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Approved Document for New Zealand Building Code External Moisture Clause E2

Prepared by the Department of Building and Housing
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Status of Approved Documents

Approved Documents are prepared by the Department of Building and Housing in accordance with section 49 of the Building Act 1991. They are non-mandatory guidance documents offering only one method of compliance with specific performance criteria of the New Zealand Building Code.

Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Approved Documents and explains alternative methods of achieving compliance.

Classified uses and defined words which are italicised in the text are explained in clauses A1 and A2 of the New Zealand Building Code.

E2: Document History

	Date	Alterations
First published	July 1992	
Second Edition	28 February 1998	Document revised – Second edition issued
Third Edition June 2004	E2/VM1 effective from 1 July 2004 E2/AS1 effective from 1 February 2005	
Amendment 1 September 2004	E2/AS1 effective from 1 July 2005	
Reprinted incorporating Amendment 1 September 2004		

NOTE:

Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.

Document Status

The most recent version of this document, as detailed in the Document History, is approved by the Building Industry Authority. E2/VM1 is effective from 1 July 2004 and supersedes all previous versions of this document. E2/AS1 is effective from 1 July 2005 and supersedes all previous versions of this document. Implementation of the clauses that refer to the requirement for installers/applicators to be approved by the manufacturers or the NZ agents will be deferred until the Licensed Building Practitioner regime is developed. Clauses in E2/AS1 affected are:

- 1.5 general requirement for the approval of applicators
- 8.2.2 requiring masonry roof tiles to be installed by tilers approved by manufacturer or the NZ agent
- 8.3.2 requiring pressed metal tile roofing to be installed by trained installers approved by the manufacturer or NZ agent
- 8.4.2 requiring the profiled metal tile roofing cladding installer to be approved by the manufacturer or NZ agent
- 8.5.2 requiring the membrane roof cladding installer to be approved by the manufacturer or NZ agent
- 9.2.2 requiring masonry veneer installer to be approved by the manufacturer or NZ agent
- 9.3.4 requiring solid plaster/stucco to be applied by an experienced applicator
- 9.6.2 requiring profiled metal wall cladding installer to be approved by the manufacturer or NZ agent
- 9.7.10.2 requiring flush-finished fibre cement installer to be approved by the supplier of the jointing and finish system
- 9.9.2 requiring the installation and finishing of EIFS cladding systems by an applicator approved by the manufacturer of the system or NZ agent.

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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.

FIRST SCHEDULE—*continued*

Clause E2—EXTERNAL MOISTURE

Provisions	Limits on application
OBJECTIVE	
E2.1 The objective of this provision is to safeguard people from illness or injury which could result from external moisture entering the *building*.	
FUNCTIONAL REQUIREMENT	
E2.2 *Buildings* shall be constructed to provide *adequate* resistance to penetration by, and the accumulation of, moisture from the outside.	Requirement E2.2 shall not apply to *buildings* in which moisture from outside would result in effects which are no more harmful than those likely to arise indoors during normal use.
PERFORMANCE	
E2.3.1 Roofs shall shed precipitated moisture. In locations subject to snowfalls, roofs shall also shed melted snow.	
E2.3.2 Roofs and exterior walls shall prevent the penetration of water that could cause undue dampness, or damage to *building elements*.	
E2.3.3 Walls, floors and structural elements in contact with the ground shall not absorb or transmit moisture in quantities that could cause undue dampness, or damage to *building elements*.	
E2.3.4 *Building elements* susceptible to damage shall be protected from the adverse effects of moisture entering the space below suspended floors.	
E2.3.5 *Concealed spaces* and cavities in *buildings* shall be constructed in a way which prevents external moisture being transferred and causing condensation and the degradation of *building elements*.	
E2.3.6 Excess moisture present at the completion of *construction*, shall be capable of being dissipated without permanent damage to *building elements*.	

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For the purposes of New Zealand Building Code compliance, acceptable reference documents include only the quoted edition and specific amendments as listed below.

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AS/NZS 2269: 1994	Plywood – Structural	AS1 8.5.3, 9.3.6.1, 9.8.2
AS/NZS 2728: 1997	Prefinished/prepainted sheet metal products for interior/exterior building applications – Performance requirements	AS1 4.2.2, 4.3.2, 4.3.3, 4.3.4, 8.3.4.1, 8.3.4.2, 8.3.4.3, 8.4.3.1, 8.4.3.2, 8.4.3.3, 9.6.3.1, 9.6.3.2, 9.6.3.3, Table 20
AS/NZS 2904: 1995	Damp-proof courses and flashings	AS1 4.3.10
AS/NZS 2908: Part 2: 2000	Cellulose-cement products Flat sheet	AS1 9.3.6.2, 9.5.2, 9.7.2
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NZS 3604: 1999	Timber framed buildings	VM1 1.2, AS1 1.1, 4.2.2, 4.3.5, 7.2.1, 7.3.1.1, 8.2.3, 8.3.4.1, 8.4.3.1, 9.1.3.4, 9.1.3.5, 9.2.3, 9.2.7, 9.3.2, 9.4.3.1, 9.6.3.1, 10.3.1, 10.3.5, Definitions, Table 1, Table 2, Table 4, Table 5, Table 6, Table 18, Table 20 and Table 24
NZS 3617: 1979	Specification for profiles of weatherboards, fascia boards, and flooring	AS1 9.4.1.1
AS/NZS 4020: 2002	Testing of products for use in contact with drinking water	AS1 8.1.1
AS/NZS 4200: Part 1: 1994	Pliable building membranes and underlays – Materials	AS1 8.1.5.1, Table 23
AS/NZS 4201	Pliable building membranes and underlays – Methods of test	
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Part 4: 1994	Resistance to water penetration	AS1 Table 23
Part 6: 1994	Surface water absorbency	AS1 Table 23

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NZS 4211: 1985	Specification for performance of windows *Amend: 1, 2, 3*	VM1 1.2, AS1 9.1.10
NZS 4217	Pressed metal tile roofs	AS1 8.3.3, Table 20
Part 1: 1980	Specification for roofing tiles and their accessories	
Part 2: 1980	Code of practice for preparation of the structure and the laying and fixing of metal roofing tiles	
SNZ HB 4236: 2002	Masonry veneer wall cladding	AS1 9.1.3.2, 9.2.3, 9.2.6, 9.2.7, Table 3
NZS 4251:	Solid plastering	
Part 1: 1998	Cement plasters for walls, ceilings and soffits	AS1 9.3.2, 9.3.4.1, 9.3.4.2, 9.3.6.1, 9.3.6.2
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Part 2: 1994	Unplasticized polyvinyl chloride (uPVC) building sheets	
AS/NZS 4284: 1995	Testing of Building Facades	VM1 1.1, 1.4, 1.4.2, 1.4.3, 1.4.4
AS/NZS 4534: 1998	Zinc and zinc/aluminium-alloy coatings on steel wire	AS1 8.1.5.1, 9.1.8.5
AS/NZS 4680: 1999	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles	AS1 8.4.8, 8.4.9.1, 9.9.4.1, Table 20
AS/NZS 4858: 2004	Wet area membranes	AS1 9.7.8.1, 9.9.4.4, 9.9.10.2
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AS 1366	Rigid cellular plastics sheets for thermal insulation	
Part 3: 1992	Rigid cellular polystyrene – Moulded (RC/PS-M)	AS1 9.9.3.1
Part 4: 1989	Rigid cellular polystyrene – Extruded (RC/PS-E)	AS1 9.9.3.1
AS 1397: 2001	Steel sheet and strip – Hot-dip zinc-coated or aluminium/zinc-coated	AS1 4.3.3, 4.3.4, 8.3.4.2, 8.4.3.2, 9.6.3.2
AS 1566: 1997	Copper and copper alloys – Rolled flat products	AS1 4.3.6, 8.1.6.1
AS 1804: 1976	Soft lead sheet and strip	AS1 4.3.7
AS 2049: 2002	Roof tiles	AS1 8.2.1
AS 2050: 2002	Installation of roof tiles	VM1 2.1, AS1 8.2.3
AS 3566	Self-drilling screws for the building and construction industries	
Part 2: 2002	Corrosion resistance	AS1 8.4.8, 8.4.9.1, 9.6.6, Table 20
AS 3730	Guide to the properties of paints for buildings	AS1 9.3.7, 9.4.9, 9.5.6, 9.7.10.1, 9.7.10.2, 9.8.9, 9.9.3, 9.9.6.3

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ASTM D6134: 1997	Standard Specification for Vulcanised Rubber Sheets Used in Waterproofing Systems	AS1 4.3.9, 8.5.4
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ASTM E903: 1996	Standard Test Method for Solar Absorbance, Reflectance, and Transmittance of Materials Using Integrating Spheres	AS1 2.4
ASTM E2098: 2000	Standard Test Method for Determining Tensile Breaking Strength of Glass Fibre Reinforcing Mesh for Use in Class PB Exterior Insulation and Finish Systems (EIFS), after Exposure to a Sodium Hydroxide Solution	AS1 9.9.3.2
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ASTM G155: 2000	Standard Practice for Operating Xenon Arc Light Apparatus for UV Exposure of Nonmetallic Materials	AS1 9.1.10.7

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	Measurement of moisture content of assembled timber framing: 1993	AS1 11.3.1
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Definitions

This is an abbreviated list of definitions for words or terms particularly relevant to this Approved Document. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

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.

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**.

COMMENT:
A *bird's beak* is used at the bottom of a *capping* to deflect water away from the *enclosed balustrade cladding*.

Building wrap A building paper, synthetic wrap or 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*.

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

A *butt flashing* is shaped to underflash the *cladding*, with the *cladding* butting against the exposed box portion of the *flashing*.

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

COMMENT:
Cantilevered balconies are often *constructed* by extending *framing* members through the *cladding* beyond the *building* face.

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.

A *cavity spacer* is required to be set to a slight fall (5° minimum from horizontal) to allow drainage of any moisture from the top.

Cladding The exterior weather-resistant surface of a *building*.

COMMENT:
Includes any supporting substrate and, if applicable, surface treatment.

Cladding system The weatherproof enclosure of a *building*, including *building wraps*, *claddings* and their fixings, windows, doors and all penetrations, *flashings*, seals, joints and junctions.

Where required by this Acceptable Solution, the *cladding system* shall include a *drained cavity*.

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

Damp-proof course (DPC) A narrow strip (generally up to 300 mm wide) 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 prevent water and water vapour movement through concrete in contact with the ground. (Also known as a concrete underlay.)

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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.

A d*rained 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.

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 horizontal member fixed between vertical *framing* timbers. Also known as nogging.

Eaves That part of the roof *construction*, including *cladding*, fascia and gutter, 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.

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 exterior face of a *building* within 30° of vertical, consisting of *primary* and/or *secondary elements* intended to provide protection against the outdoor environment, but which may also contain *unprotected areas*.

COMMENT:
A roof is an *external wall* if within 30° of the vertical.

Finished ground level (FGL) The level of the ground after all backfilling, landscaping and surface paving has been completed.

Flashing A component, formed from a rigid or flexible *waterproof* material, that drains or deflects water back outside the *cladding system.*

Flexible flashing tape A flexible self-adhesive *waterproof* tape, used as part of a *flashing* system. Usually used as an accessory for *building wraps*, 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**.

COMMENT:
Hidden gutters are distinct from gutters or spouting that are externally located beyond the bounds of the roof and wall *framing*.

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

COMMENT:
A *hook* is distinct from a *hem*, as it is open at an acute angle rather than flattened.

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.**

COMMENT:
A *kick-out* is used at the bottom of a *capping* or other *flashing* to deflect water away from the *cladding* below.

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*.

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*.

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 underlay An absorbent permeable building paper that absorbs or collects condensation or water that may penetrate the roof *cladding* or metal wall *cladding*.

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.

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

Specific weathertightness design Design and detailing of a proposed *building* or parts of a *building*, demonstrating *weather-tightness*, that shall be provided to the *territorial authority* or *building certifier* for assessment and approval as part of the *building consent* process.

Buildings, or parts of *buildings*, requiring *specific weathertightness design* are beyond the scope of 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.

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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.

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

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.

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Verification Method E2/VM1

Weathertightness

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

1.1 General

This Verification Method for determining compliance with NZBC E2.3.2 of windows, doors and *cladding systems* for housing and communal residential *buildings* utilises the *weathertightness* testing procedure of AS/NZS 4284 to performance criteria detailed in Paragraph 1.4.

The verification tests shall be undertaken in a test facility with IANZ or equivalent accreditation for testing the *weathertightness* of *claddings* to the parts of AS/NZS 4284 referenced in this Verification Method.

This test method is only applicable to *claddings* with a 20 mm nominal cavity behind the *cladding*.

COMMENT:
The *weathertightness* test of AS/NZS 4284 is modified for generic domestic-oriented *cladding* because it was developed primarily for testing specific, non-absorptive facades and curtain wall systems on high-rise commercial *buildings*.

1.2 Scope

The scope of this Verification Method shall be restricted to:

a) *Buildings* within the scope of Clause 1.1.2 of NZS 3604, and:
   i) up to 3 *storeys* of timber *framing*, with a maximum height from ground to *eaves* of 10 m,
   ii) with floor plan area limited only by seismic and structural *control joints*,

b) Where *buildings* are based on NZS 3604, but require specific engineering design input, the *framing* shall:
   i) be of at least equivalent stiffness to the *framing* provisions of NZS 3604, or
   ii) comply with the serviceability criteria of NZS 4203,

c) *Buildings* with *wind zones* covered by Clause 5.2 of NZS 3604, and *buildings* subject to specific design up to an ultimate limit state (ULS) wind pressure of 2500 Pa,

d) *Claddings* shall contain a cavity of nominally 20 mm depth,

e) While the procedures outlined in this Verification Method may be used for *buildings* with ULS wind pressures of greater than 2500 Pa, they will require the calculation of specific test pressures, and are outside the scope of this document, and

f) While the test specimens used for this Verification Method may include windows and doors, it is only the junctions of these elements with other *cladding* elements that are assessed in the test. Window and door units must be tested to NZS 4211 to the appropriate *wind zone* or specific design wind pressure.

1.3 Specimen details

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

If the *cladding system* is never to be used with *building elements* penetrating the exterior surface wall, then the sample shall include the details from Class 1. In all other cases, 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 only *fixtures* are likely. Testing is to include vertical joints, internal and 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 a representative sample of joints and penetrating elements, including vertical and horizontal *control joints*, internal and external wall junctions, windows and/or doors, electrical meterboxes, balcony drainage and *parapet flashings*, and footer and header termination systems, plus any other relevant details.

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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 *building wrap* 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 2% of the area of the *building wrap* (or equivalent) be so removed.

1.4 Test procedure

The Verification Method shall consist of the extended water penetration tests of AS/NZS 4284, following a preconditioning pressure loading exposure. An optional test of the structural integrity of the *cladding* (*wetwall)* may be undertaken following removal of the internal *lining* and *building wrap*.

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 1360 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 *building wrap* 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 7.5 of AS/NZS 4284 at the maximum test pressure of 500 Pa.

1.4.3 Series 1 Cyclic Pressure Water Penetration

The water penetration test by cyclic pressure shall be conducted in accordance with Clause 7.6 of AS/NZS 4284 at the prescribed Stage 1 and Stage 2 cyclic test pressures, with the Stage 3 test 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 8.8 in at least 4 places, as noted below:

a) Through the window/wall joint at $\frac{3}{4}$ 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.

1.4.5 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 1.4.8) noted.

1.4.6 Series 3 "Wetwall Test"

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

1.4.7 Non-compliance shall be the presence of water (as defined in Paragraph 1.4.8) 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.

1.4.8 During the *Wetwall* Test, water is allowed to spatter up from the footer *flashing*, provided it is not held above any cavity obstruction. Water which is able to penetrate to the back of the *wetwall* shall be controlled. It may contact battens and other cavity surfaces, but no water shall be transferred to the plane of the *building wrap*, cavity air sealing or structural *framing*. 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 *building wrap*. However, the spattering of water into the cavity through the introduced defects shall be ignored.

1.4.9 Exterior cladding load test

An optional test may be performed on completion of water testing. This shall be carried out in accordance with Paragraph 1.4.1, but with a differential pressure across the *wetwall* equal to the SLS pressure, or 1000 Pa whichever is the greater.

There shall be no structural failure of the *wetwall*.

1.5 Alternative test options

Where a supplier wishes to test a *cladding* to a ULS wind load less than 2500 Pa, the procedures shall be the same as described in Paragraph 1.4, apart from the following changes.

1.5.1 Preconditioning

The test pressure for use in the preconditioning step in Paragraph 1.4.1 shall be the SLS wind pressure calculated using a combined pressure coefficient of 1.0.

1.5.2 Series 1 Static Pressure Water Penetration

The maximum test pressure for use in the static pressure water penetration test in Paragraph 1.4.2 shall be determined from the SLS wind pressure (SWP) using a combined pressure coefficient of 0.7. The formula for calculating the test pressure shall be 0.4 SWP + 120 Pa.

1.6 The pro forma attached as Appendix 1 to this Verification Method shall be used to provide specifiers with the test details and results.

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

2.1 Appendix C of AS 2050 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.

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

Series 1: Static Water Penetration Test pressure 500 Pa Duration 15 mins	
Series 1: Cyclic Water Penetration Test pressure 150 – 300 Pa Duration 5 mins Test Pressure 300 – 600 Pa Duration 5 mins	
Series 2: Water Management Tests **Static Water Penetration** Test pressure 50 Pa Duration 15 mins	
Series 2: Water Management Tests **Cyclic Water Penetration** Test pressure 150 – 300 Pa Duration 5 mins Test Pressure 300 – 600 Pa Duration 5 mins	
Series 3: Wetwall Test Static Water Penetration Test pressure 50 Pa Duration 15 mins	

Additional water penetration requirements:

Comments:

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EXTERNAL MOISTURE

Acceptable Solution E2/AS1

(Effective date revised by amendment 1)

1.0 Scope

This Acceptable Solution covers the *weathertightness* of the *building* envelope.

1.1 Construction included

The scope of this Acceptable Solution is limited to *buildings* within the scope of Clause 1.1.2 of NZS 3604, and:

a) Up to 3 *storeys* of timber *framing*, with a maximum height from ground to *eaves* of 10 m, and

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

COMMENT:
The floor plan limitations of NZS 3604 may be exceeded up to the point that specific engineering design is required to accommodate seismic or wind movement. Beyond that point, *specific weathertightness design* is required.

While parts of a *building* may be outside the scope of NZS 3604, this Acceptable Solution may be used for those parts covered by NZS 3604.

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, or comply with the serviceability criteria of NZS 4203.

COMMENT:
Claddings also required to perform as bracing must comply with NZS 3604.

Where a *drained cavity* is used, specific testing will be required to demonstrate that a *cladding* on *cavity battens* can provide the required bracing resistance.

1.2 Construction excluded

1.2.1 Outbuildings

Outbuildings, such as garages and other unlined structures, do not come within the scope of this Acceptable Solution.

COMMENT:
Details contained in this Acceptable Solution can be used for unlined spaces, 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 Steel framing

Steel-framed *buildings* do not come within the scope of this Acceptable Solution.

1.2.3 Spread of flame

Buildings with *drained cavities* and spread-of-flame requirements, as specified in NZBC C3.3, are outside the scope of this Acceptable Solution.

COMMENT:
Cavities in such circumstances must be specifically designed for both *weathertightness* and spread of flame.

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.

Details must be approved by the *territorial authority* or *building certifier*.

1.2.4 Acoustics

Buildings with *drained cavities* and acoustic requirements, as specified in NZBC G3, 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 weathertightness design for preventing the ingress of snow melt water is required when the open ground snow load S_9, as defined in NZS 4203, exceeds 1.0 kPa, and:

a) The roof pitch is less than 70°, or

b) 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.

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1.4 Specific weathertightness design

Buildings, components or junction details outside the scope of this Acceptable Solution require *specific weathertightness design*.

Details of *specific weathertightness design* shall be provided to the *territorial authority* or *building certifier* for assessment and approval as part of the *building consent* process.

1.5 Qualifications

Paragraph 8.0 and Paragraph 9.0 of this Acceptable Solution require that installers of *claddings* and associated materials shall be trained in correct installation and approved by the manufacturer or the NZ agent (in the case of imported materials) of the *cladding*.

COMMENT:

An understanding of the proper methods of installation and the importance of the correct *construction* sequence is essential if an NZBC compliant *building* is to be achieved.

While qualifications approved by the New Zealand Qualifications Authority (NZQA) are recommended, personnel with these qualifications may not be readily available for all *cladding systems*.

Territorial authorities and *building certifiers* should ensure that those responsible for installing *claddings* and associated weatherproofing materials have the required levels of skill and support from the relevant manufacturers.

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 an 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 fixings additional to those 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 weathertightness 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.

COMMENT:

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

Where possible, materials used to *construct* the *building* envelope shall be designed, specified and tested as a complete *cladding system* rather than as separate items.

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 or ASTM E903.

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.

Colour cards from some coating manufacturers may include reflectance values.

2.5 Maintenance

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

c) Repair or replacement of items when necessary, in order to preserve the *weathertightness* of the *building*.

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 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 elevation 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.

3.2 Roof claddings

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	Paragraph 8.4
d) *Membrane* roofing	Paragraph 8.5.

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

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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	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 beyond the scope of this Acceptable Solution.

Figure 1: How to assess risk
Paragraph 3.1

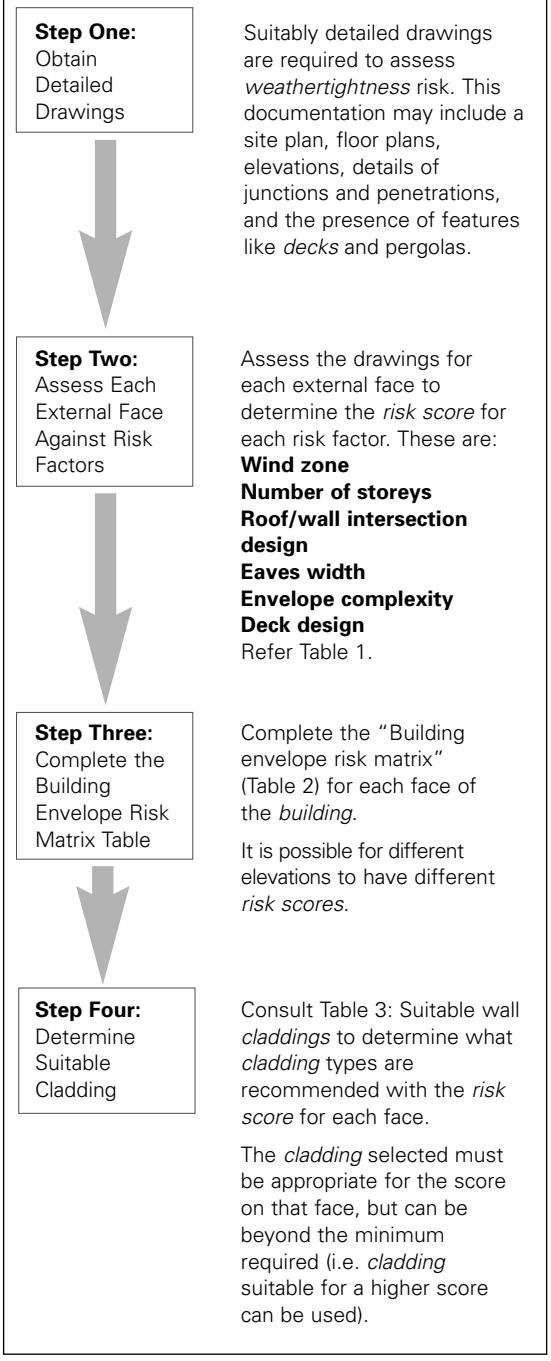

Table 1: Definitions of risk
Paragraph 3.1.1, Figure 1

A: Wind zone	**Low risk**	Low *wind zone* as described by NZS 3604
	Medium risk	Medium *wind zone* as described by NZS 3604
	High risk	High *wind zone* as described by NZS 3604
	Very high risk	Very high *wind zone* as described by NZS 3604
B: Number of storeys	**Low risk**	One *storey*
	Medium risk	Two *storeys* in part
	High risk	Two *storeys*
	Very high risk	More than two *storeys*
C: Roof/wall intersection design	**Low risk**	Roof-to-wall intersection fully protected (e.g. hip and gable roof with *eaves)*
	Medium risk	Roof-to-wall intersection partly exposed (e.g. hip and gable roof with no *eaves*)
	High risk	Roof-to-wall intersection fully exposed (e.g. *parapets* or *eaves* at greater than 90° to vertical with soffit *lining*)
	Very high risk	Roof elements finishing within the boundaries formed by the exterior walls (e.g. lower ends of aprons, *chimneys* etc)
D: Eaves width (1)	**Low risk**	Greater than 600 mm at first floor level
	Medium risk	450 – 600 mm at first floor, or over 600 mm at second floor level
	High risk	100 – 450 mm at first floor, or 450 – 600 mm at second floor level
	Very high risk	0 – 100 mm at first floor, or 100 – 450 mm at second floor level, or 450 – 600 mm at third floor level (2)
E: Envelope complexity	**Low risk**	Simple rectangular, L, T or boomerang shape, with single *cladding* type
	Medium risk	More complex, angular or curved shapes (e.g. Y or arrowhead) with single *cladding* type
	High risk	Complex, angular or curved shapes (e.g. Y or arrowhead) with multiple *cladding* types
	Very high risk	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)
F: Deck design	**Low risk**	None, timber slat *deck* or porch at ground level
	Medium risk	Fully covered in plan by roof, or timber slat *deck* attached at first or second floor level
	High risk	*Enclosed deck* exposed in plan or cantilevered at first floor level
	Very high risk	*Enclosed deck* exposed in plan or cantilevered at second floor level or above

NOTES:

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

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

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Table 2: Building envelope risk matrix
Paragraph 3.1.2, Figure 1

Risk factor	Risk severity: LOW	score	MEDIUM	score	HIGH	score	VERY HIGH	score	Subtotals for each risk factor
Wind zone (per NZS 3604)	0		0		1		2		
Number of storeys	0		1		2		4		
Roof/wall intersection design	0		1		3		5		
Eaves width	0		1		2		5		
Envelope complexity	0		1		3		6		
Deck design	0		2		4		6		
							Total risk score:		

(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.)

Table 3: Suitable wall claddings
Paragraphs 3.1.2, 3.4.1.1, 3.4.2.1, 3.4.2.2, 3.4.3.2, 9.1.1, 9.4.1.2, 9.4.1.3, 9.6, Figure 1

Risk Score	Suitable wall claddings[1]	
	Direct fixed to framing	**Over 20 mm minimum drained cavity**
0 – 6	a) Timber weatherboards – all types b) Fibre cement weatherboards c) Vertical profiled metal [3] – corrugated and symmetrical *trapezoidal* only d) Fibre cement sheet [4] e) Plywood sheet f) *EIFS*	a) *Masonry veneer* [2] b) *Stucco* c) Horizontal profiled metal [3] – corrugated and *trapezoidal* only
7 – 12	a) Bevel-back weatherboards b) Vertical board and batten c) Vertical profiled metal [3] – corrugated only	a) *Masonry veneer* [2] b) *Stucco* c) Horizontal profiled metal d) Rusticated weatherboards e) Fibre cement weatherboards f) Fibre cement sheet g) Plywood sheet h) *EIFS*
13 – 20	a) Vertical profiled metal [3] – corrugated only	a) *Masonry veneer* [2] b) *Stucco* c) Horizontal profiled metal d) Rusticated weatherboards e) Fibre cement weatherboards f) Fibre cement sheet g) Plywood sheet h) *EIFS* i) Bevel-back weatherboards
Over 20	a) Redesign the *building* to achieve a lower score, or b) Specific design – The design may need changing to reduce the risk – The *territorial authority* or *building certifier* will require more comprehensive details and documentation providing evidence of *weathertightness* – The *territorial authority*, *building certifier*, designer or *owner* may require more inspections – A third party audit of design by a *weathertightness* expert may be required.	

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.

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3.4 Examples using the risk matrix

Paragraph 3.4.1 to Paragraph 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.

3.4.1 Example 1

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

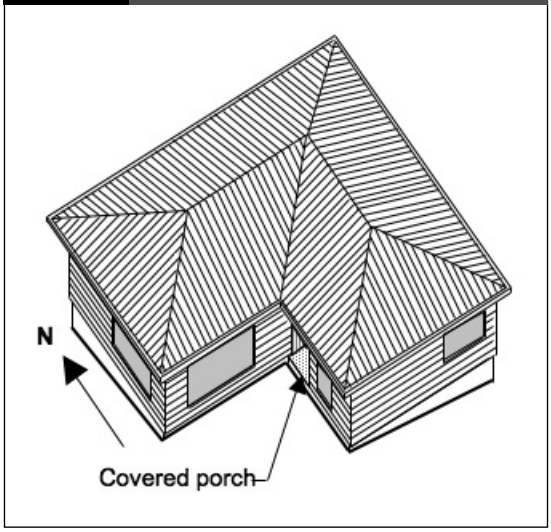
COMMENT:
The house in this example is a simple single *storey* L shape and is considered low risk in terms of *envelope complexity*.

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*.

Figure 2: Risk matrix example 1



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
   ii) Fibre cement weatherboards
   iii) Vertical profiled metal – corrugated and symmetrical *trapezoidal* only
   iv) Fibre cement sheet
   v) Plywood sheet
   vi) *EIFS*, and

b) Wall *cladding* with a 20 mm minimum *drained cavity*:
   i) *Masonry veneer* (with 40 mm cavity)
   ii) *Stucco*
   iii) Horizontal profiled metal – except for *trough profile*.

Table 4: Risk matrix example 1 – south face

	Risk severity								
Risk factor	**LOW**	**score**	**MEDIUM**	**score**	**HIGH**	**score**	**VERY HIGH**	**score**	**Subtotals for each risk factor**
Wind zone (per NZS 3604)	0		0		1	*1*	2		*1*
Number of storeys	0	*0*	1		2		4		*0*
Roof/wall intersection design	0	*0*	1		3		5		*0*
Eaves width	0		1	*1*	2		5		*1*
Envelope complexity	0	*0*	1		3		6		*0*
Deck design	0	*0*	2		4		6		*0*
							Total risk score:		***2***

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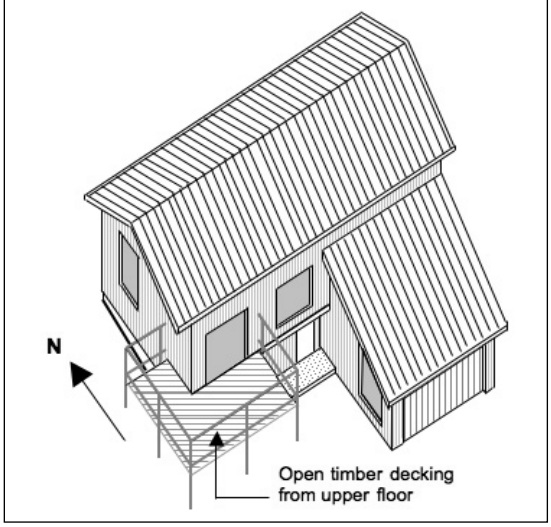
3.4.2 Example 2

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

Figure 3: Risk matrix example 2



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 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

	Risk severity								
Risk factor	**LOW**	**score**	**MEDIUM**	**score**	**HIGH**	**score**	**VERY HIGH**	**score**	**Subtotals for each risk factor**
Wind zone (per NZS 3604)	0		0		1	*1*	2		*1*
Number of storeys	0		1	*1*	2		4		*1*
Roof/wall intersection design	0		1		3	*3*	5		*3*
Eaves width	0		1		2	*2*	5		*2*
Envelope complexity	0		1	*1*	3		6		*1*
Deck design	0		2	*2*	4		6		*2*
							Total risk score:		***10***

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 steel, and

b) Wall *cladding* with a 20 mm minimum *drained cavity*:
   i) *Masonry veneer* (with 40 mm cavity)
   ii) *Stucco*
   iii) Horizontal profiled metal
   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
   iv) Fibre cement sheet
   v) Plywood sheet
   vi) *EIFS,* and

b) Wall *cladding* with a 20 mm minimum *drained cavity*:
   i) *Masonry veneer* (with 40 mm cavity)
   ii) *Stucco*
   iii) Horizontal profiled metal.

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 weathertightness design*, or redesign to lower the risk.

Specific weathertightness design may result in the *territorial authority* or *building certifier* possibly:
a) Needing more details to be provided,
b) Requiring more inspections during *construction*,
c) Requiring a third party audit of design by a *weathertightness* expert.

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 20 mm minimum *drained cavity*.

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

Figure 4: Risk matrix example 3

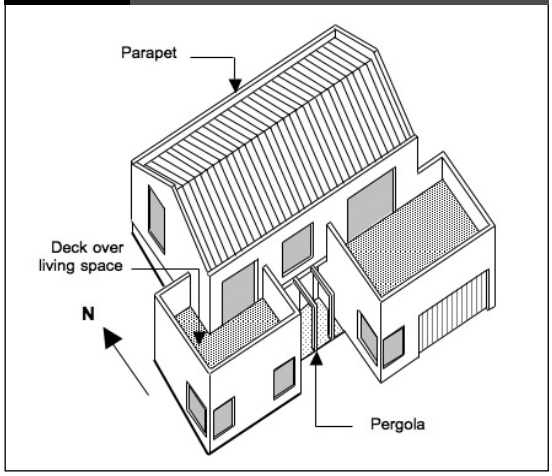


Table 6: Risk matrix example 3 – south elevation

	Risk severity								
Risk factor	**LOW**	**score**	**MEDIUM**	**score**	**HIGH**	**score**	**VERY HIGH**	**score**	**Subtotals for each risk factor**
Wind zone (per NZS 3604)	0		0		1	*1*	2		*1*
Number of storeys	0		1	*1*	2		4		*1*
Roof/wall intersection design	0		1		3		5	*5*	*5*
Eaves width	0		1		2		5	*5*	*5*
Envelope complexity	0		1		3		6	*6*	*6*
Deck design	0		2		4	*4*	6		*4*
							Total risk score:		***22***

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3.4.3.1 Cladding options – south elevation

As the south face scores over 20, it will require:

a) *Specific weathertightness 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 steel, and

b) Wall *cladding* with a 20 mm minimum *drained cavity*:
   i) *Masonry veneer* (with 40 mm cavity)
   ii) *Stucco*
   iii) Horizontal profiled metal
   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

In all applications, the choice of *flashing* materials shall take into account the following factors:

a) The requirements of NZBC B2 Durability,

b) The environment where the *building* is located,

c) The specific conditions of use, and

d) Consideration of the surrounding materials.

4.2.1 Durability requirements

Flashings shall comply with the requirements of NZBC B2 Durability, which sets out the requirements for *flashings* as:

a) 50 years, where *flashings* are:
   i) completely hidden behind *claddings*
   ii) not accessible, or

b) 15 years, where *flashings* are:
   i) exposed
   ii) accessible.

4.2.1.1 Two part flashings

Where a *flashing* is partly exposed with the other part hidden and not accessible:

a) If it is in one piece, the total *flashing* must last the required 50 years, or

b) If it is in two pieces:
   i) the hidden part must last the required 50 years, and
   ii) the exposed part, if able to be replaced without *cladding* removal, may last 15 years.

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

4.2.2 Environment

Flashing materials shall be selected according to the relevant exposure conditions as defined in either:

a) NZS 3604 Clause 4.2, or

b) AS/NZS 2728.

Flashings shall be selected from Table 20 to minimise corrosion.

COMMENT:

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

AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

Exposure zones are defined in Clause 4.2 of NZS 3604, based on the likely exposure to wind-driven sea-salt or geothermal gases.

4.2.3 Specific conditions of use

Flashing materials shall be selected according to the specific conditions of their use.

Flashings shall be selected from Table 20 to minimise the effects of sheltered corrosion.

COMMENT:

The specific location of a material on a *building* can substantially affect the *durability* of that material.

In particular, many metals can undergo accelerated corrosion if they are exposed to wind-driven sea-salt in sheltered locations, where they are not exposed to being washed by rainwater.

4.2.4 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

Table 20 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 only be used in accordance with Table 20, and 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 B2 Durability as detailed in B2/VM1.

4.3.2 Aluminium flashings

Uncoated aluminium *flashings* shall be a minimum thickness of 0.9 mm, and grade 5052 or 5552 to AS/NZS 1734.

Factory coating of aluminium *flashings* shall be specified in accordance with AS/NZS 2728, and the aluminium shall be grade 3000 series or 5000 series.

4.3.3 Galvanized steel flashings

Galvanized steel *flashings* shall only be used in accordance with Table 20.

Galvanized steel *flashings* shall have a *BMT* of 0.55 mm minimum, with galvanizing of:

a) Hot-dipped zinc coated 450 to AS 1397, or

b) Hot-dipped zinc coated 275 for pre-painted roofing with a factory-applied finish complying with AS/NZS 2728 Type 4 or better.

4.3.4 Aluminium-zinc coated steel flashings

Aluminium-zinc coated steel *flashings* shall only be used in accordance with Table 20.

Aluminium-zinc coated steel *flashings* shall have:

a) 0.55 mm minimum *BMT* of steel, and

b) Aluminium-zinc coating of AZ150 to AS 1397, with a factory-applied finish complying with AS/NZS 2728 Type 4 or better.

4.3.5 Stainless steel flashings

Stainless steel *flashings* shall be:

a) Minimum thickness of 0.45 mm, and

b) X5CrNi 18-9 (304) or X5CrNiMo 17-12-2 (316) stainless steel in accordance with Table 1 of ISO/TS 15510.

Stainless steel *flashings* shall not be used with coated and uncoated aluminium or steel *cladding* (aluminium-zinc or galvanized) in sea-spray zone or corrosion zone 1, as defined in Clause 4 of NZS 3604, unless they are separated to protect against *electrolytic corrosion*.

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4.3.6 Copper flashings

Copper *flashings* shall be:

a) A minimum thickness of 0.7 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 unit mass of:
   i) 10 kg/m^2 in fully concealed applications
   ii) 20 kg/m^2 where used in exposed locations.

4.3.8 Zinc sheet flashings

Zinc sheet *flashings* shall only be used in accordance with Table 20.

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 Table 20.

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, and shall be compatible with any adjacent *building wrap* or *roof underlay*.

4.4 Fixings

Fixings of metal *flashings* shall comply with Table 20 to Table 22.

COMMENT:
Fixings that penetrate *flashings* should be avoided where possible, particularly for horizontal *flashings*.

4.5 Flashing requirements

All *flashings* shall have *expansion joints* where necessary to provide adequate allowance 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

The edges of *flashings* may be required to be folded to form a *kick-out* or a *bird's beak*. Where a detail shows a *hem* or *hook*, these are optional unless noted otherwise. Other edge treatments, such as barge rolls, may also be used.

Edge treatments are shown in Figure 5.

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

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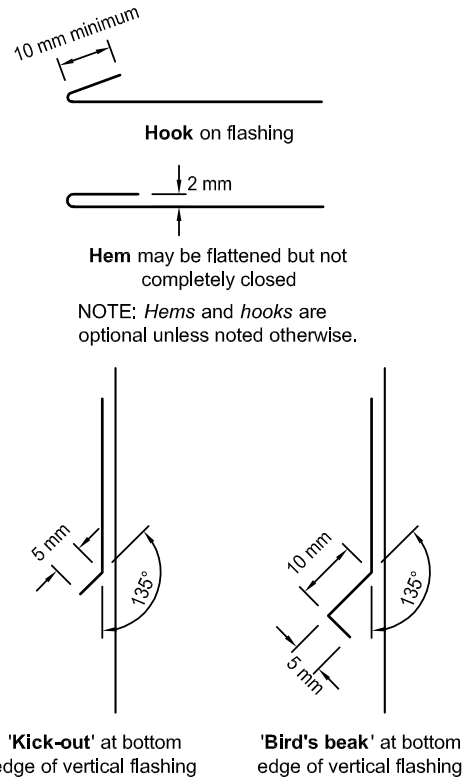
ii) sealed against moisture, or
iii) of a sealing type,

Figure 5: Metal flashings edge treatments
Paragraphs 4.5.2, 6.4 d), 7.4.4 and 9.6.7 a)



b) *Expansion joints* shall be provided for joined *flashings* with a combined length exceeding:
   i) 12 metres for steel,
   ii) 9 metres for copper and stainless steel,
   iii) 6 metres for aluminium,

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

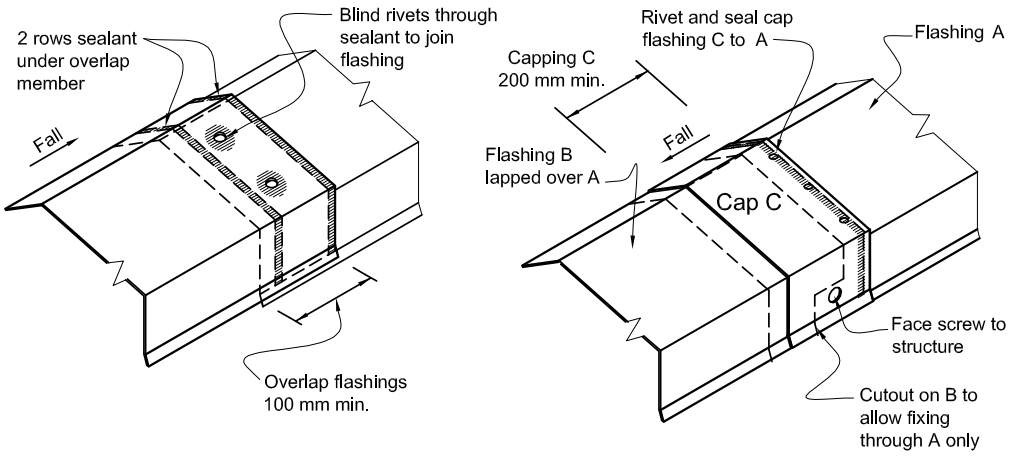
d) Where necessary, *expansion joints* shall be formed as shown in Figure 6, with:
   i) 200 mm laps, and
   ii) sliding clips at both sides of the lap,

e) When using uncoated galvanized steel, zinc, stainless steel or copper *flashings*, joints shall be riveted and soldered as described in Section 5.6.6 of the New Zealand Metal Roof and Wall Cladding Code of Practice, and

f) 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.

Figure 6: Joints in metal flashings
Paragraphs 4.5.2 and 4.5.2 d), 8.4.11.1 c), d) and 9.6.7.b)



(a) FLASHING SEALED JOINT

(b) FLASHING EXPANSION JOINT

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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*.

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) a turn-down to leave a 5 mm gap between the *flashing* and the roof *cladding*, 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) cover at least two crests, and

iii) terminate 5 mm from the roof *cladding* in the following trough.

4.6.1.2 Ridges and hips

Refer to Figure 46 for example of use.

a) The turn-down of the *flashing* shall leave a 5 mm gap between the *flashing* and the roof *cladding*.

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 *hook* 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.

b) Where *flashing* is not accessible for maintenance and replacement, it may be made of two pieces as shown in Figure 7.

COMMENT:

This alternative detail allows the lower *flashing* to be replaced if necessary, without disturbing the upper.

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 heads

Refer to Figure 81 for example of use.

a) Slopes and covers of *flashings* at window 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.

COMMENT:

Details for door penetrations shall be based on those applying to windows, except for the sill which depends on the specific threshold.

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 the top of the slope of the head *flashing,* shall be in accordance with Table 7.

Table 7: Metal flashings – general dimensions

Paragraphs 4.6, 4.6.1.1 a), 4.6.1.2 b), 4.6.1.3 a), b), 4.6.1.4, 4.6.1.5 b), 4.6.1.7 a), b), 5.1 a), c), d), 6.4 c), 7.4.4, 8.3.8, 9.1.10.4, 9.1.10.5, 9.1.10.6 and 9.4.5.3 b) Figures 7, 9, 10, 36, 41-48, 54, 55, 61, 92, 97 and 101

Type	Description	All [1]	Situation 1 [2] minimum mm	Situation 2 [3] minimum mm	Figure reference (as example)
Aprons: general	*Transverse flashing* over roofing		130 [4]	200 [4]	Figure 7 (X values)
	Parallel flashing over roofing	Two crests, finish in next trough – Paragraph 4.6.1.1 b)			Figure 48 (Y values)
Ridges/ hips	*Transverse flashing* over roofing	Refer **Aprons: general**			Figure 46 (X values)
Changes in roof pitches	Upper lap under roofing	250 mm min.			Figure 44 (X values)
	Transverse flashing over roofing	Refer **Aprons: general**			
Barges	Overlap to barge board		50 [8]	70 [8]	Figure 47 (Z values)
Cappings	Overlaps to *cladding*		50 [8]	70 [8]	Figure 10 (Z values)
	Slope to top: *parapet*	5°			
	Housing – balustrade [5]	5°			
Roof or deck to wall	Overlaps to roofing	Refer **Aprons: general**			Figure 7 (X or Y values)
	Lap under *cladding* above	75 mm min.			
	Clearance below *cladding*	35 mm min.			
	Total upstand	**110** mm min.			
Windows	Window flange clearance	5 mm			Figure 81
	Cover to window flange	10 mm [7]			
Sills	Sill *flashing* slope [6]	5°			
Heads	Head *flashing* slope	15°			
	Lap under *cladding* above	35 mm min.			
	Anti-capillary gap to *cladding*	5 mm			
	Total upstand	**40** mm min.			
Corners	Corner *flashings* [1]	50 mm x 50 mm minimum			Figure 79
Inter-storey junctions	Junction *flashing*: slope	15°			Figure 70
	Lap over *cladding* below [1]	35 mm min. [8]			
	Lap under *cladding* above	35 mm min.			
	Clearance under *cladding*	5 mm			
	Total upstand	**40** mm min.			

NOTES:

(1) Unless otherwise dimensioned in details.

(2) **Situation 1:** In low or medium *wind zones*, where roof pitch is 10° or greater (X or Z values).

(3) **Situation 2:** For all roof pitches in high or very high *wind zones*,
For all *wind zones* where roof pitch is less than 10° (X or Z values).

(4) Excluding any *soft edge* or turn-down to roofing.

(5) For *buildings* other than housing, slope shall be as per F4/AS1.

(6) Where applicable, unless shown otherwise in details – for windows requiring sill *flashings*. Sill *flashings* must extend past the condensation channel.

(7) Excluding *drip edge*. The aim is for at least 10 mm, but this may be reduced if necessary to account for on-site tolerances – to give an absolute minimum of 8 mm.

(8) Excluding *drip edge*.

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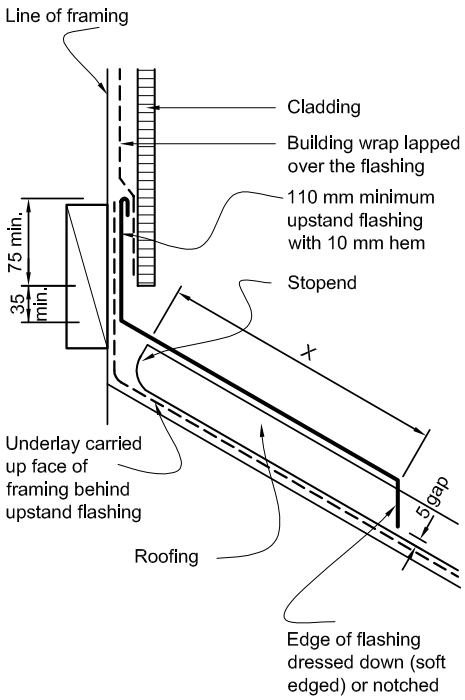
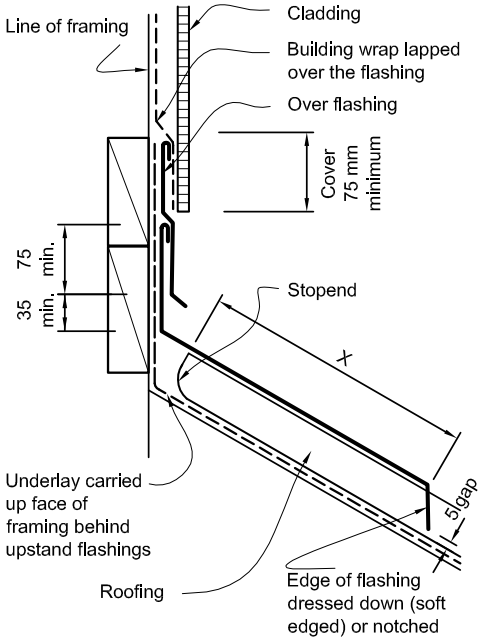
Figure 7: Basic apron flashing
Paragraphs 4.2.1.1, 4.6.1.1 a), 4.6.1.4 b), and 5.1

NOTE: (1) X = variable according to *wind zone* – refer Table 7.
(2) *Stopends* to profiled metal – refer Figure 49.



(a) ONE PIECE FLASHING



(b) TWO PIECE FLASHING

5.0 Roof/Wall Junctions

5.1 Apron flashings

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 secondary *flashing* fitted in order to achieve the minimum required overlap of wall *cladding*,

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*,
   ii) pitch of the roof, and
   iii) profile of the roof *cladding*.

COMMENT:
40 mm is the maximum upturn achievable with pressed metal tiles, meaning that a secondary *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 8 shall be provided to direct water out from the wall *cladding* onto the roof *cladding* and gutter.

5.2 Gutters, barges and fascias

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

Gutters, barges and fascias shall terminate so as to leave a gap of 10 mm from the finished wall *cladding* as shown in Figure 8.

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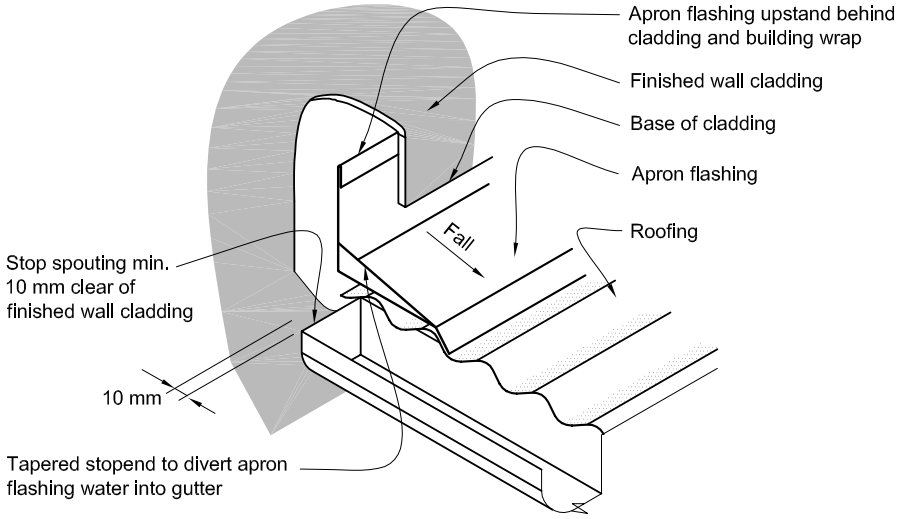
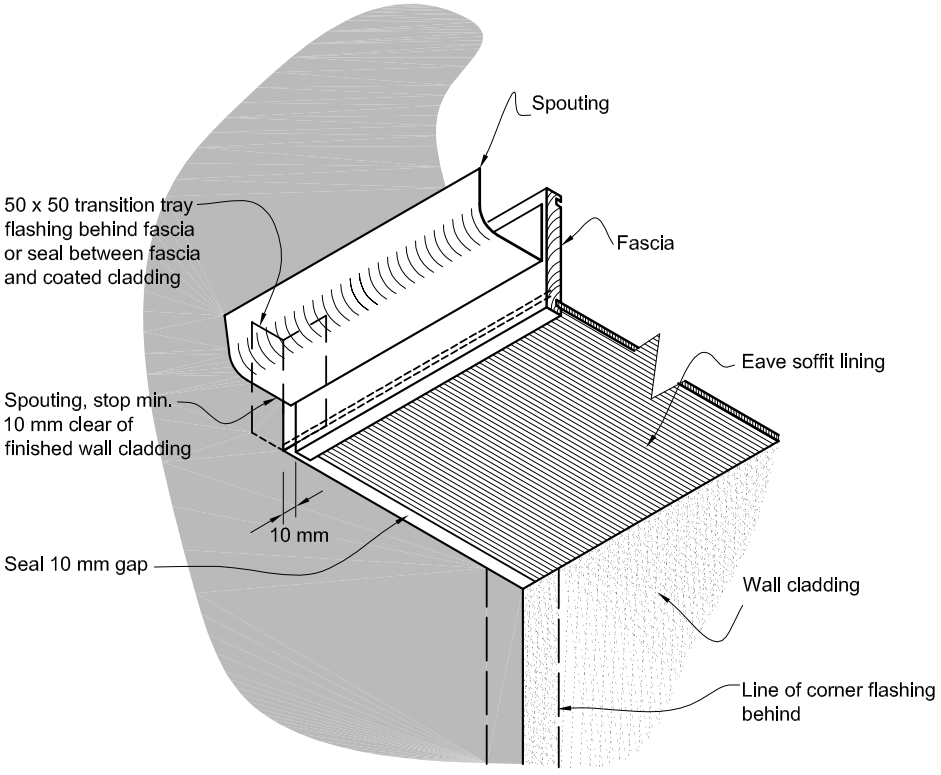
Figure 8: Gutter/wall junction
Paragraphs 5.1, 5.2 and 8.3.9

NOTE: (1) The upstand at the lower edge of the *apron flashing* may be preformed to a larger size and then trimmed on site to suit.
(2) The transition *flashing* bridges gap at the end of the fascia to protect the soffit *framing*. View (b) indicates position of transition *flashing* in relation to soffit, when viewed from below.
(3) *Building wrap* omitted for clarity.



(a) VIEW FROM ABOVE



(b) VIEW FROM BELOW

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

6.0 Parapets

Based on the *risk score* for an *external wall* calculated as per Paragraph 3.1, a *parapet* may require the inclusion of a *drained cavity*.

COMMENT:
The ability to have a *parapet* using *direct fixed* wall *claddings* is unlikely, but may occur for a weatherboard-clad *building* that scores low for other risk factors. Caution is recommended.

6.1 Limitations

This Acceptable Solution does not cover *parapet cappings* that use *EIFS* and *flush-finished* fibre cement materials.

6.2 General

COMMENT:
The same general requirements apply to *enclosed balustrades*. Refer to Paragraph 7.4.

Parapets shall be *constructed* as shown in Figure 10, and shall comply with the following requirements:

a) Timber for *framing* and *cavity battens* shall comply with NZS 3602,

b) Sloped packers under *cappings* shall be treated to H3.1, and

c) *Framing* shall be fully enclosed with *building wrap*.

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

Specific requirements for *enclosed balustrades* are given in Paragraph 7.4.

6.3 Capping materials

Parapets shall be capped with metal, butyl or *EPDM membrane*. *Cappings* shall comply with the requirements of Paragraph 4.0.

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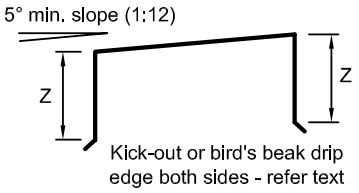
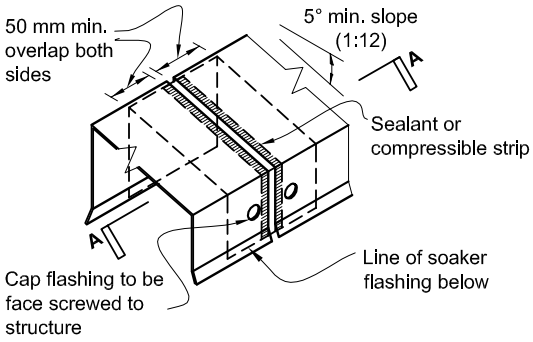
Figure 9: General capping joints for parapets and enclosed balustrades
Paragraphs 6.2, 6.4 e), f) and i), Figure 10

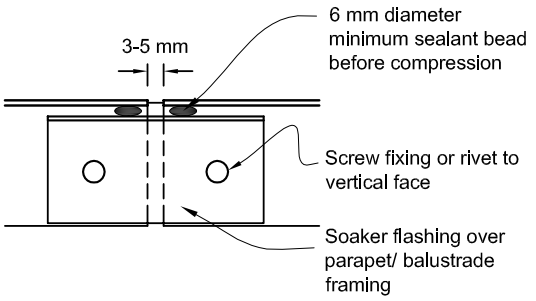
NOTE: (1) Z = variable according to *wind zone* – refer Table 7.
(2) *Capping* joints – refer Paragraph 4.5.2.



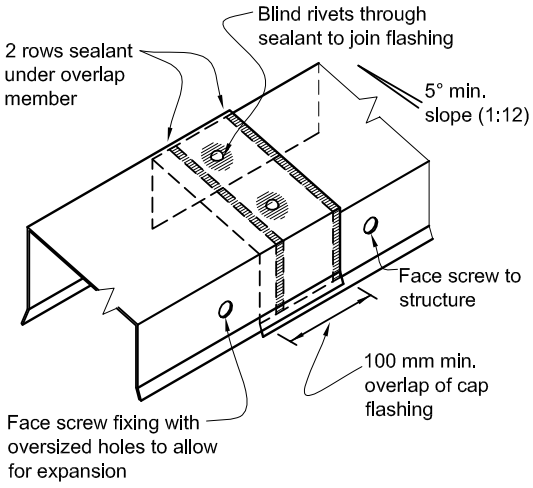
(a) PARAPET FLASHING



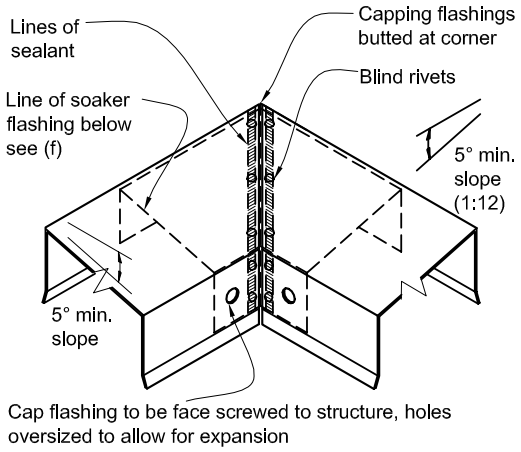
(b) PARAPET FLASHING SOAKER JOINT



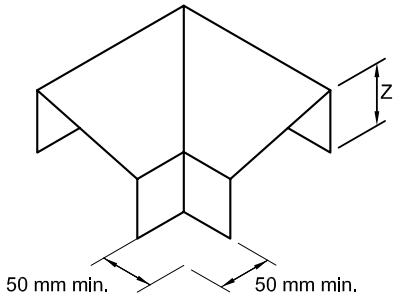
(c) SECTION A - A THROUGH SOAKER FLASHING



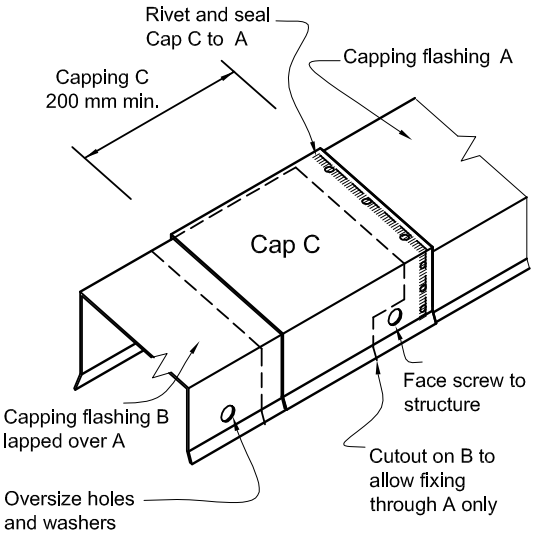
(d) PARAPET FLASHING OVERLAP JOINT



(e) CAPPING FLASHING AT EXTERNAL CORNER OF PARAPET



(f) PREFORMED CORNER SOAKER



(g) PARAPET FLASHING EXPANSION JOINT

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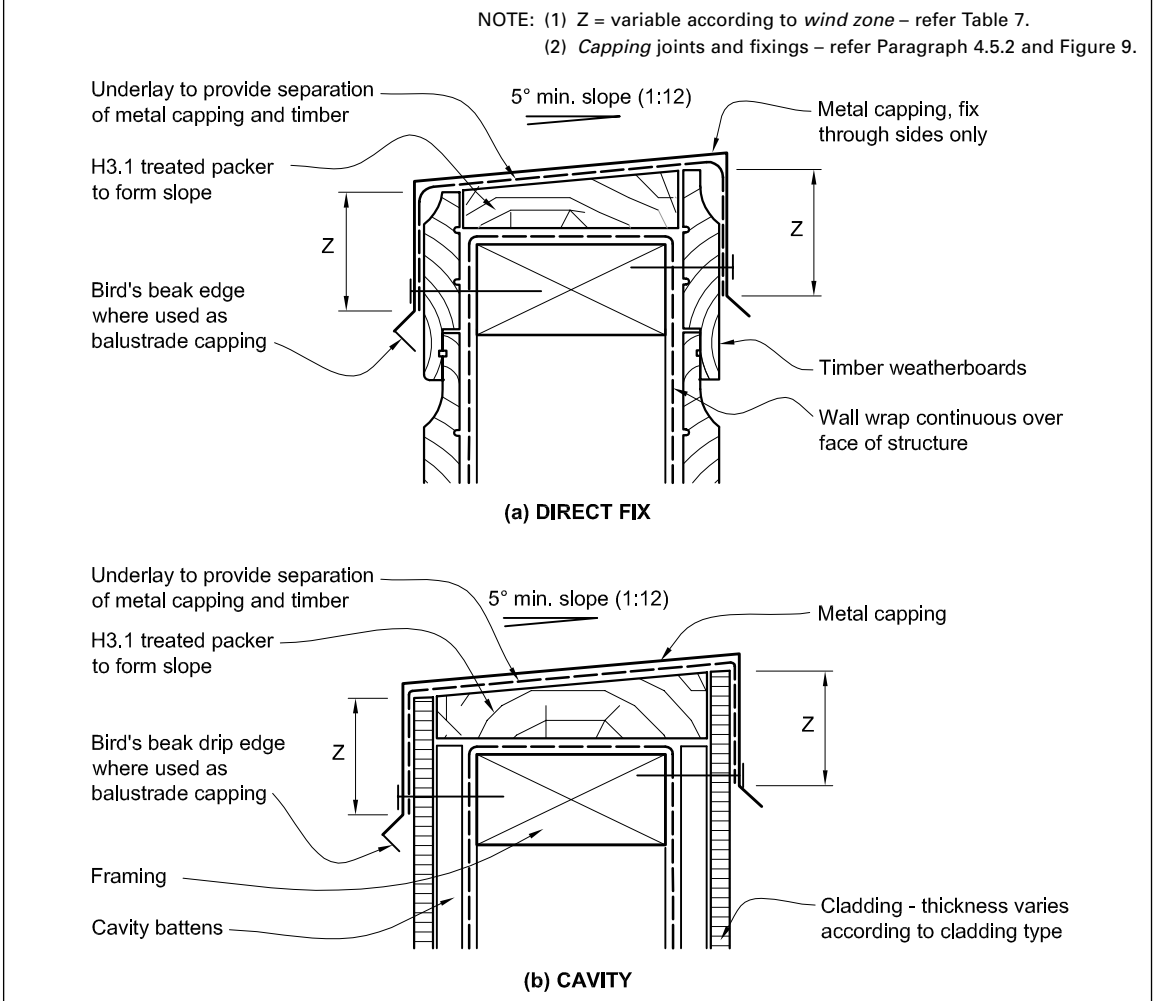
Figure 10: General construction of parapet and enclosed balustrade
Paragraph 6.2



6.4 Metal cappings

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

Metal *cappings* shall 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:

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i) 12 metres for steel
ii) 9 metres for copper and stainless steel
iii) 6 metres for aluminium,

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

j) Where necessary, *expansion joints* shall be formed as shown in Figure 9 (g), and with:
i) 200 mm laps
ii) sliding clips at both sides of the lap.

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 to Figure 13.

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

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° (1:6),

b) Sides of *membrane cappings* shall overlap the wall *claddings* by a minimum of 55 mm, 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.

a) *Stucco* – refer Paragraph 9.3.9.1.

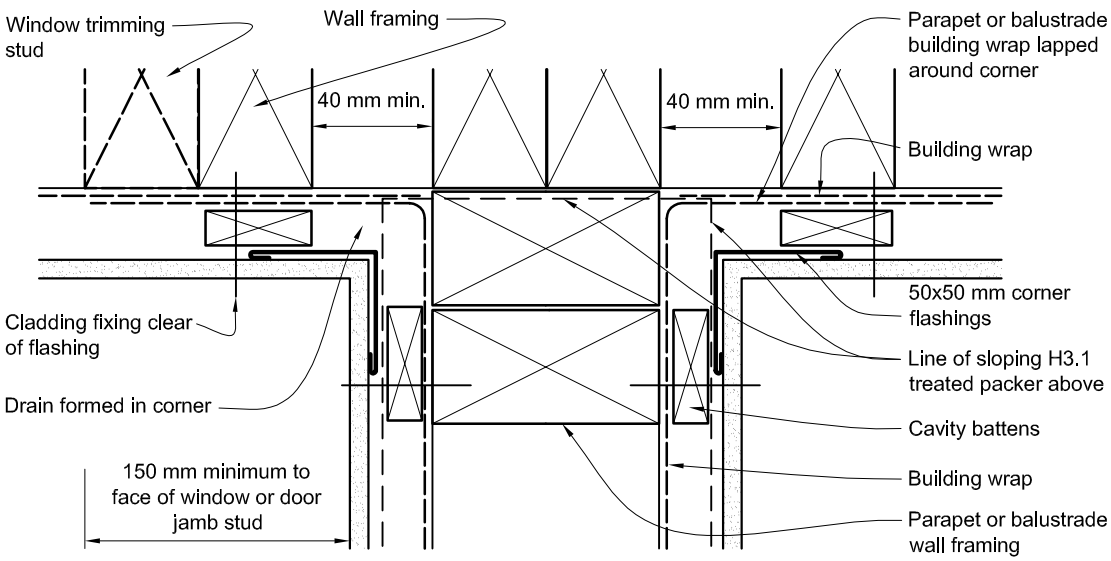
b) *Flush-finished* fibre cement – refer Paragraph 9.7.8.1 and Figure 117.

c) *EIFS* – refer Paragraph 9.9.10.2 and Figure 129.

COMMENT:
The tops to *parapets* are considered to be more risky locations, as they are less accessible for inspection and regular maintenance than the tops to *enclosed balustrades*.

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 12, 13, 117 and 129

NOTE: (1) Refer Figure 12 and Figure 13 for *saddle flashing* and *capping* to wall junction.
(2) Plan section is through balustrade or *parapet framing*, below *capping* packer.



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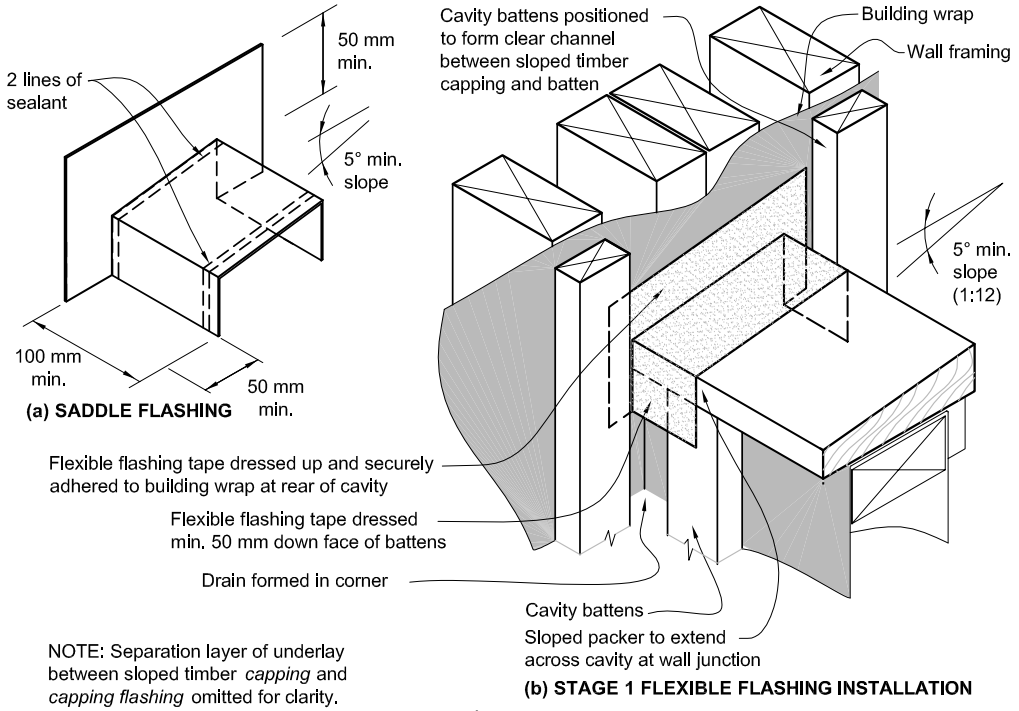
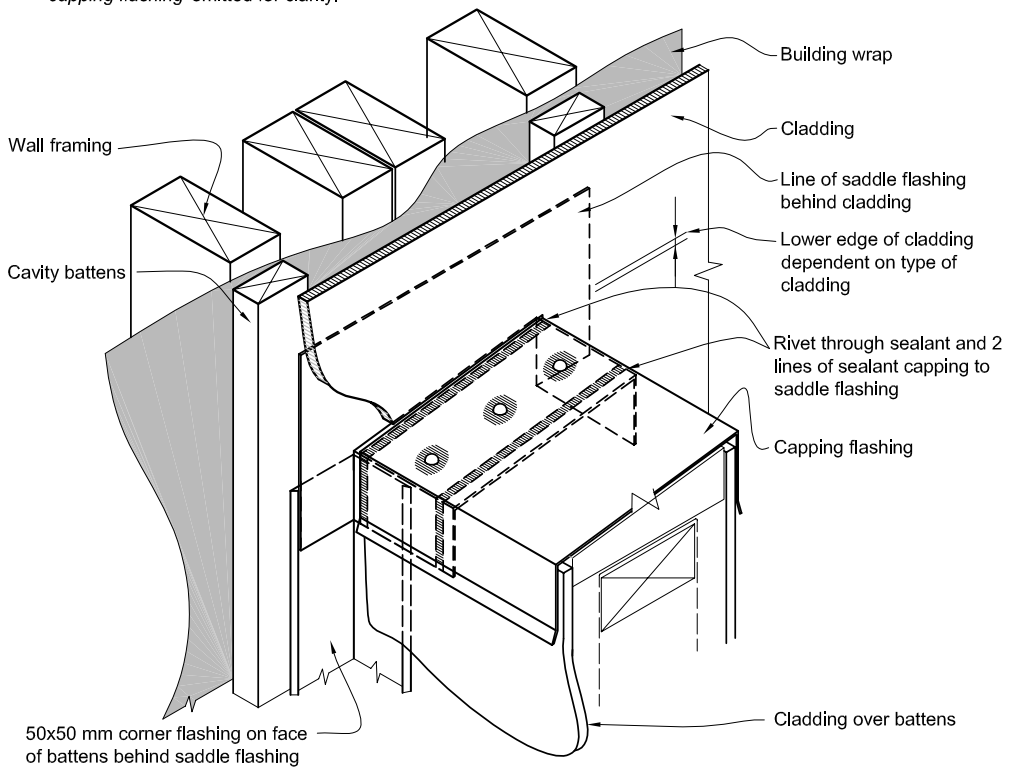
Acceptable Solution E2/AS1

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 11, 13, 117 and 129

NOTE: The junction is weatherproofed by the *saddle flashing* which is positioned at the front of the cavity as shown in (c). 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.





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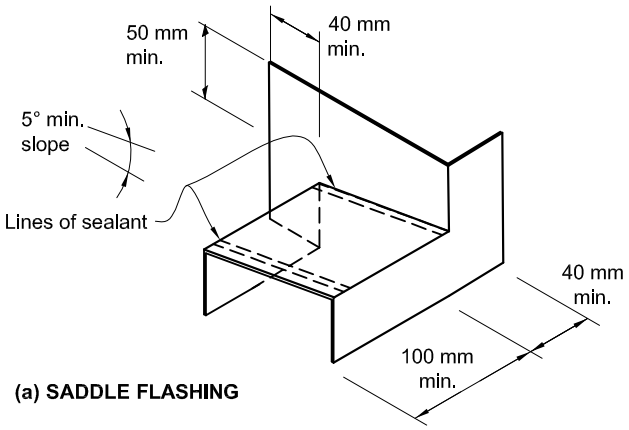
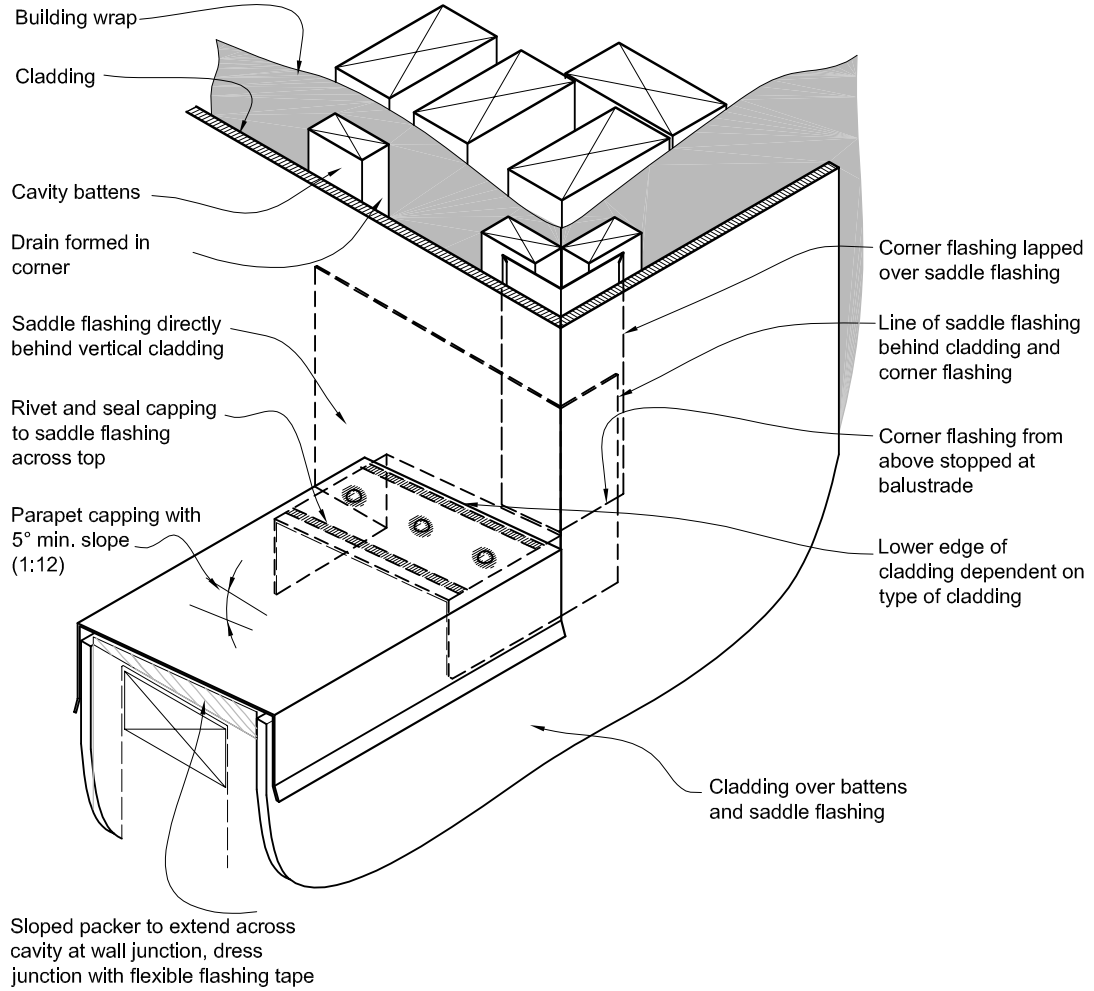
EXTERNAL MOISTURE

Figure 13: General corner 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 11, 117 and 129

NOTE: (1) Refer Figure 12 (b) for *flexible flashing tape* over packer.
(2) Refer Figure 11 for plan section.
(3) Separation layer between sloped *capping* packer and metal *capping* omitted for clarity.



(a) SADDLE FLASHING



(b) PARAPET TO WALL JUNCTION

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7.0 Decks and Pergolas

Timber used to construct *decks*, *enclosed balustrades* and other attachments such as pergolas shall comply with NZS 3602.

7.1 Thresholds for decks

The vertical separation between the inside floor and the upper surface of the *deck* shall be as shown in Figure 14.

7.1.1 Slatted decks

For *decks* using spaced timber slats, a minimum gap of 12 mm shall be provided between the exterior wall and the adjacent timber slat.

The level of the upper surface of the timber decking:

a) Shall be a minimum of 50 mm below the interior floor level for *cantilevered decks* as shown in Figure 16, or

b) May be at the same level as the interior floor for non-cantilevered *decks* that are formed as shown in Figure 15.

7.1.2 Enclosed decks

This Acceptable Solution is limited to *enclosed decks* with a maximum area of 40 m^2.

For *enclosed decks*, the vertical separation between the inside floor 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

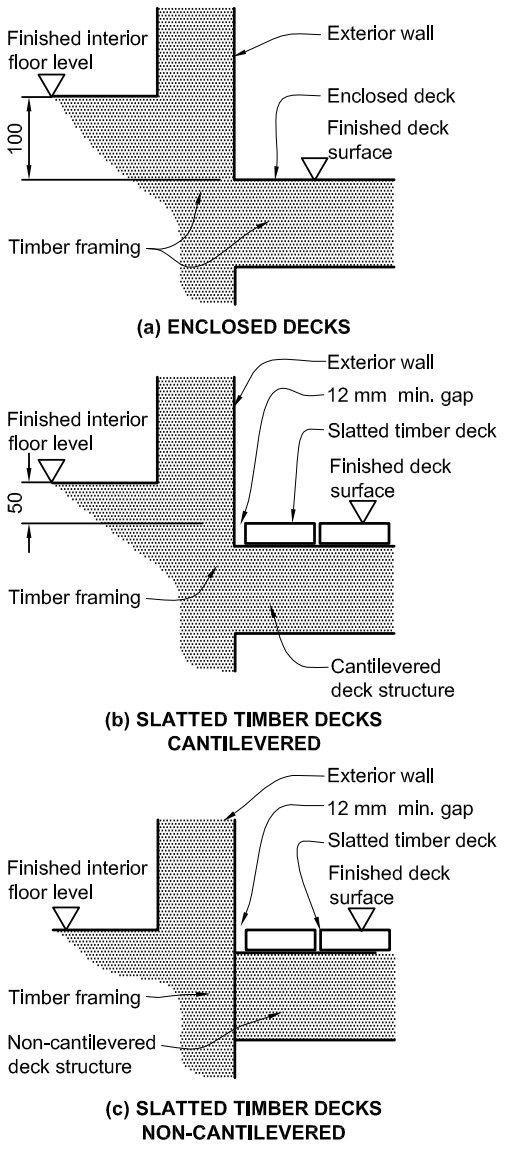
Junctions of slatted timber *decks* and pergola stringers with walls shall be made *weathertight* as shown in Figure 15.

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 *cladding* that is absorbent, such as fibre cement, shall be sealed on surfaces and edges prior to fixing the stringers.

Figure 14: Threshold separations
Paragraph 7.1



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.

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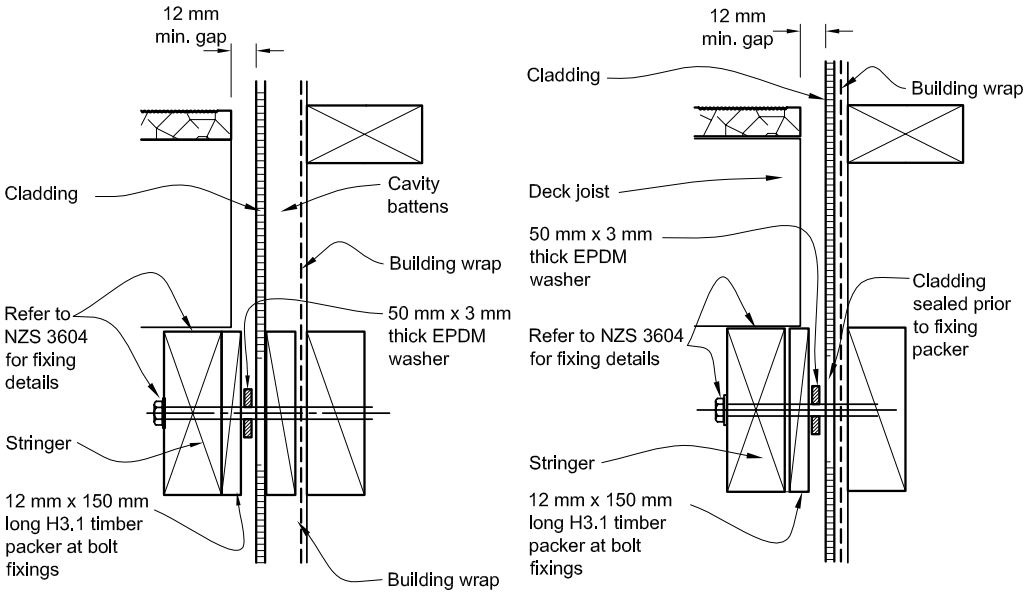
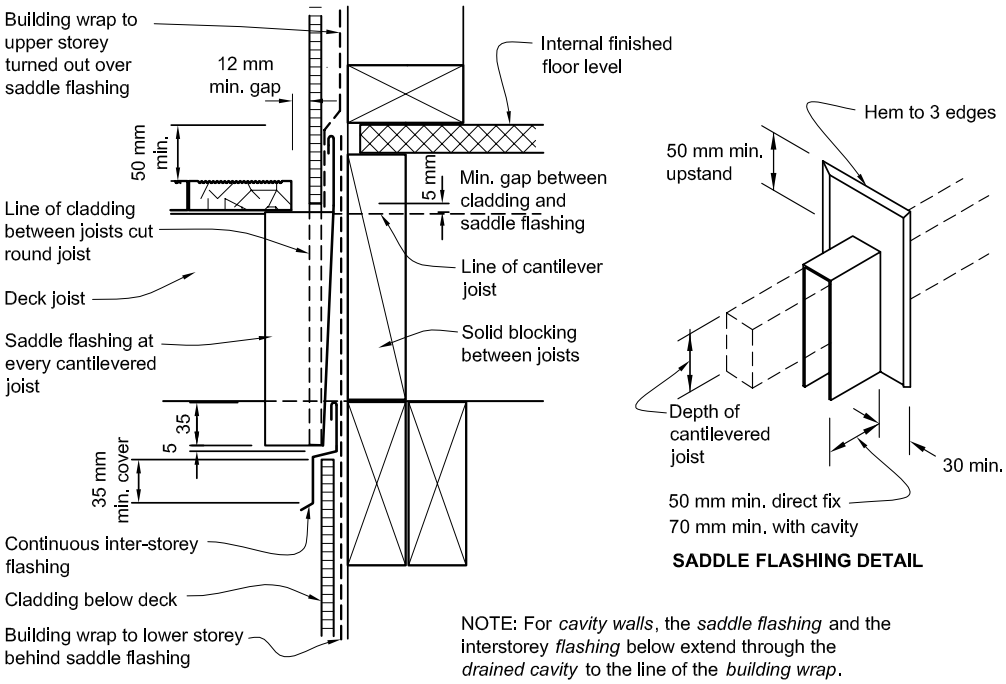
Figure 15: Junction with wall for non-cantilevered timber deck
Paragraphs 7.1.1 b), 7.2.1 and 7.2.2



NOTE:
(1) Not suitable for *stucco*, *EIFS* or profiled metal.
(2) The top of the *deck* slats may be level with the interior floor level.
(3) The same stringer to wall junction applies when joist hangers are used.

Figure 16: Junction with wall for cantilevered timber deck
Paragraphs 7.1.1 a), 7.2.1.1 and 7.3.1



NOTE: For *cavity walls*, the *saddle flashing* and the interstorey *flashing* below extend through the *drained cavity* to the line of the *building wrap*.

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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 or timber shall be provided over the underlying *weathertight enclosed deck* surface, 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 option

Timber decking shall be over 75 x 50 mm *framing* supported on blocks, with spacing in accordance with NZS 3604.

No fixings shall penetrate the underlying *deck membrane*.

COMMENT:

Access to the underlying *weathertight* surface, for cleaning and maintenance, must be provided.

Tiled boards or structural pavers sit on proprietary supports, that 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 alternative 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.

COMMENT:

The specific features of a *building* and its site can have a significant effect on the options available for providing level access at doors. These features include the provision of shelter, prevailing winds and ground levels. Where level access is required, it is highly recommended that the services of a designer experienced in this field be obtained.

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 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 2000 mm, and
   iv) 1:200 minimum fall along length of channel,

b) Grating, in accordance with Table 20, 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*, and

c) Exterior paving that:
   i) has a minimum fall of 1:40 away from the channel,

COMMENT:

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

   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 to the exterior, this may be provided as shown in Figure 17B, with clearances in accordance with Paragraph 9.1.3.

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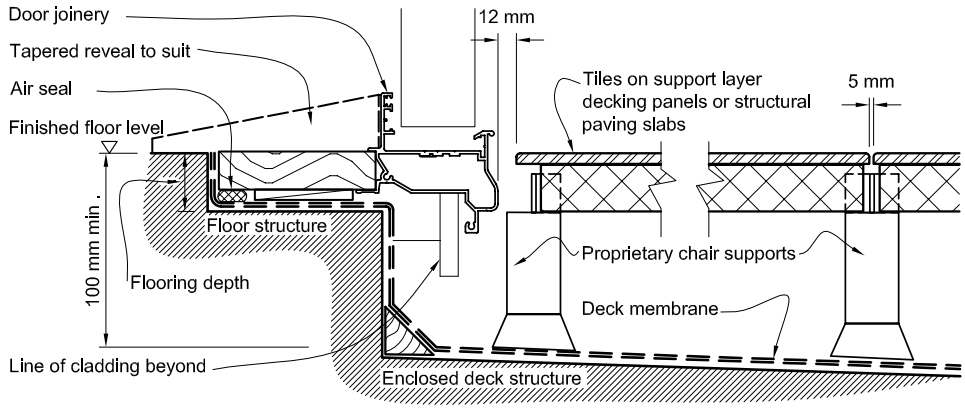
EXTERNAL MOISTURE

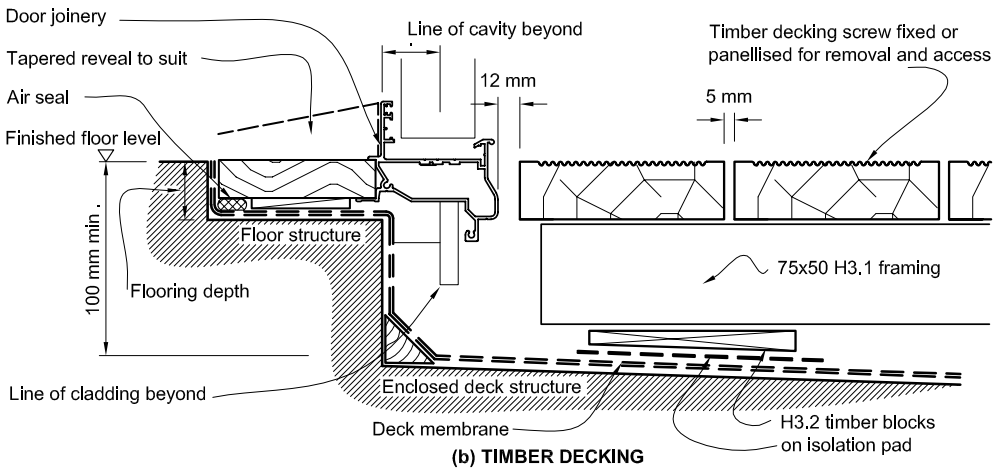
Figure 17A: Level thresholds for enclosed decks
Paragraphs 7.3, 7.3.1.1, 7.3.2 and 8.5.1 d), Figure 17B

NOTE: (1) For use for timber framed, above ground *enclosed decks* with *membrane* surfaces. Care must be taken to ensure that no fixings or sharp edges penetrate the *weathertight membrane*. Refer also to Paragraph 8.5.

(2) Proprietary sill support system omitted for clarity.



(a) TILE/PAVING



(b) TIMBER DECKING

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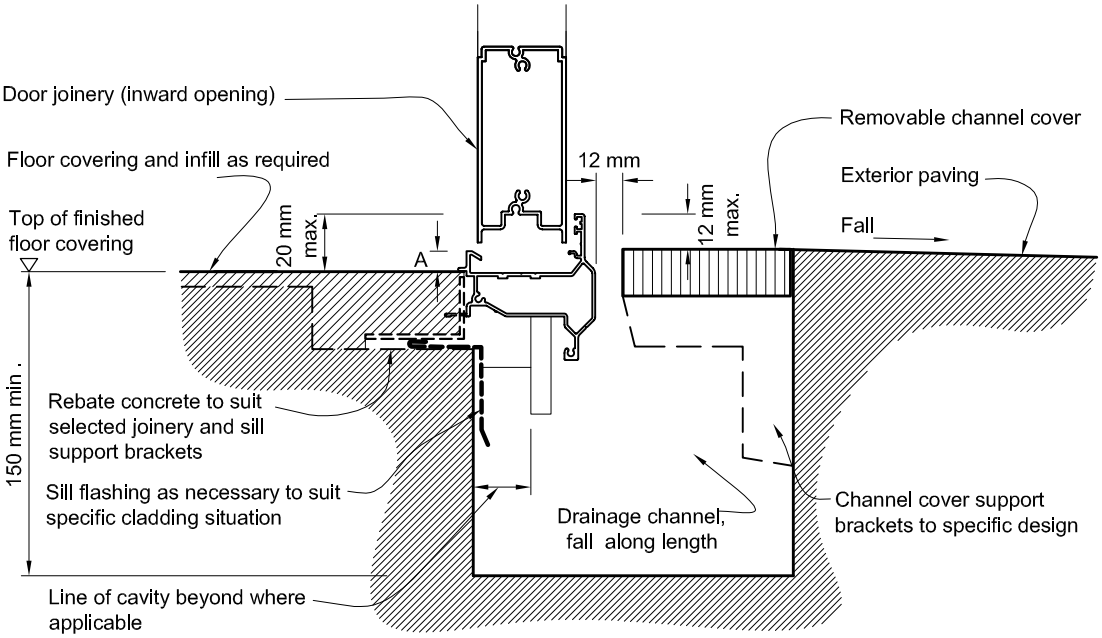
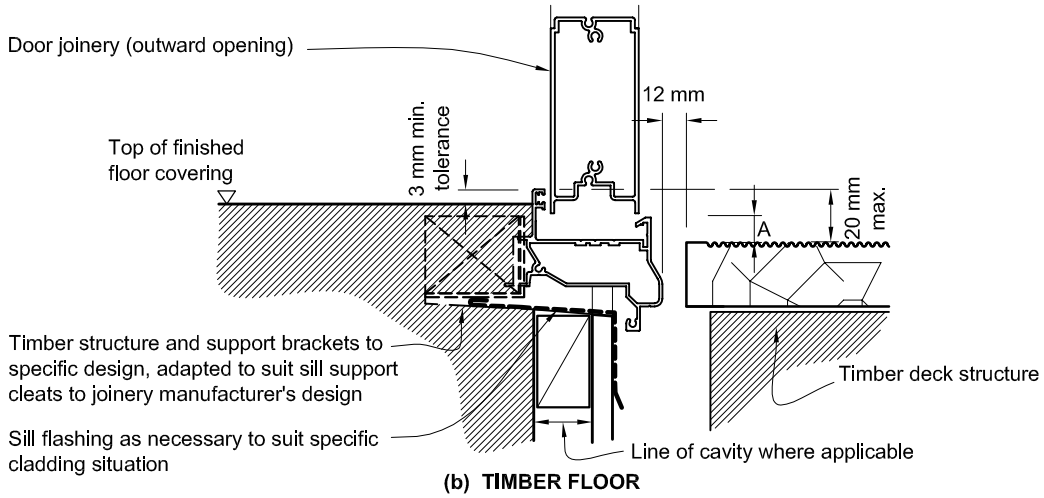
Figure 17B: Level thresholds for ground level
Paragraphs 7.3, 7.3.2, 7.3.2.1 and 7.3.2.2

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) Sill brackets to support joinery must be specifically designed to suit the particular joinery, the floor structure and the particular conditions of the site.
(5) Exposure to wind-driven rain must be taken into account when using these details, and shelter to doors and joinery provided where local conditions warrant.



(a) CONCRETE SLAB



(b) TIMBER FLOOR

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

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7.4 Enclosed balustrades

Enclosed balustrades shall be detailed as required for *parapets*, as described in Paragraph 6.2 to Paragraph 6.4. Details for specific *cladding systems* are given in Paragraph 9.0.

When *enclosed balustrades* incorporate *drained cavities*, these shall comply with Paragraph 9.1.8.

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 Figure 12 and Figure 13, with internal corner *flashings* as shown in Figure 11.

COMMENT:
Reports on leaky *buildings* show that these junctions are prone to leakage and care must be taken in detailing and in 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:

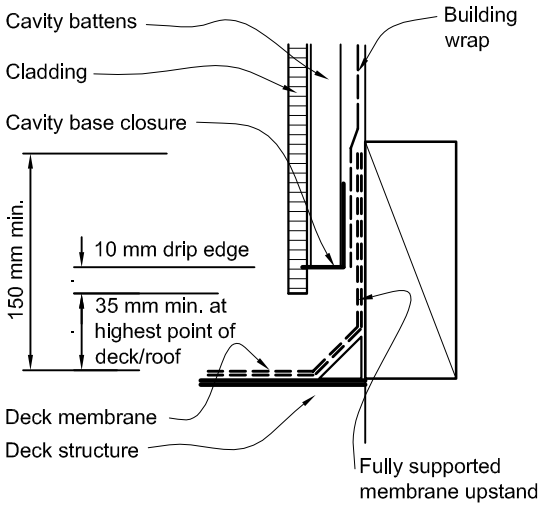
a) Slope to the top of the *capping*, for *buildings* other than housing, and

b) *Drip edge* to the side 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
Paragraph 7.4.3



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7.4.4.1 Balustrades for housing

Cappings to *enclosed balustrades* shall be detailed as shown in Figure 11 to Figure 13, with the exception of the *drip edge* to the *deck* side of the *capping*.

7.4.4.2 Balustrades – other than housing

Cappings to *enclosed balustrades* shall be detailed as shown in Figure 11 to Figure 13, with the exception of the *drip edge* to the *deck* side of the *capping*, and the slope to the top of the *capping*.

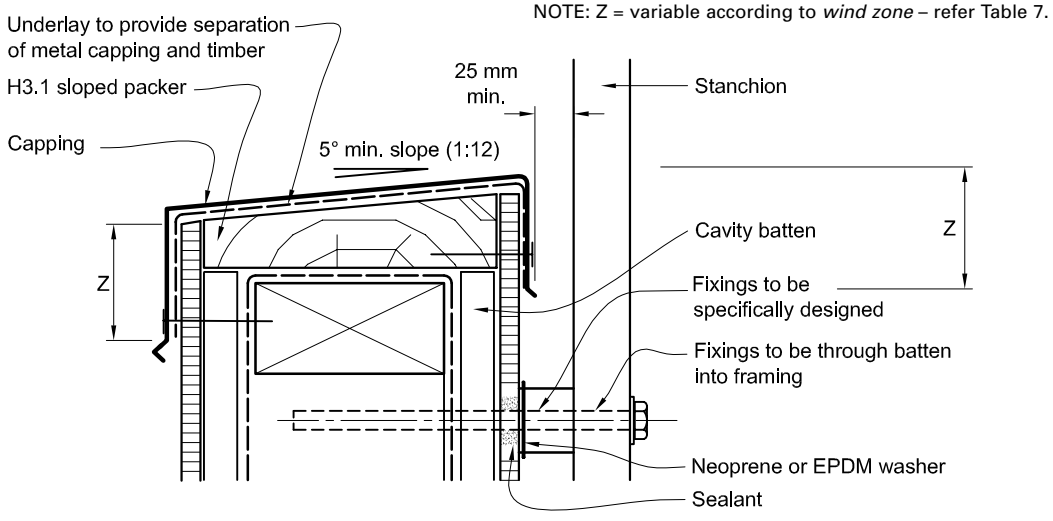
The minimum slope to the top of the *capping* to *enclosed balustrades*, in *buildings* other than housing, shall be as required in F4/AS1.

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.

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

Figure 19: Stanchion fixing
Paragraph 7.4.5



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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:
Where roofs are used to collect water for human consumption, roof materials shall comply with AS/NZS 4020.

8.1.2 Limitations

This Acceptable Solution is limited to roof *cladding systems* listed in Paragraph 3.2.

8.1.3 Maintenance

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

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

a) Type of *cladding* used,

b) Position of the *cladding* on the *building*,

c) Geographical location of the *building*, and

d) Specific site conditions.

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.

COMMENT:
This minimises the unwashed area of the roof *cladding*. Washing by rain removes most accumulated atmospheric contaminants, but sheltered areas are protected from the direct effects of rain and 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.

8.1.4 Fixings

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

Fixings for roof *claddings* and *flashings*, where necessary, shall be selected from Table 20 to minimise corrosion.

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

8.1.5 Underlays

All *roof underlays* shall have laps of no less than 150 mm.

Where required, *roof underlays* complying with Table 23 shall be laid either:

a) Vertically, when the roof pitch is not less than 8° (1:7), or

b) Horizontally, with the upper sheets lapped over lower sheets to ensure water is shed to the outer face of the underlay.

8.1.5.1 Underlay support

Roof underlays shall be installed in a manner that prevents ponding of water by:

a) Allowing *roof underlays* classed as extra heavy or heavy in AS/NZS 4200 to span no more than 1200 mm in one direction, or

b) If supported by a corrosion-resistant material:
   i) *roof underlays* classed as medium light or extra light in AS/NZS 4200 shall span no more than 300 mm in one direction, and shall be used only at pitches of 8° or above, or
   ii) *roof underlays* classed as extra heavy or heavy in AS/NZS 4200 shall be used at pitches less than 8°.

Appropriate corrosion-resistant materials are polypropylene tape or a minimum 0.9 mm diameter steel wire mesh galvanized in compliance with AS/NZS 4534.

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

8.1.6 Gutters

Gutters shall be sized to comply with E1/AS1.

Where gutter depth is reduced to allow entry of a *valley gutter*, the reduced depth shall be used to calculate the capacity of the gutter.

Downpipes discharging to a lower roof shall be fitted with a spreader as detailed in Figure 20, with the discharge limited to a section of roofing with no side laps.

Spreaders shall not be used on *masonry tile* roofs unless a *roof underlay* is installed.

A maximum catchment area of 25 m^2 shall be permitted to discharge via a spreader on to a lower roof area.

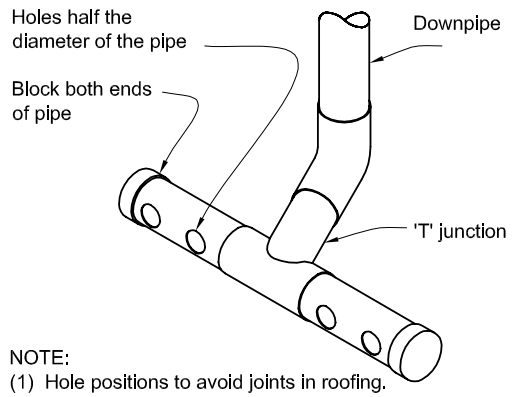
COMMENT:
Design calculations for a specific roof may allow larger catchment areas per spreader to be used.

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

The ends of spreaders should be blocked off to avoid a sideways flow of water against laps in roof *claddings*.

The holes in spreaders should be positioned to allow water to fall onto the roof troughs, not the laps.

Figure 20: Spreader for roof discharge
Paragraph 8.1.6



NOTE:
(1) Hole positions to avoid joints in roofing.
(2) When downpipe is located in corner, spreader to be L-shaped.

8.1.6.1 Internal, valley and hidden gutters

Internal, *valley* and *hidden gutters* shall:

a) Be continuously supported with gutter boards, treated in accordance with NZS 3602,

b) If metal, be separated from any CCA treatment by *roof underlay*,

c) Have no fixings in gutter bottom or sides,

d) Have all joints lapped and sealed in accordance with Paragraph 4.5.2,

e) Receive no direct discharge from downpipes or spreaders, and

f) Be formed from the same material as the roofing, or:
   i) G5000 series aluminium to AS/NZS 1734, temper O, with a minimum thickness of 1.2 mm, or
   ii) X5CrNiMo 17-12-2 (316) stainless steel in accordance with Table 1 of ISO/TS 15510 with a minimum thickness of 0.45 mm, or
   iii) C1100 or C1220 copper to AS 1566 with a minimum thickness of 0.7 mm, or
   iv) butyl rubber, complying with Paragraph 4.3.9, on timber or plywood.

AZ150 or Z275 coated steel with a factory finish shall only be used where gutters can be readily maintained to prevent ponding and may be easily replaced within 15 years.

AZ150 or Z275 coated steel without a factory finish shall not be used.

COMMENT:
Internal and *valley gutters* are vulnerable areas on a roof and should be minimised, and avoided if possible.

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8.1.6.2 Valley gutters

Valley gutters shall be *constructed* as shown for the applicable roof *cladding*, and shall:

a) Not change direction in plan form,

b) Not be used with roof pitches below 12.5°,

c) Be fixed at the upper end only,

d) Be secured with a purpose-made clip system for the remaining length,

e) Have a minimum clearance of 100 mm between the ends of the roof *cladding*,

f) Have a minimum depth of 20 mm minimum at the edges of the *valley gutter*,

g) Have a minimum depth of 50 mm at the centre of the *valley gutter*, and

h) Have minimum widths in accordance with the catchment area feeding into the *valley gutter* as shown in Table 8.

Table 8: Maximum catchment areas for valley gutters
Paragraphs 8.1.6.2 and 8.4.16.2, Figures 27, 37 and 51

Gutter width	Maximum catchment area
250 mm	25 m²
160 mm	16 m²

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 beyond those shown in Table 8 shall be specifically designed in accordance with E1/AS1.

8.1.6.3 Internal gutters

Internal gutters shall be *constructed* as shown for the applicable roof *cladding*, and shall:

a) Be dimensioned to provide the greater of a:
   i) calculated size as per E1/AS1, or
   ii) minimum depth of 70 mm and minimum width of 300 mm,

b) Be sized to provide an additional freeboard allowance of 20 mm minimum,

c) Be provided with a weir outlet and discharge into a rainhead that has an overflow with the bottom below the sole of the gutter, and

d) Allow for an *expansion joint* at the upper end.

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.

Table 9: Maximum catchment areas above penetrations
Paragraph 8.1.7 b) and Figure 22

Penetration width	Maximum roof length above penetrations in metres
800 to 1200 mm	4 m
600 to 800 mm	6 m
400 to 600 mm	8 m
0 to 400 mm	10 m

NOTE: Refer to Table 17 for profiled metal roofing.

COMMENT:

Flashing of roof penetrations shall be as required for the specific roof *cladding* used.

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

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Figure 21: Penetration support
Paragraphs 8.1.7 a) and 8.4.17

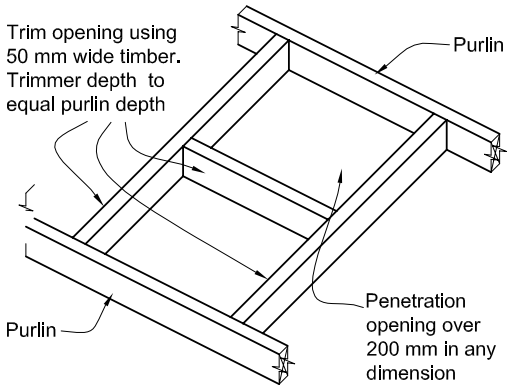
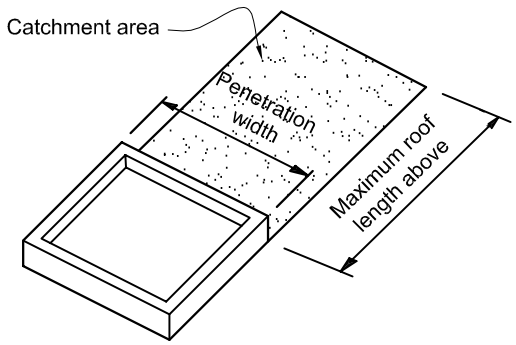


Figure 22: Catchment area for penetrations
Paragraph 8.1.7 b)

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.



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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 a minimum of 25 mm in height, 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

Installation of *masonry tile* roof *cladding* shall be installed by trained tilers, approved by the tile manufacturer or the NZ agent (in the case of imported tiles).

COMMENT:
It is recommended that a tiler will have successfully completed, or demonstrated skill to the level of, an NZQA recognised course in roof tiling. The National Certificate in Concrete Tile Roofing is such a qualification.

8.2.3 Installation

Masonry tile roof *cladding* shall be installed in accordance with NZS 4206 or AS 2050 onto battens, installed in accordance with NZS 3604, except the minimum pitch shall be as specified in Table 10. Where required in AS 2050, underlay shall comply with Table 23.

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 do not fall within 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°.

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

Tile material	Profile type	With underlay (refer Note)	Without underlay (refer Note)
Concrete	Type I	15°	20°
tiles (to *rafter*	Type II	25°	–
length 4.5 m)	Type III	25°	–
Clay tiles	Type I	20°	25°
(to *rafter*	Type II	25°	–
length 4.5 m)	Type III	25°	–

NOTE: Increase pitch by 1° per additional 0.5 metres of *rafter* length over 4.5 m.
Roof underlay is required for any roof receiving discharge from a spreader.

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 pitches less than 17° (1:3.25) shall have *anti-ponding boards* installed. Where *anti-ponding boards* are used, these shall be set to a minimum fall of 5° (1:12), and shall be treated in accordance with NZS 3602.

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.

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Figure 23: Masonry tile ridge
Paragraph 8.2.6

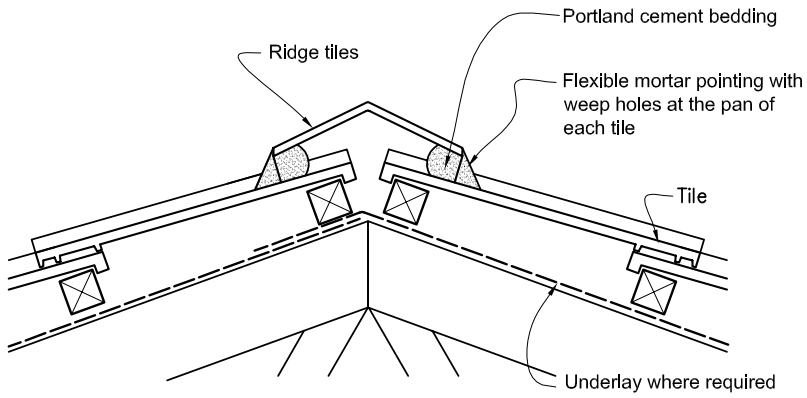
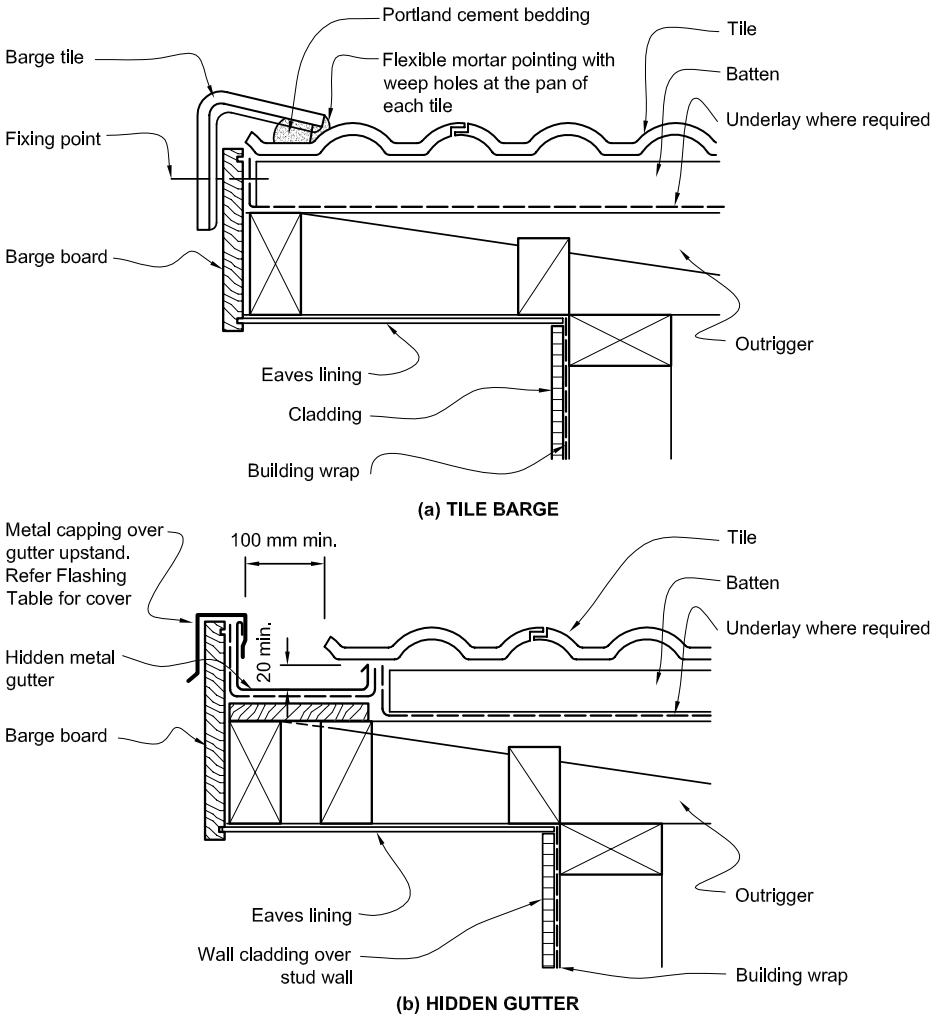


Figure 24: Barges for masonry tile
Paragraph 8.2.6



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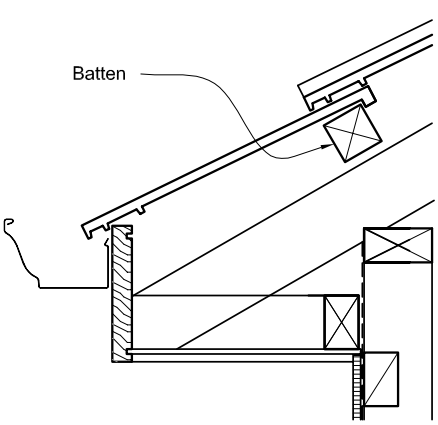
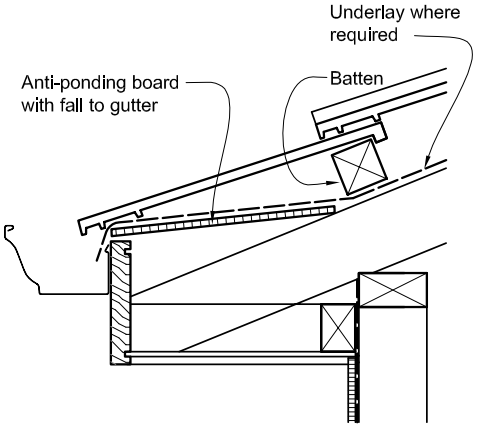
EXTERNAL MOISTURE

Figure 25: Timber fascia eaves for masonry tile
Paragraph 8.2.6

NOTE: (1) *Anti-ponding boards* required for roof pitches below 17°.
(2) Refer Table 10 for tile types and roof pitches requiring *roof underlays*.

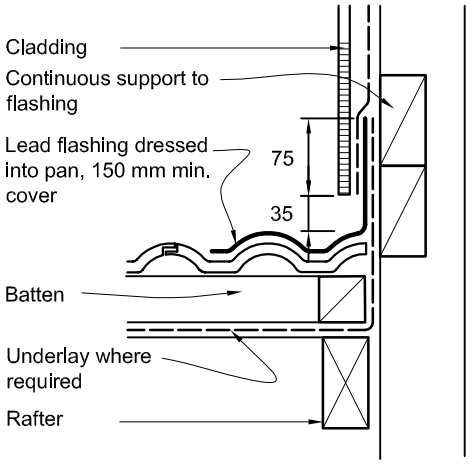


(a) WITHOUT UNDERLAY

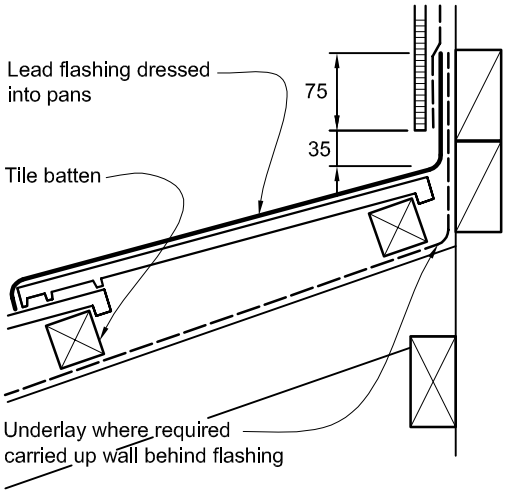


(b) WITH UNDERLAY

Figure 26: Apron details for masonry tile
Paragraph 8.2.6



(a) PARALLEL FLASHING



(b) TRANSVERSE FLASHING

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Figure 27: Valley for masonry tile
Paragraph 8.2.6

NOTE: (1) Refer to Table 8 for maximum roof 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.

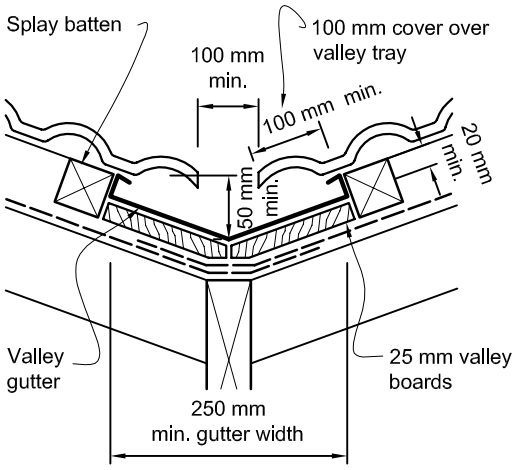
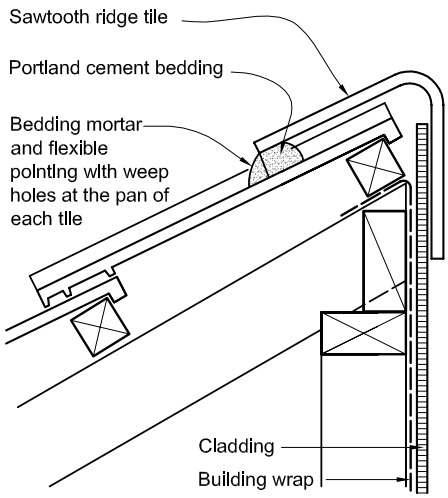


Figure 28: Roof/wall ridge for masonry tile
Paragraph 8.2.6

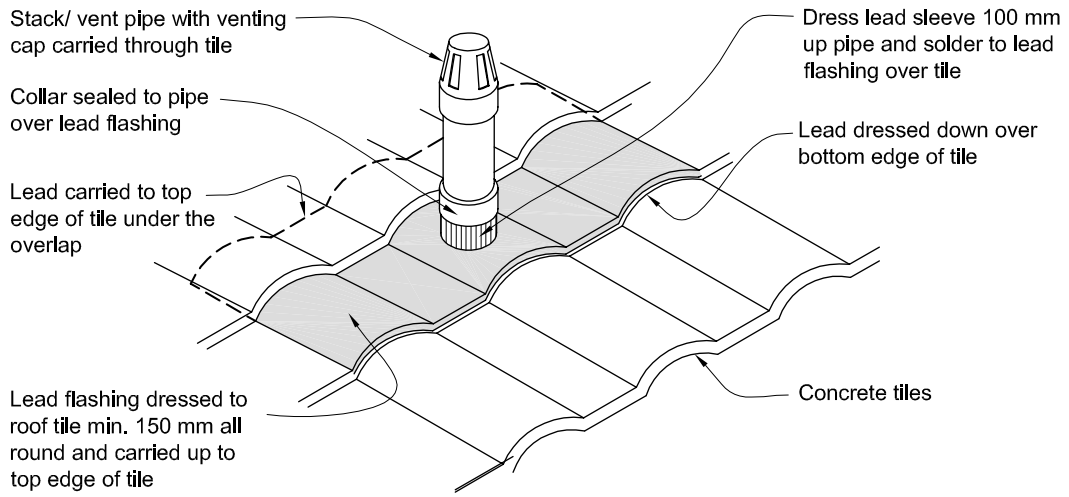


8.2.7 Penetrations

Holes in tiles for pipe penetrations shall be machine-cut to minimise the size of the hole.

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

Figure 29: Pipe penetration for masonry tile
Paragraph 8.2.7



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EXTERNAL MOISTURE

Figure 30: Abutment at framed penetration for masonry tile
Paragraph 8.2.7

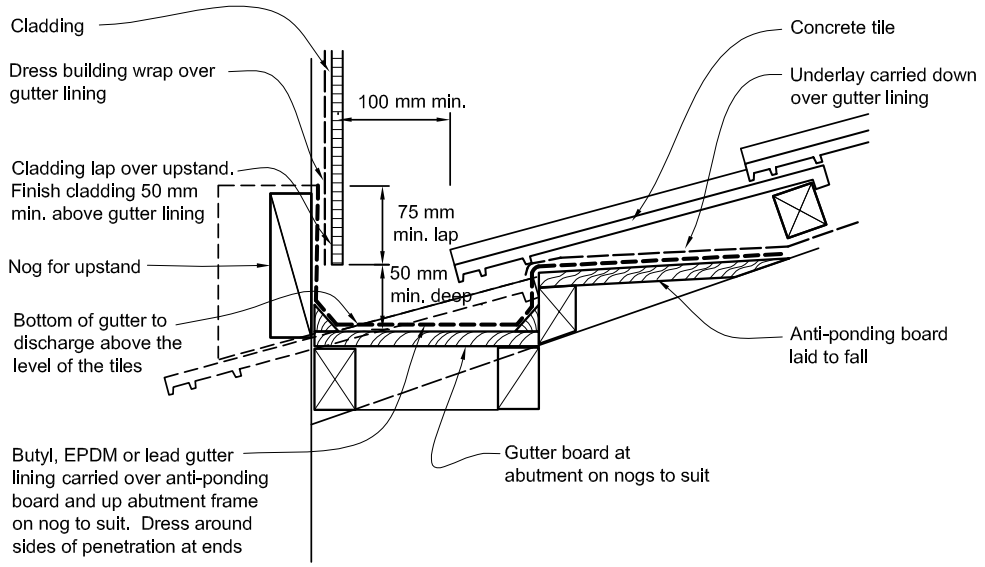
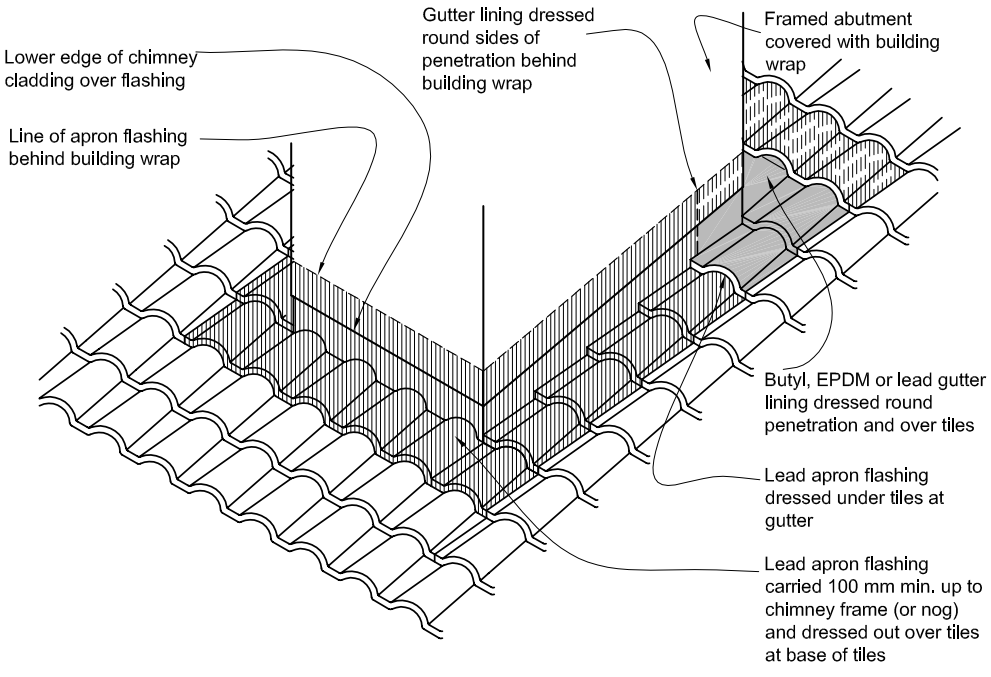


Figure 31: Flashing to framed penetration for masonry tile
Paragraph 8.2.7



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8.3 Pressed Metal Tiles

8.3.1 Limitations

This Acceptable Solution is limited to pressed metal tile roofs with:

a) A maximum length from *eaves* to ridge of 12 metres, and

b) No internal gutters (except *hidden gutters* and *valley gutters* as detailed in Figure 37).

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

The installation of pressed metal tile roof *cladding* shall be by trained installers, approved by the tile manufacturer or the New Zealand agent (in the case of imported tiles).

8.3.3 Tiles

Tiles shall meet the requirements of NZS 4217.

8.3.4 Metal substrate

8.3.4.1 Choice of metal

The metal substrate shall be selected according to the exposure conditions as defined in:

a) NZS 3604 Clause 4.2, and

b) AS/NZS 2728.

The metal substrate shall be selected from Table 20 to minimise corrosion.

COMMENT:

The exposure zone in which a *building* is located can affect the *durability* of pressed metal tiles.

AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

Exposure zones are defined in Clause 4.2 of NZS 3604, based on the likely exposure to wind-driven sea-salt or geothermal gases.

8.3.4.2 Steel

Steel for the manufacture of pressed metal tiles shall:

a) Have a *base metal thickness (BMT)* of 0.4 mm minimum,

b) Be grade G300,

c) Have applied protective metallic coating of:
   i) aluminium-zinc AZ 150 to AS 1397, or
   ii) zinc Z450 to AS1397, and

d) Have a factory-applied finish complying with AS/NZS 2728.

8.3.4.3 Aluminium

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

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

b) Be minimum grade G5000 series,

c) Be hardness H34, and

d) 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 profile metal roof tiles are shown in Figure 32.

The minimum roof pitches for metal tiles shall be limited to:

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

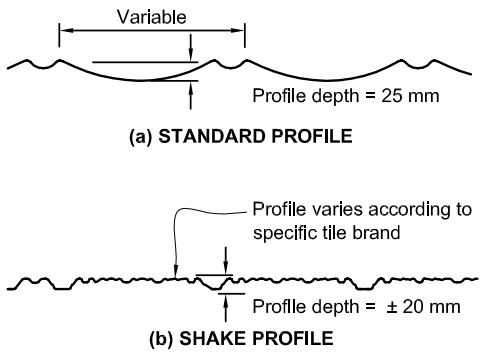
b) 15° (1:3.75) for profiles resembling shake profiles.

COMMENT:

Panels are available in a wide range of patterns.

Where manufacturers have more stringent requirements, these should be followed to optimise performance and to avoid invalidating guarantees.

Figure 32: Metal tile profiles
Paragraph 8.3.5



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8.3.6 Underlay

All metal tile roofing shall have a *roof underlay* installed. Only bitumen-impregnated or fire-retardant paper-based *roof underlays* complying with Table 23 shall be used. Refer to Paragraph 8.1.5 for installation details.

If LOSP-treated timber is used, roof underlay should not be applied until any LOSP solvent has been allowed to evaporate.

COMMENT:
Freshly LOSP-treated timber can affect the bitumen in *building wraps*, so solvent must evaporate prior to the timber coming in contact with the *roof underlay*.

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 with neoprene washers containing no more than 15% carbon black, 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* shall comply with Paragraph 4.3 and Table 7, unless specifically shown otherwise in the details.

COMMENT:
Use purpose-made pre-folded *flashings* supplied by the tile manufacturer where available.

Figure 33: Metal tile fixings
Paragraph 8.3.7

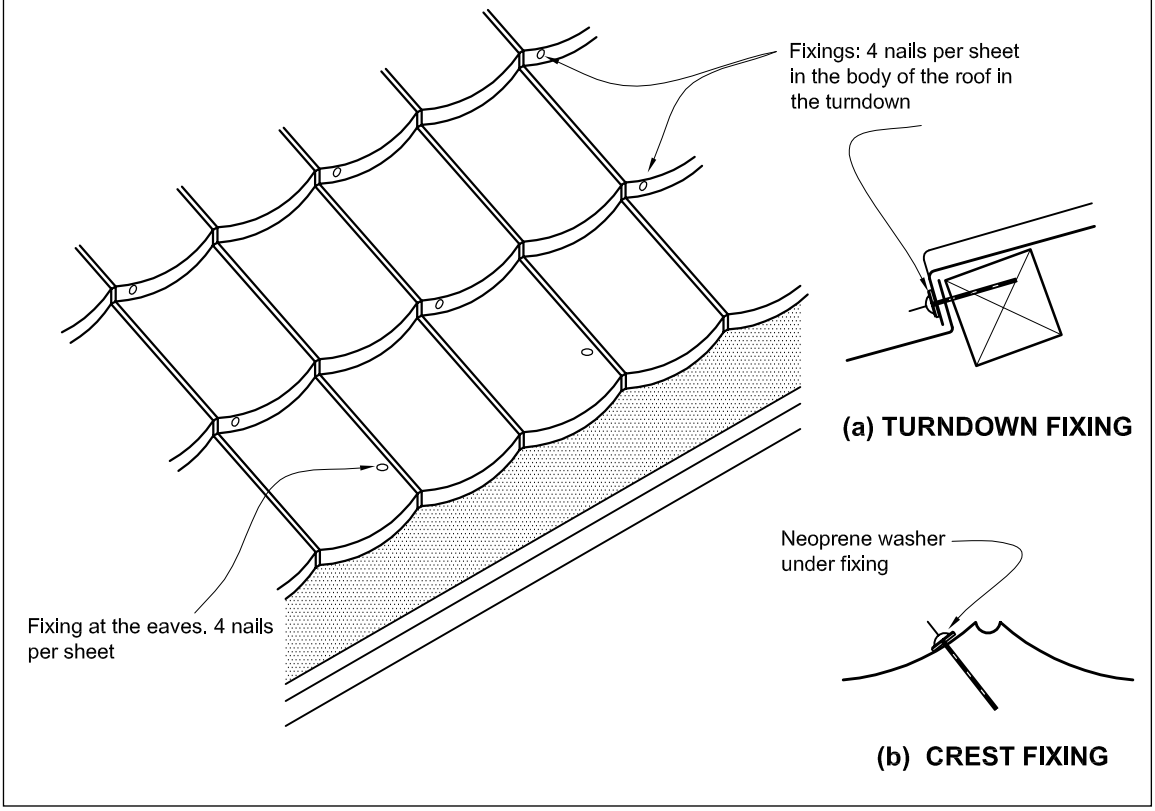

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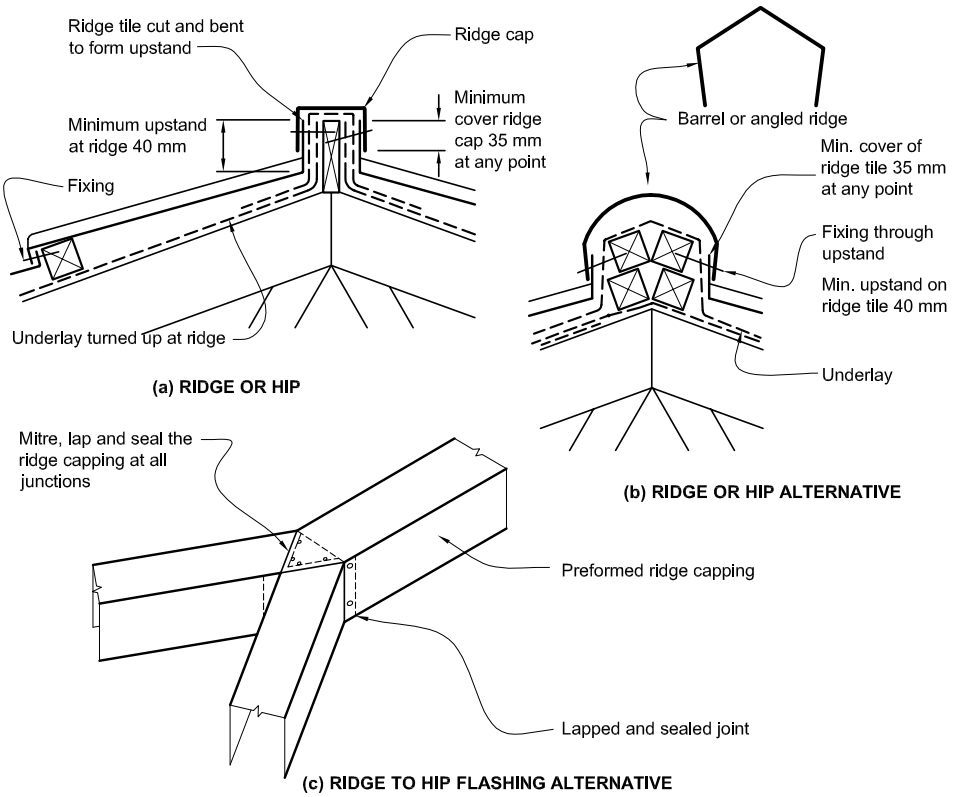
Figure 34: Ridge or hip flashings for metal tile
Paragraph 8.3.8



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

Figure 35: Apron flashings for metal tile
Paragraph 8.3.8

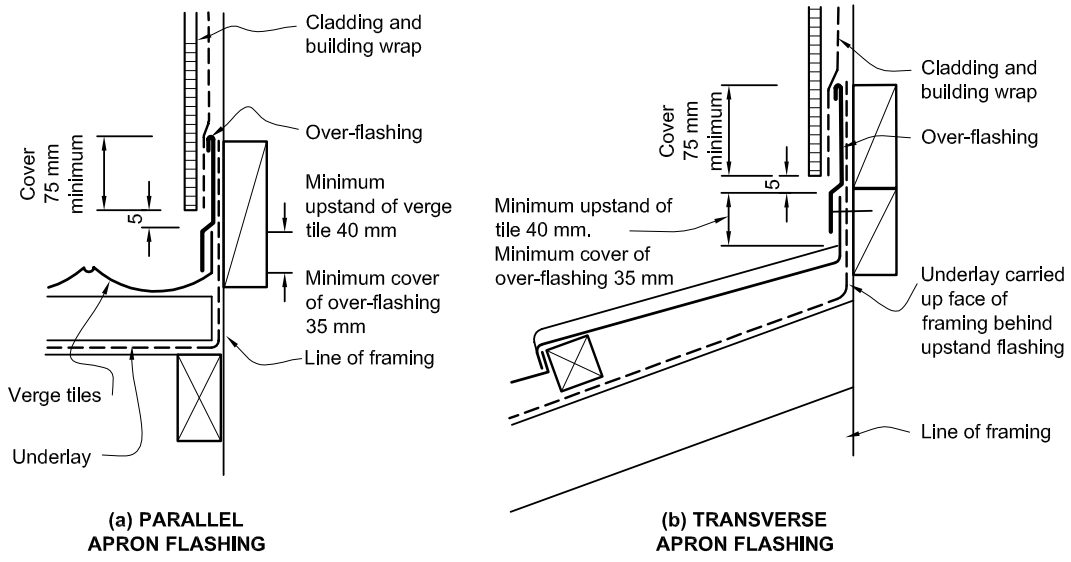


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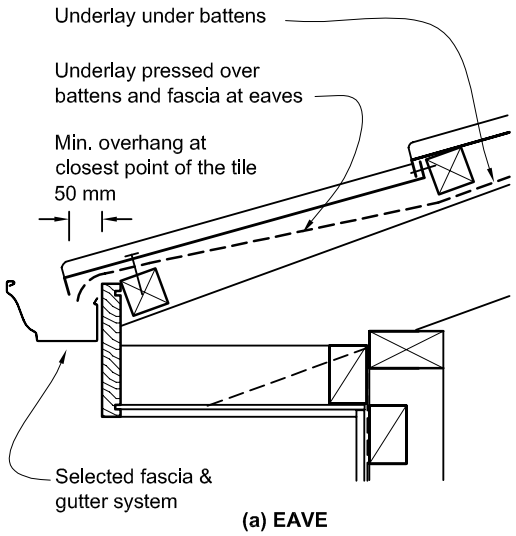
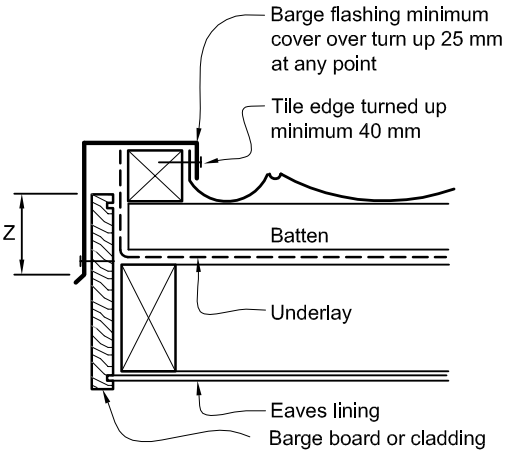
Figure 36: Eaves and barge for metal tile
Paragraph 8.3.8

Note: (1) Z = variable according to *wind zone* – refer Table 7.
(2) If alternate barge *flashing* profiles are used, these profiles must achieve equivalent covers.



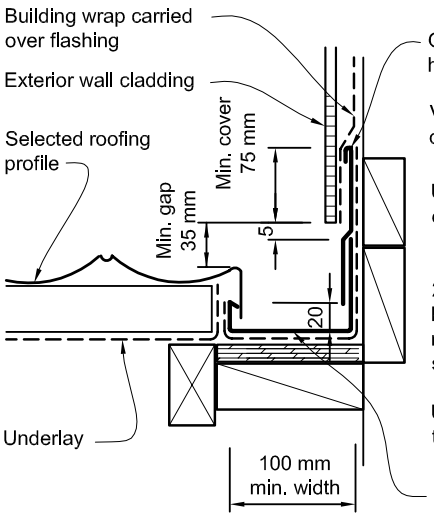
(a) EAVE



(b) BARGE

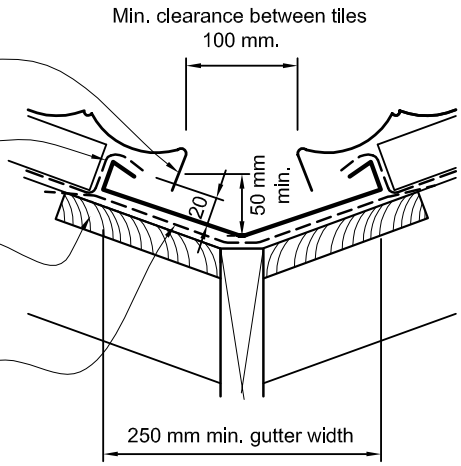
Figure 37: Hidden and valley gutter flashings for metal tile
Paragraphs 8.3.1 b) and 8.3.8

NOTE: (1) Refer to Table 8 for maximum roof 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.



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.

(a) HIDDEN GUTTER



(b) VALLEY GUTTER

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8.3.9 Gutters, barges and fascias

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

Gutters, barges and fascias shall terminate so as to leave a gap of 10 mm from the finished wall *cladding* as shown in Figure 8.

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

8.3.10 Roof penetrations

Pipe penetrations shall be flashed using *EPDM* or silicone rubber boot *flashings* as shown for profiled metal roofing in Figure 53 and Figure 54.

COMMENT:
Use purpose-made preformed rooflights and ventilators supplied by the manufacturer of the tiles where available.

8.4 Profiled Metal

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) Without *valley gutters* that change direction in plan form,

c) Not curved, and

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

d) With sheets no more than 18 metres long.

8.4.2 General

Installation of profiled metal roof *cladding* shall be by trained installers, approved by the manufacturer or the NZ agent (in the case of imported *cladding)*. In some cases, an exception to this requirement may be made for experienced builders if the:

a) *Building* has a maximum floor plan area of 50 m^2;

b) Roof is simple gable, hip or lean-to design,

c) Roof sheeting is either standard corrugated or low-ribbed *trapezoidal* profile, and

d) Roof pitch is 15° minimum.

COMMENT:
It is recommended an installer has successfully completed, or demonstrated skill to the level of, an NZQA recognised course. The Roofing Industry Training Organisation offers such a qualification.

8.4.3 Materials

8.4.3.1 Choice of metal

Metal roof *cladding* shall be selected according to the exposure conditions as defined in:

a) NZS 3604 Clause 4.2, and

b) AS/NZS 2728.

The metal *cladding*, *flashings* and fixings shall be selected from Table 20 according to the *durability* required for the specific application.

COMMENT:
The exposure zone in which a *building* is located can affect the *durability* of metal roof *cladding*.

AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand. Exposure zones are defined in Clause 4.2 of NZS 3604, based on the likely exposure to wind-driven sea-salt or geothermal gases.

8.4.3.2 Steel

Materials for the manufacture of profiled galvanized steel roofing shall:

a) Have *base metal thickness (BMT)* of 0.55 mm minimum,

b) Be grade G550 with an applied protective metallic coating,

c) Have a minimum protective metal coating of:
   i) Aluminium-zinc AZ150 to AS 1397, or
   ii) Zinc Z450 to AS 1397, or
   iii) Zinc ZM275 for pre-painted roofing, and

d) Where required for additional *durability*, a factory-applied finish complying with the *durability* requirements of AS/NZS 2728, Table 2.4.

COMMENT:
While galvanized metal roofing may be left unpainted in some environments, this may shorten its life, especially in areas where it is not washed naturally by the rain.

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 0.9 mm,

b) Grade G5000 series, and

c) Hardness H34.

For pre-painted aluminium, a factory-applied finish complying with *durability* requirements of AS/NZS 2728 shall be applied.

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*.

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Acceptable Solution E2/AS1

8.4.4 Profiles

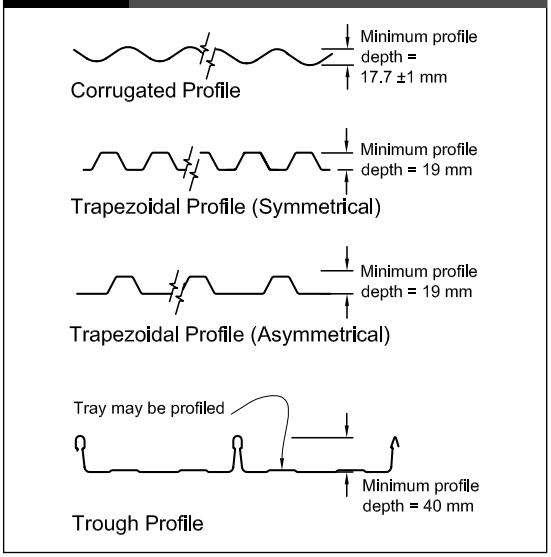
Profiles covered in this Acceptable Solution are shown in Figure 38, and consist of:

a) **Corrugated** – curved with a crest height of 17.7 ±1 mm,

b) ***Trapezoidal*** – symmetrical or asymmetrical, with a minimum crest height of 19 mm, and

c) ***Trough profile*** – with vertical ribs at a minimum height of 40 mm, and flat, or lightly profiled, pans between the ribs.

Figure 38: Profiled metal profiles
Paragraphs 8.4.4, 9.6.1 and 9.6.5, Table 3



8.4.5 Roof pitch

For roofs up to 10 metres, pitches shall be:

a) Corrugated – not less than 10° (1:6), or 8° (1:7) if no end laps are present.

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).

For roofs over 10 metres, minimum pitches shall be increased by an additional 2°.

COMMENT:
Where manufacturers have more stringent requirements, these should be followed to optimise performance and to avoid invalidating guarantees.

8.4.6 Structure

The maximum spacing of *purlins* to comply with this Acceptable Solution is given in Table 11, Table 12 or Table 13.

COMMENT:
Purlin spacing will depend on the wind load, pitch and spanning capacity of the metal roofing. The spacing for the *purlin* closest to the edge of the roof is to be reduced over those in the centre of the roof to account for localised wind effects.

Additional support will be required around roof-mounted services such as air-conditioning in order to avoid roof distortion.

Table 11: Maximum spans – corrugated
Paragraph 8.4.6

Metal	BMT	Purlin spacing (unlimited access Type A roofs)	
		End mm	Internal mm
Steel	0.55 mm	700	1000
Aluminium	0.90 mm	500	800

Table 12: Maximum spans – trapezoidal
Paragraph 8.4.6

Metal	BMT	Purlin spacing (unlimited access Type A roofs)	
		End mm	Internal mm
Steel	0.55 mm	1000	1500
Aluminium	0.90 mm	800	1200

Table 13: Maximum spans – trough profile
Paragraph 8.4.6

Metal	BMT	Purlin spacing (unlimited access Type A roofs)	
		End mm	Internal mm
Steel	0.55 mm	700	1200
Aluminium	0.90 mm	600	900

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8.4.7 Underlay

All profiled metal long-run roofing shall have a *roof underlay* installed.

Only bitumen-impregnated or fire-retardant paper-based *roof underlays* complying with Table 23 shall be used under metal roofing. See Paragraph 8.1.5 for installation details.

8.4.8 Fixings: corrugated and trapezoidal

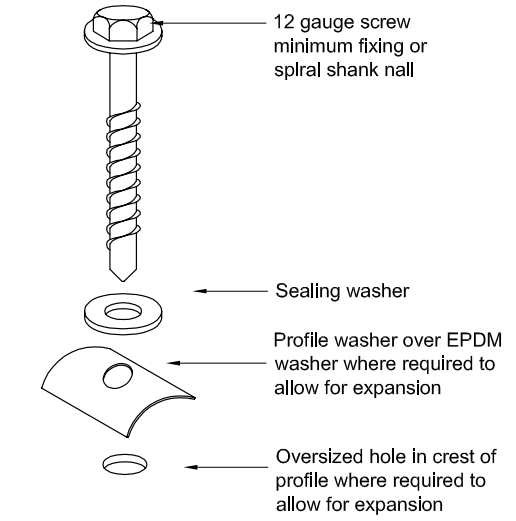
Fixings for corrugated and *trapezoidal* profiles shall be either:

a) A 3.8 mm minimum diameter spiral shank nail hot-dipped galvanized to AS/NZS 4680, or

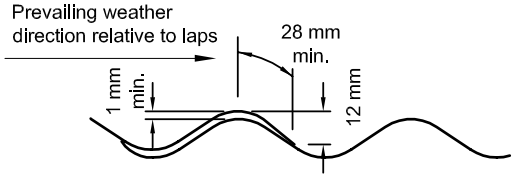
b) A minimum 12-gauge screw, as shown in Figure 39, which complies with Class 4 of AS 3566: Part 2.

Figure 39: Corrugated fixings and sheet lap
Paragraph 8.4.8 b) and 9.6.6 e)

NOTE: Refer to Table 16 for expansion provisions.



TYPE OF FIXING FOR PROFILED METAL ROOFING



CORRECT WAY TO LAP SHEETS

8.4.8.1 Fixing requirements

Fixing patterns shall be as shown in Table 14 and Table 15, and fixings shall:

a) Be fixed through crests,

b) Penetrate *purlins* by a minimum of 35 mm,

c) Include sealing washers of:
   i) neoprene (having a carbon black content of 15% or less), or
   ii) *EPDM*, and
   iii) if sliding washers, shall be coated with PTFE.

COMMENT:

For additional guidance, refer to Figure 10.16 in NZS 3604 and to the New Zealand Metal Roof and Wall Cladding Code of Practice, Drawing 7.9A.

These spacing requirements for fixings are conservative, and a specific design may produce a more optimum spacing.

Table 14: Corrugated spacing of fixings
Paragraph 8.4.8.1

Profile	Ridge, hip, valley and gutter line. Periphery roof areas (refer Comment)	Remainder of roof
0.4 mm corrugate	Fix side laps and fix every second corrugation	Fix side laps, miss 2, hit 1, miss 2...

Table 15: Trapezoidal spacing of fixings
Paragraph 8.4.8.1

Profile	Ridge, hip, valley and gutter line. Periphery roof areas (refer Comment)	Remainder of roof
0.4 mm *trapezoidal* profile 5 rib	Fix every crest	Fix side laps, miss 1, hit 1... (i.e. alternate)
0.4 mm *trapezoidal* profile 6 rib	Fix every crest	Fix side laps, miss 1, hit 2, miss 1...

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8.4.9 Fixings: trough profile

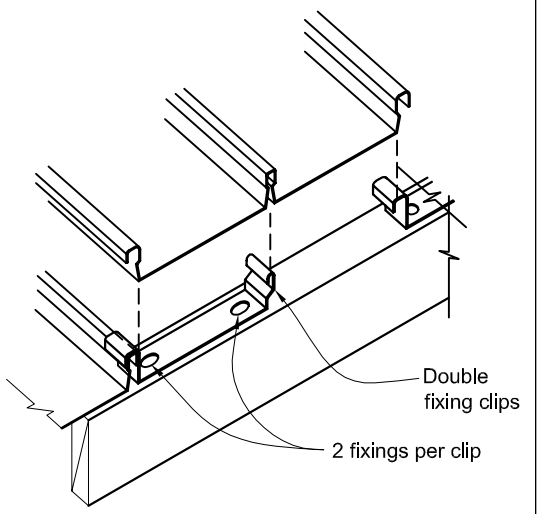
Clip fixings for *trough profile* shall be as shown in Figure 40, and shall:

a) Have a minimum *BMT* of 1.2 mm,

b) Be made from a grade of metal at least equal to that of the *cladding*, and

c) Be a minimum width of 30 mm.

Figure 40: **Trough profile fixings**
Paragraph 8.4.9



8.4.9.1 Fixing requirements

Every clip must be fastened with either:

a) Two 2.8 mm x 50 mm spiral shank nails hot-dipped galvanized to AS/NZS 4680, or

b) Two 10-gauge by 25 mm waferhead hot-dipped galvanized screws which comply with Class 4 of AS 3566: Part 2.

8.4.10 Allowance for expansion

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

Where Table 16 requires sliding 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 sliding washers as shown in Figure 39, and:
   i) using oversized holes, and
   ii) positioning fixing in centre of hole.

Table 16: **Expansion provisions**
Paragraph 8.4.10, Figure 39

Material	< 8 m	8-12 m	12-18 m	>18 m
Steel	NSR	Sliding washers	Sliding washers	SD
Aluminium	Oversized holes	Sliding washers	SD	SD

SD – Requires *specific weathertightness design*
NSR – No special requirements

8.4.11 Flashing requirements

The roofing shall be flashed at all boundaries, except at the discharge to a gutter.

a) At the bottom edge of a cover *flashing* to corrugated roofing, dress *soft edge flashing* down over corrugate profile and finish 5 mm from the troughs as shown in Figure 41. Check the compatibility of the *soft edge* material against Table 21 and Table 22.

b) At the bottom edge of cover *flashing* to *trapezoidal* or *trough profiles*, notch the *flashing* over the ribs and finish 5 mm from the pans as shown in Figure 42.

c) 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.

d) Provide expansion joints in accordance with Paragraph 4.5.2 for:
   i) coated steel *flashings* 12 m or more in length, and
   ii) aluminium *flashings* 8 m or more in length.

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, or
   ii) for aluminium-zinc coated steel, 4 mm diameter aluminium rivets.

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

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.

Figure 41: Corrugated soft edge flashing
Paragraph 8.4.11 a)

NOTE: *Apron flashing* cover varies according to *wind zone* – refer Table 7.

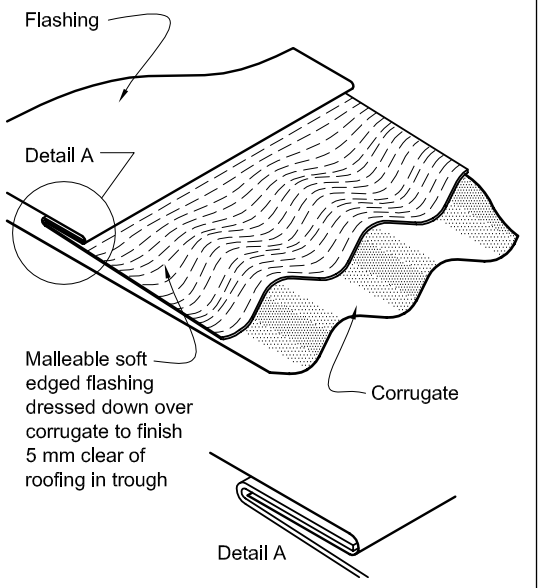
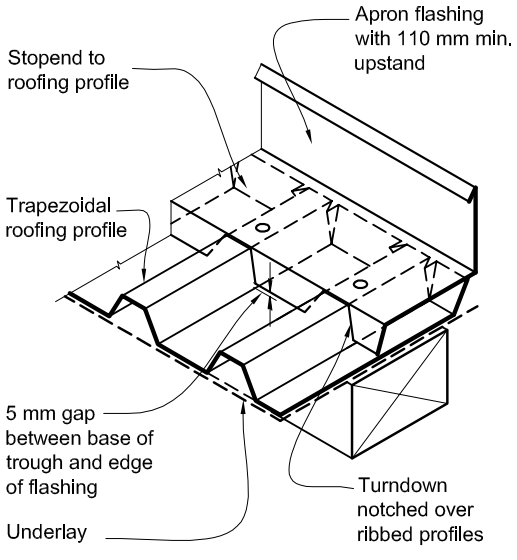


Figure 42: Trapezoidal notched flashing
Paragraph 8.4.11 b)

NOTE: *Apron flashing* cover varies according to *wind zone* – refer Table 7.



8.4.12 Flashing details

The roof shall be flashed at all boundaries, except at the discharge to the gutter using details shown below:

a) Ridge to hip as shown in Figure 43,

COMMENT:
Preformed caps are only suitable for a small range of roof types. Caps formed on site are commonly used – refer to the New Zealand Metal Roof and Wall Cladding Code of Practice for additional guidance.

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

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

d) Ridge and hip as shown in Figure 46,

COMMENT:
Note the preformed cap in Figure 46 is only suitable for a small range of lower pitch roofs.

Flashings that are site-painted will fade at a different rate from *flashings* manufactured from the same factory-coated material as the roofing.

e) Barge *flashings* as shown in Figure 47,

f) *Apron flashing – parallel flashing* to profile as shown in Figure 48.

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Figure 43: Corrugated – ridge to hip
Paragraph 8.4.12 a)

NOTE: *Apron flashing* cover varies according to *wind zone* – refer Table 7.

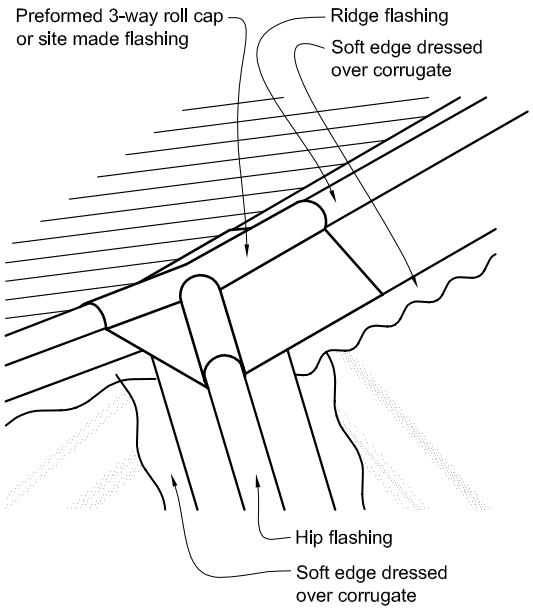
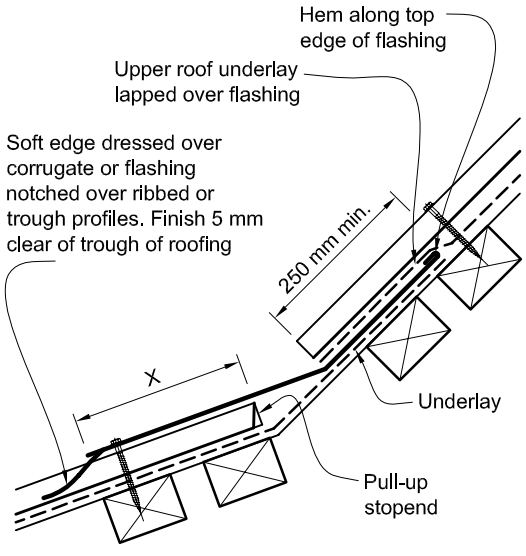
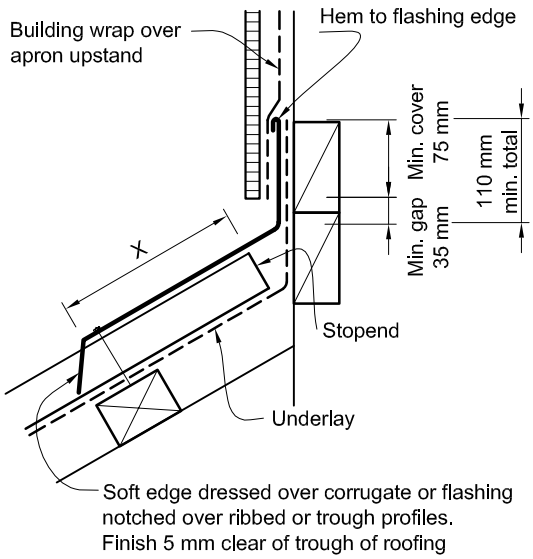


Figure 44: Apron flashing and change in pitch for profiled metal
Paragraphs 4.6.1.3 and 8.4.12 b)

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



(a) CHANGE IN PITCH



(b) APRON FLASHING

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Figure 45: Eaves and roof/wall ridge for profiled metal
Paragraph 8.4.12 c)

NOTE: (1) Situation 2 – *Flashings* table – refer Table 7.
(2) X = variable according to *wind zone* – refer Table 7.
(3) Z = variable according to *wind zone* – refer Table 7.

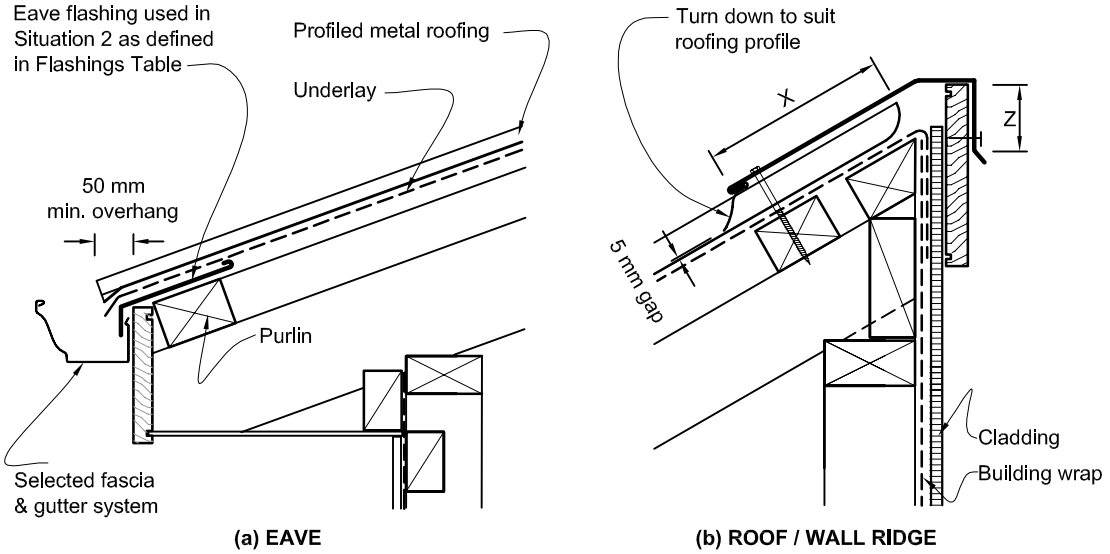

Figure 46: Ridge and hip flashings for profiled metal
Paragraphs 4.6.1.2 and 8.4.12 d)

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

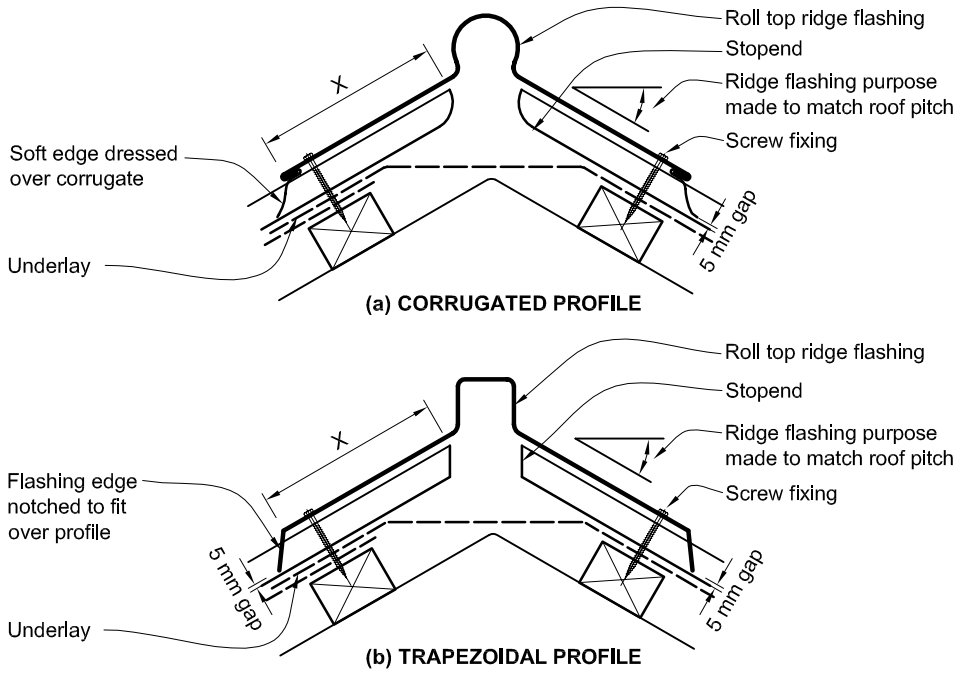

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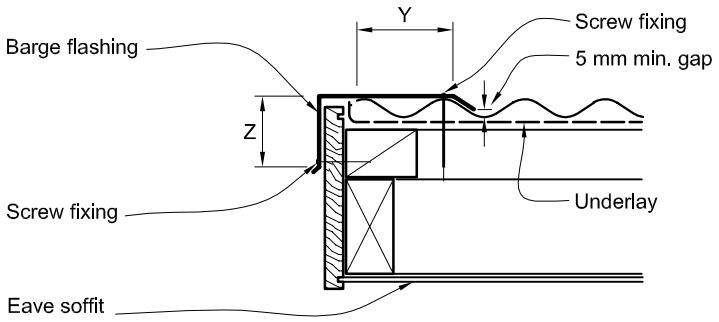
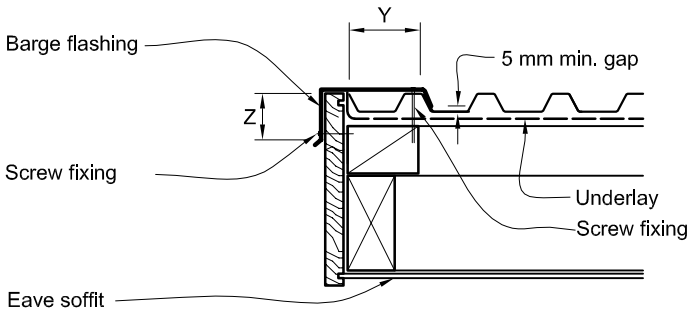
Figure 47: Barge flashings for profiled metal
Paragraphs 4.6.1.5 and 8.4.12 e)

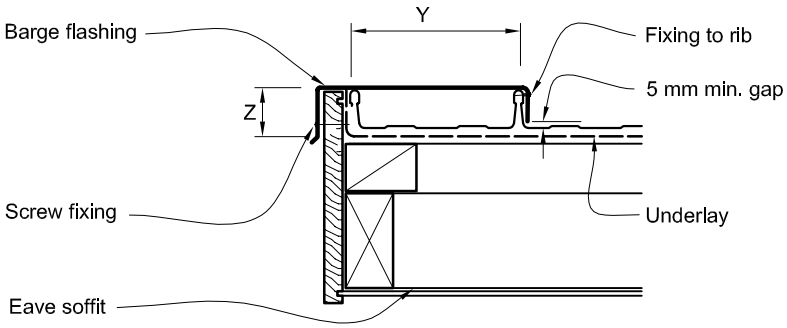
NOTE: (1) Y = variable according to *wind zone* – refer Table 7.
(2) Z = variable according to *wind zone* – refer Table 7.



(a) CORRUGATED PROFILE



(b) TRAPEZOIDAL PROFILE



(C) TROUGH PROFILE

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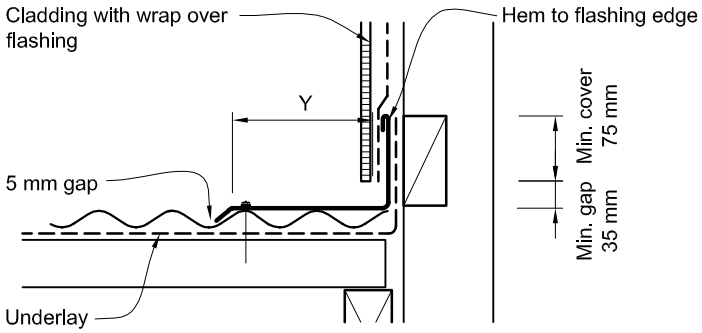
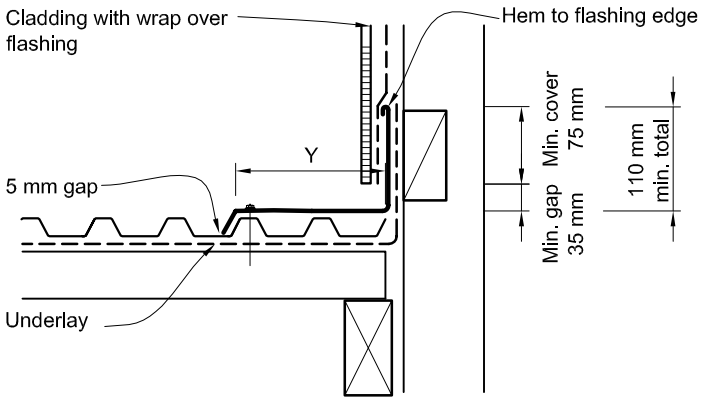
Figure 48: **Parallel apron flashings for profiled metal**
Paragraph 8.4.12 f)

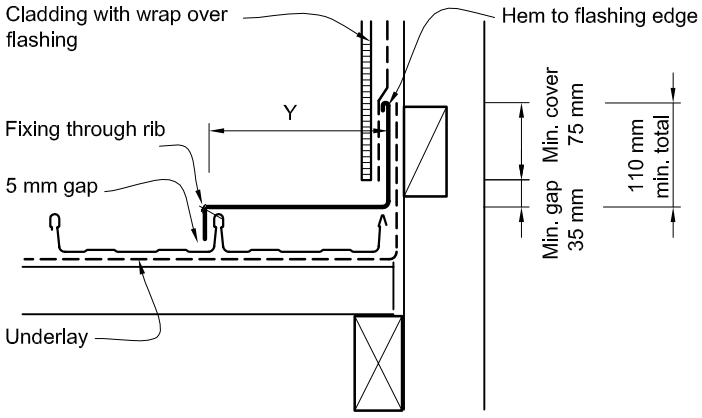
NOTE: Y = to cover minimum of two crests – refer Table 7.



(a) CORRUGATED PROFILE



(b) TRAPEZOIDAL PROFILE



(c) TROUGH PROFILE

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8.4.13 Stopends

The top ends of profiled metal roof *cladding* shall have *stopends* as shown in Figure 49.

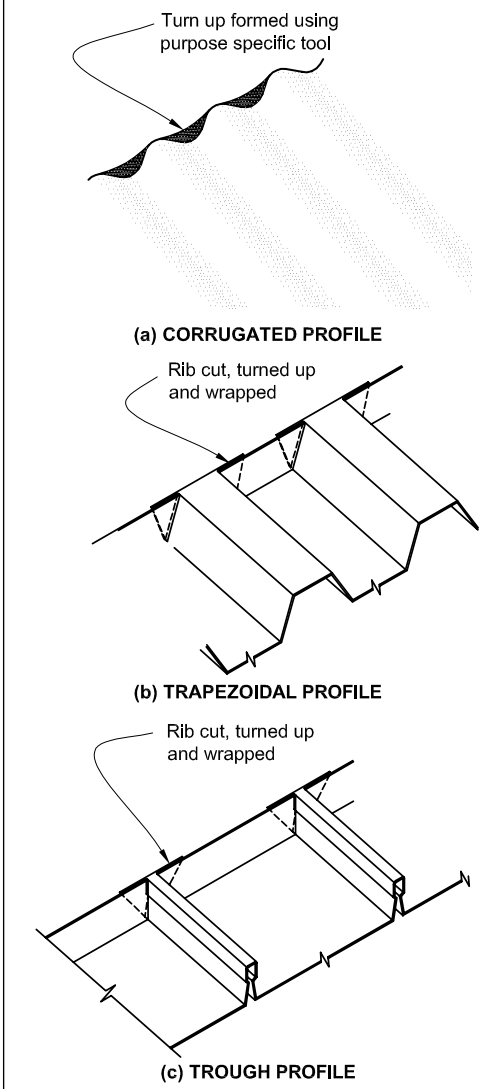
Folded *stopends*, as shown in Figure 49, shall be provided for *trapezoidal* and *trough profile* metal roof *cladding*, where:

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

b) The *building* is in a high/very high *wind zone*.

For other situations, *stopends* shall be provided by pulling up the *cladding* to the maximum allowable, without tearing the metal.

Figure 49: Profiled metal stopends
Paragraph 8.4.13, Figure 7



8.4.14 Turn-downs at gutters

The 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, Section 7.1.3 for guidance on methods.

8.4.15 Profile closure

Crests of *trapezoidal* metal roof *cladding* shall be closed at the *eaves* with a fixing through the centre of each crest.

COMMENT:

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

Preformed compressible seals shall not be used at the *eaves*.

8.4.16 Internal, valley and hidden gutters

Internal, *valley* and *hidden gutters* shall be in accordance with Paragraph 8.1.6.1.

8.4.16.1 Hidden gutters

Hidden gutters shall be as shown in Figure 50.

8.4.16.2 Valley gutters

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

COMMENT:

Refer to the New Zealand Metal Roof and Wall Cladding Code of Practice, Sections 8.4.4 and 8.4.5 for additional guidance on sizing, materials and fixing.

8.4.16.3 Internal gutters

Internal gutters shall be in accordance with Paragraph 8.1.6.3, and shall be as shown in Figure 52.

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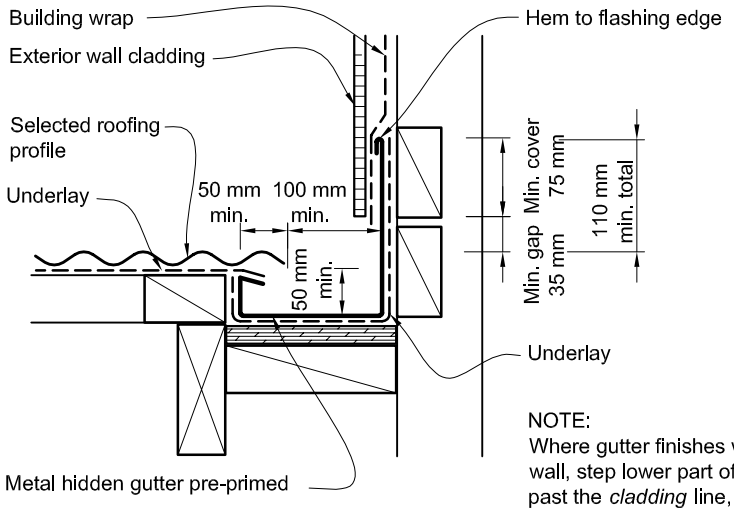
Figure 50: Hidden gutter for profiled metal
Paragraph 8.4.16.1



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
Paragraph 8.4.16.2

NOTE: (1) Refer to Table 8 for maximum roof 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.

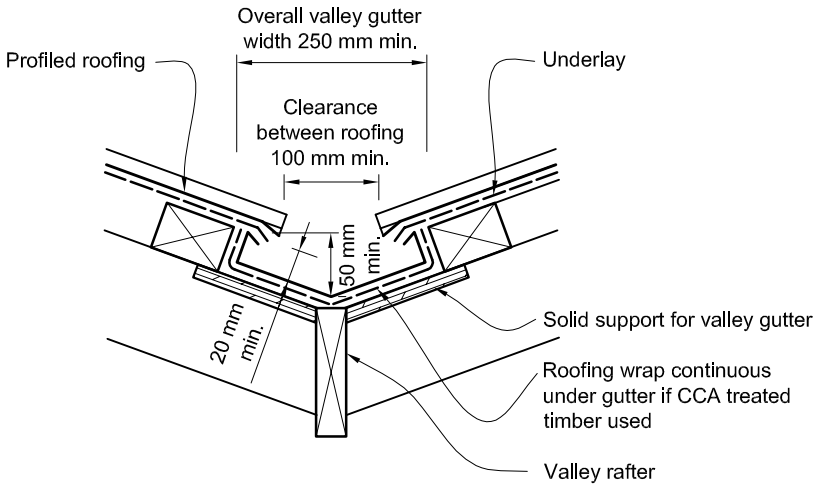


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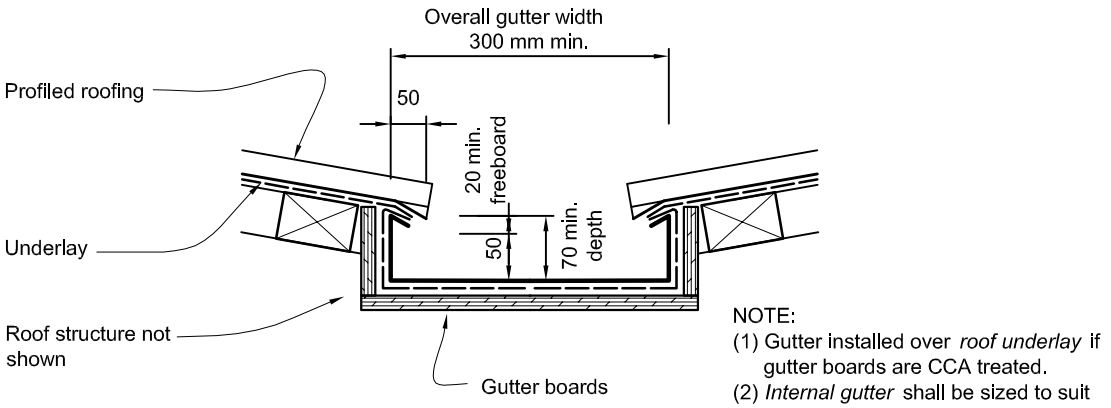
Figure 52: Internal gutter for profiled metal
Paragraph 8.4.16.3



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 60 mm shall be flashed using an *EPDM* boot *flashing* as shown in Figure 53,

b) Pipe penetrations up to 200 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 cricket *flashings* will require *specific weathertightness 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
Paragraphs 8.1.7 b), 8.4.17 and 9.1.3.4, Table 9, Figure 22

Penetration width	Maximum roof length above penetration in metres		
	Corrugated	Trapezoidal	Trough profile
800 to 1200 mm	4 m	8 m	16 m
600 to 800 mm	6 m	12 m	18 m (refer Note)
400 to 600 mm	8 m	16 m	18 m (refer Note)
0 to 400 mm	12 m	18 m (refer Note)	18 m (refer Note)

NOTE: Limited to 18 m as per the limitations of this Acceptable Solution.

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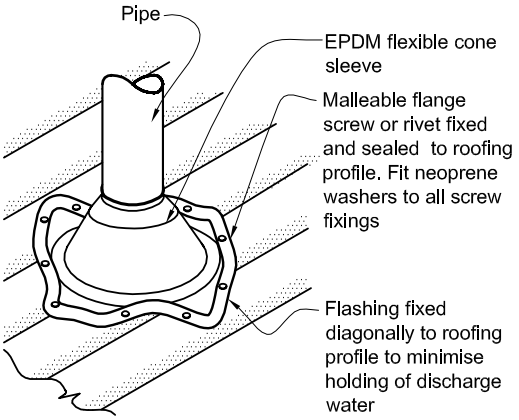
Figure 53: Flashing for small pipes
Paragraphs 8.3.10, 8.4.17 a), 9.6.8.5 and 9.6.9.6



NOTE:
(1) Max. roof pitch for this flashing 45°, minimum pitch 10°.
(2) For pipes up to 60 mm diameter.

Figure 54: Soaker flashing for pipe penetrations
Paragraphs 8.3.10 and 8.4.17 b)

NOTE: (1) X = variable according to *wind zone* – refer Table 7.
(2) Y = to cover minimum of two crests – refer Table 7.
(3) Suitable for pipes from 60 mm to 200 mm diameter.
(4) Suitable only for roof pitches of 10° or higher.

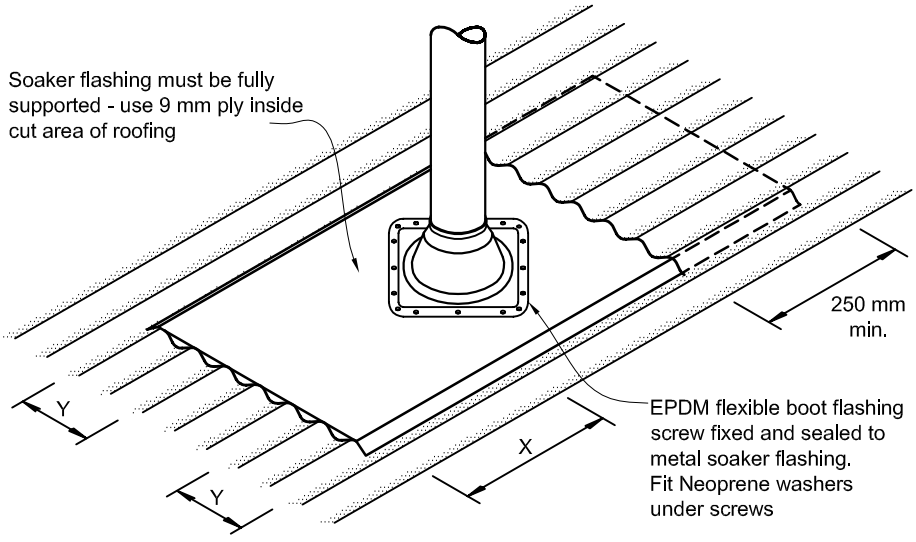


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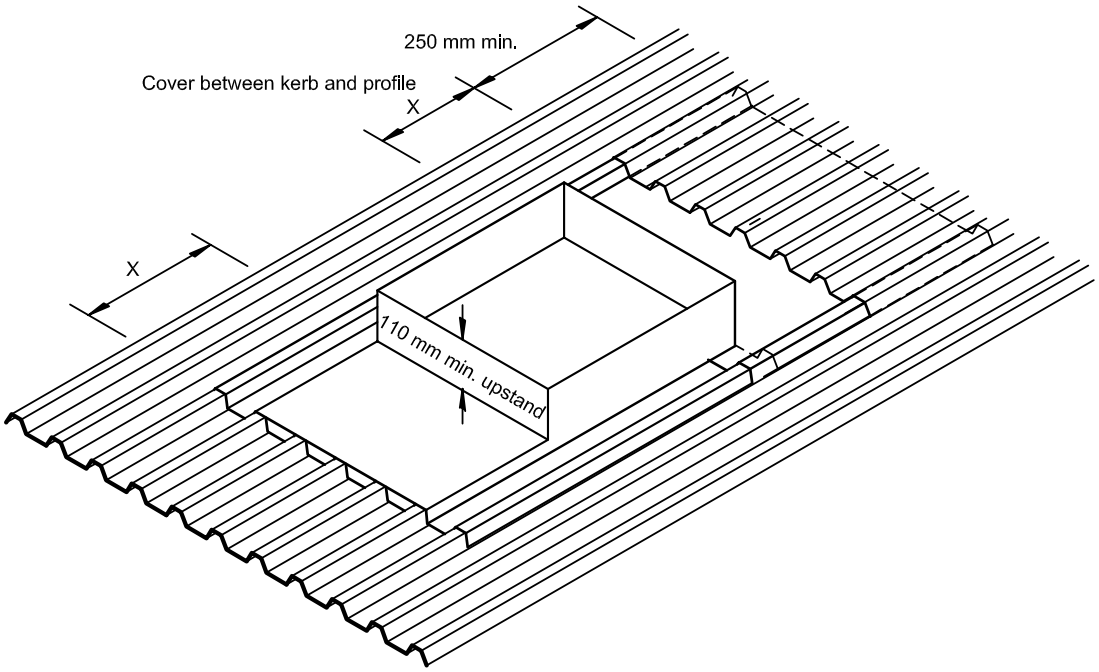
Figure 55: Soaker flashing for other penetrations
Paragraph 8.4.17 c)

NOTE: (1) X = variable according to *wind zone* – refer Table 7.
(2) Suitable for penetrations up to 1200 mm wide.
(3) Suitable only for roof pitches of 10° or higher.



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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 1.5° (1:40),

b) *Decks* with:
   i) a minimum fall of 1° (1:60),
   ii) a maximum area of 40 m^2,
   iii) no steps in level within *deck* area,
   iv) no integral roof gardens, and
   v) no downpipe direct discharge to *deck*,

COMMENT:
Discharging gutters directly onto *decks* increases the chances of water entry into sensitive areas.

Direct discharge may be allowed into gutters calculated to have sufficient water-carrying capacity, but this is outside the scope of this Acceptable Solution.

c) Internal gutters with a minimum fall of 1 in 100, with no seams in the gutters closer than 1 m to an outlet, and

COMMENT:
Seams should be avoided in gutters where possible. Where they cannot be avoided they should be positioned at a high point or a change in plane to reduce the risks of ponding on the seam. 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.

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

Installation of *membrane cladding* shall be by trained installers, approved by the manufacturer or the NZ agent (in the case of imported *membrane)*.

COMMENT:
It is recommended an installer has successfully completed, or demonstrated skill to the level of, an NZQA recognised course.

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) H3.1 with treatment type compatible with *membrane* and adhesives used, and kiln dried after treatment.

COMMENT:
The compatibility of LOSP-treated plywood 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 used for *membrane* roofing or *decks* shall:

a) Be a minimum thickness of:
   i) 1 mm for roofing or when used for *decks* with a protective wearing surface, or
   ii) 1.5 mm with no protective surface, 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 and seam tapes 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 the timber substructure shall have a maximum moisture content of 20% when a *membrane* is adhered.

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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) The edge of sheets shall be supported with *dwangs* or *framing*, unless a structurally tested tongue-in-groove edge provides equivalent support,

c) The maximum span shall be 400 mm in each direction,

d) Plywood shall be laid with the face grain at right angles to the supports,

e) A 20 mm triangular fillet shall be used at the base of any 90° upstand,

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

g) Plywood shall be fixed:
   i) with 10 g x 50 mm stainless steel countersunk head screws,
   ii) with 3 mm gaps between all sheets,
   iii) at 150 mm centres on edges, and
   iv) 200 mm in the body of the sheets.

COMMENT:
Closed-in construction spaces under *membrane* roofs and *decks* shall have adequate ventilation to prevent the accumulation of moisture under the *membrane*. There should be a minimum gap of 20 mm between the underside of the substrate and any insulation.

For roof or *deck* areas over 40 m^2, roof vents will be required. Roof vents are not covered by this Acceptable Solution.

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),

b) Gutters or where water could pond,

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. The use of joins in butyl or *EPDM* should be avoided in gutters. Where this is not possible, the plywood should be rebated to minimise the effect of the seam.

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

Roofs and *decks* shall be *constructed* to provide falls as shown in Figure 56.

Roofs and *decks* shall be *constructed* so that:

a) The highest point of the roof or *deck* is a minimum of 100 mm below an adjoining floor as shown in Figure 56,

b) *Membrane* upstands extend to a minimum level of 50 mm above the floor level at all walls or *parapets* as shown in Figure 62,

COMMENT:
This will lead to a minimum total *membrane* upstand of 150 mm which, if the clearance of the *cladding* from the *deck* or roof surface is at the minimum of 35 mm, gives an overlap of 115 mm.

c) Water discharges either:
   i) directly into roof outlets with a minimum diameter of 75 mm as shown in Figure 64, or
   ii) via *scupper* openings, into a rainwater head, or a gutter with a minimum width of 300 mm as shown in Figure 63,

d) Where the discharge is through a *parapet* or *enclosed balustrade*, the *scupper* opening shall have a minimum clear opening of 200 mm wide and 75 mm high, with a lip as shown in Figure 63,

e) External corner upstands in the *membrane* around the *scupper* opening are formed as shown in Figure 57, and

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COMMENT:
Refer to E1/AS1 for specific drainage requirements, as minimum sizes for outlets and gutters may be higher than shown in this Acceptable Solution.

f) When an internal outlet is used, allowance for additional run-off shall be provided by:
   i) an overflow in addition to the outlet, or
   ii) an extra outlet, with both outlets sized to take the full required capacity.

When an overflow is provided in addition to the outlet, a lip to the overflow shall be formed as shown in Figure 63.

Figure 56: Falls in membrane roofs and decks
Paragraphs 8.5.6 and 8.5.6 a)

NOTE: (1) Refer Figure 62 for thresholds and clearances.
(2) Junction *saddle flashing* – refer Figure 13.

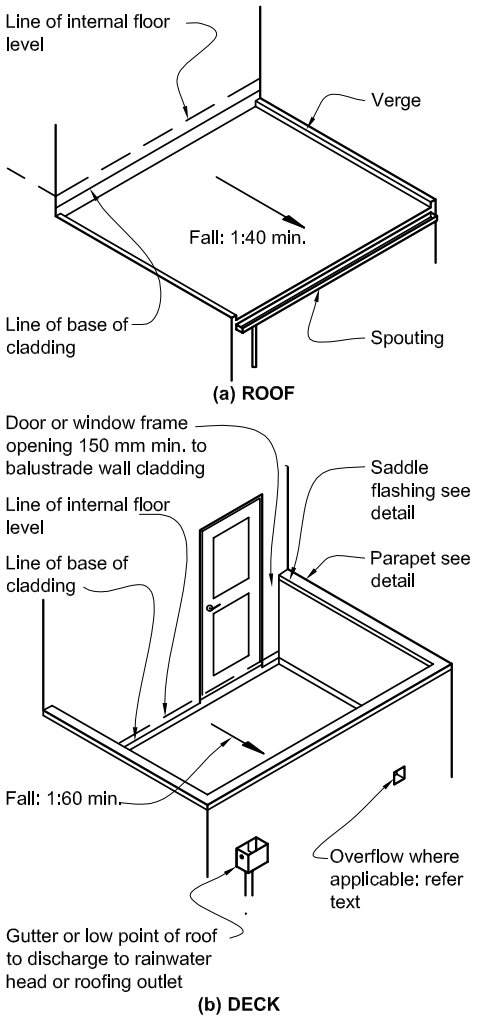
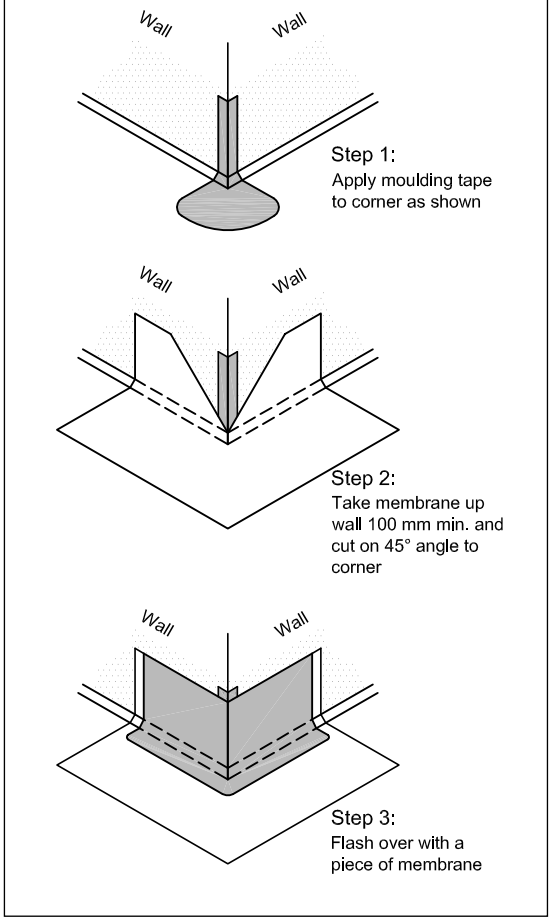


Figure 57: External corner in upstand
Paragraphs 8.5.6 e) and 8.5.8 a), Figures 59 and 63



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 weathertightness 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,*

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Figure 58: Internal corner in upstand
Paragraph 8.5.8 b), Figure 62

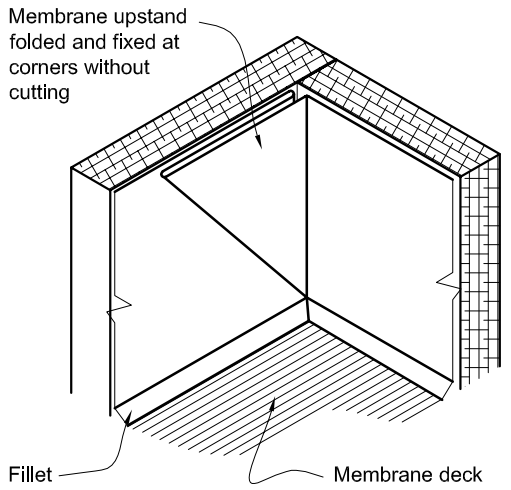


Figure 59: Roofing penetration in membrane
Paragraphs 8.5.8 and 8.5.9

NOTE: (1) For maximum penetration size of 1200 mm x 1200 mm.
(2) External corners to be formed as shown in Figure 57.

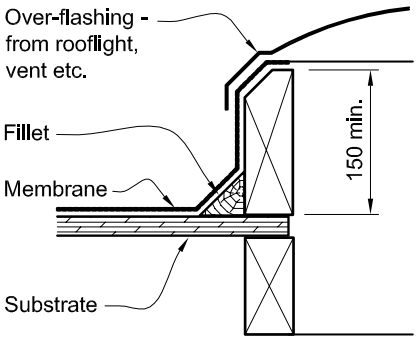
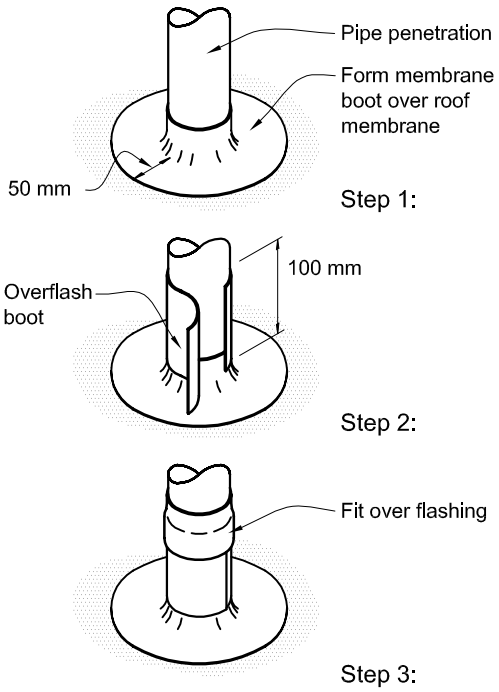


Figure 60: Pipe penetration in membrane
Paragraph 8.5.9



d) Figure 62: Junctions of *decks* and walls, and

e) Figure 63: *Scupper* discharge from a roof to a rainwater head and the weatherproofing of the opening.

8.5.8.1 Junctions with walls

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

Clearances in Figure 62 are shown to the *membrane* surface. Where there is an additional material applied over the *membrane*, all required clearances shall apply to the highest level of the upper wearing surface, where this is also the draining surface.

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

COMMENT:
Adding wearing surfaces such as tiles over the *membrane* will effectively reduce clearances, and should be allowed for when setting *membrane* levels.

8.5.9 Penetrations

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

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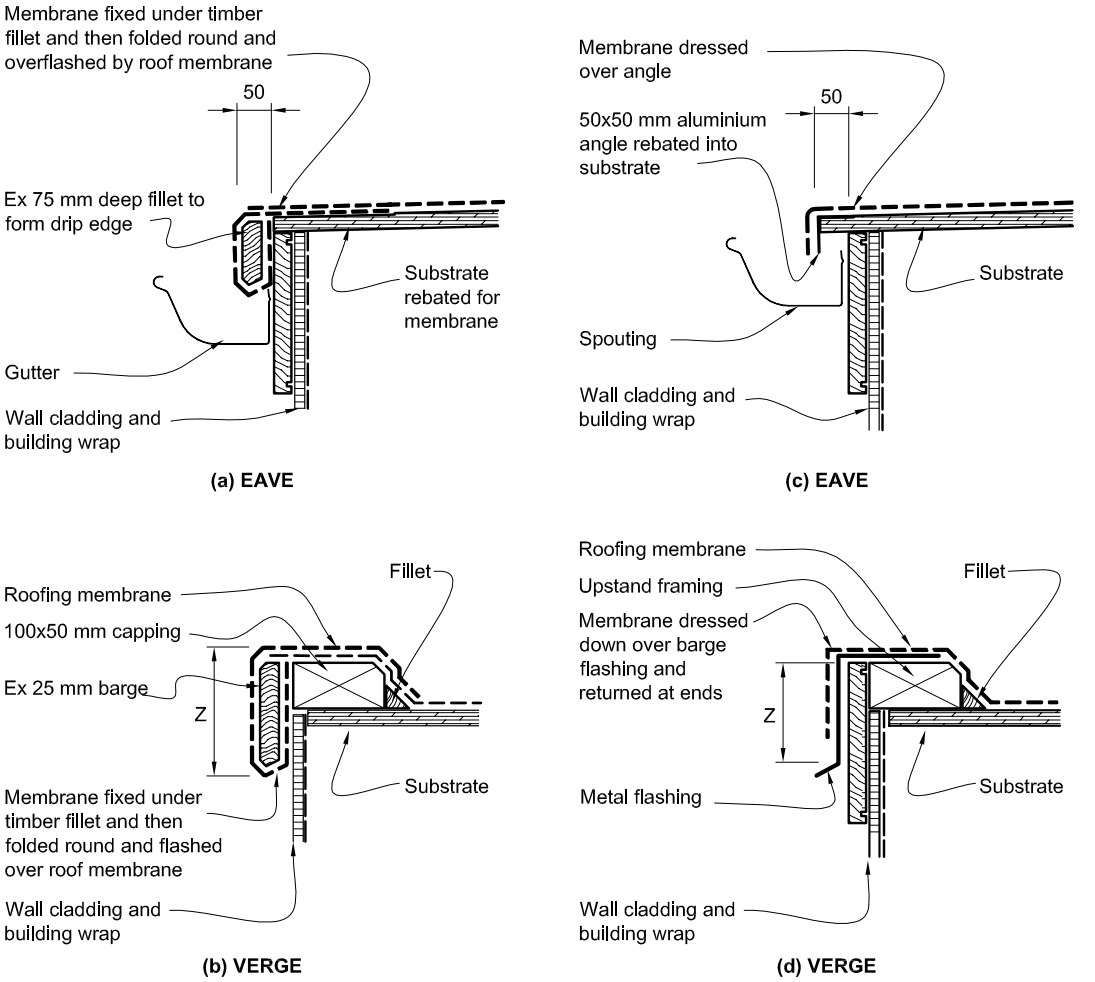
Figure 61: Verges in membrane
Paragraph 8.5.8 c)

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



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 weathertightness 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.

When an overflow is provided for roofs or *enclosed decks* as per Paragraph 8.5.6 f) i), the overflow shall have a cross-sectional area equal to 1.5 times the cross-sectional area of the calculated discharge downpipe.

Any plywood adjacent to *deck* gutters shall be treated to H3.1, and protected from water splash.

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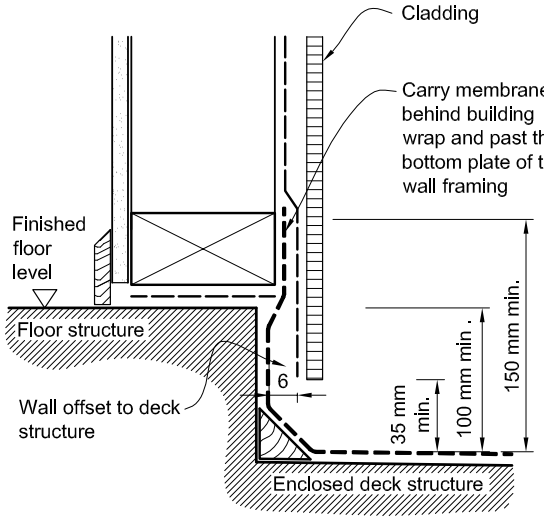
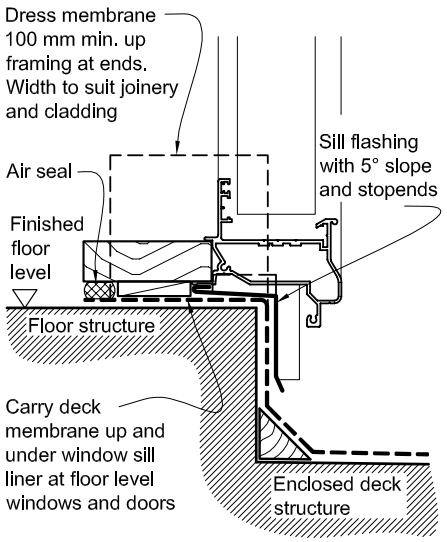
Figure 62: Junctions with walls for membrane
Paragraphs 7.4.3, 8.5.6 b), 8.5.8 d) and 8.5.8.1

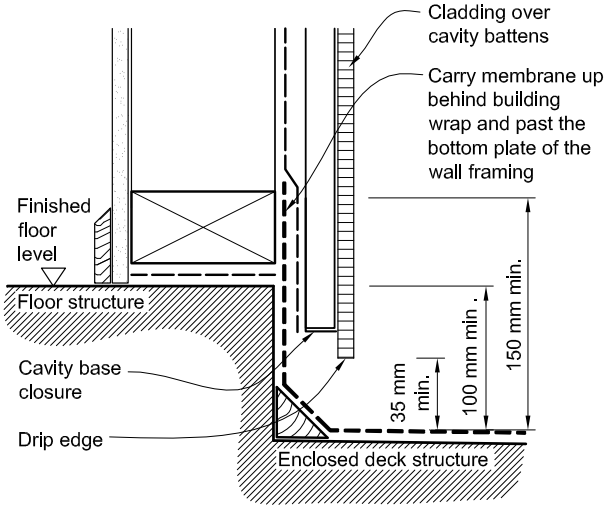
NOTE: (1) Internal corners to be formed as shown in Figure 58.
(2) Dimensions are shown to *membrane*. However, where there is an additional material applied over the *membrane*, all dimensions shall apply to the highest level of the wearing surface.



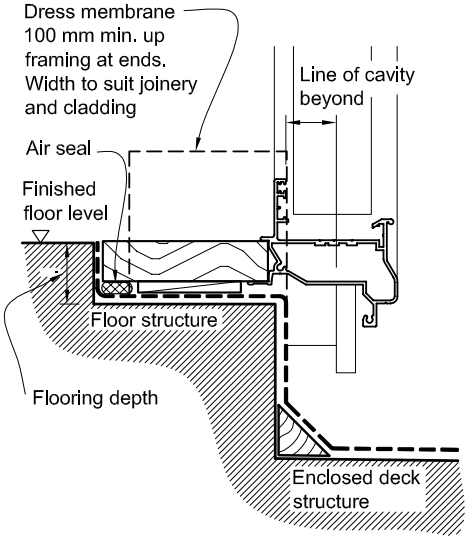
(a) DIRECT FIX THRESHOLD AT WALL



(b) DIRECT FIX THRESHOLD AT OPENING



(c) CAVITY THRESHOLD AT WALL



(d) ALTERNATIVE THRESHOLD AT OPENING

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Figure 63: Rainwater head and scupper opening in membrane
Paragraphs 8.5.6 d) and f)

NOTE: (1) A preformed *scupper* unit may be used, but this will require *specific weathertightness design*.
(2) External corners of *scupper* opening to be formed as shown in Figure 57.

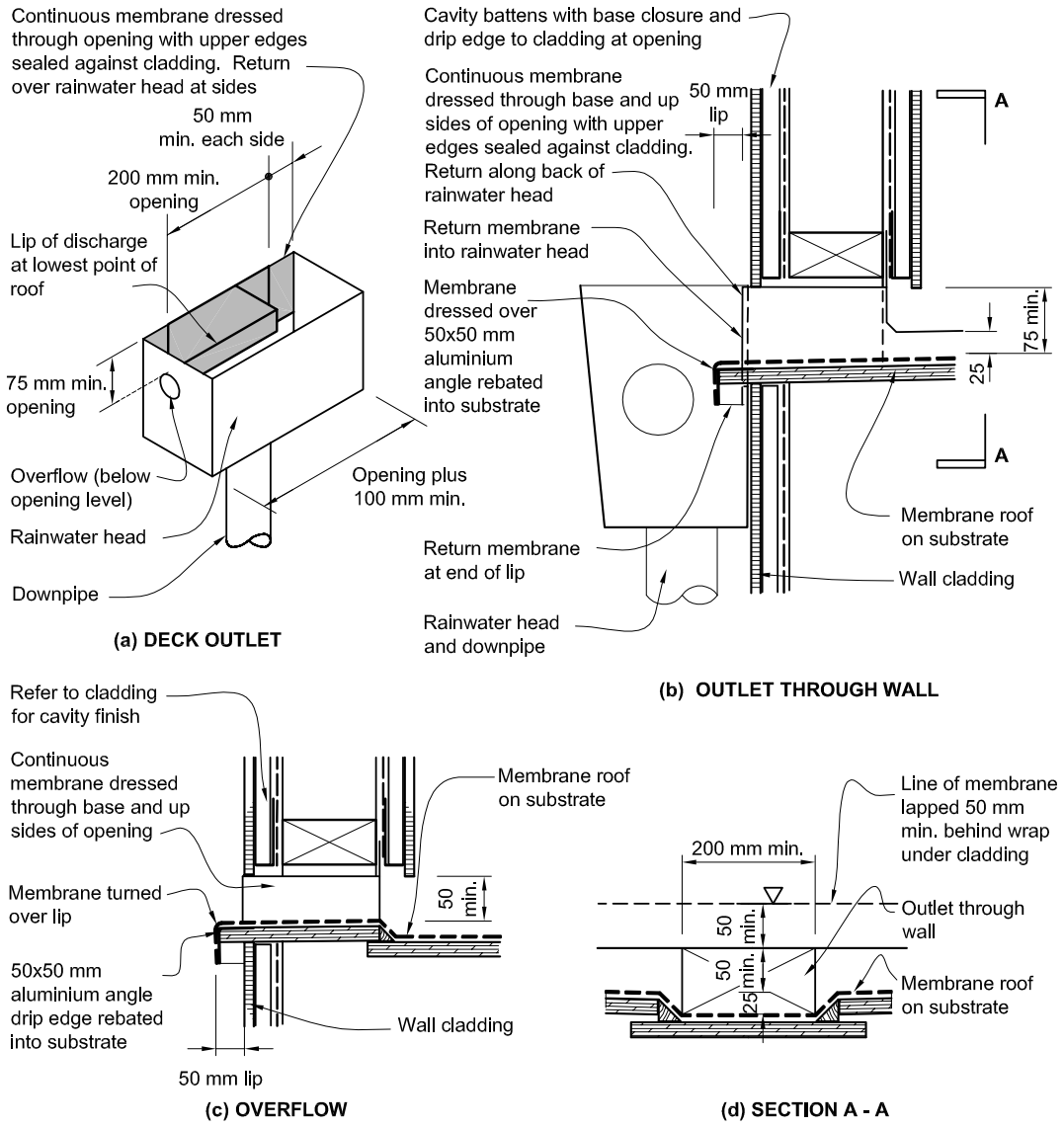

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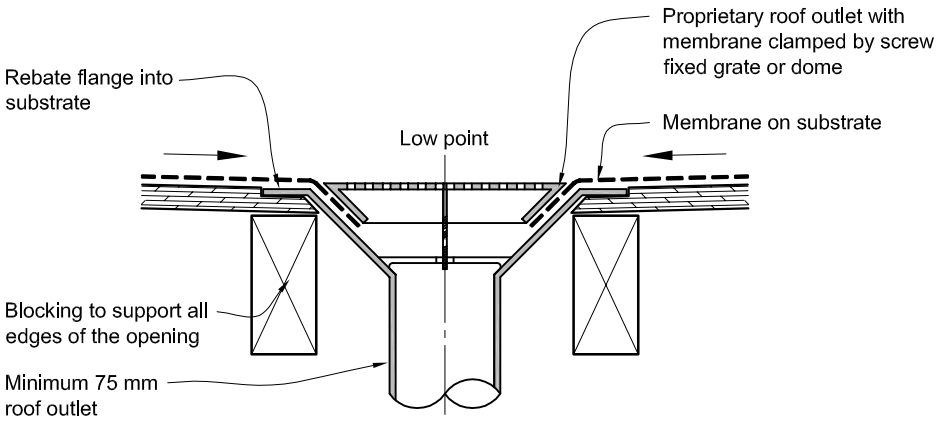
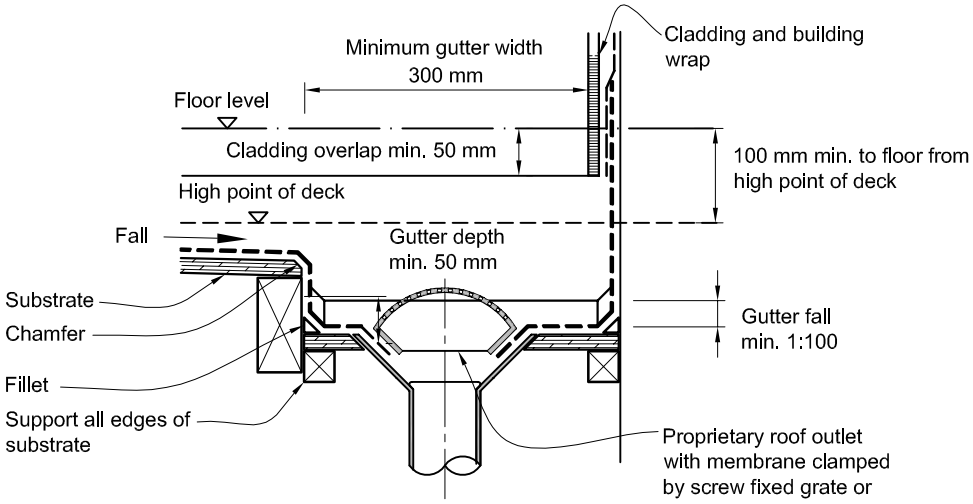
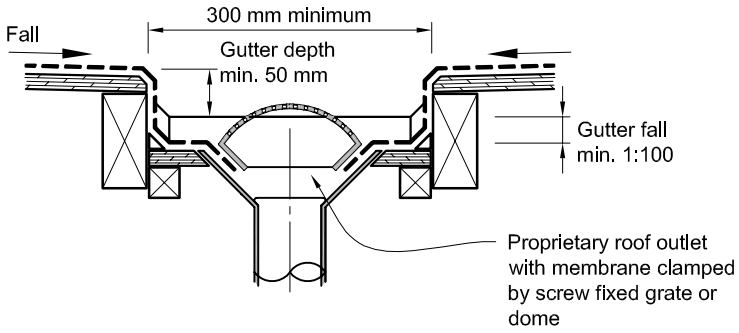
Figure 64: **Gutters and outlets in membrane**
Paragraphs 8.5.6 c) and 8.5.10



(a) TYPICAL GUTTER OUTLET



(b) EDGE GUTTER



(c) CENTRAL GUTTER

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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.

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.

9.1.2 Maintenance

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

Maintenance of wall *claddings* shall be carried out as necessary to achieve the expected *durability* of the material – refer Paragraph 2.5. The extent and nature of the necessary maintenance is dependent on the:

a) Type of *cladding* used,

b) Position of the *cladding* on the *building*,

c) Geographical location of the *building*, and

d) Specific site conditions.

COMMENT:
Washing by rain removes most accumulated atmospheric contaminants, but sheltered areas are protected from the direct effects of rain and require more regular manual washing. Some heavily textured surfaces will not be as effectively washed by rain as smoother surfaces, so will require regular manual washing (high pressure water should not used).

9.1.3 Bottom of cladding

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

Figure 65: Levels and garage openings
Paragraphs 9.1.3 and 9.1.3.4

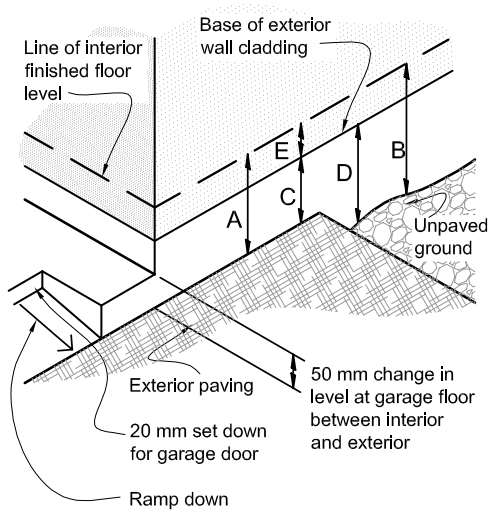

Table 18: Clearances
Paragraphs 9.1.3, 9.1.3.2, 9.1.3.3, 9.1.3.4 and 10.3.5

Minimum clearances (mm)	Masonry veneer		Other claddings				
	A	B	A	B	C	D	E
Concrete slab	100	150	150	225	100	175	50
Timber floor	Refer Note		Refer Note		100	175	50

NOTE: Refer to NZS 3604 for requirements.

9.1.3.1 Concrete slabs

Concrete slabs shall meet the requirements of Paragraph 10.3 as shown in Figure 132.

9.1.3.2 Masonry veneer clearances

The height of the floor slab above *finished ground level* shall be in accordance with Paragraph 10.3.5, as shown in Table 18.

Ground clearances for *masonry veneer* shall be as shown in the Brick Veneer Handbook SNZ HB 4236.

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9.1.3.3 Bottom of other wall claddings

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 an unpaved surface,

b) Overlap the concrete slab by 50 mm, and

c) Be offset horizontally by a minimum of 6 mm to prevent capillary action.

9.1.3.4 Openings to garages

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, and

b) Provision to drain water away from the threshold of the opening.

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.

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

COMMENT:
NZS 3604 may require greater separations depending on floor type and materials.

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

9.1.3.5 Ground level timber framing

Suspended timber floors shall meet the requirements of Paragraph 10.0. 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.

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.

9.1.3.6 Balconies, decks and roofs

A minimum of 35 mm clearance shall be provided from the bottom edge of the wall *cladding* to:

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

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

At any junction of a wall with a *deck* or roof, clearance shall be measured from the highest point of the adjacent *deck* or roof, and the highest point of any surface ridges or textures.

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

9.1.4 Barriers to airflow

This Acceptable Solution requires that *buildings* have barriers to airflow, in the form of:

a) Interior *linings* with all joints stopped, or

b) Where walls are not lined, such as attic spaces at gable ends, a rigid sheathing or an air barrier, complying with Table 23, fixed to *framing* prior to fixing *cladding* or *cavity battens*.

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 wrap or sheathing acts as an air barrier as well.

9.1.5 Building wrap to wall openings

Prior to window or door installation:

a) *Building wrap* shall be cut and dressed into all sides of openings as per Figure 72, and

b) *Flexible flashing tape* shall be applied to head and sill *framing* as shown in Figure 72. *Flexible flashing tape* shall:
   i) comply with Parts 3.2 and 4 of ICBO Acceptance Criteria AC148, and
   ii) be compatible with the *building wrap*.

COMMENT:
Dressing the *building wrap* 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, and

c) Made of:
   i) self-expanding polyurethane foam complying with ASTM C1330, 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:
Care must be taken when using self-expanding polyurethane foam as there is a danger of over-filling due to the foam expanding up to twenty times its original volume. A backing rod should be used.

9.1.7 Building wrap

The *building wrap* 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 *building wrap*,

c) Be lapped not less than 75 mm at horizontal joints,

d) Be lapped not less than 150 mm over *studs* at vertical joints, and

e) Be added as a second layer over head *flashings* as shown in Figure 71.

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 Paragraph 3.1.

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 *building wrap* or rigid sheathing 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,

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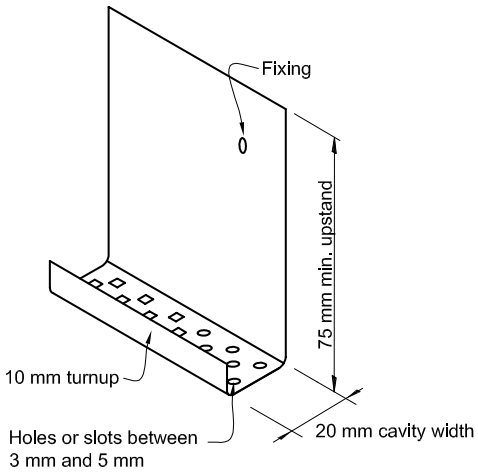
e) Use vermin-proofing at the cavity base as per Paragraph 9.1.8.3 and Figure 66,

f) Use *cavity spacers* as shown in Figure 67, where fixing is required between *cavity battens*, and

g) Not use horizontal *cavity battens*.

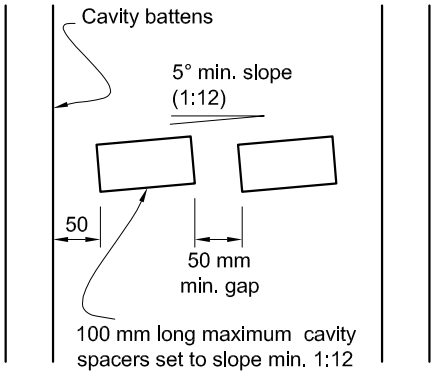
COMMENT:
Horizontal battens obstruct the flow of air in cavities.

Figure 66: Cavity base closure
Paragraphs 9.1.8.2 e) and 9.1.8.3



NOTE: To be used in *drained cavities* at the base of walls and above window head and inter-storey *flashings*.

Figure 67: Cavity spacers
Paragraph 9.1.8.2 f)



NOTE: Spacing of cavity spacers will vary to suit individual cladding fixings.

9.1.8.3 Vermin-proofing

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

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 a total area of opening of 1000 mm^2 per lineal metre of wall, and

c) Be positioned to allow a minimum *drip edge* to the wall *cladding* of:
   i) 10 mm at the base of walls, and
   ii) 15 mm above window 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. Providing 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

Cavity battens shall:

a) Be a minimum of 20 mm in thickness,

b) Be at least the same width as the *stud*,

c) Be fixed, by the *cladding* fixings, through the *building wrap* into the *framing*, and

COMMENT:
Battens will be fixed by the *cladding* fixings, which will penetrate the wall *framing*. Battens will therefore need only temporary fixing until the *cladding* is fixed.

Polystyrene battens may be temporarily adhered to the *building wrap*.

d) Comply with the *durability* requirements of B2/AS1, and
   i) if timber, comply with NZS 3602, or
   ii) if polystyrene, comply with Paragraph 9.9.3.1, and be protected from any incompatible vapours from timber treatment.

COMMENT:
The solvents from freshly LOSP-treated timber may melt polystyrene, so these should not be used together.

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9.1.8.5 Wall framing behind cavities

Where *stud* spacings are greater than 450 mm, an intermediate means of restraining the *building wrap* and insulation from bulging into the *drained cavity* shall be installed. Acceptable means of achieving this are by using:

a) 75 mm galvanized mesh,

b) Polypropylene tape at 300 mm centres,

c) Galvanized wire at 300 mm centres fixed to *dwangs* over the *building wrap*, or

d) Vertical *cavity battens* at 300 mm centres.

Wire or mesh shall be galvanized in accordance with AS/NZS 4534.

Dwangs shall be at a minimum of 800 mm centres, except when rigid sheathing is fixed to the *framing* prior to fixing *cavity battens*.

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 *flashings* and, where necessary, 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.

Details specific to particular *claddings* are given in Paragraph 9.2 to Paragraph 9.9.

Acceptable methods of *flashing* pipes and a meterbox are shown in Figure 68 and Figure 69.

COMMENT:

Where possible, meterboxes should be located in sheltered areas of the *building*, such as a porch, or be installed behind a weatherproof glazed panel.

Figure 68: General pipe penetration
Paragraph 9.1.9.3, Figure 126

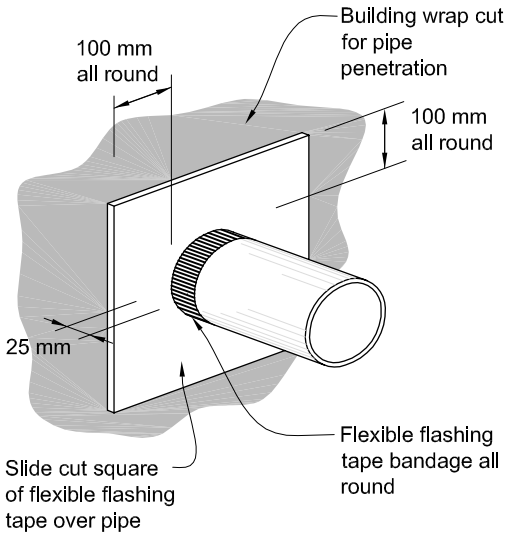
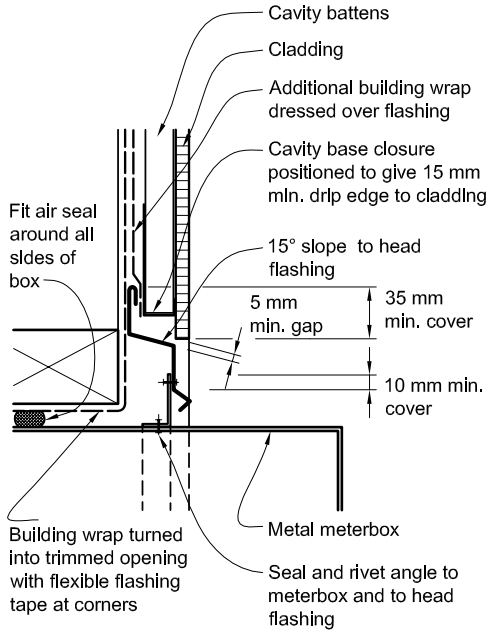


Figure 69: General meterbox
Paragraphs 9.1.9.3, 9.6.8.5 and 9.6.9.6



NOTE:
(1) Fix angle and seal to all sides of box. At sides and base, *claddings* shall overlap angle by 10 mm minimum. Continuously seal *cladding* against angle.
(2) Suitable for other similar penetrations.

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9.1.9.4 Inter-storey junctions

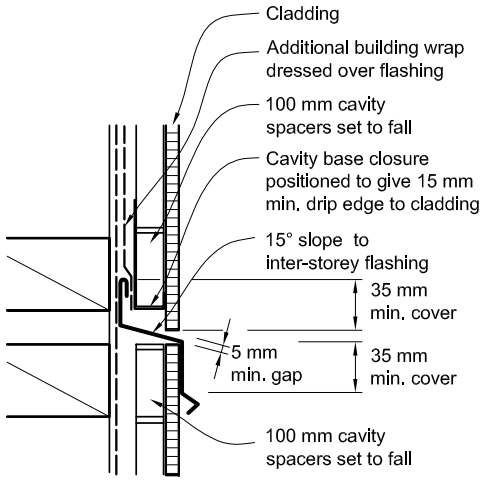
Inter-storey junctions in *claddings* over *drained cavities* shall be formed for walls:

a) Up to a maximum of 2 *storeys* in height, as shown for the specific wall *claddings* in Paragraph 9.2 to Paragraph 9.9, or

b) Over 2 *storeys*, by using an inter-storey *flashing* bridging the *drained cavity* as shown in Figure 70.

COMMENT:
A *drained cavity* is limited to a height of 2 *storeys* to limit the amount of moisture handled by the cavity

Figure 70: General inter-storey junction
Paragraph 9.1.9.4, Figures 108, 121, 123, 124 and 125



NOTE: To be used to limit continuous cavities to a height of two storeys.

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.

After installation, the flange forming the window or door facing shall have a 10 mm overlap over the surrounding *cladding* material or associated back *flashings*. A minimum of 8 mm effective overlap on the sill shall be permitted where necessary to allow for on-site tolerances.

9.1.10.1 Scope

This Acceptable Solution is limited to hinged windows and doors, and does not cover bi-fold, sliding and other non-hinged profiles. Due to window profiles, non-hinged windows and doors shall require *specific weather-tightness design*.

9.1.10.2 Treatment of opening

Treatment of the window opening for *direct fixed* wall *claddings* shall be as shown in Figure 72. The top of the opening shall be treated similarly. As shown, the sill trimmer may need to be chamfered to allow installation of the sill tray. A sloped packer may be used to support the tray.

Window openings for wall *claddings* over *drained cavities* shall be as shown in Figure 72, except that there shall be no sill *flashing*.

9.1.10.3 Window heads

All windows and doors shall include head *flashings*, sealed to the *building wrap* as shown in Figure 71.

In walls with a *drained cavity*, a *flashing* system shall be installed at the head of the window to:

a) Protect the window opening from water entry, and

b) Direct any water entering the *drained cavity* above the window opening to the outside away from the opening.

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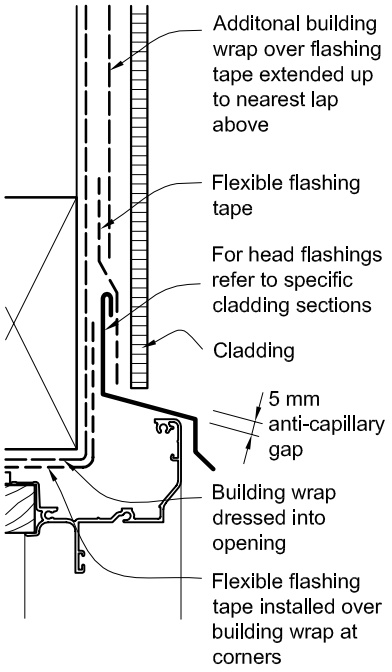
Figure 71: General sealing of head flashing
Paragraphs 9.1.7 e), 9.1.10.3 and 9.1.10.4 c)

NOTE: May also use *building wrap* lapped over flashing upstand in lieu of *flexible flashing tape*. Refer cladding window details, for example Figure 115.



9.1.10.4 Head flashings

Head *flashings* shall be in accordance with Paragraph 4.6.1.6 and Table 7, and shall:

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

b) For *direct fixed cladding*, *stopends* shown on drawings are optional,

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

c) For wall *claddings* on cavity walls, incorporate 10 mm turn-ups as *stopends,*

d) Have the upstand of the *flashing* protected from moisture by lapping an additional layer of *building wrap* over the upstand, or by using *flexible flashing tape* as shown in Figure 71. The additional *building wrap* shall extend from the nearest lap above, and be lapped under the top layer.

9.1.10.5 Window sills

Sill tray *flashings* shall be in accordance with Paragraph 4.6.1.6 and Table 7.

a) *Direct fixed claddings* shall have sill tray *flashings* that direct moisture to the outside face of the *cladding system* as shown in the details included in Paragraph 9.2 to Paragraph 9.9. The sill *flashing* shall extend back past the condensation channel of the window. The 5 mm gap between the window facing and sill tray must not be sealed.

b) *Claddings* over a *drained cavity* shall have:
   i) face-fixed windows and doors, installed so the window frame flange facing is forward of the line of the *cavity battens*, and
   ii) no sill trays,
   iii) there is no requirement to maintain a 5 mm gap between the *cladding* and window facing at the sill with a cavity. Sealing this gap may reduce water entry during routine maintenance such as washing the *building*.

COMMENT:
If a *cladding* requires continuous horizontal support below the window sill, a sill tray will be needed to direct water from the back of the *drained cavity* out over the *cladding*. This will require *specific weathertightness design*.

c) Where sill supports are needed, these shall be to the manufacturer's recommendations, and shall be no closer than 200 mm from corners of the opening, and 100 mm from mullion to frame junction positions.

d) Certain aluminium joinery sections with a deep profile (such as bi-fold and sliding doors and windows) will not be able to use the sill details included in this Acceptable Solution and achieve the required window facing cover and sill support with a sloped sill tray. The sill details in these cases shall be specifically designed.

COMMENT:
Alternatives may include a flat extruded sill tray with a *stopend* on three sides. Manufacturers should be consulted for specific details and results of testing on these.

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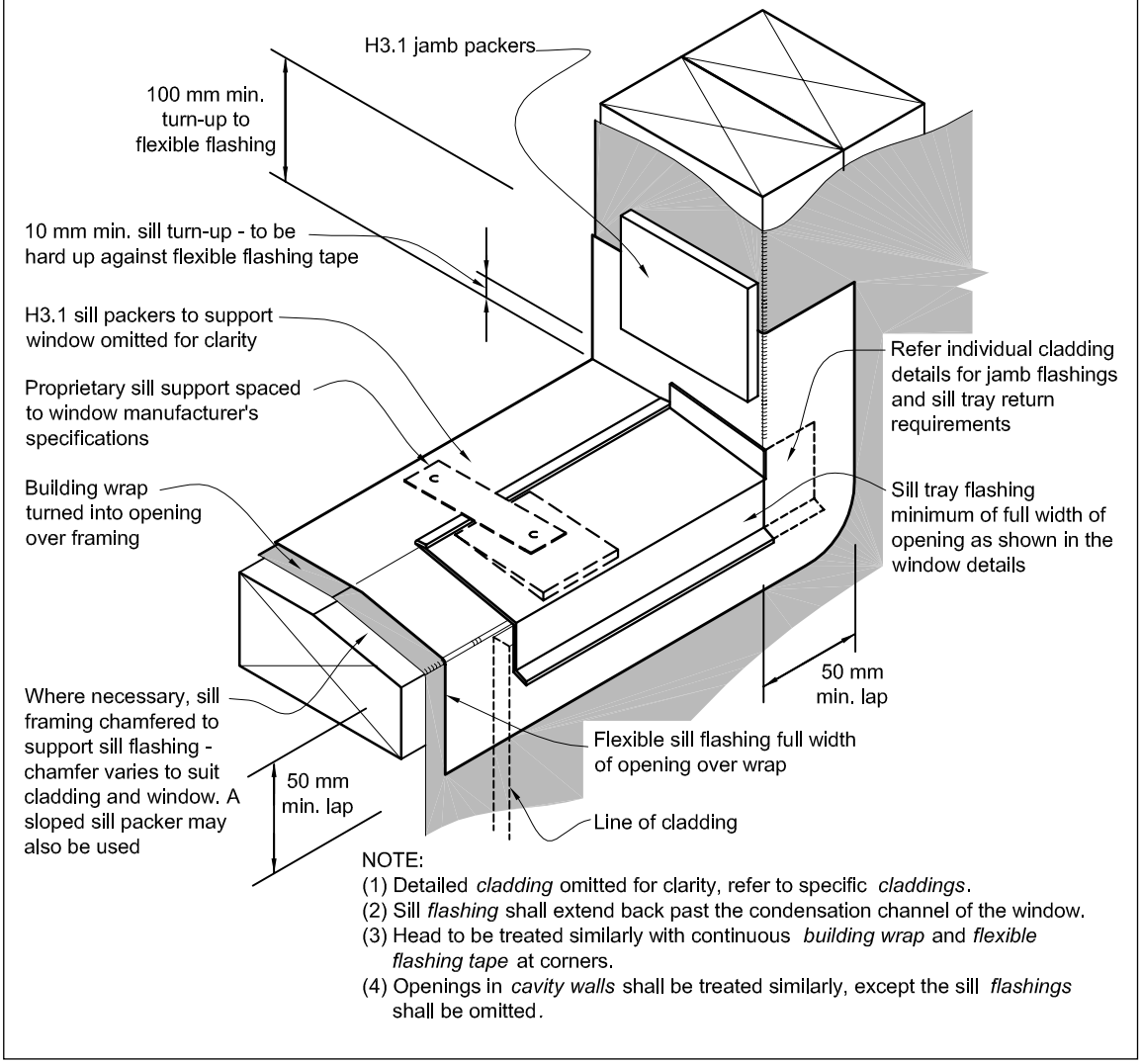
Figure 72: General window opening
Paragraphs 9.1.5 and 9.1.10.2, Figures 76, 81-86, 90, 91, 95, 99, 115, 116, 127 and 128



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 wrap* and *flexible flashing tape* at corners.
(4) Openings in *cavity walls* shall be treated similarly, except the sill *flashings* shall be omitted.

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9.1.10.6 Jamb flashings

Jamb *flashings* shall be in accordance with Paragraph 4.6.1.6 and Table 7, and shall be installed where required in the figures included in Paragraph 9.2 to Paragraph 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.

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9.2 Masonry Veneer

9.2.1 Limitations

This Acceptable Solution is limited to:

a) Clay brick veneer on timber *framing*, and

b) Concrete brick or block veneer on timber *framing*.

COMMENT:
Natural stone bricks or blocks may be suitable. However, these are not part of this Acceptable Solution. Refer to the manufacturer's recommendations for *specific weathertightness design* information.

9.2.2 General

Installation of *masonry veneer* shall be by trained installers, approved by the manufacturer or the NZ agent (in the case of imported *masonry veneer).*

COMMENT:
It is recommended that an installer has successfully completed, or demonstrated skill to the level of, an NZQA recognised course.

9.2.3 Installation

Masonry veneer on timber *framing* shall be an Acceptable Solution provided that:

a) The installation complies with SNZ HB 4236 and NZS 3604,

b) The *drained cavity* is sealed off from both the roof space and subfloor space,

c) A *building wrap* complying with Table 23 is applied to the face of timber *framing* in the cavity, and

d) *Control joints* are included as described in Paragraph 9.2.4.

9.2.4 Control joints

9.2.4.1 Clay bricks

Control joints shall be included at locations specified by the brick manufacturer.

When *control joints* are used, they shall be formed as shown in Figure 73, and shall have:

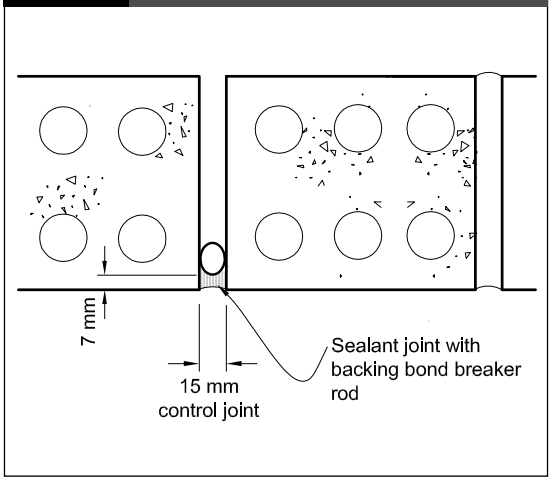
a) A backer rod of compressible foam complying with ASTM C1330, and

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.

COMMENT:
Control joints are not normally necessary for clay bricks except in long walls or at abutments.

Cracks are cosmetic and not likely to cause a moisture problem because of the presence of the cavity. Manufacturers can provide additional information on *control joints.*

Figure 73: Vertical control joint
Paragraphs 9.2.4.1 and 9.2.5



9.2.5 Concrete bricks

Control joints shall be included as specified in the New Zealand Concrete Masonry Manual and in any other locations specified by the manufacturer. *Control joints* shall be formed as shown in Figure 73.

COMMENT:
Concrete bricks shrink over time and this must be allowed for in the design of the *masonry veneer.* Manufacturers can provide additional information on *control joints.*

9.2.6 Windows and doors

The openings in wall *framing* for windows and doors shall have *building wrap* and *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 SNZ HB 4236.

9.2.7 Bottom of masonry veneer

Clearances to ground levels at the bottom of *masonry veneer* shall be in accordance with Paragraph 9.1.3.2.

Vents at the top and drainholes at the base of the *masonry veneer* shall be installed in accordance with SNZ HB 4236 and NZS 3604.

9.2.8 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*.

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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*.

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.

COMMENT:
NZS 3604, Clause 11.8.2 gives *stud* spacing requirements for *stucco* over rigid and non-rigid backing.

9.3.3 Stucco cladding system

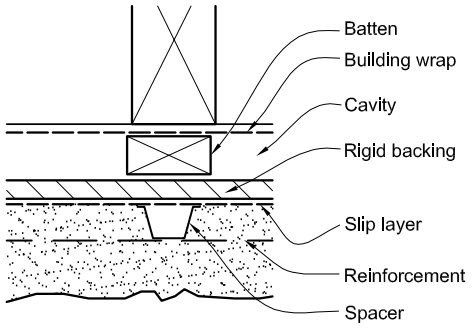
All *stucco claddings* shall be used over a *drained cavity* as described in Paragraph 9.1.8, and shown in Figure 74.

All *stucco cladding* shall have *building wrap:*

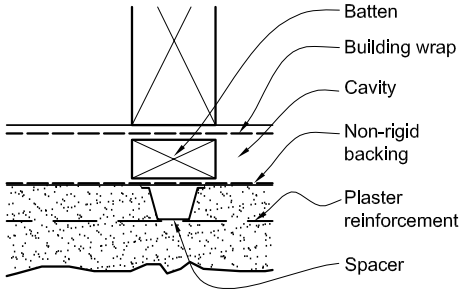
a) Fixed to the *framing* as specified in Table 23, and

b) Provided as an overlay to rigid backings to provide a slip layer that permits the independent movement of plaster and backing.

Figure 74: Types of stucco cladding
Paragraph 9.3.3



(a) RIGID BACKING



(b) NON-RIGID BACKING

9.3.4 Installation

9.3.4.1 General

Plaster shall be applied by a trained and experienced applicator.

COMMENT:
It is recommended that a plasterer will have successfully completed, or demonstrated skill to the level of, an NZQA recognised course. A BCITO qualification would meet this level.

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.

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9.3.5 Non-rigid plaster backings

9.3.5.1 Installation of building wrap

The *building wrap* shall be in accordance with Table 23, and shall:

a) Be run horizontally,

b) Be lapped 75 mm minimum at joints, and

c) Have upper sheets lapped over lower sheets to ensure water is shed to the outside of the *building wrap*.

9.3.5.2 Support

Non-rigid backing shall be provided with support that keeps it taut in order to limit deflection to a maximum of 5 mm. This shall be achieved using:

a) 75 mm galvanized mesh, or

b) Plastic tape or wire at 150 mm centres run across the supporting *cavity battens*.

9.3.6 Rigid plaster backings

Rigid backings shall be made of either:

a) Plywood,

b) Fibre cement sheet, or

c) Expanded or extruded polystyrene as per NZS 4251.

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 as specified in Table 5 of NZS 4251,

b) H3.1 treated as per AS/NZS 2269, and

c) Fixed as specified in Clause 4.2.1.2.2 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 4.2.1.3.2 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 weathertightness design*, and the use of tested and rated systems.

9.3.7 Finishes

All *stucco* surfaces shall be sealed by applying a minimum of 2 coats of a 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.

9.3.9.1 Stucco-topped balustrades

In lieu of metal *cappings*, the *stucco* surface may be taken over the top of *enclosed balustrades* if a liquid-applied *membrane* is used that is:

a) In compliance with Paragraph 9.7.8.1,

b) Used as shown in Figure 117,

c) A minimum dry thickness of 1 mm, and

d) Protected by an applied surface finish complying with Paragraph 9.3.7.

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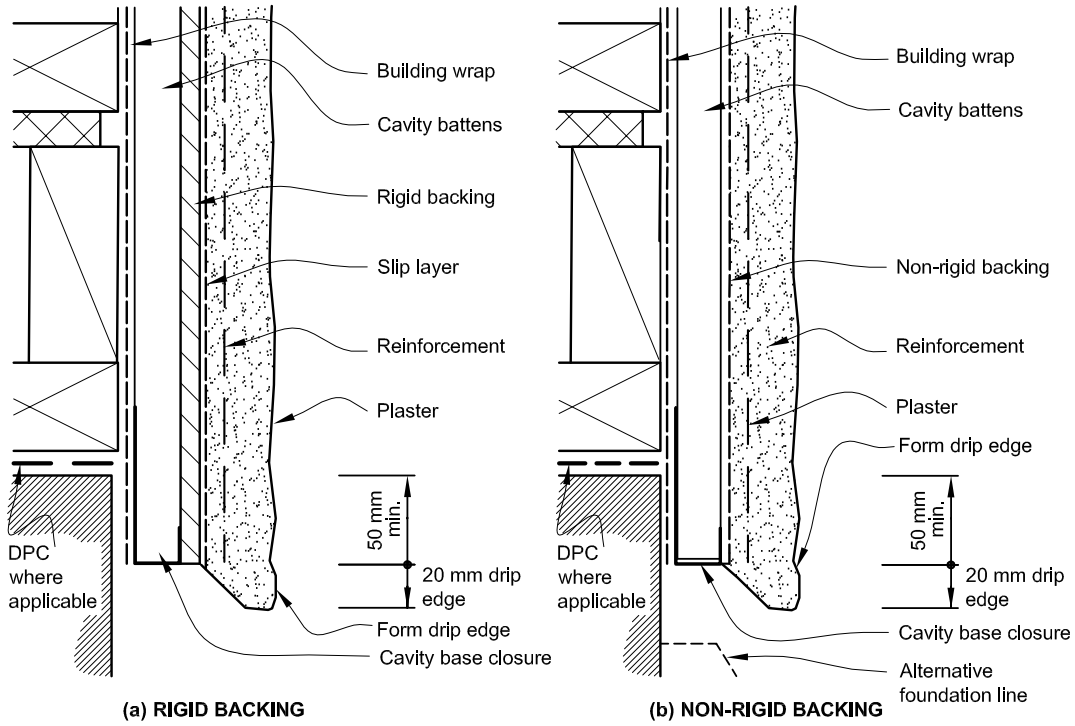
Figure 75: Bottom of stucco cladding
Paragraph 9.3.8

NOTE: 6 mm offset of *framing* to foundation is not necessary where *drained cavities* are used.



9.3.10 Decorative attachments

Where decorative attachments are used, the final weatherproofing system shall be applied prior to the attachments. Attachments shall not interfere with the functioning of critical joints such as *control joints*.

COMMENT:
Regular inspections and maintenance are necessary to identify and seal movement cracks. It is advisable to do such work on an annual basis.

9.3.11 Windows and doors

Windows and doors shall comply with Paragraph 9.1.10, as shown in Figure 76.

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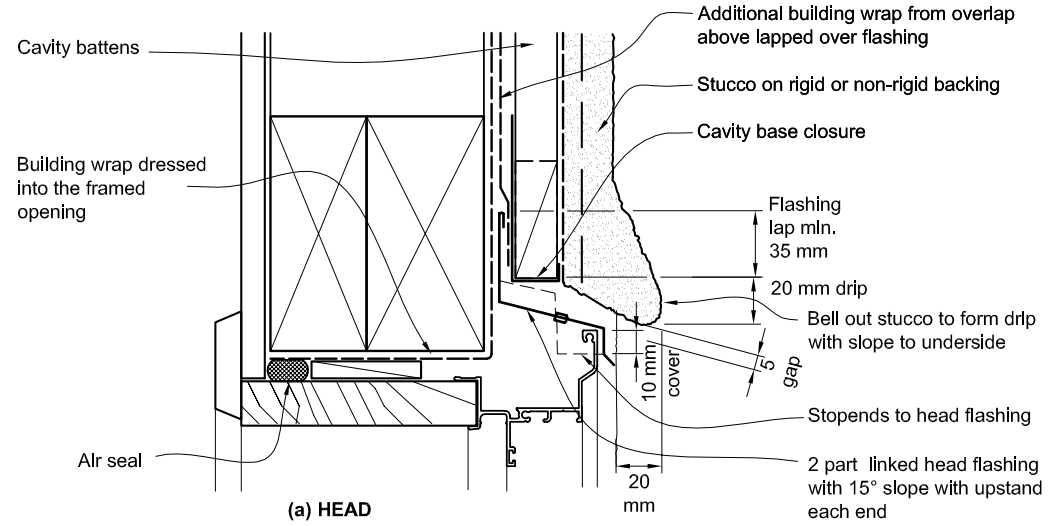
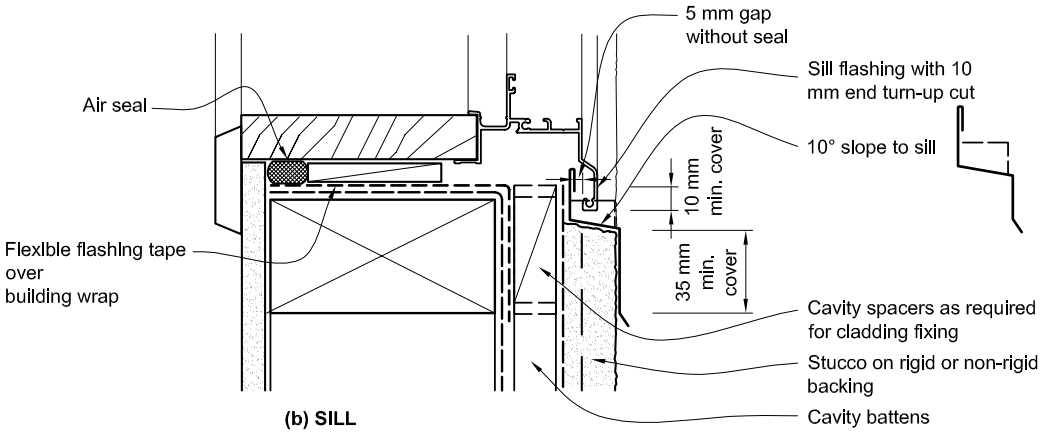
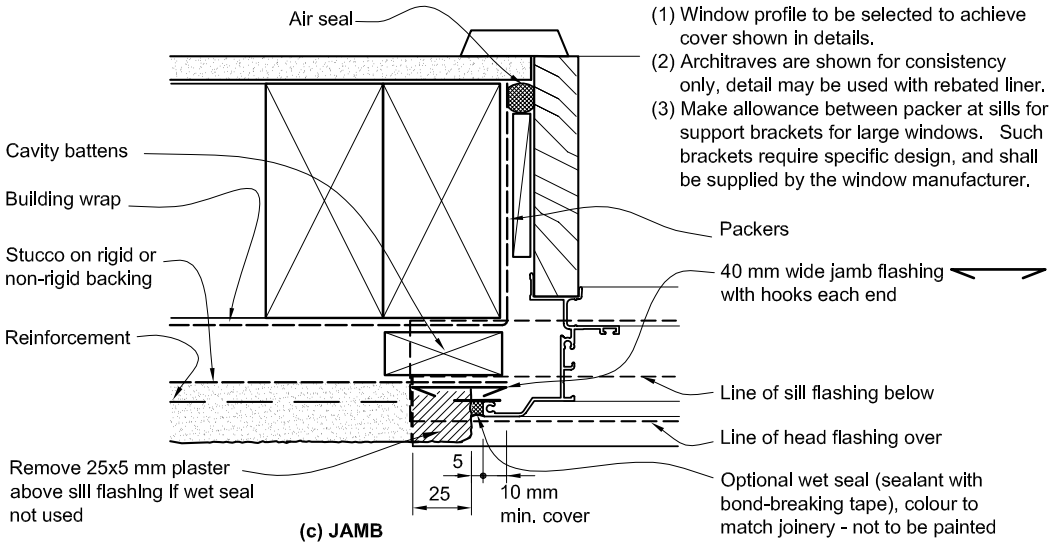
Figure 76: Windows in stucco cladding
Paragraph 9.3.11

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.







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9.4 Timber Weatherboards

Timber weatherboard *claddings* shall be either *direct fixed* to *framing* over a *building wrap* 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 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) *Building wrap* or rigid sheathing complying with Table 23, and

b) Timber selection and treatment of weatherboards in accordance with NZS 3602.

9.4.3 Installation

A *building wrap*, 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*.

9.4.3.1 Fixings

Fixings shall comply with Table 24.

In sea-spray zones (as described in Section 4 of NZS 3604), all fixings shall be of Type 316 stainless steel.

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 4.3.6, or

b) Scarf or splay joints.

9.4.4.3 Fixings

Boards shall be fixed through the *building wrap* to the *framing* in accordance with Table 24.

9.4.4.4 External corners

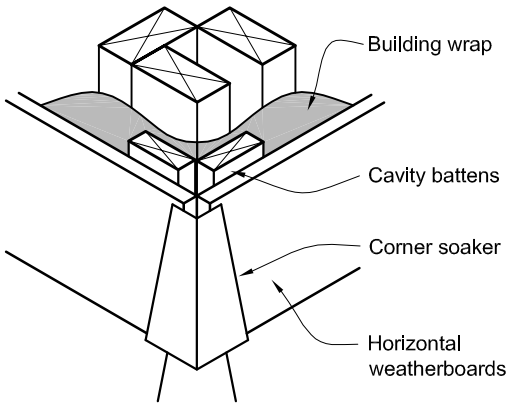
External corners shall be weatherproofed by one of the following methods:

a) For rusticated and bevel-back weatherboards, corner boxes with:
   i) scribers for bevel-back weatherboards, as shown in Figure 78, or
   ii) plugs or scribers 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) corrosion-resistant soakers complying with Paragraph 4.3.2 to Paragraph 4.3.6, and as shown in Figure 77.

COMMENT:
The external corner with soakers for *direct fixed* bevel-back weatherboards is similar to that shown for the *cavity wall* in Figure 77.

Figure 77: Corner soakers for bevel-back weatherboards
Paragraph 9.4.4.4 b)



NOTE: External corner detail with soaker is similar for direct fix weatherboards.

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 *direct fixed* weatherboards at all internal corners as shown in Figure 79.

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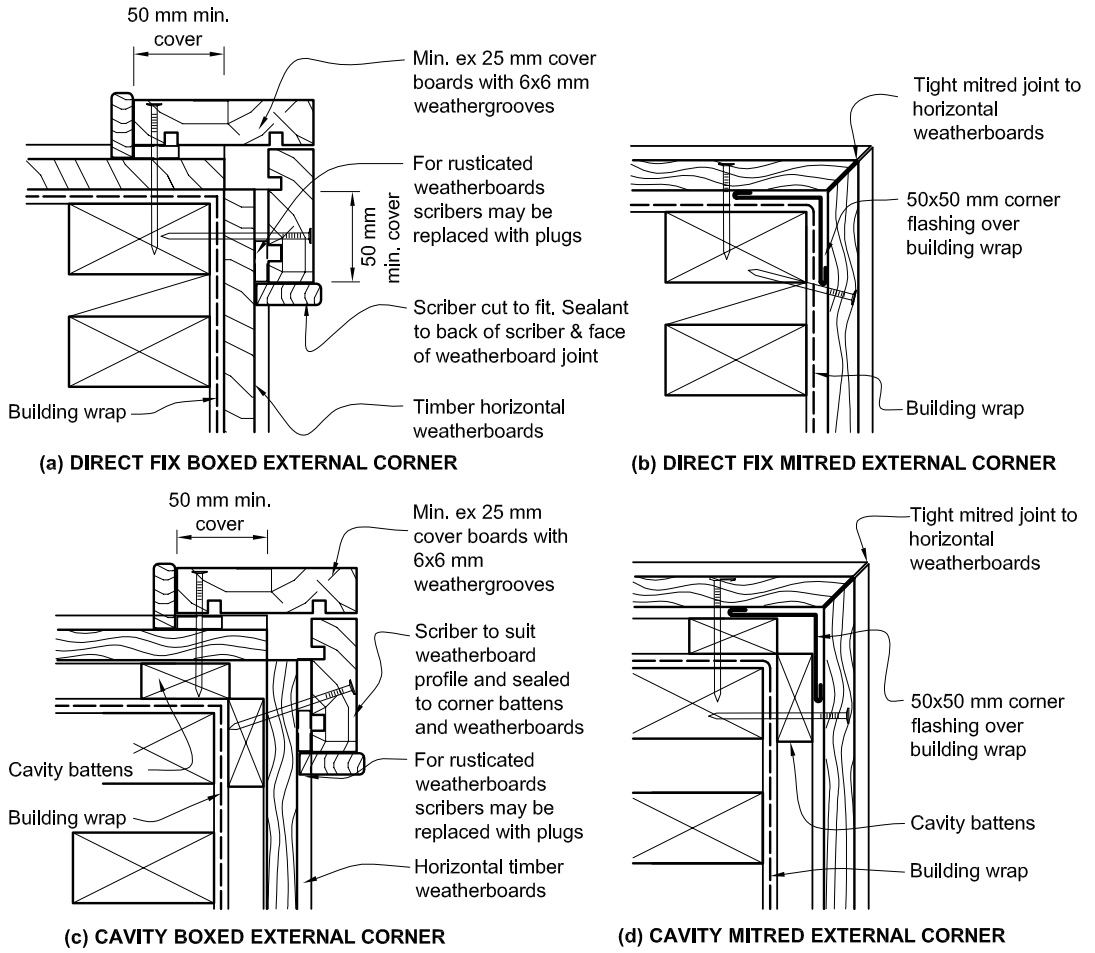
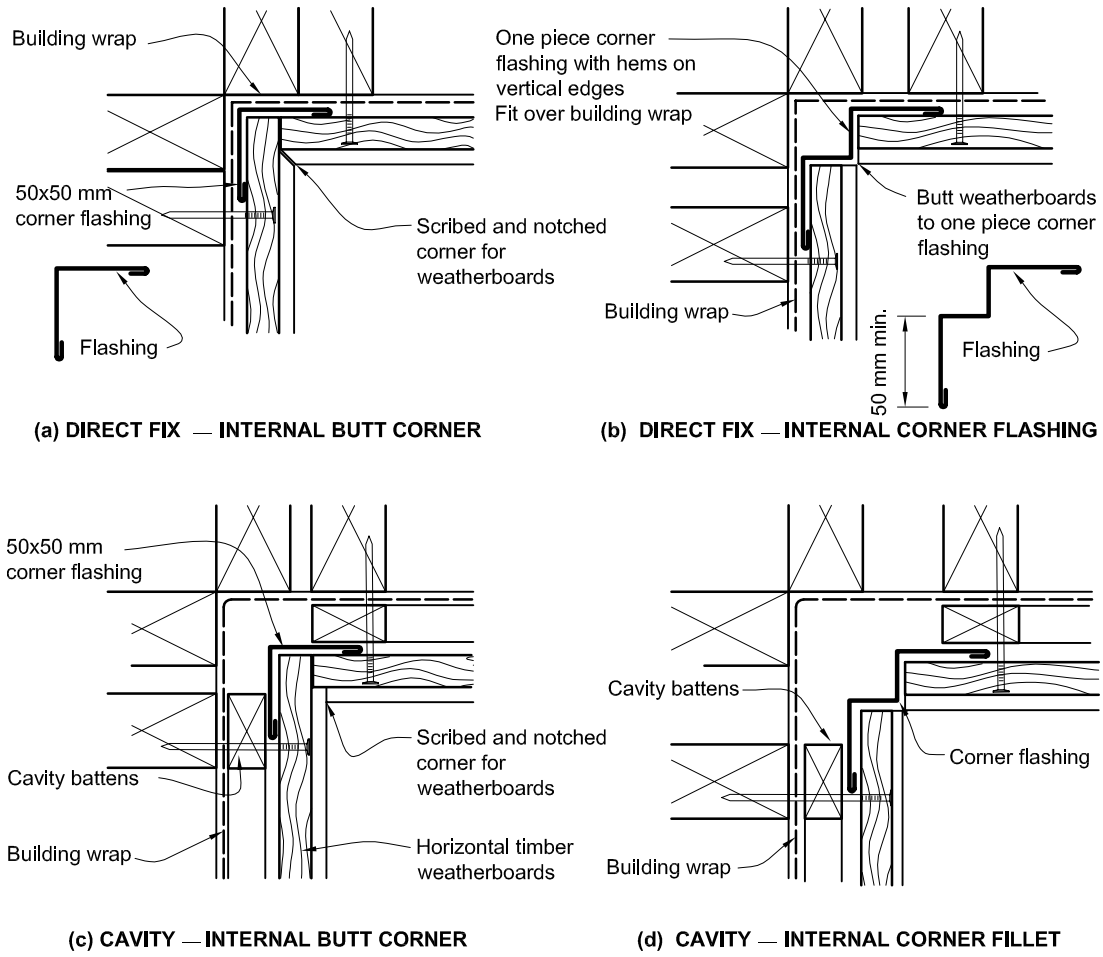
Figure 78: External corners for horizontal weatherboards
Paragraphs 9.4.4.4 a) and b)



NOTE: Corner battens shall be sized to provide 50 mm minimum cover over *cladding*.

Figure 79: Internal corners for horizontal weatherboards
Paragraph 9.4.4.5



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* 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 80.

b) Internal corners

A corrosion-resistant corner *flashing*, as per Table 7, shall be fitted behind the weatherboards at all internal corners.

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9.4.6 Windows in direct fixed weatherboards

Window details for:

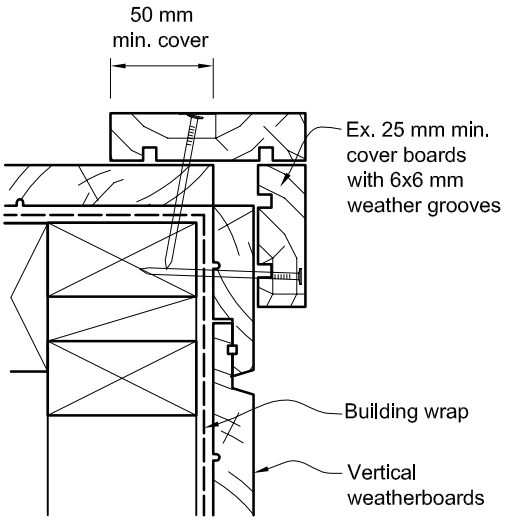
a) *Direct fixed* bevel-back weatherboards are shown in Figure 81,

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.

Figure 80: External corners for vertical weatherboards
Paragraph 9.4.5.3 a)



NOTE: Corner battens shall be sized to provide 50 mm minimum cover over *cladding*.

9.4.7 Windows in cavity walls

Window details for bevel-back weatherboards on a *drained cavity* shall be as shown in Figure 85.

Window details for rusticated weatherboards on a *drained cavity* are shown in Figure 86.

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.

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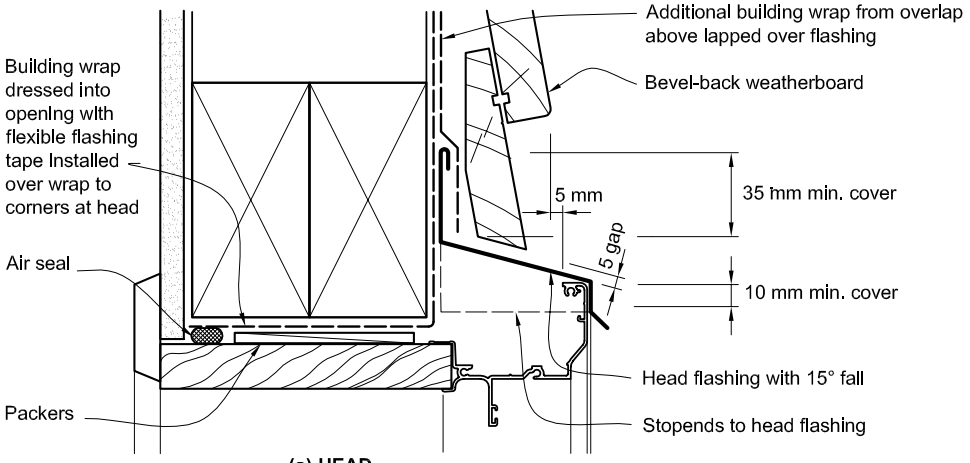
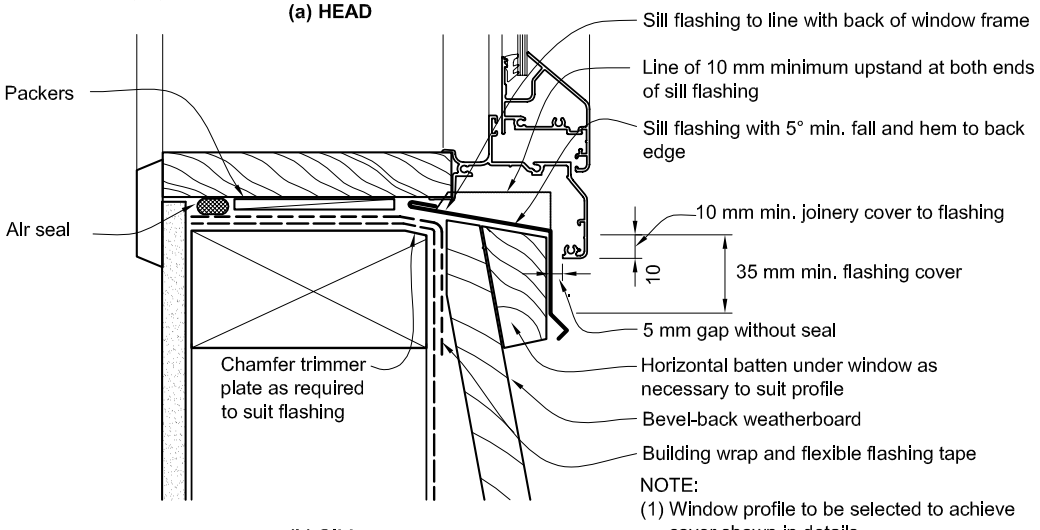
EXTERNAL MOISTURE

Figure 81: Windows for direct fixed bevel-back weatherboards
Paragraphs 9.1.6 and 9.4.6 a)

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

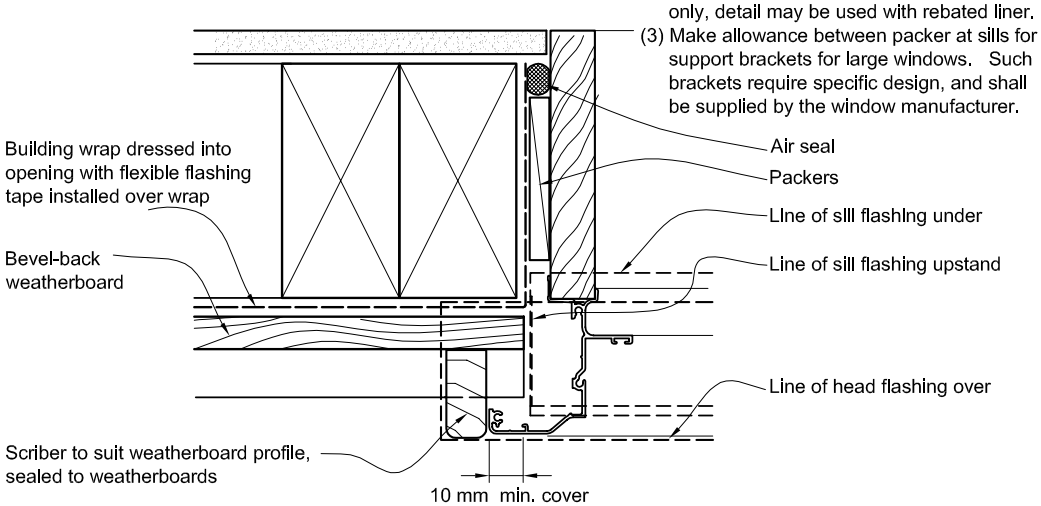


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

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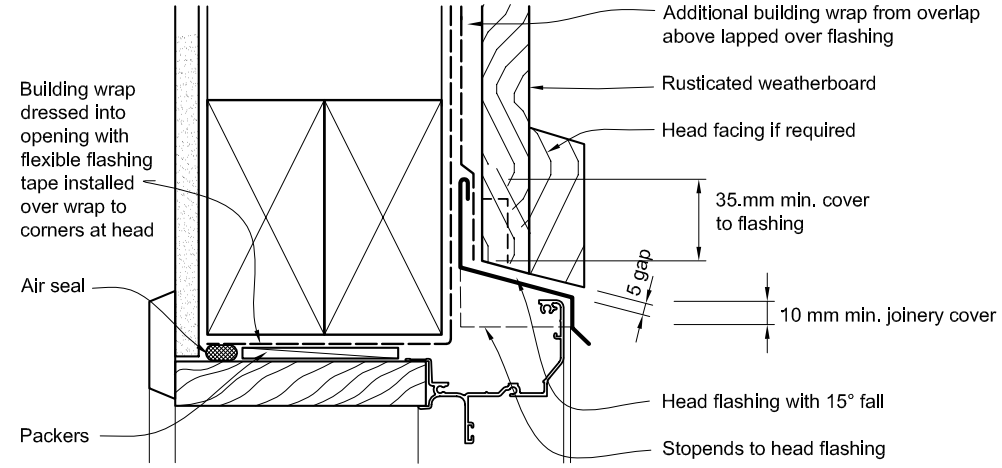
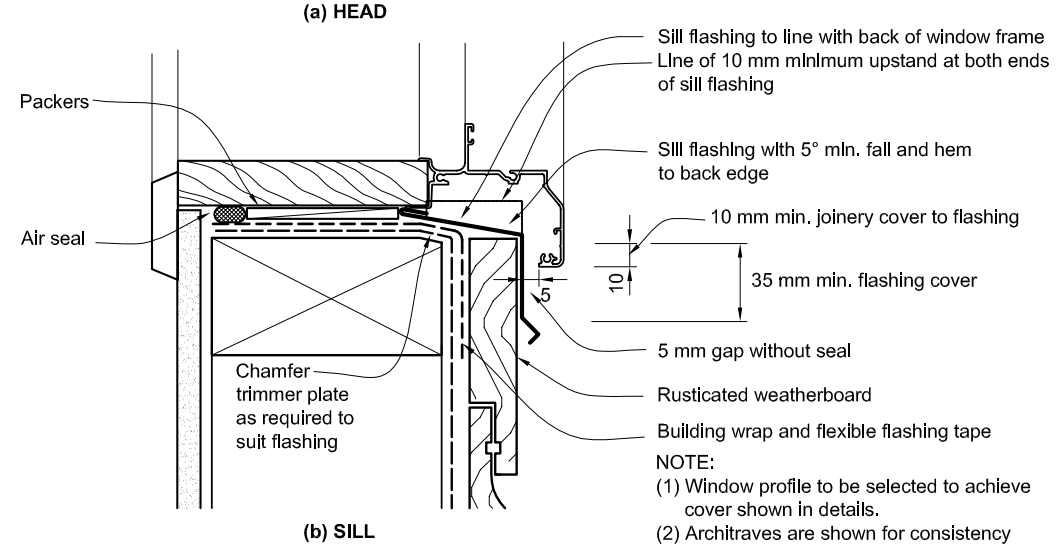
Figure 82: Windows for direct fixed rusticated weatherboards
Paragraph 9.4.6 b)

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

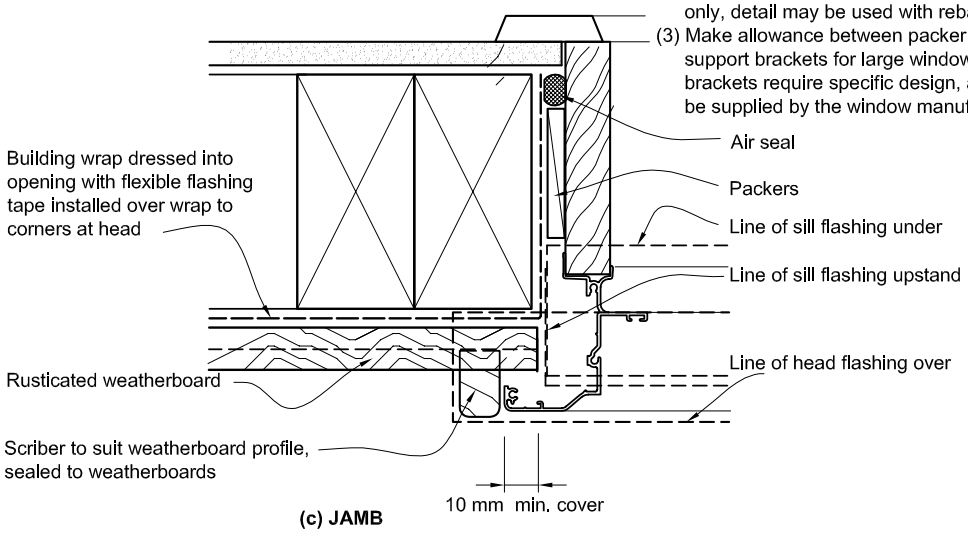


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

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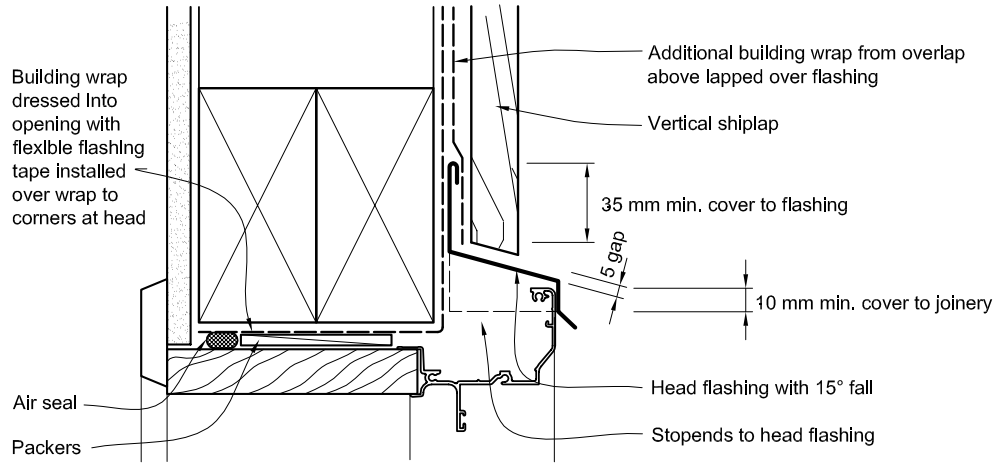
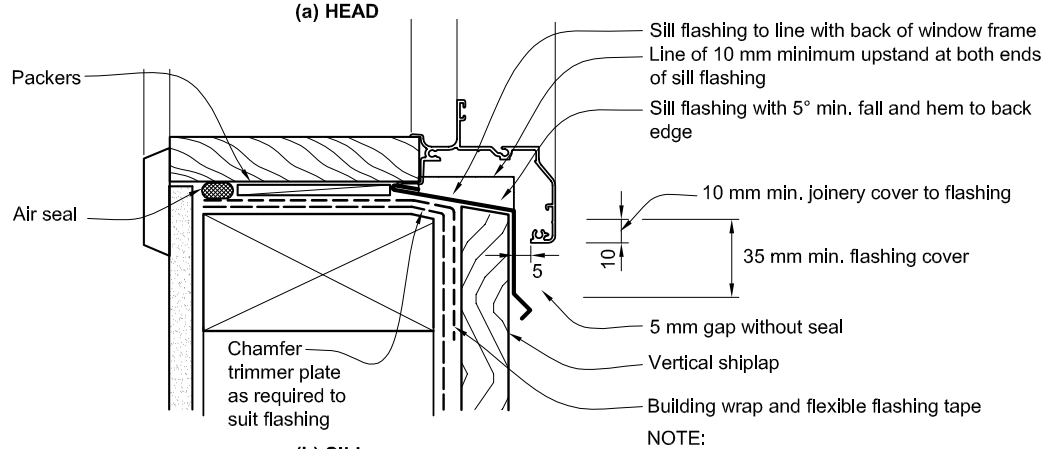
Figure 83: Windows for direct fixed vertical shiplap weatherboards
Paragraph 9.4.6 c)

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

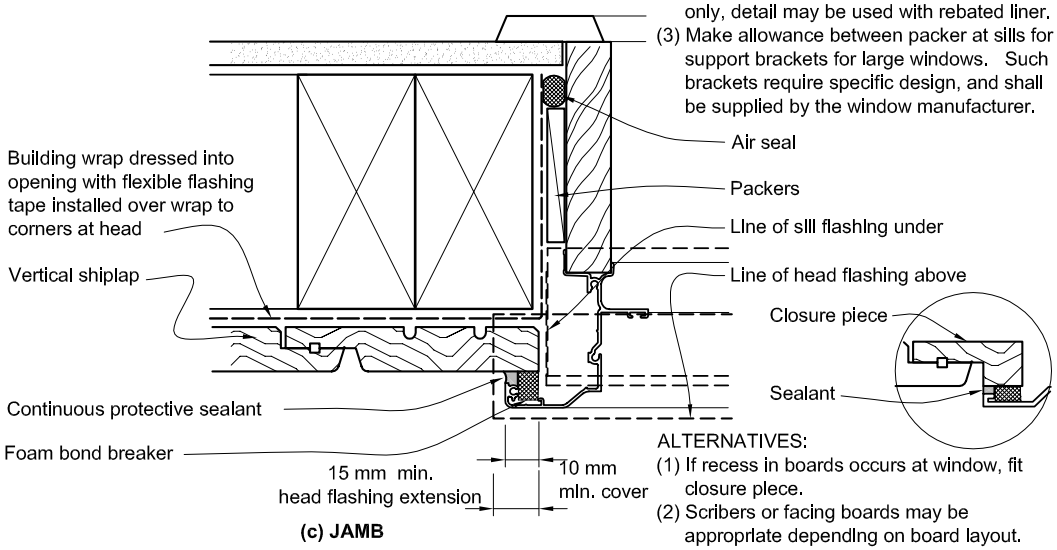


(a) HEAD



(b) SILL

NOTE:
(1) Window profile to be selected to achieve cover shown In detalls.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

ALTERNATIVES:
(1) If recess in boards occurs at window, fit closure piece.
(2) Scribers or facing boards may be appropriate depending on board layout.

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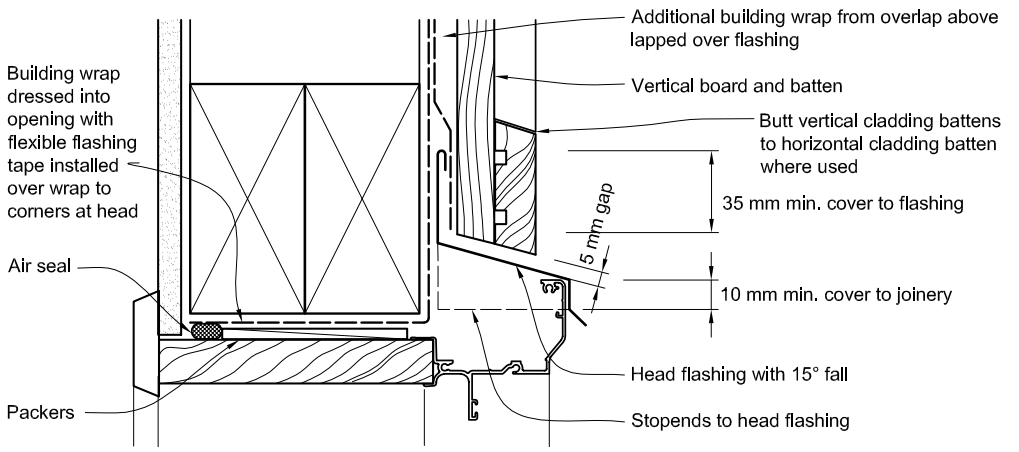
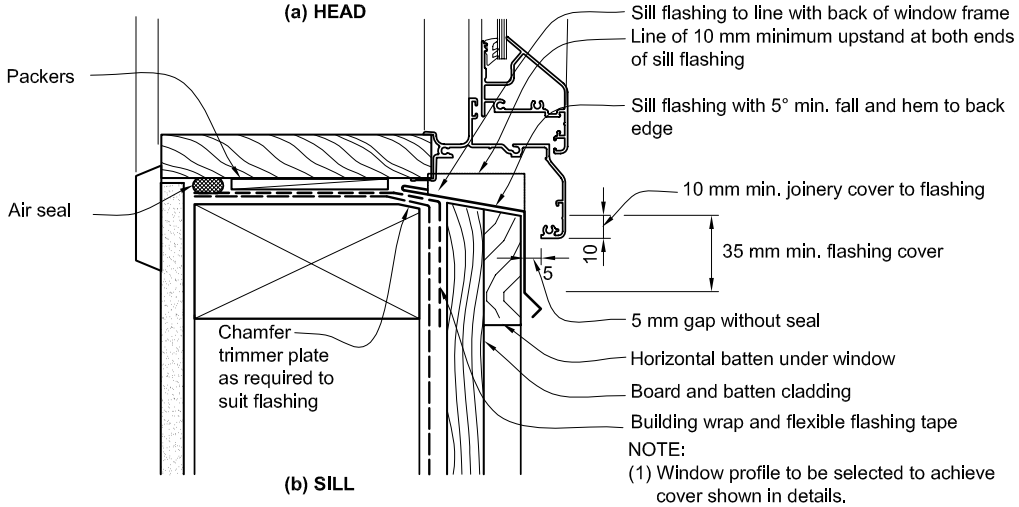
Figure 84: Windows for direct fixed board and batten weatherboards
Paragraph 9.4.6 d)

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

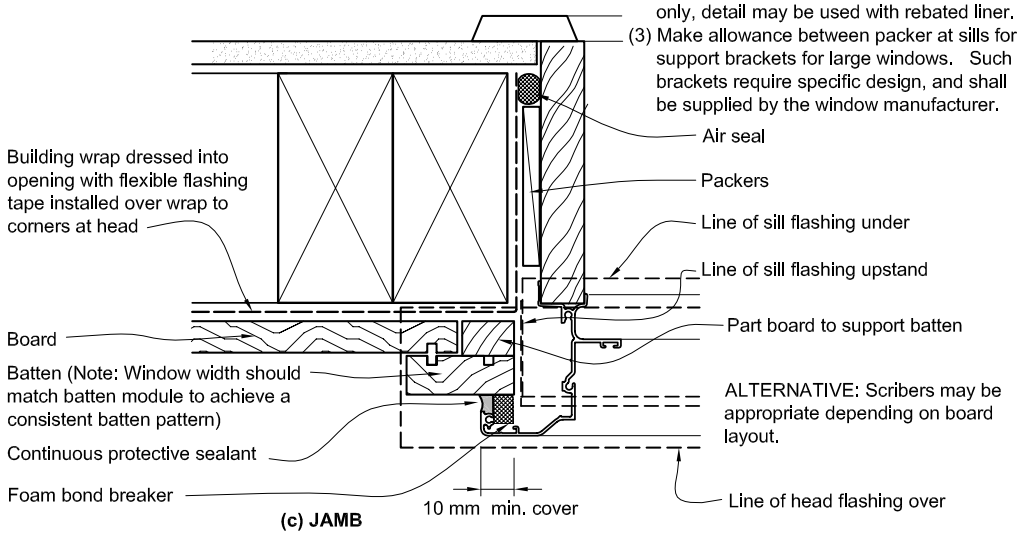


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

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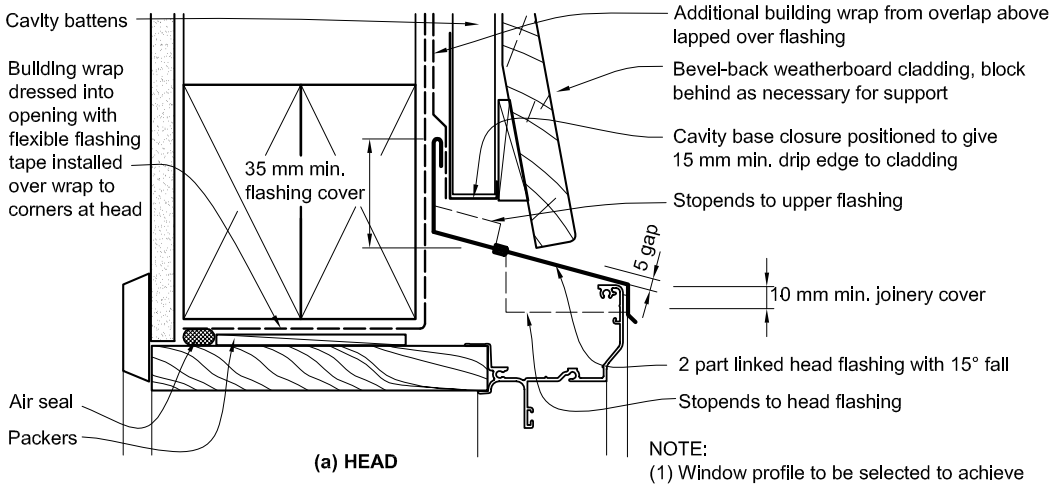
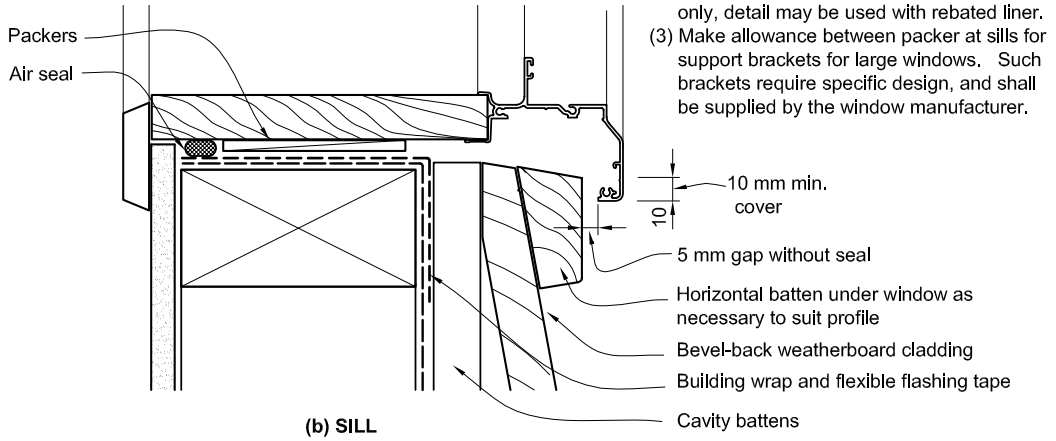
Figure 85: Windows for bevel-back weatherboards on cavity
Paragraph 9.4.7

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

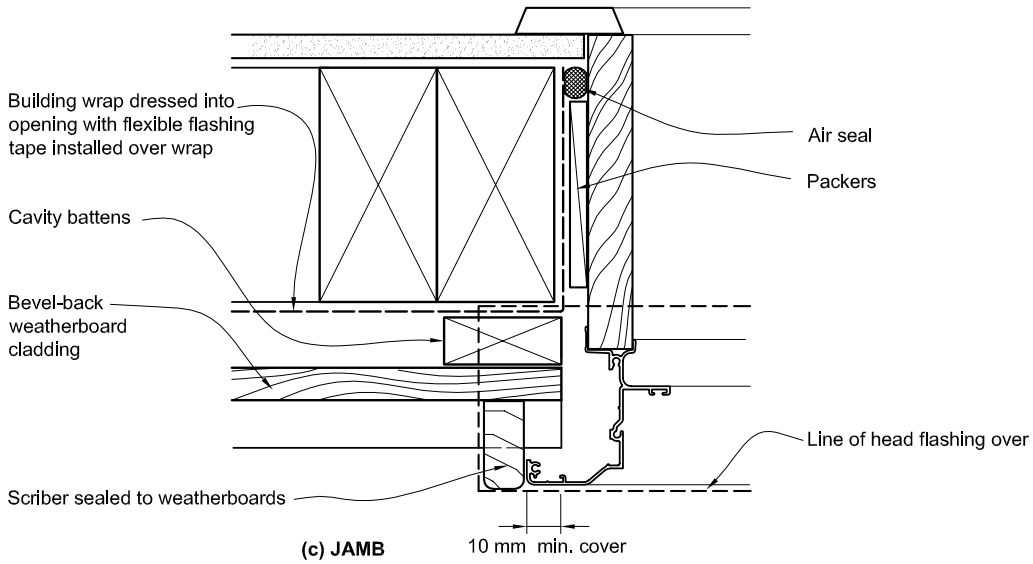


(a) HEAD

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(b) SILL



(c) JAMB

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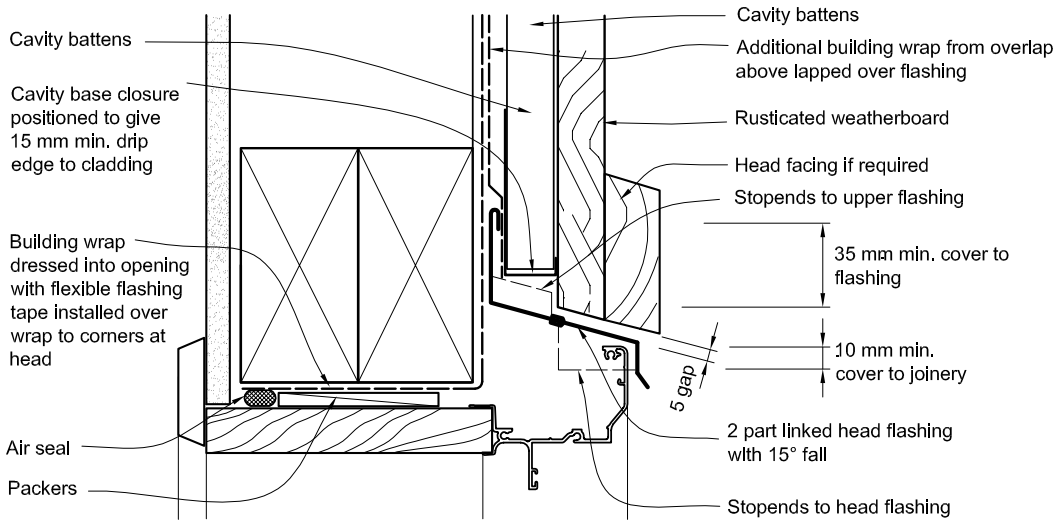
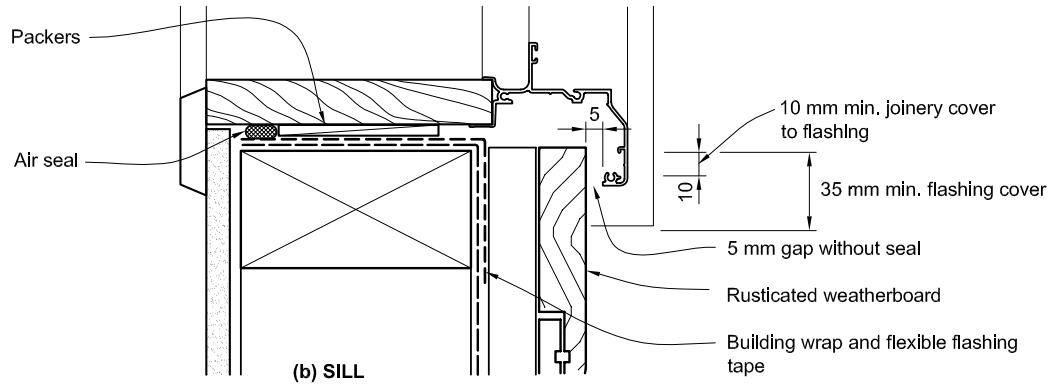
Figure 86: Windows for rusticated weatherboards on cavity
Paragraph 9.4.7

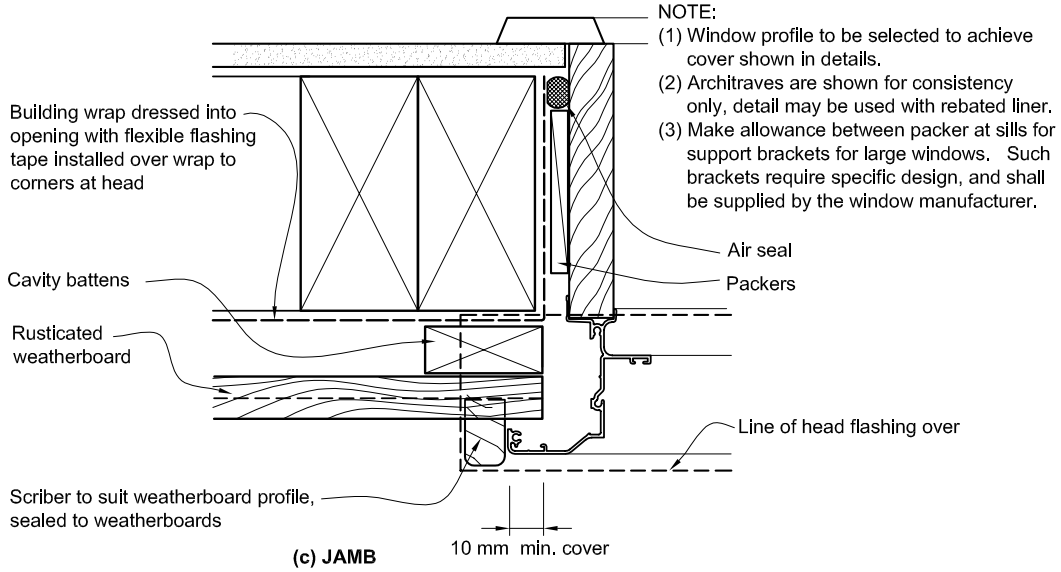
GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.



(a) HEAD



(b) SILL



(c) JAMB

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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 AS 3730.

COMMENT:

The minimum *durability* period for protective coatings is 5 years.

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.

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9.5 Fibre Cement Weatherboards

Fibre cement weatherboard *claddings* shall be either *direct fixed* to *framing* over a *building wrap,* 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 *building wrap*, as specified in Table 23, shall be installed behind fibre cement weatherboard *claddings*.

9.5.3.1 Fixings

Fibre cement weatherboards shall be fixed through the *building wrap* 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.

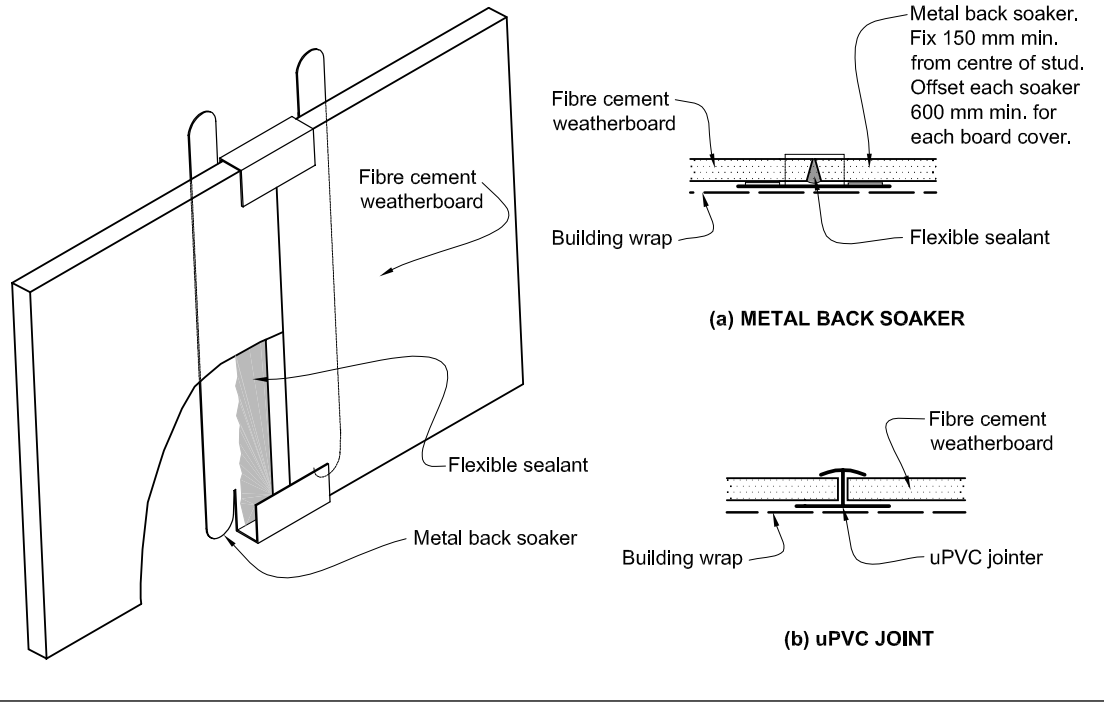
Joints shall be:

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: Fibre cement joints in weatherboards
Paragraph 9.5.3.2 c)



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9.5.3.3 External corners

External corners shall be weatherproofed as shown in Figure 88 and Figure 89 by:

a) The use of corrosion-resistant soakers complying with Paragraph 4.2.2 to Paragraph 4.3.6, or

b) Facings with weathergrooves, or

c) Preformed aluminium or uPVC corner *flashings*.

9.5.3.4 Internal corners

Internal corners shall be weatherproofed by metal or uPVC 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 – direct fixed

For *direct fixed* fibre cement weatherboards, windows shall be detailed as shown in Figure 90.

9.5.4.2 Windows – on cavity

For fibre cement weatherboards fixed over a *drained cavity*, windows shall be detailed as shown in Figure 91.

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 two coats of latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

Figure 88: External corners in fibre cement weatherboards
Paragraph 9.5.3.3

NOTE: Corner details for cavity walls are similar.

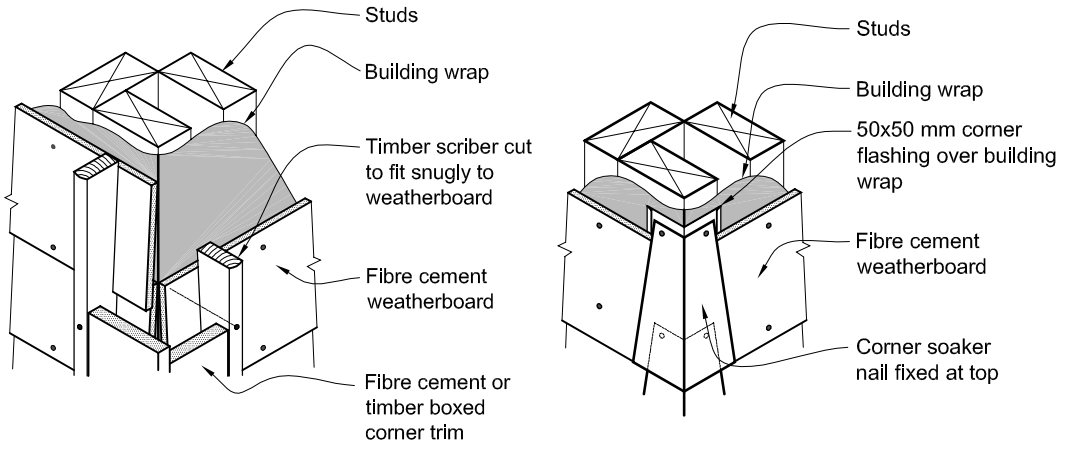

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Figure 89: **uPVC or aluminium corners in fibre cement weatherboards**
Paragraphs 9.5.3.3 and 9.5.3.4

NOTE: Corner details for cavity walls are similar.

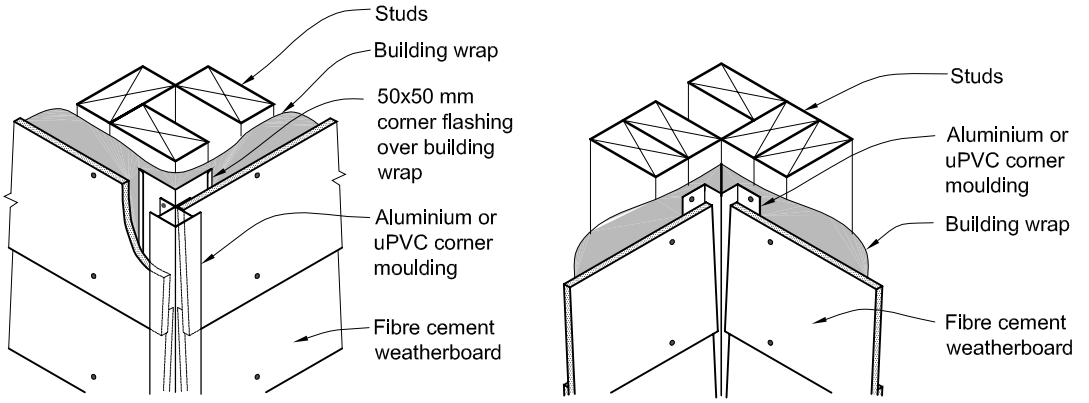

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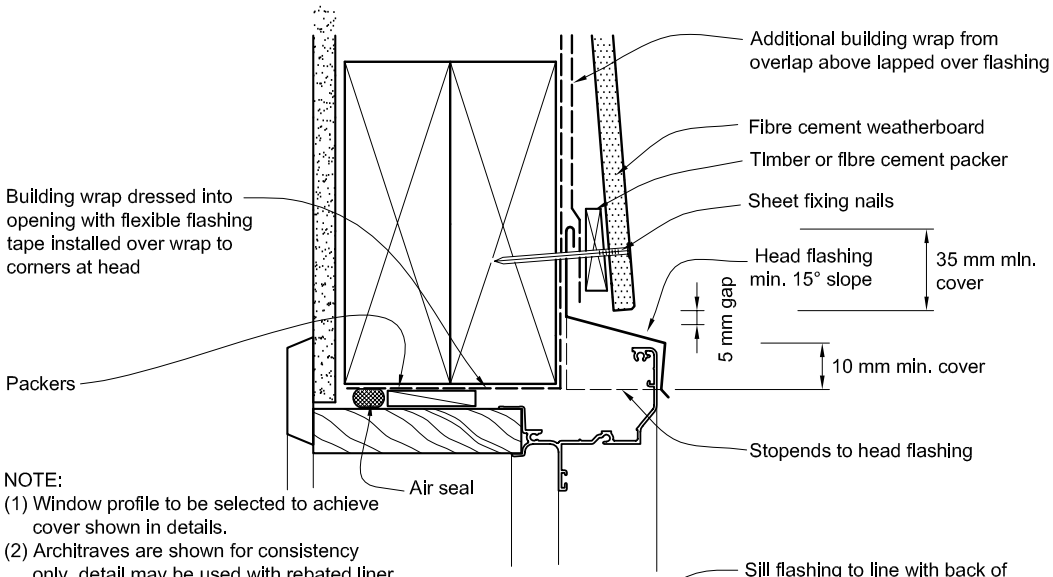
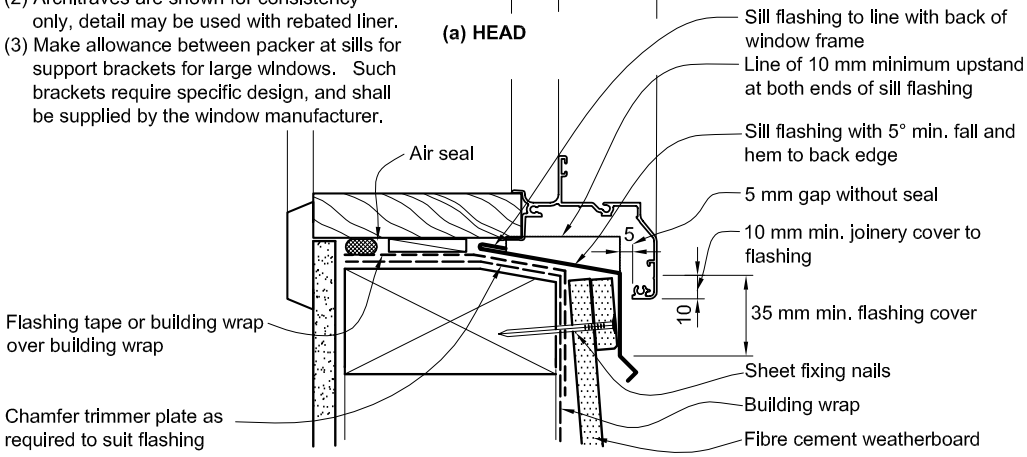
Figure 90: Windows in fibre cement direct fixed weatherboards
Paragraph 9.5.4.1

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

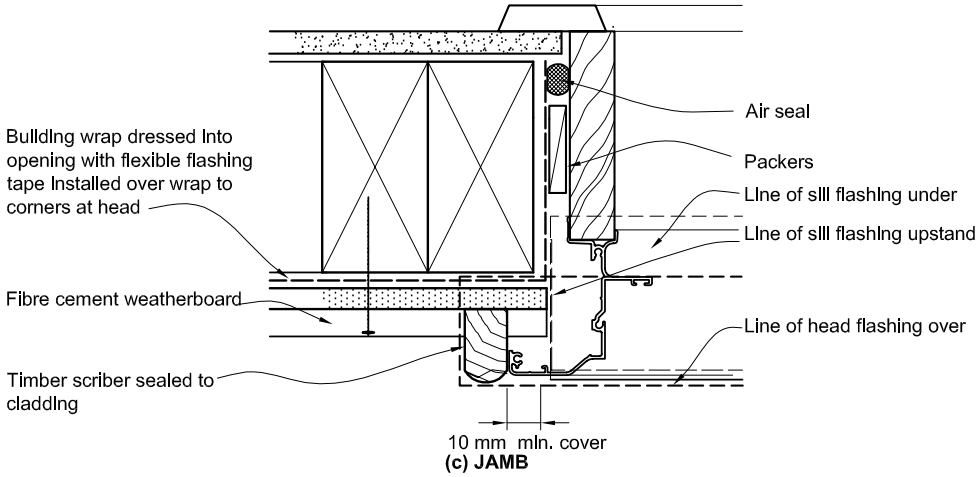


NOTE:
(1) Window profile to be selected to achieve cover shown in details.
(2) Architraves are shown for consistency only, detail may be used with rebated liner.
(3) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.

(a) HEAD



(b) SILL



(c) JAMB

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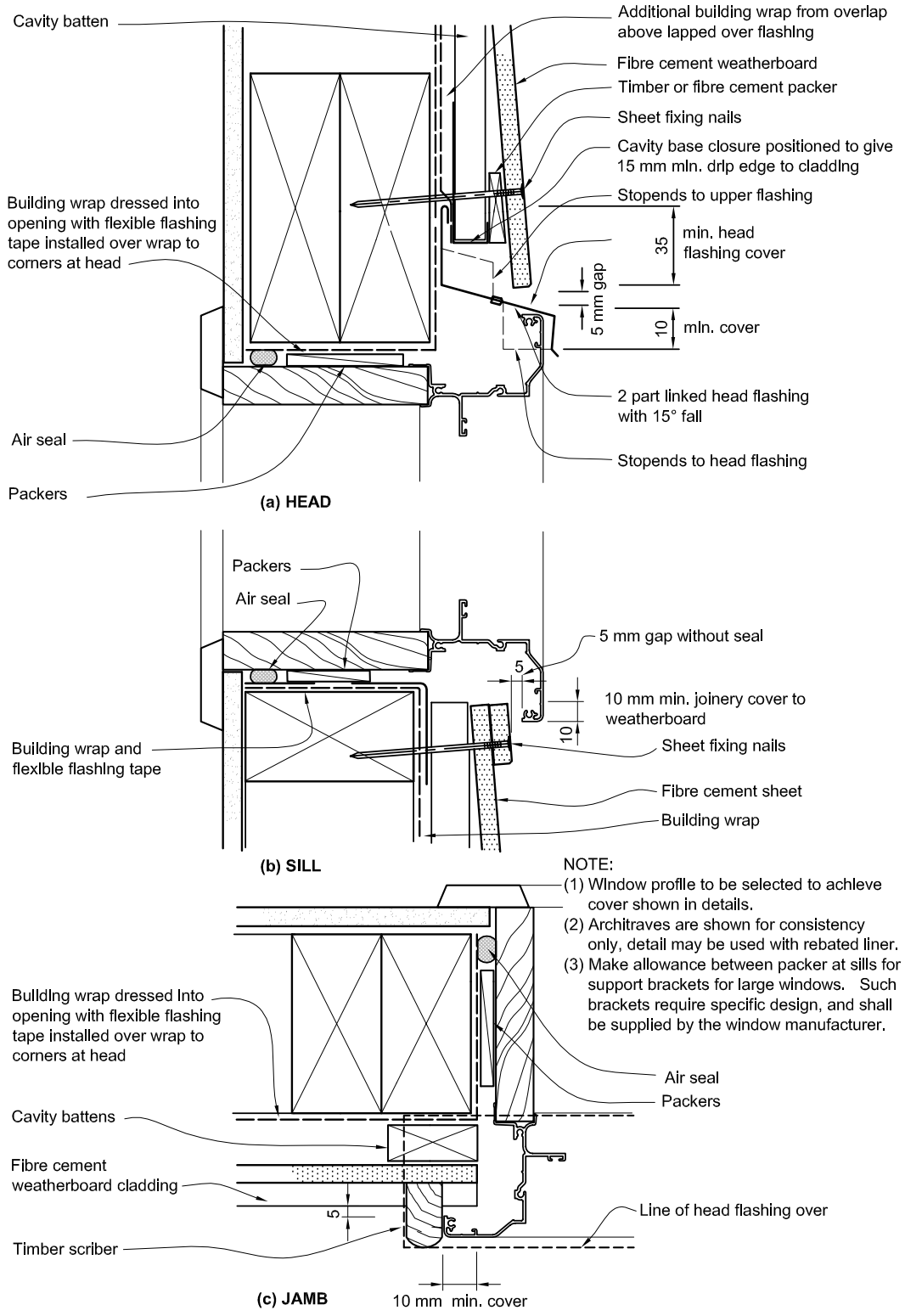
Figure 91: Windows in fibre cement weatherboards on cavity
Paragraph 9.5.4.2

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.



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9.6 Profiled Metal

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, running:

a) Horizontally, and fixed over a *drained cavity*, or

b) Vertically, and *direct fixed* to *framing*.

9.6.2 General

Installation of profiled metal wall *cladding* shall be by trained installers, approved by the manufacturer or the NZ agent (in the case of imported *cladding*).

COMMENT:
It is recommended that an installer has successfully completed, or demonstrated skill to the level of, an NZQA recognised course. The Roofing Industry Training Organisation offers such a qualification.

9.6.3 Materials

9.6.3.1 Choice of metal

The metal *cladding* shall be selected according to the exposure conditions as defined in:

a) NZS 3604 Clause 4.2, and

b) AS/NZS 2728.

The metal *cladding*, *flashings* and fixings shall be selected from Table 20 according to the *durability* required for the specific application.

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

AS/NZS 2728 lists atmospheric classes derived from ISO 9223 for Australia and New Zealand.

Exposure zones are defined in Clause 4.2 of NZS 3604, based on the likely exposure to wind-driven sea-salt or geothermal gases.

9.6.3.2 Steel

Materials for the manufacture of profiled steel *cladding* shall:

a) Have a *base metal thickness (BMT)* of 0.55 mm minimum,

b) Be grade G550 with an applied protective metallic coating,

c) Have a minimum protective metal coating of:
   i) aluminium-zinc AZ150 to AS 1397, or
   ii) zinc Z450 to AS 1397, or
   iii) zinc ZM275 for pre-painted roofing, and

d) Where required for additional *durability*, a factory-applied finish complying with the *durability* requirements of AS/NZS 2728, Table 2.4.

COMMENT:
While galvanized steel wall *cladding* may be left unpainted in some environments, this may shorten its life, especially in areas where it is not washed naturally by the rain.

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 grade G5000 series, and

c) Hardness H34.

For pre-painted aluminium, a factory-applied finish complying with AS/NZS 2728 shall be applied.

9.6.4 Maintenance

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*.

Maintenance of profiled metal wall *cladding* shall be carried out as necessary to achieve the expected *durability* of the material – refer Paragraph 2.5. The extent and nature of the necessary maintenance is dependent on the:

a) Type of *cladding* used,

b) Position of the *cladding* on the *building*,

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c) Geographical location of the *building*, and

d) Specific site conditions.

COMMENT:

Washing by rain removes most accumulated atmospheric contaminants, but sheltered areas are protected from the direct effects of rain and require more regular manual washing.

However, high pressure water should not be used, due to the risk of driving water past *flashings*.

9.6.5 Profiles

Profiles covered in this Acceptable Solution are:

a) Corrugated – curved with a minimum crest height of 17.7 ±1 mm, and

b) *Trapezoidal – trapezoidal*, symmetrical or asymmetrical, with a minimum crest height of 19 mm.

For details of these profiles, refer to Figure 38.

9.6.6 Fixings

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 25 mm,

c) Be hot-dipped galvanized, complying with AS 3566: Part 2, at least Class 3,

d) Be selected from Table 20 to minimise corrosion,

e) Include neoprene (having a carbon black content of 15% or less) or *EPDM* sealing washers as shown in Figure 39, and

f) Be used on the *cladding* at side laps and every second trough:
   i) to *framing*, and
   ii) at all external and internal corners.

9.6.7 Flashings

Flashings used with metal wall *cladding* shall be in accordance with Paragraph 4.0, and with the following requirements:

a) Where shown in details, *flashings* shall have *hooks* or *hems* as shown in Figure 5,

b) Have joins formed with 150 mm laps and sealed 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) Over-*flashings* shall be fixed to *framing* at 500 mm maximum centres, using the same screws as specified for the metal *cladding* fixings,

e) Under-*flashings* shall be fixed to *framing* with 40 mm x 2.5 mm flat-head hot-dipped galvanized clouts at 200 mm centres, and

f) *Flashings* shall be fixed together at junctions or to *cladding* at 50 mm maximum 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.

9.6.8 Vertical profile – direct fixed

9.6.8.1 Installation

For *direct fixed* vertical profile, the *building wrap* shall be in accordance with the properties listed for *roof underlay* in Table 23.

COMMENT:

In *direct fixed* metal *cladding*, the wrap will be in contact with the back of the vertical profiled metal *cladding*.

In the same way as for roof situations, underlay is needed to separate treated timber from the back of the metal to minimise the risk of *electrolytic corrosion*.

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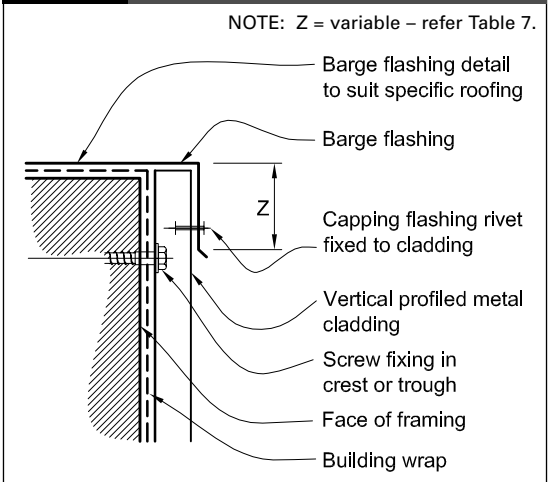
9.6.8.2 Barges

Barge *flashings* shall be as shown in Figure 92.

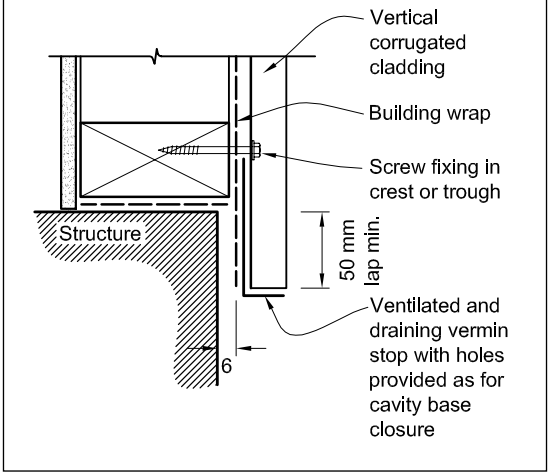
Figure 92: Barge for vertical profiled metal
Paragraph 9.6.8.2



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.

Figure 93: Bottom of cladding for vertical profiled metal
Paragraph 9.6.8.3



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, and

c) Terminate 5 mm from the wall *cladding* in the following trough.

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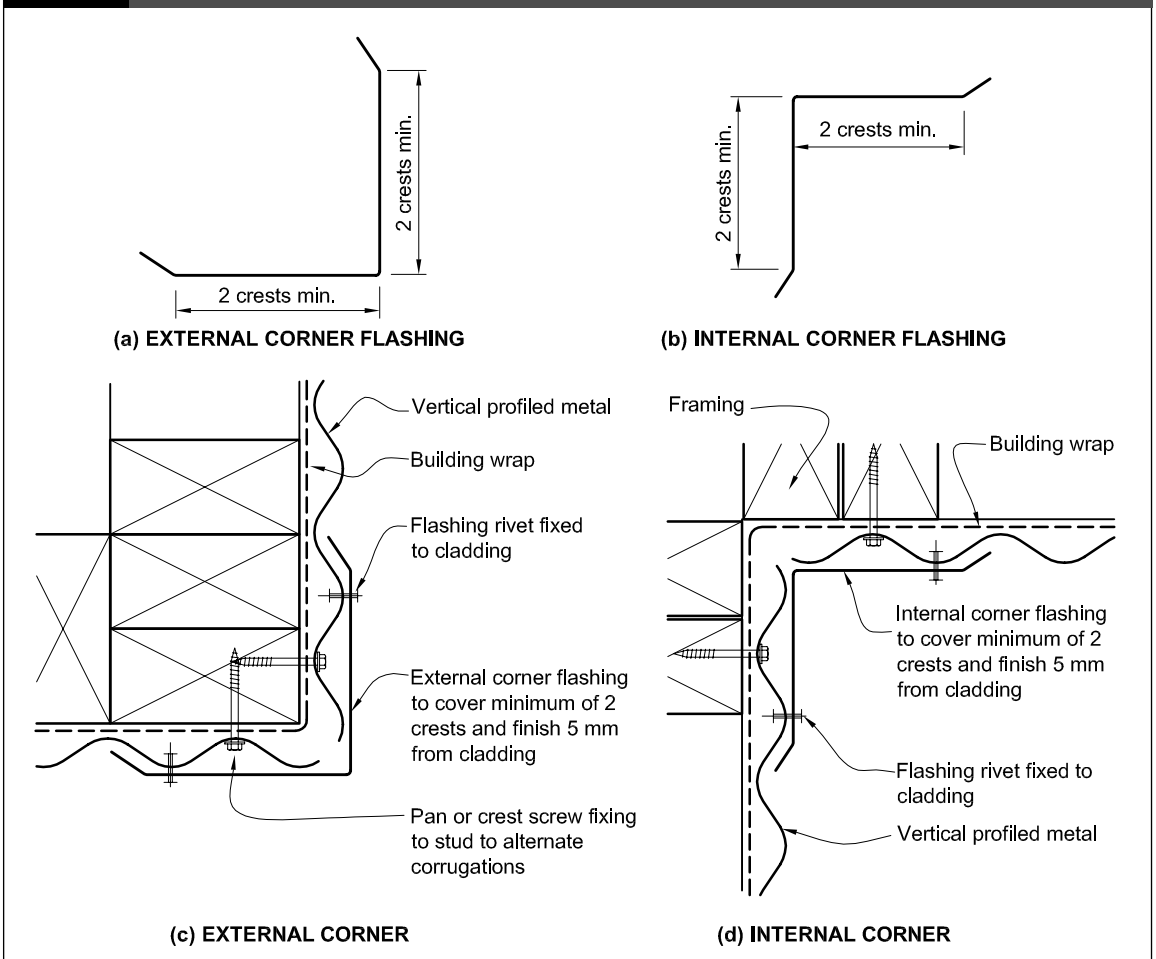
Acceptable Solutions E2/AS1

Figure 94: Corners for vertical profiled metal
Paragraph 9.6.8.4



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 details in relevant paragraphs.

9.6.8.6 Vertical profile: windows

Windows in vertical profiled metal *claddings* shall be flashed as shown in Figure 95 and Figure 100.

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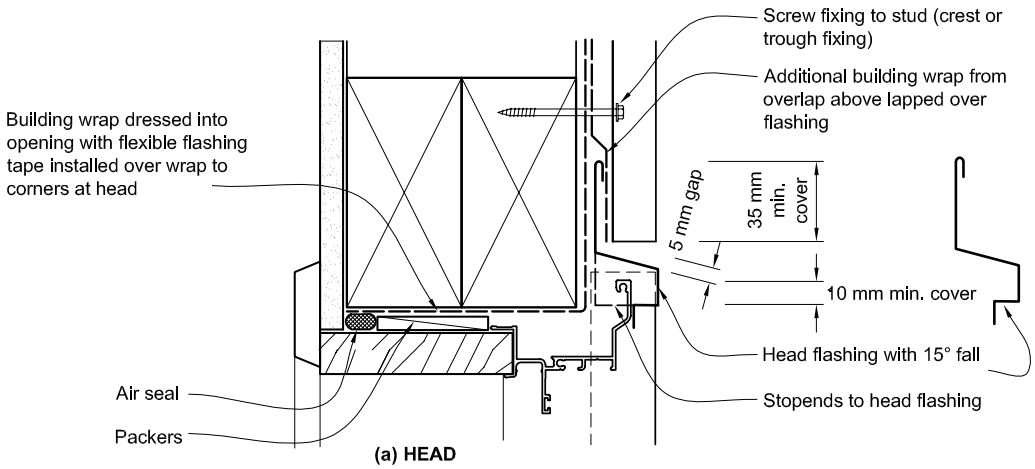
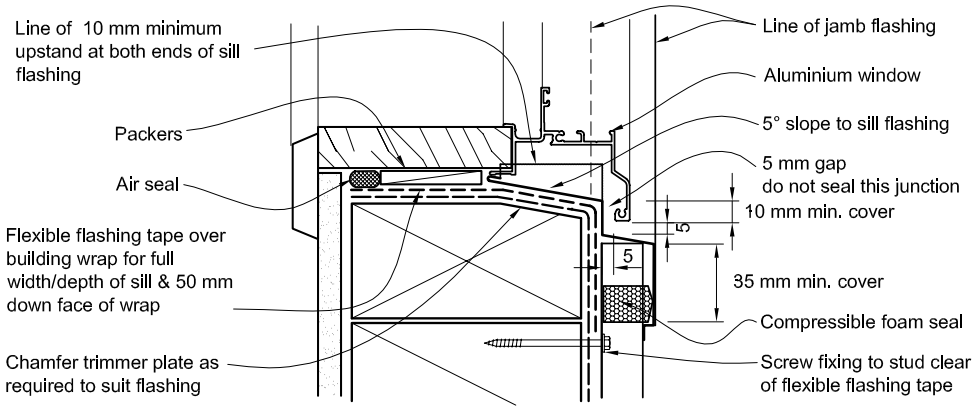
Figure 95: Windows for vertical profiled metal
Paragraph 9.6.8.6, Figure 100

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Refer Figure 100 for sketch of *flashings*.
(c) Sliding and bi-fold windows will require specific design.
(d) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

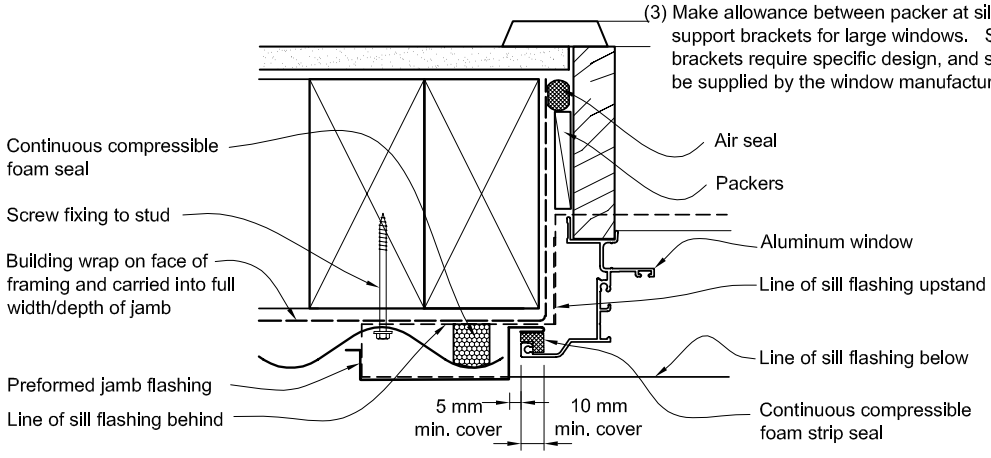


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

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9.6.9 Horizontal profiled metal on cavity

9.6.9.1 Installation

A *building wrap*, as specified in Table 23, 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 *DPC* or paper-based *building wrap* complying with Table 23 on the face of *cavity battens*,

c) uPVC strips on the face of the *cavity battens*, or

d) Pre-priming *cavity battens*.

9.6.9.3 Corners

Corners shall be weatherproofed by using the *flashings* and details shown in Figure 96.

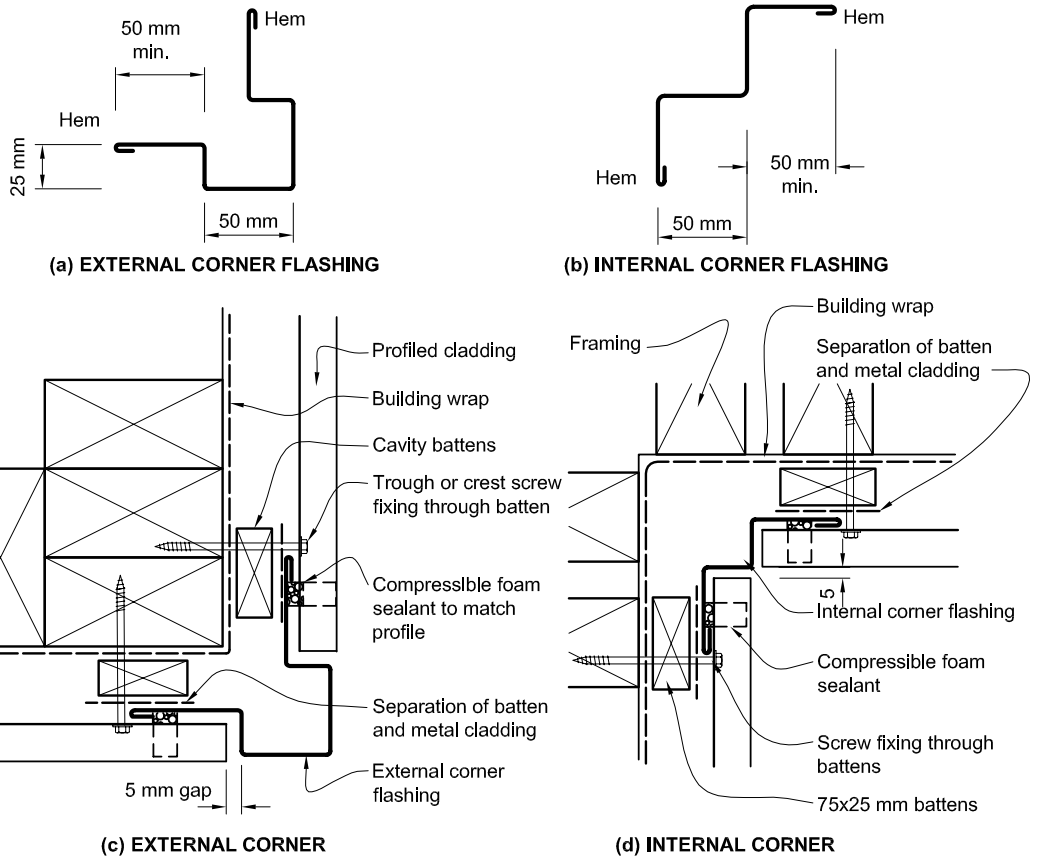
Horizontal profiled metal wall *cladding* shall be under-flashed using *butt flashings* which shall:

a) Be formed in one shaped piece as shown in Figure 96,

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
Paragraphs 9.6.9.3 and 9.6.9.3 a)



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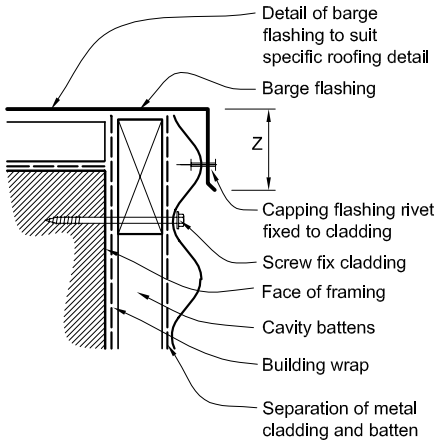
9.6.9.4 Barges

Barge *flashings* shall be as shown in Figure 97.

Figure 97: Barge for horizontal profiled metal
Paragraph 9.6.9.4

NOTE: Z = variable – refer Table 7.

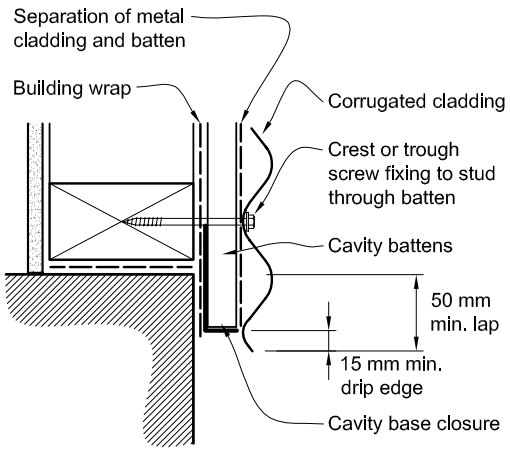


9.6.9.5 Bottom of cladding

The bottom edge of the *cladding* shall overlap the foundation wall as described in Paragraph 9.1.3 and as shown in Figure 98.

Figure 98: Bottom of cladding
Paragraph 9.6.9.5

GENERAL: 6 mm offset of *framing* to foundation is not necessary where *drained cavities* are used.



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, with head *flashings* adjusted to suit profile and other *flashings* as per window details in relevant paragraphs.

9.6.9.7 Horizontal profile: windows

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

Parapets shall be in accordance with Paragraph 6.0.

Enclosed balustrades shall comply with Paragraph 7.4, and be as shown in Figure 101 and Figure 102.

COMMENT:
Side fixings of *handrails* or other attachments to *enclosed balustrades* or *parapets* will require *specific weathertightness design* to demonstrate *weathertightness*, together with specific structural design for *stanchion* fixings.

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Figure 99: Windows for horizontal profile
Paragraph 9.6.9.7, Figure 100

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Refer Figure 100 for sketch of *flashings*.
(c) Sliding and bi-fold windows will require specific design.
(d) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

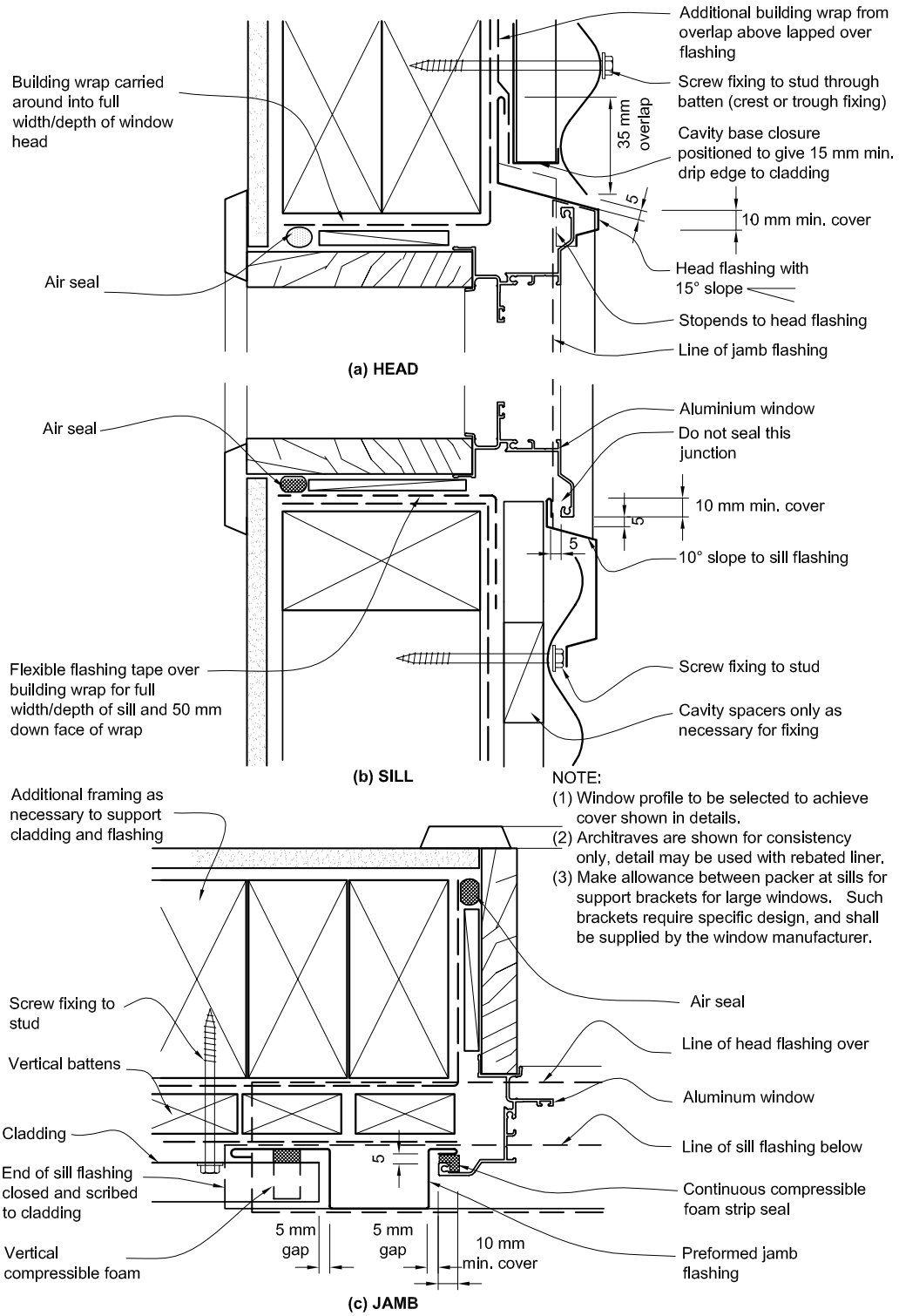

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Figure 100: Window flashings for profiled metal
Paragraphs 9.6.8.6 and 9.6.9.7, Figures 95 and 99

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) *Building wrap* omitted for clarity.

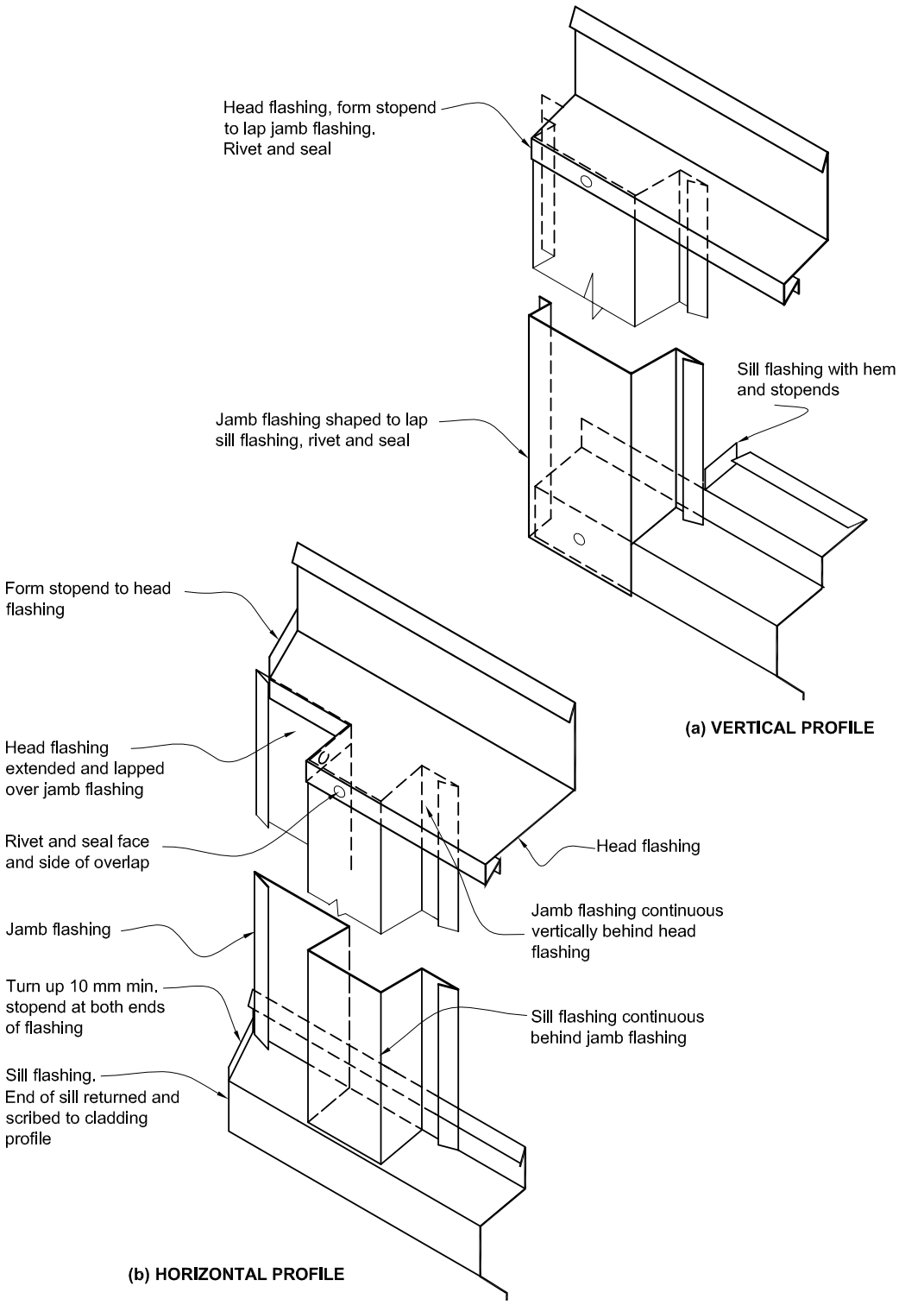

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Figure 101: **Balustrade for vertical profiled metal**
Paragraph 9.6.9.8

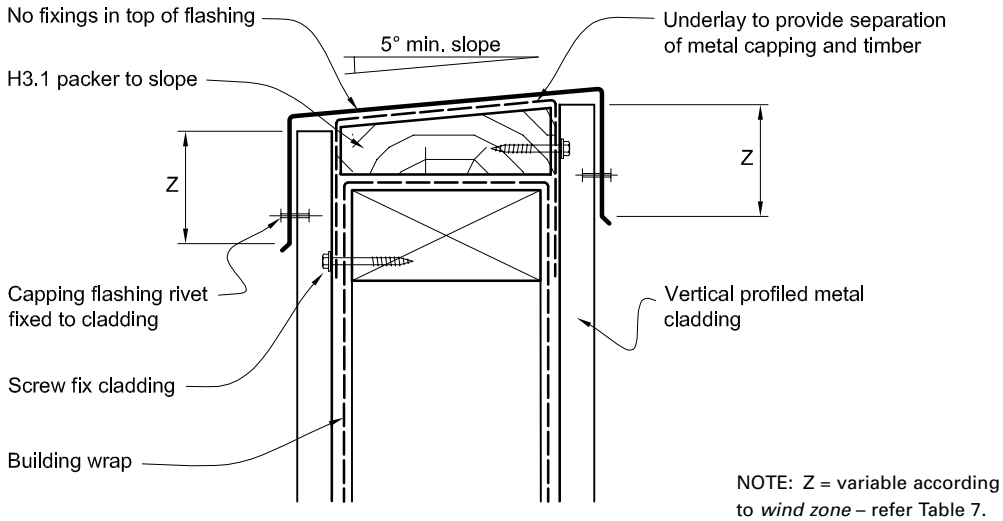
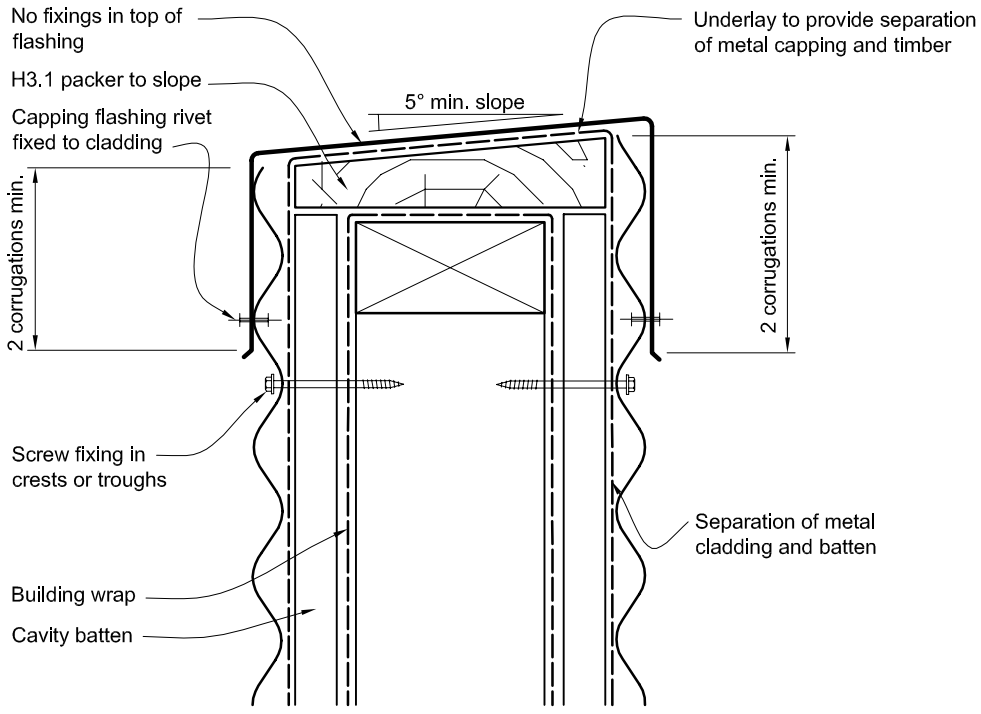


Figure 102: **Balustrade for horizontal profiled metal**
Paragraph 9.6.9.8



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9.7 Fibre Cement Sheet

Fibre cement sheet *claddings* shall be either *direct fixed* to *framing* over a *building wrap* 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 sheet *cladding* may require the inclusion of a *drained cavity*.

9.7.1 Limitations

This Acceptable Solution is limited to the following types of fibre cement sheet *cladding systems*:

a) *Flush-finished* joint systems using sheets of 7.5 mm minimum thickness, or

b) Other joint systems using sheets of 6 mm minimum thickness with:
   i) purpose-made jointers,
   ii) timber battens over joints,
   iii) silicone sealant joints, or
   iv) open joints with neoprene backers.

9.7.1.1 Flush-finished joint systems

Flush-finished joint systems shall:

a) Be used only on fibre cement sheets that:
   i) are manufactured with a rebated edge for this purpose,
   ii) are, if necessary for part sheets, rebated on site using a purpose-made tool, and
   iii) have edges primed after fixing of the sheets.

b) Have joints, comprising a bedding compound and reinforcing tape, that are finished in accordance with Paragraph 9.7.10.2.

9.7.2 Material

Fibre cement shall comply with AS/NZS 2908: Part 2.

9.7.3 Installation

All sheet edges shall be pre-painted with a seal coat prior to fixing. A *building wrap*, as specified in Table 23, shall be installed behind fibre cement sheet *claddings*.

9.7.3.1 Fixings

Fibre cement sheets shall be fixed through the *building wrap* into the wall *framing* with fixings as required in Table 24.

9.7.4 Joints

Fibre cement *cladding* joints shall be located only over supports.

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) May be staggered across horizontal *control joints*, and

c) Shall extend the full height of the wall, where there is a *flush-finished* horizontal joint and a vertical *control joint* on the wall.

Table 19: Control joint requirements
Paragraph 9.7.4.1

Vertical control joints	Horizontal control joints
5400 mm centres max. (6000 mm allowed on walls that finish at an exterior corner)	5400 mm centres max. (on *dwangs* between full-height, continuous *studs*)
All internal corners	All floor joist locations

NOTE: Non-*flush-finished* joints are *control joints*.

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9.7.4.2 Non-flush-finished joints

Non-*flush-finished claddings* shall have:

a) Vertical joints as shown below:
   i) expressed joint – Figure 103,
   ii) uPVC joint – Figure 104,
   iii) timber batten joint – Figure 105, or
   iv) sealant filled joint – Figure 106.

b) Horizontal joint – *direct fixed* – Figure 107, or

c) Horizontal joint – *drained cavity* – Figure 108.

Figure 103: Vertical expressed joints for fibre cement sheet
Paragraph 9.7.4.2 a)

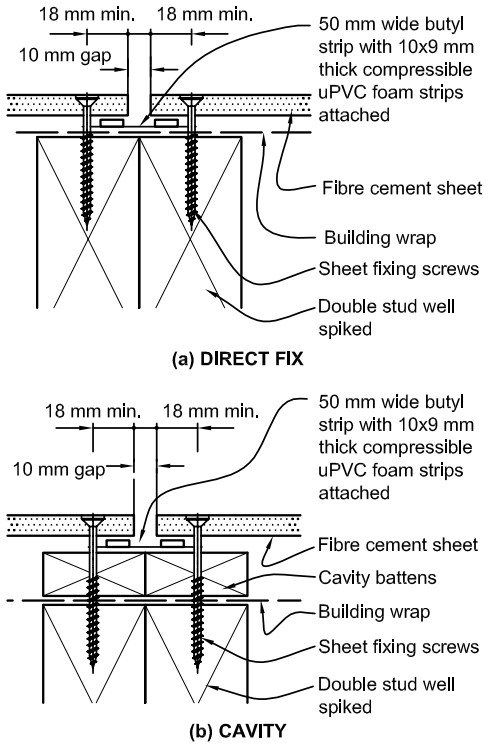

Figure 104: Vertical uPVC joints for fibre cement sheet
Paragraph 9.7.4.2 a)

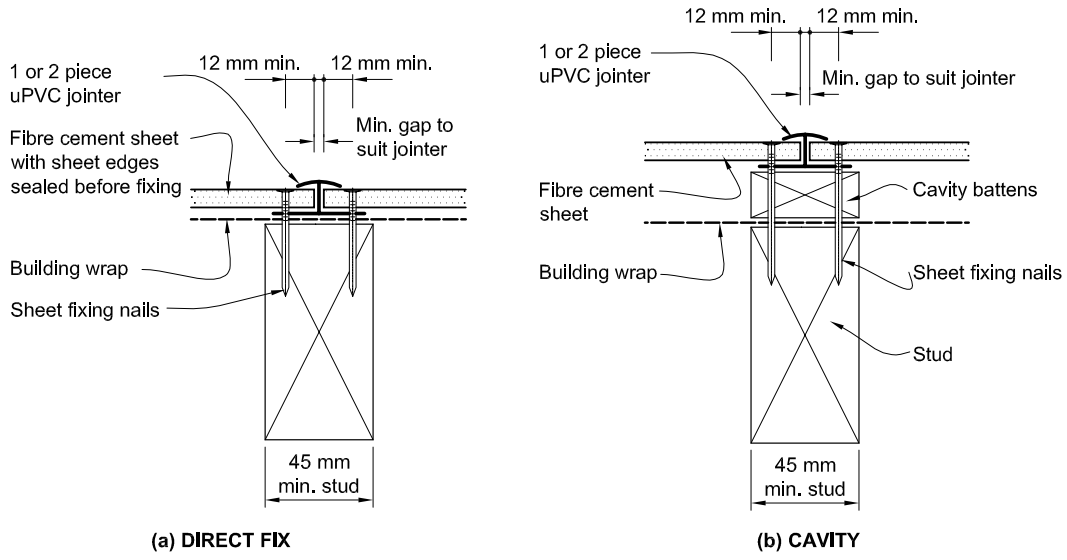

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Figure 105: **Vertical timber batten joints for fibre cement sheet**
Paragraph 9.7.4.2 a)

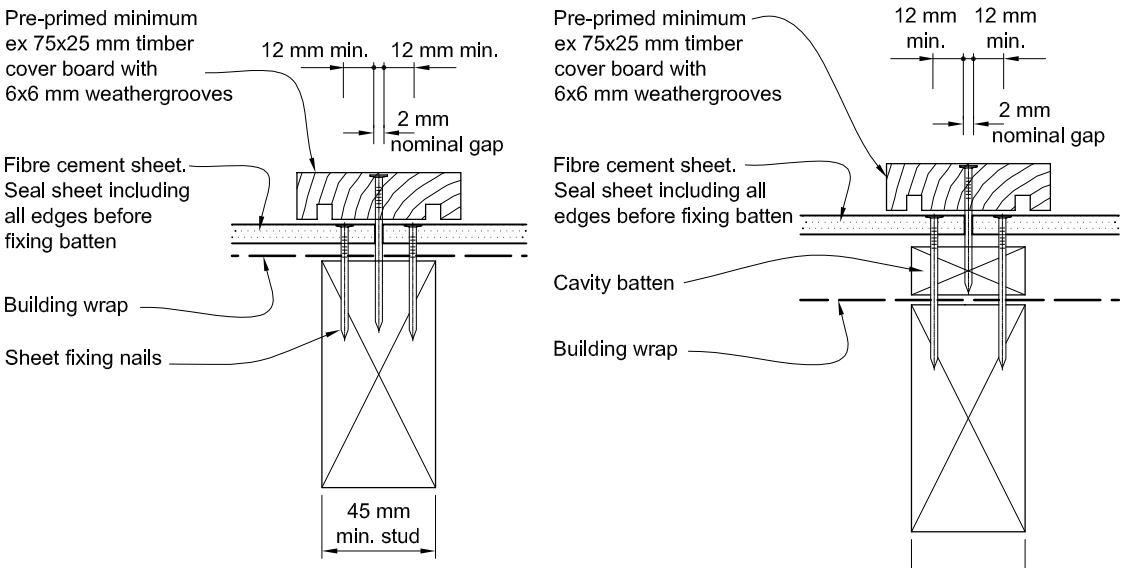

Figure 106: **Vertical sealant joints for fibre cement sheet**
Paragraph 9.7.4.2 a)

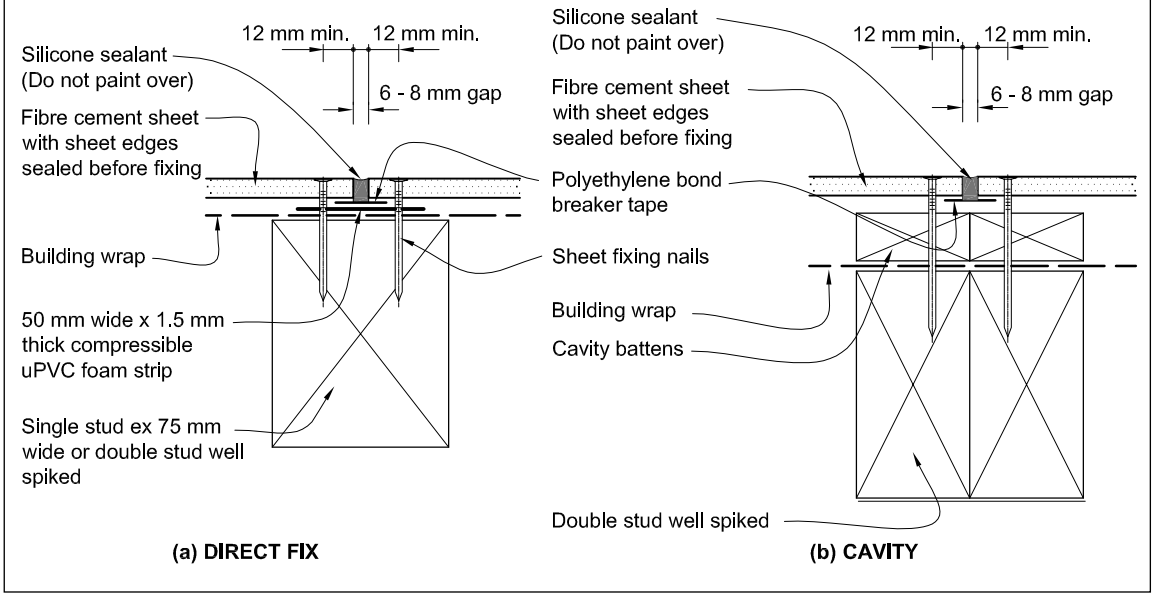

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Figure 107: **Horizontal joints for direct fixed fibre cement sheet**
Paragraph 9.7.4.2 b)

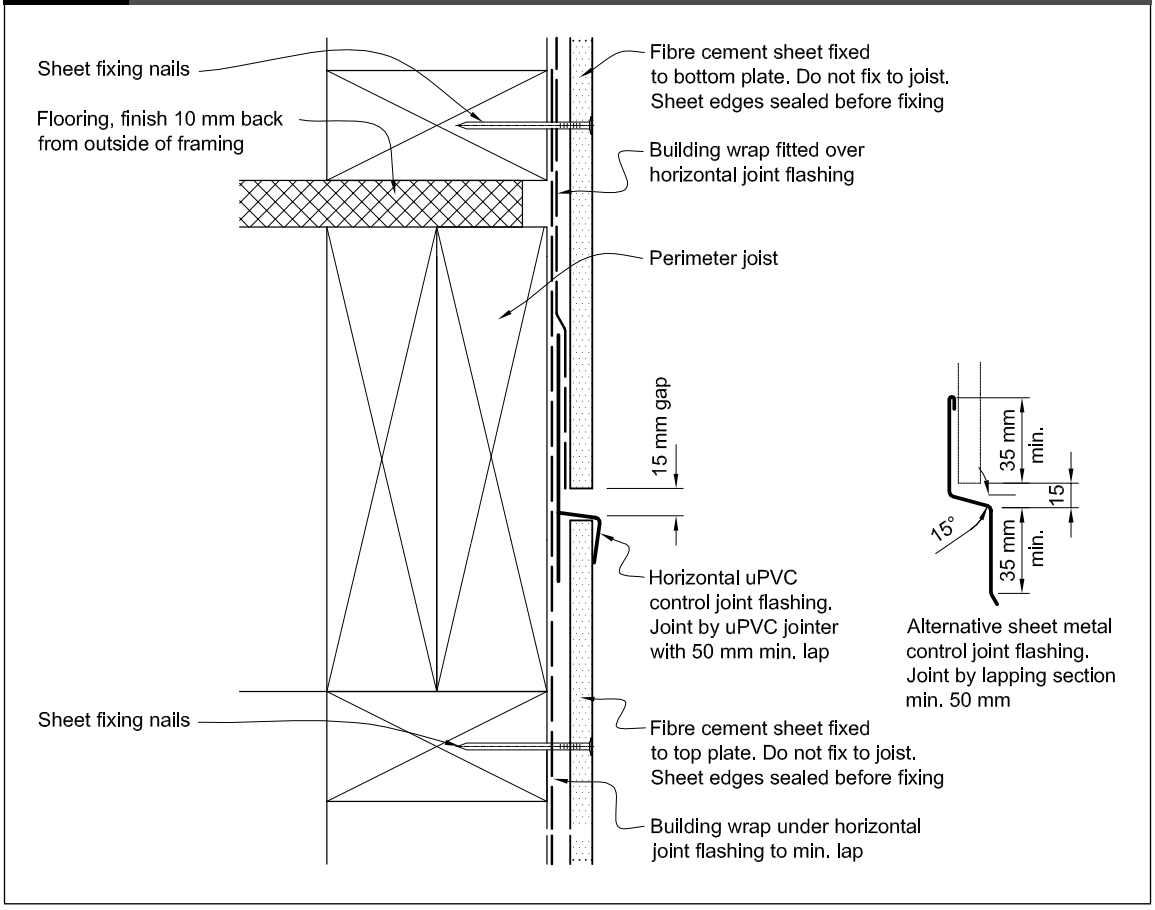

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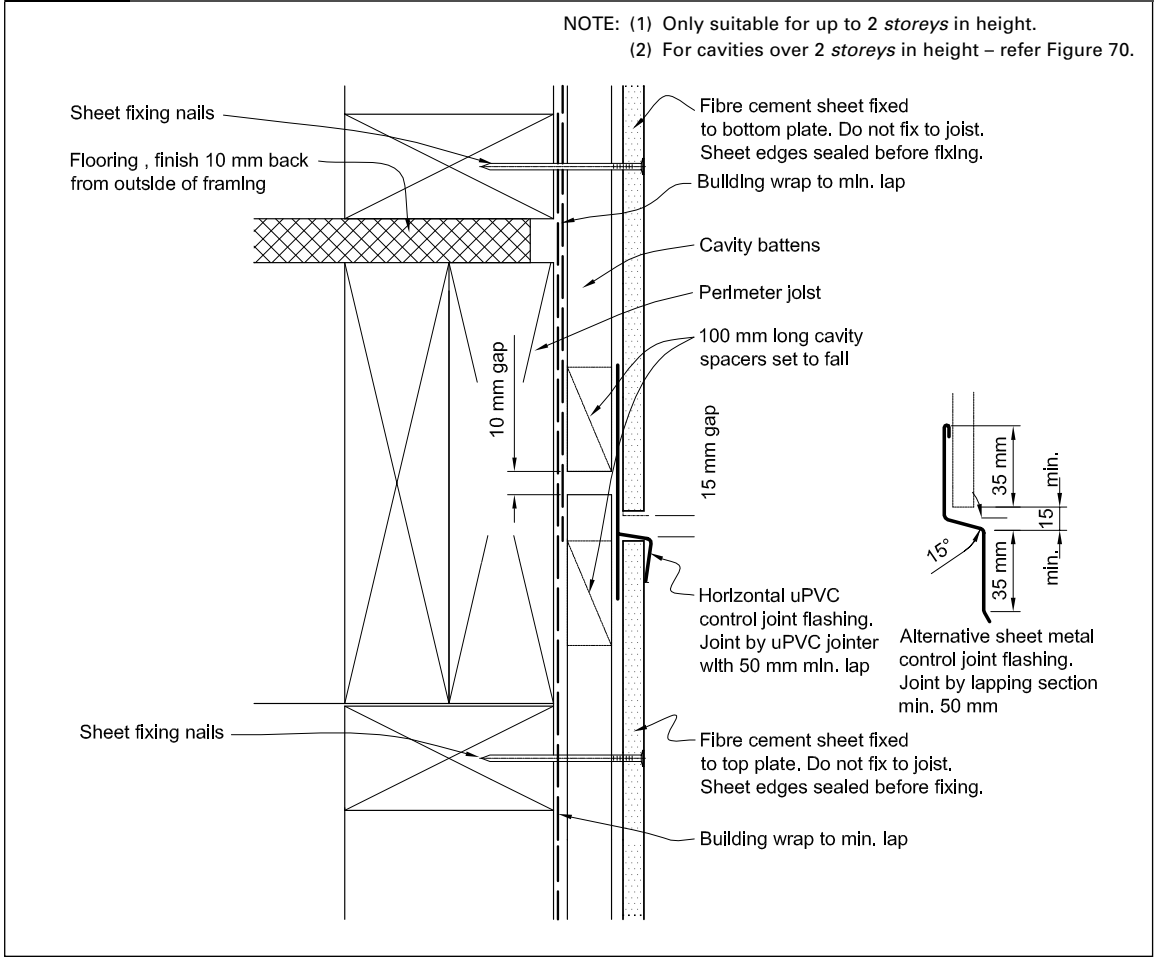
Figure 108: Horizontal joints for fibre cement sheet on cavity
Paragraph 9.7.4.2 c)



9.7.4.3 Flush-finished joints

Flush-finished joints shall:

a) Not occur at corners of window or door openings or at changes in the height of a wall,

b) Be a minimum of 200 mm on either side of the jamb-line of an opening, and

c) Be detailed as shown in Figure 110.

9.7.5 Corners

9.7.5.1 Non-flush-finished

a) **Internal corners:**
   i) uPVC jointers – Figure 109,
   ii) corrosion-resistant *flashing* and optional corner batten – Figure 111.

b) **External corners**
   i) uPVC jointers – Figure 109,
   ii) corrosion-resistant *flashing* and corner battens – Figure 112.

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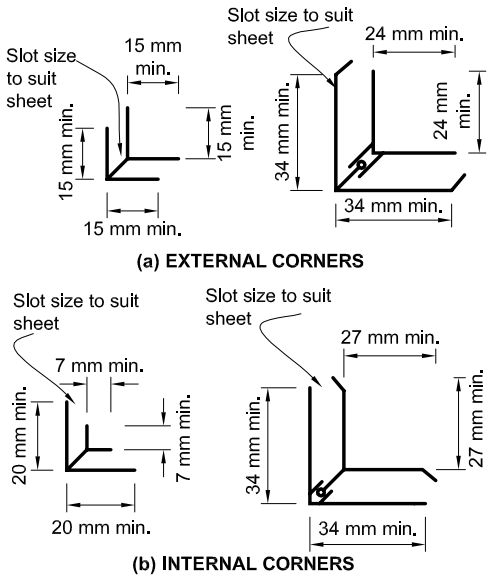
Figure 109: **uPVC corners for fibre cement**
Paragraphs 9.7.5.1 a) and b)



9.7.5.2 Flush-finished systems

a) **External corners:**
Use of uPVC corner reinforcement beneath tape and finishing compound as shown in Figure 113.

b) **Internal corners:**
Use of a sealant-filled joint over compressible foam tape as shown in Figure 111 and Figure 112, with polyethylene bond breaker tape behind joint.

9.7.6 Soffit details

Soffits shall be detailed as shown in Figure 114.

9.7.7 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10.

9.7.7.1 Windows – direct fixed

Windows shall be detailed as per Figure 115.

9.7.7.2 Windows – on cavity

Windows shall be detailed as per Figure 116.

Figure 110: **Flush-finished joints for fibre cement sheet**
Paragraph 9.4.7.3

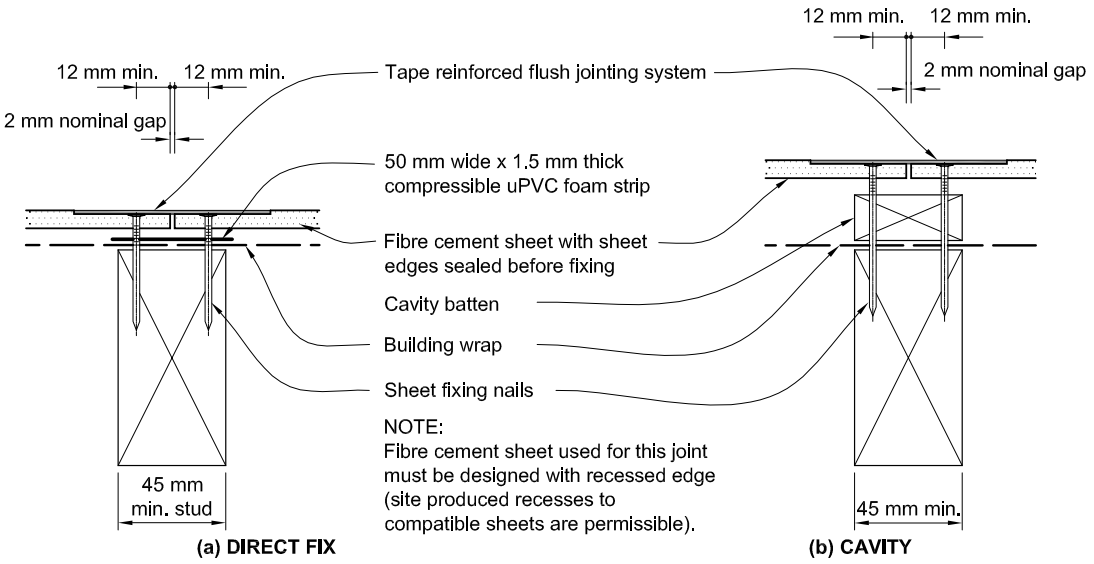


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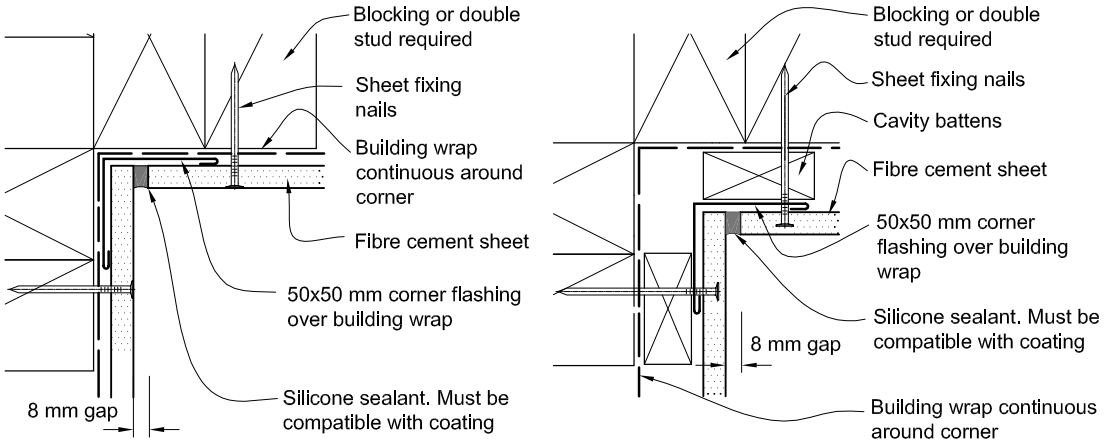
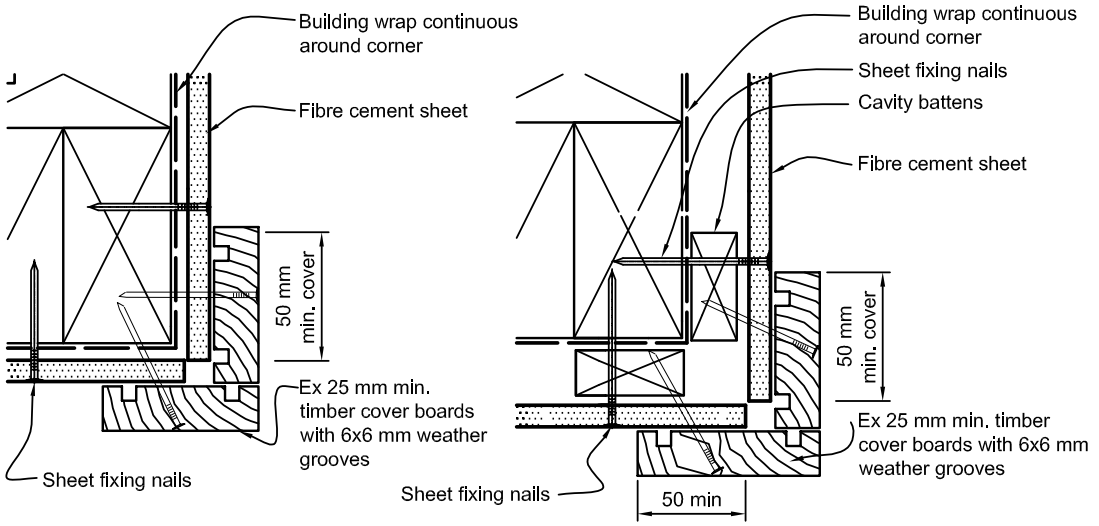
Figure 111: Internal corners for fibre cement sheet
Paragraphs 9.7.5.1 a) and 9.7.5.2 b)



(a) DIRECT FIX **(b) CAVITY**

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 112: External corners for fibre cement sheet
Paragraphs 9.7.5.1 b) and 9.7.5.2 b)



(a) DIRECT FIX **(b) CAVITY**

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*.

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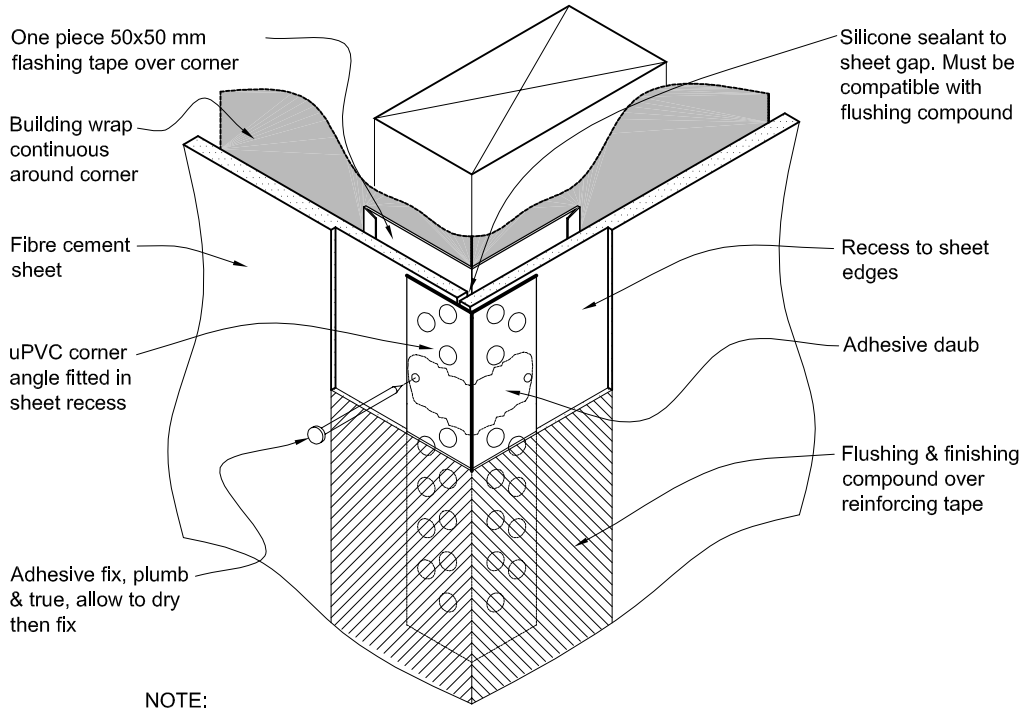
Figure 113: Flush-finished external corners for fibre cement sheet
Paragraph 9.7.5.2 a)



NOTE:
(1) Fibre cement sheet used for this joint must be designed with recessed edge (site produced recesses to compatible sheets are permissible).
(2) *Cavity wall* corner shall be similar to above detail, with the corner *flashing* positioned over the *cavity battens*.

Figure 114: Soffits for fibre cement sheet
Paragraphs 9.7.6 and 9.8.6

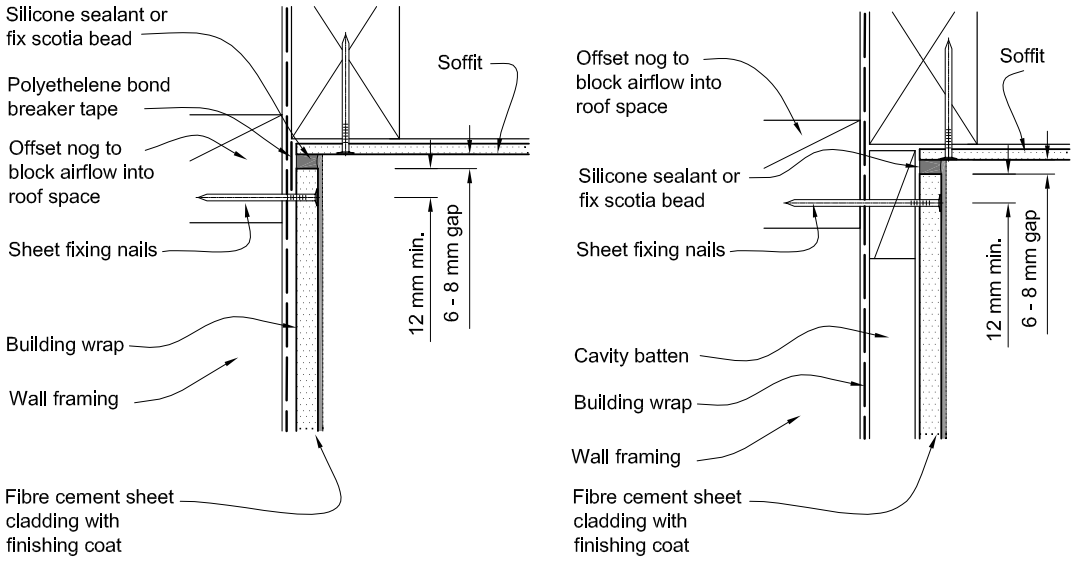


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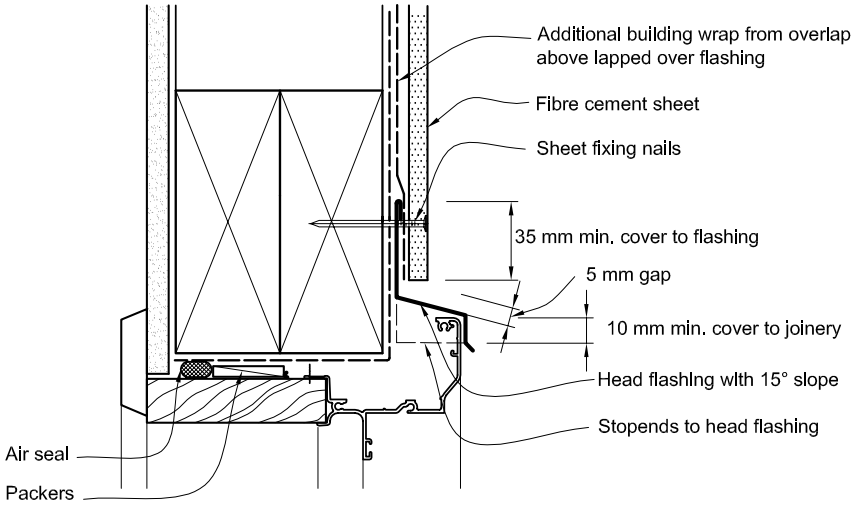
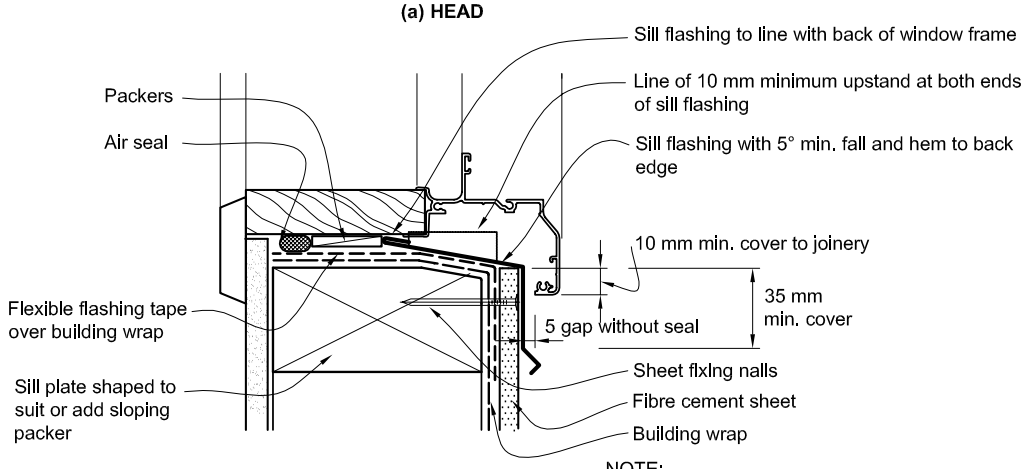
Figure 115: Windows for direct fixed fibre cement sheet
Paragraphs 9.7.7.1 and 9.8.8.1, Figure 71

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

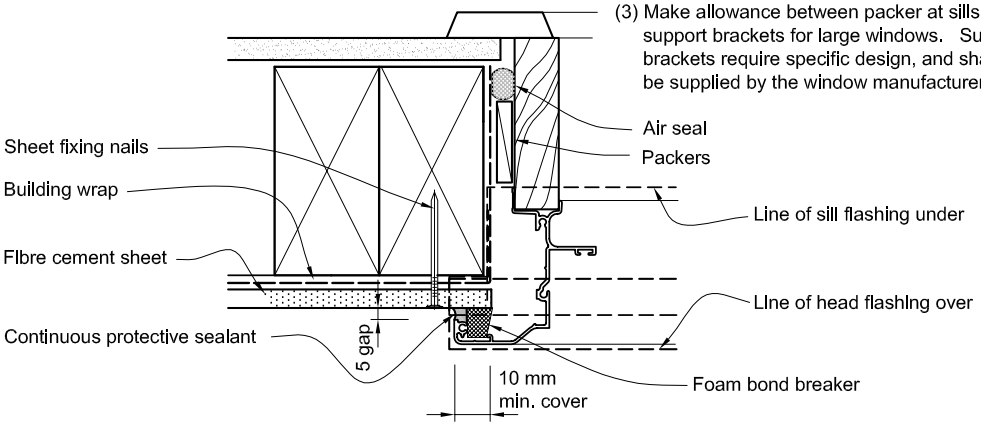


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

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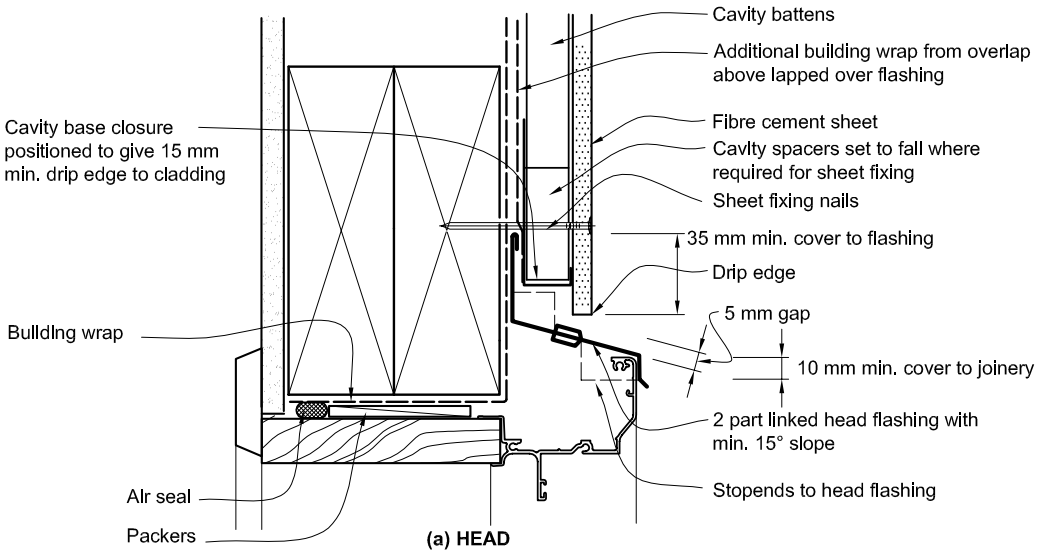
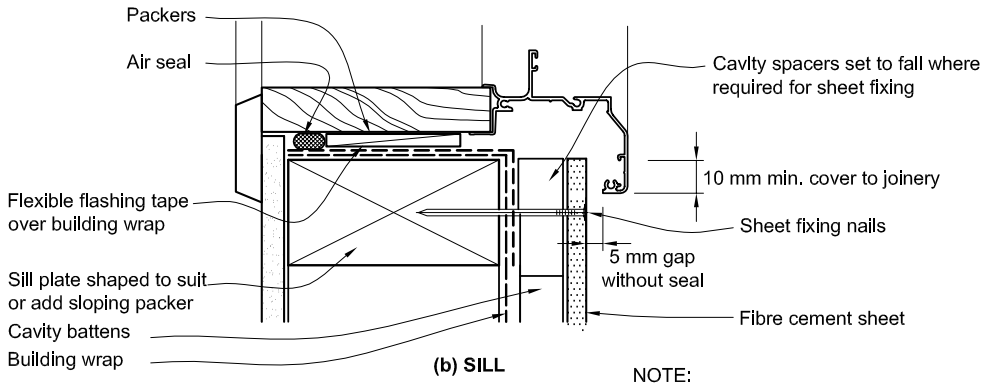
Figure 116: Windows for fibre cement sheet on cavity
Paragraphs 9.7.7.2 and 9.8.8.2

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

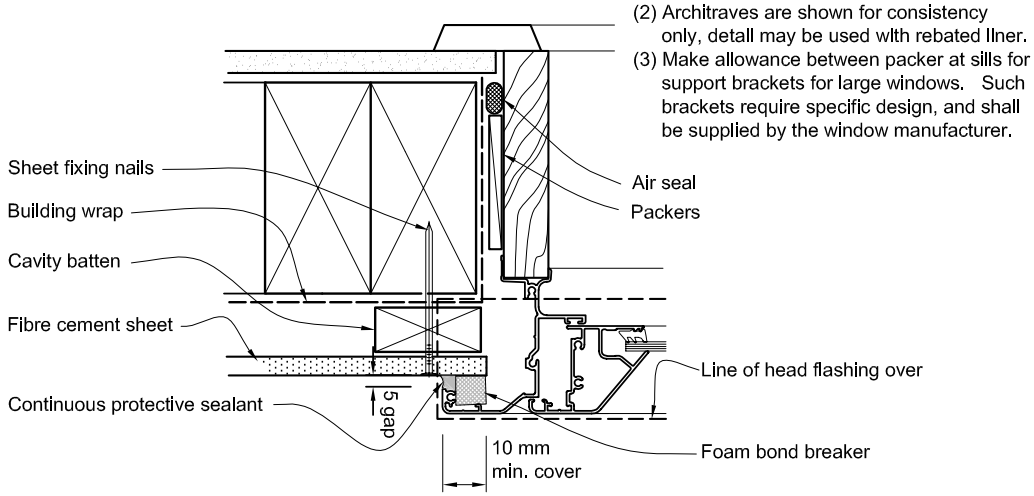


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



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9.7.8 Parapets and enclosed balustrades

Parapets shall comply with Paragraph 6.0.

Enclosed balustrades shall comply with Paragraph 7.4.

9.7.8.1 Flush-finished topped balustrades

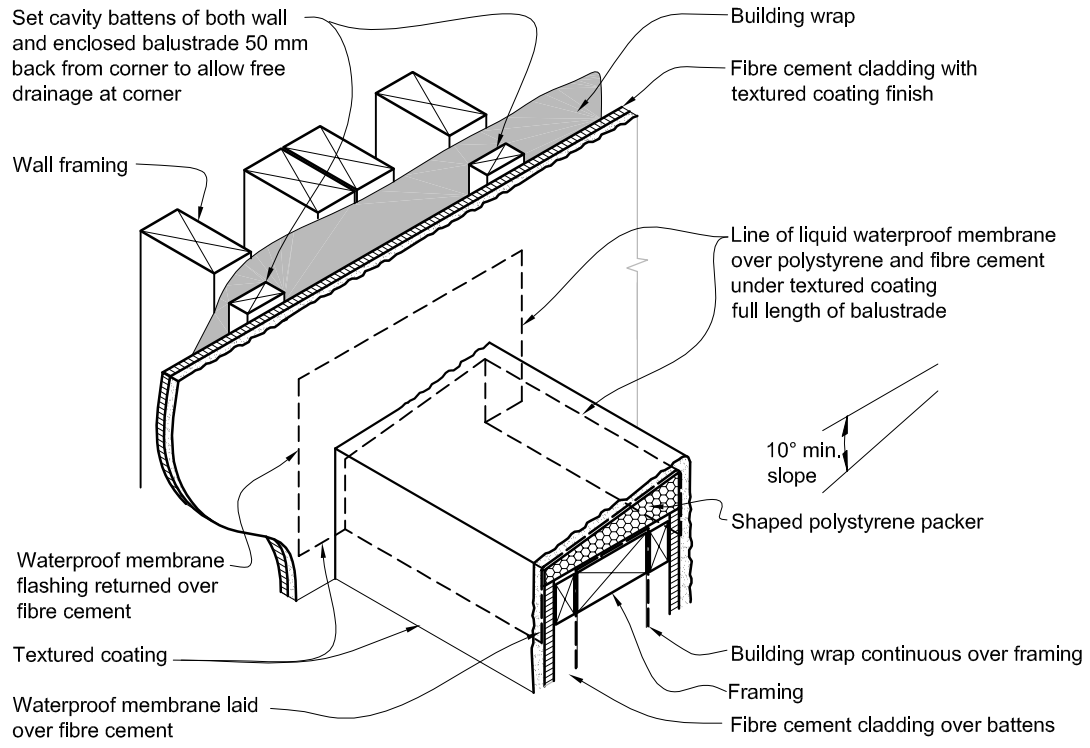
Where the tops to *enclosed balustrades* are formed using *flush-finished* fibre cement, they shall have a minimum fall of 10° (1:6), and be wrapped as shown in Figure 117, with a *waterproofing membrane*, approved by the supplier of the jointing and finish system. The *membrane* shall be fully protected by the coating and shall:

a) 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, and

b) Be applied by a trained applicator, approved by the supplier of the jointing and finish system.

Figure 117: Enclosed balustrade to wall for fibre cement sheet
Paragraphs 6.6, 9.3.9.1 and 9.7.8.1

NOTE: (1) Refer Figure 11 to Figure 13 for details of *framing* and bridge over cavity.
(2) Shaped polystyrene packer may be replaced with fibre cement over H3.1 treated timber packer.



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9.7.9 Decorative attachments

Where decorative attachments are used, the final weatherproofing system shall be applied prior to the attachments.

COMMENT:

Alternatively, a decorative moulding may be formed from the coating by using mesh and plaster.

Attachments shall not interfere with the functioning of critical joints such as *control joints*.

9.7.10 Finishes

9.7.10.1 Non-flush-finished cladding

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.

9.7.10.2 Flush-finished cladding

The applicator of the *flush-finished* jointing and coating shall be trained, and approved by the supplier of the jointing and finish system.

COMMENT:

It is recommended that an installer has successfully completed, or demonstrated skill to the level of, an NZQA recognised course.

The BCITO National Certificate in Proprietary Plaster Cladding Systems – Fibre Cement is such a course.

Flush-finished fibre cement shall be finished with a textured finish system, and shall:

a) Comply with BRANZ EM 4, when tested with the specific fibre cement substrate and jointing system used for the *cladding*,

b) Have all components approved by the supplier of the jointing and finish system.

Where a topcoat of paint over the finish is required to provide weather protection, it shall be a latex exterior paint system complying with any of Parts 7, 8, 9 or 10 of AS 3730.

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9.8 Plywood Sheet

Plywood-sheet *claddings* shall be either *direct fixed* to *framing* over a *building wrap* 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 the following types of plywood panel *claddings*:

a) Vertical lapped and grooved sheets,

b) Vertical sheets with jointers,

c) Vertical sheets with battened joints, and

d) Vertical sheets with exposed joints.

9.8.2 Materials

Vertical lapped and grooved plywood shall have a weathergroove to the lap as shown in Figure 118.

Batten-jointed panels shall have weather-grooved timber battens as shown in Figure 119.

Plywood panels shall be:

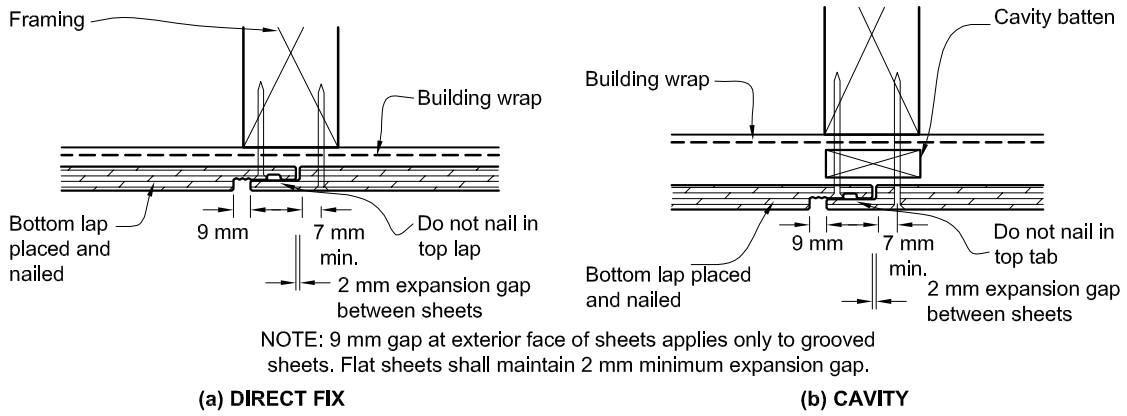
a) Manufactured to AS/NZS 2269, grade CD,

b) A minimum of 5 ply,

c) A minimum of 12 mm in thickness, and

d) Treated as required by NZS 3602.

Figure 118: Vertical lapped joints for plywood sheet
Paragraphs 9.8.2 and 9.8.3.2 c)



NOTE: 9 mm gap at exterior face of sheets applies only to grooved sheets. Flat sheets shall maintain 2 mm minimum expansion gap.

(a) DIRECT FIX **(b) CAVITY**

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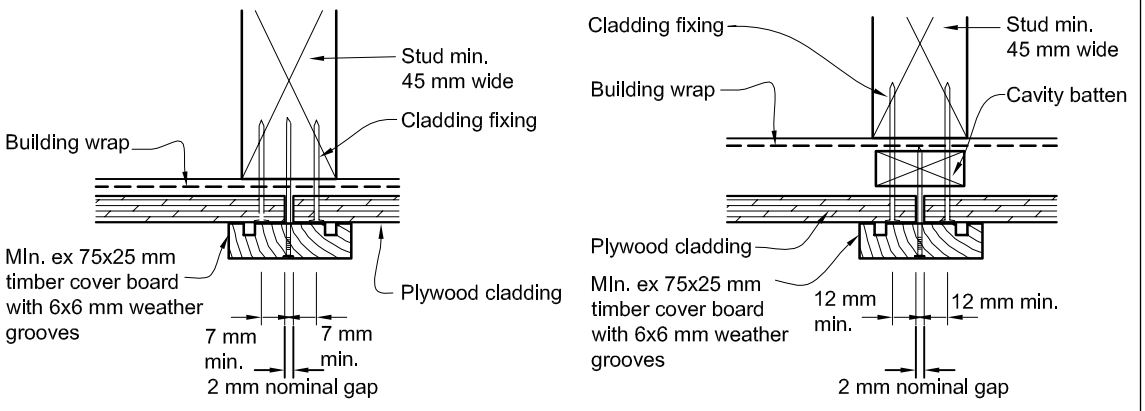
Acceptable Solutions E2/AS1

Figure 119: Battened joints for plywood sheet
Paragraphs 9.8.2 and 9.8.3.2 c)



9.8.3 Installation

A *building wrap*, as specified in Table 23, shall be installed behind plywood sheet *claddings*.

9.8.3.1 Fixings

Plywood sheets shall be fixed through the *building wrap* into the wall *framing* with fixings as required in Table 24.

9.8.3.2 Joints

All joints shall be detailed to shed moisture outside the *cladding*, and 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, be detailed as shown below:
   i) lapped joints – refer Figure 118,
   ii) battened joints – refer Figure 119, or
   iii) open joints – refer Figure 120.

Figure 120: Expressed joints for plywood sheet
Paragraph 9.8.3.2 c)

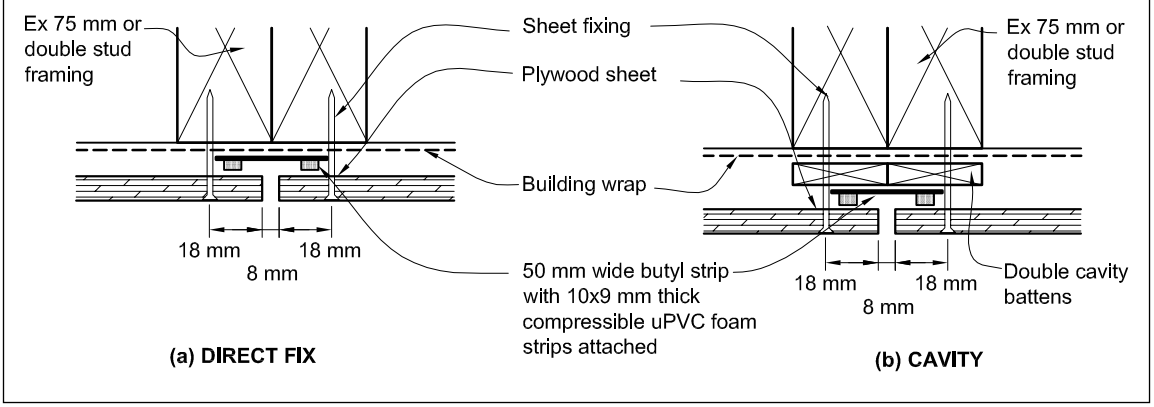


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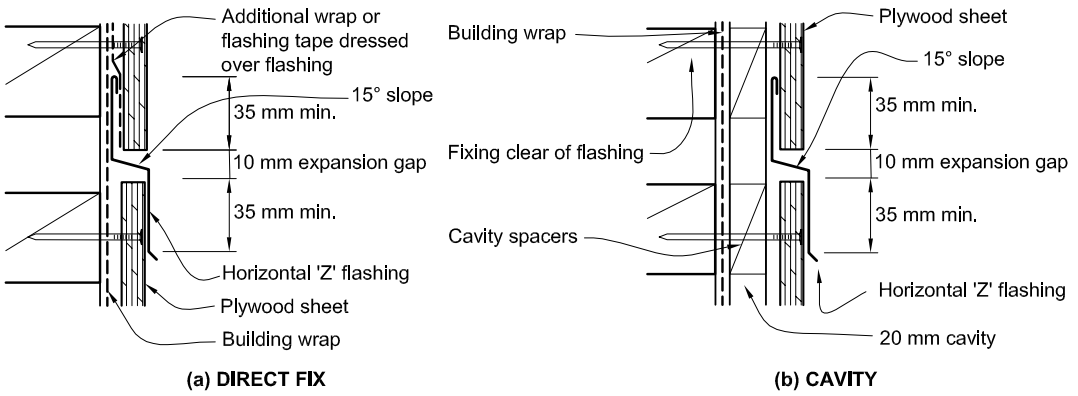
Figure 121: Horizontal joints for plywood sheet
Paragraph 9.8.3.2 b)

NOTE: (1) Detail (b) is only suitable for *drained cavities* over 2 *storeys* in height.
(2) For *drained cavities* over 2 *storeys* in height – refer Figure 70.



9.8.4 Corners

9.8.4.1 External corners

All external corners shall be fitted with *flashings* or timber battens, as shown in Figure 122.

9.8.4.2 Internal corners

All internal corners shall be fitted with *flashings* or timber battens, as shown in Figure 123.

9.8.5 Flashing material

Flashings shall be selected in accordance with Table 20 to Table 22.

9.8.6 Soffit details

Soffits shall be as shown for fibre cement sheet *cladding* in Figure 114.

9.8.7 Parapets and enclosed balustrades

Parapets shall be in accordance with Paragraph 6.0.

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: direct fixed

Windows shall be detailed as shown for fibre cement sheet *cladding* – refer Figure 115.

9.8.8.2 Windows: with cavity

Windows shall be detailed as shown for fibre cement sheet *cladding* – refer Figure 116.

COMMENT:
The same principles of window installation apply to both fibre cement and plywood sheet *cladding*.

9.8.9 Finishes

For *claddings* required to have a 50-year *durability*, plywood treated to H3.1 (LOSP) shall be 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.

A solution of 12.5% copper naphthenate or tin naphthenate preservative in white spirits, and/or mineral turpentine shall be brushed on to any edges cut after treatment.

COMMENT:
Regular maintenance of the paint finish is essential to ensure the 50-year *durability* is achieved.

While H3.2 (CCA, ACQ or copper azole) plywood can be left unpainted, it is likely to develop checking and mould growth on the surface.

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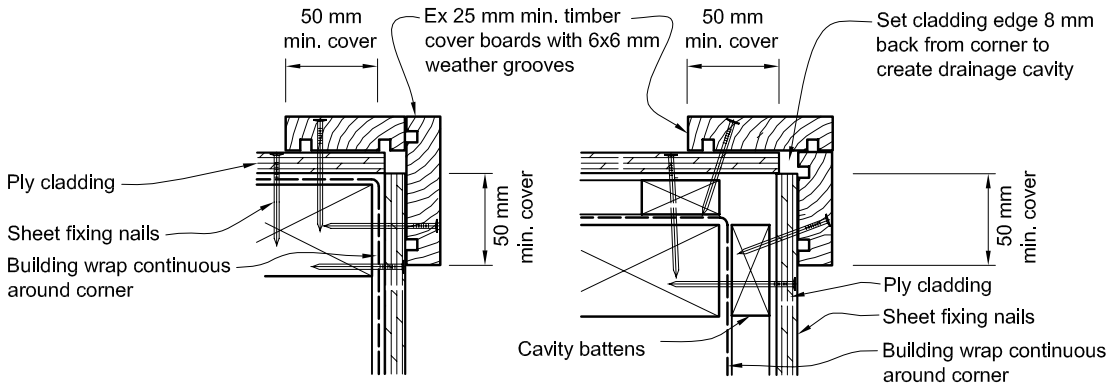
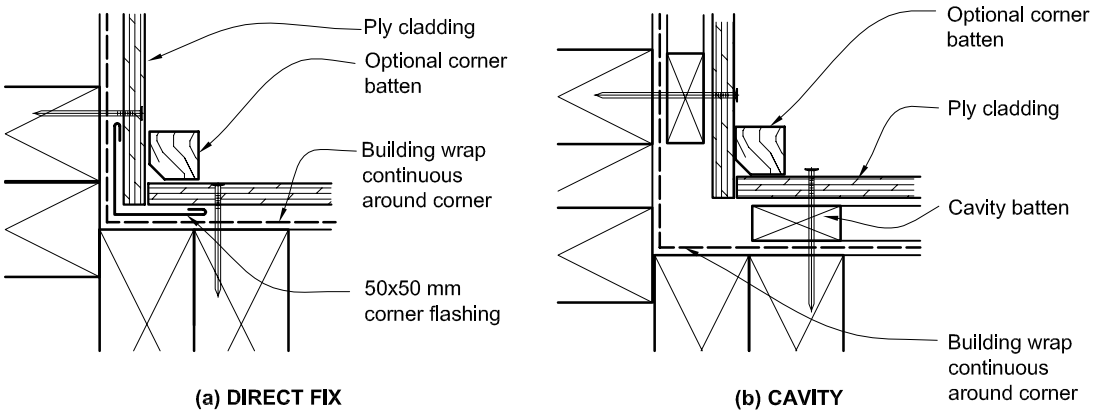
Figure 122: External corners for plywood sheet
Paragraph 9.8.4.1



NOTE: Corner battens shall be sized to provide 50 mm minimum cover over *cladding*.

Figure 123: Internal corners for plywood sheet
Paragraph 9.8.4.2



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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 either *direct fixed* to *framing* over a *building wrap,* 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 *cladding* may require the inclusion of a *drained cavity*.

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

Installation and finishing of *EIFS cladding systems* shall be by trained applicators, approved by the manufacturer of the system or the NZ agent (in the case of imported *cladding*).

COMMENT:
It is recommended that an installer has successfully completed, or demonstrated skill to the level of, an NZQA recognised course. The BCITO National Certificate in Proprietary Plaster Cladding Systems – EIFS is such a course.

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 m^2,

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 *building wrap*, as specified in Table 23, shall be fixed to the *framing*.

9.9.4.1 Fixings

Polystyrene sheets shall be fixed through the *cavity battens*, where applicable, and *building wrap* 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.

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9.9.4.2 Joints

Joints to plain-edged boards 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 6 metres high,

COMMENT:
The system supplier may require *control joints* at closer spacings.

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

H3.1 treated timber blocks shall be provided at appropriate locations for fixing all downpipe brackets, garden taps, and other outside fittings.

The block 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:

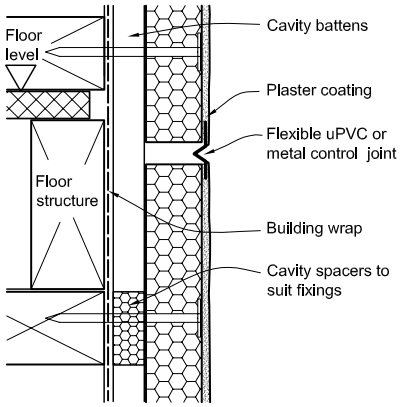
a) Extends over the timber block face and overlaps the adjacent polystyrene by a minimum of 50 mm, and

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.

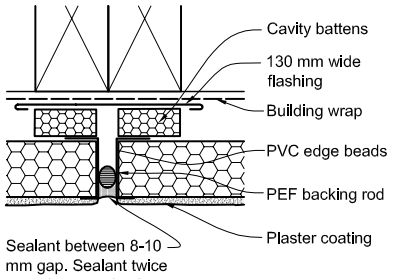
The design of fixing blocks for connecting items carrying substantial loads such as stringers for *decks* are outside the scope of this Acceptable Solution.These will require specific structure and *specific weather-tightness design.*

Figure 124: Control joints for EIFS
Paragraph 9.9.4.3

NOTE: (1) Detail (b) is only suitable for *drained cavities* over 2 *storeys* in height.
(2) For *drained cavities* over 2 *storeys* in height – refer Figure 70.



(a) HORIZONTAL CONTROL JOINT



(b) VERTICAL CONTROL JOINT

9.9.5 Insulation

Where a *drained cavity* is used, the polystyrene thickness of the *wall cladding* (together with any additional insulation) shall maintain the insulation required by NZBC H1. If necessary in order to meet the thermal resistance requirements of NZBC H1:

a) The polystyrene thickness shall be increased, and/or

b) Additional wall insulation shall be added.

9.9.5.1 Battens

Where a *drained cavity* is used, *cavity battens* shall comply with the following requirements:

a) *Cavity battens* shall be spaced at 600 mm maximum centres,

b) *Cavity spacers* shall be:
   i) a maximum length of 100 mm,
   ii) set 5° minimum from horizontal, and
   iii) limited to the minimum number necessary to provide for *cladding* fixings.

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

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 *weathertightness*, *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 fastened 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.

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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.

COMMENT:
Where possible, pipe penetrations should be installed to slope towards the *cladding* exterior.

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.

Figure 125: Bottom of cladding for EIFS
Paragraph 9.9.7

GENERAL: 6 mm offset of *framing* to foundation is not necessary where *drained cavities* are used.

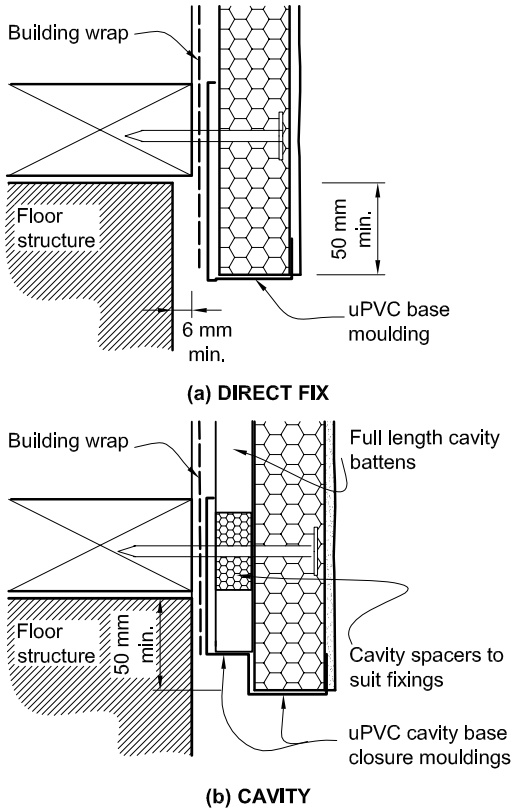
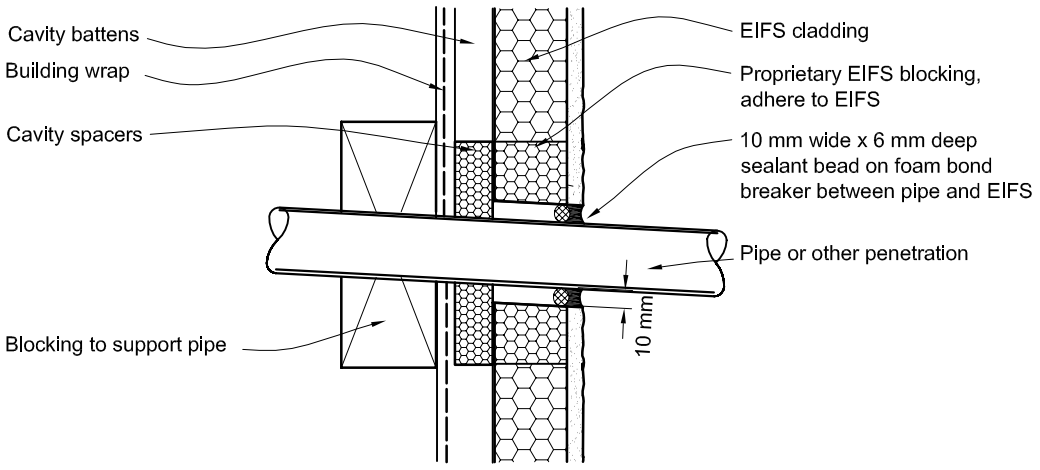


Figure 126: Penetration for EIFS
Paragraph 9.9.8 a)

NOTE: Refer Figure 68 for pipe sealing to *building wrap*.



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9.9.9 Windows and doors

Windows and doors shall be installed in accordance with Paragraph 9.1.10.

a) Windows: direct fixed
Windows shall be detailed as per Figure 127.

b) Windows: with cavity
Windows shall be detailed as per Figure 128.

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 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.

9.9.10.2 EIFS-topped enclosed balustrades

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, with a *waterproofing membrane* approved by the supplier of the *EIFS cladding system*. The *membrane* shall be fully protected by the coating, and shall:

a) 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, and

b) Be applied by a trained applicator, approved by the supplier of the *EIFS cladding system*.

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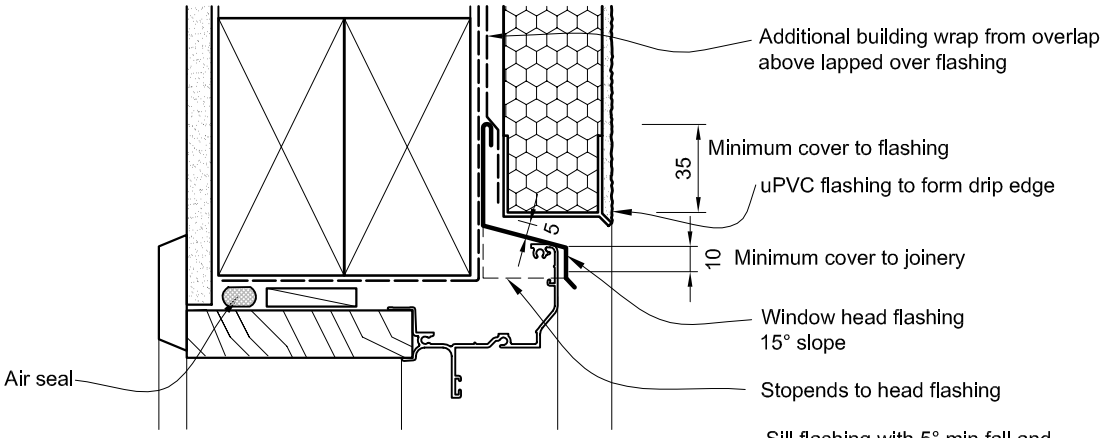
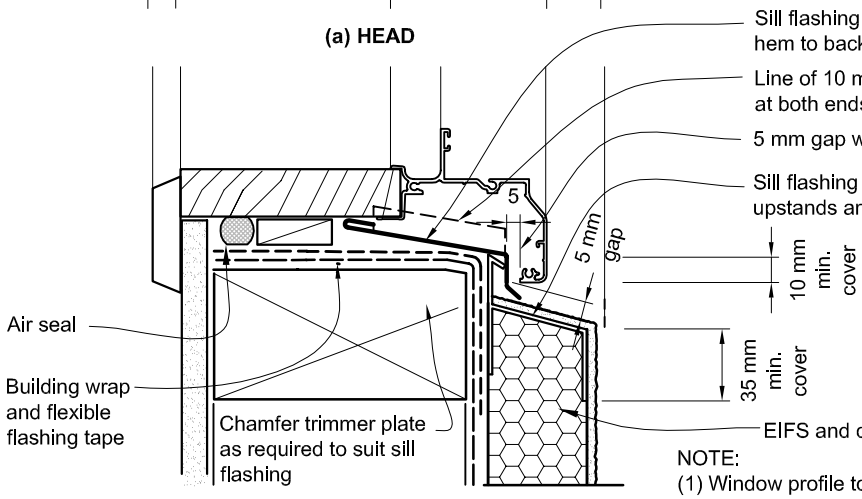
Figure 127: Windows for direct fixed EIFS
Paragraph 9.9.9 a)

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

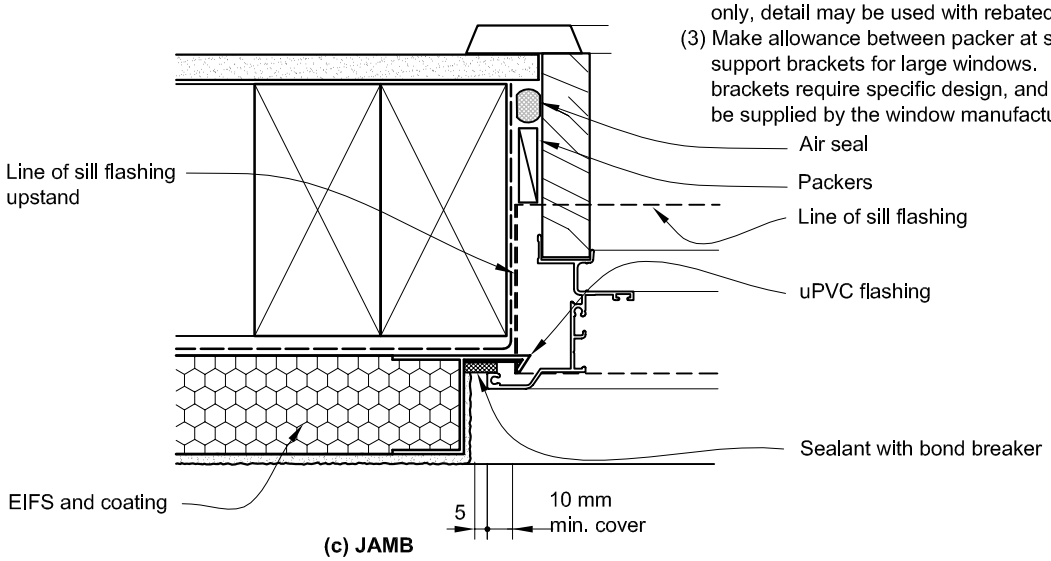


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

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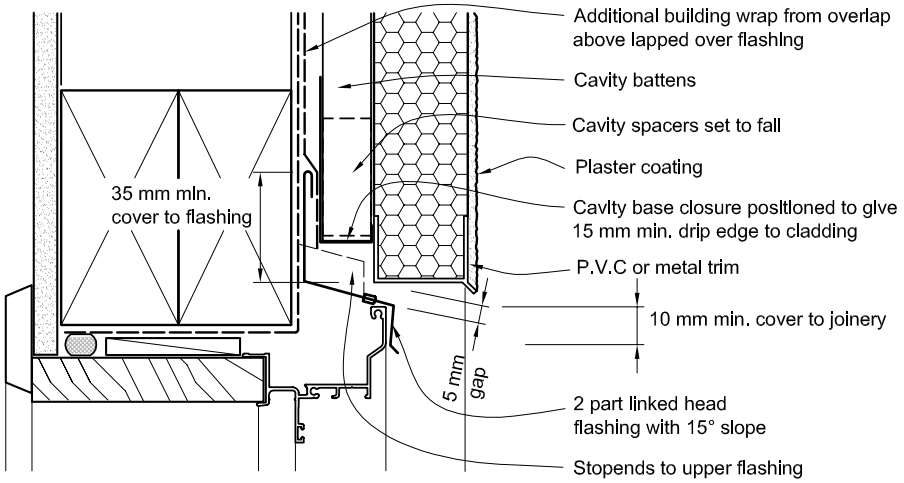
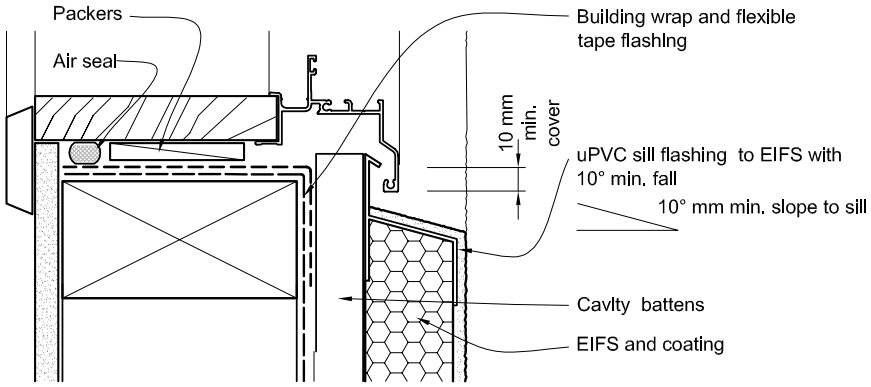
Figure 128: Windows for EIFS on cavity
Paragraph 9.9.9 b)

GENERAL: (a) Refer Figure 72 for wrapping of framed opening prior to window installation.
(b) Sliding and bi-fold windows will require specific design.
(c) A minimum of 8 mm effective cover at sills shall be permitted where necessary to allow for tolerances.

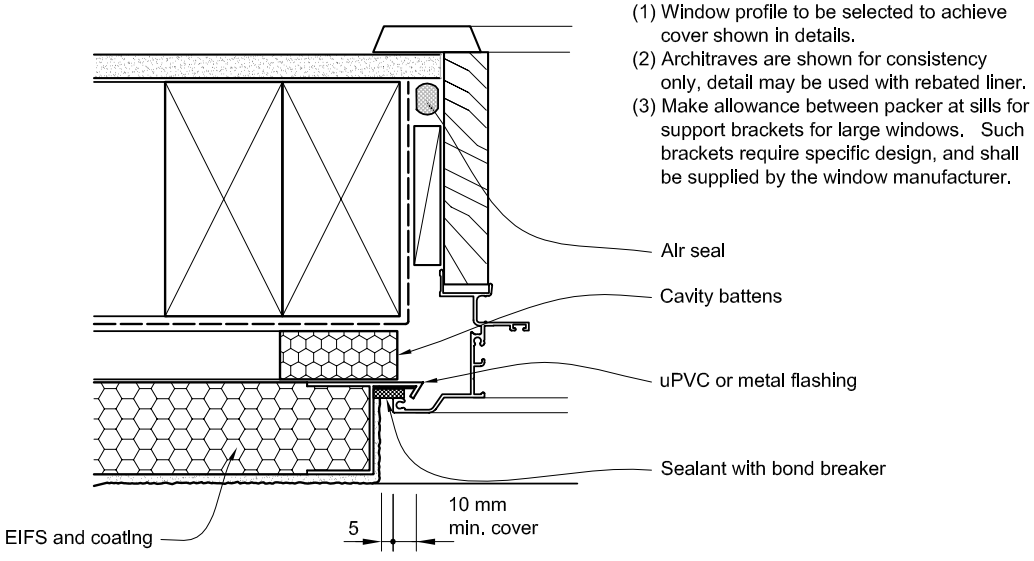


(a) HEAD



(b) SILL

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) Make allowance between packer at sills for support brackets for large windows. Such brackets require specific design, and shall be supplied by the window manufacturer.



(c) JAMB

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Figure 129: Enclosed balustrade-to-wall junction for EIFS
Paragraphs 6.6 c) and 9.9.10.2

NOTE: Refer Figure 11 to Figure 13 for *framing* and bridge over *drained cavity*.

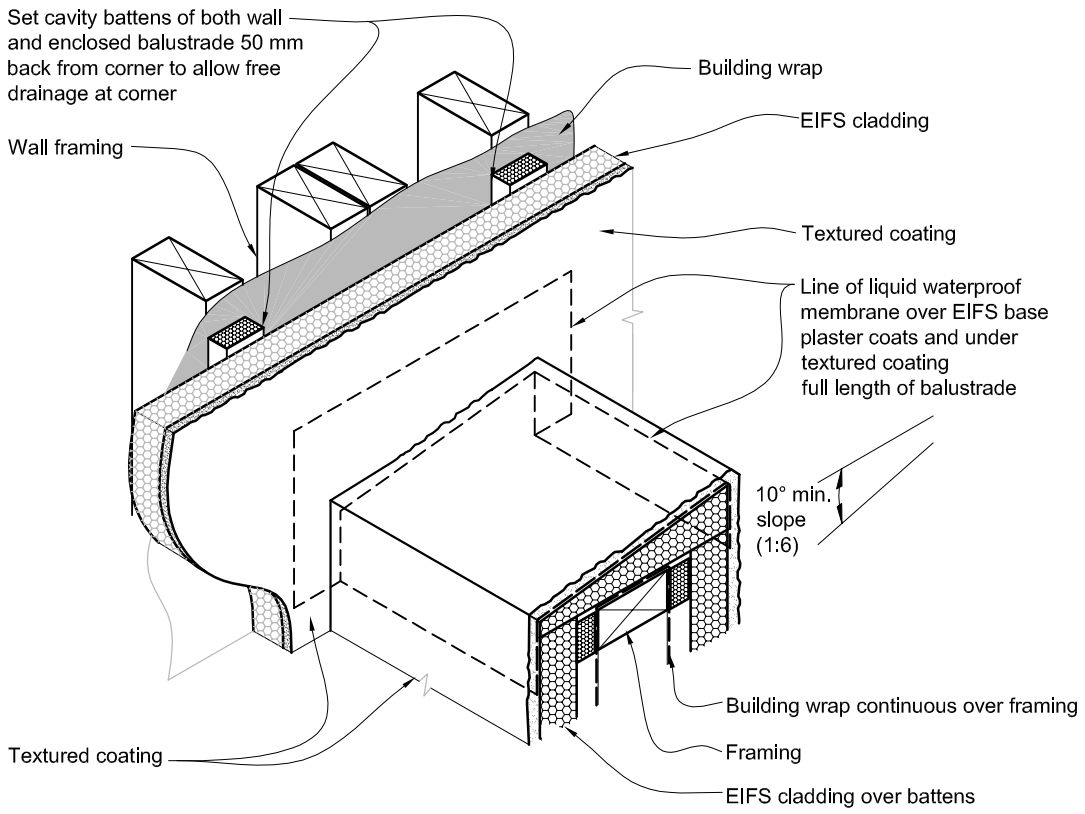
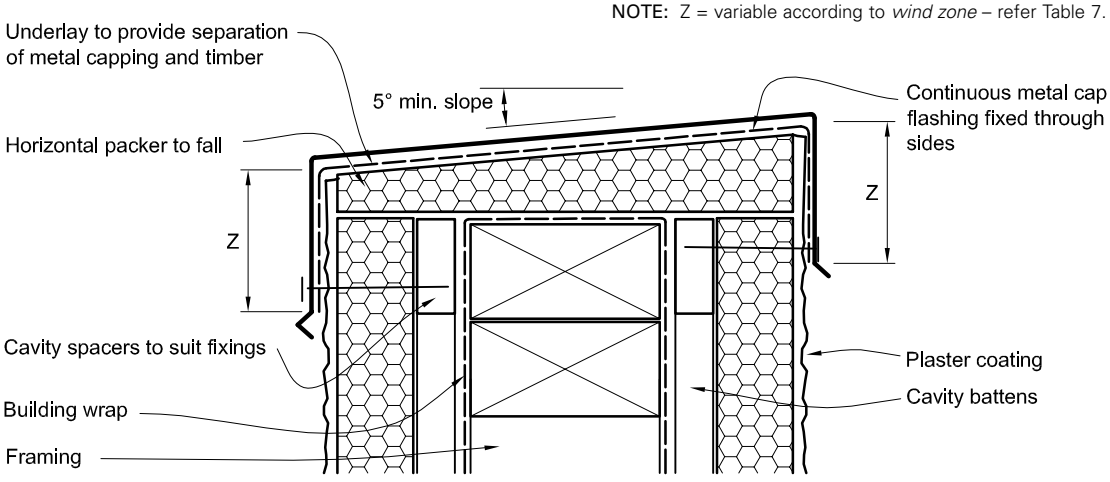


Figure 130: Parapet with metal capping for EIFS
Paragraph 9.9.10.1

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



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10.0 Floors

10.1 General

The floor levels of suspended timber floors and concrete slabs shall comply with the requirements of E1/AS1.

10.2 Suspended timber floors

10.2.1 General

Suspended timber floors at ground level shall have:

a) All timber protected against damage from groundwater moisture, and

b) Subfloor *framing* protected against deterioration from contact with concrete or masonry that is, or could become, damp.

Vapour flow resistances where required in this Paragraph shall be determined according to ASTM E96 Method B at a temperature of 23°C (± 0.6°C) and an external humidity of 50% (± 2%).

10.2.2 Protection of timber

All timber shall be in accordance with NZS 3602. Where subfloor *framing* timber is supported on concrete or masonry which is subject to moisture, the timber shall be either:

a) Treated to H4, or

b) Treated to a minimum of H1.2 and separated from direct contact with the concrete or masonry.

10.2.3 Separation

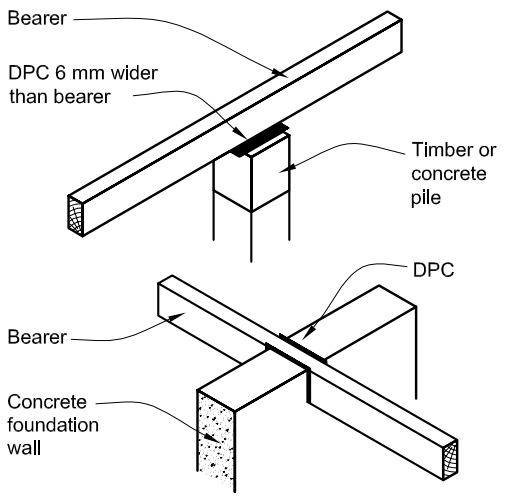
Separation shall be achieved as shown in Figure 131 by providing either of the following:

a) A free-draining air space of at least 12 mm on each face of the timber, or

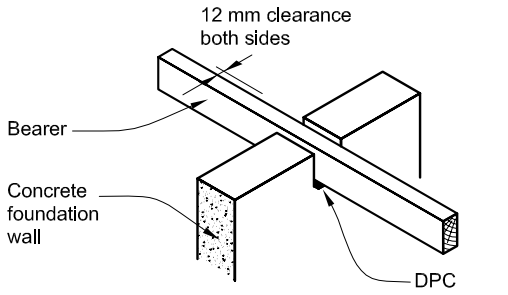
b) Using a separating layer of *damp-proof course (DPC)* that shall extend at least 6 mm beyond each face of the timber.

The *DPC* shall have a vapour flow resistance of no less than 90 mega-newton seconds per gram (MN s/g).

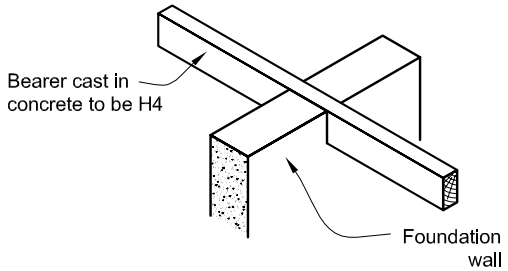
Figure 131: Protection against moisture
Paragraph 10.2.3



(a) PROTECTED BY DPC



(b) PROTECTED BY AIR GAP AND DPC



(c) PROTECTED BY PRESERVATIVE TREATMENT

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10.2.4 Subfloor ventilation

The subfloor space of all suspended timber floors shall be ventilated. This requirement shall be met by providing openings in the foundation wall, at the rate of no less than 3500 mm^2 of net open area for every m^2 of floor area. The openings shall be as near as possible to the underside of plates and bearers.

10.2.5 Openings

Ventilation openings shall be *constructed* by either one of the following methods, or by a combination of both methods:

a) Create continuous gaps, of at least 20 mm wide, between baseboards around the entire perimeter of the *building*, and/or

b) Install perimeter wall ventilators to give sufficient net open area. Ventilators shall be spaced regularly, commencing 750 mm from wall corners and at intervals of no greater than 1.8 m to all sides of the *building*.

10.2.6 Airflow

Where the subfloor space cannot be adequately ventilated as specified in this paragraph, it shall be as described in Paragraph 10.2.7.

Adequate ventilation shall be provided by ensuring that:

a) The subfloor airflow is not obstructed by party walls, internal foundations, attached terraces, or any other impediment,

b) No point on the subfloor ground is more than 7.5 m from a ventilation opening,

c) The subfloor ventilation rate is greater than 10 air changes per hour for wet sites, or 5 air changes per hour for dry sites, and

d) Wall ventilators, complying with the requirements of Paragraph 10.2.4 and Paragraph 10.2.5, are present on all sides of the *building*.

10.2.7 Vapour barriers in subfloor space

Where the subfloor space cannot be adequately ventilated in accordance with Paragraph 10.2.6, the ground under a suspended timber floor shall be entirely covered with a *vapour barrier* that:

a) Has a vapour-flow resistance of no less than 50 MN s/g, and a thickness of no less than 0.25 mm, and

b) Is 0.25 mm thick virgin polyethylene film, or any other material that satisfies this requirement.

10.2.7.1 Minimum ventilation with vapour barrier

Even with a *vapour barrier*, ventilation openings shall:

a) Have a net open area of no less than 700 mm^2 for every m^2 of floor area, and

b) Be located to provide cross-flow of air to all parts of the subfloor space.

10.2.7.2 Installation

The *vapour barrier* shall be laid over ground that is shaped to prevent water accumulation on the barrier, and to allow drainage to the exterior.

COMMENT:

The purpose of the *vapour barrier* is to minimise dampness.

However, a *vapour barrier* will not necessarily eliminate moisture, meaning that ventilation openings to the subfloor space are still necessary.

The *vapour barrier* shall be installed so that:

a) It covers all of the subfloor ground area,

b) Sheets are lapped by a minimum of 75 mm and taped together,

c) It is held securely in place by bricks, large stones or by a similar method, and

d) It fits closely around piles and, where possible, is taped to the piles.

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10.3 Concrete slab-on-ground

10.3.1 General

Concrete slabs shall be cast on a granular base in accordance with Clause 7.5.3 of NZS 3604.

Every concrete floor slab cast on the ground shall have a *damp-proof membrane (DPM)*, which shall be either:

a) Laid between the ground and the slab as shown in Figure 132, or

b) Laid between the top of the slab and a concrete floor topping that is no less than 50 mm thick.

10.3.2 Floor levels

Laying of *damp-proof membranes* shall be as shown in Figure 132.

10.3.3 Damp-proof membranes (DPM)

The *DPM* shall:

a) Have a water vapour flow resistance of no less than 90 MN s/g (mega-newton seconds per gram),

b) Be sufficiently *durable* to resist damage from installation and normal worksite operations,

c) Continue to function satisfactorily as a *DPM* for a minimum of 50 years,

d) Be continuous over the whole slab area, except where the *DPM* is used under a concrete floor topping,

e) Extend under the foundation walls as shown in Figure 132,

f) Be laid on a surface which is unlikely to damage the *DPM*, and

g) Have penetrations by services, reinforcing or other objects that are sealed by taping.

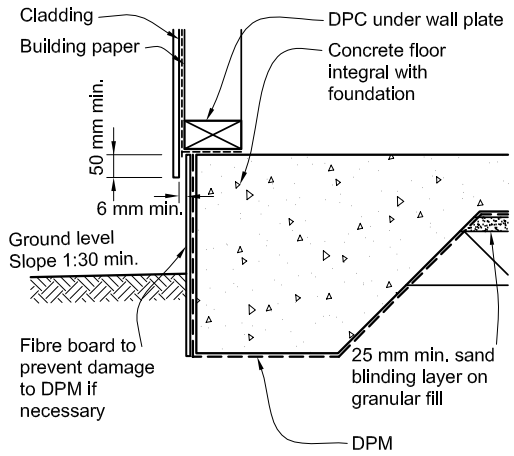
10.3.4 Acceptable materials

The *DPM* shall be:

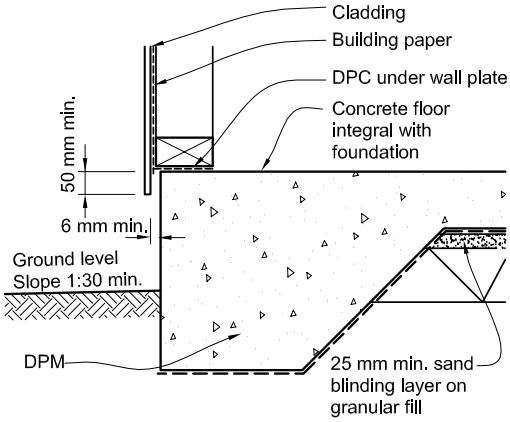
a) 0.25 mm thick minimum virgin polyethylene film, or

b) Any other material that can be shown to meet the criteria of Paragraph 10.3.3.

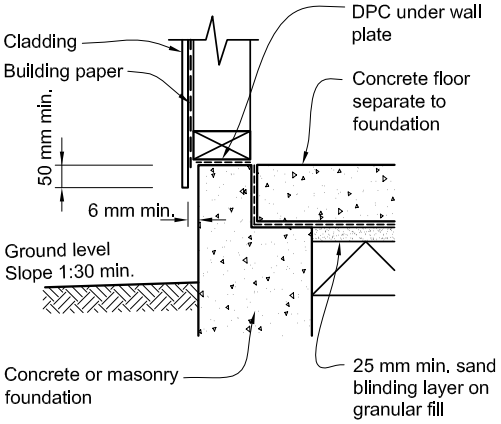
Figure 132: DPM for concrete slabs
Paragraphs 9.1.3.1, 10.3.1, 10.3.2, 10.3.3 e) and 10.3.5



(a) THICKENED EDGE SLAB POORLY DRAINED SITE



(b) THICKENED EDGE SLAB WELL DRAINED SITE



(c) CAST ON FOUNDATION ALTERNATIVE

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10.3.5 Finished floor level

The ground shall be sloped as shown in Figure 132 to carry water away from the *building*.

The height of the finished floor level above adjacent ground shall comply with Clause 7.5.2 of NZS 3604 and Table 18, and be no less than:

a) For *masonry veneer* wall *claddings*:
   i) 100 mm if ground is permanently paved, or
   ii) 150 mm if ground is unpaved.

b) For *cladding* other than *masonry veneer*:
   i) 150 mm if ground is permanently paved, or
   ii) 225 mm if ground is unpaved.

COMMENT:

It is important that ground clearances are maintained after completion and occupation of the *building*.

It is recommended that the *building* platform be formed at a level of at least 300 mm below the finished floor level, with the exterior ground sloped to carry water away from the exterior walls.

This allows landscaping and paving to be built up, while still maintaining the required clearances.

10.3.6 Protection of timber

Wall *framing* shall be separated from the concrete slab by a *damp-proof course (DPC)*.

11.0 Construction Moisture

11.1 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) Timber or other materials as a result of exposure to the weather, and

c) Concrete, mortar or plaster that is not completely cured.

11.2 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.

11.3 Measuring moisture content

11.3.1 Timber

Measurement shall be by the recommended procedure in the New Zealand Forest Research Institute publication "Measurement of moisture content of assembled timber framing".

11.3.2 Concrete floors

Measurement shall be made in accordance with BRANZ Bulletin 330 "Thin Flooring Materials – 2 – Preparation and Laying".

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12.0 Basements

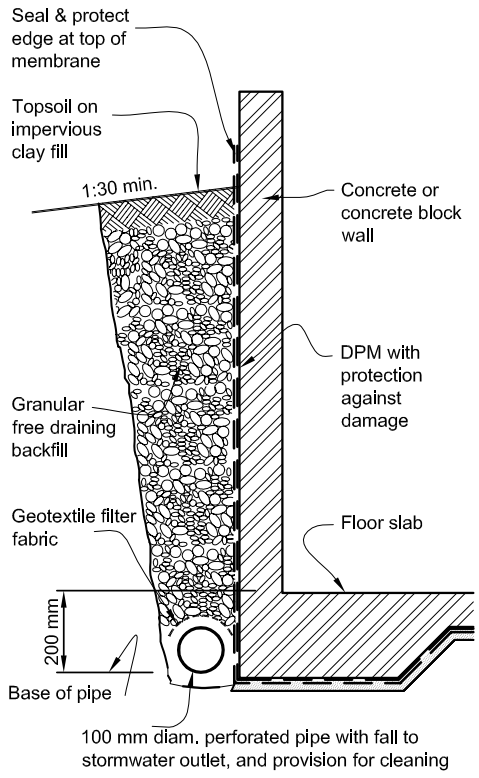
12.1 Moisture in basements

Water or water vapour shall be prevented from penetrating to the interior face of basement retaining walls, in spaces where moisture may cause damage.

COMMENT:
This applies to both *habitable* and non-*habitable spaces*. *Habitable spaces* may adjoin a non-habitable basement, and be affected by any moisture penetration.

An Acceptable Solution is the provision of a *damp-proof membrane* against the exterior face of the walls, and drainage at the base of the walls as shown in Figure 133.

Figure 133: Basement waterproofing
Paragraph 12.1



12.2 Damp-proof membranes (DPM)

A *DPM* shall be installed under the floor slab as specified in Paragraph 10.3, and applied to the buried part of the wall. The floor and wall *DPM* shall be continuous to ensure effective tanking of the buried part of the *building*.

COMMENT:
Damp-proof membranes used in basement situations are normally referred to as tanking *membranes*.

12.2.1 DPM requirements

The *damp-proof membrane* material shall:

a) Have a vapour flow resistance of no less than 90 MN s/g,

b) Have all joints and penetrations sealed,

c) Be adequately protected against damage during backfilling, and

d) If polyethylene sheet *vapour barrier*, be protected where granular surface is likely to cause intrusions into the *vapour barrier* by:
   i) surface blinding with sand to nominal minimum thickness of 25 mm, or
   ii) heavy-weight building paper.

12.2.2 DPM materials

The following are acceptable *damp-proof membrane* materials:

a) Mastic asphalt complying with BS 6925, and which is applied in at least two layers to give a *membrane* thickness of no less than 30 mm under floor slabs and 20 mm on walls,

b) Modified bituminous sheet comprising modified bitumen on a polyethylene backing, with or without layers of fabric reinforcement,

c) Synthetic rubber sheet,

d) Polyethylene sheet having minimum thickness of 0.25 mm, and

e) Liquid coatings, such as bitumen or tar emulsions, and those based on epoxies or urethanes.

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COMMENT:
When using liquid coatings, it is essential to confirm that rate and method of application will ensure that relevant *durability* is achieved. In most cases this will be 50 years. They should not be used where the manufacturer is unable to provide appropriate documentation in regard to compliance with *durability* requirements.

When using liquid coatings on concrete block walls, all joints should be concave-tooled, and be brushed free of surplus mortar.

12.3 Drainage

Subsoil drainage shall be provided to divert groundwater from behind the basement wall to an appropriate *outfall* beyond the *building*.

12.3.1 Drainage requirements

The subsoil drainage system shall:

a) Use a pipe of at least 100 mm diameter, with openings to collect water,

b) Have the subsoil pipe at the base of the wall with invert a minimum of 200 mm below floor level and pipe sloped a minimum of 1:200 to the outlet,

c) Incorporate a geotextile fabric or other filter material to prevent silting of the pipe,

d) Have access for cleaning subsoil pipe, and

e) Have, for the height of the buried wall, free draining backfill above the pipe.

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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 b), 4.2.2, 4.2.3, 4.3, 4.3.1, 4.3.3, 4.3.4, 4.3.8-10, 4.4, 7.3.2 b), 8.1.4, 8.2.4, 8.3.4.1, 8.4.3.1, 9.6.3.1, 9.6.6 d) and 9.8.5

			Durability	
Material		**Exposure**	**15 yrs**	**50 yrs**
Aluminium, copper, lead, zinc, stainless steel		Hidden	✓	✓
		Exposed to weather	✓	✓
		Sheltered	✓	✓
Aluminium-zinc coated steel AZ150 uncoated, or coated to NZS 4217		Hidden	✓	✓ (2)
		Exposed to weather	✓ (1)	✓ (4)
		Sheltered	✓ (3)	✓ (6)
Aluminium-zinc: AZ150 factory-coated to AS/NZS 2728		Hidden	✓	✓
	Type 4	Exposed to weather	✓	✓ (4)
	Type 5		✓	✓ (3)
	Type 6		✓	✓ (1)
	Type 4	Sheltered	✓ (3)	✓ (6)
	Type 5		✓ (1)	✓ (5)
	Type 6		✓	✓ (3)
Bituminous material, uPVC		Hidden	✓	✓
		Exposed to weather	✓	✘
		Sheltered	✓	✓
Butyl rubber		Hidden	✓	✓
		Exposed to weather	✓	✘
		Sheltered	✓	✘
Galvanized steel Z450 uncoated, or coated to NZS 4217		Hidden	✓	✓ (4)
		Exposed to weather	✓ (3)	✓ (6)
		Sheltered	✓ (5)	✓ (3)
Galvanized steel: Z275 factory-coated to AS/NZS 2728		Hidden	✓	✓
	Type 4	Exposed to weather	✓ (1)	✓ (6)
	Type 5		✓	✓ (4)
	Type 6		✓	✓ (1)
	Type 4	Sheltered	✓ (3)	✓ (6)
	Type 5		✓ (1)	✓ (6)
	Type 6		✓	✓ (4)
FIXINGS: Aluminium, bronze, monel and stainless steel		Hidden	✓	✓
		Exposed to weather	✓	✓
		Sheltered	✓	✓
FIXINGS: Hot-dipped galvanized steel to AS/NZS 4680		Hidden	✓	✓ (2)
		Exposed to weather	✓ (2)	✓ (6)
		Sheltered	✓ (4)	✘
Screws to AS 3566: Part 2	Class 3	Hidden	✓	✓ (2)
	Class 4		✓	✓
	Class 3	Exposed to weather	✓ (2)	✓ (6)
	Class 4		✓	✓ (4)
	Class 3	Sheltered	✓ (4)	✘
	Class 4		✓ (2)	✘

LEGEND: ✓ Suitable for *durability* requirement in all NZS 3604 exposure zones, including sea-spray zones
✘ Not suitable for *durability* requirement
✓ **(no.)** Conditionally suitable – refer relevant acceptable zone number

Acceptable zones as per NZS 3604: (1) Zones 1, 2, 3 and 4 (2) Zones 1, 2 and 3 (3) Zones 2, 3 and 4 (4) Zones 2 and 3 (5) Zones 3 and 4 (6) Zone 3

Note: *Durability* may be improved by regular washing of sheltered materials.
The term "sheltered" is as defined in AS/NZS 3604, Figure 4.2.
The term "hidden" is defined as concealed behind another element that would need to be removed to allow monitoring of performance or maintenance. A hidden *flashing* may be exposed to H_2S in geothermal areas, but not to salt spray in coastal zones. If exposed to salt spray, it is classified as "sheltered".

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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 c), 4.2.4, 4.4, 4.5.2 a), 8.2.4, 8.4.11 a) and c), 8.4.11.1 b), 9.6.7 f) and 9.8.5

	Aluminium, anodised or mill-finish	Aluminium, coated [1]	Butyl rubber	CCA-treated timber [2]	Cedar	Cement plaster (uncoated)	Ceramic tiles (cement grout)	Clay bricks (cement mortar)	Concrete carbonated (unpainted)	Concrete green (unpainted)	Copper/brass	Fibre cement (unpainted)	Glass	Glazed roof tiles	Lead (including lead-edged)	Plastics	Stainless steel	Steel coil-coated	Steel, galvanized (unpainted)	Zinc (unpainted)	Zinc/aluminium (unpainted)
Aluminium, anodised or mill-finish	✓	✓	✓	✘	✓	✘	✘	✘	✓	✘	✘	✘	✓	✓	✘	✓	B	✓	✓	✓	✓
Aluminium, coated [1]	✓	✓	✓	B	✓	✘	✘	✘	✓	✘	✘	✘	✓	✓	B	✓	B	✓	✓	✓	✓
Butyl rubber	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘
CCA-treated timber [2]	✘	B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	B	✘	✘	✘
Cedar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘
Cement plaster (uncoated)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✓	✓	✓	✓	✓	✘
Ceramic tiles (cement grout)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Clay bricks (cement mortar)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘
Concrete old (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Concrete green (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✓	✓	✘	✘	✘	✘
Copper/brass	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	B	✓	B	✘	✘	✘	✘
Fibre cement (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Glazed roof tiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lead (including lead-edged) unpainted	✘	B	✓	✓	✓	✘	✓	✓	✓	✘	B	✓	✓	✓	✓	✓	B	B	B	B	✘
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stainless steel	B	B	✓	✓	✓	✓	✓	✓	✓	✓	B	✓	✓	✓	B	✓	✓	B	✘	✘	B
Steel coil-coated	✓	✓	✓	B	✓	✓	✓	✓	✓	✘	✘	✓	✓	✓	B	✓	B	✓	✓	✓	✓
Steel, galvanized (unpainted)	✓	✓	✓	✘	✘	✓	✓	✓	✓	✘	✘	✘	✓	✓	B	✓	✘	✓	✓	✓	✓
Zinc (unpainted)	✓	✓	✓	✘	✘	✓	✓	✓	✓	✘	✘	✘	✓	✓	B	✓	✘	✓	✓	✓	✓
Zinc/aluminium (unpainted)	✓	✓	✓	✘	✘	✘	✘	✘	✓	✘	✘	✘	✓	✓	✘	✓	✘	✓	✓	✓	✓

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 1.

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 c), 4.2.4, 4.4, 4.5.2 a), 8.2.4, 8.4.11 a) and c), and 9.8.5

Material that water flows from \ Material that water flows onto	Aluminium, anodised or mill-finish	Aluminium, coated [1]	Butyl rubber	CCA-treated timber [2]	Cedar	Cement plaster (uncoated)	Ceramic tiles (cement grout)	Clay bricks (cement mortar)	Concrete carbonated (unpainted)	Concrete green (unpainted)	Copper/brass	Fibre cement (unpainted)	Glass	Glazed roof tiles	Lead (including lead-edged)	Plastics	Stainless steel	Steel coil-coated	Steel, galvanized (unpainted)	Zinc (unpainted)	Zinc/aluminium (painted)	Zinc/aluminium (unpainted)
Aluminium, anodised or mill-finish	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Aluminium, coated [1]	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✘
Butyl rubber	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘
CCA-treated timber [2]	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘
Cedar	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘
Cement plaster (uncoated)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✘	✓	✓	✓	✘	✘	✘	✘
Ceramic tiles (cement grout)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✘	✘	✘	✘
Clay bricks (cement mortar)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✘	✘	✘	✘
Concrete old (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✓	✓	✓	✓
Concrete green (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✘	✓	✓	✘	✘	✘	✘	✘
Copper/brass	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘
Fibre cement (unpainted)	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	A	✓	✓	✓	✓	✓	✘	✘	✘	✘
Glass	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Glazed roof tiles	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Lead (including lead-edged) unpainted	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘
Plastics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Stainless steel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Steel coil-coated	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓
Steel, galvanized (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Zinc/aluminium (unpainted)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✓	✓

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.

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Table 23: Properties of roof underlays and building wraps
Paragraphs 8.1.5, 8.2.3, 8.3.6, 8.4.7, 9.1.4, 9.1.7, 9.1.8.2 a), 9.2.3 c), 9.3.3, 9.3.5.1, 9.4.2, 9.4.3. 9.5.3. 9.6.8.1 9.6.9.1, 9.6.9.2 a) and b), 9.7.3, 9.8.3. and 9.9.4

Category	Application	Absorbency	Vapour resistance	Water resistance	pH of extract	Shrinkage	Mechanical
Roof underlay (includes bitumen and fire-retardant paper-based products)	All roofs. *Direct fixed* non-absorbent *claddings* (1)	≥100 g/m² AS/NZS 4201: Part 6	≤ 7 MN s/g ASTM E96 B	≥ 100 mm AS/NZS 4201: Part 4	≥ 6.0 and ≤ 9.0	≤ 0.5% AS/NZS 4201: Part 3	Edge tear and tensile strength to AS/NZS 4200
Wall wrap (includes building papers and synthetic wall wraps)	All *cavity walls* and *direct fixed* absorbent *claddings* (2) (e.g. timber, fibre cement etc)	No requirement	≤ 7 MN s/g ASTM E96 B	≥ 20 mm AS/NZS 4201: Part 4	≥ 6.0 and ≤ 9.0	≤ 0.5% AS/NZS 4201: Part 3	Edge tear and tensile strength to AS/NZS 4200
Rigid sheathing (plywood (3) and fibre cement sheet)	*Direct fixed* non-absorbent *claddings* (4)	≥100 g/m² AS/NZS 4201: Part 6	≤ 7 MN s/g ASTM E96 B	≥ 20 mm AS/NZS 4201: Part 4	≥ 6.0 and ≤ 9.0	NA	NA
Rigid sheathing (plywood (3) and fibre cement sheet)	*Direct fixed* absorbent *claddings* and *claddings* over a cavity (4)	No requirement	≤ 7 MN s/g ASTM E96 B	≥ 20 mm AS/NZS 4201: Part 4		NA	NA
Air barrier	Where no internal *linings*	≥100 g/m²	≤ 7 MN s/g ASTM E96 B	≥ 20 mm AS/NZS 4201: Part 4	≥ 6.0 and ≤ 9.0	≤ 0.5% AS/NZS 4201: Part 3	Edge tear strength AS/NZS 4200 90N Air resistance BS 6538: Part 3: ≥ 0.1 MN s/m³
DPC/DPM	All applications – there will be separate thicknesses depending on use		≥ 90 MN s/g ASTM E96				

NOTE:
(1) Used where necessary directly behind (and so in contact with) profiled metal wall *cladding.*
(2) Not used in contact with profiled metal wall *cladding.*
(3) Plywood to be treated in accordance with NZS 3602.
(4) Bitumen-based products shall not be used in direct contact with LOSP-treated plywood.

Table 24: Fixing selection for wall claddings

Refer to Table 4.3 in NZS 3604 to determine suitable fixing types for the *building* location and B2 Durability requirement.

COMMENT: Some manufacturers may require more *durable* fixings than those specified in NZS 3604 to maintain product warranties.

Paragraphs 9.4.3.1, 9.4.4.3, 9.4.5.2, 9.5.3.1, 9.7.3.1, 9.8.3.1, 9.9.4.1 and 9.9.4.1 a)

Joint	Length (mm) x diameter (mm) and type	Minimum framing penetration	Fixing pattern	Requirements
Cavity battens				
Battens to *framing*	NA	NA	NA	Battens will be fixed by the *cladding* fixings, which will penetrate the wall *framing*. Battens will therefore need only temporary fixing until the *cladding* is fixed.
Stucco plaster				
Rigid backing to *framing*	60 x 2.5 FH nail	35 mm	150 mm centres to sides and 300 mm centres in middle	
Metal lath to *framing*	40 x 2.5 FH nail or 40 x 2.8 FH nail	35 mm	150 mm centres	
Fibre cement weatherboards				
Weatherboard DIRECT FIXED	50 x 2.8 fibre cement nail	35 mm	Single fixing 20 mm above lower board, through both thicknesses	
Weatherboard OVER CAVITY	75 x 3.15 fibre cement nail	35 mm	as above	
Timber weatherboards: paint finish DIRECT FIXED				
Horizontal bevel-back	75 x 3.15 JH nail	35 mm	Single fixing 10 mm above top of lower board	
Horizontal rebated bevel-back	60 x 2.8 JH nail	35 mm	as above	
Horizontal rusticated	60 x 2.8 JH nail	35 mm	as above	
Vertical shiplap	60 x 2.8 JH nail	35 mm	Single fixing 10 mm from side lap (40 mm from edge of board)	*Dwangs* at maximum 480 mm centres.
Board and batten: board	60 x 2.8 JH nail	35 mm	Single fixing in centre or nails clenched over each side	as above
Board and batten: batten	75 x 3.15 JH nail	35 mm	Single fixing in centre of batten	as above
Timber weatherboards: paint finish OVER CAVITY				
Horizontal bevel-back	90 x 4.0 JH nail	35 mm	Single fixing 10 mm above top of lower board	
Horizontal rebated bevel-back	75 x 3.15 JH nail	35 mm	as above	
Horizontal rusticated	75 x 3.15 JH nail	35 mm	as above	
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.	

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Table 24: Fixing selection for wall claddings *(continued)*

Joint	Length (mm) x diameter (mm) and type	Minimum framing penetration	Fixing pattern	Requirements
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)	*Dwangs* at maximum 480 mm centres
Board and batten: board	60 x 3.2 RH annular grooved nail	30 mm	Single fixing in centre of board	as above
Board and batten: batten	75 x 3.2 RH annular grooved nail	30 mm	as above	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				**Refer Paragraph 9.6.8**
Horizontal profiled metal: OVER CAVITY				**Refer Paragraph 9.6.9**
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	40 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: stained or bare finish OVER CAVITY				
Plywood	60 x 3.2 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	To *cavity battens* only	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* is varied, length shall be adjusted accordingly.	

Table 24: Fixing selection for wall claddings *(continued)*

Joint	Length (mm) x diameter (mm) and type	Minimum framing penetration	Fixing pattern	Requirements
Fibre cement sheet: joints expressed DIRECT FIXED				
Sheet	40 x 2.5 fibre cement nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
External cover batten	65 x 3.15 JH nail	30 mm	Single fixing in centre of batten	
Fibre cement sheet: joints expressed OVER CAVITY				
Sheet	60 x 2.8 fibre cement nail	30 mm	150 mm centres to sides, 300 mm centres in middle	
External cover batten	65 x 3.15 JH nail	To *cavity battens* only	Single fixing in centre of batten	
Fibre cement sheet: flush-finished				
Sheet DIRECT FIXED	40 x 2.8 fibre cement nail		150 mm centres to sides, 300 mm centres in middle	
Sheet OVER CAVITY	60 x 2.8 fibre cement nail		as above	
EIFS				
40 mm polystyrene sheet DIRECT FIXED	75 x 3.55 nail	30 mm	300 mm centres, except within 1.5 m of an external corner	
40 mm polystyrene sheet OVER CAVITY	90 x 4.0 nail	30 mm	as above	
		***EIFS* corner zone spacing**		
		Wind zone	**Spacing (mm)**	
		Low-medium	200	
		High	150	
		Very high	150 with 40 mm plastic washer	
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.	

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EXTERNAL MOISTURE

Index E2/VM1 & AS1

All references to Verification Methods and Acceptable Solutions are preceded by **VM** or **AS** respectively.

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