.1.6.

8.4.16.1 Hidden gutters
Parallel hidden gutters shall be as shown in Figure 50 and Paragraph 8.1.6.2.

8.4.16.2 Valley gutters
Valley gutters shall be in accordance with catchment areas shown in Table 8, and as shown in Figure 51 and Paragraph 8.1.6.2.

**COMMENT:** Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for additional guidance on sizing, materials and fixing.

8.4.16.3 Internal gutters
Internal gutters shall be as shown in Figure 52 and Paragraph 8.1.6.1.
Figure 50: Parallel hidden gutter for profiled metal
Paragraphs 4.3, 4.5, 8.1.6.2 and 8.4.16

- Building wrap
- Exterior wall cladding
- Selected roofing profile
- Underlay

Min. 20 mm

80 mm min

Min. 10 mm

25 mm min

Hem to flashing edge

Min. 80 mm

35 mm min

NOTE: Where gutter finishes within the length of the wall, step lower part of gutter out to 10 mm past the cladding line, while maintaining required clearances, to allow the gutter to feed into the lower eaves gutter.

Figure 51: Valley gutters for profiled metal
Paragraphs 4.3, 4.5, 8.1.6.2 and 8.4.16

NOTE: (1) Refer to Table 8 for maximum roof catchment areas for valley gutters.
(2) Minimum width of valley gutter may reduce to 180 mm, providing roof catchment area is in accordance with Table 8. In this case, cover of roof cladding over gutter shall be reduced to 60 mm to provide a clearance gap of 40 mm.

- Overall valley gutter width 250 mm min.
- Clearance between roofing 50 mm min.
- Underlay
- Roofing wrap continuous under gutter if copper based treatments are used
- Valley rafter
- Solid support for valley gutter

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Amend 5
Aug 2011
Amend 5
Aug 2011
Amend 2
Jul 2005
8.4.17 Roof penetrations

The maximum length of profiled roof cladding above penetrations shall be as shown in Table 17.

The edge of roofing penetrations over 200 mm wide shall be supported in either direction with additional framing as shown in Figure 21.

Roof penetrations shall be flashed as follows:

a) Pipe penetrations up to 85 mm shall be flashed using an EPDM boot flashing as shown in Figure 53,

b) Pipe penetrations up to 500 mm shall be flashed using a soaker flashing and EPDM boot flashing as shown in Figure 54,

c) Rectangular penetrations up to 1200 mm wide shall be flashed using a soaker type flashing as shown in Figure 55.

COMMENT:
Penetrations on lower pitched roofs, larger penetrations, or needing specialised complex flashings will require specific design to suit the particular circumstances.

The New Zealand Metal Roof and Wall Cladding Code of Practice should be consulted for guidance.

Table 17: Catchment areas for profiled metal

<table>
<thead>
<tr>
<th>Penetration width</th>
<th>Maximum roof length above penetration in metres</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Corrugated</td>
</tr>
<tr>
<td>800 to 1200 mm</td>
<td>4 m</td>
</tr>
<tr>
<td>600 to 800 mm</td>
<td>6 m</td>
</tr>
<tr>
<td>400 to 600 mm</td>
<td>8 m</td>
</tr>
<tr>
<td>0 to 400 mm</td>
<td>12 m</td>
</tr>
</tbody>
</table>

NOTE: Limited to 18 m as per the limitations of this Acceptable Solution.
**Figure 53: Flashing for small pipes**

Paragraphs 8.3.10, 8.4.17, 9.6.8.5 and 9.6.9.6

**NOTE:**
1. Max. roof pitch for this flashing 45°, minimum pitch 10° if base of flange covers one or more complete troughs.
2. For pipes up to 80 mm diameter.

**Figure 54: Soaker flashing for pipe penetrations**

Paragraph 8.4.17

**NOTE:**
1. Suitable for pipes from 86 mm to 500 mm diameter.
2. Suitable only for roof pitches of 10° or more.

Soaker flashing to be fully supported by roofing under - refer Figure 21

Lines of roof penetration

- refer Table 7

Separate roofing sheet over

EPDM flexible boot flashing screw fixed and sealed to metal soaker flashing. Fit Neoprene washers under screws

- refer Table 7

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NOTE: 
(1) Suitable for penetrations up to 1200 mm wide.
(2) Suitable only for roof pitches of 10° or higher.

Figure 55: Soaker flashing for other penetrations
Paragraph 8.4.17, Table 17
8.5 Membrane Roofs and Decks

8.5.1 Limitations
This Acceptable Solution is limited to membranes composed of butyl or EPDM installed over plywood substrates for:

a) Roofs with a minimum fall of 2° (1:30),
b) Decks with:
   i) a minimum fall of 1.5° (1:40),
   ii) a maximum area of 40 m²,
   iii) no steps in level within deck area except into gutters,
   iv) no integral roof gardens, and
   v) no downpipe direct discharge to deck,
c) Internal gutters with a minimum fall of 1 in 100, with no cross seams in the gutters, and

d) Decks with removable raised surfaces to give level access as shown in Figure 17A.

The application of directly applied wearing or decorative surfaces to membranes is not covered in this Acceptable Solution.

COMMENT:
EPDM and butyl rubber membranes are subject to damage when on trafficable roof-decks. A suitable wearing surface will help reduce such damage.

8.5.2 General
Closed-in construction spaces under membrane roofs and decks require adequate ventilation to prevent the accumulation of moisture under the membrane. Maintain a minimum gap of 20 mm between the underside of the substrate and any insulation, and for membrane roofs greater than 40 m², refer to manufacturer’s details for roof cavity vents and/or substrate vent requirements.

8.5.3 Plywood substrates
Plywood shall be:

a) A minimum of 17 mm complying with AS/NZS 2269,
b) At least CD Grade Structural plywood with the sanded C face upwards, and
c) H3 with treatment type compatible with membrane and adhesives used, and kiln dried after treatment.

COMMENT:
The compatibility of LOSP-treated timber must be checked with membrane suppliers.

If using plywood containing copper-based preservatives, check the compatibility of adhesives and membranes with copper with the product manufacturers.

8.5.4 Butyl and EPDM
Butyl rubber and EPDM rubber sheet and system components used for membrane roofing or decks shall:

a) Be a minimum thickness of:
   i) 1 mm for roofing, or
   ii) 1.5 mm for decks, and

b) Comply with the following parts of Table 1 in ASTM D6134:
   i) tensile strength,
   ii) elongation,
   iii) water absorption,
   iv) water vapour permeance, and
   v) heat aging followed by:
      a. tensile strength
      b. elongation, and

c) Have adhesives, primers, seam tapes and pre-formed components where supplied by the manufacturer that:
   i) comply with BRANZ EM 5, and
   ii) are part of a complete system approved by the manufacturer or supplier of the membrane.
8.5.5 Installation

8.5.5.1 Plywood

Substrates must be dry when membranes are applied. The plywood and timber substructure must be a maximum moisture content of 20% when a membrane is adhered.

**COMMENT:**
This will generally require substrates to be covered to prevent rain wetting, or to be pre-primed to avoid moisture uptake.

Manufacturers’ recommendations should be consulted, as some require a lower moisture content in order to validate guarantees.

Plywood substrates shall be fixed according to the following requirements:

a) Panels shall be laid with staggered joints (brick bond),

b) Panels shall be laid with the face grain at right angles to the main supports,

c) Supports in b) shall be at 400 mm maximum centres,

d) The edge of sheets shall be supported with dwangs or framing,

e) External edges shall be chamfered with a minimum radius of 5 mm,

f) A 20 mm H3.2 triangular fillet shall be used at the base of any 90° upstand, and

g) Shall be fixed:

i) with 3 mm gaps between all sheets,

ii) using 10 g x 50 mm stainless steel countersunk head screws,

iii) at 150 mm centres on edges, and

iv) at 200 mm centres in the body of the sheets.

8.5.5.2 Butyl and EPDM

Seam tapes shall be used on all joints of:

a) Roofs or decks with falls less than 5° (1:12),

c) Penetrations through the membrane where butyl or EPDM flashing is required,

d) EPDM membrane, and

e) Butyl membranes that contain EPDM.

**COMMENT:**
Coloured butyl membranes contain EPDM, which makes them more difficult to adhere properly.

Seams should be aligned parallel to the fall of the deck to minimise ponding.

Where a penetration is made through the membrane subsequent to laying, the flashing should be installed by the applicator of the membrane system.

All joints in the plywood and junctions of plywood with other materials shall have 25 mm polyethylene release tape applied before application of the membrane.

8.5.6 Roof and deck drainage

Membrane roofs and decks shall be constructed to provide:

a) Falls as shown in Figure 56 and details in Figures 57–64

b) A minimum of 100 mm below an adjoining threshold as shown in Figure 62

c) Membrane upstands against all walls, parapets, or enclosed balustrades extending to a minimum level of 150 mm above deck level as shown in Figure 62.

**COMMENT:**
If the clearance of the cladding from the deck or roof surface is at the minimum of 35 mm, give an overlap of 115 mm to the cladding.

d) Water discharging either:

i) into a roof or gutter outlet with a minimum diameter of 75 mm as shown in Figure 64 with either:

- an overflow as shown in Figure 63 (c) or

- an extra outlet, with both outlets sized to take the full required capacity.

or,
ii) via a scupper, into a gutter, or rainwater head, as shown in Figure 63 (a), (b) and (d).

e) Gutters formed with continuous butyl or EPDM strip complying with Paragraph 4.3.9, with no cross-joints.

COMMENT:
Refer to E1/AS1 for specific drainage requirements outside the scope of this Acceptable Solution.

Seams in gutters are particularly difficult to form at outlets through enclosed balustrade walls, and the risk of failure is high. Failure of a seam can result in damage to underlying walls.

8.5.7 Control joints

All control joints in the substrate shall be accommodated in the membrane roof design.

The design of control joints for membrane roofing is subject to specific design and is outside the scope of this Acceptable Solution.
8.5.8 Junctions

All junctions of roof or deck to walls, parapets and enclosed balustrades shall be made weathertight using the following appropriate details:

a) Figure 57: External corner in upstands,
b) Figure 58: Internal corner in upstands,
c) Figure 61: Verges and eaves,
d) Figure 62: Junctions of decks and walls, and
e) Drainage details to Paragraph 8.5.6.

8.5.8.1 Junctions with walls

Junctions of membrane decks or walls shall be formed as shown in Figure 62.

The bottom of the wall cladding above the deck or roof surface shall be sealed prior to fixing.

8.5.9 Penetrations

Penetrations through membrane roofs and decks shall be as shown in Figure 59 and Figure 60.
8.5.9.1 Handrails

Fixing of posts for handrails into membrane roofs or decks is not covered by this Acceptable Solution.

**COMMENT:**
Any fixing of posts into membrane roofs or decks will require specific design.

The fixing of posts into tiles over a membrane is particularly risky, and should be avoided.

8.5.10 Gutters

Deck gutters and internal outlets shall be constructed as shown in Figure 64.

**COMMENT:**
Internal outlets should have a dome-type cover to reduce risk of blockage, except where this could constitute a pedestrian hazard.
Figure 62: Junctions with walls for membrane
Paragraph 7.4.3, Figure 56

NOTE: (1) Internal corners to be formed as shown in Figure 58.
(2) Dimensions are shown to membrane. However, where there is an additional material applied over the membrane, all dimensions shall apply to the highest level of the wearing surface.
Figure 63: Rainwater head and scupper opening in membrane
Paragraph 8.5.6, Figure 56

NOTE: (1) Use preformed scuppers where provided by the membrane supplier.
(2) External corners of scupper opening to be formed as shown in Figure 57.

Continuous membrane dressed through opening with upper edges sealed against cladding. Return over rainwater head at sides.

Cavity battens with base closure and drip edge to cladding at opening.

Continuous membrane dressed through base and upper edges sealed against cladding. Return along back of rainwater head.

Return membrane into rainwater head.

Membrane dressed over 50x50 mm aluminium angle rebated into substrate.

Opening plus 100 mm min.

Return membrane at end of lip.

Rainwater head and downpipe.

Overflow below opening level, 1.5 x cross section area of downpipe.

(a) DECK OUTLET

Refer to cladding for cavity finish.

Continuous membrane dressed through base and upper edges of opening.

Membrane turned over lip.

50x50 mm aluminium angle drip edge rebated into substrate.

(b) OUTLET THROUGH WALL

Line of membrane lapped 50 mm min. behind wrap under cladding.

Outlet through wall.

Membrane roof on substrate.

(c) OVERFLOW

50 mm lip.

(d) SECTION A - A

Membrane roof on substrate.
Figure 64: Gutters and outlets in membrane

Paragraphs 8.5.6 and 8.5.10

(a) TYPICAL ROOF OUTLET

Rebate flange into substrate
Low point
Blocking to support all edges of the opening
Minimum 75 mm roof outlet
Proprietary roof outlet with membrane clamped by screw fixed grate or dome
Membrane on substrate

(b) EDGE GUTTER

Minimum gutter width 300 mm
Cladding overlap min. 50 mm
35 mm min. Fall
High point of deck
Gutter depth min. 50 mm
High point of gutter
Gutter fall min. 1:100
Proprietary roof outlet with membrane clamped by screw fixed grate or dome

(c) CENTRAL GUTTER

300 mm minimum Fall
Gutter depth min. 50 mm
Gutter fall min. 1:100
Proprietary roof outlet with membrane clamped by screw fixed grate or dome
9.0 Wall Claddings

9.1 General

Wall claddings shall meet the requirements of NZBC E2.3.2 to E2.3.7, and comply with the provisions of Paragraph 9.1.1 to Paragraph 9.9.

Claddings in Extra High wind zones require:

a) Rigid underlays to Paragraph 9.1.7.2
b) Drained cavities to Paragraph 9.1.8
c) Hooks and hems on flashing upstands, and additional 25 mm height to Paragraph 4.6.

9.1.1 Limitations

This Acceptable Solution is limited to the wall cladding systems listed in Paragraph 3.3. Table 3 lists wall cladding systems that shall be used for buildings with varying risk scores.

The method of establishing the level of risk associated with the use of a specific wall cladding is given in Paragraph 3.1. Based on this risk score, a wall cladding may require the inclusion of a drained cavity as described in Paragraph 9.1.8.

Claddings in Extra High wind zones require rigid underlays and drained cavities – refer to Table 3.

9.1.2 Maintenance

Maintenance of wall claddings shall be carried out as necessary to achieve the expected durability of the material – refer to Paragraph 2.5.

9.1.3 Bottom of cladding

Separations, clearances to ground level, and overlaps shall be as shown in Figure 65 and Table 18.

Clearances to roof claddings and decks shall be minimum 35 mm – refer to Table 7 and Figure 18.

Clearances shall be measured to:

a) The finished plane of any adjacent horizontal surface, or

b) The top surface of any adjacent sloped or horizontal apron flashing.

COMMENT:

This keeps the bottom edge of the cladding dry, and allows cleaning and painting of the bottom surfaces.

Table 18: Minimum clearances

<table>
<thead>
<tr>
<th>Minimum clearances (mm)</th>
<th>Masonry veneer</th>
<th>Other claddings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Concrete slab</td>
<td>100</td>
<td>150</td>
</tr>
<tr>
<td>Timber floor (Refer Note 1)</td>
<td>100</td>
<td>175</td>
</tr>
</tbody>
</table>

NOTE: 1) Refer to NZS 3604 for requirements.
2) Cladding to extend minimum 50 mm below bearer or lowest part of timber floor framing.

9.1.3.1 Concrete slabs

Slab levels shall be set to allow reinstatement of final landscaped ground levels as outlined in Figure 65 and Table 18.

COMMENT:

NZS 3604 may require greater ground clearances depending on floor type and materials.

The likely final landscaped ground levels are to be taken into account when planning foundations and earthworks to avoid reductions to the minimum ground clearances in the finished building.

9.1.3.2 Masonry veneer clearances

The height of the floor slab above finished ground level shall be in accordance with Figure 73D and as shown in Table 18.
9.1.3.3 Bottom of wall claddings for concrete ground slabs (except masonry veneer)

At concrete slab level, the base of the cladding system shall be as shown in Table 18, and:

a) Finish a minimum of:
   i) 100 mm above a paved surface, or
   ii) 175 mm above finished unpaved surface,

b) Overlap the concrete slab by 50 mm, and
c) Be offset horizontally by a minimum of 6 mm for direct fixed claddings to prevent capillary action.

9.1.3.4 Garages and openings to garages

Refer to Figure 65 and Table 18 for overall level change requirements.

COMMENT:

This paragraph does not apply to garages that are detached outbuildings.

Garage spaces within, or attached to, the building envelope shall have:

a) Openings provided with a 50 mm minimum total level change between the interior and the exterior paving,

COMMENT:

Methods for achieving the required step may include:
- A 50 mm difference in finished ground level adjacent to the opening, or
- A raised threshold at the opening, or
- Concrete nibs at the opening.

b) Provision to drain water away from the threshold of the opening
c) Rigid wall underlays, to Table 23, where external garage walls are unlined
d) Linings to garage walls adjoining habitable spaces
e) Weather resisting garage doors
f) Window and door details (where included) to Paragraphs 9.2 to 9.9.

9.1.3.5 Bottom of wall claddings for timber floor framing

Suspended timber floors shall meet the requirements of NZS 3604. Clearances from paved and unpaved surfaces to the wall framing shall be in accordance with NZS 3604, and Table 18.

At ground floor level, the base of the cladding system shall:

a) Overlap the timber floor structure by 50 mm minimum, and
b) For walls with direct fixed claddings, be offset horizontally from a concrete foundation wall by a minimum of 6 mm
c) Have no direct connection between subfloor spaces and drained cavities.

COMMENT:

Where claddings require drained cavities, care must be taken to ensure air from the subfloor space cannot enter the cavity. This is important, as moisture levels in subfloor air can be high.

9.1.4 Barriers to airflow

This Acceptable Solution requires external walls to have barriers to airflow, in the form of:

a) Interior linings with all joints stopped for wind zones up to Very High, or
b) Rigid underlays (and drained cavities) for buildings in Extra High wind zones – refer to Paragraph 9.1.7.2
c) Where walls are not lined, such as attic spaces at gable ends, an air barrier complying with Table 23, fixed to framing prior to fixing cladding or cavity battens
d) For attached garages, underlays to Paragraph 9.1.3.4.
COMMENT:
The primary function of air barriers and air seals is to moderate airflows at junctions and inside the wall cavity.
Airflows in certain weather conditions encourage significant amounts of water to move along their path, and it is therefore important to manage airflow in cavity walls with barriers and air seals.
In the absence of internal linings, an air barrier is required to support wind pressures at locations such as gable ends and unlined garage spaces. Air pressure drop is not always across the internal lining, indicating the wall underlay acts as an air barrier as well.

9.1.5 Wall underlays to wall openings
Prior to window or door installation:
a) Flexible wall underlay shall be cut and dressed into all sides of openings as per Figure 72A and B,
b) Flexible flashing tape shall be applied to head and sill framing as shown in Figures 72A and 72B. Flexible flashing tape shall:
   i) comply with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148, and
   ii) be compatible with the wall underlay.

COMMENT:
Dressing the wall underlay around the framing timber and providing a flexible air seal limits airflows around the window reveal.
The flexible flashing tape keeps any water that does get past the cladding, or through the joinery, from direct contact with the timber.

9.1.6 Air seals
Window, door and other penetration openings shall be provided with flexible air seals to minimise the risk of airflows carrying water into the building wall. The air seal shall be:
a) Provided between the reveal or frame and the wrapped opening (for example of use, refer to Figure 81),
b) Installed over a closed cell polyethylene foam (PEF) backing rod, or similar
c) Made of:
   i) self-expanding polyurethane foam, or
   ii) sealant complying with:
      a. Type F, Class 20LM or 25LM of ISO 11600, or
      b. low modulus Type II Class A of Federal Specification TT-S-00230C.

COMMENT:
Some sealants can react with bitumen based flashing tape, preventing full curing of the sealant. Where necessary, consult sealant manufacturers for application requirements.
Backing rods are used for sealant and for self-expanding polyurethane foam as there is a danger foam will expand to the outside of the wall and form a moisture bridge to the interior.
For further information refer to ASTM C1330 for backing rod material performance.

9.1.7 Wall underlay
9.1.7.1 Flexible wall underlays shall be in accordance with Table 23, and shall:
a) Be run horizontally,
b) Have upper sheets lapped over lower sheets to ensure that direction of laps will allow water to be shed to outside of the wall underlay,
c) Be lapped not less than 75 mm at horizontal joints,
d) Be lapped not less than 150 mm over studs at vertical joints,
e) Extend 35 mm below bottom plate or bearer,
f) Be restrained from bulging into a drained cavity. Refer to Paragraph 9.1.8.5.

9.1.7.2 Rigid wall underlays, in association with drained cavities (including direct fixed corrugated profiled metal), are required in Extra High wind zones. Refer to Table 3 and Table 23. Rigid underlays are also required to external walls of attached garages that are unlined. Refer Paragraphs 1.1.1 and 9.1.3.4 c).
Rigid wall underlays shall be in accordance with Table 23, and shall:
a) Be minimum 7 mm H3 plywood, or 6 mm fibre cement sheet
b) Be installed with sheet edges fixed over solid framing
c) Be over-fixed with a flexible wall underlay from Table 23 and installed as in Paragraph 9.1.7.1

COMMENT:
Some proprietary systems may not require the addition of a flexible underlay
d) Have flexible underlay folded into opening reveals as in Paragraph 9.1.5 a)
e) Have cavity battens at maximum 600 mm centres
f) Be finish flushed with underside of bottom plate or bearer.
COMMENT:
External air pressures in higher wind zones can transfer to interior linings, and exceed recommended loadings prescribed by some lining manufacturers. Rigid underlays will protect linings from undue air pressure loadings, and help ensure cavity depths are maintained for the proper functioning of the drained cavity.

9.1.8 Drained cavities
Based on the risk score for an external wall calculated as per Paragraph 3.1, a wall cladding may require the inclusion of a drained cavity. Where a drained cavity is required, it shall meet the requirements of Paragraphs 9.1.8 to 9.1.9.4.

COMMENT:
Cavities manage occasional ingress of water past the cladding, but should not act as gutters or drains.

9.1.8.1 Limitations
This Acceptable Solution is limited to systems where:

a) Cavity battens are fixed, by the cladding fixings, to the wall framing,

b) Claddings are fixed through the cavity battens into the wall framing, and

c) The drained cavity behind claddings, except in masonry veneer, is not vented at the top.

Systems where the cladding is fixed into the cavity batten only are outside the scope of this Acceptable Solution.

9.1.8.2 Requirements
Where a drained cavity is required, it shall:

a) Be installed over a wall underlay, either flexible or rigid, that:
   i) complies with Table 23, and
   ii) is fixed to wall framing,

b) Be formed using vertical cavity battens,

c) Restrict air movement between the drained cavity and:
   i) floor, wall and roof framing,
   ii) attic roof space, and
   iii) subfloor space,

d) Be drained and open to the exterior at the bottom of cavities,

e) Use vermin-proofing at the cavity base as per Paragraph 9.1.8.3 and Figure 66,

f) Use cavity spacers as shown in Figure 67, where fixing is required between cavity battens. Alternative cavity spacers to those described in Paragraph 9.1.8.2 are permitted. Refer to Paragraph 9.1.8.4 f).

COMMENT:
Solid horizontal cavity spacers risk obstruction of air flow in cavities and risk bridging moisture across the cavity.
9.1.8.3 Vermin-proofing

Vermin-proofing shall be provided above window and door heads and at the base of the drained cavity. Figure 66 provides one example of an appropriate cavity closer.

Aluminium, stainless steel or uPVC in accordance with Paragraph 4.1 shall be used where vermin-proofing material is not readily accessible or replaceable.

Vermin-proofing shall:

a) Provide holes or slots between 3 mm and 5 mm,  
b) Provide an area of opening of 1000 mm² per lineal metre of wall, and  
c) Be positioned to allow a minimum drip edge to the wall cladding:
   i) 10 mm at the base of walls, and  
   ii) 15 mm above window and door head flashings.

COMMENT:
It is important the openings in vermin-proofing are kept clear and unobstructed in order to maintain draining and venting of the cavity. The closure shown is only one option for vermin-proofing. Provided openings are as specified, other dimensions can vary, so allowing the use of other shapes such as channels and right-angles.

9.1.8.4 Cavity battens and jamb battens

Cavity battens shall:

a) Be nominal 20 mm (between limits of 18 mm and 25 mm in thickness),  
b) Be a minimum 45 mm wide,  
c) Be fixed, by the cladding fixings, through the wall underlay into the framing,  
d) If timber, comply with B2/AS1,  
e) If polystyrene, comply with Paragraph 9.9.3.1, and be protected from any incompatible vapours from timber treatment.

Cavity battens and/or cavity spacers that meet E2/VM1 Class 1 testing and B2/AS1, permit air circulation are allowed. The Class 1 test must include a horizontal cladding joint supported on a cavity spacer batten of a proposed type.

Jamb battens shall:

f) be nominal 20 mm (between limits of 18 mm and 25 mm in thickness), minimum 45 mm wide, and of timber complying with B2/AS1. Refer to Figure 72A.

9.1.8.5 Wall framing behind cavities

Dwangs shall be at a maximum of 1350 mm centres generally and maximum 480 mm centres for direct-fixed vertical weatherboard profiles, and vertical metal corrugated and symmetrical trapezoidal claddings.

Where stud spacings are greater than 450 mm, and flexible wall underlays only are used, an intermediate means of restraining the flexible wall underlay and insulation from bulging into the drained cavity shall be installed. Acceptable means of achieving this are by using:

a) 75 mm galvanized mesh or wire galvanized in accordance with AS/NZS 4534,  
b) Polypropylene tape or galvanized wire at 300 mm centres fixed horizontally and drawn taut, or  
c) Vertical cavity battens at 300 mm centres maximum.

9.1.9 Penetrations

9.1.9.1 Penetrations through cavities

Window penetrations through cavities shall meet the requirements of Paragraph 9.2 to Paragraph 9.9.

9.1.9.2 Other cavity penetrations

Where penetrations of the wall cladding are wider than the cavity batten spacing, allowance shall be made for air flow between adjacent cavities by leaving a minimum gap of 10 mm between the bottom of the vertical cavity batten and the flashing to the opening.

9.1.9.3 Pipes and service penetrations

Pipes and service penetrations shall be made weathertight by using methods shown in Figures 68 and 69. Flashing tape complying with Paragraph 4.3.11, and sealant complying with:

a) Type F, Class 20LM or 25LM of ISO 11600, or  
b) low modulus Type II Class A of Federal Specification TT-S-00230C.
COMMENT:
Where possible, pipe penetrations, meterboxes and similar penetrations should be located in sheltered areas of the building, such as a porch, or be installed behind a weatherproof glazed panel.
9.1.9.4 Inter-storey junctions

Inter-storey junctions in claddings over drained cavities shall be formed for walls:

a) Up to a maximum of two storeys or 7 metres in height, as shown for the specific wall claddings in Paragraph 9.2 to Paragraph 9.9, or

b) Over two storeys or 7 metres by using an inter-storey flashing bridging the drained cavity as shown in Figure 70.

COMMENT:
A drained cavity height is limited to manage the moisture handled by the cavity before it is directed to the outside.

9.1.10 Windows and doors

Windows and doors shall comply with the requirements of NZS 4211, and reveals shall comply with NZS 3602. Flashings shall comply with Paragraph 4.0. Window details specific to particular claddings are given in Paragraph 9.2 to Paragraph 9.9. Door details shall be based on window details and shown in Figures 17A–D.

After installation, the flange forming the window or door facing shall have an overlap to the surrounding cladding material or associated back flashings of:

a) For jambs – 10 mm minimum

b) For sills – 8 mm minimum.

9.1.10.1 Scope

This Acceptable Solution is limited to aluminium window and door joinery that:

a) Has horizontal window and door heads only

b) Has maximum frame dimensions of 5000 mm wide or 5000 mm high, and a maximum overall frame area, for any one frame, of 13.5 m², or

c) For sills to floor level, has maximum width of 6 m and maximum overall frame area is 16 m².
COMMENT:
Sloped heads require specifically designed kick-out flashings at bottom edges of head flashings.

Where width outlined in Paragraph 9.1.10.1 are beyond the limits for sill and head trimmer framing in NZS 3604 specific engineering design of the framing is required.

Certain aluminium joinery sections and installation requirements may not be able to meet the details of this Acceptable Solution, especially in regard to window facing cover, sill support, window fixing, and sill flashing requirements. The window details in these cases require specific design.

9.1.10.2 Treatment of opening

a) Treatment of the window openings for direct fixed wall claddings shall be as shown in Figure 72A.

b) For direct fixed claddings, windows and doors shall have a 5 mm stand-off of the flange to the cladding to allow for air intrusion to the trim cavity for pressure equalisation. Note that this gap is sealed or trimmed down the jambs, but left open along the sill.

c) Window openings for wall claddings over drained cavities shall be as shown in Figure 72B. Note there shall be no sill flashing.

d) For cavity fixed claddings, windows and doors shall finish against the cladding, except for flat fibre cement and ply claddings that require a 5 mm stand-off to allow for sealant weather seals between facings and cladding – eg, Figure 116.

e) Materials for flashings shall be selected from Paragraph 4.0, Table 7, and Table 20.

9.1.10.3 Window and door heads

Windows and doors shall include head flashings, finished to the wall underlay as shown in Figure 71, by either using flexible flashing tape, or lapping an additional layer of wall underlay over the upstand. The additional wall underlay shall extend to the top of the wall, or to the nearest lap above, and be lapped under the top layer.
9.1.10.4 Head flashings

Head flashings shall be in accordance with Paragraph 4.6.1.6 and Table 7, unless specifically shown otherwise, and shall:

a) Direct water to the outside of the wall cladding, and

b) Finish to the window head with clearance dimensions shown in Figure 71

c) For direct fixed claddings, have 50 mm bead of sealant installed between cladding and each end of the head flashing

d) For wall claddings on cavity walls:

   i) incorporate 10 mm turn-ups as stop-ends, terminating at the inside face of the cladding so they do not pass through the cladding, and

   ii) permit ventilation of the drained cavities above, by the installation of cavity base closers as shown in Figure 66.

e) For Very High and Extra High wind zones, have sealant installed between underside of head flashing and top edge of window head flange – refer Figure 71 (c).

   COMMENT:
   Stopends are useful to prevent water moving past the ends of head flashings. However, additional problems of weatherproofing occur where the stopend penetrates the cladding.

9.1.10.5 Window and door sills

a) Direct fixed claddings shall have

   i) sill tray flashings as shown in Paragraphs 9.2 to 9.9 for each cladding type. The sill flashing shall extend back past the condensation channel of the window. Ensure flat sill trays do not slope backwards. The 5 mm gap between the window facing and sill tray must not be sealed.

   ii) direct fixed door sills, installed as for windows, and as shown in Figure 17D.

b) Claddings over a drained cavity shall have:

   i) window sills as shown in Paragraphs 9.2 to 9.9, without sill flashings

   iv) door sills as shown in Figure 17C.

   v) Sill support bars and mechanisms for all doors, and for windows with a trim opening wider than 600 mm. Support bars and mechanisms shall comply with BRANZ Evaluation Method EM6, E2/VM1 and B2/AS1. Support bars and mechanisms must be installed prior to installation of the window or door.

   COMMENT
   Support bars and mechanisms are rated for their capacity to support the total weight of a joinery unit when installed at given offsets from the frame depending on cladding type. Designers select the an appropriate complying support mechanism for the joinery weight. Manufacturers provide build-in instructions for support bars and mechanisms.

   c) Mitred aluminium window and door sills, for both cavity and direct fixed, shall have a corner soaker fitted to the back of the sill/jamb joint and installed at point of manufacture. The soaker will be designed to act as a secondary device to prevent water ingress to the building in support of the primary mitre seals. Soaker materials shall be either uPVC, aluminium, polypropylene, high impact styrene or other semi rigid moulded polymeric material.

   Sill support bars and mechanisms must be designed to not impede the possible drainage of water from surfaces of sill flashing tape, and permit an air passage (of at least 1000 mm²/m sill width) from the drained cavity to the window/door trim cavity.

9.1.10.6 Window and door jambs

Jamb flashings shall be installed as shown in Paragraphs 9.2 to 9.9.

Where required, jamb flashings shall overlap sill flashings, and direct moisture to the outside face of the cladding system.
9.1.10.7 Closed cell foam tape
Compressible foam tape shown behind window facings and cladding joints shall be closed cell PVC foam, with:
- a) Hardness 55-60 to ASTM D2240 Scale OO,
- b) Grade VE-43 to ASTM D1667,
- c) Compression set of 20% maximum to ASTM D1667, and
- d) UV weathering in UV Weatherometer for 1500 light hours to ASTM G154 or ASTM G155 with no visible deterioration in appearance.

9.1.10.8 Attachments for windows and doors
Install windows and doors using pairs of minimum 75 x 3.15 galvanised jolt head nails or 8 gauge x 65 mm stainless steel screws, through reveals into surrounding framing at:
- a) Maximum 450 mm centres along sills, jambs and heads, and
- b) Maximum 150 mm from reveal ends.
Install packers between reveals and framing at all fixing points, except between head reveals and lintels.

Figure 72A: General window and door opening for direct fixed
Paragraphs 9.1.5, 9.1.10.2, Figures 81, 82, 83, 84, 90, 95 and 115

NOTE:
1. Detailed cladding omitted for clarity, refer to specific claddings.
2. Sill flashing shall extend back past the condensation channel of the window.
3. Head to be treated similarly with continuous building underlay and flexible tape at corners.
4. Refer individual cladding details for jamb flashings and sill tray return requirements.
Figure 72B: General window and door opening with drainage cavity


NOTE:
(1) Detailed cladding omitted for clarity, refer to specific claddings.
(2) Head to be treated similarly with continuous wall underlay and flexible tape at corners.
(3) Refer individual cladding details for jamb flashings.

100 mm min. turn-up to flexible tape

Sill support bar - refer 9.1.10.5 b)

Wall underlay turned into opening over framing

Flexible tape turned out 50 mm min. over underlay

100 mm max.

50 mm min. lap

Flexible tape full width of opening over underlay

Wall underlay turned into opening

Cavity batten

Line of cladding
9.2 Masonry Veneer

9.2.1 Limitations
This Acceptable Solution is limited to masonry veneer cladding attached to timber wall framing outlined in NZS 3604. Masonry veneer is either:

a) Clay brick, or
b) Concrete brick or block.

COMMENT:
Natural stone bricks or blocks may be suitable. However, they are not part of this Acceptable Solution. Refer to the manufacturer’s recommendations for specific design information.

Refer to Paragraph 1.5 for qualification of installers.

9.2.2 General
1) The materials and workmanship of masonry veneer shall be in accordance with SNZ HB 4236 and have a maximum mass of veneer of 220 kg/m² and minimum veneer thickness of 70 mm
2) Masonry units shall be laid-up in running bond
3) Mortar, materials (cement, sand and admixtures) shall comply with NZS 4210
4) Mortar joints less than 24 hours old shall not be subject to vibration, such as would result from the nailing of interior linings

9.2.3 Installation
Masonry veneer construction shall be as shown in Figure 73B, and have:

a) A maximum height of veneer above adjacent finished ground level of 7 m.

b) A maximum height of veneer of 4.0 m, measured from the top of the concrete masonry wall, foundation wall or slab edge foundation. In the case of a veneer faced concrete block wall or foundation wall height is measured from the top of that wall.

b) A maximum height of veneer of 5.5 m on a gable end wall.

d) A minimum wall or panel width of 230 mm.

Note: The bracing demand for framing supporting masonry veneer is determined from values listed in NZS 3604.

COMMENT:
Refer to Paragraph 1.5 for qualification of installers

9.2.4 Flashings
1) Sill and head flashings shall be as described in Paragraph 4.3 and be either:

a) 1.5 mm butyl rubber– refer to Paragraph 4.3.9
b) 2 ply asphaltic pliable waterproofing membrane – refer to Paragraph 4.3.10

c) Pliable polyethylene minimum 0.5 mm thick complying with DPC/DPM Table 23.

2) Jamb flashings shall be:

d) 2 ply asphaltic pliable waterproofing membrane complying with AS/NZS 2904
e) Pliable polyethylene minimum 0.5 mm thick complying with DPC/DPM Table 23.

COMMENT:
For further information refer to ASTM C1330 for backing rod material performance.
Figure 73B: Masonry veneer height limitations
Paragraph 9.2.3

(a) 1 STOREY
(b) 2 STOREY ON MASONRY
(c) 2 STOREY VENEER
(d) 1 STOREY WITH PART STOREY
**Figure 73C: Masonry veneer window and door installation**

Paragraphs 9.2.4, 9.2.6 and 9.2.9

- **Masonry wall tie**
- **Head flashing turned into angle or flat steel lintel. Extend flashing 200 mm each side of opening**
- **Drainage holes in masonry veneer**
- **Steel lintel**
- **Sealant**
- **Flexible flashing tape over wall underlay behind sill flashing**
- **Window sill, do not seal to masonry sill**
- **Masonry or tile sill, cantilevered or flush, with min. 15° slope. Refer Paragraph 9.2.6 e).**

**NOTE:**
1. Window profile to be selected to achieve cover shown in details.
2. Architraves are shown for consistency only, detail may be used with rebated liner.
3. Window support brackets required conforming with EM6 and Paragraph 9.1.10.5 not shown on detail, refer Figure 72B.

- **Sill vents to Paragraph 9.2.6**
- **Air seal**
- **Packers**
- **Wall underlay**
- **Jamb flashing**
- **Line of masonry wall tie**
- **Line of head and sill flashings extended 200 mm each side of opening**

- **Additional wall underlay lapped over flashing**
- **Wall underlay**
- **Air seal**
- **Temporary packers, if required, are to be removed after fixing**
- **Frame block**
- **Sill support bar**
- **Sill flashing with drip edge, extend 200 mm each side of window**
- **H3.2 timber kick-out fillet**
- **Masonry wall tie**

**Errata 2 Dec 2011**

**Amend 5 Aug 2011**
Figure 73D: Masonry Veneer Details

Paragraph 9.2.5

(h) MASONRY VENEER - DOOR SILL

- Turn-up flashing tape 100 mm min. against trimmer studs
- Packer to suit
- Air seal
- Floor finishes

(i) MASONRY VENEER - FLOOR REBATE DETAIL

- Timber frame
- Wall underlay

(j) MASONRY VENEER - MASONRY BELOW GROUND

- Timber frame
- Wall underlay
- Damp proof course

- Masonry veneer
- Masonry veneer wall ties. Refer Table 18B
- Drainage/vent openings
- 100 mm min. to paved ground, 150 mm min. to unpaved ground
- 25 mm min. to paved ground, 100 mm min. to unpaved ground
- 0 - 20 mm overhang

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Acceptable Solution E2/AS1

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Figure 73E: Masonry veneer details
Paragraphs 9.2.5 and 9.2.6

(k) MASONRY VENEER - ABOVE GROUND SUPPORT

(l) MASONRY VENEER - SOFFIT DETAIL

(m) MASONRY VENEER - CANTILEVER UPPER FLOOR
9.2.5 Foundation support and damp proofing

1) Masonry veneer shall be supported by one, or a combination of the following:
   a) Concrete of masonry foundation wall
   b) Thickened slab edge footing
   c) Concrete or masonry lower storey wall.

2) The level of the concrete slab above ground shall comply with Figure 65.

3) The top of a foundation wall or concrete slab shall be stepped down, so that the surface supporting the veneer is 50 mm or more below the surface supporting the timber framing.

4) Provide a damp-proof course to the stepped rebates supporting masonry veneer adjacent to all habitable spaces and garages attached to habitable spaces. This includes stepped rebates in foundations, or on top of concrete or concrete masonry walls supporting veneers. Damp-proofing material shall be as outlined in Table 23 and be either:
   a) For rebates lower than ground floor level:
      i) two coats of bituminous liquid, or
      ii) 1.0 mm butyl rubber or bituminous sheet, or
      iii) 0.25 mm polythene or polyethylene damp-proof membrane.
   b) For rebates above ground floor level:
      i) 1.0 mm butyl rubber or bituminous sheet, or
      ii) 0.25 mm polythene or polyethylene damp-proof membrane.

5) Lap joints in flashings minimum of 150 mm.

6) Dimension rebates to accommodate the required cavity width in Paragraph 9.2.6 and the thickness of the veneer so that the veneer is supported within the tolerances outlined in Figures 73D and E.

9.2.6 Cavities

Paragraphs 9.1.8.2(a), 9.1.8.5, and 9.1.9.3 shall apply to masonry veneer cavities.

a) The clear width of cavity between the masonry veneer and the exterior face of the wall underlay or bracing attaching to timber framing shall not be less than 40 mm or more than 75 mm wide measured at any part of the cavity.

COMMENT:
It is important to maintain the minimum cavity width of 40 mm after allowing for construction tolerances and thicknesses of wall underlays and sheet bracing.

b) Pipes and services shall not be placed in the cavity other than passing directly through the cavity to the exterior.

c) The cavity shall be drained and vented to outside at the bottom of wall panels, and above openings by open perpends that:
   i) are a minimum of 75 mm in height, by the width of the vertical mortar joint
   ii) at centres not exceeding 800 mm (where drainage/weep holes are less than 75 mm high, decrease spacing to give a ventilation area of 1000 mm²/m wall length)
   iii) are fitted with vermin proofing where gaps greater than 13 mm exist.

d) The cavity shall be ventilated to the outside at the top of walls by either similar vents as at the bottom, or a continuous 5 mm minimum gap between the top course and soffit board, with a cover bead to outside that maintains a minimum 2 mm gap to masonry – refer to Figure 73E(l).

e) The cavity shall be vented under openings exceeding 2.4 metres wide through gaps in perpends positioned at 1/3 points along the opening except at opening ends. Where these vent openings are used, protect from water entry using cantilevered sill bricks, as shown in Figure 73C (f).

f) The cavity shall be sealed off from the floor and roof space.
EXTERNAL MOISTURE

Acceptable Solution E2/AS1

9.2.7 Wall ties

Masonry veneer shall be attached to wall framing by wall ties. Wall ties and their spacings and embedment shall be in accordance with the requirements of NZS 4210 and Tables 18A, 18B and 18C. Screw fixings shall be minimum 12 gauge, 35 mm long hex washer face, galvanised or stainless steel to suit the ties required under Table 18C.

Table 18A: Specification of maximum tie spacings for type B (4) veneer ties

<table>
<thead>
<tr>
<th>Seismic zone</th>
<th>Masonry veneer less than 180 kg/m²</th>
<th>Masonry veneer 180 – 220 kg/m²</th>
<th>Masonry veneer more than 220 kg/m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tie type</td>
<td>Maximum spacings (1)</td>
<td>Tie type</td>
<td>Maximum spacings (1)</td>
</tr>
<tr>
<td>(4)(5)</td>
<td>Horizontal</td>
<td>Vertical</td>
<td>(4)(5)</td>
</tr>
<tr>
<td>1</td>
<td>EL</td>
<td>600</td>
<td>400</td>
</tr>
<tr>
<td>2 (6)</td>
<td>EM</td>
<td>600</td>
<td>400</td>
</tr>
<tr>
<td>3</td>
<td>EH (3)</td>
<td>600</td>
<td>400</td>
</tr>
<tr>
<td>4</td>
<td>SED (2)</td>
<td>SED (2)</td>
<td>SED (2)</td>
</tr>
</tbody>
</table>

NOTES:
1. Maximum masonry tie spacings of 600 mm horizontally and 400 mm vertically.
2. Spacing of ties to be determined by specific engineering design.
3. EM may be used if the horizontal spacings do not exceed 400 mm and the vertical spacings do not exceed 300 mm.
4. Type B and Prefix E indicate masonry ties manufactured to AS/NZS 2699.1.
5. L (Light), M (Medium), H (High) indicate strength capability of ties in AS/NZS 2699.1.
6. Use seismic zone 2 (minimum) for Christchurch region comprising Christchurch City, Waimakariri District and Selwyn District.

9.2.5 Placement of wall ties

<table>
<thead>
<tr>
<th>Location</th>
<th>Placement of masonry ties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsupported panel sides and edges of openings</td>
<td>Within 300 mm of panel side or edge.</td>
</tr>
<tr>
<td>Top of veneer panels and top of panels under openings</td>
<td>Within 300 mm or two courses (whichever is the smaller) of top of veneer</td>
</tr>
<tr>
<td>Bottom of veneer panel in masonry rebate sealed with liquid applied damp-proof course</td>
<td>Within 300 mm or two courses (whichever is the smaller) from bottom of veneer</td>
</tr>
<tr>
<td>Bottom of veneer panel supported on steel angle lintel</td>
<td>In each of the first two courses</td>
</tr>
</tbody>
</table>

NOTES:
Ties are to be screw fixed (ie. non-impact method) using screws outlined in Table 24.
9.2.7.1 Wall ties and screws shall be determined by the durability zone outlined in NZS 3604 and as outlined in Table 18C.

Control joints shall be formed as shown in Figure 73A and comprise:

a) A backer rod of compressible foam, and
b) Sealant in compliance with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

9.2.8 Control joints

9.2.8.1 Clay bricks

Control joints in clay brick masonry veneer are not required, unless specified by the brick manufacturer.

9.2.8.2 Concrete bricks

Longitudinal shrinkage stresses in concrete masonry veneer shall be controlled by providing vertical control joints at not more than 6 m centres.

Vertical control joints shall be located:
(a) Within 600 mm of T joints
(b) Within 600 mm of L shaped corners or by restricting the spacing to the next control joint to 3.2 m maximum
(c) At changes in wall height, exceeding 600 mm
(d) At changes in wall thickness.

Control joints shall be formed as shown in Figure 73A and comprise:

a) A backer rod of compressible foam, and
b) Sealant in compliance with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

9.2.9 Openings in masonry veneer

Openings with masonry veneer above shall be spanned by steel angle lintels.

Openings in masonry veneer for meter boxes less than 500 mm wide may be installed without lintel bars or head flashings provided the meter box is sealed to wall underlay with flashing tape to Paragraph 4.3.11.

Separate steel meter boxes from direct contact with masonry veneer or mortar with flashing tape to Paragraph 4.3.11.

Lintels shall:

a) Be protected against corrosion as in Table 18D and to exposure zones outlined in NZS 3604.

b) Have a minimum seating into adjacent veneer of:
   i) 100 mm for spans up to, and including 2 m,
   ii) 200 mm for spans over 2 m.

c) Be sized in accordance with Table 18E.
9.2.10 Windows and doors

The openings in wall framing for windows and doors shall have flexible flashing tape applied, in accordance with Paragraph 9.1.5.

Air seals shall be provided in accordance with Paragraph 9.1.6.

Window flashings shall be installed in accordance with Paragraph 9.2.4 and Figures 73C and 73D(h).

9.2.11 Secondary cladding

Where a secondary cladding is used with the masonry veneer, and is direct fixed to framing above windows or at gable ends, this shall be fully sealed on:

a) The face of the cladding,

b) All edges of the cladding, and

c) A 75 mm minimum perimeter strip on the rear of the cladding.

### Table 18E: Masonry veneer lintel sizes (minimum)

<table>
<thead>
<tr>
<th>Span of lintel (m) up to:</th>
<th>Maximum thickness of masonry veneer (mm)</th>
<th>Maximum height of veneer supported (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>70</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>350</td>
<td>350</td>
</tr>
<tr>
<td></td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>2000</td>
</tr>
<tr>
<td>0.800</td>
<td>60 x 60 x 6 L</td>
<td>60 x 60 x 6 L</td>
</tr>
<tr>
<td></td>
<td>60 x 60 x 6 L</td>
<td>60 x 60 x 6 L</td>
</tr>
<tr>
<td></td>
<td>60 x 80 x 6 L</td>
<td>60 x 80 x 6 L</td>
</tr>
<tr>
<td></td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
</tr>
<tr>
<td>2.000</td>
<td>60 x 60 x 6 L</td>
<td>60 x 60 x 6 L</td>
</tr>
<tr>
<td></td>
<td>60 x 60 x 6 L</td>
<td>60 x 60 x 6 L</td>
</tr>
<tr>
<td></td>
<td>60 x 80 x 6 L</td>
<td>60 x 80 x 6 L</td>
</tr>
<tr>
<td></td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
</tr>
<tr>
<td>2.500</td>
<td>60 x 60 x 6 L</td>
<td>60 x 60 x 6 L</td>
</tr>
<tr>
<td></td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
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<tr>
<td></td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
</tr>
<tr>
<td>3.000</td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
</tr>
<tr>
<td></td>
<td>125 x 75 x 6 L</td>
<td>125 x 75 x 6 L</td>
</tr>
<tr>
<td></td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
</tr>
<tr>
<td></td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
</tr>
<tr>
<td>3.500</td>
<td>80 x 80 x 6 L</td>
<td>80 x 80 x 6 L</td>
</tr>
<tr>
<td></td>
<td>125 x 75 x 6 L</td>
<td>125 x 75 x 6 L</td>
</tr>
<tr>
<td></td>
<td>80 x 80 x 8 L</td>
<td>80 x 80 x 8 L</td>
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<tr>
<td></td>
<td>90 x 90 x 10 L</td>
<td>90 x 90 x 10 L</td>
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<td>4.000</td>
<td>80 x 80 x 8 L</td>
<td>125 x 75 x 6 L</td>
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<td>125 x 75 x 10 L</td>
<td>125 x 75 x 10 L</td>
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<td>125 x 75 x 10 L</td>
</tr>
<tr>
<td>4.800</td>
<td>125 x 75 x 6 L</td>
<td>125 x 75 x 10 L</td>
</tr>
<tr>
<td></td>
<td>125 x 75 x 10 L</td>
<td>125 x 75 x 10 L</td>
</tr>
</tbody>
</table>

Amend 5 Aug 2011
9.3 Stucco

9.3.1 Limitations
This Acceptable Solution is limited to the following types of stucco cladding:
(a) Solid plaster cladding with a non-rigid backing and a drained cavity, and
(b) Solid plaster cladding with a rigid backing and a drained cavity. Refer to Figure 74

9.3.2 Structure
The timber framing of external walls supporting stucco wall claddings shall comply with NZS 3604 and NZS 4251. The cladding system shall be attached to the wall framing. The framing for buildings using stucco exterior cladding systems shall be supported on a:
(a) Concrete slab-on-ground, or
(b) Continuous reinforced concrete foundation wall, or
(c) Reinforced concrete masonry foundation wall.

9.3.3 Stucco cladding system
All stucco claddings shall be used over a drained cavity as described in Paragraph 9.1.8, and shown in Figure 74.

9.3.3.1 All stucco cladding shall have wall underlay as specified in Table 23 and Paragraphs 9.1.5–9.1.7, and shall be:
(a) Fixed to the framing as specified in Table 23, and
(b) Provided as an overlay to rigid backings to provide a slip layer that permits the independent movement of plaster and backing.

9.3.3.2 Have plaster backing installed as in Paragraphs 9.3.5 and 9.3.6.

9.3.3.3 Have metal lath reinforcements for stucco plaster attached through the plaster backing as described in Table 24.

9.3.4 Installation
9.3.4.1 General
COMMENT:
Refer to Paragraph 1.5 for qualification of installers.
Activities that will cause impact or vibration during plaster application are not permitted until all plastering is completed and fully cured.
The materials, proportions, mixes, thickness, reinforcement materials and fixing, control joints, and application and curing of plaster shall comply with NZS 4251.

9.3.4.2 Movement control joints
Movement control joints shall be as required in NZS 4251.
9.3.5 Non-rigid plaster backings

9.3.5.1 Installation of wall underlays

The wall underlay shall be in accordance with Table 23, and as described in Paragraphs 9.1.5–9.1.7.

9.3.6 Rigid plaster backings

Rigid backings shall be made of either:

a) Plywood, or

b) Fibre cement sheet, and

Have slip layers to Paragraph 9.3.3 b).

Backing sheets shall be no more than 3 mm out of plane at the time of plastering.

9.3.6.1 Plywood backing

Plywood shall be:

a) Selected from Table 6 of NZS 4251,

b) H3 treated as per AS/NZS 2269, and

c) Fixed as specified in Clause 4.2.4.4.2 of NZS 4251, except that nails shall:

i) be 2.8 mm in diameter, and

ii) penetrate framing by 35 mm minimum.

9.3.6.2 Fibre cement sheet backing

Fibre cement shall:

a) Comply with AS/NZS 2908: Part 2,

b) Be a minimum of 4.5 mm thick,

c) Span no more than 600 mm centres between cavity battens, and

d) Be fixed as specified in Clause 4.2.4.5.2 of NZS 4251, except that nails shall:

i) be 2.8 mm in diameter, and

ii) penetrate framing by 35 mm minimum.

COMMENT:

When the sheathing is used as bracing, the nailing patterns are subject to specific design, and the use of tested and rated systems.

9.3.7 Finishes

All stucco surfaces shall be sealed by applying a minimum of a 2-coat latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

COMMENT:

Stucco cladding systems cannot be assumed to be completely weatherproof.

It is necessary to ensure that corrosive salts are not carried into the plaster by moisture, causing corrosion of the reinforcing and fixings.

9.3.8 Bottom of stucco

The bottom of stucco wall cladding shall be in accordance with Paragraph 9.1.3, and as shown in Figure 75.

9.3.9 Parapets and enclosed balustrades

Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall be in accordance with Paragraph 7.4.

Parapets and enclosed balustrades for stucco cladding shall be capped with metal, butyl or EPDM membrane, complying with the requirements of Paragraph 4.0.

9.3.10 Windows and doors

Windows and doors shall comply with Paragraph 9.1.10, as shown in Figure 76.
Figure 75: Bottom of stucco cladding
Paragraph 9.3.8

NOTE: 6 mm offset of framing to foundation is not necessary where drained cavities are used.
Figure 76: Windows and doors in stucco cladding

Paragraph 9.3.10, Figure 72B

NOTE:

1. Window profile to be selected to achieve cover shown in details.

2. Architraves are shown for consistency only, detail may be used with rebated liner.

3. Sill support bar required conforming with EM6 and Paragraph 9.1.10.5. refer Figure 72B.

4. Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones.
9.4 Timber Weatherboards

Timber weatherboard claddings shall be either direct fixed to framing over a wall underlay or fixed over a drained cavity as described in Paragraph 9.1.8.

Based on the risk score for an external wall calculated as per Paragraph 3.1, the weatherboard cladding may require the inclusion of a drained cavity.

9.4.1 Limitations

9.4.1.1 Weatherboard profiles

This Acceptable Solution is limited to the following types of timber weatherboards:

a) Horizontal bevel-back,
b) Horizontal rebated bevel-back,
c) Horizontal rusticated,
d) Vertical shiplap, and
e) Vertical board and batten.

Profiles shall be as given in NZS 3617 or BRANZ Bulletin 411.

9.4.1.2 Vertical weatherboards

This Acceptable Solution is limited to the use of direct fixed vertical weatherboards in risk categories as shown in Table 3.

COMMENT:

Vertical weatherboards are not used over cavities because of the need for horizontal battens, which if solid would interfere with a drained cavity.

Vertical weatherboards are therefore limited to low risk applications.

9.4.1.3 Horizontal weatherboards

Horizontal weatherboards shall be either direct fixed or fixed over a drained cavity, according to the risk categories as shown in Table 3.

9.4.2 Materials

Timber weatherboard cladding shall include the following features:

a) Wall underlay complying with Table 23 and Paragraphs 9.1.5–9.1.7, and
b) Timber selection and treatment of weatherboards in accordance with NZS 3602.

9.4.3 Installation

A building underlay complying with Table 23 shall be installed behind:

a) All direct fixed timber weatherboards, or
b) Cavity battens for timber weatherboards installed over a drained cavity.

COMMENT:

Refer to Paragraph 1.5 for qualification of installers.

9.4.3.1 Fixings

Fixings shall comply with Tables 20 and 24.

Timber weatherboards shall be drilled for nailing at all joints and ends. All cut ends of painted weatherboards shall be primed.

9.4.4 Horizontal weatherboards

9.4.4.1 Horizontal laps

Laps shall be:

a) 32 mm for non-rebated bevel-back boards, or
b) 25 mm horizontal lap for rebated bevel-back and rusticated boards, with a minimum gap of 2 mm at the overlap between boards.

9.4.4.2 Joints

Joints shall be made only over supports and have:

a) Corrosion-resistant soakers fitted, complying with Paragraph 4.3.2 to Paragraph 4.3.8, or
b) Scarf or splay joints.

9.4.4.3 Fixings

Boards shall be fixed through the wall underlay to the framing in accordance with Table 24.
9.4.4.4 External corners

External corners shall be weatherproofed by one of the following methods:

a) For rusticated and bevel-back weatherboards, corner boxes with:
   i) scribes for bevel-back weatherboards, as shown in Figure 78, or
   ii) plugs or scribes for rusticated weatherboards, as shown in Figure 78,

b) For bevel-back weatherboards:
   i) mitred joints with back flashing as shown in Figure 78, or
   ii) mitred joints with corrosion-resistant soakers – refer to Paragraphs 4.3.2 to 4.3.6 and Figure 77.

9.4.4.5 Internal corners

Internal corners shall be made weathertight as shown in Figure 79. A corrosion-resistant flashing shall be fitted behind weatherboards at all internal corners as shown in Figure 79.
Figure 78: External corners for horizontal weatherboards
Paragraph 9.4.4.4

(a) DIRECT FIX BOXED EXTERNAL CORNER
- Min. ex 25 mm cover boards with 6x6 mm weathergrooves
- Scribe cut to fit. Sealant to back of scribe & face of weatherboard joint
- Timber horizontal weatherboards

(b) DIRECT FIX MITRED EXTERNAL CORNER
- Min. ex 25 mm cover boards with 6x6 mm weathergrooves
- Scribe to suit weatherboard profile and sealed to corner battens and weatherboards
- For rusticated weatherboards, scribes may be replaced with plugs
- Tight mitred joint to horizontal weatherboards

(c) CAVITY BOXED EXTERNAL CORNER
- Cavity battens
- Wall underlay

(d) CAVITY MITRED EXTERNAL CORNER
- 50x50 mm corner flashing over wall underlay
- Cavity battens
- Wall underlay
9.4.5 Vertical weatherboards

Vertical shiplap and board and batten weatherboards shall be in continuous lengths over a storey height.

9.4.5.1 Laps

a) Vertical shiplap weatherboards shall be fitted with a minimum gap of 2 mm at the overlap between boards.

b) Board and batten weatherboards shall:
   i) be fitted with a 5 mm to 8 mm gap between boards, and
   ii) have weather grooves to boards and battens aligned.

9.4.5.2 Fixings

Vertical weatherboards shall be fixed to dwangs at 480 mm maximum centres in accordance with Table 24.

9.4.5.3 Corners

a) External corners

External corners shall be weatherproofed by the use of corner facings as shown in Figure 79.

b) Internal corners

A corrosion-resistant corner flashing, as per Table 7 and Figure 79, shall be fitted behind the weatherboards at all internal corners.
9.4.6 Windows and doors in direct fixed weatherboards

Window and door details for:

a) Direct fixed bevel-back weatherboards are shown in Figure 81,
b) Direct fixed rusticated weatherboards are shown in Figure 82,
c) Vertical shiplap weatherboards are shown in Figure 83,
d) Vertical board and batten weatherboards are shown in Figure 84.

Door sill details are as shown in Figure 17D.

9.4.7 Windows and doors in cavity walls

Window and door details for bevel-back weatherboards on a drained cavity shall be as shown in Figure 85.

Window and door details for rusticated weatherboards on a drained cavity are shown in Figure 86.

Door sill details are as shown in Figure 17C.

COMMENT:
The junctions around windows are critical, and it is important that responsibility is taken for the weathertightness of the window as installed within exterior walls.

Care should be taken to ensure that this responsibility is clearly defined and assigned. One way is to clearly specify that the window manufacturer shall be responsible for the supply and installation of flashings and frames into openings.

Figure 80: External corners for vertical weatherboards
Paragraph 9.4.5.3

NOTE: Corner battens shall be sized to provide 50 mm minimum cover over cladding.
Figure 81: Windows and doors for direct fixed bevel-back weatherboards

Paragraph 9.4.6

Wall underlay dressed into opening with flexible flashing tape installed over wrap to corners at head

Air seal

Temporary packers if required are to be removed after fixing

8 mm min. packer

Air seal

Flashing tape over wall underlay

Additional wall underlay from overlap above lapped over flashing

Bevel-back weatherboard

35 mm min. cover

10 mm min. cover

Head flashing with 15° fall

50 mm long sealant strip at both ends of flashing. Refer Figure 71

Sill flashing to extend behind line of aluminium frame, with 8 mm min. upstand to back and sloping end dams. Refer Figure 72A

Frame block

8 mm min. joinery cover to flashing

35 mm min. flashing cover

5 mm gap without seal

Horizontal batten under window as necessary to suit profile

Bevel-back weatherboard

NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with related liners.
(3) Refer Figure 72A for wrapping of framed opening prior to window installation.

H 3.1 20mm jamb battens finish clear of sill flashing

Wall underlay dressed into opening with flexible flashing tape installed over underlay

Bevel-back weatherboard

Scriber to suit weatherboard profile, sealed to weatherboards

Line of head flashing over

20 mm min.

10 mm min. cover

Line of sill flashing under

Cut slot in cladding for sill flashing

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Figure 82: Windows and doors for direct fixed rusticated weatherboards
Paragraph 9.4.6

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NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Refer Figure 72A for wrapping of framed opening prior to window installation.
Figure 83: Windows and doors for direct fixed vertical shiplap weatherboards
Paragraph 9.4.6

NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only. Detail may be used with rebated liner.
(3) Refer Figure 72A for wrapping of framed opening prior to window installation.

ALTERNATIVES:
(1) If recess in board occurs at window, fit closure piece.
(2) Scribes or facing boards may be appropriate depending on board layout.
Figure 84: Windows and doors for direct fixed board and batten weatherboards
Paragraph 9.4.6

- Additional wall underlay from overlap above lapped over flashing
- Vertical board and batten
- Butt vertical cladding battens to horizontal cladding batten where used
- 35 mm min. cover to flashing
- 10 mm min. cover to joinery
- 50 mm long sealant strip at both ends of flashing. Refer Figure 71
- Head flashing with 15° fall
- Sill flashing to extend behind line of aluminium frame, with 8 mm min. upstand to back and sloping end dams. Refer Figure 72A
- Frame block
- 8 mm min. joinery cover to flashing
- 35 mm min. flashing cover
- Gap without seal
- Horizontal batten under window
- Board and batten cladding

NOTE:
1. Window profile to be selected to achieve cover shown in details,
2. Architraves are shown for consistency only, detail may be used with rebated liner,
3. Refer Figure 72A for wrapping of framed opening prior to window installation.

- Additional text and details as per diagram.

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Figure 85: Windows and doors for bevel-back weatherboards on cavity
Paragraph 9.4.7

(a) HEAD

- Cavity battens
- Wall underlay dressed into opening with flexible flashing tape installed over wrap to corners at head
- 35 mm min. flashing cover
- Additional wall underlay from overlap above tapped over flashing
- Bevel-back weatherboard cladding, block behind as necessary for support
- Cavity base closer positioned to give 15 mm min. drip edge to cladding
- 15 mm min.
- 10 mm min. joinery cover
- Head flashing with 15° fall
- Stoppers to head flashing to finish at back of cladding

(b) SILL

- Frame block
- Sill support bar
- Packers
- Air seal
- Horizontal batten under window as necessary to suit profile
- Bevel-back weatherboard cladding
- Wall underlay and flexible flashing tape
- Cavity battens
- 8 mm min. cover

(c) JAMB

- Wall underlay dressed into opening with flexible flashing tape installed over underlay
- Cavity battens
- Bevel-back weatherboard cladding
- Air seal
- Packers
- Scriber sealed to weatherboards
- 20 mm min. extension
- Line of head flashing over
- 10 mm min. cover

NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Sill support bar required conforming with EM6 and Paragraph 9.1.10.5, refer Figure 72B.
(4) Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones.
Figure 86: Windows and doors for rusticated weatherboards on cavity

Paragraph 9.4.7

- Cavity battens
- Cavity base closer positioned to give 15 mm min. drip edge to cladding
- Wall underlay dressed into opening with flexible flashing tape installed over wrap to corners at head
- Air seal
- Temporary packers if required are to be removed after fixing
- Head flashing with 15° fall

NOTE: Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones

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9.4.8 Parapets and enclosed balustrades

Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall be in accordance with Paragraph 7.4.

9.4.9 Finishes

Where a protective finish is required by NZS 3602, all timber surfaces, including end grain and laps, shall be sealed by priming.

Two coats of exterior grade paint shall be applied, after priming, to all exposed surfaces. Paint systems shall comply with any of Parts 7, 8, 9 or 10 of AS 3730.

COMMENT:

The minimum durability period for protective coatings is 5 years. Improvement in durability and stability of weatherboards can be achieved by priming all surfaces including backs of boards.

Manufacturers of coatings which have a proven performance in use may be able to show compliance with NZBC B2 Durability as detailed in B2/VM1 as an alternative to compliance with AS 3730.

With tangentially-sawn weatherboards, particularly painted or stained in dark colours, cupping is possible. Providing additional fixings may help restrain the board, but will usually result in splitting of the boards.
9.5 Fibre Cement Weatherboards

Fibre cement weatherboard claddings shall be either direct fixed to framing over a wall underlay, or fixed over a drained cavity as described in Paragraph 9.1.8.

Based on the risk score for an external wall, calculated as per Paragraph 3.1, the fibre cement weatherboard cladding may require the inclusion of a drained cavity.

9.5.1 Limitations

This Acceptable Solution is limited to flat fibre cement weatherboards, with a minimum thickness of 7.5 mm.

9.5.2 Material performance

Fibre cement weatherboards shall comply with AS/NZS 2908: Part 2.

9.5.3 Installation

A wall underlay, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, shall be installed behind fibre cement weatherboard claddings.

COMMENT:

Refer to Paragraph 1.5 for qualification of installers.

9.5.3.1 Fixings

Fibre cement weatherboards shall be fixed through the wall underlay to the framing at maximum 600 mm centres as per Table 24.

9.5.3.2 Laps and joints

Horizontal laps shall be a minimum of 30 mm.

Joints shall be:

a) Positioned between studs,

b) Staggered at a minimum of 600 mm from joints in the adjacent boards, and

c) Weatherproofed by:

i) uPVC H jointers as shown in Figure 87, or

ii) hidden soakers as shown in Figure 87, with sealant used between ends of boards complying with:

a. Type F, Class 20LM or 25LM of ISO 11600, or

b. low modulus Type II Class A of Federal Specification TT-S-00230C.

Figure 87: Joints in fibre cement weatherboards
Paragraph 9.5.3.2

[Diagram showing fibre cement weatherboard installation with annotations for metal back soaker and uPVC joint]
9.5.3.3 External corners
External corners shall be weatherproofed as shown in Figure 88 by:

a) The use of corrosion-resistant soakers complying with Paragraph 4.2.2 to Paragraph 4.3.6, or
b) Facings with weathergrooves.

9.5.3.4 Internal corners
Internal corners shall be weatherproofed by metal corner flashings as shown in Figure 89.

9.5.4 Windows and doors
Windows and doors shall be installed in accordance with Paragraph 9.1.10.

9.5.4.1 Windows and doors – direct fixed
For direct fixed fibre cement weatherboards, windows and doors shall be detailed as shown in Figure 90 and Figure 17D.

9.5.4.2 Windows – on cavity
For fibre cement weatherboards fixed over a drained cavity, windows and doors shall be detailed as shown in Figure 91 and Figure 17C.

9.5.5 Parapets and enclosed balustrades
Parapets shall be in accordance with Paragraph 6.0. Enclosed balustrades shall be in accordance with Paragraph 7.4.

9.5.6 Protective coating
The exposed faces, including top edges at sills and all bottom edges, of horizontal fibre cement weatherboards shall be finished with a minimum of a 2-coat latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.
Figure 89: Aluminium corners in fibre cement weatherboards
Paragraph 9.5.3.4

NOTE: Corner details for cavity walls are similar.

- Studs
- One piece corner flashing with hems - refer Figure 79(b)
- Wall underlay
- Fibre cement weatherboard
Figure 90: Windows and doors in fibre cement direct fixed weatherboards

Paragraph 9.5.4.1

NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Refer Figure 72A for wrapping of framed opening prior to window installation.

(a) HEAD

- Additional wall underlay from overlap above lapped over flashing
- Fibre cement weatherboard
- Timber or fibre cement packer
- Sheet fixing nails
- Head flashing
- Min. 15° slope
- 35 mm min. cover
- 50 mm long sealant strip at both ends of flashing. Refer Figure 71

(b) SILL

- Sill flashing to extend behind line of aluminium frame, with 8 mm min. upstand to back and sloping end dams. Refer Figure 72A
- Frame block
- Gap without seal
- 8 mm min. joinery cover to flashing
- 35 mm min. flashing cover
- Sheet fixing nails
- Wall underlay
- Fibre cement weatherboard
- H 3.1 20mm jamb batters finish clear of sill flashing

(c) JAMB

- Air seal
- Packers
- Line of sill flashing under
- Cut slot for sill flashing
- Wall underlay dressed into opening with flexible flashing tape installed over underlay to corners at head
- Timber scriber sealed to cladding
- Line of head flashing over
- 20 mm min.
- 10 mm min. cover
Figure 91: Windows and doors in fibre cement weatherboards on cavity
Paragraph 9.5.4.2

(a) HEAD

Additional wall underlay from overlap above lapped over flashing
Fibre cement weatherboard
Timber or fibre cement packer
Sheet fixing nails
Cavity base closer positioned to give 15 mm min. drip edge to cladding
Stopends to head flashing

NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Sill support bar required conforming with EM8 and Paragraph 9.1.0.5, refer Figure 72B.
(4) Refer Figure 72B for wrapping of framed opening prior to window installation.
(5) Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones.

(b) SILL

Packers
Air seal
Frame block
Shear support bar
8 mm min. jointery cover to weatherboard
Sheet fixing nails
Fibre cement sheet
Wall underlay

(c) JAMB

Cavity battens
Fibre cement weatherboard cladding
Timber scribe line
Line of head flashing over

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9.6 Profiled Metal Wall Cladding

**Horizontal profiled** metal wall cladding shall be fixed over a drained cavity as described in Paragraph 9.1.8.

**Vertical profiled** metal wall cladding shall be direct fixed to framing over a roof underlay. Refer to Table 3: Suitable wall claddings.

### 9.6.1 Limitations

This Acceptable Solution is limited to corrugated or trapezoidal metal wall cladding with the profiles, as shown in Figure 38, and applied as outlined in Table 3.

### 9.6.2 General

**COMMENT:**
Refer to Paragraph 1.5 for qualification of installers.

### 9.6.3 Materials

#### 9.6.3.1 Choice of metal

The metal cladding shall be selected according to the exposure conditions in Table 20 as defined in:

a) NZS 3604, or

b) AS/NZS 2728.

**COMMENT:**
The exposure zone in which a building is located can affect the durability of flashings.

Exposure zones are defined in NZS 3604, based on the likely exposure to wind-driven sea-salt. Corrosion due to geothermal or corrosive industrial atmospheres, as defined in NZS 3604, requires specific design.

Exposure zones are based on AS/NZS 2728. AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

#### 9.6.3.2 Steel

Materials for the manufacture of profiled steel cladding shall:

a) Have a BMT of 0.4 mm minimum,

b) Be grade G550, or G300 for curved and crimped cladding

c) Be selected for corrosion protection according to the intended exposure zone as shown in Table 20.

#### 9.6.3.3 Aluminium

Aluminium for the manufacture of profiled aluminium wall cladding shall comply with AS/NZS 1734, and be:

a) A base metal thickness (BMT) of a minimum of 0.7 mm,

b) Minimum 5000 series.

For pre-painted aluminium, a factory-applied finish complying with AS/NZS 2728 shall be applied.

### 9.6.4 Maintenance

Refer to Paragraph 2.5.
9.6.5 Profiles
Profiles covered in this Acceptable Solution are:

a) Corrugated – curved with a minimum crest height of 16.5 mm minimum, and

b) Trapezoidal – symmetrical and asymmetrical with a minimum crest height of 19 mm.

For details of these profiles, refer to Figure 38.

9.6.6 Fixing
The cladding shall be screw-fixed through the troughs and battens, where applicable, into the framing. Fixings shall:

a) Be minimum 12-gauge hexagonal head, self-drilling wood screws,

b) Penetrate the framing by a minimum of 30 mm,

c) Be minimum Class 4 to AS 3566: Part 2, selected from Table 20,

d) Under-flashings shall be fixed to framing at 600 mm maximum centres.

e) Flashings shall be fixed together at junctions at 50 mm maximum centres or to cladding at 900 mm centres with:

i) for galvanized steel, 4 mm diameter monel metal or stainless steel rivets, where compatible as per Table 21, or

ii) for aluminium-zinc coated steel, 4 mm diameter aluminium rivets, or

iii) for aluminium, 4 mm diameter aluminium rivets.

9.6.7 Flashings
Flashings used with metal wall cladding shall be in accordance with Paragraph 4.0, and with the following requirements:

a) Hooks and hems shall be as shown in Figure 5,

b) Have joints formed with laps and sealant as shown in Figure 6,

c) Where shown, sealant shall be neutral cure, complying with:

i) Type F, Class 20LM or 25LM of ISO 11600, or

ii) low modulus Type II Class A of Federal Specification TT-S-00230C,

d) Under-flashings shall be fixed to framing at 600 mm maximum centres.

e) Flashings shall be fixed together at junctions at 50 mm maximum centres or to cladding at 900 mm centres with:

i) for galvanized steel, 4 mm diameter monel metal or stainless steel rivets, where compatible as per Table 21, or

ii) for aluminium-zinc coated steel, 4 mm diameter aluminium rivets, or

iii) for aluminium, 4 mm diameter aluminium rivets.

9.6.8 Vertical profile – direct fixed
9.6.8.1 Installation
For direct fixed vertical profile, the wall underlay shall be in accordance with the properties listed for roof underlay in Table 23. For copper-based treated framing or underlay refer to Paragraph 9.6.9.2.

COMMENT:
In direct fixed metal cladding, the wall underlay will be in contact with the back of the vertical profiled metal cladding. Underlay is needed to separate treated timber from the back of the metal to minimise the risk of electrolytic corrosion.
9.6.8.2 Barges
Barge flashings shall be as shown in Figure 92.

9.6.8.3 Bottom of cladding
The bottom edge of the cladding shall overlap the foundation wall as described in Paragraph 9.1.3 and as shown in Figure 93.

9.6.8.4 Corners
Direct fixed vertical profiled metal wall cladding shall be over-flashed at external and internal corners as shown in Figure 94. The cover of the flashings shall:

a) Be dimensioned to suit the metal wall cladding profile,

b) Cover at least two crests for corrugated and single crests for other profiles, and

c) Terminate as shown in Figure 93.
9.6.8.5 Vertical profile: penetrations

Pipe penetrations shall be as per Figure 53. The heads of larger penetrations shall be flashed in similar fashion to Figure 69, with head flashings adjusted to suit the profile and other flashings as per window and door details in relevant paragraphs.

9.6.8.6 Vertical profile: windows and doors

Windows and doors in vertical profiled metal claddings shall be flashed as shown in Figure 95 and Figure 100.
Figure 95: Windows and doors for vertical profiled metal
Paragraph 9.6.8.6

Wall underlay dressed into opening with flexible flashing tape installed over wrap to corners at head

Air seal
Temporary packers if required are to be removed after fitting

8 mm min. packer
Flexible flashing tape over wall underlay for full width/depth of sill & 50 mm down face of wall underlay
Wall underlay

(a) HEAD

Screw fixing to stud (crest or trough fixing)
Additional wall underlay from overlap above lapped over flashing

10 mm min. cover
Head flashing with 15° fall
Stopends to head flashing
Line of jamb flashing
Sill flashing to extend behind line of aluminium frame, with 8 mm min. upstand to back and sloping end dams.
Refer Figure 72A
Frame block
5 mm gap do not seal this junction
8 mm min. cover
35 mm min. cover
Compressible foam seal
Screw fixing to stud clear of flexible flashing tape

NOTE:
(1) Window profile to be selected to achieve cover shown in detail.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Refer Figure 72A for wrapping of framed opening prior to window installation.
(4) Refer Figure 100 for sketch of flashings.
(5) Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones.

H3.1 20 mm jamb battens finish clear of sill flashing
Continuous compressible foam seal
Screw fixing to stud
Wall underlay on face of framing and carried into full width/depth of jamb
Fixing bracket
Prefomed sill flashing
Line of sill flashing behind

Air seal
Packers
Aluminum window

Line of sill flashing below
Continuous compressible foam strip seal

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9.6.9 Horizontal profiled metal on cavity

9.6.9.1 Installation

A wall underlay, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, shall be installed over the outside face of the framing.

9.6.9.2 Cavity battens

If the cavity batten contains copper (e.g. CCA, copper azole or ACQ), appropriate separation between the back of the cladding and the cavity batten shall be provided.

Examples of suitable separation are:

a) An additional layer of paper-based underlay, complying with Table 23, over cavity battens,

b) Strips of paper-based underlay complying with Table 23 on the face of cavity battens,

c) Pre-priming cavity battens.

9.6.9.3 Corners

Corners shall be weatherproofed by using the flashings and details shown in Figure 96.

Horizontal profiled metal wall cladding shall be under-flashed using butt flashings which shall:

a) Be formed in one shaped piece,

b) Allow metal cladding to butt, with a separation of 5 mm, against sides of the exposed flashing corner, and

c) Use profiled compressible foam to seal between the flashing underlap and underside of cladding.

---

**Figure 96: Corner flashings for horizontal profiled metal**

**Paragraph 9.6.9.3**

- (a) EXTERNAL CORNER FLASHING
- (b) INTERNAL CORNER FLASHING
- (c) EXTERNAL CORNER
- (d) INTERNAL CORNER
9.6.9.4 Barges

Barge flashings shall be as shown in Figure 97.

9.6.9.5 Bottom of cladding

The bottom edge of the cladding shall overlap the foundation wall as described in Paragraph 9.1.3 and as shown in Figure 98.

9.6.9.6 Horizontal profile: penetrations

All services penetrations through claddings shall be flashed and sealed. Pipe penetrations are shown in Figure 53.

The heads of larger penetrations shall be flashed in a similar fashion to Figure 69.

9.6.9.7 Horizontal profile: windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10, and as shown in Figure 99 and Figure 100.

9.6.9.8 Parapets and balustrades

Refer to Figures 101 and 102 for horizontal and vertical profiled metal. Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall comply with Paragraph 7.4.

COMMENT:
Side fixings of handrails or other attachments to enclosed balustrades or parapets will require specific design to demonstrate weathertightness, together with specific structural design for stanchion fixings.
Figure 99: Windows and doors for horizontal profiled metal on cavity

Paragraph 9.6.9.7

- Additional wall underlay from overlap above lapped over flashing.
- Screw fixing to stud through batten (crest or trough fixing).
- Cavity base closure positioned to give 15 mm min. drip edge to cladding.
- 10 mm min. cover
- Head flashing with 15° slope
- Stopends to head flashing
- Line of jamb flashing
- Line of cladding flattened under corrugation lap behind jamb flashing
- Aluminium window 8 mm min. cover
- 10° slope to sill flashing.
- End of sill flashing closed and scribed to suit cladding profile
- Rivet to secure sill flashing
- Screw fixing to stud
- Cavity spacers only as necessary for fixing
- NOTE:
  1. Window profile to be selected to achieve cover shown in details.
  2. Anchorage are shown for consistency only, detail may be used with related detail.
  3. SH support bar required conforming with EHB and Paragraph 9.1.10.5, refer Figure 72B.
  4. Refer Figure 72B for wrapping of framed opening prior to window installation.
  5. Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones

- Screw fixing to stud
- Vertical battens
- Cladding
- Continous compressible foam strip seal
- 5 mm gap
- 50 mm min. cover
- 10 mm min. cover

Temporary packers if required are to be removed after fixing.
Figure 100: Window and door flashings for profiled metal
Paragraphs 9.6.8.6 and 9.6.9.7, Figures 95 and 99

NOTE: (1) Detail (a) Direct fixed vertical profile: refer Figure 95 for window.
(2) Detail (b) Horizontal profile on cavity: refer Figure 99 for window.
(3) Wall underlay omitted for clarity.

Head flashing, form stopend to lap jamb flashing.
Rivet and seal

Jamb flashing shaped to lap
sill flashing, rivet and seal

Sill flashing with hem
and stopends

Form stopend to head flashing

Head flashing
extended and lapped
over jamb flashing

Rivet and seal face
and side of overlap

Flatten cladding behind
jamb flashing.
Horizontal lap in
cladding set out to
 coincide with sill heights

Jamb flashing

Sill flashing continuous
vertically behind head
flashing

Sill flashing continuous
behind jamb flashing

End of sill returned
and sorbed to cladding profile

(a) VERTICAL PROFILE

(b) HORIZONTAL PROFILE
Figure 101: Balustrade and parapet for vertical profiled metal
Paragraph 9.6.9.8

- No fixings in top of flashing
- 9 mm H3 ply packed to slope
- Compressible foam seal
- Underlay to provide separation of metal capping and timber
- Z - refer Table 7
- Capping flashing rivet fixed to cladding
- Birds beak as Paragraph 7.4.4
- Screw fix cladding
- Wall underlay
- Vertical profiled metal cladding - corrugated

Amend 2
Jul 2005

Amend 5
Aug 2011

Figure 102: Balustrade and parapet for horizontal profiled metal
Paragraph 9.6.9.8

- No fixings in top of flashing
- 9 mm H3 ply packed to slope
- Capping flashing rivet fixed to cladding
- Underlay to provide separation of metal capping and timber
- 2 corrugations min.
- Birds beak as Paragraph 7.4.4
- Screw fixing in crests or troughs
- Wall underlay
- Cavity batten
- Separation of metal cladding and batten
- (a) CORRUGATE CLADDING

- 9 mm H3 ply packed to slope
- 5° min. slope
- Underlay to provide separation of metal capping and timber
- 2 corrugations min.

- (b) TRAPEZOID CLADDING

Amend 5
Aug 2011

Figure 103 deleted
9.7 Fibre Cement Sheet

Fibre cement sheet claddings shall be either direct fixed to framing over a wall underlay or fixed over a drained cavity based on the risk score for an external wall, calculated as per Paragraph 3.1 and Table 3.

9.7.1 Limitations

This Acceptable Solution is limited to the following types of fibre cement sheet cladding systems:

a) Flush-finished systems over a drained cavity using sheets of 7.5 mm minimum thickness, with:
   i) fibre cement sheets manufactured with a rebated edge for this purpose,
   ii) if necessary for part sheets, rebated on site using a purpose-made tool, and
   iii) have all edges sealed,
   iv) joints, comprising a bedding compound and reinforcing tape, that are finished in accordance with Paragraph 9.7.10.4, or

b) Jointed systems in accordance with Paragraph 9.7.3 using sheets of 6 mm minimum thickness with:
   i) purpose-made jointers,
   ii) timber battens over joints.

9.7.2 Material and installation – both systems

Fibre cement shall comply with AS/NZS 2908: Part 2.

9.7.2.1 Installation

Install sheets with:

a) Paint seals to all sheet edges and cut edges, including 100 mm across back face from each edge

b) A wall underlay, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, installed behind fibre cement sheet cladding

c) Fixings as required in Table 24, installed through the wall underlay into the wall framing

d) All sheet joints located over solid framing.

COMMENT:

Refer to Paragraph 1.5 for qualification of installers.

Edge sealing can be improved by application of a second seal coating.

It is recommended that the applicator of the flush-finished jointing and coating be trained and approved by the supplier of the jointing and finish system.

9.7.3 Jointed systems

Jointed systems shall have:

a) Vertical joints with either:
   i) uPVC jointers – Figure 104A
   ii) timber battens – Figure 105A.

b) Internal corners:
   i) uPVC jointers – Figure 104B
   ii) timber battens – Figure 104B.

c) External corners
   i) timber battens – Figure 105.

d) Horizontal joints with either:
   i) 'Z' flashings, to Figure 107 for Direct fixed claddings
   ii) 'Z' flashings to Figure 108 for cavity fixed systems.

Flashings shall be either, uPVC, aluminium, stainless steel, or copper to Paragraph 4.3.

Timber battens shall comply with NZS 3602.
Figure 104A: Vertical uPVC joints for fibre cement sheet

Paragraph 9.7.3

Figure 104B: Internal corners for fibre cement sheet

Paragraph 9.7.3
NOTE:
(1) Fibre cement sheet to be sealed including all edges before fixing batten.
(2) Corner battens shall be sized to provide 50 mm minimum cover over cladding.

(a) SHEET JUNCTION DIRECT FIX

(b) SHEET JUNCTION CAVITY

(c) EXTERNAL CORNER DIRECT FIX

(d) EXTERNAL CORNER CAVITY

Figure 106 deleted
Figure 107: Horizontal joints for direct fixed fibre cement
Paragraph 9.7.3

Fibre cement sheet fixed to bottom plate. Do not fix to joist. Sheet edges sealed before fixing.

Wall underlay fitted over horizontal joint flashing

Perimeter joist

Sheet fixing nails

Flooring, finish 10 mm back from outside of framing

15 mm gap

Horizontal uPVC control joint flashing. Joint by uPVC jointer with 50 mm min. lap

Fibre cement sheet fixed to top plate. Do not fix to joist. Sheet edges sealed before fixing

Wall underlay under horizontal joint flashing to min. lap

Alternative sheet metal control joint flashing. Joint by lapping section min. 50 mm

Amend 5
Aug 2011
9.7.3.1 Paint finish
For jointed systems, all sheet edges shall be sealed prior to fixing. Fibre cement shall be finished with a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

9.7.4 Flush-finished systems
Flush-finished systems shall be constructed over a drained cavity outlined in Paragraph 9.1.8.

a) Flush-finished joints shall be finished with a textured finish system that:
   i) complies with BRANZ EM 4, when tested with the specific fibre cement substrate and jointing system used for the cladding
   ii) has all components approved by the supplier of the jointing and finish system
   iii) where a topcoat of paint over the finish is required to provide weather protection, is a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

b) Joints shall be positioned so that they:
   i) do not occur at corners of window or door openings or at changes in the height of a wall
   ii) are a minimum of 200 mm on either side of the jamb-line of an opening
   iii) detailed as shown in Figure 110.

c) External corners shall use uPVC corner reinforcement beneath tape and finishing compound as shown in Figure 113.

d) Internal corners shall use a sealant-filled joint over compressible foam tape as shown in Figure 111 b) with polyethylene bond breaker tape behind joint.
9.7.4.1 Control joints

Vertical control joints shall be located as shown in Table 19, and:

a) May occur at the edge of window or door openings,

b) Shall extend the full height of the wall, including where there is a horizontal joint and a vertical control joint on the wall – refer to Figure 111, and

c) May be staggered across horizontal control joints.

<table>
<thead>
<tr>
<th>Vertical control joints</th>
<th>Horizontal control joints</th>
</tr>
</thead>
<tbody>
<tr>
<td>5400 mm centres max.</td>
<td>5400 mm centres max.</td>
</tr>
<tr>
<td>(6000 mm allowed on walls that finish at an exterior corner)</td>
<td>(on dwangs between full-height, continuous studs)</td>
</tr>
<tr>
<td>All internal corners</td>
<td>All floor joist locations</td>
</tr>
</tbody>
</table>

NOTE: Non-flush-finished joints are control joints.

9.7.4.2 Finishes

Finish colour shall have a reflectance of 40% or more, as outlined in Paragraph 2.4.

9.7.5 Soffit details

Soffits shall be detailed as shown in Figure 114 for flush-finished and Figure 8A for jointed.

9.7.6 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10 and:

a) Direct fixed windows and doors shall be detailed as per Figure 115

b) Windows and doors on cavity shall be detailed as per Figure 116.

9.7.7 Parapets and enclosed balustrades

Parapets shall comply with Paragraph 6.0. Enclosed balustrades shall comply with Paragraph 7.4.

Balustrade cappings may include:

a) Metal, butyl or EPDM to Paragraph 6.3, or,

b) Flush-finished fibre cement to Paragraph 9.7.7.1 and Figure 117.

Figure 110: Flush-finished joints for fibre cement sheet

Paragraph 9.7.4

Tape reinforced flush jointing system

Fibre cement sheet with sheet edges sealed before fixing

Cavity batten

Wall underlay

Sheet fixing nails

NOTE: Fibre cement sheet used for this joint must be designed with recessed edge (site produced recesses to compatible sheets are permissible).
**NOTE:**

1. Fibre cement sheet to be sealed including all edges before fixing batten.
2. Do not apply paint over sealant. If texture coated, use polyethylene bond breaker tape.

---

**Figure 111:** Vertical movement control joint for flush-finished fibre cement sheet

Paragraph 9.7.4.1

(a) **SHEET JUNCTION CAVITY FIX**

- Silicone sealant
- Fibre cement sheet with sheet edges sealed before fixing
- Polyethylene bond breaker tape
- Sheet fixing nails
- Wall underlay
- Cavity battens
- Double stud well spiked

(b) **INTERNAL CORNER CAVITY FIX**

- Blocking or double stud required
- Sheet fixing nails
- Cavity battens
- Fibre cement sheet
- 50x50 mm corner flashing over wall underlay
- Silicone sealant. Must be compatible with coating
- Wall underlay continuous around corner

---

Figure 112 deleted
Figure 113: Flush-finished external corners for fibre cement sheet
Paragraph 9.7.4

- Wall underlay continuous around corner
- Cavity batten
- Silicone sealant to sheet gap. Must be compatible with flushing compound
- Recess to sheet edges
- Adhesive daub
- Flushing & finishing compound over reinforcing tape

**NOTE:**
1. Fibre cement sheet used for this joint must be designed with recessed edge (site produced recesses to compatible sheets are permissible).
2. Internal corners similar.

Figure 114: Soffit for flush-finished fibre cement sheet
Paragraph 9.7.5

- Offset nog to block airflow into roof space
- Silicone sealant or fix scotia bead
- Sheet fixing nails
- Cavity batten
- Wall underlay
- Wall framing
- Fibre cement sheet cladding with finishing coat

Amend 5 Aug 2011
Figure 115: Windows and doors for direct fixed fibre cement sheet
Paragraph 9.7.6

**Figure 115 a (HEAD):**
- Additional wall underlay from overlap above lapped over flashing
- Fibre cement sheet
- Sheet fixing nails
- 50 mm strip of sealant at both ends of flashing
- 35 mm min. cover to flashing
- 5 mm gap
- 10 mm min. cover to joinery
- Head flashing with 15° slope

**Figure 115 b (SILL):**
- Temporary packers if required are to be removed after fitting
- Air seal
- 8 mm min. packer
- Air seal
- Flashing tape over wall underlay

**Figure 115 c (JAMB):**
- H 3.1 20mm jamb battens finish clear of sill flashing
- Wall underlay
- Fibre cement sheet

**NOTE:**
1. Window profile to be selected to achieve cover shown in details.
2. Architraves are shown for consistency only, detail may be used with rebatedither.
3. Refer Figure 72A for wrapping of framed opening prior to window installation.
Figure 116: Windows and doors for fibre cement sheet and flush-finished fibre cement on cavity

Paragraph 9.7.6

NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Sill support bar required conforming with EM6 and Paragraph 9.1.10.5, refer Figure 729.
(4) Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones.
Paragraphs 6.6 and 9.7.7.1

9.7.7.1 Flush-finished topped balustrades

Where the tops to enclosed balustrades are formed using flush-finished fibre cement, they shall have a minimum fall of 10° (1:6), and be wrapped as shown in Figure 117, with a waterproofing membrane, approved by the supplier of the jointing and finish system. The membrane shall be fully protected by the coating and shall comply with the requirements of AS/NZS 4858 Table 8, Parts (a) to (e), except that bleach and detergent immersion set out in Appendix A1 shall not be required.

Figure 117: Enclosed balustrade to wall for fibre cement sheet

Paragraphs 6.6 and 9.7.7.1

NOTE: (1) Refer Figure 11 and Figure 12 for details of framing and bridge over cavity.
(2) Flush finish fibre cement balustrades only permitted with cavity construction - refer 9.1.8.
9.7.8 Decorative attachments

Where decorative attachments are used, seal sheets prior to attachment of the decorative elements. The final weatherproofing system shall be applied over decorative elements and wall cladding. Horizontal decorative elements shall have top surfaces sloped to a minimum of 10° and drip mouldings to bottom edges.

Attachments shall not interfere with the functioning of critical joints such as control joints.

COMMENT:
Alternatively, a decorative moulding may be formed from the coating by using mesh and plaster.
9.8 Plywood Sheet

Plywood-sheet claddings shall be either direct fixed to framing over a wall underlay or fixed over a drained cavity as per Paragraph 9.1.8.

Based on the risk score for an external wall, calculated as per Paragraph 3.1, the sheet cladding may require the inclusion of a drained cavity.

9.8.1 Limitations

This Acceptable Solution covers plywood panel claddings with vertical battened joints and flashed horizontal joints.

9.8.2 Materials

Batten-jointed panels shall have weather-grooved timber battens as shown in Figure 119. Plywood panels shall be:

a) Manufactured to AS/NZS 2269, grade CD,

b) A minimum of 5 ply,

c) A minimum of 12 mm in thickness, and

d) Treated as required by NZS 3602.

9.8.3 Installation

A wall underlay, as specified in Table 23, shall be installed behind plywood sheet claddings.

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

9.8.3.1 Fixings

Plywood sheets shall be fixed through the wall underlay into the wall framing with fixings as required in Table 24.

9.8.3.2 Joints

All joints shall:

a) Be made only over supports, and

b) If horizontal, incorporate a 10 mm expansion gap, and be fitted with a flashing, as shown in Figure 121, or

c) If vertical, have battened joints – refer to Figure 119.
9.8.4 Corners

9.8.4.1 External corners

External corners shall be fitted with flashings or timber battens, as shown in Figure 122.

9.8.4.2 Internal corners

Internal corners shall be as shown in Figure 123 and have:

a) Flashings and timber battens for direct fix
b) Timber battens for cavity fix.

9.8.5 Flashing Material

Flashings shall be metal selected in accordance with Table 20 to Table 22 and Paragraph 4.3.

9.8.6 Soffit Details

Soffits shall be as shown in Figure 8A and Paragraph 5.3.

9.8.7 Parapets and Enclosed Balustrades

Parapets and enclosed balustrades shall be capped with metal, butyl or EPDM membrane. Cappings shall comply with the requirements of Paragraph 4.0.

a) Parapets shall be in accordance with Paragraph 6.0
b) Enclosed balustrades shall be in accordance with Paragraph 7.4.

9.8.8 Windows and Doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10.

9.8.8.1 Windows and doors: direct fixed

Windows and doors shall be detailed as shown for fibre cement sheet cladding – refer to Figure 115.

9.8.8.2 Windows and doors: with cavity

Windows and doors shall be detailed as shown for fibre cement sheet cladding – refer to Figure 116.

COMMENT:
The same principles of window installation apply to both fibre cement and plywood sheet cladding.

9.8.9 Finishes

A solution of 12.5% copper naphthenate in white spirits, or mineral turpentine, shall be brushed on to any edges cut after treatment. Direct fixed plywood cladding used as bracing requires a minimum 50-year durability, and shall be treated to H3, painted on all edges and the outer face with a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.
COMMENT:
Plywood for cladding, treated to H3, does not require painting.

While H3 plywood can be left unpainted, it is likely to develop checking and mould growth on the surface.
Plywood used as bracing requires painting and regular maintenance of the paint finish to ensure the 50-year durability is achieved.

Figure 122: External corners for plywood sheet
Paragraph 9.8.4.1

Note: Corner battens shall be sized to provide 50 mm minimum cover over cladding.

(a) DIRECT FIX

Ex 25 mm min. timber cover boards with 6x6 mm weather grooves

50 mm min. cover

Ply cladding

Building underlay continuous around corner

(b) CAVITY FIX

Set cladding edge 8 mm back from corner to create drainage cavity

50 mm min. cover

Ply cladding

Sheet fixing nails

Cavity battens

Wall underlay continuous around corner

Figure 123: Internal corners for plywood sheet
Paragraph 9.8.4.2

Ply cladding

18 x 18 mm min. corner batten with chamfered rear edge

Wall underlay continuous around corner

50x50 mm corner flashing

(a) DIRECT FIX

18 x 18 mm min. corner batten with chamfered rear edge

Ply cladding

Cavity batten

Wall underlay continuous around corner

(b) CAVITY
9.9 EIFS

This paragraph covers polymer-modified cement-based plaster or polymer-based polystyrene-based plaster Exterior Insulation and Finish Systems (EIFS).

EIFS cladding shall be fixed over a drained cavity as described in Paragraph 9.1.8.

9.9.1 Limitations

This Acceptable Solution is limited to EIFS cladding systems that are:

a) Designed and tested as a total system, and
b) Not fixed:
   i) so as to form a horizontal surface,
   ii) as a replacement for roofing, or
   iii) in such a way as to allow water to pond.

9.9.2 General

COMMENT:
Refer to Paragraph 1.5 for qualification of installers.

9.9.3 Materials

EIFS cladding systems shall comprise the following parts:

a) A polystyrene sheet cladding material,
b) A polymer-modified cement-based plaster or a polymer-based plaster, reinforced with fibreglass mesh,
c) A polymer-modified cement or polymer-based finishing plaster, and a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730,
d) A range of head, sill, jamb, corner and base mouldings suitable for exterior use, and
e) A flexible polymeric neutral cure sealant that:
   i) is approved by the cladding system supplier, and
   ii) complies with:
      a. Type F, Class 20LM or 25LM of ISO 11600, or
      b. Low modulus Type II Class A of Federal Specification TT-S-00230C.

COMMENT:
This is the minimum standard, and extra elements deemed suitable by the system supplier should not be excluded on the basis of this Acceptable Solution.

9.9.3.1 Polystyrene sheet

Polystyrene sheet shall be a minimum of 40 mm thick and shall be either:

a) Expanded polystyrene (EPS) complying with AS 1366: Part 3, Class H or Class S, or
b) Extruded polystyrene (XPS) that complies with AS 1366: Part 4.

9.9.3.2 Fibreglass reinforcing mesh

Fibreglass reinforcing mesh shall be alkali-resistant fibreglass mesh, and shall:

a) Weigh no less than 150 grams per m²,
b) Have an aperture size from 3 mm x 3 mm to 6 mm x 6 mm square, and
c) Comply with the requirements of EIMA 101.9 test No. 6.3 and ASTM E2098.

9.9.4 Installation

A wall underlay, as specified in Table 23 and Paragraphs 9.1.5–9.1.7, shall be fixed to the framing.

9.9.4.1 Fixings

Polystyrene sheets shall be fixed through the cavity battens, and wall underlay into the wall framing with fixings as required in Table 24. Fixings shall:

a) Be spaced as shown in Table 24,
b) Penetrate the framing by 30 mm minimum,
c) Comply with AS/NZS 4680, and
d) Be either:
   i) hot-dipped galvanized springhead nails with a 22 mm top, or
   ii) hot-dipped galvanized flat head nails used in conjunction with a 22 mm minimum diameter plastic washer.
9.9.4.2 Joints
Joints to plain-edged sheets shall be butt jointed over solid timber backing.
Rebated or tongued boards may be jointed away from solid timber backing, providing the joint is self-supporting at both edges.
Corner joints shall be butted together and fully supported along the length of the joint.

9.9.4.3 Movement control joints
Control joints shall always be located over solid timber backing. Control joints shall be as shown in Figure 124, and shall be provided:

a) On all walls over 20 metres long or over 7 metres high including gables,

b) At abutments to different cladding types,

c) Where cladding covers different structural materials such as timber to concrete, and

d) Over a movement control joint in the underlying framing.

9.9.4.4 Fixing blocks
H3.2 treated timber blocks shall be provided at appropriate locations for fixing all downpipe brackets, garden taps, and other outside fittings.
The blocks shall be cut to suit the polystyrene thickness, and fixed to framing or cavity battens. Prior to applying the plaster basecoat, a patch shall be applied that:

a) Extends over the timber block face and overlaps the adjacent polystyrene by a minimum of 50 mm, and

b) Is suitable for the direct application of the base coat, and is either:

(i) a butyl-based flexible flashing tape that complies with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148, or

(ii) a waterproofing membrane that complies with the requirements of AS/NZS 4858 Table 8, Parts (a) to (e), except that bleach and detergent immersion set out in Appendix A1 shall not be required.

The design of fixing blocks for connecting items carrying substantial loads such as stringers for decks are outside the scope of this Acceptable Solution. These will require specific design.

**Figure 124: Control joints for EIFS**

Paragraph 9.8.4.3

![Control joints for EIFS](image)
9.9.5 Battens

Cavity battens shall comply with Paragraph 9.1.8.4, installed as in Paragraph 9.1.8.

COMMENT:
Cavity spacers must be short and sloped to prevent water being trapped by the battens and ventilation being restricted.

9.9.6 Coating

Suppliers of EIFS cladding systems shall demonstrate that their systems meet the tensile-adhesion performance requirements of ASTM E2134.

9.9.6.1 Reinforcing

The entire surface of the polystyrene sheet (including corners) must be continuously reinforced with alkali-resistant fibreglass reinforcing mesh as specified in Paragraph 9.9.3.2.

9.9.6.2 Reinforcing base coat

The reinforcing base coat shall have:

a) A base coat plaster at the greater of the system supplier’s minimum recommended thickness or 3 mm thick, and be either:
   i) polymer-modified cement-based, or
   ii) polymer-based,

b) Reinforcing with an alkali-resistant fibreglass mesh (Paragraph 9.9.3.2), and

c) Cover to mesh by at least 1.5 mm plaster.

9.9.6.3 Finish coats

Finish colour shall have a reflectance of 40% or more, as outlined in Paragraph 2.4.

The finish shall comprise either:

a) One or more coats of polymer-modified cement-based plaster or polymer-based plaster, or

b) One or more coats of a pre-coloured polymer-modified cement-based plaster, or
c) A pre-coloured polymer-based plaster applied according to the conditions specified by the plaster manufacturer.

Where necessary to maintain weather-tightness, EIFS shall be finished with a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

Polymer-modified cement-based plaster shall only be applied out of direct sunlight and when the temperature is between 5°C and 30°C, with the expectation that the temperature will be in that range for the following 24 hours.

9.9.6.4 Decorative mouldings

Decorative mouldings shall be formed from polystyrene, and shall be glued or mechanically fastened to ensure they remain securely attached to EIFS cladding or framing.

Where decorative mouldings are attached, the basecoat shall be applied before the moulding.

COMMENT:
Alternatively, a decorative moulding may be formed from the coating by using mesh and plaster.
9.9.7 EIFS/floor slab junction

The bottom of the EIFS cladding shall be as shown in Figure 125.

9.9.8 Pipes and service penetrations

All pipes and service penetrations through the EIFS shall be made weatherproof, by either:

a) A flange penetrating the EIFS as a sleeve and sealed into the EIFS system as shown in Figure 126, or

b) A face-fitted flange at EIFS surface, sealed with a neutral cure sealant complying with:
   i) Type F, Class 20LM or 25LM of ISO 11600, or
   ii) low modulus Type II Class A of Federal Specification TT-S-00230C.

   c) Pipe penetrations shall be installed to slope downwards to exterior. Refer to Figure 68 or 69.

   Where cables penetrate cladding, a sleeve or conduit shall be provided and sealed into the EIFS system. All wires that pass through a conduit shall be sealed into position inside the conduit.
9.9.9 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10, and shown in Figures 17C, 127 and 128.

Install uPVC three-way corner flashings at jamb/sill junctions as shown in Figure 127. Corner flashings shall be installed behind EIFS jamb and sill flashings, with flanges turned out over polystyrene backing sheets.

9.9.10 Parapets and enclosed balustrades

Parapets shall comply with Paragraph 6.0.

Enclosed balustrades shall comply with Paragraph 7.4.

9.9.10.1 Flush-finished balustrade top

Where the tops to enclosed balustrades are formed using EIFS, they shall have a minimum fall of 10° (1:6), and be wrapped as shown in Figure 129 and 130, with a liquid waterproofing membrane approved by the supplier. The EIFS system shall be fully protected by the coating, and shall comply with the requirements of AS/NZS 4858 Table 8, Parts (a) to (e), except that bleach and detergent immersion set out in Appendix A1 shall not be required.

9.9.10.2 Metal cappings

Metal cappings shall comply with the requirements of Paragraph 6.4, and shall be as shown in Figure 130.

Where a parapet or an enclosed balustrade meets EIFS wall cladding, a saddle flashing shall be used, as shown in Figure 12 and Figure 13.
Figure 127: Window and door corner flashing for EIFS
Paragraph 9.9.9

(a) 3 WAY CORNER FLASHING

(b) 3 WAY CORNER FLASHING WITH EIFS JAMB AND SILL FLASHING OVER

3 way corner flashing

EIFS jamb flashing

EIFS sill flashing

Slope to suit sill flashing - min. 10° fall

Ribbed surface for bedding to plaster. Similar for jamb and head flashings.
Figure 128: Windows and doors in EIFS

Paragraph 9.9.9

Additional wall underlay from overlap above lapped over flashing
Cavity battens
Cavity spacers set to fall
Plaster coating
Cavity base closer positioned to give 15 mm min. drip edge to cladding
P.V.C or metal trim

10 mm min. cover to joinery

Stopends to head flashing
Wall underlay and flexible tape flashing
Frame block
Sill support bar

uPVC sill flashing over corner flashing to EIFS with 10° min. fall
10° mm min. slope to sill

Cavity battens
EIFS and coating

NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Sill support bar required conforming with EM6 and Paragraph 9.1.10.5, refer Figure 72B.
(4) Refer Figure 71 (c) for sealant at head for Very High and Extra High wind zones.
**Figure 129: Enclosed balustrade-to-wall junction for EIFS**
Paragraphs 6.6 and 9.9.10.1

NOTE: Refer Figure 11 to Figure 13 for framing and bridge over drained cavity.

Set cavity battens of both wall and enclosed balustrade 50 mm back from corner to allow free drainage at corner.

![Diagram of enclosed balustrade-to-wall junction for EIFS]

- Wall framing
- Wall underlay
- EIFS cladding
- Textured coating
- Line of liquid waterproof membrane over EIFS base plaster coats and under textured coating full length of balustrade
- 10° min. slope (1:6)
- Wall underlay continuous over framing
- Framing
- EIFS cladding over battens

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**Figure 130: Parapet with metal capping for EIFS**
Paragraph 9.9.10.2

Underlay to provide separation of metal capping and timber

Horizontal packer to fall

5° min. slope

Z - refer Table 7

Cavity spacers to suit fixings

Wall underlay

Framing

Continuous metal cap flashing fixed through sides

Z - refer Table 7

Plaster coating

Cavity battens
10.0 Construction Moisture

10.1 Moisture in materials

Moisture contained in the building structure at completion of construction shall not be permitted to damage the building elements. Construction moisture includes the moisture contained in:

a) Timber products as a result of a treatment or manufacturing process,

b) Green timber, and timber or other materials that have been exposed to the weather, and

c) Concrete, mortar or plaster that is not completely cured.

10.2 Maximum acceptable moisture contents

The maximum moisture contents shall be:

a) For timber framing at the time of installing interior linings, the maximum acceptable moisture content shall be the lesser of:
   i) 20% for insulated buildings, 24% for non-insulated buildings, or
   ii) as specified in NZS 3602,

b) For timber weatherboards and exterior joinery, 20% at the time of painting,

c) For reconstituted wood products, 18% at all times, and

d) For concrete floors, sufficiently dry to give a relative humidity reading of less than 75% at the time of laying fixed floor coverings.

COMMENT:

Some manufacturers of timber or other wall or floor components may recommend lower moisture contents for their products.

It is advisable to use the manufacturer’s moisture content requirements, if these are lower than those required by this paragraph.

10.3 Measuring moisture content

10.3.1 Timber

Measurement shall be by the recommended procedure in the Scion (New Zealand Forest Research Institute) publication “Measurement of moisture content of Wood” using electrical resistance type moisture meters with insulated probes. Representative samplings of measurements shall be taken:

a) With meters calibrated to AS/NZS 1080.1 Appendix E

b) By inserting probes to at least 1/3 the depth of timber being measured, at a distance exceeding 200 mm from board ends

c) Using correction factors for timber species, temperature, and treatment type (outlined in Scion publication above).

10.3.2 Concrete floors

### Table 20: Material selection

This table shall be read in conjunction with Table 21 and Table 22 and Paragraph 4.0. Refer relevant cladding and flashings paragraphs for material and coating specifications. Paragraphs 2.2, 4.2.1, 4.3.3, 4.3.4, 4.3.8, 4.3.10, 8.2.3, 8.2.4, 8.3.4.2, 8.4.3.1, 8.4.3.2, 9.1.10.2, 9.6.3.1, 9.6.3.2, 9.6.6 and 9.8.5

<table>
<thead>
<tr>
<th>Material</th>
<th>Exposure(1)(2)(4)(6)</th>
<th>Acceptable Exposure Zones as per NZS 3604 – Section 4 (3)(4)(6)</th>
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<td></td>
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<tr>
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<td>Sheltered</td>
<td>B,C,D,E</td>
</tr>
<tr>
<td>Copper, lead, or stainless steel</td>
<td>Hidden(2)</td>
<td>B,C,D,E</td>
</tr>
<tr>
<td></td>
<td>Exposed</td>
<td>B,C,D,E</td>
</tr>
<tr>
<td></td>
<td>Sheltered</td>
<td>B,C,D,E</td>
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<tr>
<td><strong>Factory painted</strong></td>
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<td></td>
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<tr>
<td>Aluminium-zinc-magnesium (combinations) coated or galvanised steel, to AS 1397 and AS/NZS 2728 with AM100, ZM274, and AZ150 minimum coatings</td>
<td>Hidden(9)</td>
<td>B,C,D,E</td>
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<tr>
<td></td>
<td>Exposed(8)</td>
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<td></td>
<td>Sheltered</td>
<td>B,C,D,E</td>
</tr>
<tr>
<td>Pressed metal tiles coated to minimum AZ150 or AM100 to AS 1397, AS/NZS 2728 or with post-form factory painting to cl 8.3.4.2.</td>
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<td></td>
<td>Sheltered</td>
<td>B,C,D,E</td>
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<td><strong>Non-factory painted</strong></td>
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<tr>
<td>Aluminium-zinc-magnesium (combinations) coated steel, to AS 1397 with AZ150 or AM125 minimum coatings</td>
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<td>Galvanised steel Z450 to AS 1397</td>
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<tr>
<td></td>
<td>Sheltered</td>
<td>B,C</td>
</tr>
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</table>
Table 20: Material selection – continued

Note:
1) Refer to manufacturer’s information for maintenance requirements in Exposed and Sheltered locations.
2) The term “hidden” means concealed behind another element such that no part is visible. Hidden elements require a 50 year durability under the NZBC. The term “exposed” means having surfaces exposed to rain washing. The term ‘sheltered’ means being visible, but not rain washed. For diagrammatic outline, refer NZS 3604 Figure 4.3(a). Exposed and sheltered elements require a 15 year durability. Where an element can be categorised as both ‘sheltered’ and ‘exposed’, the ‘sheltered’ condition will apply.
3) AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand, determined by exposure to wind-driven sea-spray. NZS 3604 references atmospheric classes B (Low), C (Medium) and D (High). E2/AS1 references atmospheric zones B,C,D,E. For the purposes of cladding selection, Zone E (Severe marine classified as breaking surf beach fronts) has been included. Designers must consult metal supplier’s information for specific durability requirements of sites in Zone E.
4) The geographic limits of atmospheric classes in NZS 3604 and AS/NZS 2728 may vary. Table 20 uses the limits outlined in NZS 3604.
5) Includes fixings protected by putty and an exterior paint system of primer, undercoat and two top coats of paint.
6) Microclimates based on evidence from adjacent structures of corrosion caused by industrial or geothermal atmospheres are outside the scope of this Acceptable Solution.
7) Refer to Tables 21 and 22 for compatibility of fixings with metal claddings.
8) Roof only. Coated steel wall claddings must be considered as ‘sheltered’.
9) Hidden steel coated elements in ventilated cavities in zones D and E (exposure to salt air) must be considered as ‘sheltered’
10) The use of stainless steel fixings is not recommended by steel manufacturers for use with coated steel in severe marine and industrial environments, as they are considered to cause deterioration.
**Table 21: Compatibility of materials in contact**

This table shall be read in conjunction with Table 20 and Table 22. Refer relevant cladding and flashings paragraphs for material and coating specifications.

Paragraphs 2.2, 4.2.2, 4.5.2, 8.2.4, 8.4.11, 8.4.11.1 and 9.6.7

**LEGEND:**

✓ Materials satisfactory in contact.

✘ Contact between materials is not permitted. Minimum gap of 5 mm is required to prevent moisture bridging.

B Avoid contact in sea-spray zone or corrosion zone D.

**NOTES:**

(1) Coated – includes factory-painted, coil-coated and powder-coated.

(2) Includes copper azole and copper quaternary salts.
### Table 22: Compatibility of materials subject to run-off

This table shall be read in conjunction with Table 20 and Table 21. Refer relevant cladding and flashings paragraphs for material and coating specifications. Paragraphs 2.2, 4.2.2, 4.5.2, 8.2.4, 8.4.1 and 9.8.5

<table>
<thead>
<tr>
<th>Material that water flows onto</th>
<th>Aluminium, anodised or mill-finish</th>
<th>Butyl rubber &amp; EPDM</th>
<th>CCA-treated timber</th>
<th>Cedar</th>
<th>Ceramic tiles (cement grout)</th>
<th>Clay bricks (cement mortar)</th>
<th>Concrete old (unpainted)</th>
<th>Concrete green (unpainted)</th>
<th>Copper/brass</th>
<th>Glass</th>
<th>Glazed roof tiles</th>
<th>Lead (including lead-edged)</th>
<th>unplainted</th>
<th>Stainless steel</th>
<th>Steel, galvanized (unpainted)</th>
<th>Zinc</th>
<th>Zinc-aluminium-magnesium (combinations), coated (1)</th>
<th>Zinc-aluminium-magnesium (combinations), unplainted</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

**LEGEND:**
- ✓ Materials satisfactory with water run-off as indicated.
- ✗ Water run-off is not permitted as indicated.
- A Etching or staining of glass may occur with run-off.

**NOTES:**
1. Coated – includes factory-painted, coil-coated and powder-coated.
2. Includes copper azole and copper quaternary salts.
# Table 23: Properties of roof underlays and wall underlays

<table>
<thead>
<tr>
<th>Category</th>
<th>Application</th>
<th>Vapour resistance</th>
<th>Absorbency</th>
<th>Water resistance</th>
<th>pH of extract</th>
<th>Shrinkage</th>
<th>Mechanical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof (1) Underlay</td>
<td>All roofs</td>
<td>≤ 7 MN s/g ASTM E96 B.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Bitumen and fire-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>retardant paper-based</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>products)(2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexible Wall Underlay</td>
<td>Wall claddings over a cavity(6)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Includes paper and</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>synthetic underlays)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Direct fixed absorbent wall claddings(4) (eg, timber, fibre cement etc)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Direct fixed non-absorbent claddings(3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rigid Wall Underlay (</td>
<td>Wall claddings over a cavity(6)</td>
<td>≤ 7 MN s/g ASTM E96 B.</td>
<td>≥ 20 mm</td>
<td>NZS 2295</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>plywood(5) and fibre</td>
<td>Direct fixed absorbent wall claddings (eg, timber, fibre cement etc)</td>
<td>≥ 100 g/m² AS/NZS 4201: Part 4</td>
<td>≥ 20 mm</td>
<td>NZS 2295</td>
<td>≥ 6.0 and 9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cement sheet)</td>
<td>Direct fixed non-absorbent claddings (6)</td>
<td>≤ 7 MN s/g ASTM E96 B.</td>
<td>≥ 20 mm</td>
<td>NZS 2295</td>
<td>≥ 6.0 and 9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Air Barrier</td>
<td>Where no internal linings</td>
<td>≤ 7 MN s/g ASTM E96 B.</td>
<td>≥ 100 g/m²</td>
<td>NZS 2295</td>
<td>≥ 6.0 and 9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 20 mm NZS 2295</td>
<td>≥ 20 mm</td>
<td>NZS 2295</td>
<td>≥ 6.0 and 9.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 0.5% NZS 2295</td>
<td>≤ 90 MN</td>
<td>s/g ASTM E96</td>
<td></td>
<td>Edge tear</td>
<td>strength</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≥ 20 MN s/m³</td>
<td></td>
<td></td>
<td></td>
<td>NZS 2295</td>
<td></td>
</tr>
<tr>
<td>DPC/DPM</td>
<td>All applications</td>
<td>≥ 90 MN s/g ASTM E96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**
1) Metal roofs and direct-fixed metal wall claddings require paper-based underlays
2) Excluding synthetic underlays
3) Use paper based underlays where directly behind (in contact with) profiled metal wall cladding
4) Excludes profiled metal wall cladding
5) Plywood to be treated in accordance with NZS 3602
6) Bitumen based products shall not be used in direct contact with LOSP-treated plywood
7) Applies only to air barriers used with non-absorbent claddings.
### Table 24: Fixing selection for wall claddings

Refer to NZS 3604 for fixing types where claddings act as structural bracing. Minimum fixing materials for non-structural claddings, shall be galvanised steel for climate zones B, C and D (as outlined in NZS 3604). Where the cladding is a corrosive timber, such as western red cedar or redwood, or is treated with copper based ACQ or CuAz preservatives, use stainless steel.

**COMMENT:** Some manufacturers may require more durable fixings than those stated below or in NZS 3604 to maintain product warranties.

Paragraphs 9.4.4.3, 9.4.5.2, 9.5.3.1, 9.7.2.1, 9.8.3.1, 9.9.4.1, Table 18B

<table>
<thead>
<tr>
<th>Joint</th>
<th>Length (mm) x diameter (mm) and type</th>
<th>Minimum framing penetration</th>
<th>Fixing pattern</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cavity battens</td>
<td>Battens to framing</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Stucco plaster</td>
<td>Rigid backing to framing</td>
<td>60 x 2.5 FH nail</td>
<td>35 mm</td>
<td>150 mm centres to sides and 300 mm centres in middle</td>
</tr>
<tr>
<td></td>
<td>Metal lath to framing</td>
<td>40 x 2.5 FH nail or 40 x 2.8 FH nail</td>
<td>35 mm</td>
<td>150 mm centres</td>
</tr>
<tr>
<td>Fibre cement weatherboards</td>
<td>Weatherboard DIRECT FIXED</td>
<td>50 x 2.8 fibre cement nail</td>
<td>35 mm</td>
<td>Single fixing 20 mm above lower board, through both thicknesses</td>
</tr>
<tr>
<td></td>
<td>Weatherboard OVER CAVITY</td>
<td>75 x 3.15 fibre cement nail</td>
<td>35 mm</td>
<td>as above</td>
</tr>
<tr>
<td>Timber weatherboards: paint finish</td>
<td>DIRECT FIXED</td>
<td>Horizontal bevel-back</td>
<td>75 x 3.15 JH nail</td>
<td>35 mm</td>
</tr>
<tr>
<td></td>
<td>Horizontal rebated bevel-back</td>
<td>60 x 2.8 JH nail</td>
<td>35 mm</td>
<td>as above</td>
</tr>
<tr>
<td></td>
<td>Horizontal rusticated</td>
<td>60 x 2.8 JH nail</td>
<td>35 mm</td>
<td>as above</td>
</tr>
<tr>
<td></td>
<td>Vertical shiplap</td>
<td>60 x 2.8 JH nail</td>
<td>35 mm</td>
<td>Single fixing 10 mm from side lap (40 mm from edge of board) Divangs at maximum 480 mm centres.</td>
</tr>
<tr>
<td></td>
<td>Board and batten: board</td>
<td>60 x 2.8 JH nail</td>
<td>35 mm</td>
<td>Single fixing in centre or nails clenched over each side as above</td>
</tr>
<tr>
<td></td>
<td>Board and batten: batten</td>
<td>75 x 3.15 JH nail</td>
<td>35 mm</td>
<td>Single fixing in centre of batten as above</td>
</tr>
<tr>
<td>Timber weatherboards: paint finish</td>
<td>OVER CAVITY</td>
<td>Horizontal bevel-back</td>
<td>90 x 4.0 JH nail</td>
<td>35 mm</td>
</tr>
<tr>
<td></td>
<td>75 x 3.15 annular grooved nail</td>
<td>25 mm</td>
<td>Single fixing 10 mm above top of lower board</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Horizontal rebated bevel-back</td>
<td>75 x 3.15 JH nail</td>
<td>35 mm</td>
<td>as above</td>
</tr>
</tbody>
</table>

**LEGEND:**
- RH rose head
- JH jolt head
- FH flat head

**NOTE:** Nail lengths are designed for minimum penetration of framing. If thickness of the batten or cladding is varied, length shall be adjusted accordingly.
### Table 24: Fixing selection for wall claddings (continued)

<table>
<thead>
<tr>
<th>Joint</th>
<th>Length (mm) x diameter (mm) and type</th>
<th>Minimum framing penetration</th>
<th>Fixing pattern</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal rusticated</td>
<td>75 x 3.15 JH nail</td>
<td>35 mm</td>
<td>Single fixing 10 mm above top of lower board</td>
<td></td>
</tr>
</tbody>
</table>

**Timber weatherboards: stained or bare finish**

**DIRECT FIXED**

- **Horizontal bevel-back**
  - 65 x 3.2 RH annular grooved nail
  - 30 mm
  - Single fixing 10 mm above top of lower board

- **Horizontal rebated bevel-back**
  - 50 x 3.2 RH annular grooved nail
  - 30 mm
  - as above

- **Horizontal rusticated**
  - 50 x 3.2 RH annular grooved nail
  - 30 mm
  - as above

- **Vertical shiplap**
  - 50 x 3.2 RH annular grooved nail
  - 30 mm
  - Single fixing 10 mm from side lap (40 mm from edge of board)

- **Board and batten: board**
  - 60 x 3.2 RH annular grooved nail
  - 30 mm
  - Single fixing in centre of board

- **Board and batten: batten**
  - 75 x 3.2 RH annular grooved nail
  - 30 mm
  - as above

**Timber weatherboards: stained or bare finish**

**OVER CAVITY**

- **Horizontal bevel-back**
  - 85 x 3.2 RH annular grooved nail
  - 30 mm
  - Single fixing 10 mm above top of lower board

- **Horizontal rebated bevel-back**
  - 70 x 3.2 RH annular grooved nail
  - 30 mm
  - as above

- **Horizontal rusticated**
  - 70 x 3.2 RH annular grooved nail
  - 30 mm
  - as above

**Vertical profiled metal:**

**DIRECT FIXED**

- **Horizontal profiled metal:**
  - Refer Paragraph 9.6.6

**OVER CAVITY**

- **Plywood sheet: paint finish**
  - **DIRECT FIXED**
    - **Plywood to stud or batten**
      - 50 x 2.8 FH nail
      - 30 mm
      - 150 mm centres to sides, 300 mm centres in middle
    - **External cover batten**
      - 65 x 3.2 RH annular grooved nail
      - 30 mm
      - 300 mm centres in centre of batten

- **Plywood sheet: paint finish**
  - **OVER CAVITY**
    - **Plywood**
      - 60 x 2.8 FH nail
      - 30 mm
      - 150 mm centres to sides, 300 mm centres in middle
    - **Cover batten**
      - 60 x 2.8 JH nail
      - To cavity battens only
      - 300 mm centres in centre of batten

- **Plywood sheet: stained or bare finish**
  - **DIRECT FIXED**
    - **Plywood to stud or batten**
      - 50 x 2.8 FH nail
      - 30 mm
      - 150 mm centres to sides, 300 mm centres in middle
    - **External cover batten**
      - 65 x 3.2 RH annular grooved nail
      - 30 mm
      - 300 mm centres in centre of batten

**LEGEND:**

- RH rose head
- JH jolt head
- FH flat head

**NOTE:** Nail lengths are designed for minimum penetration of framing. If thickness of the batten or cladding or underlay is varied, length shall be adjusted accordingly.
## Table 24: Fixing selection for wall claddings (continued)

<table>
<thead>
<tr>
<th>Joint</th>
<th>Length (mm) x diameter (mm) and type framing penetration</th>
<th>Minimum framing penetration</th>
<th>Fixing pattern</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Plywood sheet: stained or bare finish OVER CAVITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plywood</td>
<td>65 x 3.2 FH nail</td>
<td>30 mm</td>
<td>150 mm centres to sides, 300 mm centres in middle</td>
<td></td>
</tr>
<tr>
<td>External cover batten</td>
<td>65 x 3.2 RH annular grooved nail</td>
<td>To cavity battens only</td>
<td>300 mm centres in centre of batten</td>
<td></td>
</tr>
<tr>
<td><strong>Fibre cement sheet: jointed</strong></td>
<td><strong>DIRECT FIXED</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheet</td>
<td>40 x 2.8 fibre cement nail</td>
<td>30 mm</td>
<td>150 mm centres to sides, 300 mm centres in middle</td>
<td></td>
</tr>
<tr>
<td>External cover batten</td>
<td>65 x 3.15 JH nail</td>
<td>30 mm</td>
<td>Single fixing in centre of batten</td>
<td></td>
</tr>
<tr>
<td><strong>Fibre cement sheet: jointed OVER CAVITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheet</td>
<td>60 x 3.15 fibre cement nail</td>
<td>30 mm</td>
<td>150 mm centres to sides, 300 mm centres in middle</td>
<td></td>
</tr>
<tr>
<td>External cover batten</td>
<td>65 x 3.15 JH nail</td>
<td>To cavity battens only</td>
<td>Single fixing in centre of batten</td>
<td></td>
</tr>
<tr>
<td><strong>Fibre cement sheet: flush-finish OVER CAVITY</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EIFS</td>
<td>60 x 3.15 fibre cement nail</td>
<td></td>
<td>as above</td>
<td>as above and with 40 mm plastic washers on external corner fixings</td>
</tr>
<tr>
<td><strong>NOTE:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Galvanised nails shall be hot-dipped galvanised; galvanised screws shall be mechanically zinc plated in accordance with AS 3566 Class 4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Stainless steel nails shall have annular grooves to provide similar withdrawal resistance to hot-dip galvanised nails.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**LEGEND:**
- RH rose head
- JH jolt head
- FH flat head

Amend 2 Jul 2005
Amend 5 Aug 2011
Amend 5 Aug 2011
Amend 5 Aug 2011
1.0 Earth buildings

Earth buildings complying with NZS 4299 as modified by this Acceptable Solution meet the performance criteria of NZBC E2.

Where buildings are based on NZS 4299 but require specific structural engineering design input, the structure must be of at least equivalent stiffness to the provisions of NZS 4299. Such designs are outside the scope of this Acceptable Solution and proposals must be submitted to, and approved by, the building consent authority as part of the normal building consent process.

1.1 Modifications to NZS 4299

Clause 2.1.8.5 Add new Clause:

2.1.8.5 Install a damp proof course (DPC) to separate timber from concrete, cement stabilised earth and lime stabilised earth. DPC material must be bituminous paint or sheet material as specified in Clause 4.9.1.

Figure 4.1 Replace Figure 4.1 with:

**Figure 4.1** Footing dimensions and general details

- Earth wall 280 – 350 mm
- Earth brick wall to overhang foundation by 5 mm minimum. Other earth wall methods flush with foundation.
- Top of rib
- Permanent paving
- D.P.M. (refer Clause 4.8.5) on sand blinding on selected hardfill (refer Clause 4.8.4)
- 8 – 10 mm bevel
- 50 mm min nib above floor level required during construction and in wet areas (see Clause 4.4)
- Minimum depth D as defined in 3.3:
  - (a) 150 mm in firm weathered rock;
  - (b) 300 mm in other materials;
  - (c) in expansive clay see 3.3.2
- Reinforced concrete foundation
- Firm original ground or fill certified to NZS 4433 with ultimate bearing strength ≥ 300 kPa

Note: Dimensions in mm. Ground/paving surfaces must have fall away from building according to Figure 3.1 B.

Note: Reprinted from NZS 4299-1996 by permission of Standards New Zealand.
Clause 5.1.8 Add new Clause:

5.1.8
The external surface of earth walls must be finished in accordance with Clauses 2.2.3.5, 2.2.4.2 and 2.2.4.3 of NZS 4298. The external surface of earth walls must be free from features, such as horizontal protrusions, that could cause water to become trapped or directed towards the inside of the building.

C.5.1.8
Water must be able to flow downwards and off the external surface of earth walls.

External earth wall surfaces are not required to have a surface coating to meet this Acceptable Solution. The use of surface coatings does not replace or diminish the need for eaves as required by Clause 2.10.

Clause 5.12 Add new Clause and Figure:

5.12 Soffit to wall junction
The junction between the soffit and the earth wall must be constructed as shown in Figure 5.11.

Figure 5.11 Soffit to wall junction
A) Flat soffit

Outline of roof framing and associated members indicative only

Roof cladding as specified in Acceptable Solution E2/AS1

Timber fascia or beam as required & gutter system

25 mm min

Eave soffit or verandah lining

Selected timber trim

D.P.C. (See Clause 2.1.8.5)

D.P.C. (See Clause 2.1.8.5)

Outline of roof framing and associated members indicative only

Earth wall

Note:
Gable to be detailed in a similar manner
Roof framing constructed to NZS 3604
Clause 5.13 Add new Clause and Figure:

5.13 Timber-framed gable wall

The junction between timber-framed gable walls and earth walls must be constructed as shown in Figure 5.12.
Figure 5.12  Timber-framed gable to earth wall

Clause 9.2 Add the following new paragraph to end of Clause 9.2:

“Windows and doors with arched or sloping heads are outside the scope of this Standard.”

Clause C9.2 Add the following new paragraph to end of commentary Clause C9.2:

**COMMENT:**

Requirements for window and door joinery are not included in this Acceptable Solution. For more information, designers may refer to:

- NZS 3604: 1979 Specification for aluminium windows
- NZS 3610: 1979 Specification for profiles of mouldings and joinery
Figure 9.2 Replace Figure 9.2 with:

Figure 9.2  Head details

A) Timber joinery with timber-framed wall insert

- Reinforced concrete lintel
- Ex 25mm timber boxing, or laminated ply to curve as required
- Varies according to lintel span
- Lining on ex 100x50 framing @ 600 crs
- Tight fitting closed cell compressible foam rod or tube or hemp rope
- * Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F
- Fix head trim after all shrinkage has taken place

Interiors:
- Timber plate on D.P.C. (See Clause 2.1.8.5)
- 6x6 mm drip groove
- 15 mm min
- Run cladding into jamb rebate each side of opening
- Building wrap as required by Acceptable Solution E2/AS1
- Lap building wrap over head flashing
- 50 mm min cladding lap over flashing
- 20 mm min
- 50 mm min
- 5 mm min clearance between cladding and flashing
- Flashing material as defined in Acceptable Solution E2/AS1
- Timber facing
- 15˚ min slope.
- Take flashing full width into jamb rebate each end.
- 5 mm min clearance between cladding and flashing
- Flashing material as defined in Acceptable Solution E2/AS1
- Lining on ex 100x50 framing @ 600 crs
- Ex 25mm timber boxing, or laminated ply to curve as required
- Tight fitting closed cell compressible foam rod or tube or hemp rope
- * Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F
- Fix head trim after all shrinkage has taken place

Exteriors:
- Line of jamb rebate
- Building wrap as required by Acceptable Solution E2/AS1
- Lap building wrap over head flashing
- 50 mm min cladding lap over flashing
- 20 mm min
- 50 mm min
- 5 mm min clearance between cladding and flashing
- Flashing material as defined in Acceptable Solution E2/AS1

B) Aluminium joinery with timber-framed wall insert

- Reinforced concrete lintel
- (Refer figure 8.4)
- Ex 25mm timber boxing, or laminated ply to curve as required
- Lining on ex 100x50 framing @ 600 crs
- Tight fitting closed cell compressible foam rod or tube or hemp rope
- * Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F
- Fix head trim after all shrinkage has taken place

Interiors:
- Timber plate on D.P.C. (See Clause 2.1.8.5)
- 6x6 mm drip groove
- Run cladding into jamb rebate each side of opening
- Building wrap as required by Acceptable Solution E2/AS1
- Lap building wrap over head flashing
- 50 mm min cladding lap over flashing
- 20 mm min
- 50 mm min
- 5 mm min clearance between cladding and flashing
- Flashing material as defined in Acceptable Solution E2/AS1
- Lining on ex 100x50 framing @ 600 crs
- Ex 25mm timber boxing, or laminated ply to curve as required
- Tight fitting closed cell compressible foam rod or tube or hemp rope
- * Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F
- Fix head trim after all shrinkage has taken place

Exteriors:
- Line of jamb rebate
- Building wrap as required by Acceptable Solution E2/AS1
- Lap building wrap over head flashing
- 50 mm min cladding lap over flashing
- 20 mm min
- 50 mm min
- 5 mm min clearance between cladding and flashing
- Flashing material as defined in Acceptable Solution E2/AS1
- Lining on ex 100x50 framing @ 600 crs
- Ex 25mm timber boxing, or laminated ply to curve as required
- Tight fitting closed cell compressible foam rod or tube or hemp rope
- * Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F
- Fix head trim after all shrinkage has taken place
**Figure 9.2** Head details

**C) Timber joinery with timber lintel**

- **D.P.C.** (See Clause 2.1.8.5)
- Timber lintel/bond beam (solid or boxed) as required (refer Figure 8.1)
- Tight fitting closed cell compressible foam rod or tube or hemp rope
- Fix timber trim after all earth wall shrinkage has taken place

* Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F

Pack to thickness of timber trim (if any)

**INTERIOR**

- **To suit**
- **20 mm min**
- **25 mm min**

**EXTERIOR**

- **To suit**
- **25 mm min**
- **30 mm min**

**FLAShING DIMENSIONS**

- **10 mm Ø weather groove**
- **25 mm min**
- **5 mm min @ 15˚ min**
- **30 + *20mm min**

Flashing material as defined in Acceptable Solution E2/AS1

* Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F

**Figure 9.2** Head details

**D) Aluminium joinery with timber lintel**

- **D.P.C.** (See Clause 2.1.8.5)
- Timber lintel/bond beam, solid or boxed (Refer Figure 8.1)
- Tight fitting closed cell compressible foam rod or tube or hemp rope
- Spacer to allow head facing to move over jamb facings during wall settlement

Full width packer

When eaves are less than or equal to 600 insert tight fitting, closed cell moisture resistant, compressible foam rod or tube at outer edge of lintel between lintel & earth wall at all points of contact.

- **25 mm min**
- **20 mm min**

**FLAShING DIMENSIONS**

- **10 mm min**
- **5 mm min @ 15˚ min**
- **10 + *20mm min**

Flashing material as defined in Acceptable Solution E2/AS1

* Note: 20 mm shrinkage gap may be reduced by up to 10 mm if justified by results of mortar and wall material shrinkage tests to NZS 4298, Appendix F
Figure 9.3 Replace Figure 9.3 with:

### A) Timber joinery

- **Jamb rebate depth**: Varies from 0.0 mm for face mounted joinery, to 100 mm max.
- **Pack to joinery with earth mortar**
- **Let-in concrete, fired brick or tile sill** with 3˚ inward fall towards window centre line and 15˚ min fall to exterior
- **Sill rebate**: 25 mm min - 75 mm max
- **Window or door framing** (refer Figure 9.1 for fixing)
- **D.P.C. under packer** (See Clause 2.1.8.5)
- **Tight fitting moisture resistant closed cell compressible foam rod or tube**
- **Tight fitting closed cell compressible foam rod or tube**
- **Seal with earth mortar**
- **Pack with timber trim**
- **Tight fitting closed cell compressible foam rod or tube** or hemp rope
- **Let-in concrete, fired brick or tile sill**
- **Window or door framing** (refer Figure 9.1 for fixing)
- **Jamb rebate depth**: Varies from 0.0 mm for face mounted joinery, to 100 mm max.
- **Sill rebate**: 25 mm min - 75 mm max
- **Jamb rebate depth**: Varies from 0.0 mm for face mounted joinery, to 100 mm max.
- **Sill rebate let in 25 - 75 mm behind jamb rebate**
- **Pack to joinery with earth mortar**
- **5 mm min lap**
- **Note**: Requires extra wide aluminium flange or flange extension with wider rebate

### B) Aluminium joinery

- **Jamb rebate depth**: Varies from 0.0 mm for face mounted joinery, to 100 mm max.
- **Pack to joinery with earth mortar**
- **Let-in concrete, fired brick or tile sill** with 3˚ inward fall towards window centre line and 15˚ min fall to exterior
- **Sill rebate let in 25 - 75 mm behind jamb rebate**
- **Pack to joinery with earth mortar**
- **5 mm min lap**
- **Note**: Requires extra wide aluminium flange or flange extension with wider rebate

**Figure 9.4** Replace Figure 9.4 with:

**Sill details**

**A) Timber joinery with brick or tile sill**

- **Line of sill rebate**
- **Line of jamb rebate**
- **Soaker flashing under jamb or mullions that penetrate sill**
- **Flashing material as defined in Acceptable Solution E2/AS1**
- **2 coats bituminous paint**
- **25 mm min rebate**
- **2 - 10 mm gap**
- **Fired brick or tile sill set @ 15˚ min to outside on 3:1 sand:lime putty mortar for unstabilised earth walls or 1:1:6 cement:lime:sand mortar for stabilised earth walls**
- **2 coats bituminous paint**
- **D.P.C. (See Clause 2.1.8.5)**
- **Tight fitting closed cell compressible foam rod or tube, or hemp rope**
- **Render or earth mortar brought up to sill**
- **D.P.C. under packer**
- **Earth wall**
- **Soaker flashing under jamb or mullions that penetrate sill**
- **Flashing material as defined in Acceptable Solution E2/AS1**
- **2 coats bituminous paint**
- **25 mm min rebate**
- **2 - 10 mm gap**
- **Fired brick or tile sill set @ 15˚ min to outside on 3:1 sand:lime putty mortar for unstabilised earth walls or 1:1:6 cement:lime:sand mortar for stabilised earth walls**
- **2 coats bituminous paint**
- **D.P.C. (See Clause 2.1.8.5)**
- **Tight fitting closed cell compressible foam rod or tube, or hemp rope**
- **Render or earth mortar brought up to sill**
- **D.P.C. under packer**
- **Earth wall**
- **Soaker flashing under jamb or mullions that penetrate sill**
- **Flashing material as defined in Acceptable Solution E2/AS1**
- **2 coats bituminous paint**
- **25 mm min rebate**
- **2 - 10 mm gap**
- **Fired brick or tile sill set @ 15˚ min to outside on 3:1 sand:lime putty mortar for unstabilised earth walls or 1:1:6 cement:lime:sand mortar for stabilised earth walls**
- **2 coats bituminous paint**

**B) Aluminium joinery with brick or tile sill**

- **Line of sill rebate**
- **Line of jamb rebate**
- **19 mm min lap**
- **Note: requires wide aluminium flange**
- **Note: Fit corner & mullion flashings**
- **Flashing material as defined in Acceptable Solution E2/AS1**
- **Ensure sill is positioned to capture water that may penetrate past the jamb facings and directs it to the exterior.**
- **Leave 2-5 mm gap**
- **Fired brick or tile sill set @ 15˚ min to outside on 3:1 sand:lime putty mortar for unstabilised earth walls or 1:1:6 cement:lime:sand mortar for stabilised earth walls**
- **2 coats bituminous paint**
- **D.P.C. (See Clause 2.1.8.5)**
- **Tight fitting closed cell compressible foam rod or tube, or hemp rope**
- **Render or earth mortar brought up to sill**
- **D.P.C. under packer**
- **Earth wall**
- **Soaker flashing under jamb or mullions that penetrate sill**
- **Flashing material as defined in Acceptable Solution E2/AS1**
- **2 coats bituminous paint**
- **25 mm min rebate**
- **2 - 10 mm gap**
- **Fired brick or tile sill set @ 15˚ min to outside on 3:1 sand:lime putty mortar for unstabilised earth walls or 1:1:6 cement:lime:sand mortar for stabilised earth walls**
- **2 coats bituminous paint**

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**EXTERNAL MOISTURE**

Acceptable Solution E2/AS2
Figure 9.4  Sill details

C) Timber joinery with concrete sill

- 50 mm min
- 75 mm min
- 25 - 75 mm
- 100 mm max

- 1/R10 with 50 min
- cover all round

- Selected sill

- Soaker flashing under jamb or mullions that penetrate sill
- Flashing material as defined in Acceptable Solution E2/AS1

- 2 coats bituminous paint
- 25 mm min rebate
- 2 -10 mm gap

- 15˚ min slope to exterior
- 2 coats bituminous paint

- Line of jamb rebate

- Tight fitting closed cell compressible foam rod or tube,
or hemp rope

- Render or earth mortar brought up to sill

- D.P.C. under packer
  (See Clause 2.1.8.5)

- 1/R10 with 50 min
- cover all round

- Precast concrete bond beam
  on 3:1 sand:lime putty mortar
  for unstabilised earth walls
  OR 1:1:6 cement:lime:sand mortar
  for stabilised earth walls
  OR poured insitu

- Earth wall

- 15 mm min lap

- 10 mm min Ø drip groove

- Note: requires wide aluminium flange

- Note: Fit corner and mullion flashings
- Flashing material as defined
  in Acceptable Solution E2/AS1

- Leave 2-5 mm gap

- Ensure sill is positioned
to capture water that may
penetrate past the jamb facings
and directs it to the exterior.

- D.P.C. under packer
  (See Clause 2.1.8.5)

- Soaker flashing under jamb
  or mullions that penetrate sill

- Flashing material as defined
  in Acceptable Solution E2/AS1

- Ensure sill is positioned
to capture water that may
penetrate past the jamb facings
and directs it to the exterior.

- Line of jamb rebate

- 19 mm min lap

- Note: requires wide aluminium flange

- Note: Fit corner and mullion flashings
- Flashing material as defined
  in Acceptable Solution E2/AS1

- Leave 2-5 mm gap

- Selected tiles if required
Clause 9.7 Add new Clause:

9.7 Penetrations

9.7.1
The upper surface of elements (e.g. pipes and meterboxes) that penetrate external walls must be sloped downwards to the exterior to direct moisture away from the wall and to discharge it clear of the wall surface.

COMMENT:
C9.7.1
Penetrations should be located where they are sheltered from wind-driven rain – this may be achieved by positioning the penetration in a sheltered location or as high as practical under eaves on the wall.

9.7.2
Penetrations less than 200mm wide must meet the requirements of NZS 4298 Clause 2.1.12 and must be sealed all round with a tight-fitting moisture resistant compressible closed cell foam rod or tube that is finished 25 mm behind the wall surface, with the resulting gap filled with:

i) for unstabilised earth construction, a compatible unstabilised mortar

ii) for stabilised earth construction, a compatible stabilised mortar.

COMMENT:
C9.7.2
Generally sealants do not adhere well to earthen surfaces with the possible exception of dense stabilised rammed earth or pressed earth brick.

9.7.3
Penetrations more than 200mm wide (e.g. meterboxes) must be anchored as required in Clause 9.1 and must meet the following requirements:

a) Where the depth of the penetration is more than 1/3 of the wall depth, the penetration must incorporate head, jamb and sill details similar to those required for windows.

b) Where the depth of the penetration is less than 1/3 of the wall depth, the penetration must be sealed all round with a compatible mortar as required by Clause 9.7.2.
Acceptable Solution E2/AS3

1.0 Concrete and Concrete Masonry Buildings

Concrete and concrete masonry construction with the scope of CCANZ CP 01, and that complies with CCANZ CP 01, will meet the performance criteria of NZBC E2.
Index E2/VM1 & AS1/AS2/AS3

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