# build

BRANZ

Supplement

# The RIGHT STUFF

# Flashings

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# QUICKFLASH

READY-MADE FLASHINGS

BRANZ Appraised
Appraisal No.688 (2011)


**The Most Comprehensive Wall Flashing System**

***Details and Downloads available from:***

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**Available through all Building Supply Stores**

# Build Supplement

# Flashings

Sections






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## Section 1:
# Overview

# THE ORIGINAL EDGE FLASHING FOR METAL ROOFS

15 YEAR DURABILITY

- **EXTREMELY MALLEABLE**
  Flashguard is so easy to install, it can be dressed down using finger pressure only, so there is no need for special tools. There is no need for hammering into roof profile, no need for cutting or forcing into shape and hence no risk of scratching, denting or paint damage to the roof.
- **VERY QUICK TO INSTALL**
  Because of the ease of fitting Flashguard, reduced installation time will result in major savings in labour costs.
- **COLOUR MATCHED**
  Flashguard is made in over 40 colours available to match the many colours available from metal roof manufacturing suppliers.
- **WEATHERPROOF**
  The special backing provides a weather sealing membrane with excellent elastic characteristics and resistance to moisture. Flashguard perfectly hugs the contour of the roof profile, preventing birds from gaining access.
- **COMPATIBLE**
  Compatible with Zincalume®, aluminium and galvanised steel roofing materials, pressed metal tiles and long run metal roofs.
- **POTABLE WATER**
  Flashguard is approved for installation when collecting potable water off the roof structure.

## FLASHGUARD Z

- Proven 20 years in the field
- Codemark certification CMA-CM40106

## FLASHGUARD VZ

- Allows passive ventilation through exposed expansion points on the weathering surface of the edge.
- Protected leading edge prevents abrasion against roofing eliminating possible roof damage during service and installation.
- Codemark certification CMA-CM40215

CODEMARK

NEW ZEALAND MADE

Designed and manufactured in NZ by DLM from imported materials

- Aluminium Mill Finish
- BasaltBase™
- Bone White
- Cloud
- Dark Grey Primer
- Desert Sand
- Ebony
- FernFrond™
- FlaxPod™
- Grey Flannel
- Greyfriars
- Gull Grey
- Ironsand
- Karaka
- KowhaiGlow™
- Lichen
- Light Grey Primer
- Lignite
- Mist Green
- New Denim Blue
- Nimbus
- Permanent Green
- Pioneer Red
- Rivergum
- SandScape™
- Sandstone Grey
- Scoria
- Slate
- Slate Blue
- Smokey
- Smooth Cream
- Stone
- Storm Blue
- TernStyle™
- Terracotta
- Threadbow White
- Thunder Grey
- Titania
- TuiTuft™
- Weather Copper
- Windsor Grey
- Zinc Metallic

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# 1.1 Introduction

For many years, *Build* magazine has been providing comprehensive advice on the design and installation of flashings in buildings. The best of those articles have been compiled in this *Build* supplement to provide a valuable reference for designers, builders and building officials.

**FLASHINGS PLAY** a vital role in preventing external moisture from getting through the building envelope (called primary defence) and ensuring that any moisture that does get in can drain out again (called secondary defence).

Flashings are defined in New Zealand Building Code clause E2 *External moisture* as 'component[s] formed from a rigid or flexible waterproof material that drains or deflects water back outside the cladding system'.

### *Required in many locations*

Flashings are typically required at:

- roof junctions and edges such as barges and gutters
- changes in roof pitch such as ridges and hips
- roof and wall penetrations such as windows, doors, meter boxes, skylights, flues and pipes
- roof/wall intersections such as soffits, parapets and balustrades
- vertical and horizontal junctions between cladding materials
- intersections between different building elements.

### *Building Code requirements*

Flashings must meet the requirements of Building Code clauses:

- B2 *Durability*
- E2 *External moisture.*

#### *Clause B2* Durability

Clause B2 *Durability* covers flashing material selection, design and installation.

#### *Clause E2* External moisture

The clauses in E2 *External moisture* that are relevant to flashings state that:

- roofs and exterior walls must prevent the penetration of water that could cause undue dampness, damage to building elements or both – E2.3.2
- concealed spaces and cavities in buildings must be constructed in a way that prevents external moisture being accumulated or transferred and causing condensation, fungal growth or the degradation of building elements – E2.3.5.

Acceptable Solution E2/AS1 to clause E2 provides guidance on the selection and design of roof and external wall flashings. E2/AS1 is available online from the Ministry of Business, Innovation and Employment (MBIE) website www.building.govt.nz.

#### *Alternative method*

When applying for a building consent for buildings outside the scope of E2/AS1, flashing detailing must be submitted as an alternative method. Supporting information may be sourced from:

- Acceptable Solution E2/AS1
- NZ Metal Roofing Manufacturers *NZ Metal Roof and Wall Cladding Code of Practice* details
- BRANZ Details.

### *Selecting flashing materals*

When selecting flashing materials, consider:

- the durability requirements of Building Code clause B2
- the environment and specific exposure conditions – refer to E2/AS1 Table 20
- compatibility with surrounding materials – refer to E2/AS1 Table 21 and Table 22
- thermal movement and limitations on flashing lengths for given materials and colours
- the suitability of flashings for roofs where water is collected.

Under E2/AS1, the materials that may be used for flashings are:

- uPVC – minimum 0.75 mm thick
- aluminium – minimum 0.7 mm thick
- galvanised steel – minimum 0.55 mm thick
- aluminium/zinc alloy-coated steel – minimum 0.55 mm thick
- stainless steel – minimum 0.45 mm thick
- copper – minimum 0.5 mm thick
- zinc – minimum 0.7 mm thick
- lead – minimum mass of 17 kg/m$^2$
- butyl rubber or EPDM flashing – minimum 1 mm thick
- bituminous flashings – used in accordance with E2/AS1 Table 20 and in concealed applications only.

# 1.2 Flashings keep water out

A flashing is a folded length of metal that provides a weathertight cover at junctions in and between walls and roofs. Getting flashings right is a good start towards constructing a weathertight building.

**FLASHINGS ARE** designed to stop water entering the building and should be designed to deflect water away. They are most commonly folded out of a coil or flat sheet of 0.55 mm base metal thickness (BMT) in the same material and paint finish as the roof. The colour can either match or contrast with the roof or wall.

On larger projects above 200 m², it is normal to order the flashing coil at the same time as the roofing coil, which ensures coatings and colours match.

The steel flashing coil has a tensile strength of 300 MPa, which allows the metal to bend without splitting, whereas the steel roofing coil has a higher tensile strength of 550 MPa.

### *Folding flashings*

Roofing manufacturers, installers and plumbers all use folders to bend the shapes of the flashings. Flashings are folded to customer orders and requirements. They are not stocked as their shapes are difficult to store and are prone to damage. Most shapes can be folded up, provided the shape has a dimension not tighter than 10 mm. Typically, tighter folds require the shorter 2.4 m brake press folder.

Plumbers commonly make flashings from flat sheet supplied in 2.4 m long by 1.2 m wide sheets, which suit the shorter 2.4 m long folders.

**Junctions where flashings are required.**

Roofing manufacturers cut off a coil strip in 6 m or 8 m lengths and usually 1.2 m wide to suit the longer folders of 6 and 8 m.

### *Flashing use*

Flashings are needed in any situation where the cladding has been cut or terminated, including:

- barges and ridges
- around roof edges
- as aprons under cladding on an upper storey that comes out over a lower roof
- to seal pipe penetration holes through a roof
- walls around door and window heads, sills and sides.

Folded ridges are used along the centre ridge of a building when rib heights of the roof profile are higher than 30 mm, typically on larger commercial roofs.

### *Using wide or long flashings*

Longer lengths minimise end joints in flashings. Lengths need to be sealed together with a neutral-cure silicone sealant and fixed together with rivets. Under E2/AS1, allowances for thermal expansion and contraction must be made in lengths over 18 m or over 12 m long where darker colours or aluminium have been used.

Where flashings require a total girth over 1.2 m wide, the pieces must be lapped and sealed together on site. Care is needed handling these larger widths as damage increases with the wider, more complex shapes. Wider flashings installed horizontally must also be installed over a solid support to prevent the flashing deflecting and holding water.

### *Quality installation, quality building*

Widths of flashings vary depending on their location, and the minimums are outlined in New Zealand Building Code Acceptable Solution E2/AS1 Table 7. Typically, they all cover two ribs down the roof or a minimum 130 mm along the top of the sheet in a medium wind zone.

Top edges of flashing upstands are typically finished with a hook or hem to restrict capillary water rises. Flashing downturns are finished with a kick-out, or a bird's beak. Roof flashings can be manufactured with soft edging crimped on, or for profiles with higher rib heights, they can be scribed and cut on site around the profile ribs.

Cut edges must avoid contact with concrete or plaster work by use of a separation strip such as closed-cell foam or butynol.

### *Computer-driven folders*

A new generation of folders, called RAS folders, are now available. The shapes and dimensions to be folded are loaded into the computer of the machine. A flat sheet cut to the required girth is loaded, and the folder automatically folds the intricate shape that has been loaded.

This new technology eliminates any human error in the measurement of the folds and is hands-free. It allows manufacturers to fold any shape accurately, removes the limits on shapes imposed by traditional folders and is all performed safely.

# 1.3 Cladding and flashing materials

Table 20 of Building Code Acceptable Solution E2/AS1 is often used to select building materials. Here are a few pointers to help you intrepret the table correctly.

**E2/AS1 TABLE 20** is used to choose building envelope materials that are suitable for their end use, location and environment. The table covers claddings and flashings first, then fixings. Materials are listed under these headings, but you have to work through the rows and columns to find the appropriate materials for a particular situation (see Figure 1). There is a section of numbered explanatory notes at the end of Table 20. Where an item in the table has a number after it, refer to that number in the notes.

### *How to use Table 20*

Start with some questions:

- Step 1: Where will the material be positioned in the building – hidden, exposed or sheltered?
- Step 2: What durability is required – 15 or 50 years?
- Step 3: What acceptable exposure zone applies from NZS 3604:2011 – B, C, D or E?

Materials can be used that have the acceptable exposure zone (B, C, D or E) listed in the table where the required durability (15 or 50 years) meets the correct exposure (hidden, exposed or sheltered).

### *Hidden, exposed or sheltered*

The second column of Table 20 – exposure – refers to where the building element is located:

- 'Hidden' elements are concealed behind another element and are not visible or accessible.
- 'Exposed' elements are visible and rain washed.
- 'Sheltered' elements are visible but not rain washed.

Use the sheltered designation for:

- elements that may be either sheltered or exposed (see Note 2)
- all steel-based wall claddings (see Note 8 in the table)
- hidden steel-coated elements located in a ventilated cavity in zones D and E (exposed to salt air) (see Note 9 in the table).

### *15 or 50 years durability*

Hidden elements require not less than 50 years durability under the Building Code. Use the far right column – 50 years – for choices.

Claddings and exposed and sheltered flashings require not less than 15-year durability, so use the 15 years column.

### *Acceptable exposure zones*

The acceptable exposure zones column of E2/AS1 Table 20 contains letters – B, C, D and E. These are atmospheric corrosivity categories based on the corrosion rates of mild steel in NZS 3604:2011 *Timber-framed buildings* ➤

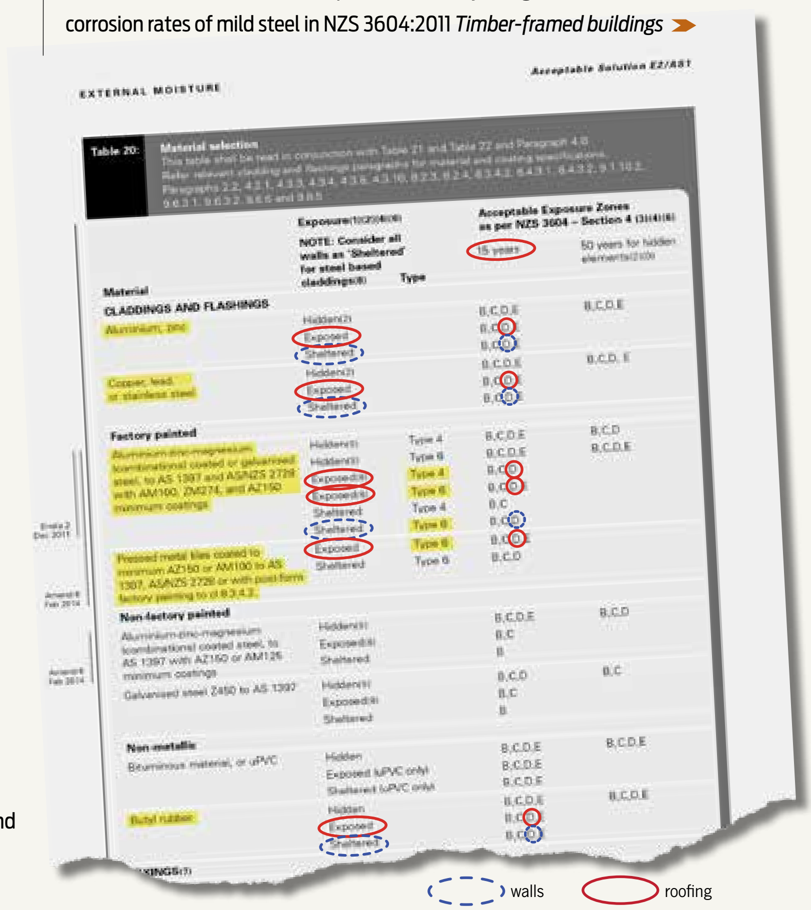



**Figure 1** **Working through E2/AS1 Table 20 to find materials that can be used for roofs and walls in zone D. E2/AS1 is available from the MBIE website at www.building.govt.nz.**

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

The zones are B (low), C (medium), D (high) and E (severe marine – breaking surf beachfronts). These use the limits outlined in NZS 3604:2011.

Before confirming material selection, designers should check with metal suppliers that the material is suitable for the environment it is to be used in so that the warranty will be valid.

### Type 4 and type 6

Prepainted and prefinished metal products are divided into types defined in AS/NZS 2728:2013 Table 1.1 related to corrosion rates and the severity of application. Table 20 includes two of these types:

- Type 4 for high corrosive or tropical environments.
- Type 6 for very high geothermal and marine environments.

The types may also have different scratch resistance and blistering requirements.

### Example in zone D

Follow these examples to find suitable materials for a structure in zone D.

#### Roof

Roofing materials are considered exposed (see Note 8) and require a durability of not less than 15 years.

Suitable materials in Table 20 for the roof in zone D (see Figure 1) include:

- aluminium, zinc, copper, lead, stainless steel
- factory-painted aluminium-zinc-magnesium (combinations) coated or galvanised steel to AS 1397 and AS/NZS 2728 with AM100, ZM274 and AZ150 minimum coatings (type 4 or 6)
- pressed metal tiles, coated to minimum AZ 150 or AM100 to AS 1397, AS/NZS 2728 or with post-form factory painting to clause 8.3.4.2 (type 6 only)
- non-factory coated option – not permitted
- non-metallic option – butyl rubber.

The base metal thickness (BMT), profiles and roof pitches for metal roofing and other permitted roofing materials are found in E2/AS1 Section 8.

#### Walls

Table 20 considers all walls as sheltered for steel-based claddings (see Note 8) and requires a durability of not less than 15 years.

Suitable materials in Table 20 for walls in zone D (see Figure 1) include:

- aluminium, zinc, copper, stainless steel
- factory-painted aluminium-zinc-magnesium (combinations) coated or galvanised steel to AS 1397 and AS/NZS 2728 with AM100, ZM274 and AZ150 minimum coatings (type 6 only)
- non-factory coated option – not permitted.

The BMT, profiles and application requirements (direct-fixed or on a cavity) for profiled metal wall claddings are covered in E2/AS1 section 9.6.

Where roofs and walls are different materials, check E2/AS1 Tables 21 and 22 for compatibility in contact and run-off.

#### Flashings

In zone D, the materials for flashings that are not hidden must have a durability of not less than 15 years and are considered sheltered. Options include:

- aluminium, zinc, copper, lead, stainless steel
- factory-painted aluminium-zinc-magnesium (combinations) coated or galvanised steel to AS 1397 and AS/NZS 2728 with AM100, ZM274 and AZ150 minimum coatings (type 6 only)
- non-metallic flashings – uPVC, bituminous material and butyl rubber.

Hidden flashings require a durability of not less than 50 years (see Note 2).

See E2/AS1 section 4 for flashing material types and minimum thicknesses, and always check compatibility of flashing materials with materials in contact and run-off (see E2/AS1 Tables 21 and 22).

**Note** E2/AS1 can be downloaded for free from the MBIE website at www.building.govt.nz.

# Flashing cross-falls

## E2/AS1 specifies a minimum cross-fall for some flashings. Do you know which ones and how much?

**FOR SOME FLASHINGS,** E2/AS1 specifies a minimum cross-fall to ensure water drains from the surface. Typically these are a minimum of:

- 15º for a head flashing to a window
- 5º for a balustrade or parapet cap flashing
- 15º for inter-storey flashings
- 10º for sill flashings to stucco and horizontal profiled metal.

### Sill flashing on profiled metal

For the sill flashing to the top of direct-fixed vertical profiled metal terminating below a window, E2/AS1 shows a slope to the part of the flashing capping the cladding. However, no angle is given. A minimum cross-fall of 5º is suggested to ensure water drainage.

### Raking apron flashings

It is the same for raking apron flashings. E2/AS1 shows a slope, but the amount of slope is not stated.

While a cross-fall may appear unnecessary because of the roof slope, without it, water draining down the surface of the flashing can be trapped and held by the metal stop-end. When water is trapped with dirt and dust, the potential for corrosion is created.

BRANZ recommends a 5º minimum cross-fall for raking apron flashings.

# 1.4 Sizing E2 roof flashings

It can be difficult to determine the critical dimensions for roof flashings in E2/AS1. We step through Table 7 to help clarify confusion when working out the minimum sizes of flashings.

**THE REQUIRED DIMENSIONS** of a roof flashing are determined by three factors – wind zone, roof pitch and roofing material. Wind zone has the most significant influence on flashing dimensions, especially for sites in extra high wind zones.

### *Look to E2/AS1*

New Zealand Building Code Acceptable Solution E2/AS1 Table 7 prescribes the critical dimensions for flashings. These are in terms of the:

- cover – 'X' for transverse apron flashings (see Figure 2) and 'Y' for barge flashings parallel to the roof (see Figure 3)
- downstand – 'Z' for verge flashings and cappings (see Figure 3).

The dimensions given exclude any soft edge, turn-down or drip edge.

### *What are the situations in Table 7?*

In Table 7, Notes 2–3a define Situations 1–3 which are in columns 4–6 of the Table (see Figure 4):

- For low, medium or high wind zones where the roof pitch is 10° or more, use the minimum dimensions given for Situation 1 (column 4).
- For any roof in a very high wind zone and for roofs with a pitch of less than 10° in low, medium or high wind zones, use the minimum dimensions given in Situation 2 (column 5).
- For all roofs in extra high wind zones, use the minimum dimensions given in Situation 3 (column 6). Note that a change of roof pitch in a roof plane is not permitted in an extra high wind zone.

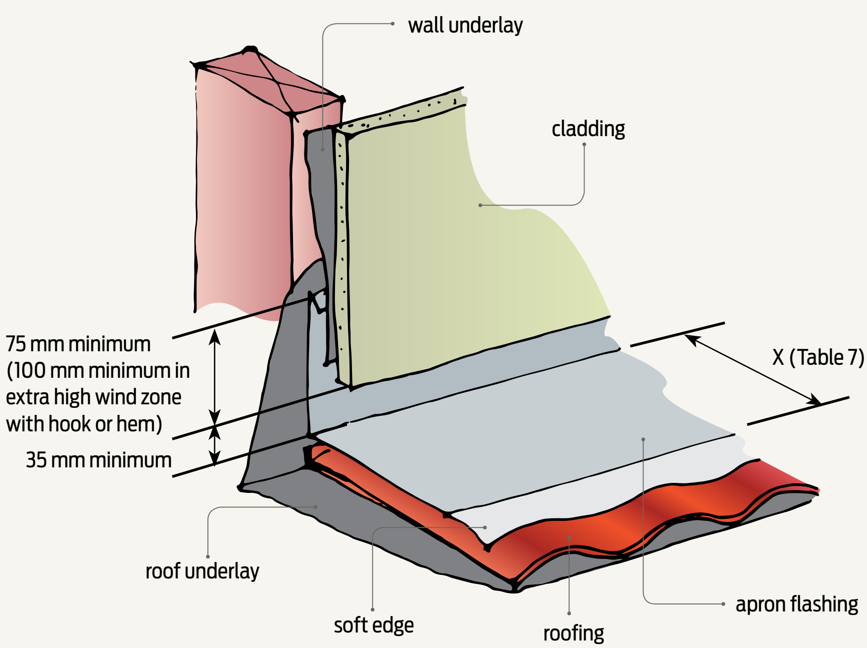



**Figure 2** **Transverse apron flashing.**

### *Working out X, Y and Z dimensions*

Work through these steps to determine X and Z dimensions for a corrugated profile roof with a pitch of 8° in a medium wind zone:

1. Check Notes 2–3a on the second page of Table 7 to select the correct situation (see Figure 4). Note 3 defines this roof as Situation 2.
2. Read down Situation 2 (column 5) on the first page of Table 7 (see Figure 5) and across the relevant rows to find the minimum dimensions:
   - For X, read across the row 'Aprons:general: Transverse flashing over roofing that gives 200 mm minimum, excluding the soft edge (Note 4)
   - For Z, read across the row 'Barges: Overlap to barge board'. This gives 70 mm minimum, excluding drip edge (Note 8).

Y is governed by the geometry of the roofing material. For this corrugated profile roof, the flashing must cover two crests and finish in the next trough (see Figure 3).

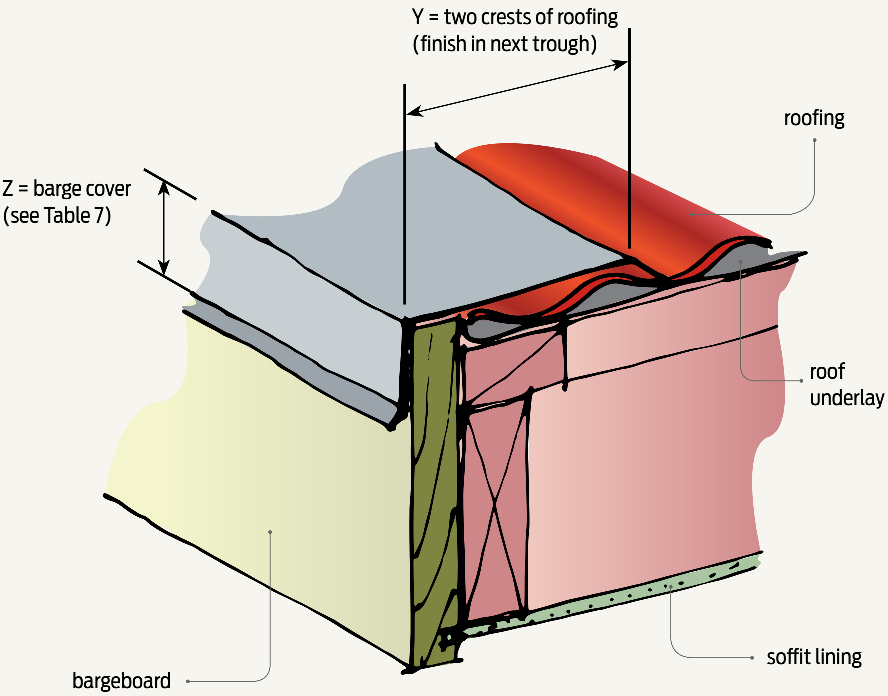



**Figure 3** **Barge flashing.**

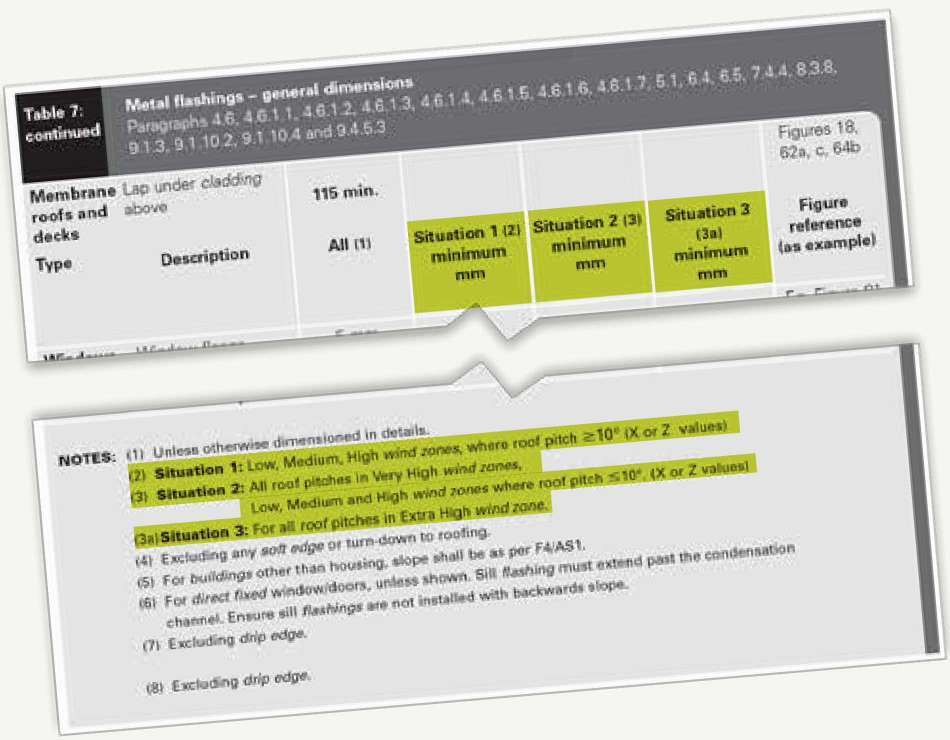


**Table 7: continued** — **Metal flashings – general dimensions**
Paragraphs 4.6, 4.6.1.1, 4.6.1.2, 4.6.1.3, 4.6.1.4, 4.6.1.5, 4.6.1.6, 4.6.1.7, 5.1, 6.4, 6.5, 7.4.4, 8.3.8, 9.1.3, 9.1.10.2, 9.1.10.4 and 9.4.5.3

| Type | Description | All (1) | Situation 1 (2) minimum mm | Situation 2 (3) minimum mm | Situation 3 (3a) minimum mm | Figure reference (as example) |
|---|---|---|---|---|---|---|
| Membrane roofs and decks | Lap under cladding above | 115 min. | | | | Figures 18, 62a, c, 64b |

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

**Figure 4** **New Zealand Building Code clause E2/AS1 Table 7 — selecting the situation.**

### *Edge treatment of flashings*

The exposed bottom edge of a flashing must have an edge treatment to stiffen the flashing and form a drip edge, allowing positive drainage. Acceptable edge treatments are:

- kick-out
- bird's beak (see Figure 6).

In an extra high wind zone, flashing upstands must:

- have hems or hooks
- be 25 mm higher than given by Table 7 or the relevant figures.

In other wind zones, the top edge of the flashing may have:

- a hem or hook with upstand dimensions as shown in the relevant figures
- no hem or hook but upstand dimensions 25 mm higher than shown in the relevant figures.

### *Range of roofing materials covered*

E2/AS1 includes typical details for a selection of roofing materials, which are referred to in ection 8.

#### *Profiled metal*

This is corrugated, trapezoidal or trough section:

- transverse apron flashing (X) – see E2/AS1 Figure 44b
- parallel apron flashing (Y) – see Figure 48a–c
- barge flashing (Y and Z) – see Figure 47a–c
- change in pitch (X) – see Figure 44a (not permitted in extra high wind zone)
- roof/wall ridge (verge) flashing (X and Z) – see Figure 45b.

For corrugate profiled roofing, Y must be large enough to cover two crests of the roofing, finishing in the next trough. Some combinations of roof dimension and roofing profile can result in large flashings, which may be a consideration when choosing the roofing profile.

### *Pressed metal tiles*

Refer to E2/AS1 Figures 35a, 35b and 36b. Flashings are generally supplied by the tile manufacturer and must meet the minimum dimensions of the figures.

Where an overflashing is used, ensure:

- the minimum cover to the tile upstand is 35 mm
- the minimum cover behind the cladding is 75 mm
- a 5 mm minimum clearance is required between the bottom of the cladding and the overflashing.

For a barge flashing, dimension Z relates to cover to the bargeboard only. The total depth of the flashing will need to be larger to allow a minimum cover of 25 mm to the 40 mm tile edge upstand.

### *Masonry tiles*

Refer to E2/AS1 Figure 26. X and Y are not specifically shown.

Minimum cover is given as:

- 150 mm for the transverse flashing
- 150 mm for the parallel flashing, and it must cover at least one crest, finishing in a trough.

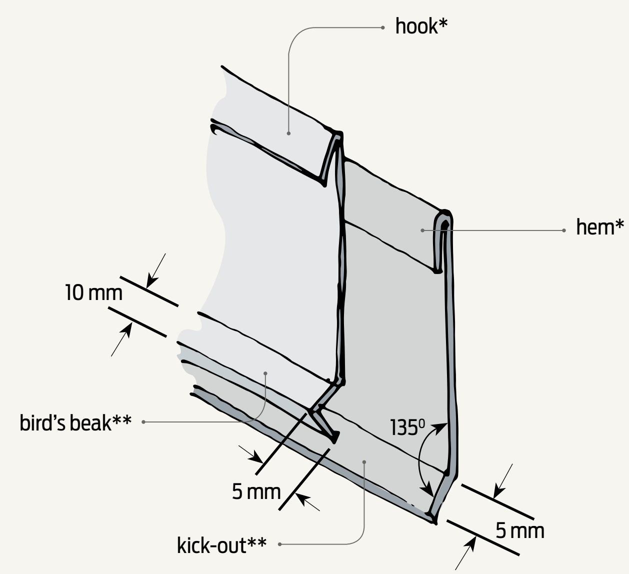
There must be 35 mm minimum clearance between flashing and cladding and 75 mm minimum upstand behind the cladding (total upstand of 110 mm).

**For more** All Building Code clauses are freely available at www.building.govt.nz/building-code-compliance/.

**Table 7: Metal flashings – general dimensions**
Paragraphs 4.6, 4.6.1.1, 4.6.1.2, 4.6.1.3, 4.6.1.4, 4.6.1.5, 4.6.1.6, 4.6.1.7, 5.1, 6.4, 6.5, 7.4.4, 8.3.8, 9.1.3, 9.1.10.2, 9.1.10.4 and 9.4.5.3

| Type | Description | All (1) | Situation 1 (2) minimum mm | Situation 2 (3) minimum mm | Situation 3 (3a) minimum mm | Figure reference (as example) |
|---|---|---|---|---|---|---|
| Aprons: general | *Transverse flashing over roofing* | | 130 (4) | 200 (4) | 200 mm | Figure 7 and Figure 44 (X values) |
| | *Parallel flashing over roofing* | | Two crests, finish in next trough – refer 4.6.1.1b) | | | Figures 47, 48 (Y values) |
| Ridges/ hips | *Transverse flashing over roofing* | | Refer **Aprons: general** | | | Figures 43, 45b, 46 |
| Changes in roof pitches | Upper lap under roofing | 250 mm min. | | | Not permitted under E2/AS1 | Figure 44 |
| | *Transverse flashing over roofing* | | Refer **Aprons: general** | | | |
| Barges | Overlap to barge board | | 50 (8) | 70 (8) | 90 mm | Figure 47 (Z values) |
| Cappings | Overlaps to *cladding* | | 50 (8) | 70 (8) | 90 mm | Figure 10 (Z values) |
| | Slope to top: parapet and balustrade – metal capping | 5° min. | | | | Figures 10, 11, 12, 130 |
| | Slope to balustrade – *flush-finished EIFS* and fibre cement(5) | 10° min. | | | | Figures 117, 129, 130 |
| Roof or Deck to Wall – See membranes below | Overlaps to roofing | | Refer **Aprons: general** | | | |
| | Lap under *cladding* above | 75 mm min. | | | 90 mm | Figures 7, 26, 30, 35, 37, 44, 48, 50 |
| | Clearance below *cladding* | 35 mm min. | | | | |
| | **Total upstand** | **110** mm min. | | | | |

**Figure 5** New Zealand Building Code clause E2/AS1 Table 7 finding minimum dimensions.




*stiffen top edge and prevent moisture tracking behind the flashing

**stiffen bottom edge and provide a positive drip edge

**Figure 6** Flashing edge treatments.

Tyvek.

# DuPont™ Tyvek® FlexWrap™ NF

## BUILDING SCIENCE BULLETIN


DuPont™ FlexWrap™ NF addresses the issues of flashing vulnerable bottom corners of the sill where water damage is most likely to occur.

**An integral component of DuPont Building Envelope Systems, DuPont™ FlexWrap™ NF is a conformable, self-adhesive flashing solution for sills and non-straight portions of windows, doors and other wall penetrations.**

DuPont™ FlexWrap™ NF is a premium performance, extendable self-adhered flashing material that can be applied over a wide range of building substances, including non-nailable sheathing materials like PS foam board, fiberboard,concrete masonry unit (CMU) and other such materials. Unlike competitive products, DuPont™ FlexWrap™ NF does not require the use of mechanical fasteners in the flexed corner areas.

DuPont™ FlexWrap™ NF also flashes round-top or custom-shaped windows in a seamless manner, eliminating the need to cut and place individual pieces of conventional flashing on an arched opening.

### BENEFITS

#### Superior protection from water damage

- Helps seal the building envelope when used with DuPont Building Envelope Systems products
- Meets the AAMA 711-13 material standard at the highest classification level: Class A (no primer) and Level 3 Thermal Exposure (80°C / 176°F for 7 days)
- Meets and Exceeds ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference: no leakage at 300 Pa (equivalent to 50 mph windload), even after thermal aging (0-120°F)
- Does not contain asphaltic / bitumen adhesive materials which many window manufacturers prohibit due to adverse material reactions, such as black staining, oozing, and deformation over time, particularly with vinyl flanges.
- Can be installed at external temperatures as low as -4°C (25°F) as long as the surface is clean and free from frost and ice

#### Easy installation

- Packaged in ready-to-use 152mm x 22.9m and 228 x 22.9m rolls
- Helps to facilitate the creation of airtight and water tight seals around windows, doors sills, chimney breasts, pipe penetrations, and any custom shapes

#### Superior durability

- Extendable flashing constructed with a durable, microcreped DuPont™ Tyvek® top-sheet, a premium butyl adhesive layer, and a specially designed release liner
- Designed to withstand up to 270 days of UV exposure

#### Excellent adhesion performance

- 100% butyl adhesive performs through extreme tempratures
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# 1.5 Folded and ironed

Flashing junctions can be tricky but it's important to get them right. Here we review the steps for barge and ridge flashing intersections and termination of a raked apron flashing.

**FLASHINGS ARE A CRITICAL** component of the weathertightness of a building, whether protecting the head of a window or a roof cladding junction.

### *Flashing basics*

While metal flashings need to be aesthetically pleasing, to ensure they will be durable and keep out water when installed, you must:

- allow for thermal movement
- prevent damage to factory-applied coatings during installation
- correctly lap the flashing elements so that water cannot get into and/or be trapped within the joint
- avoid total reliance on sealants to weatherproof the junction
- ensure the finished joint is neat and precise with straight folds where required
- install the fixings through the flashing and into underlying framing
- meet cladding and bargeboard cover requirements – for buildings within the scope of E2/AS1, Table 7 gives the required flashing covers for the wind zone the building is erected in.

### *Assembling in the right order*

Two flashings junctions that need to be accurately folded and assembled in the right order are:

- the intersections of the barge flashing and the ridge flashing to the gable end of a roof (see Figures 7a–d)
- the termination of a raked apron flashing that requires the forming of a stop-end by folding the flashing (see Figures 8–9) or by inserting a proprietary fabricated stop-end at the termination of the flashing.

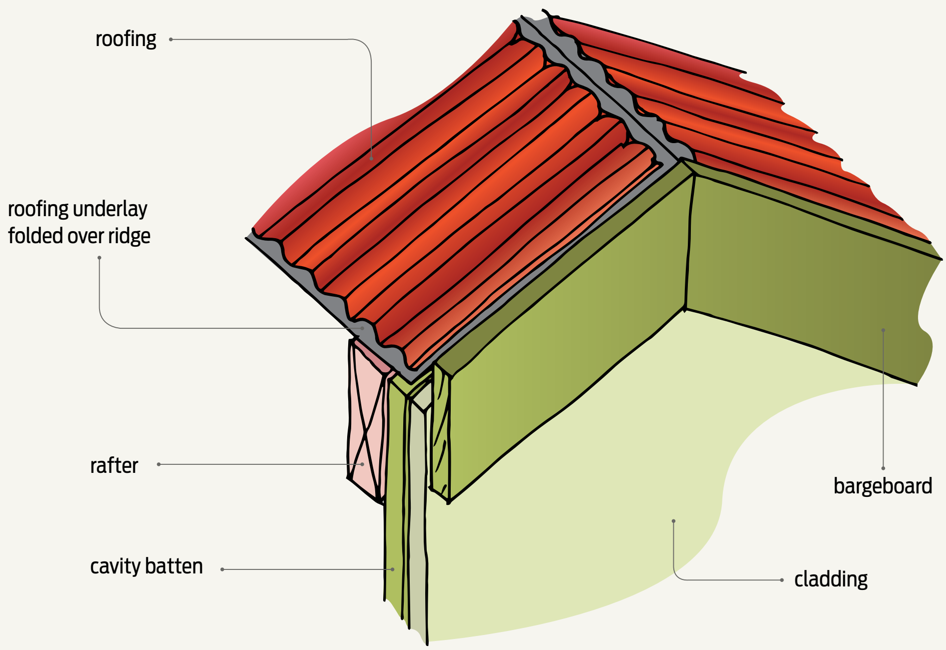



**Figure 7a** **Intersection of the barge flashing and the ridge flashing to the gable end of a roof – Step 1.**

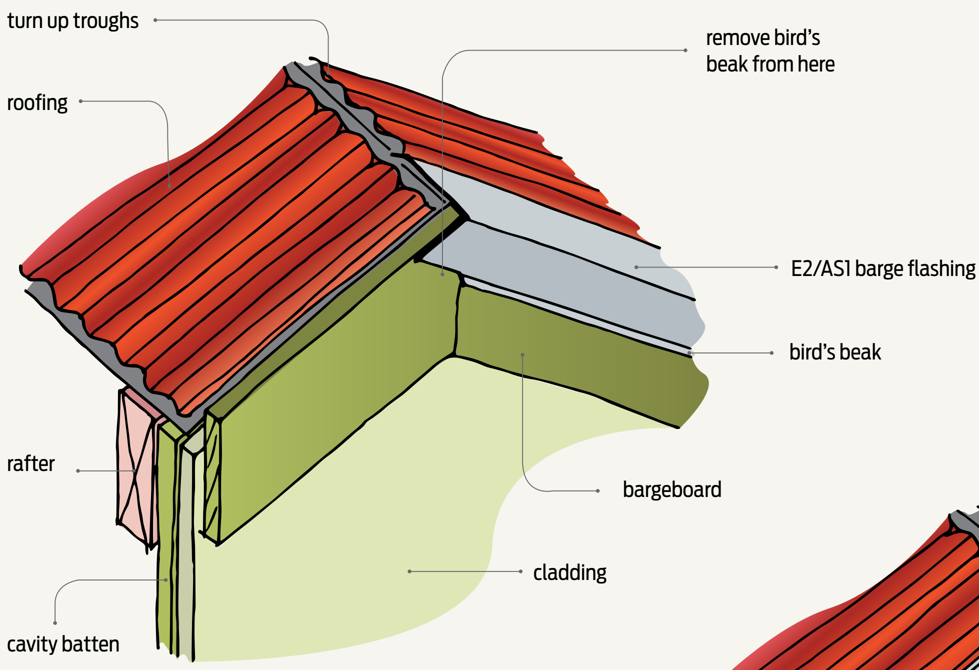



**Figure 7b** **Step 2.**

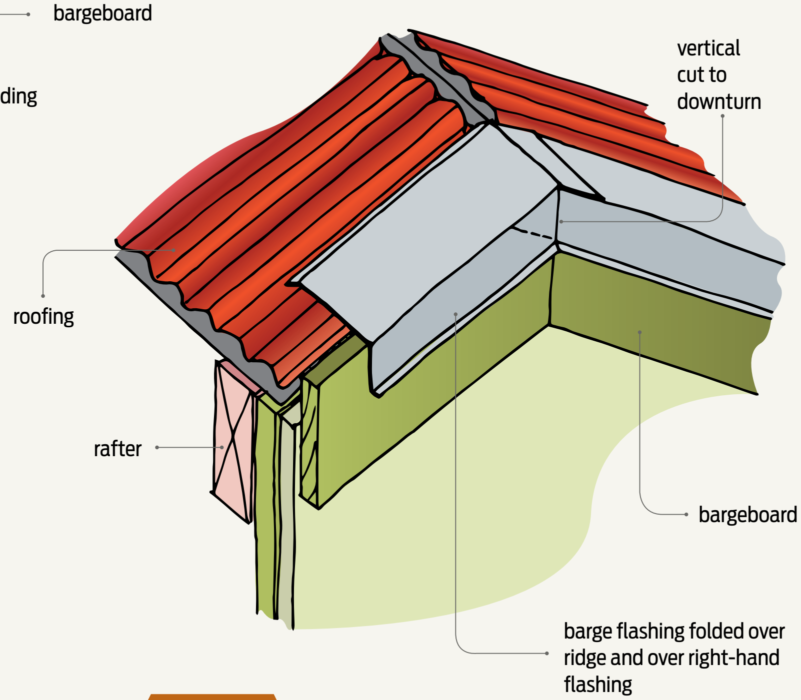



**Figure 7c** **Step 3.**

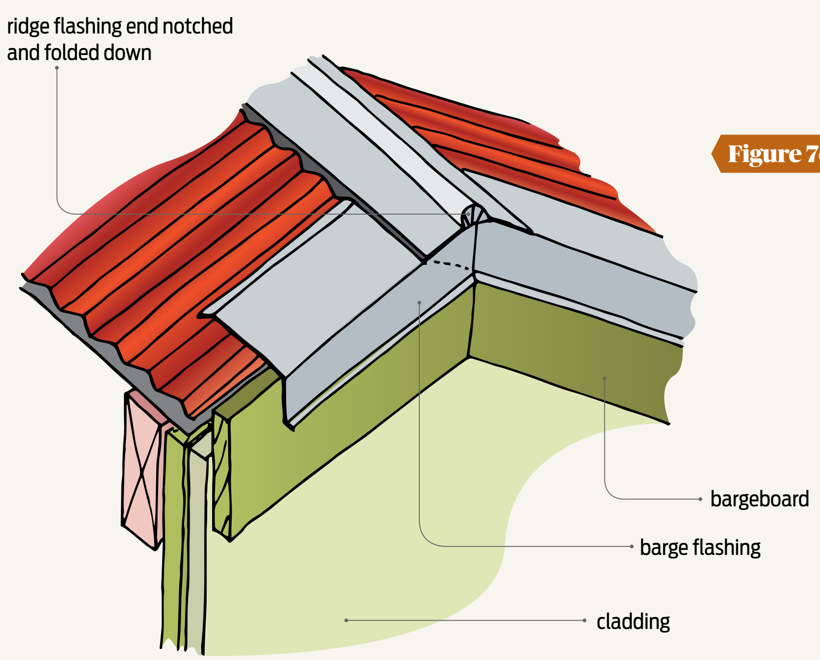



**Figure 7d** **Step 4.**

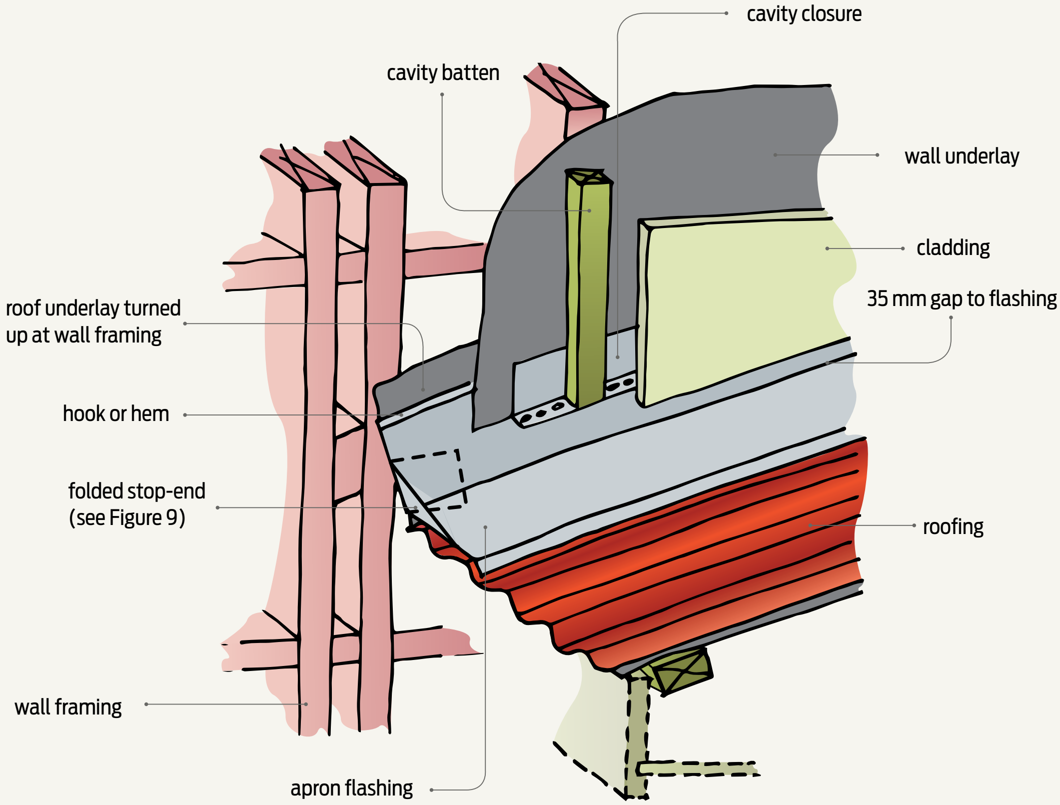
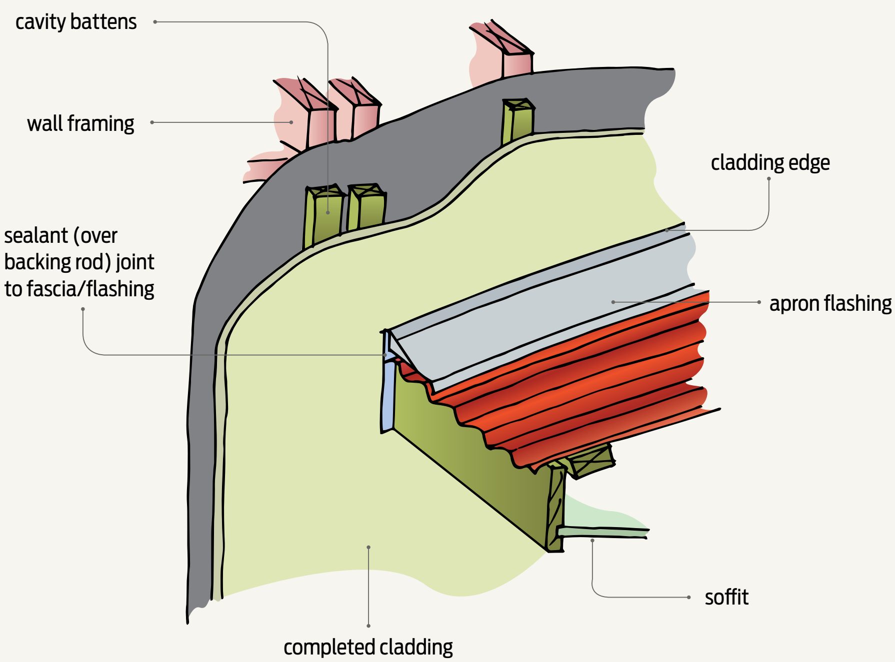



**Figure 8a** **Termination of a raked apron flashing – Step 1.**




Note: Gutter not shown.

**Figure 8b** **Step 2.**

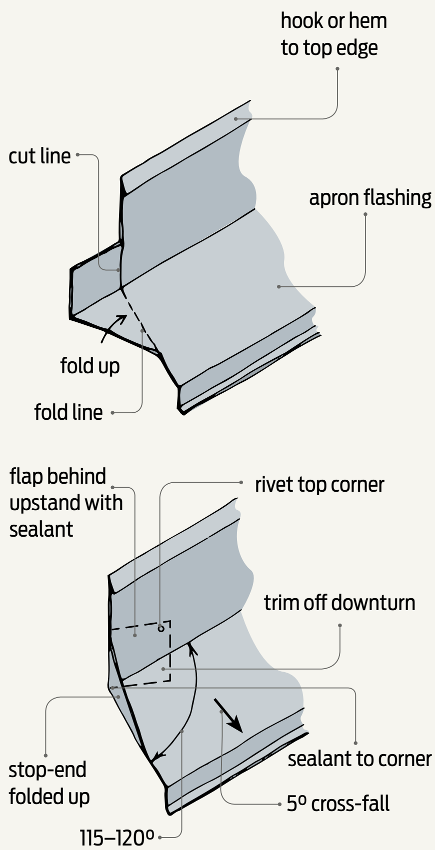



**Figure 9** **Stop-end folds in Figure 8a.**

# Section 2:
# Roof flashings

# 2.1 Roof flashings

Flashings play a vital role in keeping water out of buildings. Follow this useful guide to check the requirements for roof flashings in Acceptable Solution E2/AS1.

**THE TYPE** of roof flashings required depends on what part of the roof is being flashed and what the roofing material is.

### *Apron flashings*

Horizontal apron flashings must:

- extend over profiled metal roofing (see Figure 10) for:
  - 130 mm (excluding the soft edge) in low (L), medium (M) and high (H) wind zones where the roof pitch is 10º or more – E2/AS1 Table 7, Situation 1
  - 200 mm (excluding the soft edge) in L, M and H wind zones where the roof pitch is less than or equal to 10º – E2/AS1 Table 7, Situation 2
  - 200 mm (excluding the soft edge) for all roof pitches in very high (VH) and extra high (EH) wind zones – E2/AS1 Table 7, Situation 3
- extend over clay and concrete tiles for 150 mm minimum and have the lead flashing dressed into the pans – E2/AS1 Figure 26(b).

Raked metal apron flashings must have tapered stop-ends to the lower end of the flashing to divert water away from the back of the upstand and into the gutter and have a 5º minimum cross-fall (see 4.1 *Roof-to-wall junction*, pages 78–80).

### *Metal tiles*

Metal tiles must be installed with a 40 mm minimum upstand and a minimum overflashing cover of 35 mm – E2/AS1 Figure 35(b).

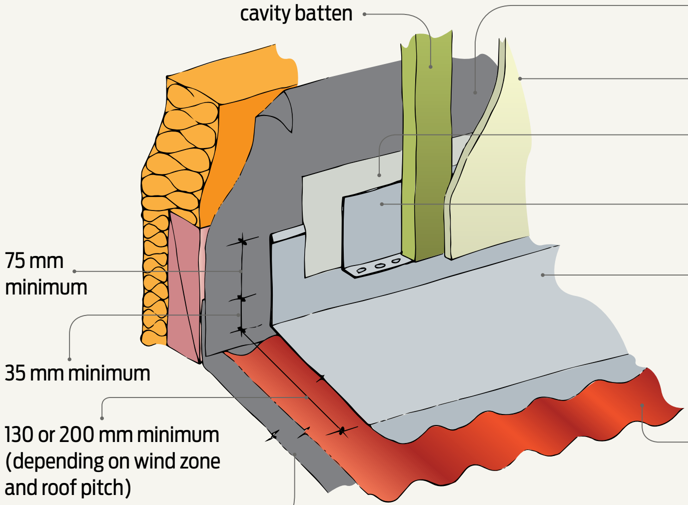



**Figure 10** **Apron flashing at roof/wall junction – horizontal flashing.**

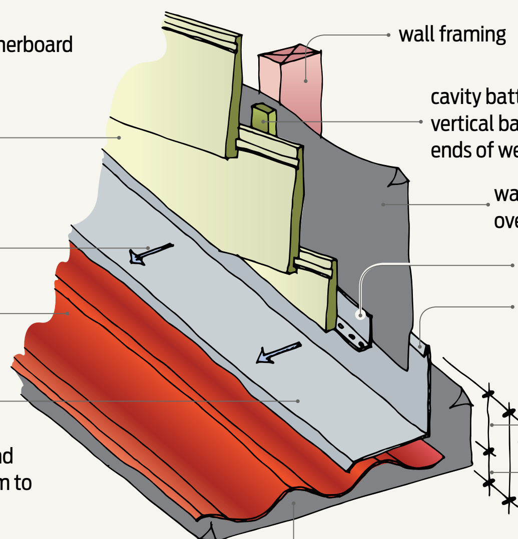



**Figure 11** **Apron flashing at roof/wall junction – parallel flashing.**

### Parallel to roof slope

Apron flashings that are installed parallel to the roof slope must:

- for profiled metal roofing (see Figure 11), extend over at least two crests – E2/AS1 Table 7 and Figures 47 and 48
- extend over clay and concrete tiles for 150 mm minimum and have the lead flashing dressed into the pans – E2/AS1 Figure 26(a)
- for metal tiles, have a 40 mm minimum upstand and a minimum overflashing cover of 35 mm – E2/AS1 Figure 35(a).

### Hems and hooks

A hem or hook is required to flashing upstands in L, M, H and VH wind zones in addition to the dimension set out in E2/AS1.

Alternatively, the upstand dimension may be increased by 25 mm.

In EH wind zones, flashing upstands must have both a hem or hook and a 25 mm increase to the upstand dimension.

## Cap flashings

Under E2/AS1, cap flashings must be installed over parapets or enclosed balustrades. They may be either metal cap flashings or butyl or EPDM membrane underflashings.

Metal capping flashings are detailed in E2/AS1 Figures 9 and 10 (see Figure 12). They must have:

- a minimum cross-fall across the top of 5°
- drip edges to both sides – use a bird's beak drip edge on the deck side of a balustrade ➤

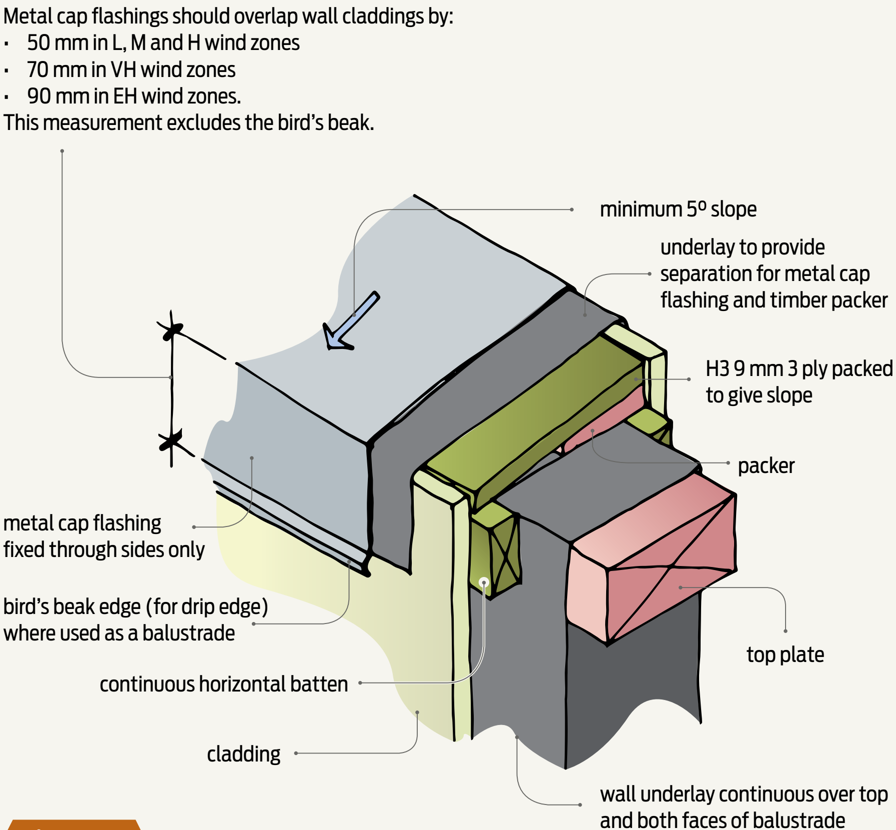



**Figure 12** **Metal cap flashing.**

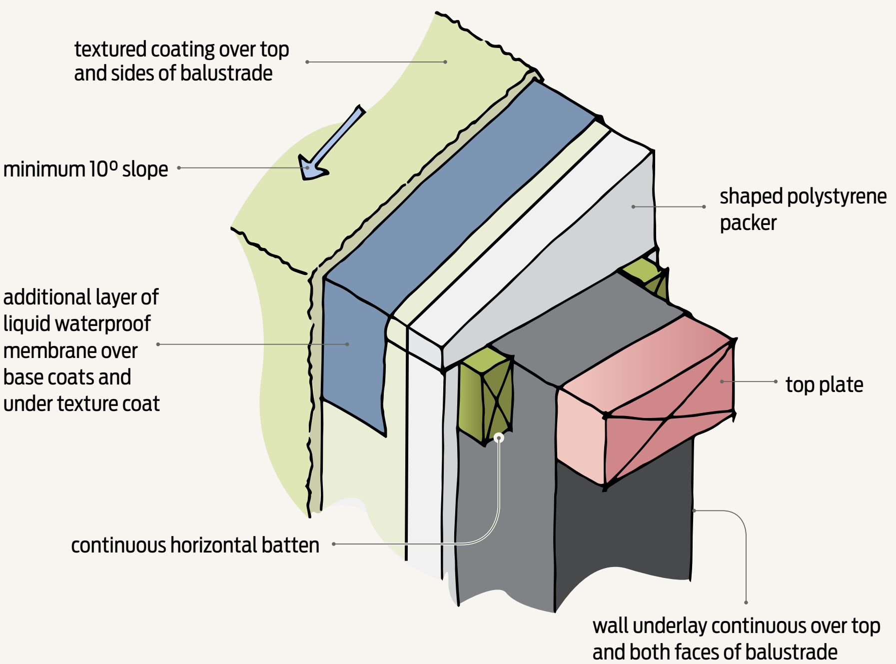



**Figure 13** **Membrane underflashing to parapet/balcony wall.**

- expansion joints at maximum spacings of:
  - 12 m for light-coloured steel and stainless steel
  - 8 m for dark-coloured steel, copper and aluminium.

Membrane underflashings (see Figure 13) must have a minimum cross-fall of 10º when used as an underflashing with a textured top coat – E2/AS1 6.5. (Note: BRANZ recommends 15º minimum.)

Both metal and membrane cap flashings must:

- not have any penetrations
- overlap wall claddings on both sides by:
  - 50 mm for L, M and H wind zones – E2/AS1 Table 7, Situation 1
  - 70 mm for VH wind zones – E2/AS1 Table 7, Situation 2
  - 90 mm for EH wind zones – E2/AS1 Table 7, Situation 3.

### *Saddle flashings*

Fabricated saddle flashings are required:

- at the junction between a framed balcony wall and an adjacent wall
- where parapets at different heights may intersect (see Figure 14)
- at junctions of walls and joists for cantilevered timber decks.

Details for saddle flashings are provided in E2/AS1 Figures 11 (which gives the internal corner flashing requirements below the saddle), 12 and 16.

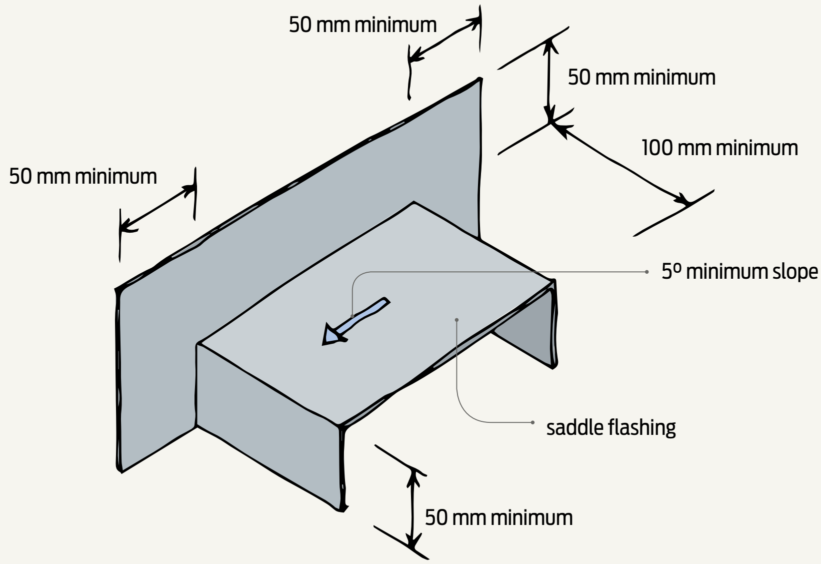



**Figure 14** **Fabricated saddle flashing to framed balcony/wall junction or at intersection between different height parapets.**

Barge flashings should be:

- 50 mm for L, M and H wind zones when roof pitch ≥ 10º
- 70 mm for all roof pitches in VH wind zones and L, M, H wind zones where roof pitch < 10º
- 90 mm for all roof pitches in EH wind zones.

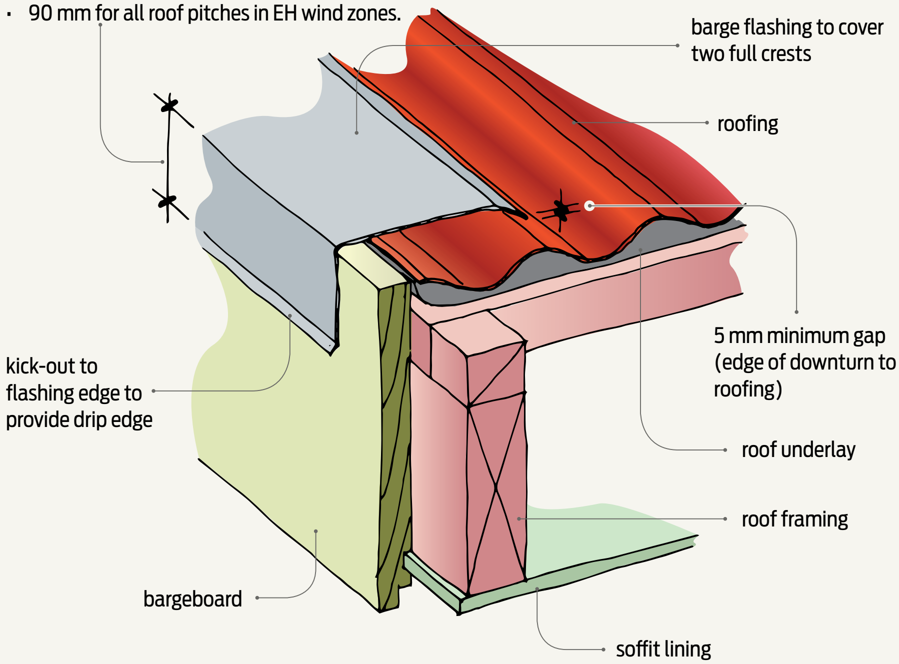



**Figure 15** **Barge flashing.**

### *Barge flashings*

E2/AS1 barge flashings (see Figure 15) must have a minimum overlap over the bargeboard or fascia board of:

- 50 mm for L, M and H wind zones where the roof pitch is 10º or more – E2/AS1 Table 7, Situation 1 and Figure 47
- 70 mm for L, M and H wind zones where the roof pitch is less than or equal to 10º and all roof pitches for VH wind zones – E2/AS1 Table 7, Situation 2 and Figure 47
- 90 mm for all roof pitches for EH wind zones – E2/AS1 Table 7, Situation 3 and Figure 47.

Barge flashing cover over roofing is the same as for apron flashings installed parallel to the roof slope.

### *Eaves flashings*

E2/AS1 requires eaves flashing (see Figure 16) to be installed with long-run profiled metal roofing in VH or EH wind zones where the roof slope is 10º or less and the soffit width is 100 mm or less from the cladding.

The flashing must extend 125 mm back up under the roofing and have a 35 mm overlap to the back upstand of the gutter – E2/AS1 Figure 45(a).

### *Ridge and hip roof flashings*

Ridge and hip flashings (see Figure 17) for profiled metal roofing must provide a minimum cover as for apron flashings. They must have:

- soft edges dressed to a corrugated profile – E2/AS1 Figure 41 ➤

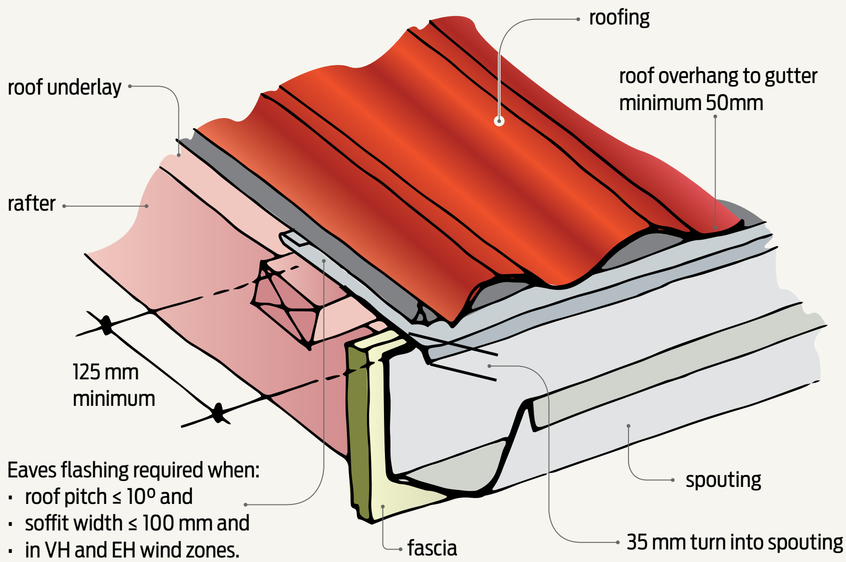



**Figure 16** **Eaves flashing.**

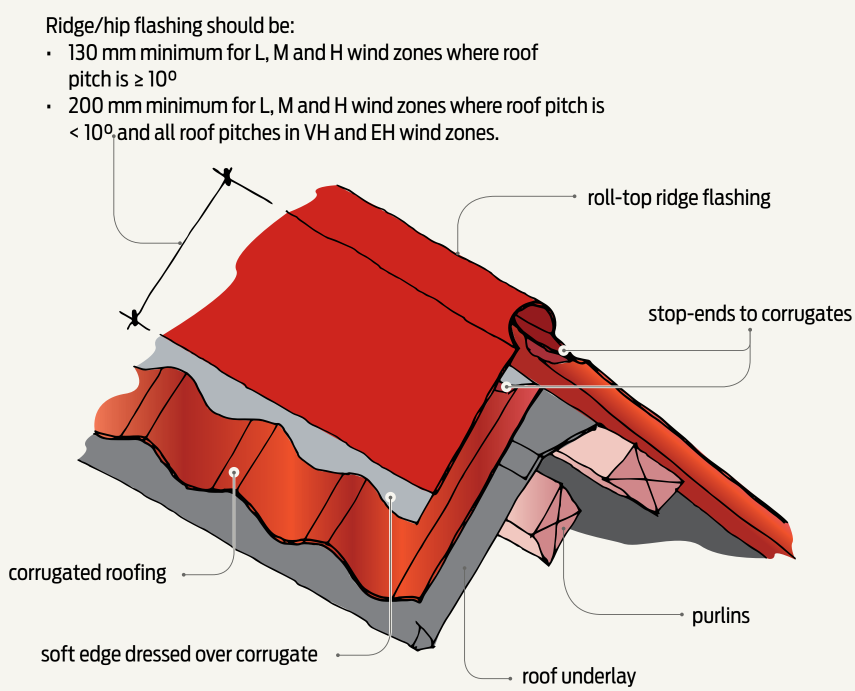



**Figure 17** **Ridge/hip flashing (non-vented).**

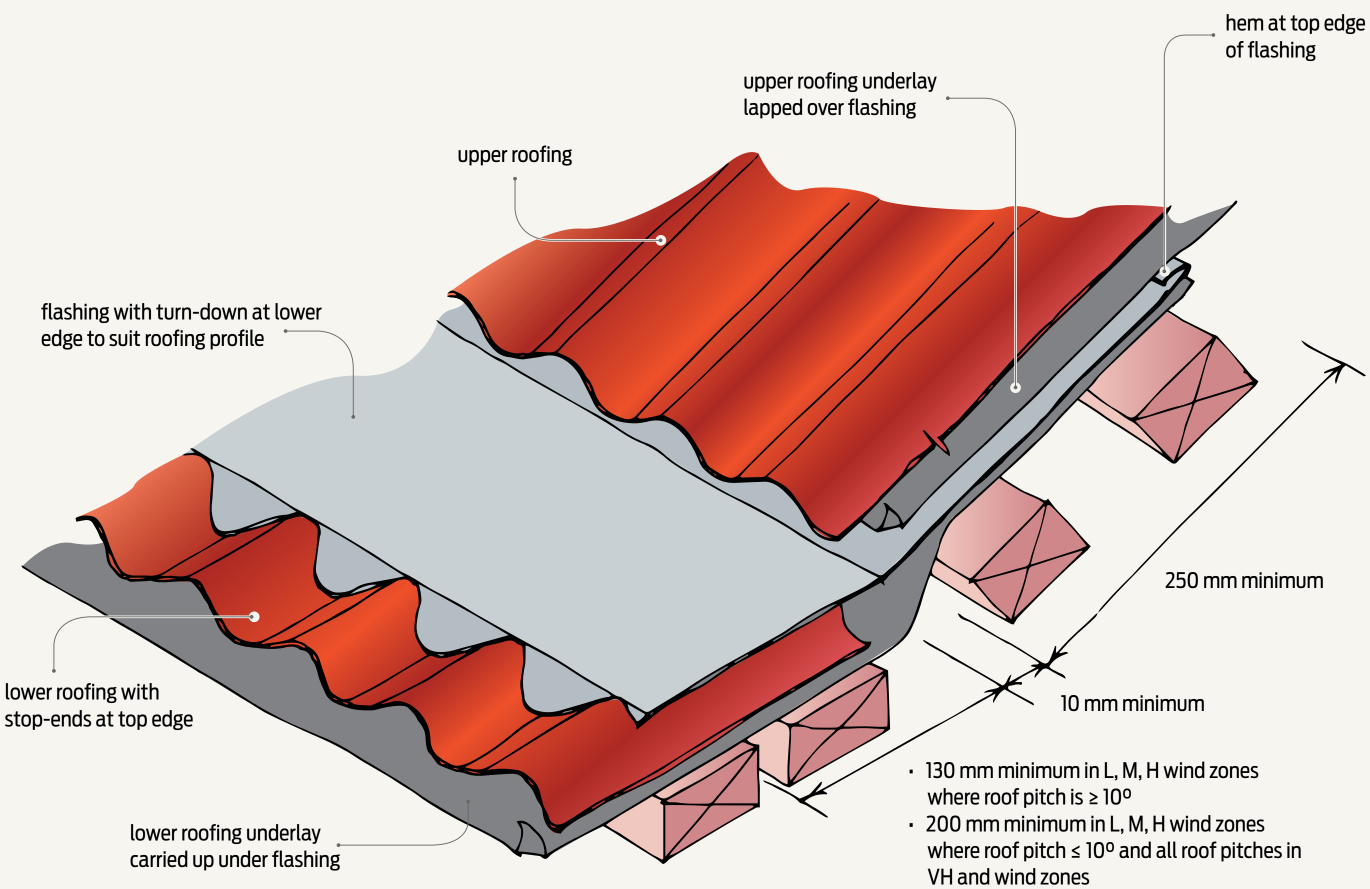



**Figure 18** **Apron flashing at change in roof pitch for profiled metal roofing.**

- the edges turned down and notched to accurately match a trapezoidal profile, leaving a 5 mm gap between the flashing and the cladding – E2/AS1 Figure 42.

All troughs ending under a ridge or hip flashing of profiled metal roofing must be turned up.

Metal tile roofs must be installed with preformed ridge caps of 35 mm over 40 mm minimum metal tile upstands – as detailed in E2/AS1 Figure 34.

Clay and concrete tiles must have a ridge tile as shown in E2/AS1 Figure 23, bedded in mortar with weepholes at the pan of each tile.

### *Change in roof pitch*

If there is a change in roof pitch on profiled metal roofing (see Figure 18):

- the minimum cover for the lower roof pitch is as for an apron flashing
- the flashing must be extended at least 250 mm under the higher roof pitch – E2/AS1 Figure 44.

Flashing at a change of pitch for EH wind zone is outside the scope of E2/AS1 and must be treated as an alternative method.

# 2.2 Joints in flashings

Expansion joints and non-movement control joints are sometimes needed in metal flashings. We look at when they are required and how to construct them.

**ACCEPTABLE SOLUTION** E2/AS1 to Building Code clause E2 *External moisture* sets out where metal flashings require joints. Construction details are given in the *NZ Metal Roof and Wall Cladding Code of Practice*.

### *Expansion joints*

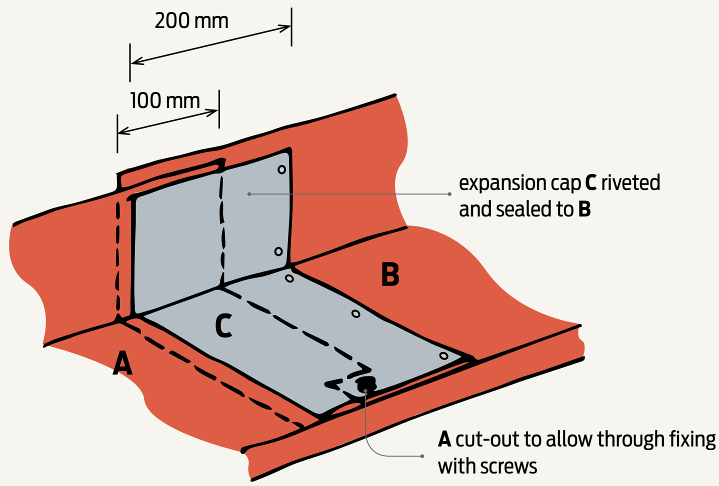
Expansion joints that allow for thermal movement are required wherever both ends of the flashing are constrained (see Figure 19). E2/AS1 requires:

- maximum spacings at:
  - 12 m for light-coloured steel and stainless steel
  - 8 m for dark-coloured steel, copper and aluminium
- a 200 mm minimum lap, and the fixings on both sides of the lap must be able to slide (E2/AS1 clause 4.5.2(b) and Figure 6, and clause 6.4 and Figure 9(g)).

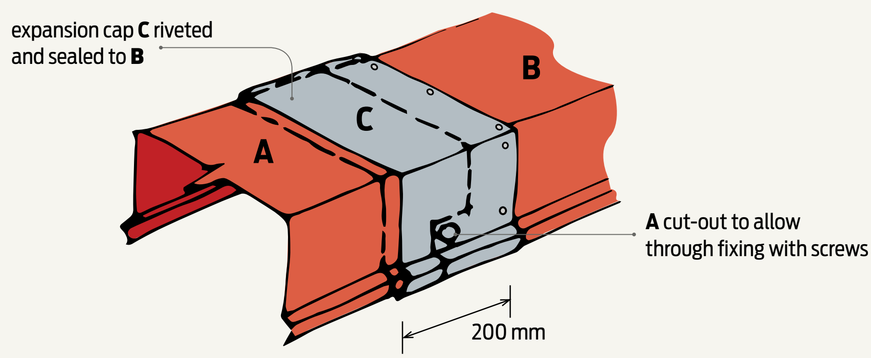
### *Non-movement control joints*

Non-movement control joint laps:

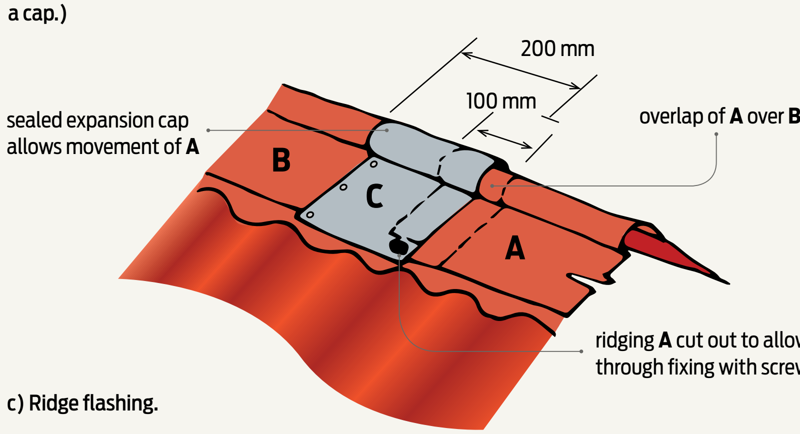
- are mechanically fixed by rivets spaced at 50 mm maximum centres
- are sealed against moisture ingress
- have 100 mm minimum overlap (but 150 mm recommended) except where the pitch of the flashing is 15° or less. In that case, there must be a 100 mm minimum overlap and the flashing underneath the lap must have a hook at the edge. ➤




a) Apron flashing.




b) Parapet flashing. (Note this differs from E2/AS1 Figure 9g, which has an underflashing rather than a cap.)




c) Ridge flashing.

**Figure 19** **Expansion joints to allow thermal movement (from *NZ Metal Roof and Wall Cladding Code of Practice*).**

Screws and rivets (if used) must be compatible with the flashing material and may be a sealing type or a blind rivet.

### *Sealing*

Sealing can be either using solder for uncoated galvanised steel, zinc or copper or the application of two rows of neutral-cure silicone sealant under the overlap for all other metal flashings (see Figure 20).

Exposed flashings such as barge and ridge flashings must be fixed along both edges. Laps in ridge or parapet flashings should face away from the prevailing wind direction.

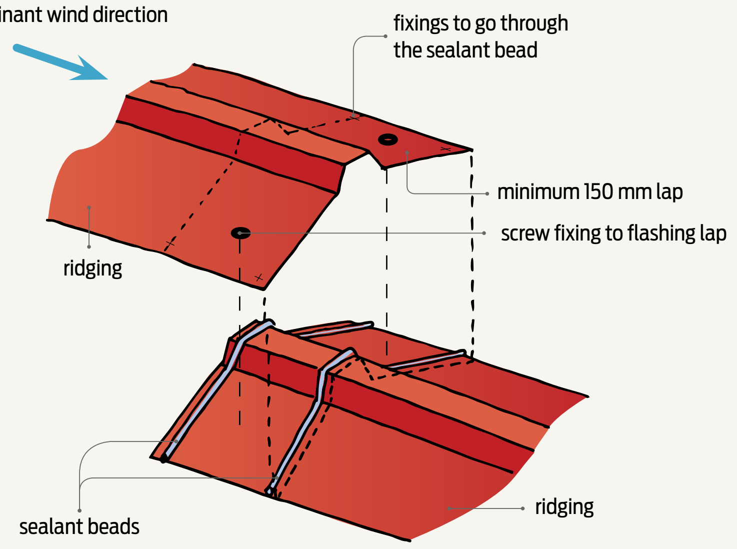
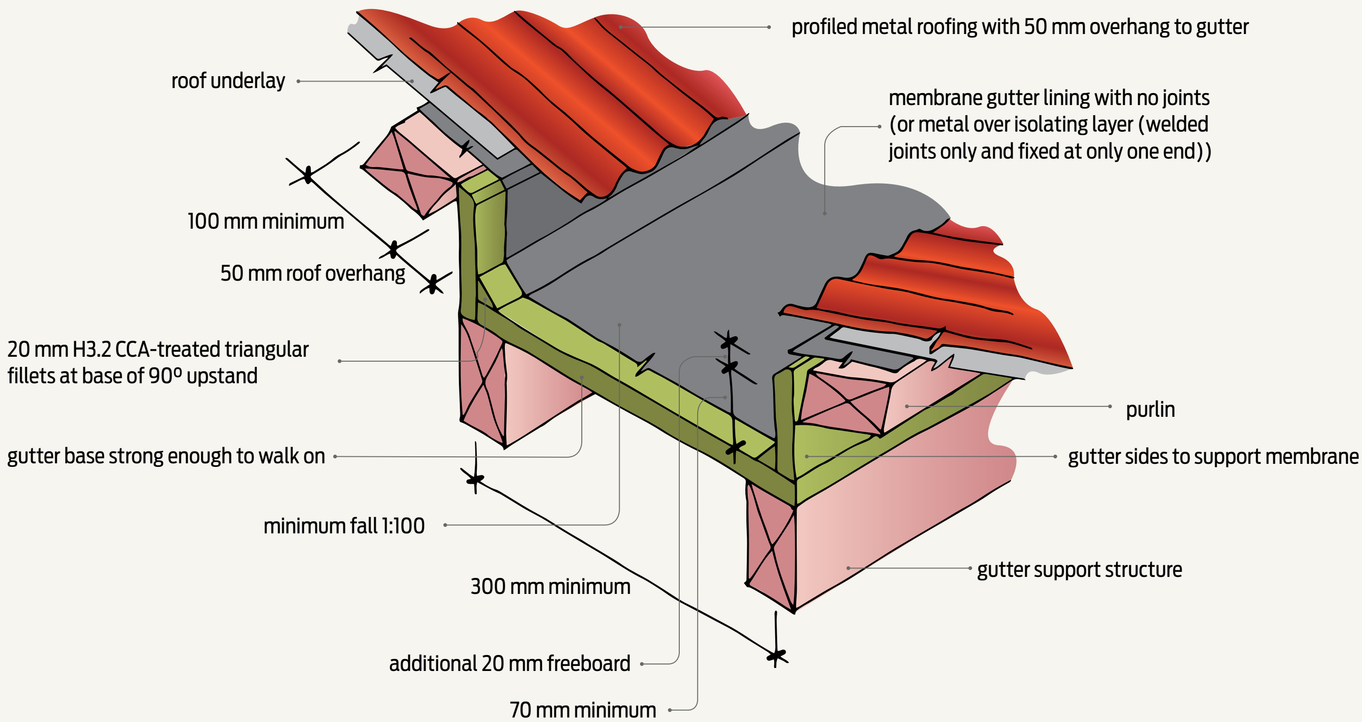



**Figure 20** **Ridging lap minimum 150 mm.**

# 2.3 Internal gutters

The best way to deal with internal gutters is to design them out, but sometimes this isn't an option. With good design and construction and ongoing maintenance, the risk of an internal gutter overflowing can be minimised.




**Note:** Other roof framing not shown for clarity.

**Figure 21** **Internal gutter design.**

**IF AN INTERNAL GUTTER** servicing a metal roof overflows, the only place for the water to go is into the building below, causing inconvenience and damage to the building and incurring repair costs. With a membrane gutter that is integral with a roof membrane, the risk from an internal gutter overflowing is lower.

### *Good design principles*

Good internal gutter design includes:

- constructing gutters that are large enough to cope with the maximum rainfall intensity for the region
- lining the gutter with a continuous, impermeable material
- providing a good fall to outlets
- providing sufficient outlets so that, if one is blocked, another is able to discharge the full volume of water
- providing overflow outlets in obvious locations to give early warning of issues.

### *Start with the Building Code*

There are three New Zealand Building Code clauses that must be applied to internal gutter design:

- Clause B2 *Durability* requires 15-year minimum durability.
- Clause E1 *Surface water* requires that construction protects people and other property from the adverse effects of surface water.

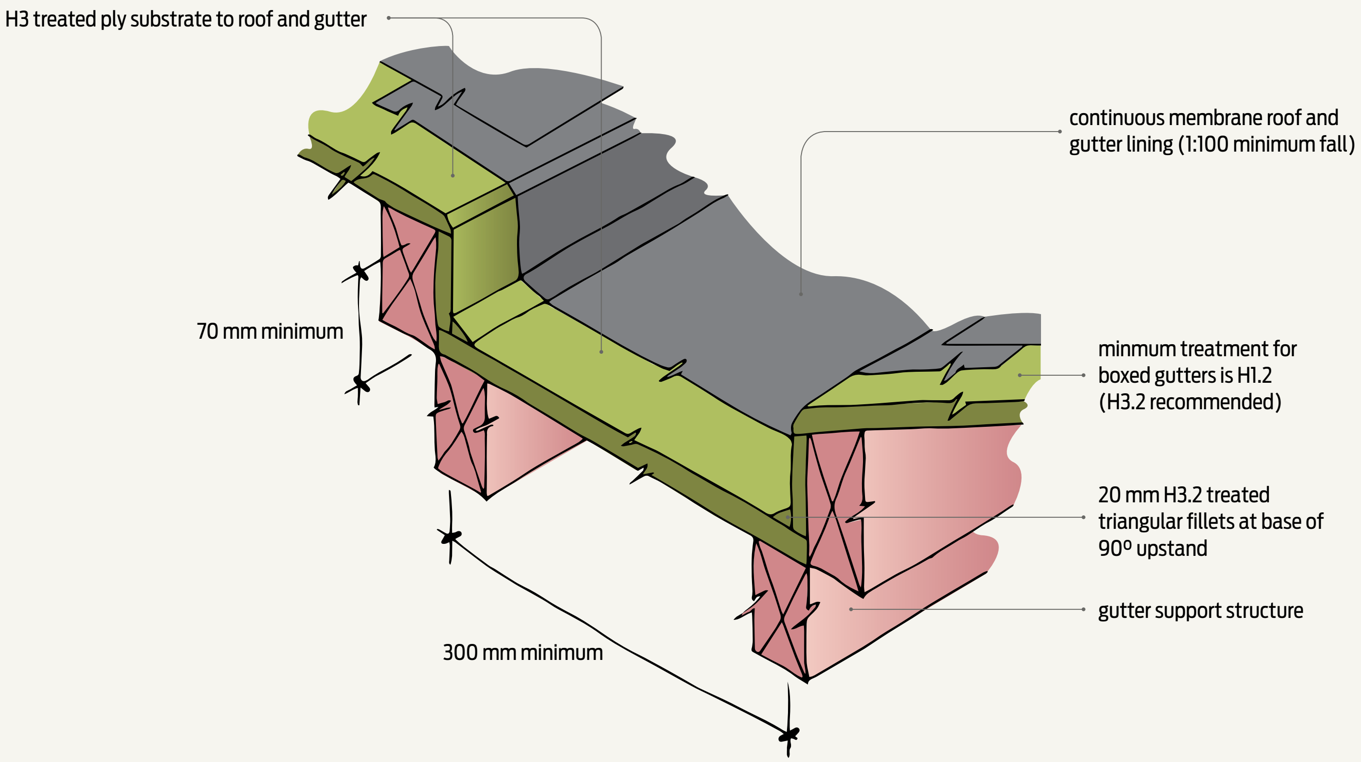



**Figure 22** **Membrane roof and gutter design.**

- Clause E2 *External moisture* requires that roofs:
  - shed precipitated moisture, hail and melted snow
  - prevent water entry into the building to cause dampness or damage to building elements.

Clauses E1 and E2 both have Acceptable Solutions with specific design requirements for internal gutters.

Although clause B2 requires gutters to remain durable for at least 15 years, an internal gutter should perform for the serviceable life of the roof, which is generally expected to be far longer.

Acceptable Solution E2/AS1 specifies materials that may be used for internal gutters including non-corrosive metals (aluminium, copper, stainless steel or zinc), which must be able to be welded at joints, or membrane linings with no joins in the gutter, such as butynol or EPDM.

### *Sizing internal gutters*

For buildings within its scope, Acceptable Solution E2/AS1 8.1.6.1 gives minimum dimensions for internal gutters (shown in Figure 52) or requires dimensions to be calculated from E1/AS1, whichever is greater.

Appendix 1 gives rainfall intensities around New Zealand, and Figure 16 provides a graph from which to determine internal gutter sizes based on a rainfall intensity of 100 mm/hour. Where the rainfall intensity exceeds 100 mm/hour, the minimum gutter cross-sectional area, based on roof pitch, can be determined from the graph.

E2/AS1 Figure 52 requires internal gutter dimensions to be at least 300 mm wide and 70 mm deep (see Figures 21 and 22). This gives a cross-sectional area of 21,000 mm². If a larger cross-sectional area is required to comply with E1/AS1, the depth or width of the gutter must be increased. Ensure the 20 mm freeboard depth in Figure 21 is maintained.

When sizing an internal gutter, the gutter should be divided into sections – each section is the length of gutter between the downpipe and the high point on one side of the downpipe. Sections are sized according to the roof catchment, and the largest calculated size is used for the whole gutter.

### *Discharge to outlets*

E2/AS1 (8.1.6.1) requires all internal gutters to have a minimum 1:100 slope.

With the exception of membrane roofs, water from internal gutters must discharge into a rainwater head or to an internal outlet (as shown in E2/AS1 Figures 63(a) and (b) and Figures 64(b) or (c)) (see Figure 23). Where an internal gutter discharges to an internal outlet, an overflow must be provided by a second outlet to a rainwater head or an overflow located below any potential overflow into the building (shown in E2/AS1 Figure 63(c)) (see Figure 24).

E2/AS1 8.5.6(d) states that membrane roofs must discharge into:

- a minimum 75 mm diameter roof or gutter outlet (as per Figure 64) with an overflow (as per Figure 63(c)) or an extra outlet with both outlets sized to deal with full required capacity, or

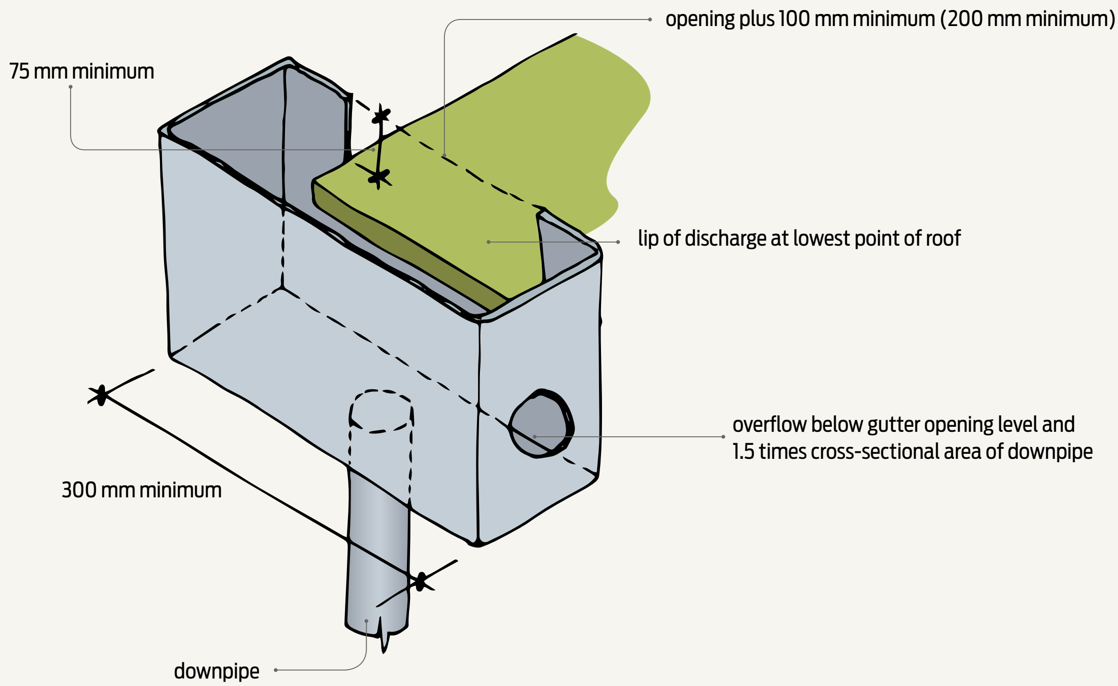



**Figure 23** **Rainwater head.**

- a scupper discharging into a gutter or rainwater head (as per Figure 63(a) and (b)) (see Figure 23).

E1/AS1 5.5 also requires that all internal gutters are fitted with overflow outlets that drain to the exterior of the building. The top of these outlets must be at least 50 mm below the top of the gutter. The cross-sectional area of each outlet must have at least the same diameter as the cross-sectional area of the downpipe into which it flows (E1/AS1 4.2.1). Downpipe sizes are calculated from E1/AS1 Table 5 to cope with the catchment area.

### *Gutter support and lining from E2/AS1*

Internal gutters must be continuously supported on timber boards treated to H1.2 or on ply treated to H3. There must be no fixings in the bottom or sides of the gutter.

Metal-lined gutters must have welded cross joints and a strip of roof underlay between the metal and the timber or ply. Membrane gutters may be lined with continuous 1 mm minimum thick butynol or EPDM for gutters less than 1.0 m wide or 1.5 mm thick for wider gutters. There must be no cross-seams in the membrane.

### *Good design practice*

In addition to the Acceptable Solution design requirements, good design requires:

- the gutter capacity to be increased for a rainfall intensity of 200 mm/hour
- wider gutters to allow easy access during maintenance, cleaning and repair
- greater fall than the minimum required – 1:60 fall gives better drainage and ensures that:
  - all water is removed
  - small inaccuracies in construction will not negate the fall
  - sagging over time won't compromise the drainage
- the sides of the gutter to extend well above the level of the outlet – a severe hailstorm can block an outlet, and if followed by heavy rain, water can flow over the sides of the gutter and into the roof space
- enough freeboard to prevent overflow from wave action in windy conditions (this can occur when the water level is 50 mm below the top of the gutter)
- a base strong enough to walk on, particularly if the adjacent roofs are steeply pitched
- outlets at 12 m maximum intervals, giving a maximum gutter run of 6 m if regularly spaced
- overflow outlets at locations where overflow will quickly be noticed, for example, visible from a doorway
- discharge into a rainwater head.

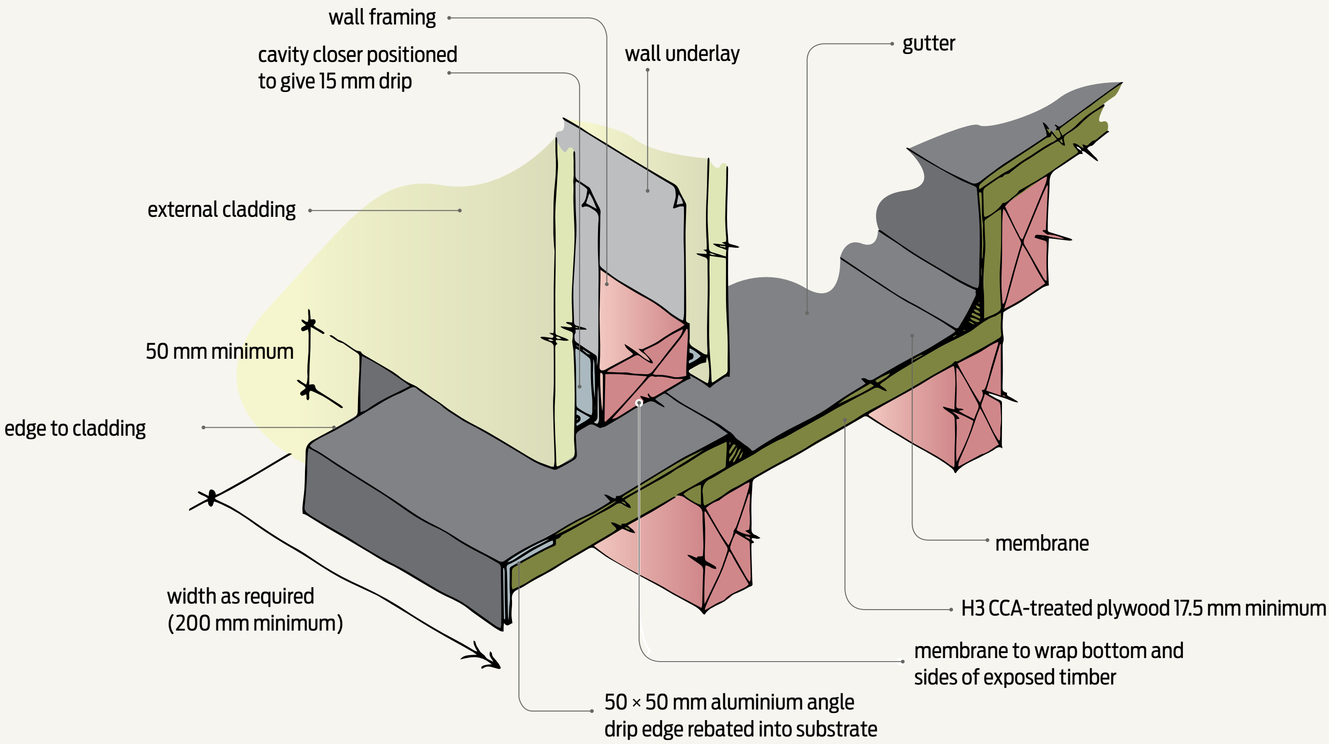



**Figure 24** **Overflow located below any potential overflow into building (from E2/AS1).**

During construction:

- chamfer internal corners of membrane-lined gutters
- allow for an expansion joint at the upper end or termination of each gutter section.

To prevent blockage, install:

- snow guards in areas with snowfall
- dome-type leaf guards.

Don't discharge downpipes and/or spreaders directly into the gutter.

### *Testing important*

Once installed, an internal gutter should be flood tested to ensure there are no leaks. Water or pressure-test concealed internal downpipes to ensure joints are adequately sealed before they are enclosed.

### *Maintenance*

Ongoing maintenance of internal gutters is as essential as good design and construction. They should be:

- checked annually for any damage or deterioration to the gutter lining
- cleared to remove debris, leaves, etc.

**For more** BRANZ Bulletin 556 *Internal gutter design* can be purchased for $13.50 from www.branz.co.nz or call 0800 80 80 85.

# 2.4 Valley gutters

Detailing around the intersection of a valley gutter and a fascia board can be a little tricky. Here are a few pointers.

**CROSS-SECTIONAL DETAILS** for valley gutters are given in both Acceptable Solution E2/AS1 and the *NZ Metal Roof and Wall Cladding Code of Practice*. However, neither document shows what happens at the fascia board/valley gutter intersection.

### *Current practice*

Roof cladding is generally installed over purlins or battens, the top faces of which are generally aligned with the top of the fascia board (see Figure 25). This means that the roof cladding can be carried over the top of the fascia board to overhang and discharge into the spouting fixed to the fascia board.

The valley gutter, however, is at a lower level than the roofing and therefore also at a lower level than the top of the fascia board. The usual way of dealing with this situation is to cut down the fascia board where the valley gutter intersects with it (see Figure 26), but the eaves spouting *must not* be cut down as this will compromise its capacity.

### *Requirements for valley gutters*

Valley gutter requirements are set out in E2/AS1:

- They may only be installed where the roof pitch is greater than 8º.
- They must have a minimum depth at the centre of 50 mm.
- They must be a minimum of 250 mm wide if receiving run-off from a spreader.

### *Maximum catchment area*

Maximum catchment areas for valley gutters are given in Table 8 of E2/AS1 for minimum roof pitch and gutter widths.

Where the roof pitch is between 8–12.5º, the:

- catchment area must be no more than 25 m²
- gutter must be at least 250 mm wide.

Where the roof pitch is 12.5º or greater, the:

- gutter catchment area must be no more than 16 m²
- gutter may be a minimum of 160 mm wide.

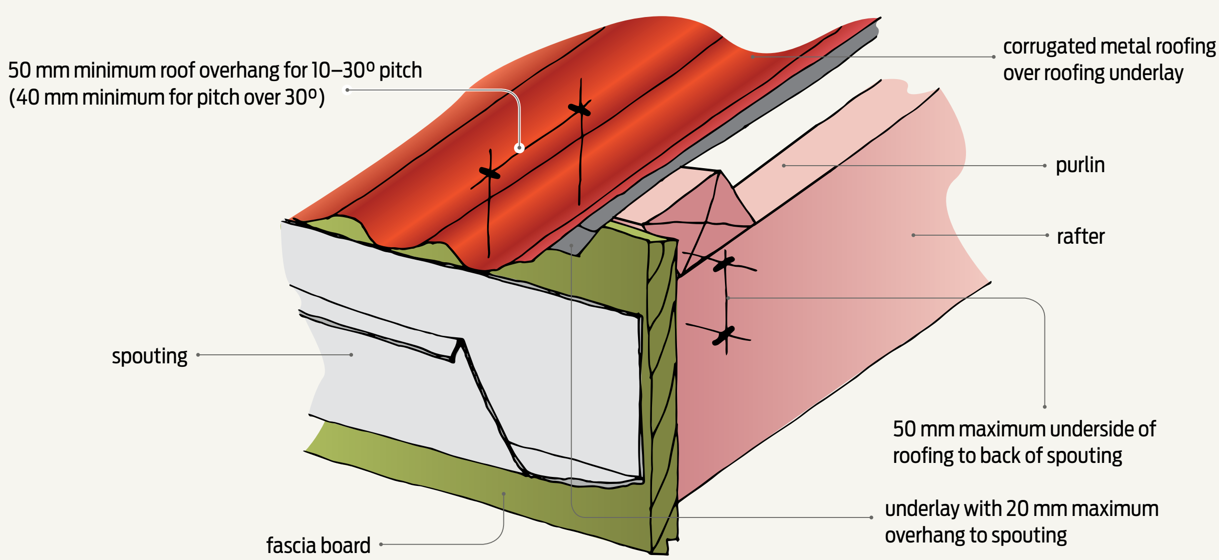



**Figure 25** Section A – section through eaves.

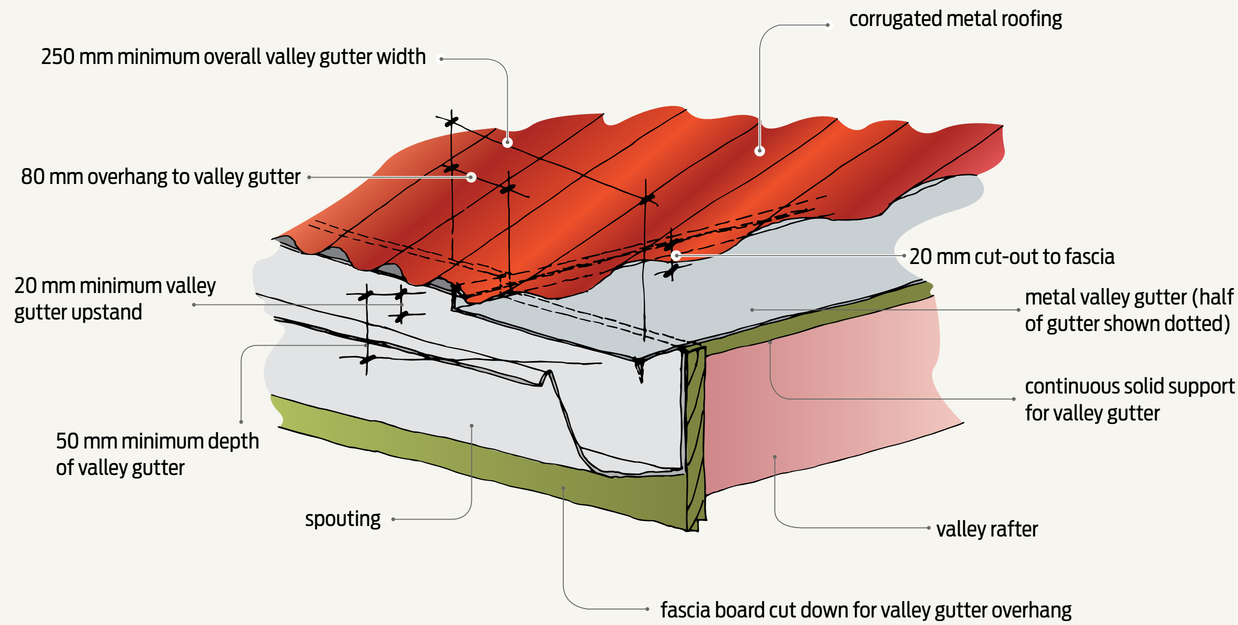



**Figure 26** **Section B – longitudinal section through the gutter.**

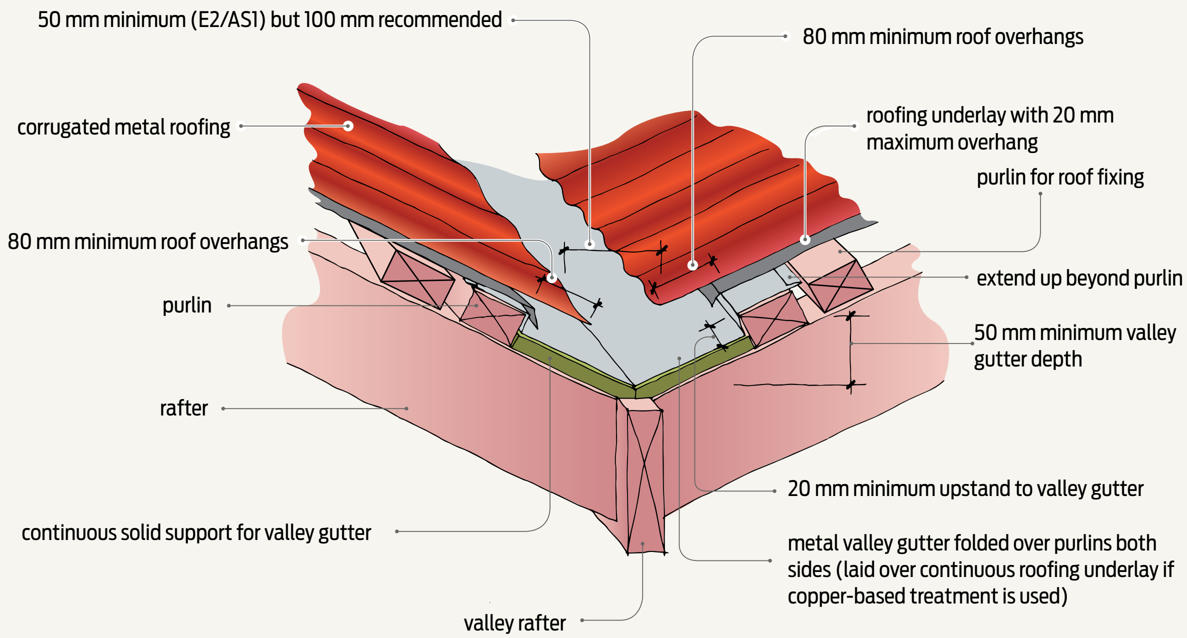



**Figure 27** **Section C – cross-section through alternative valley gutter detail to E2/AS1.**

### *Minimum roof overhangs*

The roof overhangs to valley gutters vary according to the type of roof cladding (see Table 1), but E2/AS1 requires a minimum clearance of 50 mm between the overhangs to be maintained.

Where a valley gutter is less than 250 mm wide, for profiled metal and masonry tile roofing, E2/AS1 allows the roof overhangs to be reduced to 60 mm to give a 40 mm clearance between overhangs.

However, a valley gutter with a minimum clearance of 100 mm allows the gutter to be accessed more easily for cleaning (see Figure 27).

The *NZ Metal Roof and Wall Cladding Code of Practice* also recommends increasing the minimum depth of the valley gutter to 75 mm where the roof pitch is between 8–12º.

### *Downpipe for catchment over 50 m²*

Where a valley gutter discharges into an eaves spouting that has a total catchment area greater than 50 m², a downpipe must be installed within 2 m of the valley (see Figure 28).

### *Gutters and upstands*

Valley gutters should be fully supported and fixed at the upper end only to allow for thermal expansion and contraction.

Upstands should be on both sides of the valley gutter and extend full height to the underside of the roofing (see Figure 28). The upstands should be terminated with a hook and must not be fixed under the roofing.

### *Spreaders*

Spreaders may not discharge directly into valley gutters.

Where a valley gutter receives run-off from a spreader, the gutter must be at least 250 mm wide.

**Table 1**

## ROOF OVERHANGS TO VALLEY GUTTERS IN E2/AS1

| TYPE OF ROOF CLADDING | MINIMUM ROOF OVERHANG TO VALLEY GUTTER |
|---|---|
| Profiled metal roofing | 80 mm |
| Masonry tile roofing | 100 mm |
| Pressed metal roofing | 50 mm |

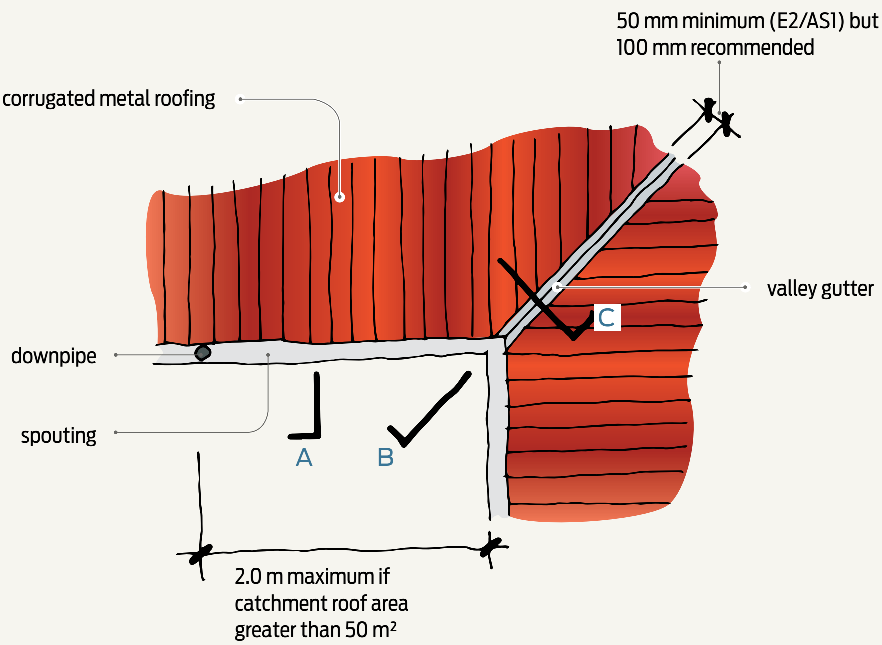



**Figure 28** **Plan of valley gutter.**

# 2.5 Pipe penetration through roof

Small pipe penetrations in roofs are typically flashed using proprietary EPDM boot flashings.

**FOR PROFILED METAL ROOFING**, E2/AS1 permits use of boot flashings where:

- the maximum roof pitch is 45º
- the minimum pitch is 10º if the base of the flange covers one or more complete troughs
- the pipe diameter is no more than 85 mm
- they are installed on the diagonal so water will flow around the flashing.

The boot flashings must be dressed, sealed and fixed to the roof profile (see Figure 29).

For larger penetrations, flashing is using:

- a soaker flashing with an EPDM boot flashing for penetrations up to 500 mm – E2/AS1 Figure 54
- a soaker type flashing (for penetrations up to 1200 mm) – E2/AS1 Figure 55.

For masonry tiles, a pipe penetration may be flashed using:

- an EPDM boot flashing fitted to an integral malleable soaker flashing dressed to the tile profile, or
- a lead sleeve taken 100 mm up the pipe and soldered to a lead flashing that is dressed to the roof tile profile 150 mm all around and carried up to the top edge of the tile – E2/AS1 Figure 29.

For larger framed penetrations, refer to E2/AS1 Figure 31 or use a proprietary boot flashing designed for flues. These are outside that scope of E2/AS1 and must be submitted for consent with supporting information as an alternative method.

A preferable option is to carry the soaker flashing up the roof to a ridge flashing (see Figure 30) rather than the details shown in E2/AS1 Figures 54 and 55. The *NZ Metal Roof and Wall Cladding Code of Practice* recommends a maximum length for a soaker flashing of 1.5 m to a ridge.

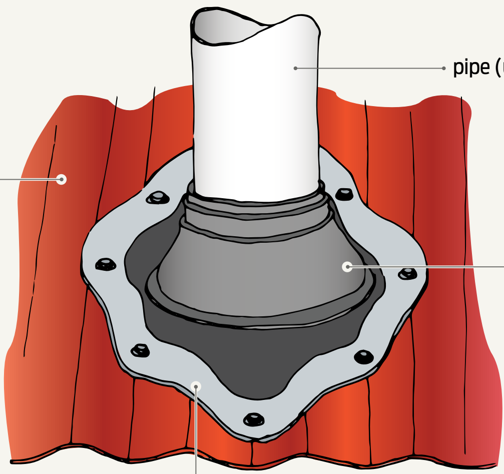



**Figure 29** **Pipe flashing.**

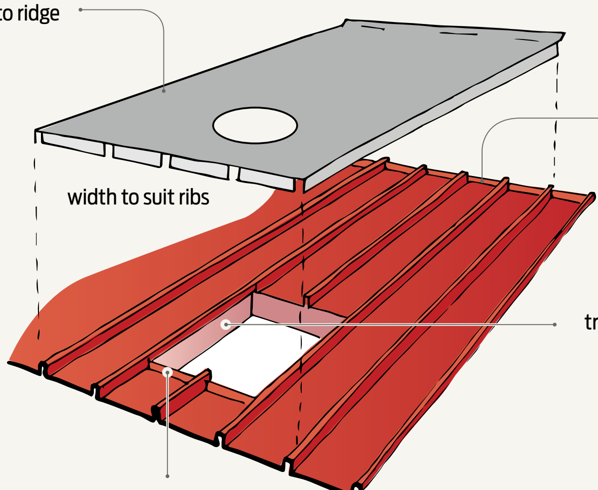



**Figure 30** **Detailing option for a larger penetration.**

# 2.6 Flashing a timber-framed chimney

Chimneys obstruct rainwater flowing off a roof and need to be well detailed and flashed to prevent problems.

**RAINWATER FLOWS FASTER** on steeper pitches, so the design of timber-framed chimney flashings is influenced by:

- the roof pitch
- the roof cladding – capacity of the troughs/pans, height of the profile and how the module of the cladding matches the dimensions of the chimney
- the size and shape of the chimney
- where the chimney is situated on the roof.

Another consideration is the risk of corrosion:

- from direct contact with another metal or substance
- as the result of run-off
- from poor design or installation allowing moisture to pond on the flashings.

### *Range of flashing types*

Several types of flashing are typically used for chimneys:

- Soaker or underflashings that drain beneath the roof pan.
- Watershed, also known as overflashings or backflashings, that drain at the plane of the rib of the roof and are run up to the ridge. These are suitable when the chimney falls between the ridge purlin and the next purlin down the roof.
- Tray soaker flashings that drain at the plane of the roof pan into a gutter. These are useful when the chimney is located between the gutter purlin and the next purlin up the roof.
- Tapered flashings that drain from beneath the roof pan at the top and over the ribs at the bottom. These are also known as under/over or transition flashings.

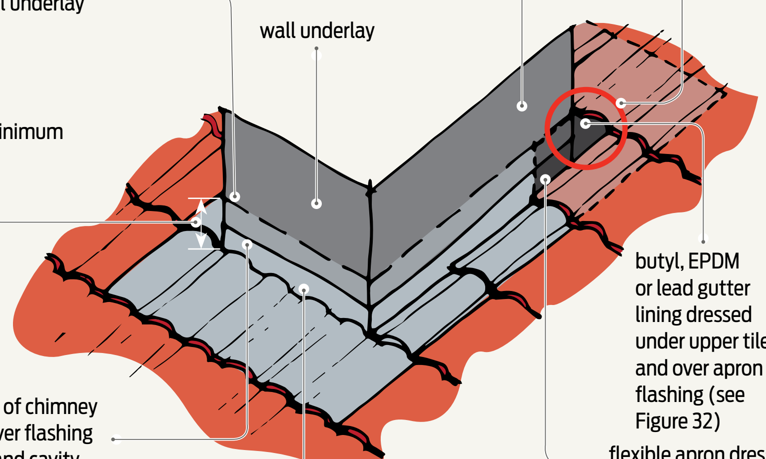



**Figure 31** **Chimney flashing for concrete tiles.**

- Cricket flashing or diverter to channel water around the chimney.

### *Sealing and underlay*

Flashings on unpainted and painted zinc and aluminium-zinc coatings are usually sealed with a neutral-cure silicone sealant in conjunction with mechanical fasteners. The sealant should be applied between the two sheets before they are fixed together.

Roof underlay should be lapped over the flashing so any condensation forming beneath the roof cladding above can drain.

### *Limited Acceptable Solutions*

Acceptable Solutions covered by E2/AS1 are limited. There is a relationship between the width of the chimney, the catchment area above it and the type of roofing material. As the width of the chimney increases, the permissible ➤

length of roofing above the penetration decreases (see E2/AS1 Table 17 for profiled metal roofing and Table 9 for other roof claddings).

For all types of roofing, penetrations over 200 mm wide must be supported with additional framing. An alternative method of providing support is 12 mm H3 treated plywood. The plywood should be securely fastened to the structure and be separated from the flashing by roofing underlay.

### *Masonry and pressed metal tiles*

For masonry tiles and pressed metal tiles, the minimum roof pitch is determined by the tile profile and material, the rafter length and, for masonry tiles, whether or not a roofing underlay is used. Refer to E2/AS1 Table 10.

At the sides, including downslope, a lead apron flashing is used, returning 100 mm minimum up the chimney and dressed out over the tiles at the base and sides.

At the rear of the chimney, a butyl, EPDM or lead gutter lining is carried over an anti-ponding board. This forms a secret gutter behind the chimney, extending at least 125 mm up the chimney framing. It is then dressed down over the lower flashing (see Figures 31 and 32). The gutter must be at least 100 mm wide, although wider is recommended, to facilitate drainage and removal of debris.

### *Profiled metal roofing*

E2/AS1 applies to penetrations up to 1,200 mm wide and roof pitches above 10º. It uses a soaker flashing based on details in E2/AS1 Figure 55 with a minimum 110 mm upstand to the chimney.

The flashing is lapped a minimum of 250 mm beneath the roofing sheets above. Cover dimensions above and below the chimney are given by dimension X from E2/AS 1 Table 7. The upslope face of the flashing upstand is splayed to shed water.

### *Membrane roofs*

E2/AS1 permits a maximum penetration size of 1200 × 1200 mm for membrane roofs with the membrane extending up a coved upstand at least 150 mm high.

## *Alternative methods*

Penetrations may be formed in roofs with any pitch down to 10º for corrugate and 3º for other profiles but will require specific design as alternative methods. Note that no penetrations are permitted in the portion of curved or draped roofs where the pitch falls below these limits.

The Acceptable Solution given in E2/AS1 shows the side gutter one full pan width on each side. For specific design, the capacity of the side gutters should be calculated based on catchment area, design rainfall and profile of the roofing material. For example, the capacity of a single corrugate valley is less than a single pan of a trapezoidal or trough profile roof cladding.

A metal flashing upslope of a chimney must be designed to prevent moisture or debris collecting behind the chimney, or the manufacturer's warranty may be void due to the risk of deterioration and premature corrosion.

The *NZ Metal Roof and Wall Cladding Code of Practice* recommends using a cricket flashing (see Figure 33) where the width of the penetration is more than 600 mm or the roof pitch is below 10º.

The intention of a cricket flashing is to divert the water and debris around the chimney rather than allowing it to collect behind the chimney. This type of flashing must be submitted as an alternative method.

**For more** See the *NZ Metal Roof and Wall Cladding Code of Practice*, available from www.metalroofing.org.nz/design.

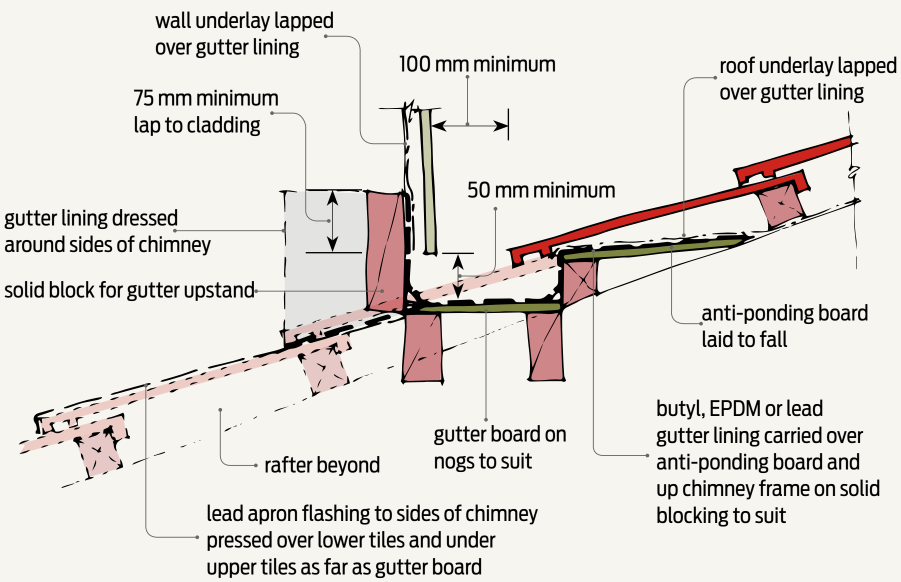



**Figure 32** **Section through gutter for concrete tiles.**

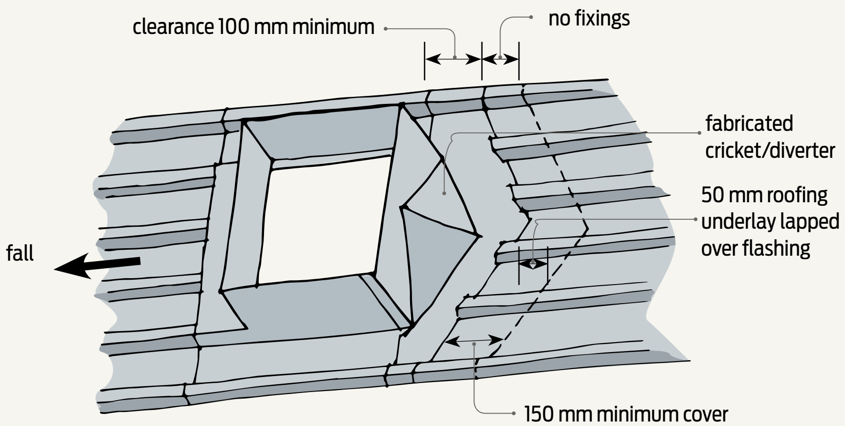



**Figure 33** **Cricket flashing.**

# Section 3:
# Wall flashings

# 3.1 Door and window flashings

## What are the requirements for door and window flashings?

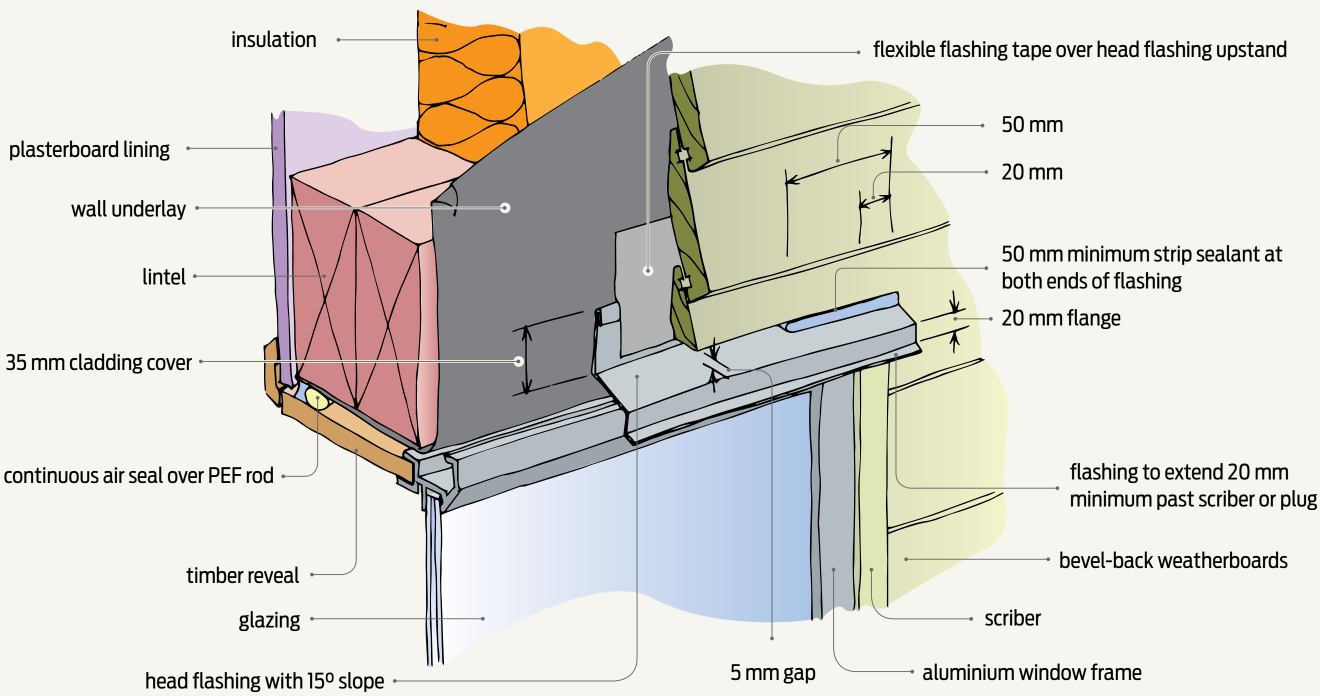



**Figure 34** **Window head flashing – direct-fixed cladding.**

**DOOR AND WINDOW** flashings include:

- head flashings
- window sill flashings
- jamb flashings.

### *Head flashings*

Minimum requirements for head flashings for both direct-fixed claddings and claddings on a cavity (see Figures 34 and 35) include that they:

- comprise a single continuous flashing for the full width of the frame with 10 mm stop-ends terminating at the back face of the claddings
- have a 15º cross-fall
- have a 10 mm minimum cover (excluding drip edge) to the face of the window frame
- have upstands behind the cladding that have a minimum:
  - 35 mm cladding cover for stucco, weatherboard and fibre-cement cladding in low (L), medium (M), high (H) and very high (VH) wind zones (that is, total upstand of 40 mm) – E2/AS1 Figure 81(a)
  - 50 mm for vertical and horizontal profiled metal in L, M, H and VH wind zones (total upstand of 55 mm) – E2/AS1 Figure 95 and 99
  - a 60 mm minimum cladding cover (total upstand of 65 mm) for extra high (EH) wind zones
- have a 5 mm minimum gap between the top of the sloped flashing and the bottom of the cladding above to let water drain out and air to enter for drying
- do not allow water to enter at flashing ends by extending the head flashing at least 20 mm past the window opening trim (facing boards and closing scribers)
- have sealant installed between the underside of the head flashing and the top edge of the window and door head flanges in VH and EH wind zones – E2/AS1 Figure 71(c).

Other requirements:

- For direct-fixed claddings, install a 50 mm long bead of sealant between the cladding and head flashing at each end of the flashing to

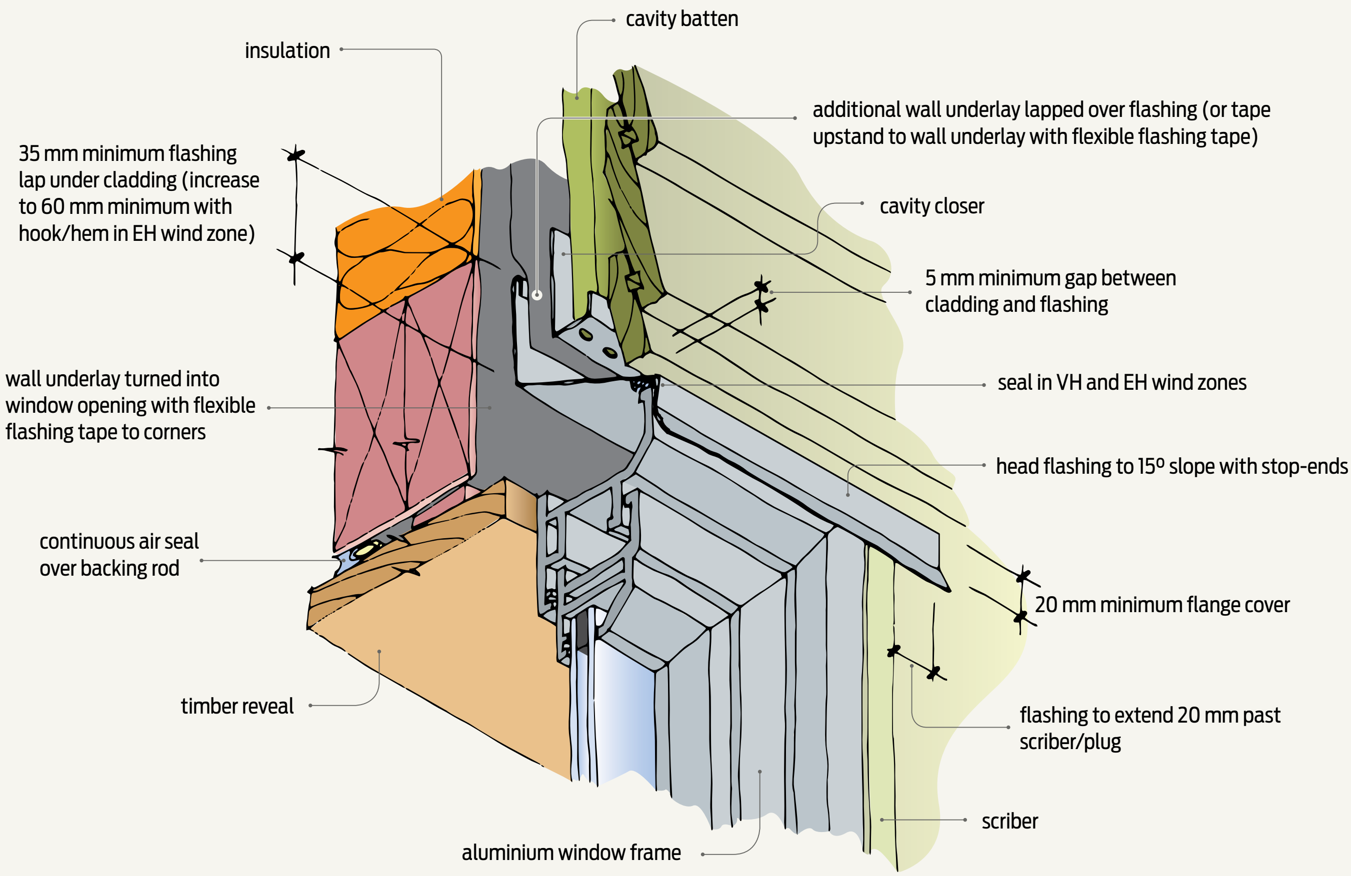



**Figure 35** **Aluminium window head detail – drained cavity construction.**

perform the function of stop-ends (see Figure 34) – E2/AS1 Figure 71(b).

- For cavity construction, the head flashing must bridge the drainage cavity so that water can drain to the exterior across the top of the opening. Provide a cavity base closer and vermin proofing to allow drainage and ventilation (1,000 mm²/m) but prevent vermin entry (see Figure 35).

### *Window sill flashings*

Sill tray flashings (see 3.6 *Sill support for windows* (pages 49–51)) are required for all windows and doors where the cladding is direct-fixed – E2/AS1 Figure 72A.

Sill tray flashings must:

- be continuous for the full width of the opening
- extend back past the condensation channels of the window
- not slope backwards
- not be sealed between the window facing and the tray
- have an 8 mm minimum upstand to the back of the tray and sloping end dams – E2/AS1 Figure 95.

A sill tray flashing that extends behind the line of the aluminium frame is also required with vertical profiled metal cladding.

A flexible sill flashing is required with masonry veneer – E2/AS1 9.2.4 and Figure 73(c).

### *Jamb flashings*

Jamb flashings are required by E2/AS1 for:

- stucco – E2/AS1 Figure 76
- profiled metal – E2/AS1 Figures 95, 99 and 100
- EIFS – E2/AS1 Figures 127 and 128
- masonry veneer – a flexible flashing – E2/AS1 Figure 73(c).

# 3.2 Direct-fixed window installation

What is the construction sequence for openings in walls with direct-fixed claddings?

**DIRECT-FIXED CLADDINGS** are not permitted in the EH wind zone, parapets or enclosed balcony walls. Since 2012, there have been changes for designs following E2/AS1. For openings in walls with direct-fixed claddings, this particularly concerns:

- the sill tray flashing design
- installation of jamb battens
- head flashing sealant at each end of the window.

### *Sill tray flashing*

Windows installed in openings with direct-fixed wall claddings must have a sill tray flashing as shown in Figure 36. It must:

- extend for the full width of the opening between trimming studs
- have an 8 mm back upstand
- have tapered end upstands
- provide 35 mm minimum cover to the cladding.

The sill tray can be flat – the 5º slope required in previous versions of E2/AS1 is removed.

The window must be supported on frame support blocks (supplied by the joinery manufacturer) and have a minimum 8 mm flange cover over the sill tray flashing downturn (previously, this was a 10 mm minimum cover) with a 5 mm unsealed air gap.

The jamb flanges must have a 10 mm minimum cover, and if not protected by a scriber or plug, the gap must be sealed (unchanged from previously). The changes mean that the packers underneath the timber reveal to the sill need to be a minimum of 8 mm – measure with the flashing in place to get the correct height.

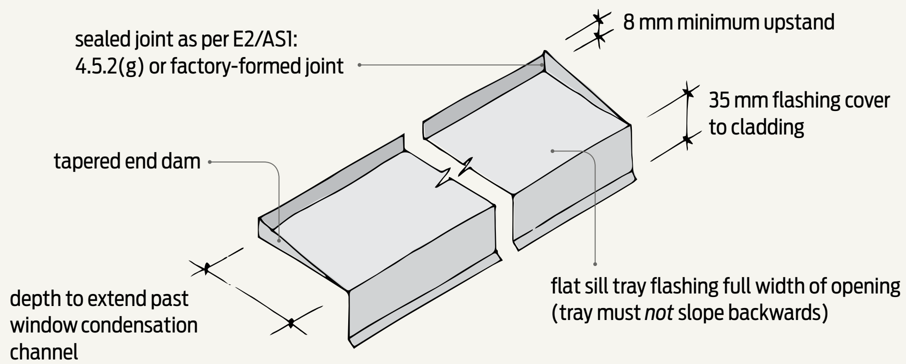



**Figure 36** **Sill tray flashing.**

### *Jamb battens*

Window openings with direct-fixed wall claddings require two 45 × 20 mm vertical jamb battens to be fixed to the face of the trimming stud on each side of the opening:

- The inside batten must be fitted between the lintel and the sill trimmer.
- The outside batten is fitted to the underside of the lintel but is stopped 20–40 mm short of the sill trimmer. This allows the sill flashing to extend along the full length of the sill trimmer between trimming studs without requiring stud notching.

The battens are installed after the timber-framed opening has been protected by folding the wall underlay back around the frame opening, then covering the corners and the full length of the sill trimmer with flexible flashing tape.

The cladding is fixed and trimmed to the battens, not the studs. The window opening width should be measured after the sill battens and the sill tray have been installed.

### *Head flashing sealant*

A 50 mm long bead of sealant must be installed between the cladding and each end of the head flashing to prevent water tracking around the end of the flashing. .

# Installing a window with direct-fixed cladding

The construction sequence for installing a window in direct-fixed cladding is described in Steps 1–15 and shown in Figures 37a–e.

**Step 1** – Install wall underlay across the full window opening. Make diagonal cuts, then fold the underlay round the opening and secure.

**Step 2** – Install flexible flashing tape in the corners and across sill trimmer:

- 100 mm along the head and down the jamb at the top corners and turned out 50 mm over the face of the wall
- across the full length of the sill trimmer and 100 mm up jambs at bottom corners and turned out 50 mm over the face of the wall.

**Step 3** – Install jamb battens to both trimming studs.

**Step 4** – Fix cladding up to sill level.

**Step 5** – Fix horizontal trim batten (which will be under the sill tray flashing).

**Step 6** – Fit the sill tray flashing. Provide a 35 mm minimum cover over the cladding.

**Step 7** – Fix the cladding up to the top of the opening. Cut slots in the cladding as required round the sill tray flashing.

**Step 8** – Install sill packers behind the sill flashing to support timber window reveal.

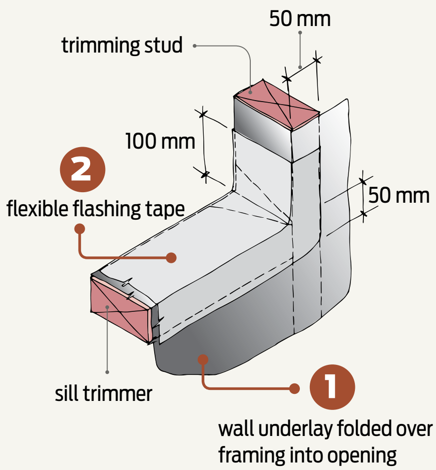



**Figure 37a** **Construction sequence Steps 1–2.**

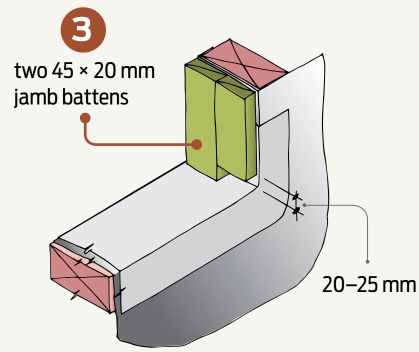



**Figure 37b** **Step 3.**

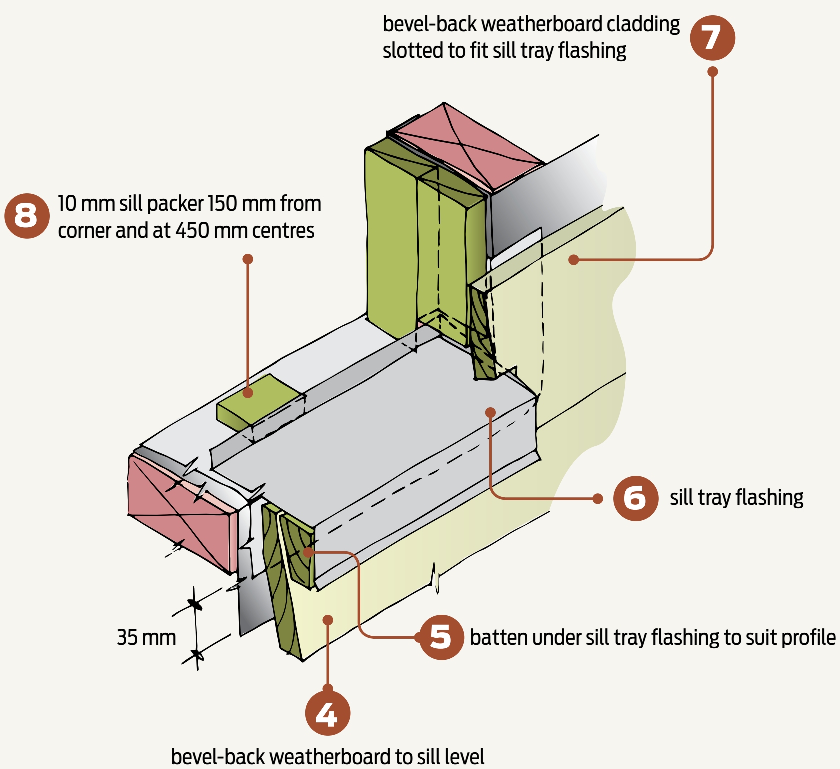



**Figure 37c** **Steps 4–8.**

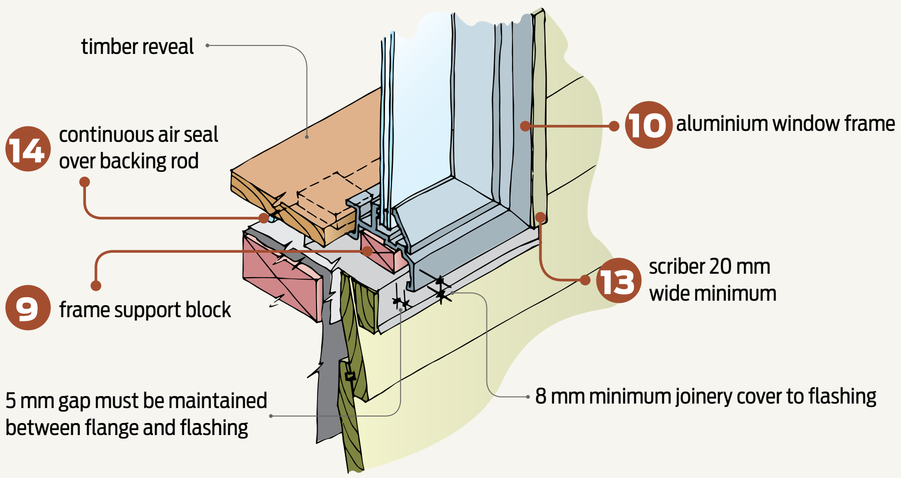



**Figure 37d** **Steps 9–14 for sill.**

**Step 9** – Install the window frame support blocks (supplied with window by manufacturer).

**Step 10** – Install the window, providing the requisite minimum flange cover, i.e. 8 mm at the sill, 10 mm at the jambs. Ensure that a minimum 5 mm gap between the window flange and sill tray flashing is maintained.

**Step 11** – Fit head flashing and cover either with additional wall underlay extended up under next lap or flashing tape for the flashing full length.

**Step 12** – Fix the remaining cladding.

**Step 13** – Install scribers or plugs to suit weatherboard profile. Scribers need to be 20 mm wide minimum to cover sill flashing.

**Step 14** – Install air seal over PEF backing rod around perimeter of the trim opening.

**Step 15** – Install a 50 mm bead of sealant between the cladding and head flashing at each end of the window.

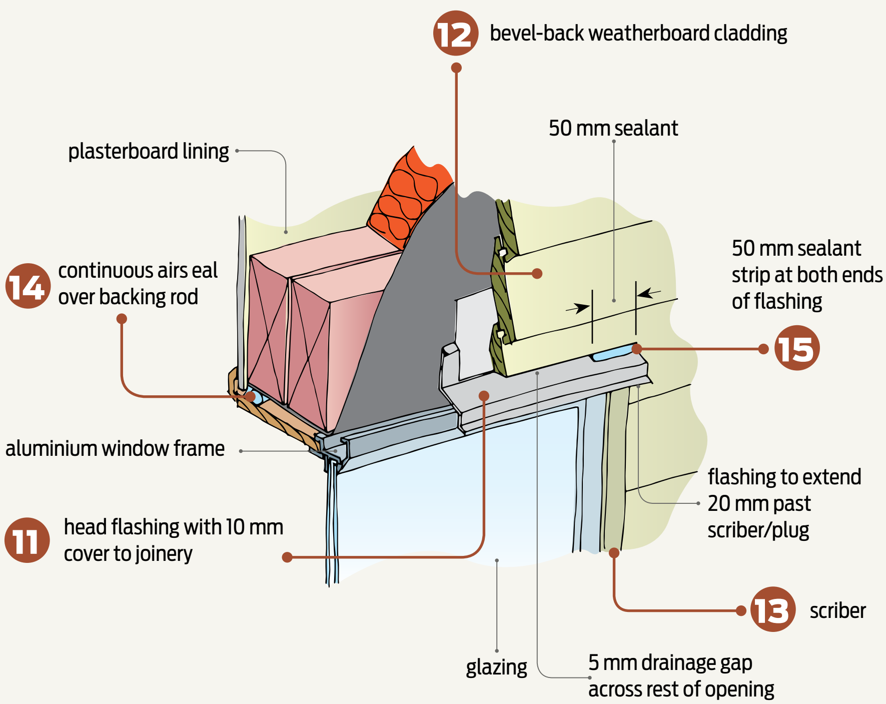



**Figure 37e** **Steps 11–15 for window head.**

# 3.3 Drained cavity window installation

What are the requirements for window installation in drained cavity construction?

**AMENDMENT 5** in 2011 to Acceptable Solution E2/AS1 *External moisture* included changes to both direct-fixed and drained cavity construction window installation requirements. The changes to direct-fixed window installation are described in 3.2 *Direct-fixed window installation* on pages 38–40.

### *Sill support bar*

The most significant change for drained cavity window installation requires the fitting of a sill support bar to all doors and windows over 600 mm wide.

The sill support bar must allow any water that gets past the external cladding to drain away, and it must maintain at least 1,000 mm² clear opening per metre length of window between the drainage cavity and the window or door trim cavity to allow air passage. To do this, sill support bars incorporate drainage and ventilation openings.

Sill support bars must end within 100 mm of the trimming stud.

Sill support bars must also comply with BRANZ Evaluation Method EM6, Verification Method E2/VM1 and Acceptable Solution B2/AS1.

Additionally, manufacturers must provide information about the support bar loading limits.

### *Jamb flange gap*

For fibre-cement sheet or ply claddings, E2/AS1 now requires a 5 mm gap for sealant to be left between the jamb flange and cladding.

### *Other cavity construction changes*

There are several other changes:

- In extra high (EH) wind zone situations, flashing upstand dimensions must be 25 mm more than the dimensions stated in E2/AS1 section 4.5.1 or Table 7, and all flashings must have a hook or a hem.
- In very high (VH) and EH wind zones, sealant must be inserted between the head flashing and the window head flange as shown in E2/AS1 Figure 71(c).
- The minimum cover to the cladding for window sill flanges has been reduced to 8 mm, although the minimum jamb flange cover remains at 10 mm.
- Factory-fitted soakers are required behind the sill/jamb mitred frame joints of aluminium windows and doors.

# Installing a window into cladding with cavity

The construction sequence for installing a window into a cladding with a cavity is described in Steps 1–13 and shown in Figures 38a–e.

**Step 1** – Install flexible wall underlay across the full window opening. Make diagonal cuts, then fold the underlay round the opening and secure. For rigid underlay, trim to opening.

**Step 2** – Install a small patch of flexible flashing tape across corners. Then install flexible flashing tape in the corners and:

- at the top corners 100 mm along the head and down the jamb and turned out 50 mm over the face of the wall
- across the sill trimmer with 100 mm return up the jambs and turned out 50 mm over the face of the wall.

If rigid underlay is used, tape the whole opening.

**Step 3** – Install the sill support bar.

**Step 4** – Fix cavity battens beside and below the window opening.

**Step 5** – Fix cladding over cavity battens below window and to side of opening.

**Step 6** – Fix horizontal trim under window to suit profile. Notch edge over cladding as required.

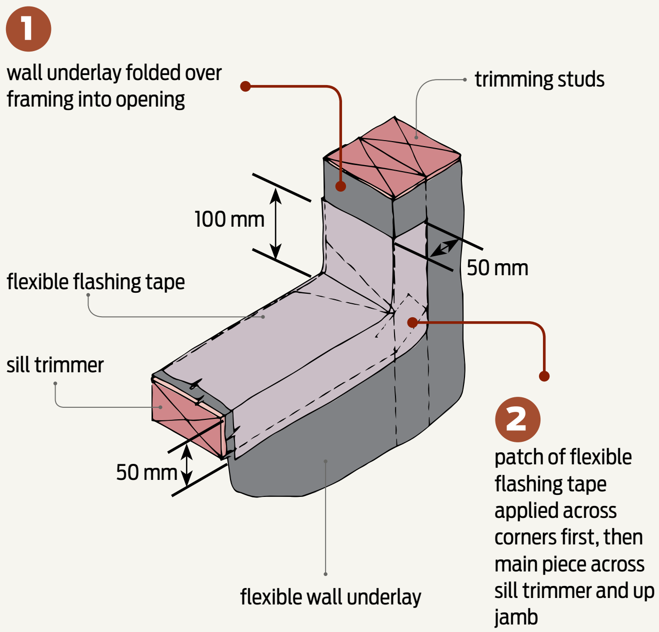



**Figure 38a** Steps 1–2: Install wall underlay and flexible flashing tape.

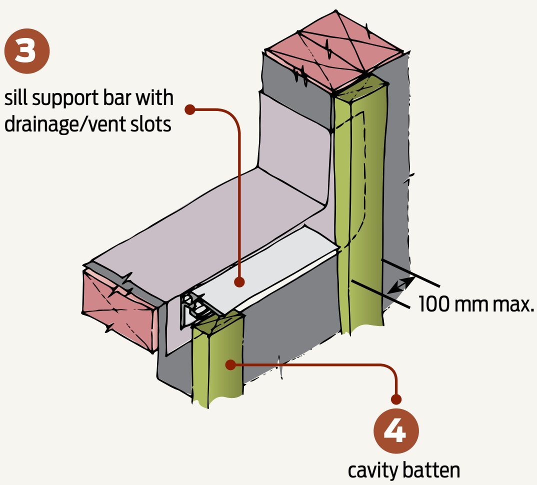



**Figure 38b** Steps 3–4: Install support bar and cavity battens.

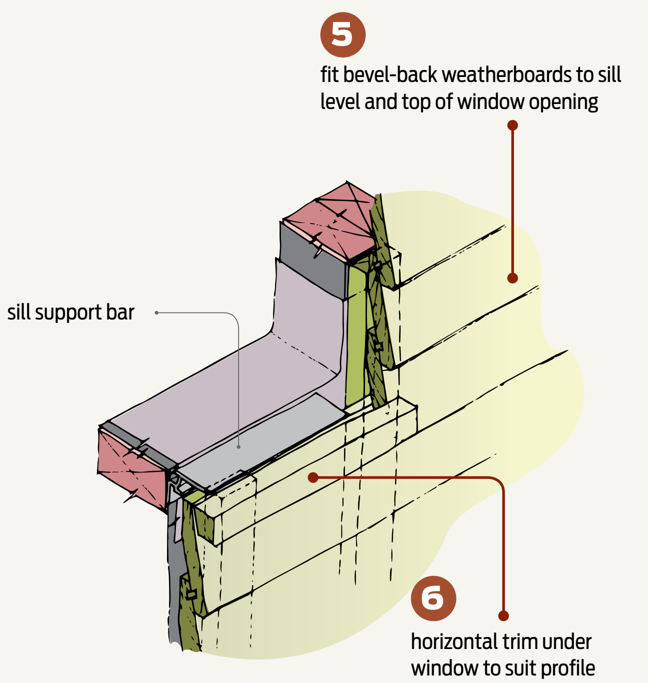



**Figure 38c** Steps 5–6: Fix cladding to sill level and top of window.

**Step 7** – Install windows to meet the minimum flange cover – 8 mm at sill, 10 mm at jamb. No gap is required at jambs or sills unless fibre-cement sheet or ply cladding.

**Step 8** – Fit head flashing and cover with either additional wall underlay extended up to next lap or flashing tape for full length of the flashing. Apply sealant between head flashing and window head flange in very high (VH) and extra high (EH) wind zones before fitting flashing. Ensure head flashing is stop-ended.

**Step 9** – Fit cavity closure.

**Step 10** – Fit cavity battens above window opening.

**Step 11** – Fix the remaining cladding above the opening.

**Step 12** – Install scribers and plugs to suit weatherboard profile.

**Step 13** – Install air seal over backing rod around perimeter of the trim opening shortly before fixing interior linings.

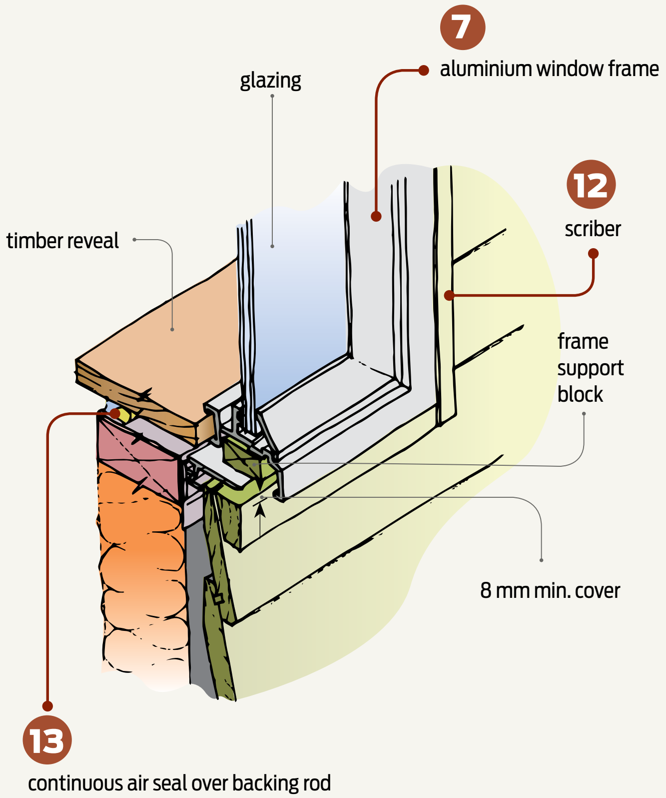



**Figure 38d** Steps 7, 12 and 13: Install window and finish sill.

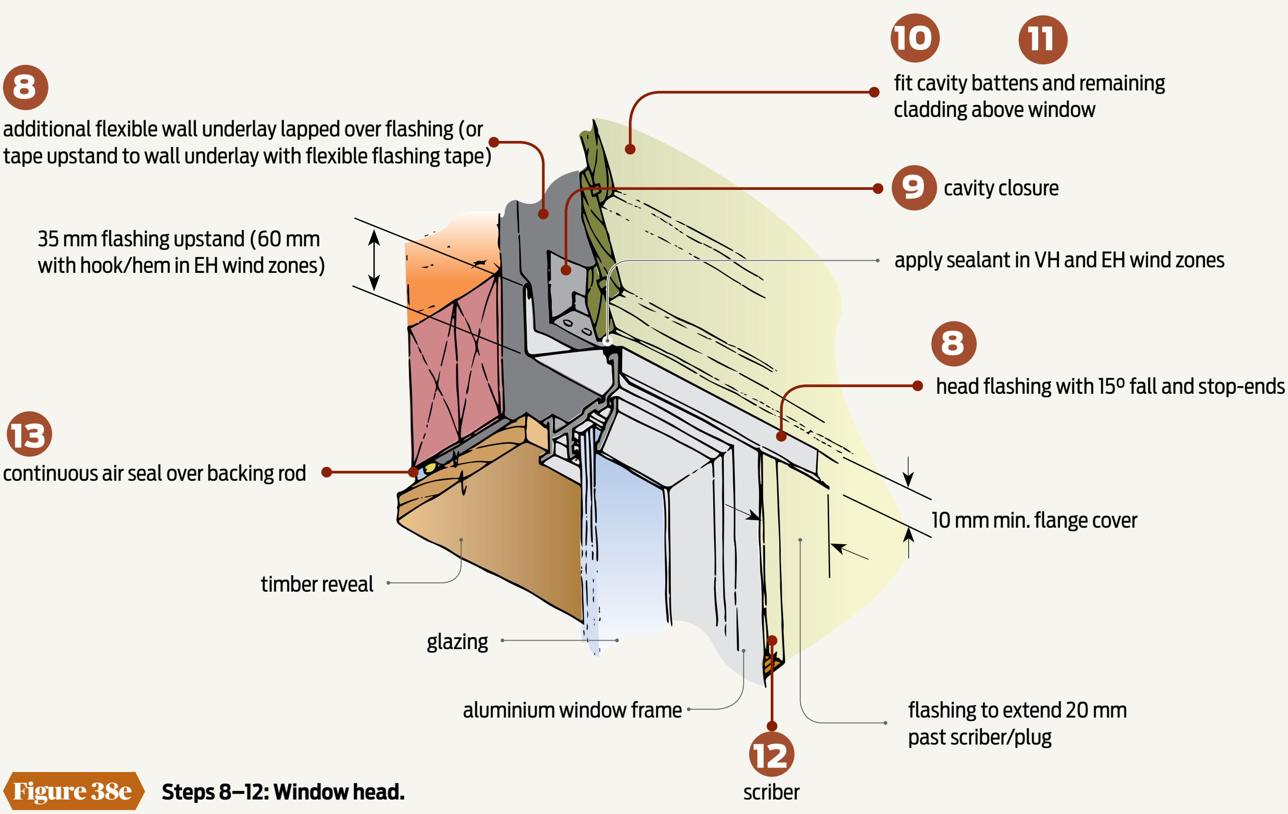



**Figure 38e** Steps 8–12: Window head.

# 3.4 Timber windows in a cavity

These details should help you to correctly install timber windows into a cavity cladding system.

**TIMBER WINDOW FRAMES** and sashes were the sole option for New Zealand buildings until the 1970s when aluminium became the dominant material for window frames and sashes.

Demand continues for timber windows, particularly in renovation projects or where the natural appearance and thermal properties of timber are desired.

### *Get the installation right*

Allied with this is the demand for reference details that show the correct installation for timber windows, particularly into cavity cladding systems.

Figures 39 and 40 give two options for the window head detail, while Figure 41 covers the sill and Figure 42 the jamb.

The details incorporate features to improve performance such as:

- folding the flexible wall underlay into the framed opening
- installation of flexible flashing tape as shown in E2/AS1 for aluminium windows
- taping the head flashing upstand to the wall underlay or installing an additional layer of flexible wall underlay
- installation of air seals over backing rods.

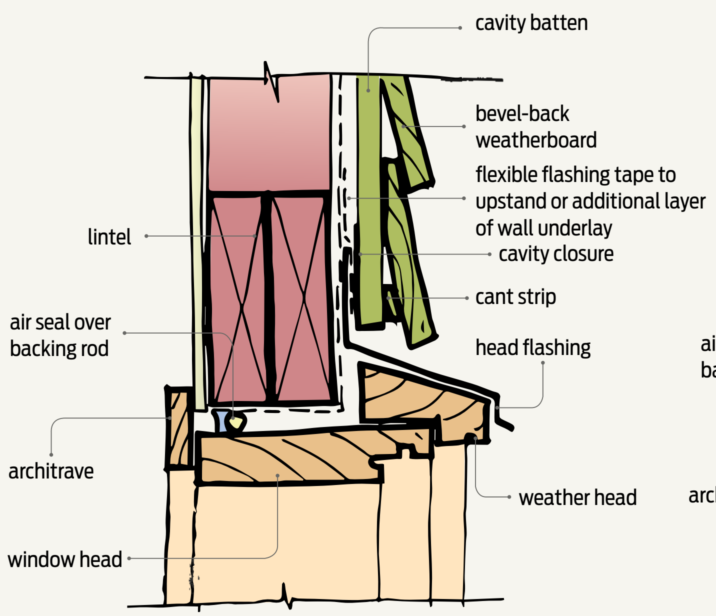



**Figure 39** Window head detail option 1.

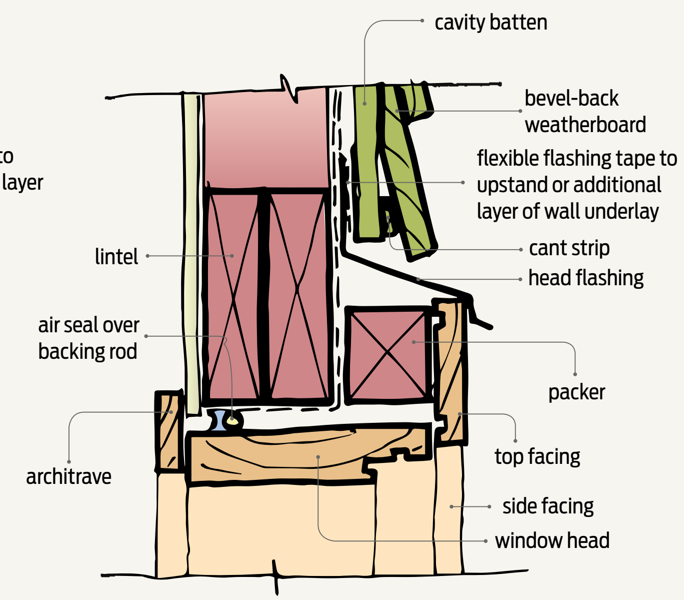



**Figure 40** Window head detail option 2.

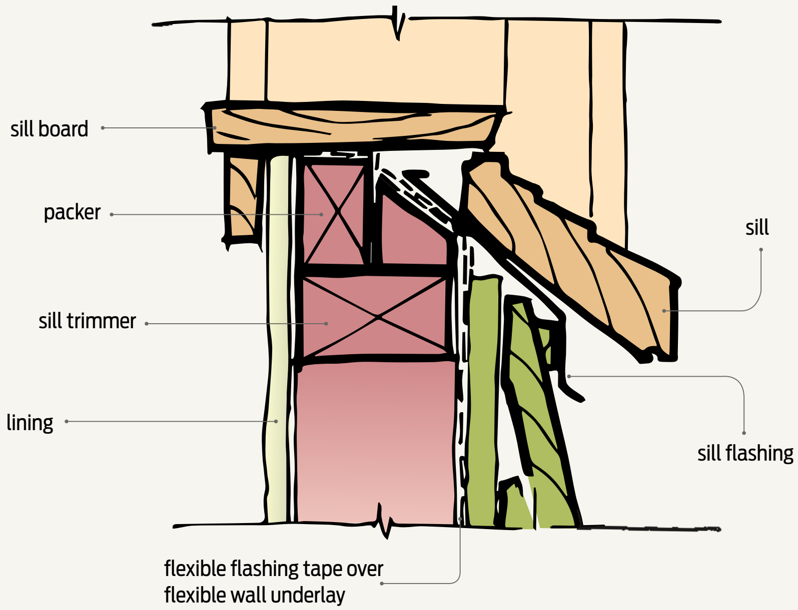



**Figure 41** **Sill detail.**

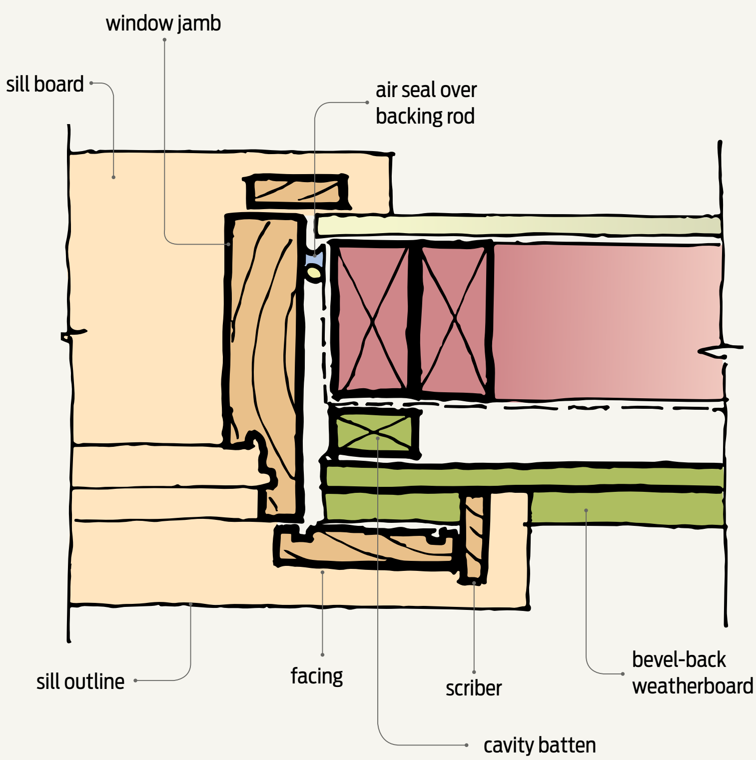



**Figure 42** **Jamb detail.**

# 3.5 Raking window head detail

Raked windows make an interesting feature with a sloped rather than horizontal window head that may follow the roofline. Careful design and installation is needed so they are weathertight, particularly at the low end of the rake.

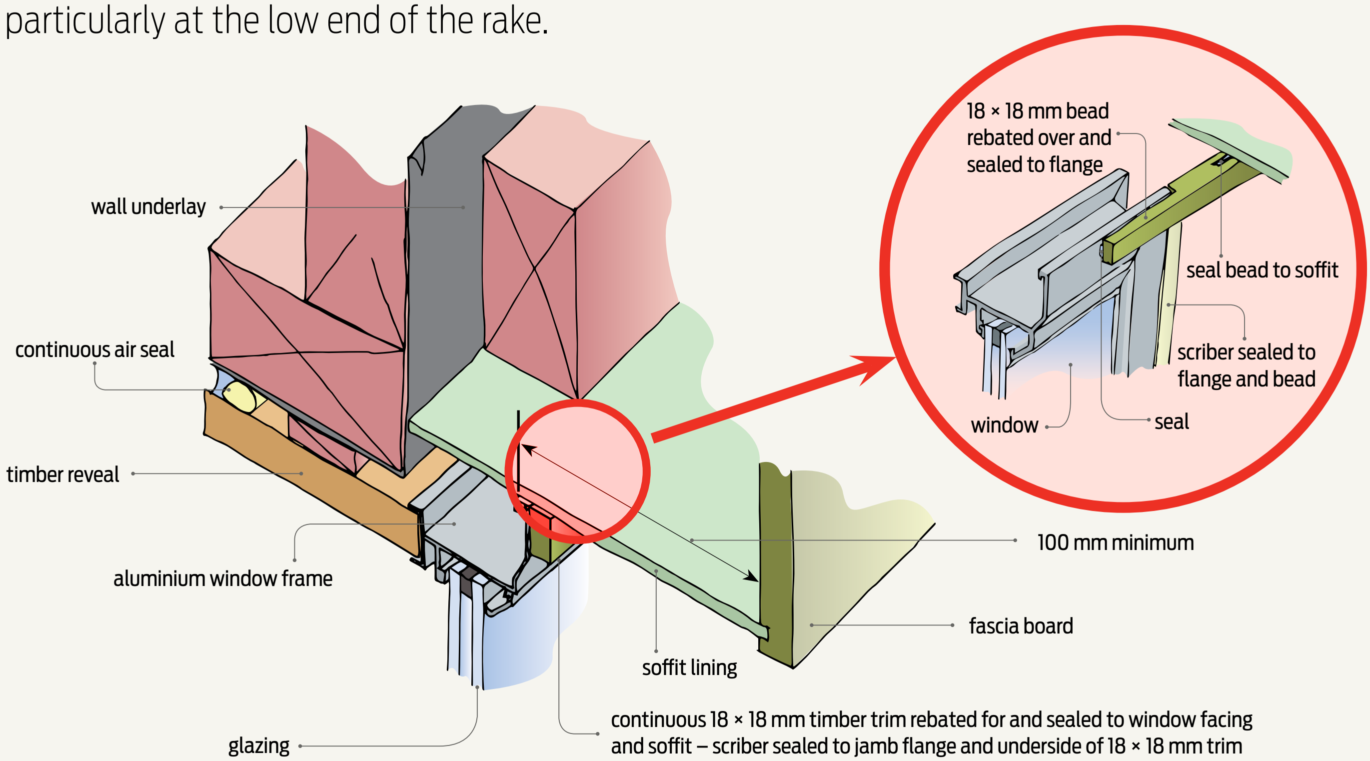



**Figure 43** **Raked window head directly under soffit (based on traditional soffit installation). A window head detail based on BRANZ's soffit details in *Build* 158 will be published in *Build* 163.**

**RAKED WINDOWS** are often found where high-level glazing follows the roofline. The sloping head means that it may have rainwater flowing along as well as across the head flashing. Water accumulating at the low end of the rake makes this area of a raking window particularly vulnerable to water entry.

### *Always an alternative method*

Acceptable Solution E2/AS1 to New Zealand Building Code clause E2 *External moisture* only applies to aluminium windows (with flanges that overlap the cladding) with a horizontal head.

No solution is provided in E2/AS1 for the installation of any raked windows. For a building consent application, the raked window head detail must be designed and submitted as an alternative method.

However, some of the requirements of E2/AS1 may be applied to a raked window head detail (see Figures 43 and 44). For example, E2/AS1 allows a window directly under a horizontal soffit to be installed without a head flashing. Figure 43 shows this applied to raked windows.

### *Applicable E2/AS1 requirements*

E2/AS1 window head flashings must deflect water to the outside of the wall cladding and:

- have a 15º minimum cross-fall
- have a minimum upstand behind the cladding above of:
  - 40 mm (35 mm minimum cladding cover plus 5 mm gap for drainage and ventilation) in low (L), medium (M), high (H) and very high (VH) wind zones
  - 65 mm (60 mm minimum cladding cover plus 5 mm gap) in extra high (EH) wind zones

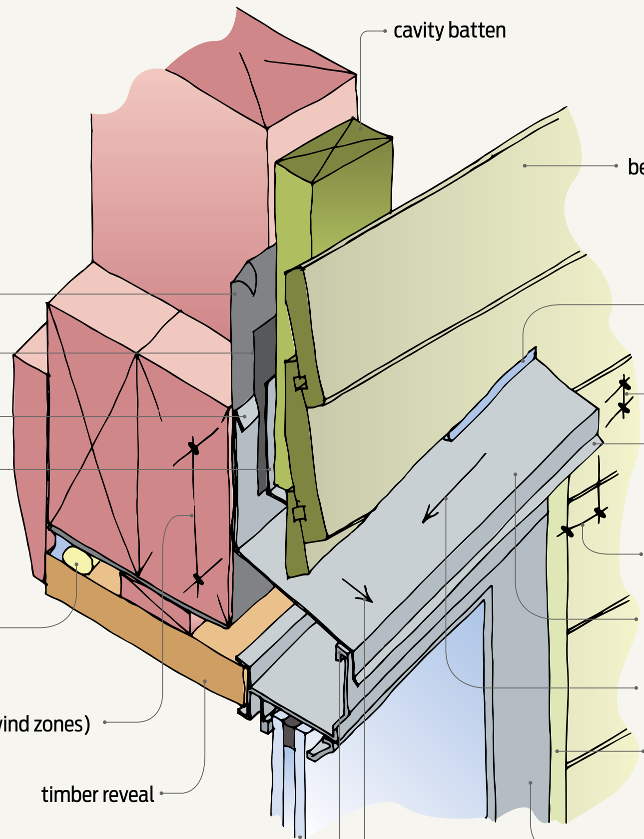



**Figure 44** **Raked flashed window head – preferred option.**

- have:
  - in L, M, H and VH wind zones, either a hem or hook or a 25 mm increase in the upstand beyond the requirement of E2/AS1 Table 7
  - in EH wind zones, a hem or hook and a 25 mm increase in the upstand beyond the requirement of E2/AS1 Table 7
- be sealed to the face of the wall underlay with flexible flashing tape or be overlapped by an extra layer of wall underlay from above
- provide 10 mm minimum cover to the face of the window flange, and the exposed bottom edge of a head flashing must be folded out to form a bird's beak or kick-out
- extend at least 20 mm beyond the face of the window frame or the scriber or rustic plug where horizontal weatherboards are installed (see Figure 44)
- have sealant installed between the underside of the head flashing and the top of the window flange in VH and EH wind zones.

For direct-fixed cladding, E2/AS1 requires a 50 mm length of sealant at each end of the flashing between the cladding and flashing. For raked windows, install the sealant at the top end of the flashing only to allow the stop-end to discharge water.

Where a drained and vented cavity is installed, a horizontal flashing must have a 10 mm stop-end at each end that finishes at the inside face of the cladding. Raked windows require a 10 mm stop-end at the top and a kickout at the bottom (see Figure 45). The stop-ends **must not** pass through the cladding. The base of the drainage cavity above the window head must be closed off by a ventilated cavity closer.

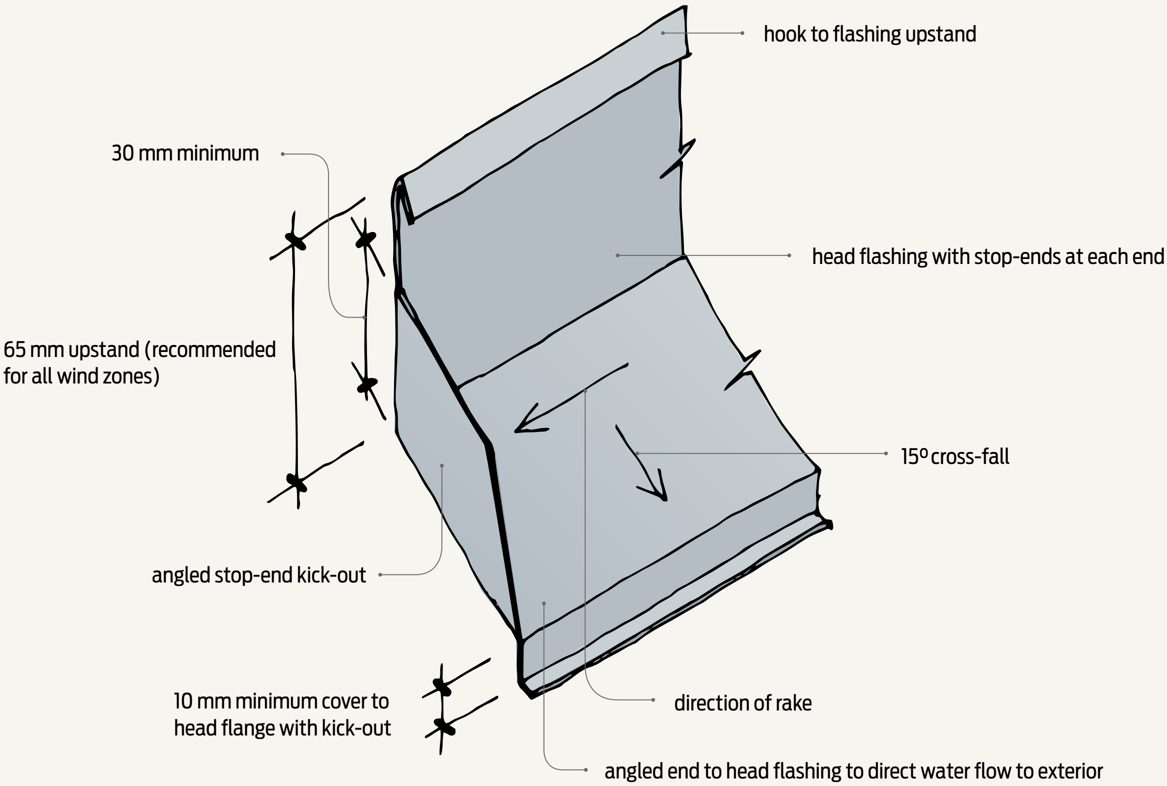



**Figure 45** **Head flashing shaped to deflect water.**

### *Pointers when detailing a raked window head*

The key elements to the detailing of a raked aluminium head (Figure 44) that overlaps the cladding are:

- getting water off the flashing at the bottom of the rake
- stopping water getting in at the top of the rake.

Key elements of Acceptable Solution E2/AS1 that can be applied to the raked flashing installation are the interaction of the flashing upstands (suggested increase in height), cladding cover and cover to the window flange.

### *Option 1 – Head as apron flashing*

The preferred option is to consider the raked head flashing as an apron flashing with a stop-end kick-out (see Figure 45) at the bottom of the rake. This will discharge water to the outside for both cavity and direct-fixed claddings (having a cavity is preferred). A flashing stop-end as detailed in E2/AS1 is designed to prevent water being driven past the end of the flashing into a cavity. When applied to a raked window, it has two flaws:

- It does not deflect water to the outside face of the cladding as it terminates at the back face of the cladding.
- It is not of sufficient size to deflect the amount of water that may be present.

Key requirements include:

- sealing any cut in the cladding to allow the installation of the kick-out flashing
- sealing the top of the scriber to the underside of the head flashing.

### *Option 2 – Timber bead*

A second option where the top of the window fits directly under a flat sheet soffit (see Figure 43) is to protect the junction at the raked head with a timber bead that is sealed to both the window flange and the soffit.

# 3.6 Sill support for windows

New Zealand houses often have large, typically double-glazed windows. Care is needed to support the weight of these windows particularly when installed beyond the face of the wall framing.

**TWO CHALLENGES CREATED** by large, double-glazed units installed beyond the face of the wall framing are:

- ensuring the weight of the window is carried down through supporting elements to the building structure
- providing support to the sill flashing in direct-fixed cladding situations.

### *Align setting blocks and frame support blocks*

Double-glazed units are supported within the window frame on setting blocks to prevent glass-to-frame contact. They are used in pairs and must be located in accordance with AS/NZS 4666:2012 *Insulating glass units* generally at ¼ and ¾ points across the width of the glazing units (see Figure 46a) but they may also be located within the greater of the width/8 or 150 mm from the glass edge (see Figure 46b).

For direct-fixed claddings, E2/AS1 requires aluminium window frames to be supported on frame support blocks. These may either be fitted to the frame by the manufacturer or be a proprietary product that is installed by

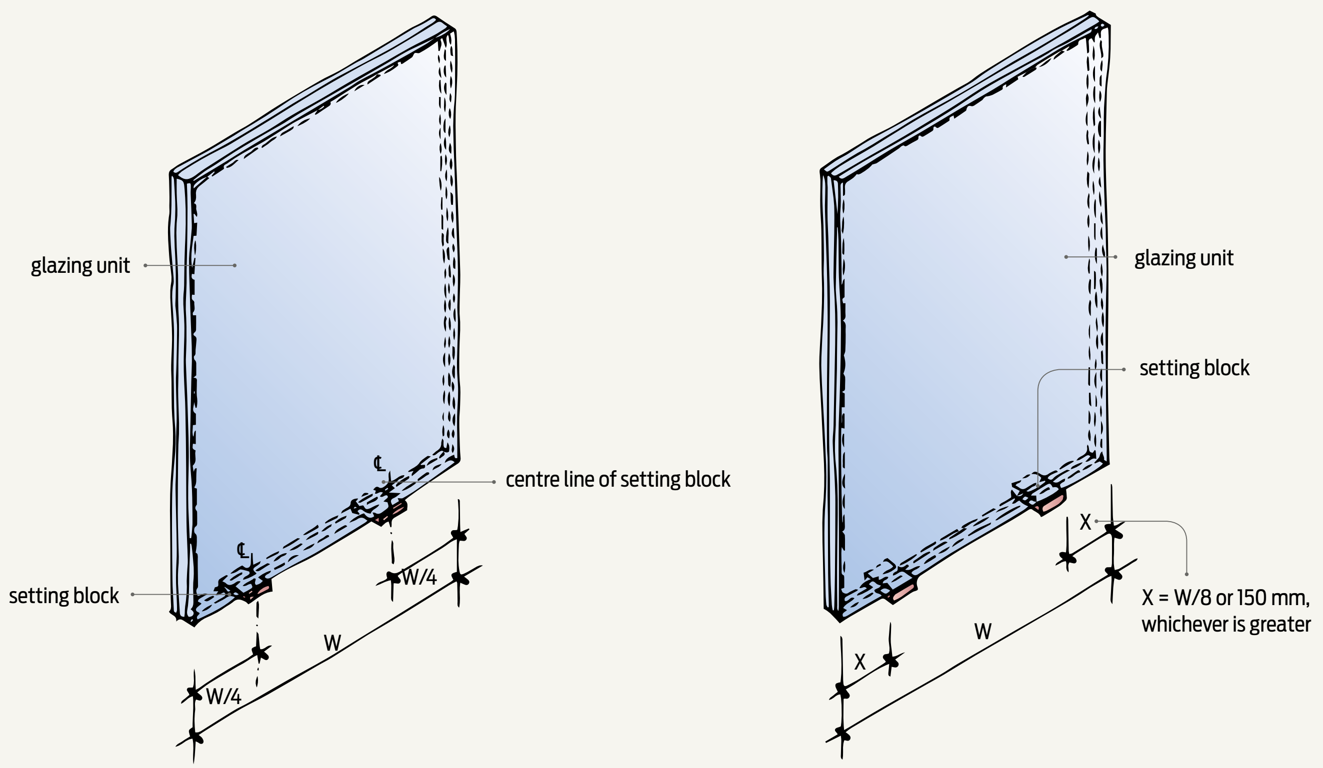



**Figure 46** **Location of setting blocks.**

the window installer. However, E2/AS1 does not state where the support blocks must be installed.

Support blocks must be located directly underneath the setting blocks to ensure the load of the windows is transferred directly to the building structure. In some situations, windows have failed because the support blocks have not been aligned with the setting blocks.

Therefore, before installing the window, confirm the location of the setting blocks, and ensure that the support blocks align with them (see Figure 47).

### *Sill flashing support for windows*

The flat sill tray flashing that is required by E2/AS1 for direct-fixed claddings must also be supported and allow for the installation and support of the frame support blocks.

Typically, the sill tray is supported at least in part by the sill trimmer (E2/AS1 Figure 72A) and by the top edge of the cladding where it is accurately trimmed to the opening (E2/AS1 Figures 81 to 84 for weatherboards and Figure 115 for flat sheet cladding).

A problem can arise where the cladding is not installed accurately and there may be insufficient bearing for the frame support blocks because of the cladding used and/or the location of the installed window frame, for example, E2/AS1 Figure 90 for fibre-cement weatherboards.

Where this occurs, the options are to install:

- a metal angle bracket to the sill trimmer (not a proprietary sill support bar used for cavity construction) to support both the part of the

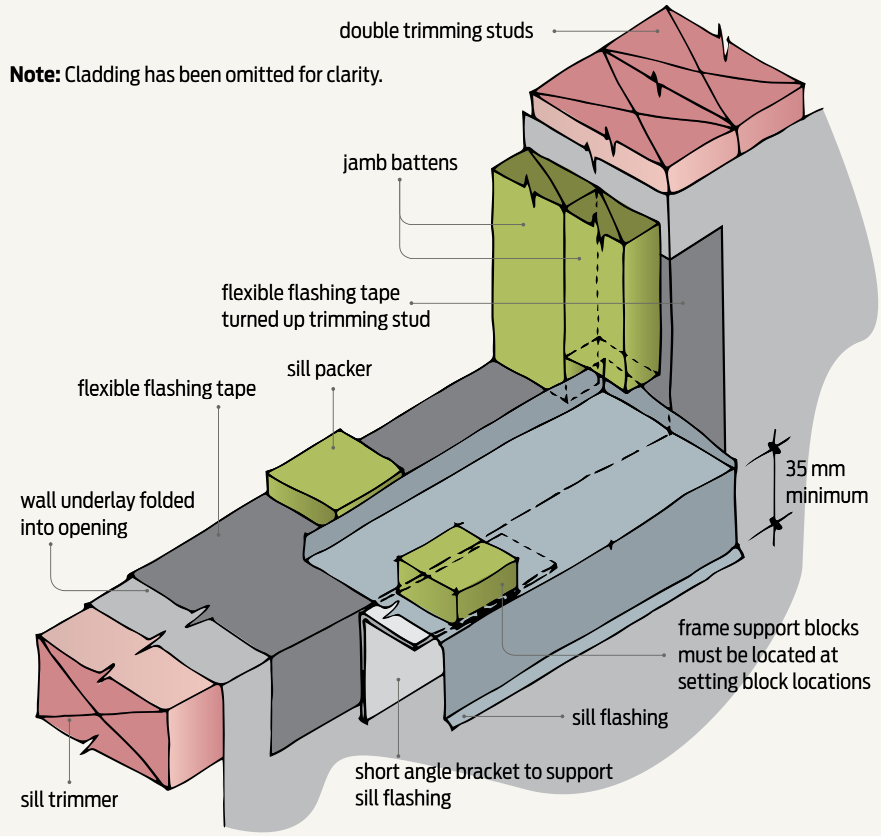



**Figure 47** **Angle bracket supporting sill tray – preferred option.**

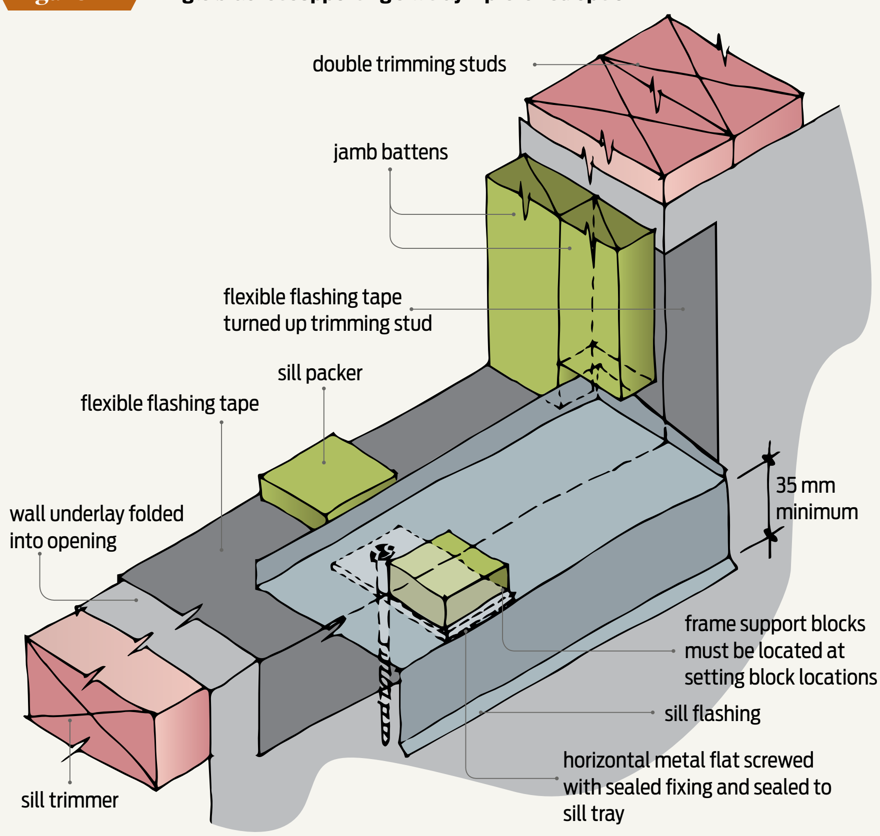



**Figure 48** **Horizontal metal flat supporting sill tray.**

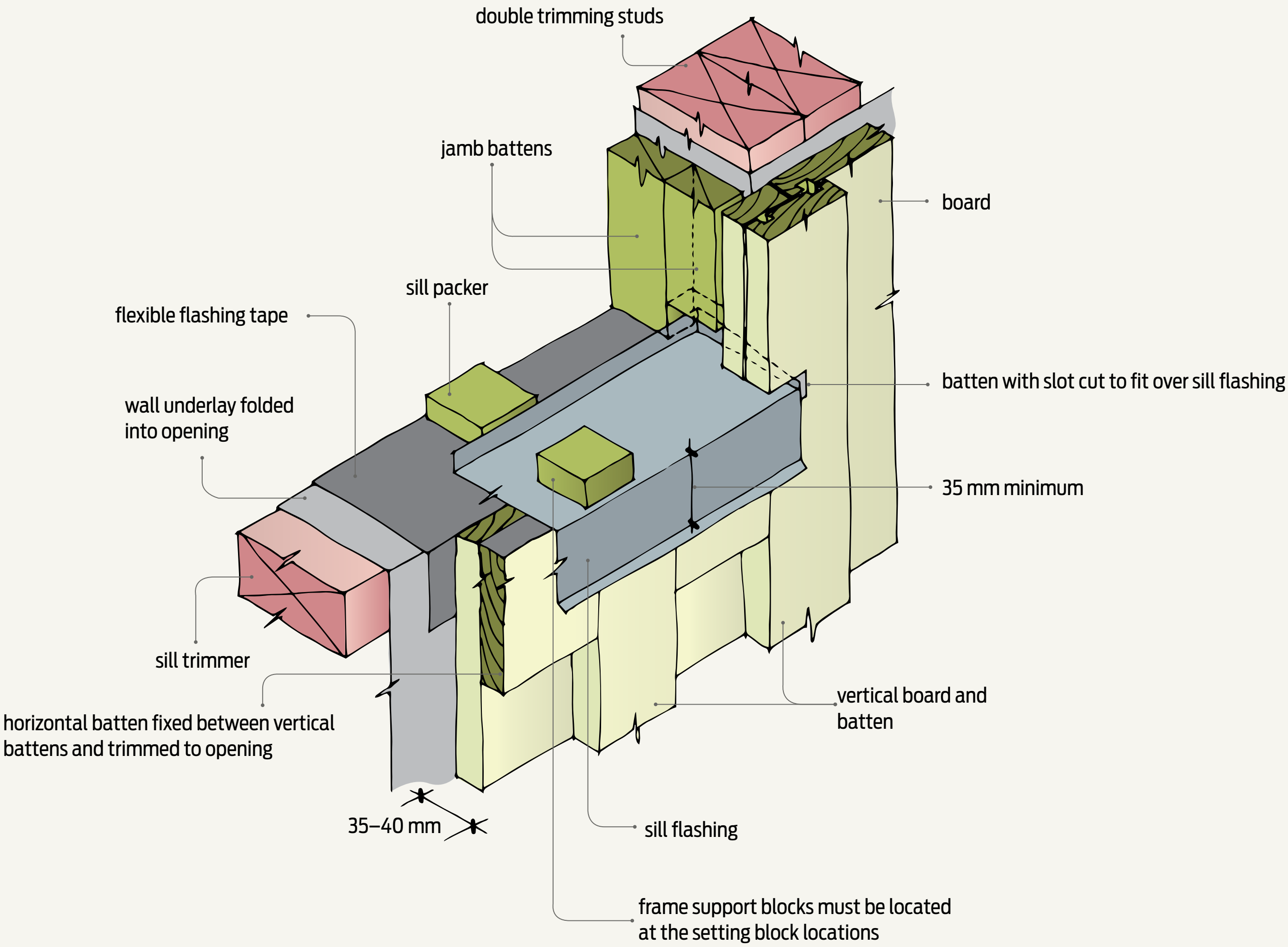



**Figure 49** **Horizontal batten supporting sill tray.**

sill tray flashing forward of the framing and the frame support blocks (see Figure 47)

- a horizontal metal flat sealed to the sill tray and screwed with a sealed fixing into the upper face of the sill trimmer and projecting forward of the framing line on which a frame support block can be placed (see Figure 48).

Figure 49 shows the board and batten cladding trimmed to the line of the sill trimmer with support also provided by the horizontal batten fixed between the vertical battens. (Fixing the horizontal batten between the verticals ensures the vertical board joint is fully protected from the weather. If the horizontal board under the sill is continuous and the verticals butted to it, the bottom edge should be undercut or the flashing downturn extended to provide better weathering to the joint.)

### *Simpler over a cavity*

It is worth noting that installing windows is considered easier where a cladding is installed over a cavity, a proprietary sill support bar can be used and the sill tray flashing omitted.

# 3.7 Installing a timber sill

There are 10 main steps to installing timber windows in direct-fixed bevel-back weatherboards.

**WHILE NOT IN E2/AS1**, this installation sequence for the sill of a timber window into a direct-fixed bevel-back cladding system is relatively straightforward.

There are 10 key steps for an Alternative Solution (see Figures 50a–f).

**Step 1** – Turn the wall underlay into the rough opening. Remember to allow for the vertical packers at the jamb when setting out and site measuring for the windows.

**Step 2** – Fit a flexible flashing tape that is compatible with the wall underlay to the sill trimmer.

**Step 3** – Install the weatherboards.

**Step 4** – Fit the flashing support packer to the sill trimmer.

**Step 5** – Fit the vertical jamb packer where required.

**Step 6** – Insert the sill tray flashing across the full width, over tape and to jambs.

**Step 7** – Insert the window and install the air seals.

**Step 8** – Fit insulation (not shown for clarity).

**Step 9** – Line interior.

**Step 10** – Fit sill and architraves.

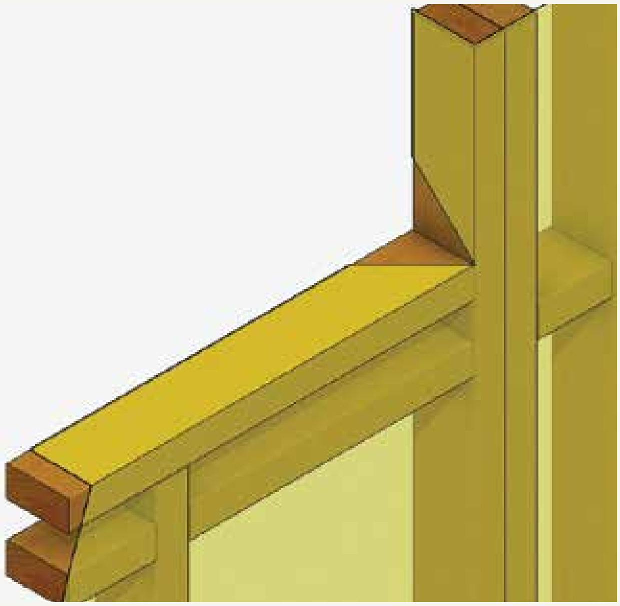


**Figure 50a** Construction sequence – Step 1.

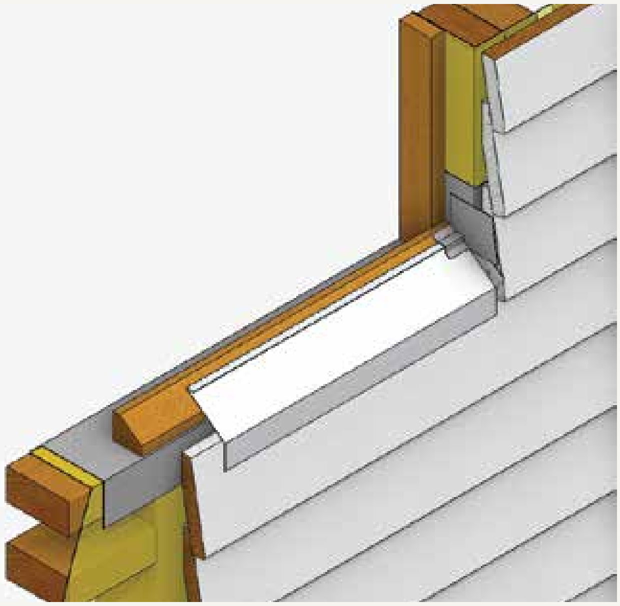


**Figure 50d** Step 6.

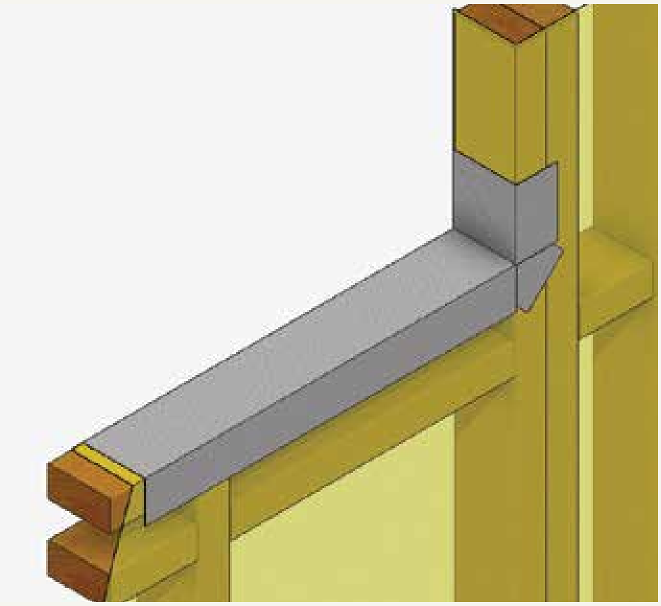


Figure 50b Step 2.

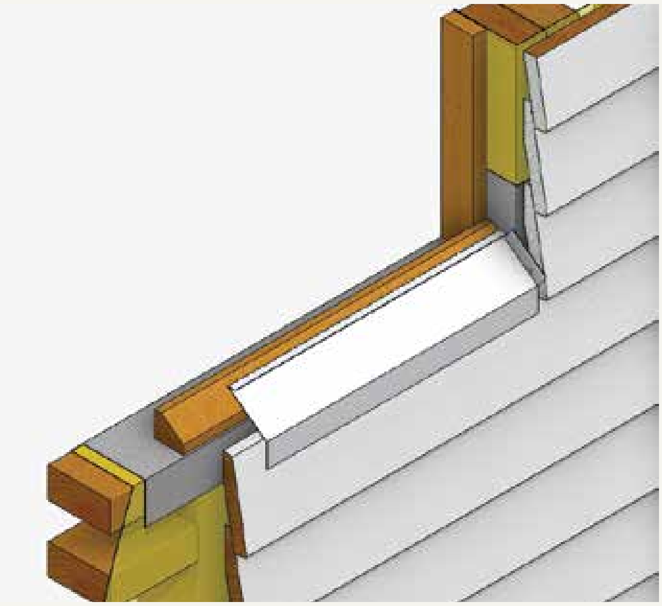


Figure 50c Steps 3–5.

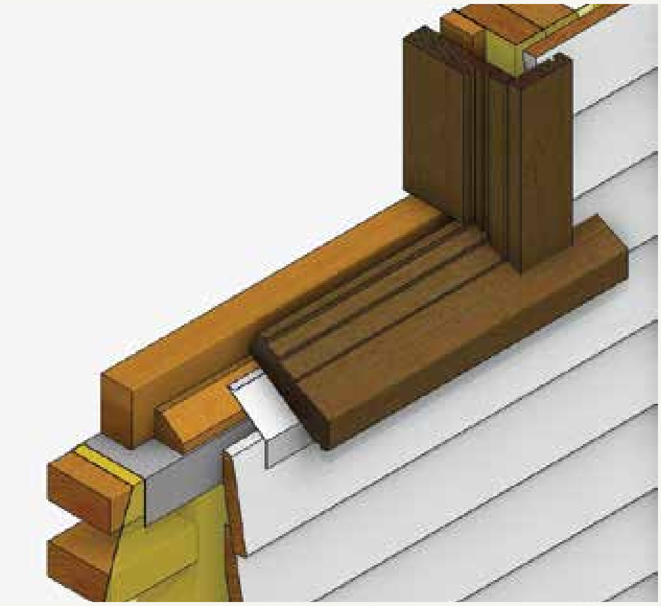


Figure 50e Step 7.

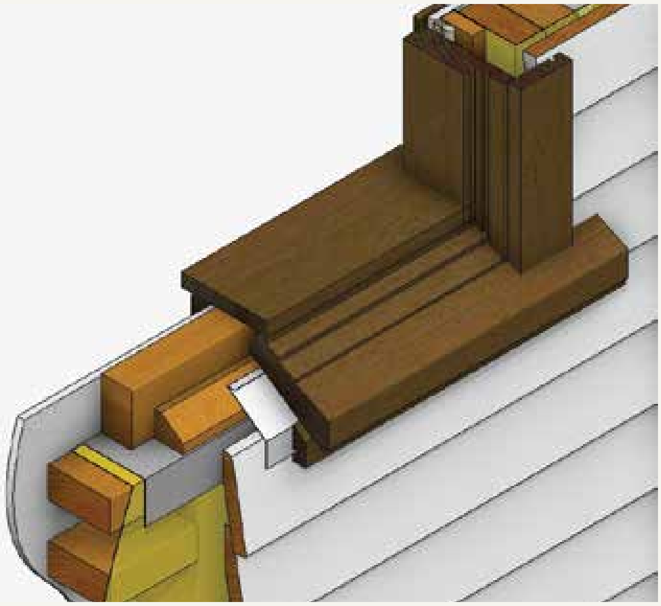


Figure 50f Steps 8–10.

# 3.8 Flashing openings in masonry veneer

Correctly flashing openings in masonry veneer is the first step to ensuring weathertightness.

**MASONRY VENEER** comprises about a third of the domestic external cladding market. With its common usage, it is important to understand the specific requirements for flashing openings in masonry veneer.

### *Flashings to openings generally*

Openings in the timber or steel wall framing must have the following:

- Flexible wall underlay cut and dressed into the opening on all sides (or, for proprietary RAB systems, follow the specific installation details).
- Flexible flashing tape applied to the top corners of window and door openings and extended 100 mm from the corners both horizontally and vertically (see Figure 51).
- Flexible flashing tape applied across the full opening width of the sill and extended vertically 100 mm up the trimming studs under the jamb battens (see Figure 51).
- Flexible head flashing across the opening, bedded into the mortar joint above the opening and extended 200 mm beyond the jamb line on both sides. A layer of wall underlay or flexible flashing tape must be lapped over the flexible flashing (see Figures 52 and 53).
- Flexible sill flashing across the sill, folded into the opening and down the face of the wall underlay and over a tilting fillet to provide a kick-out to give a drip edge. The flashing must be extended 200 mm beyond the jamb line on both sides (see Figures 54 and 55).
- Flexible jamb flashings attached to the window jamb section and fixed on both sides of the opening for the full height of the opening, clout-fixed over the wall underlay so moisture is directed to the outside face of the cladding (see Figures 54 and 55).

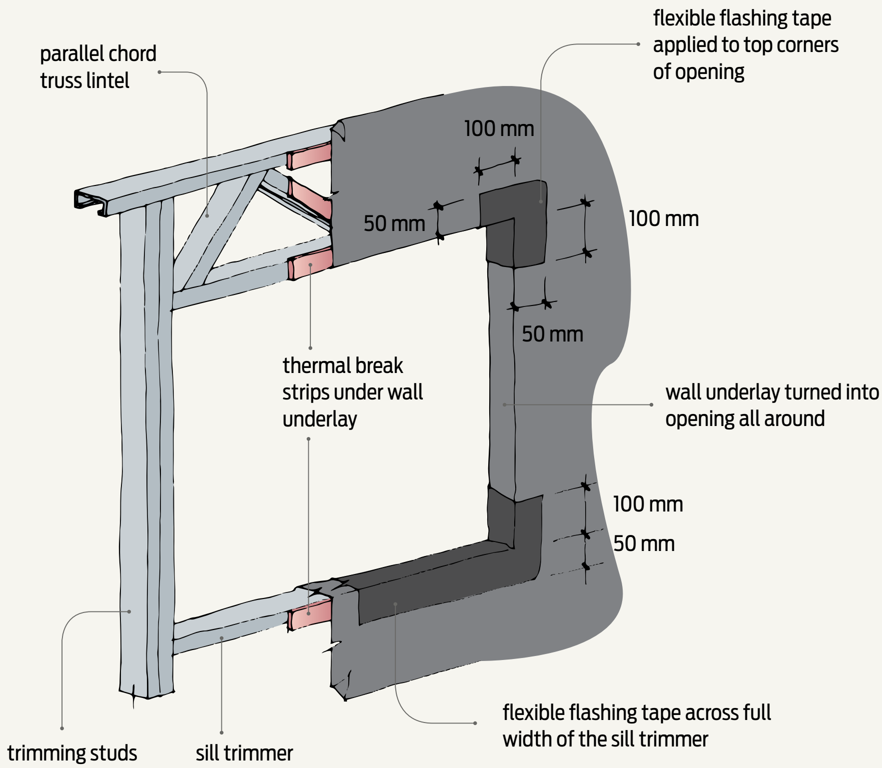



**Figure 51** **Flexible wall underlay and flexible flashing tape turned into a steel-framed opening with thermal break strips.**

### *Rigid head flashing*

BRANZ also recommends installing a rigid head flashing with a minimum 15º slope and stop-ends abutting the brick jambs for both aluminium

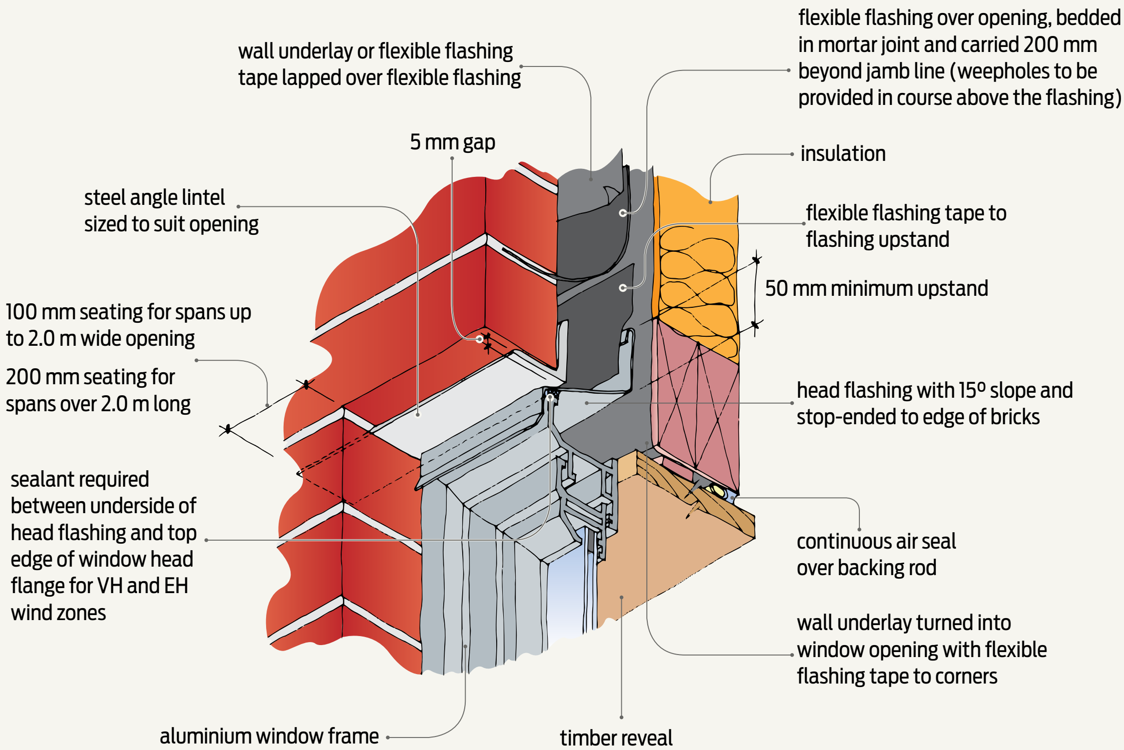



**Figure 52** **Aluminium window installation – head detail.**

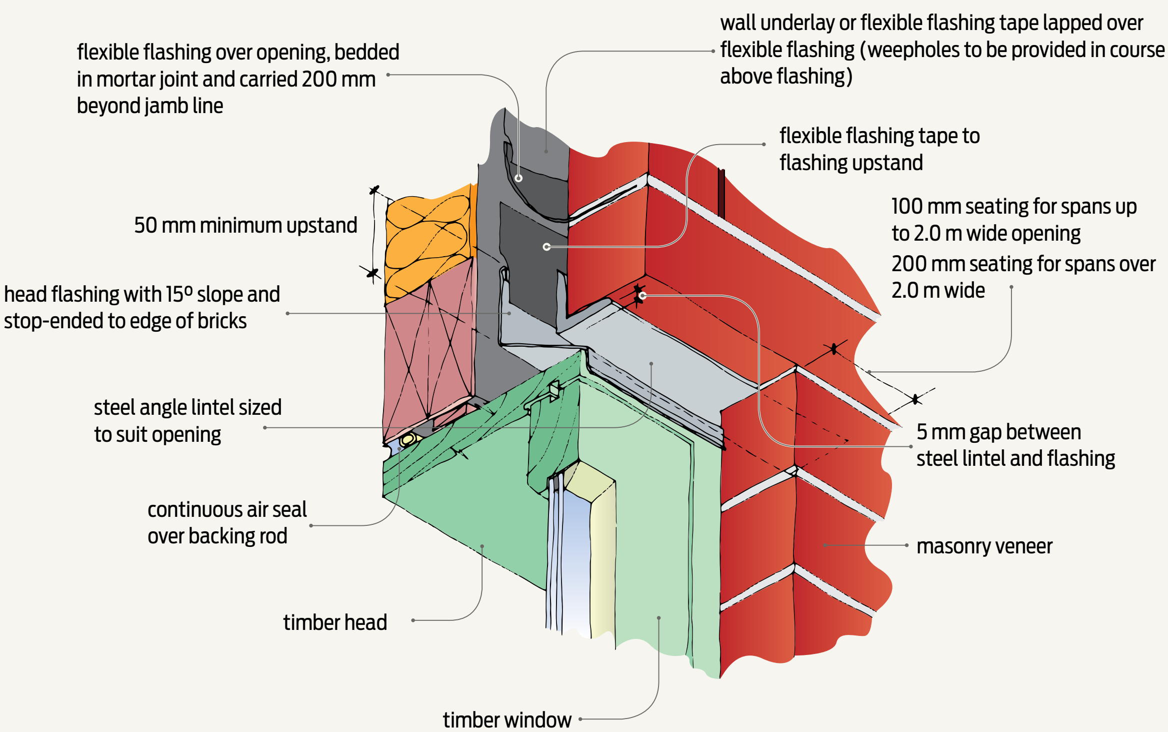



**Figure 53** **Timber window installation – head detail.**

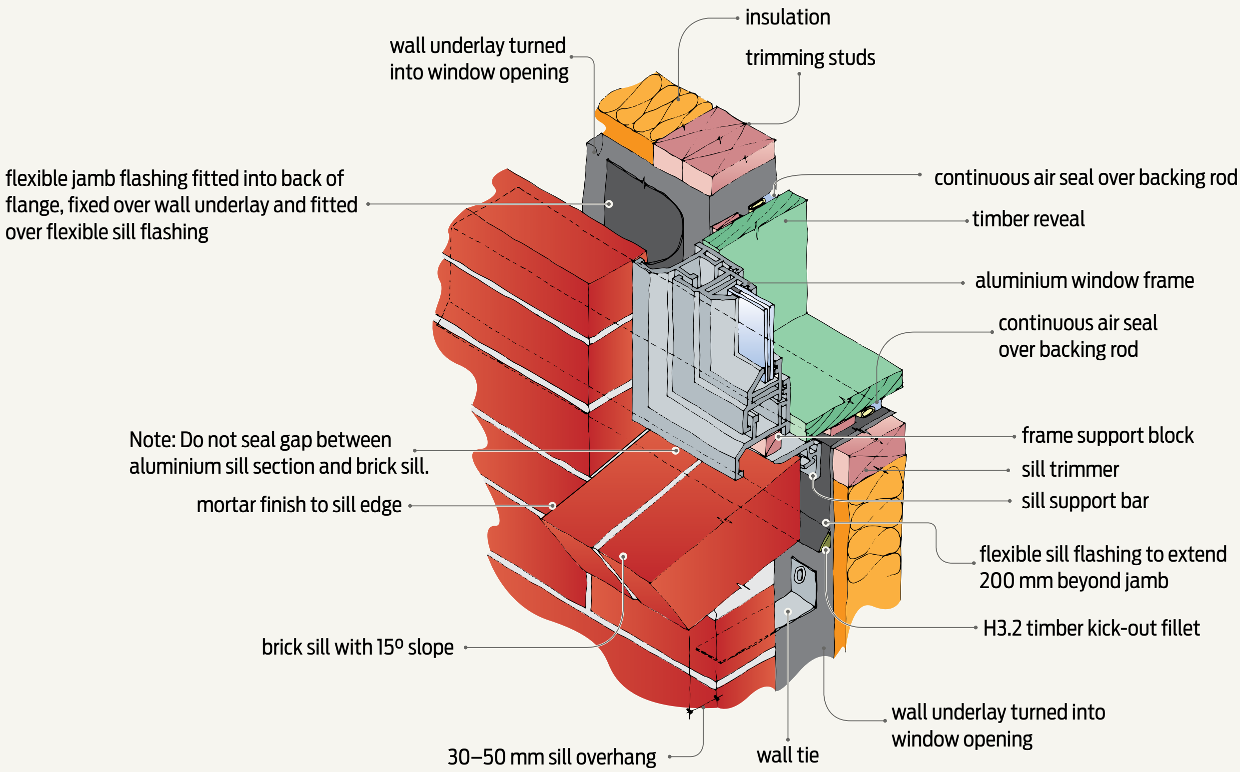



**Figure 54** **Aluminium window installation – jamb and sill detail.**

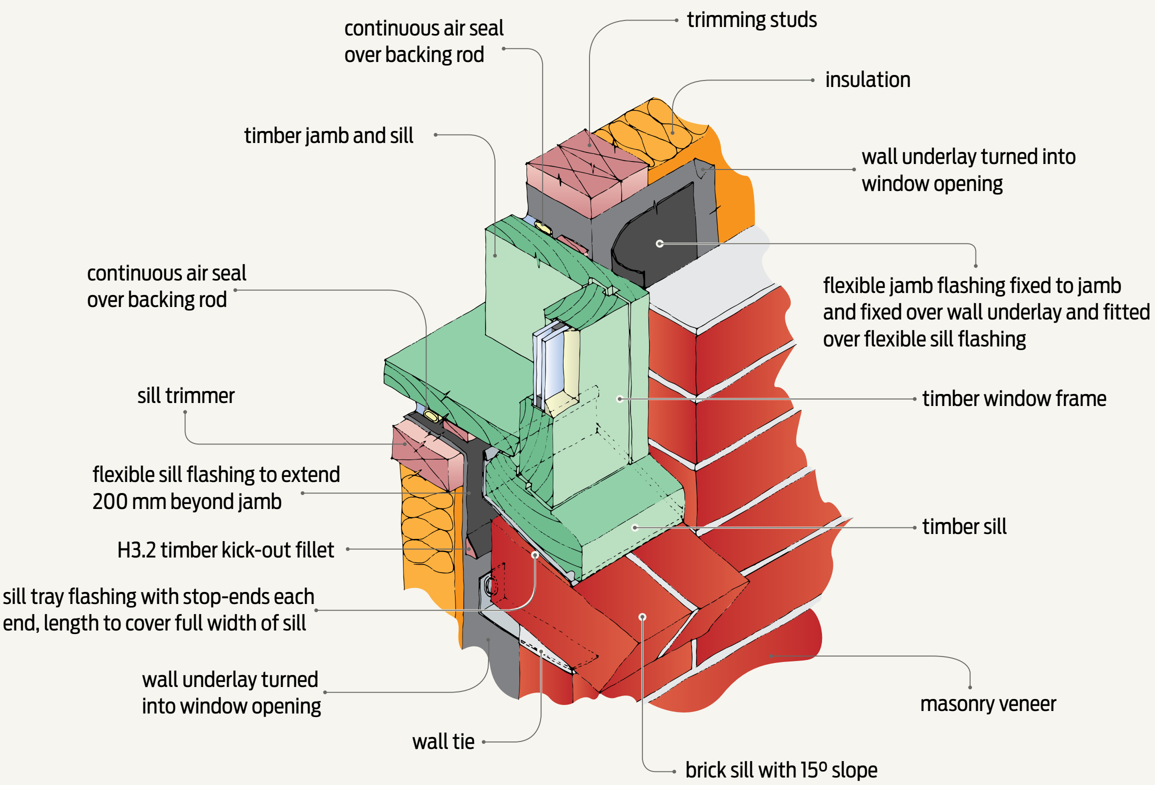



**Figure 55** **Timber window installation – jamb and sill detail.**

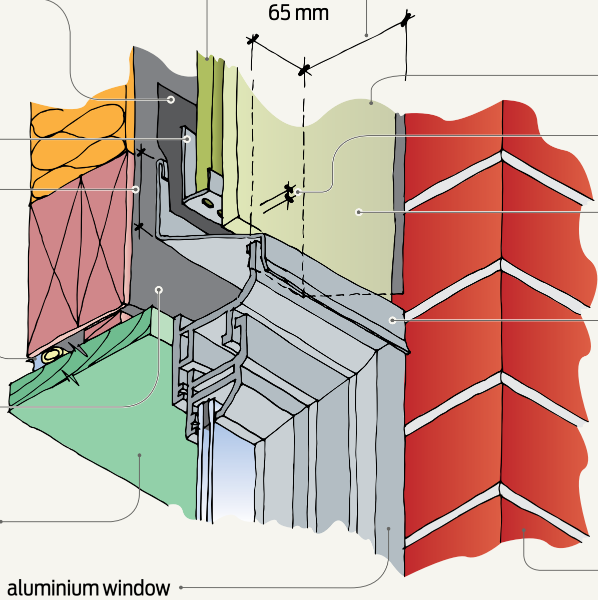



**Figure 56** **Aluminium window installation – head detail with infill panel.**

and timber window frames. Note that E2/AS1 does not require a rigid head flashing for aluminium windows.

For very high (VH) and extra high (EH) wind zones, sealant must be applied between the underside of the head flashing and the top edge of the window head flange (see Figure 52).

### Infill panel above opening

Where a window is installed with an infill panel instead of bricks above the opening, rigid corner flashings for the full height of the panel must be installed behind the cavity battens. They must be lapped at least 65 mm by the panel and butted to the face of the bricks (see Figure 56).

### Head and sill flashings

Head and sill flashings to masonry veneer openings must be either:

- 1.5 mm butyl rubber
- 2-ply asphaltic pliable waterproofing membrane
- 0.5 mm minimum pliable polyethylene.

### Jamb flashings

Jamb flashings must be either:

- 2-ply asphaltic pliable waterproofing membrane
- 0.5 mm minimum pliable polyethylene.

The flashings must direct any water that gets past the external cladding to the back face of the masonry veneer.

### Window flanges

Window flanges must be forward of the back face of the veneer by 10 mm minimum.

Continuous flexible air seals must be installed over a PEF backing rod between the reveals and window and door openings.

### Meter box

Openings for meter boxes less than 500 mm wide do not require a lintel or head flashing. However, the meter box must be sealed to the wall underlay and separated from direct contact with the masonry veneer or mortar with flexible flashing tape.

## Sill requirements

Sill bricks or tiles should have a 15º minimum slope to the outside and an overhang to provide protection for ventilation slots if required below the window.

A gap of at least 20 mm should be left between the back of the sill bricks and the wall underlay and framing. This gap is to prevent mortar getting trapped and/or water bridging the gap.

### Door sill openings

Door sill openings must have:

- a sill tray flashing that is the full width of the opening and has a depth that extends past the back of the aluminium joinery profile
- an 8 mm minimum upstand and sloped end dams
- a 5 mm minimum air gap behind the downturn.

### Window sill openings

Specific requirements for window sill openings include:

- aluminium window sills must have a sill support bar where the window is wider than 600 mm (see Figure 54)
- the flexible sill flashing must have a drip edge created using a 20 mm H3.2 timber kick-out fillet
- window sill flanges must not be sealed at the sill edge.

BRANZ also recommends installing a rigid sill tray flashing for timber windows. The sill tray should be the full width of the opening, have stop-ends at each end and be sloped to suit the timber sill (see Figure 55). Note that aluminium windows do not require a sill tray.

# [3.9] Detailing garage door heads

Here we cover the sometimes overlooked requirements for flashing garage door heads with a timber lintel.

**ALTHOUGH THE NEED** for flashings at external door and window heads is generally well understood, there is not the same understanding about the need for flashing at garage door heads.

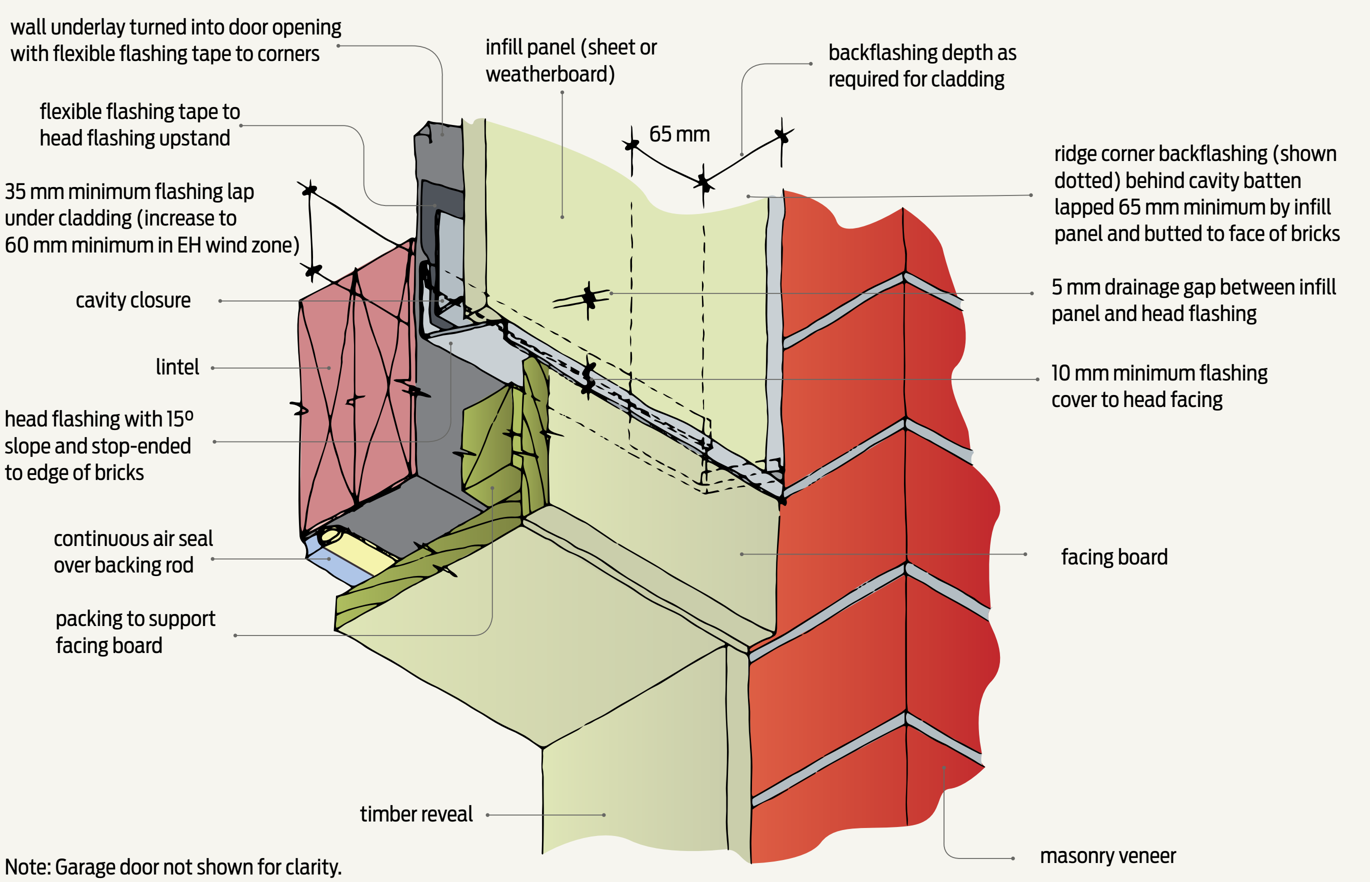
Building consent authorities are receiving applications for building consents in which garage door head details do not follow the same requirements for flashing as for other door and window head details.

### *Flashing needed for garage doors*

The requirements for flashing garage door openings are simple – they are the same as for external door and window details.

Acceptable Solution E2/AS1 to Building Code clause E2 *External moisture* is quite prescriptive in terms of head flashing profile when used as a means of compliance.

Figures 57–59 are details based on E2/AS1 principles for both direct-fixed and cavity construction bevel-back, horizontal weatherboard cladding, and where an infill panel is used with masonry veneer cladding.




Note: Garage door not shown for clarity.

**Figure 57** **Garage door head detail with masonry veneer cladding and infill panel over the door.**

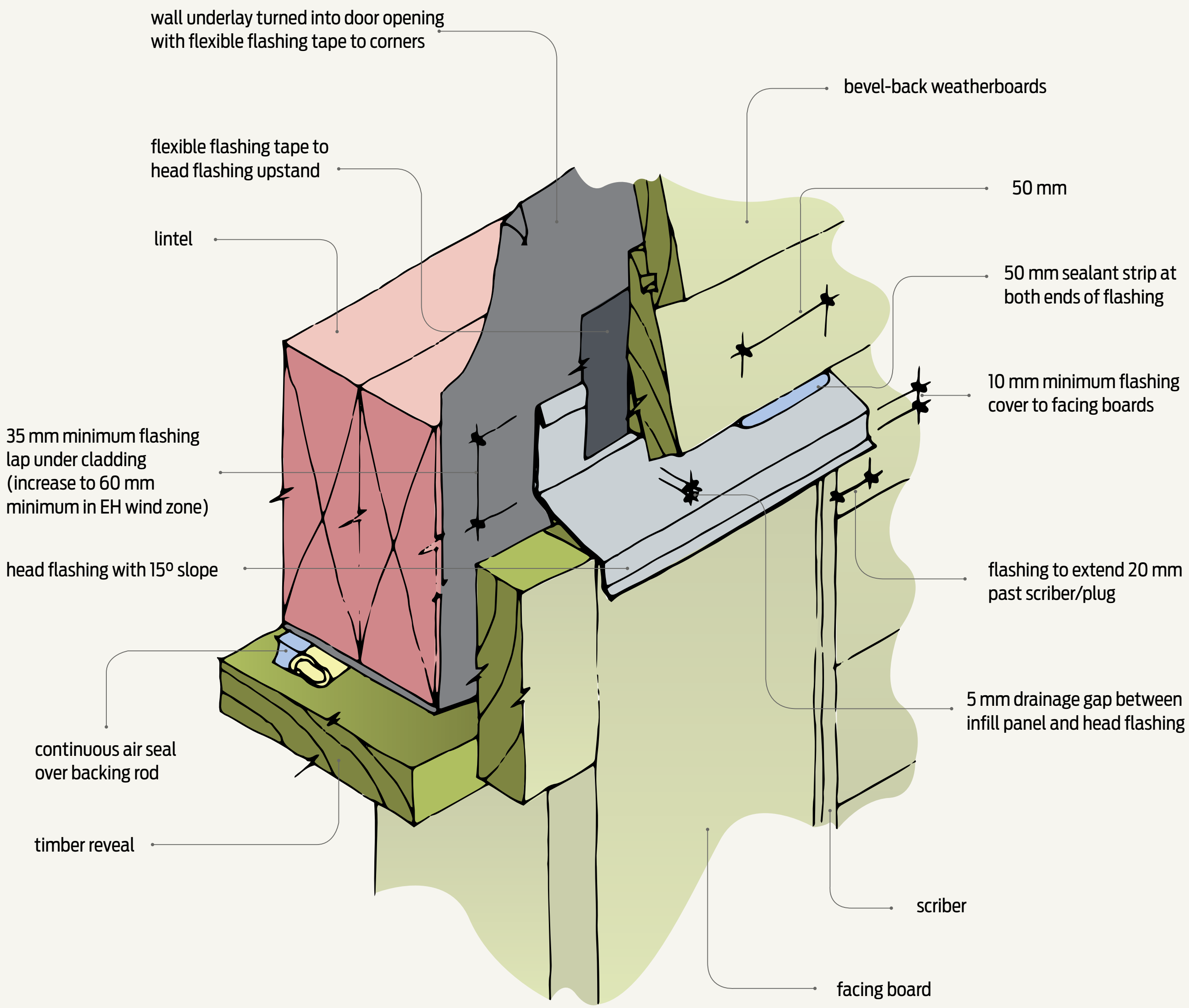
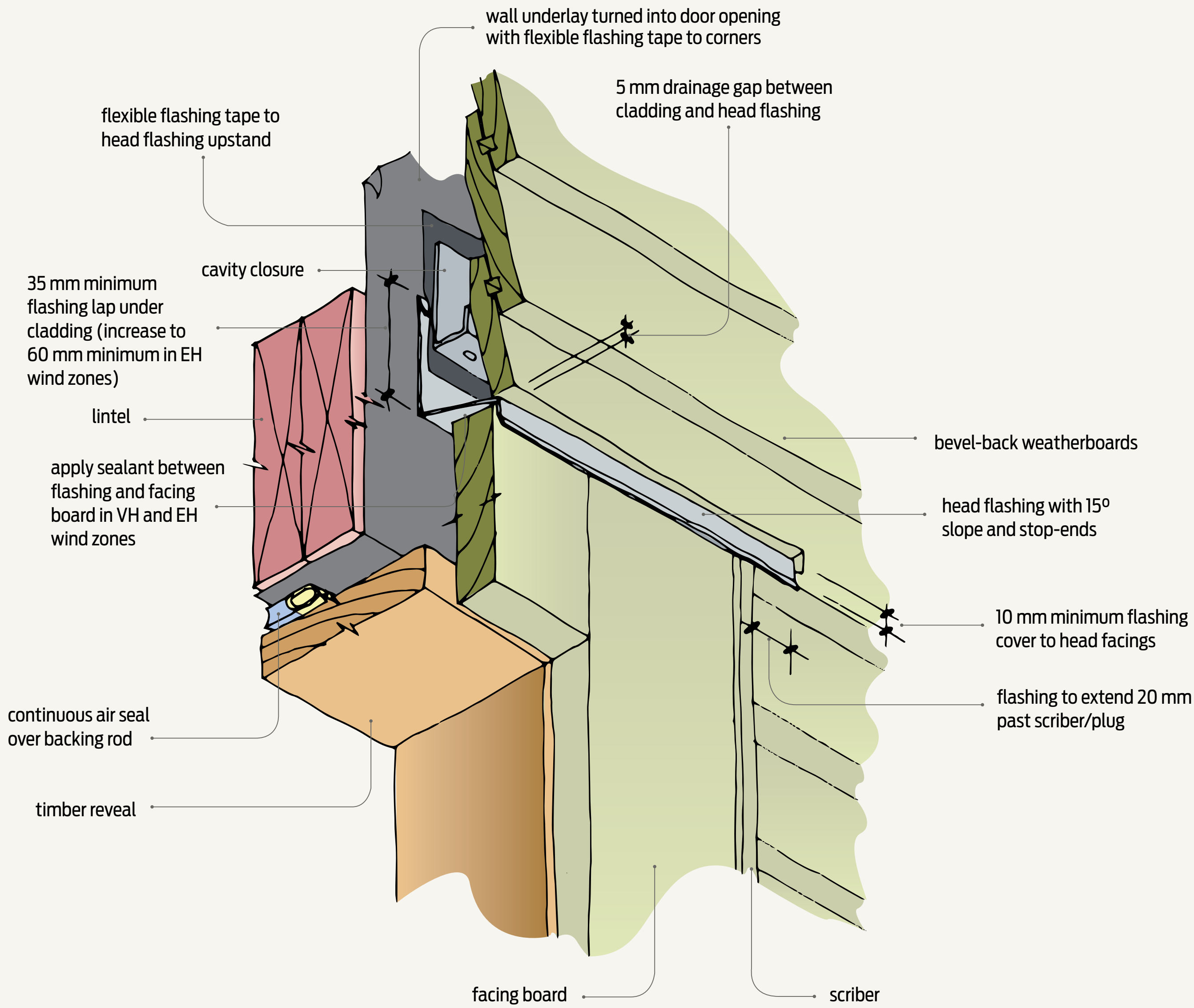



**Figure 58** **Garage door head detail with direct-fixed bevel-back, horizontal weatherboard cladding.**




Note: Garage door not shown for clarity

**Figure 59** **Garage door head detail with bevel-back, horizontal weatherboard cladding over a cavity.**

# 3.10 Horizontal cladding joints and inter-storey junctions

Use the correct specifications for flashings at horizontal cladding joints and inter-storey junctions.

**HORIZONTAL Z** flashings must be installed between cladding joints and at inter-storey junctions (see Figure 60). Z flashings must have a:

- 35 mm minimum upstand in L, M, H and VH wind zones and a 60 mm minimum upstand in EH wind zones
- 35 mm minimum cover in L, M, H and VH wind zones and a 60 mm minimum cover in EH wind zones over the lower cladding
- minimum cross-fall of 15º
- drip edge (kick-out or bird's beak) at the bottom edge of the flashing
- 5 mm gap above the slope of the flashing to enable water to drain from behind the cladding.

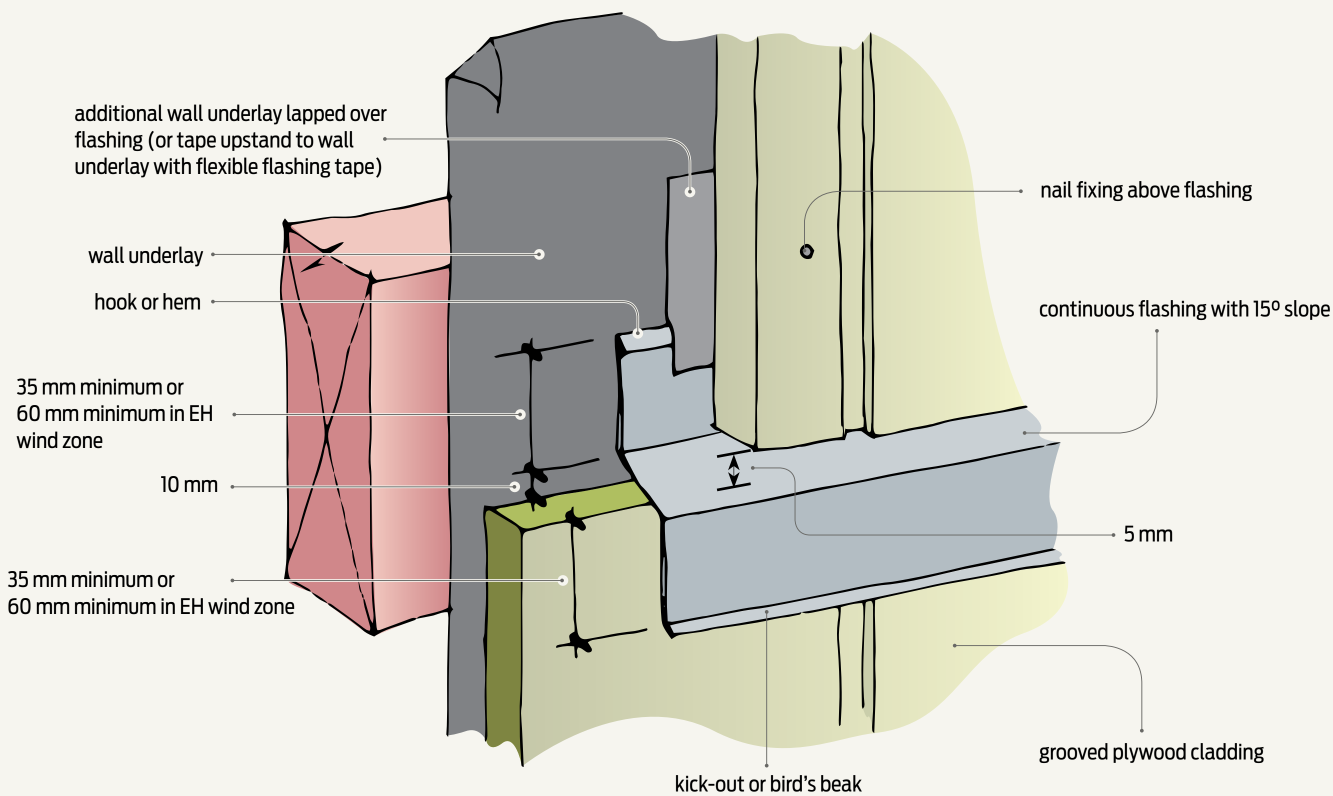



**Figure 60** **Inter-storey horizontal flashed joint.**

# 3.11 At the crossroads

The junctions between different cladding materials can present a few challenges for designers. BRANZ has developed some details to help fill the gap.

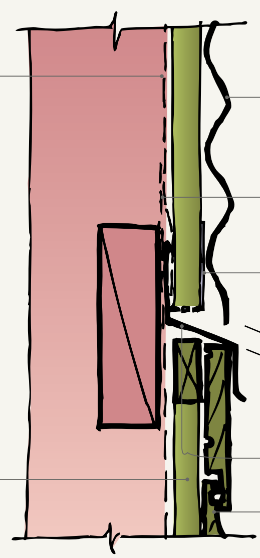



**Figure 61** **Junction detail for horizontal profiled metal and rusticated weatherboards on cavity.**

**E2/AS1** has junction details for cladding materials, including the top and bottom of claddings, internal corners, external corners or the interface between the cladding and aluminium window and door joinery.

However, there are no details within the Acceptable Solution that cover junctions between different cladding materials.

## *Often need flashing*

In many cases, the junction between different materials is best designed incorporating a flashing shaped to accommodate the peculiarities of the different cladding, such as:

- substantially different profile shapes
- thickness differences – both the material and the profile
- transitions between direct-fixed and cavity claddings or vice versa.

## *Individual CAD details also available*

Individual junction details can also be purchased from the BRANZ Shop in pdf or cad/dwg formats.

While these details are not an Acceptable Solution, they do provide solutions for horizontal and vertical junctions between a range of cladding materials and can be used to support the consent application for an alternative method. Figures 61–63 are examples from Volume 1 *Horizontal weatherboards*.

**Note** To purchase BRANZ Details, see the BRANZ Shop at www.branz.co.nz.

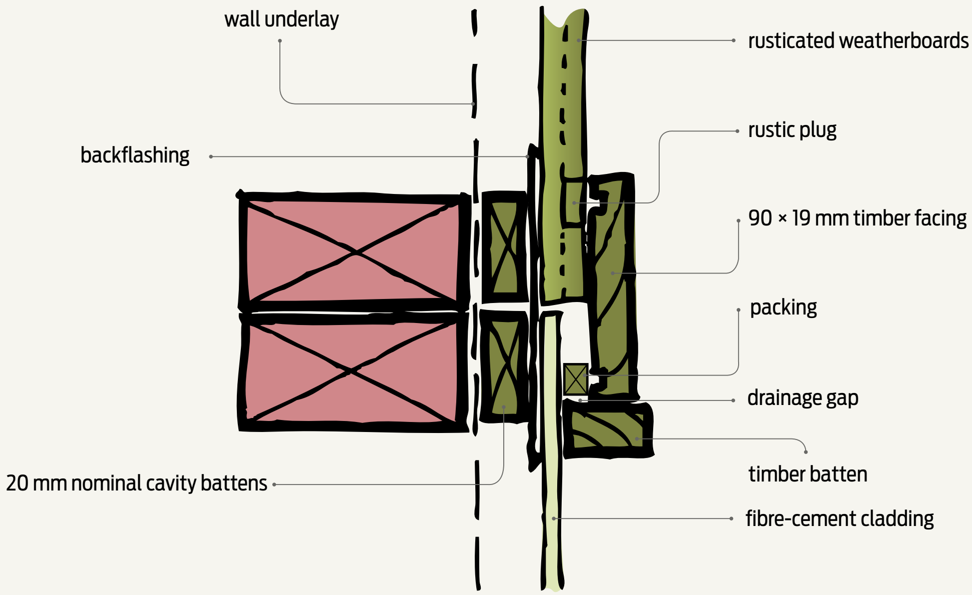



**Figure 62** **Fibre-cement sheet junction abutting weatherboards on cavity.**

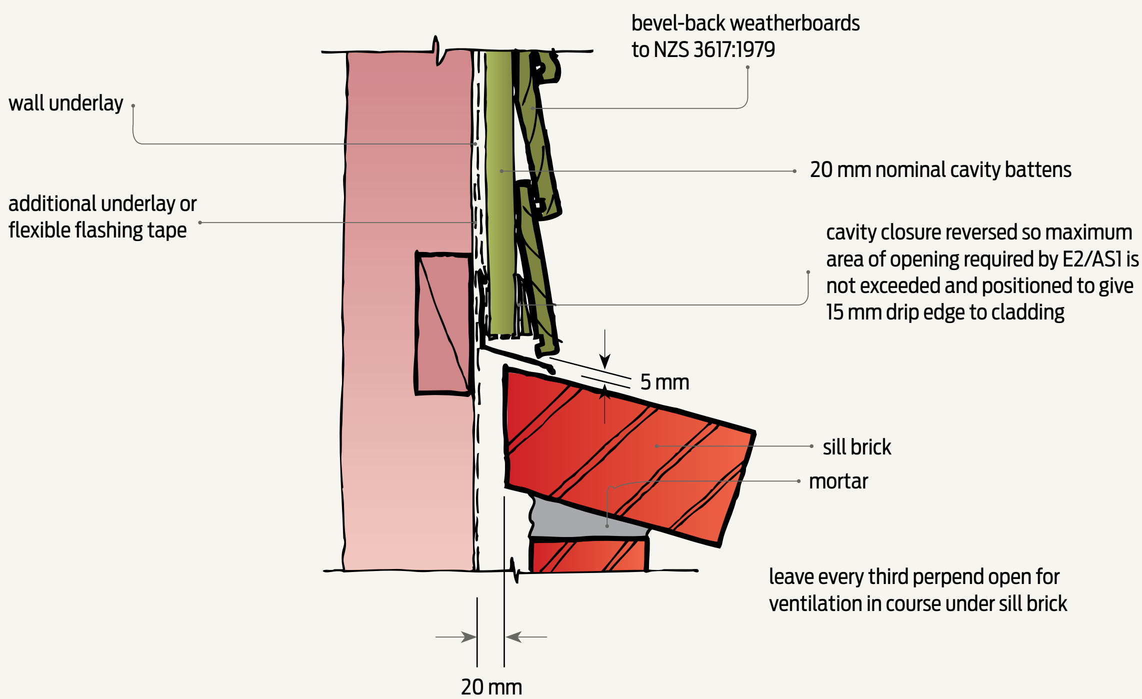



**Figure 63** **Masonry veneer junction with weatherboards on cavity.**

# 3.12 Cladding junctions

Multiple claddings are common on new houses. Getting the junctions between these claddings right can be tricky but is critical for the weathertightness of the building.

**TWO CLADDINGS** commonly used together on modern houses are brick veneer with bevel-back weatherboards installed over a cavity.

The following two sequences of 3D drawings outline the construction sequence for:

- a vertical junction between bevel-back weatherboards installed over a cavity and brick veneer (see Figures 64a–f)
- a horizontal junction when the bevel-back weatherboards are above brick veneer (see Figures 65a–f).

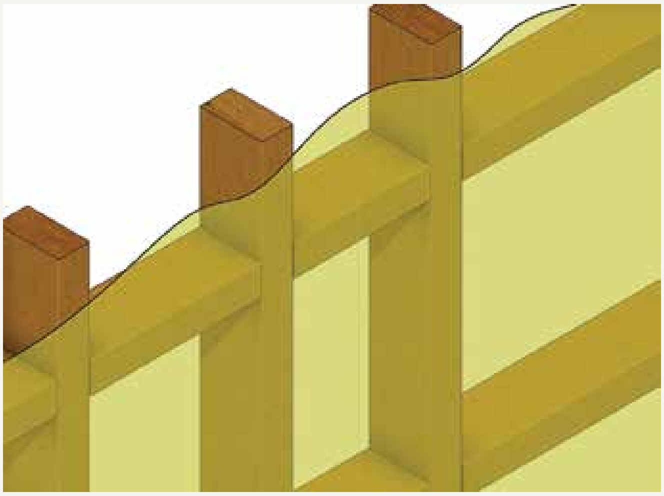


**Figure 64a** **Construction sequence for vertical junction between bevel-back weatherboards over a cavity and brick veneer – Step 1.**

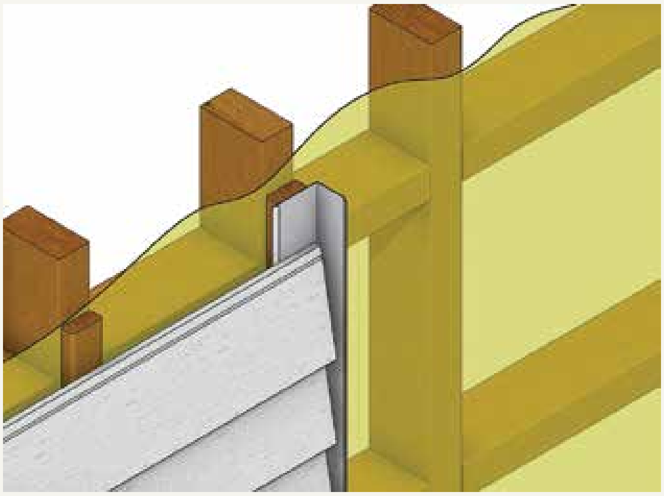


**Figure 64d** **Step 4.**

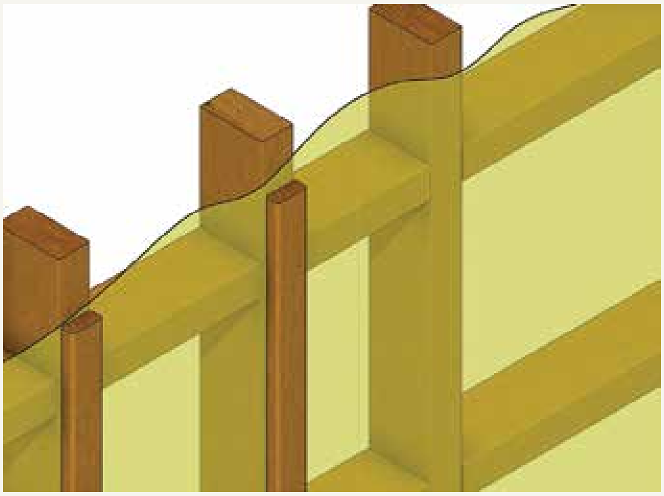


Figure 64b Step 2.

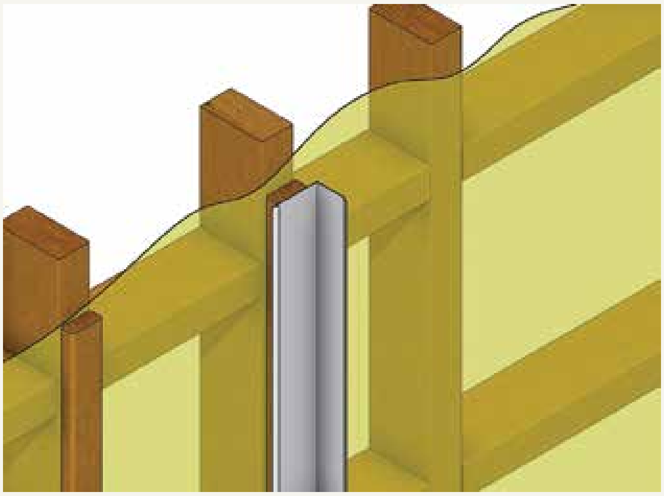


Figure 64c Step 3.

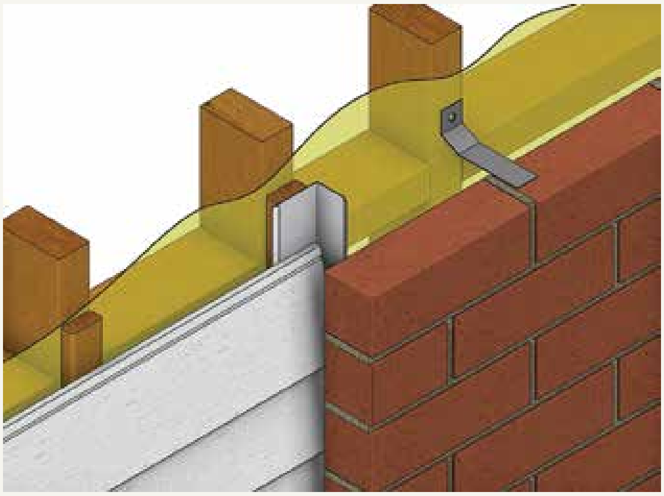


Figure 64e Step 5.

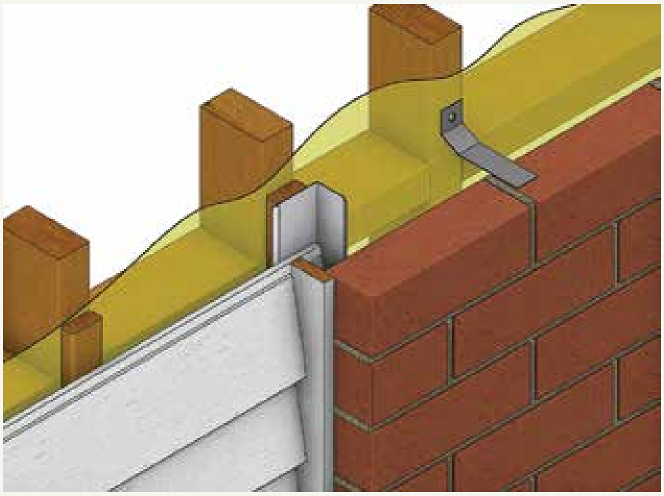


Figure 64f Step 6.

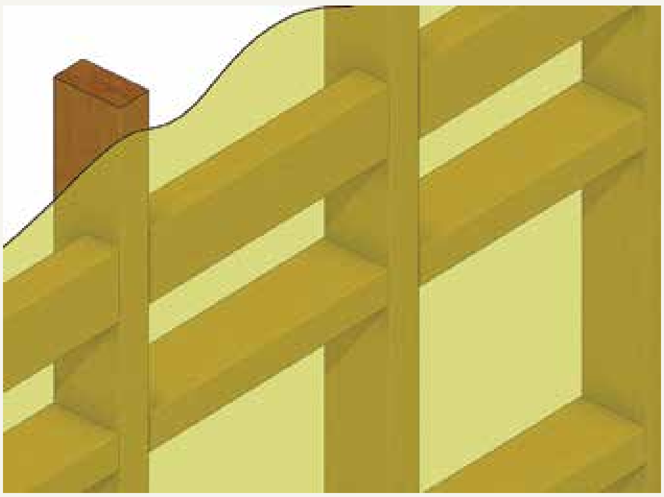


Figure 65a Construction sequence for horizontal junction between bevel-back weatherboards over cavity above brick veneer – Step 1.

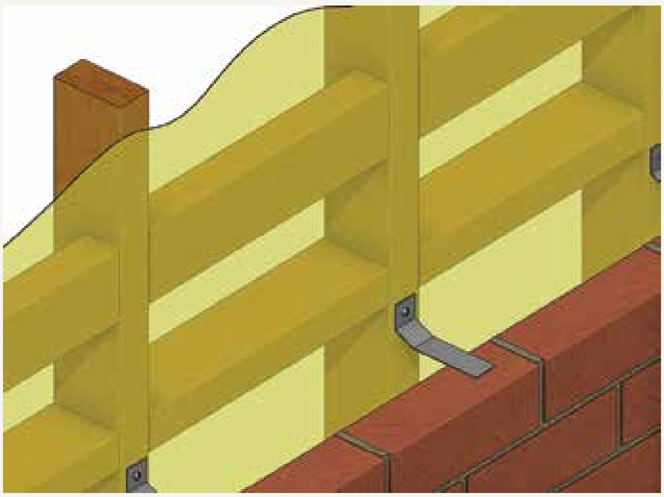


Figure 65b Step 2.

Figure 65d Step 4.

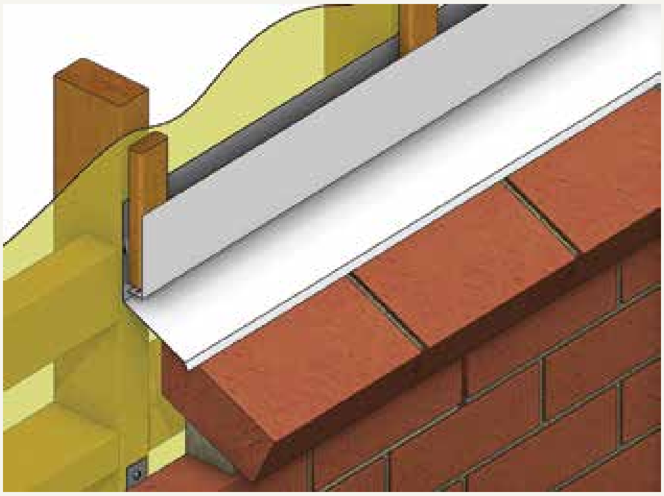


Figure 65e Step 5.

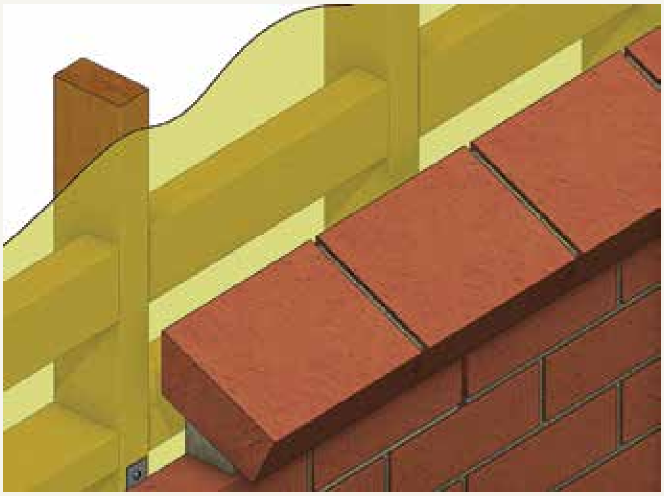


Figure 65c Step 3.

Figure 65f Step 6.

# Building consent for junction detail

## Buildings often have junctions between different wall claddings that require careful flashing.

**MANY NEW** constructions incorporate more than one wall cladding, and additions to an existing building may have a different wall cladding. The range of flashing details that these situations can encompass is extensive (and beyond the scope of this supplement).

### *Usually alternative methods*

Almost invariably, the details will need to be submitted as alternative methods in the building consent application. This requires the applicant to demonstrate compliance of the detail with the relevant Building Code clauses.

### *Resources available*

Several resources are available to help demonstrate compliance:

- BRANZ Details – available on the BRANZ website at www.branz.co.nz. To find a suitable detail:
  1. Select the main cladding from the options provided:
     - rusticated weatherboards
     - bevel-back weatherboards
     - vertical profiled metal
     - horizontal profiled metal
     - masonry veneer
     - concrete masonry
  2. Scroll down to the section 'Junctions to other claddings'.
- *NZ Metal Roof and Wall Cladding Code of Practice* available online at www.metalroofing.org.nz.
- CCANZ CP 01: 2014 *Code of Practice for Weathertight Concrete and Concrete Masonry Construction* available online at www.ccanz.org.nz.
- Manufacturers' product literature – most cladding manufacturers provide manuals with installation details of their products.

# 3.13 Weatherboards above brick veneer

House designs with brick veneer cladding at the bottom and weatherboards above present a design challenge. Here we have some details that allow ventilation and drainage from the upper cladding while preventing additional moisture entering from the brick cavity and maintaining ventilation of the veneer cavity.

**FOR ALL ITS SOLID** appearance, masonry veneer is not a waterproof cladding. Masonry veneers are absorbent, and water can migrate through to the cavity – hence masonry veneers are known as wet cavity systems.

### *E2/AS1 applies*

E2/AS1 applies to veneers of clay brick, concrete brick or concrete block attached to timber framing with a drained and ventilated cavity between the framing and the veneer. The width of the cavity must be between 40 and 75 mm.

Figures 66a and 66b highlight some issues with details in E2/AS1 Figure 73E(m).

### *Let moisture drain or evaporate*

Any moisture that penetrates the veneer must be able to drain away or evaporate from the cavity, so the cavity must be:

- drained and ventilated at the head of openings to allow moisture out
- drained and ventilated at the bottom to allow air in and moisture out
- ventilated at the top of walls and beneath openings wider than 2.4 m to allow air in to the cavity
- sealed off from the roof, subfloor space and

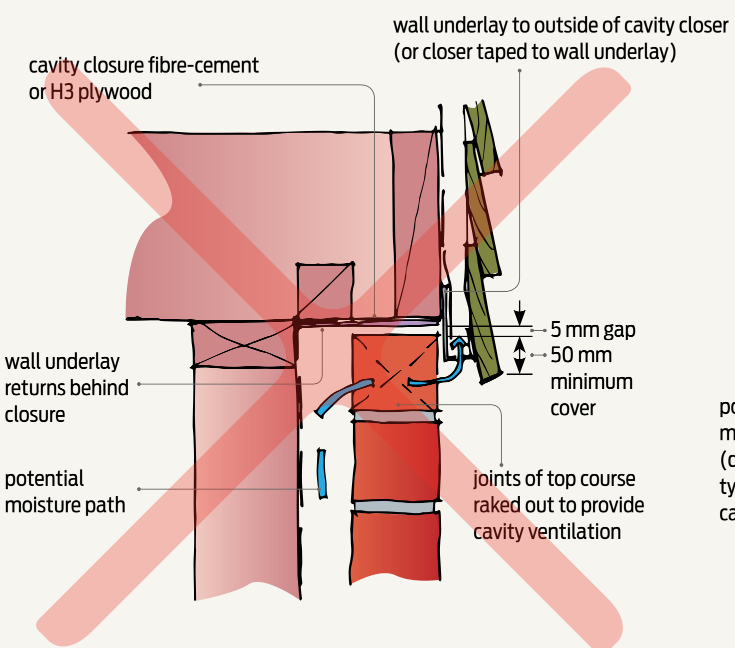



Figure 66a

**Unacceptable detail – Figure 73E(m) from E2/AS1 with upper cladding on a cavity and ventilation via top course of bricks allows transfer of air between cavities.**

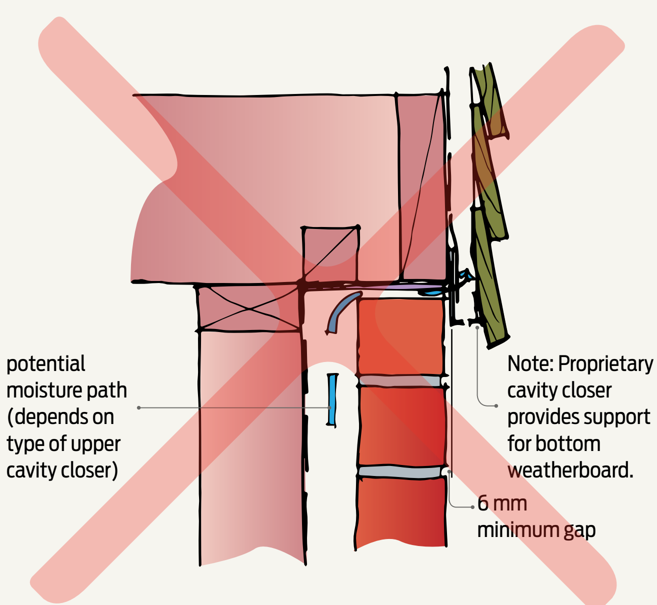



Figure 66b

**Unacceptable detail – Figure 73E(m) with upper cladding on a cavity and continuous ventilation above the top of the bricks. The top of the veneer cavity is unvented (blocked by the weatherboard cavity closure).**

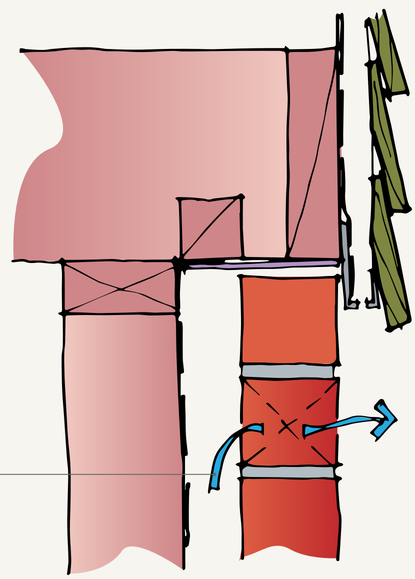



**Figure 66c** **Brick cavity vented through second-to-top course of bricks allows moisture to exit the cavity well clear of the upper level cladding.**

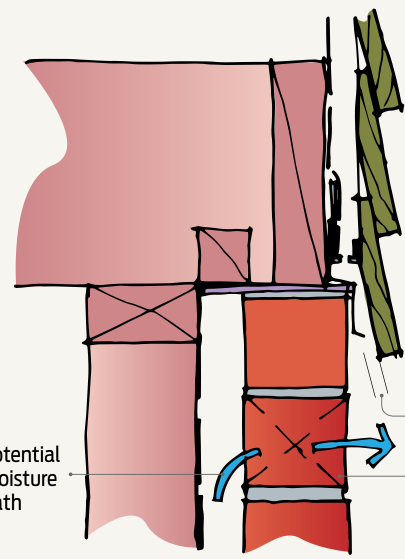



**Figure 67** **Bevel-back weatherboard, flashed cavity.**

any cladding cavity above the veneer to prevent moisture from migrating into these areas.

### *Important to get cavity ventilation right*

Veneer cavity ventilation is usually provided by raking out perpend joints to a minimum of 75 mm at 800 mm maximum centres or 1,000 mm²/m wall length.

Ventilation can also be achieved by forming a 5 mm minimum continuous gap between the top course and the soffit. The upper cladding must have 6 mm minimum clearance to the bricks and extend 50 mm below the top of the veneer.

BRANZ recommends providing ventilation by raking out joints in the second-to-top course rather than the top course of brickwork (see Figure 66c). This allows moisture to evaporate clear of the cavity above and facilitates installation of the upper course of bricks.

### *Adapting E2/AS1 details not the answer*

The details in E2/AS1 cover a variety of situations but do not provide a solution where there is an upper floor with a lightweight cladding fixed over a 20 mm cavity. Simply adapting Figure 73E(m) from ES/A21 by adding a cavity

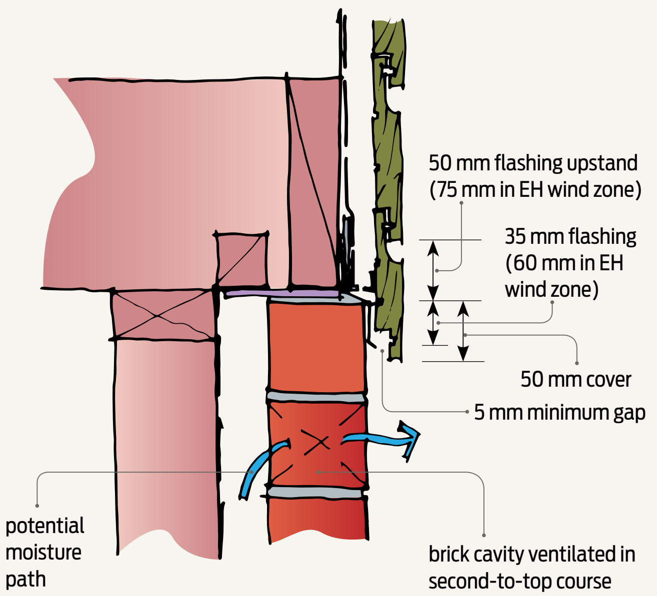



**Figure 68** **Rusticated weatherboard, flashed cavity (flat sheet similar).**

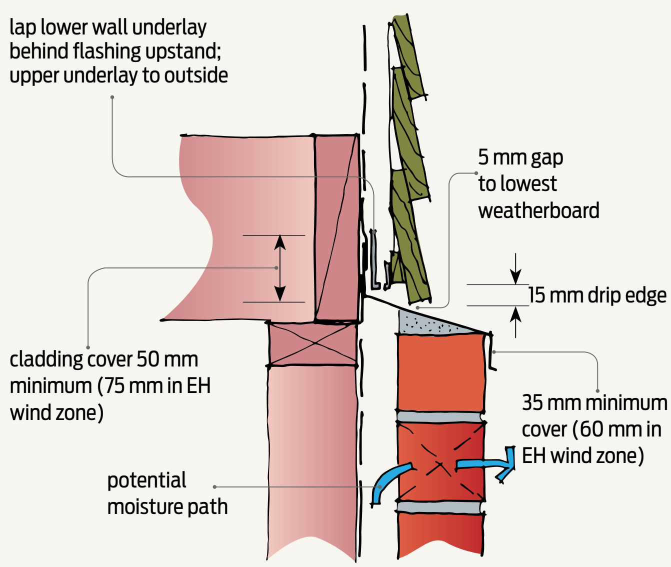



**Figure 69** **Upper floor framing in line with lower floor.**

behind the upper cladding may create a path for moisture to migrate into the upper cavity (see Figures 66a and 66b).

### *Detailing options*

There are several detailing options to isolate the two cavities, allowing drainage from the upper cavity without compromising the ventilation of the veneer cavity. To further protect the upper cavity from ingress of moisture, a flashing can be installed at the base of the upper cladding (see Figures 67–69).

The flashing upstand should be 50 mm minimum (75 mm in EH wind zone) and cover the veneer by 35 mm minimum (60 mm in EH wind zone). A 5 mm minimum gap must be maintained between the flashing and the back of the upper cladding to provide ventilation for the upper cavity.

The soffit or closure to the brick cavity shown in these details provides a consistent finish where there may be a porch or other recess in the lower wall.

# 3.14 Cavity closures to cantilevered joists

Drained cavities to external walls need to be constructed correctly to keep wind-driven rain and vermin out and allow drainage and ventilation. One overlooked area is when external walls are supported on cantilevered floor joists.

**DRAINAGE AND VENTILATION** is achieved in drained cavities by leaving the bottom of the cavity open and fitting a cavity closure to prevent the entry of vermin.

### *Cavity closures at base of all cavities*

Cavity closures are required at the base of all cavities including:

- above window and door heads
- at the base of all walls
- at inter-storey flashed junctions.

They should have 3–5 mm drainage holes or slots to provide an opening area of 1,000 mm² per metre length of wall.

### *Walls on cantilevered floor joists*

A sometimes overlooked location for cavity closures is at the base of an upper level external wall supported on cantilevered floor joists (see Figure 70).

Although the cantilevered floor joist space must be closed off, the base of the cavity to the wall above must remain open, so cavity closures should be installed.

### *Position above bottom of cladding*

A drip edge is needed at the base of all walls, above door and window openings and above horizontal flashings that bridge the cavity (E2/AS1 9.1.8.3).

This is done by positioning the cavity closure 10–15 mm above the bottom edge of the cladding.

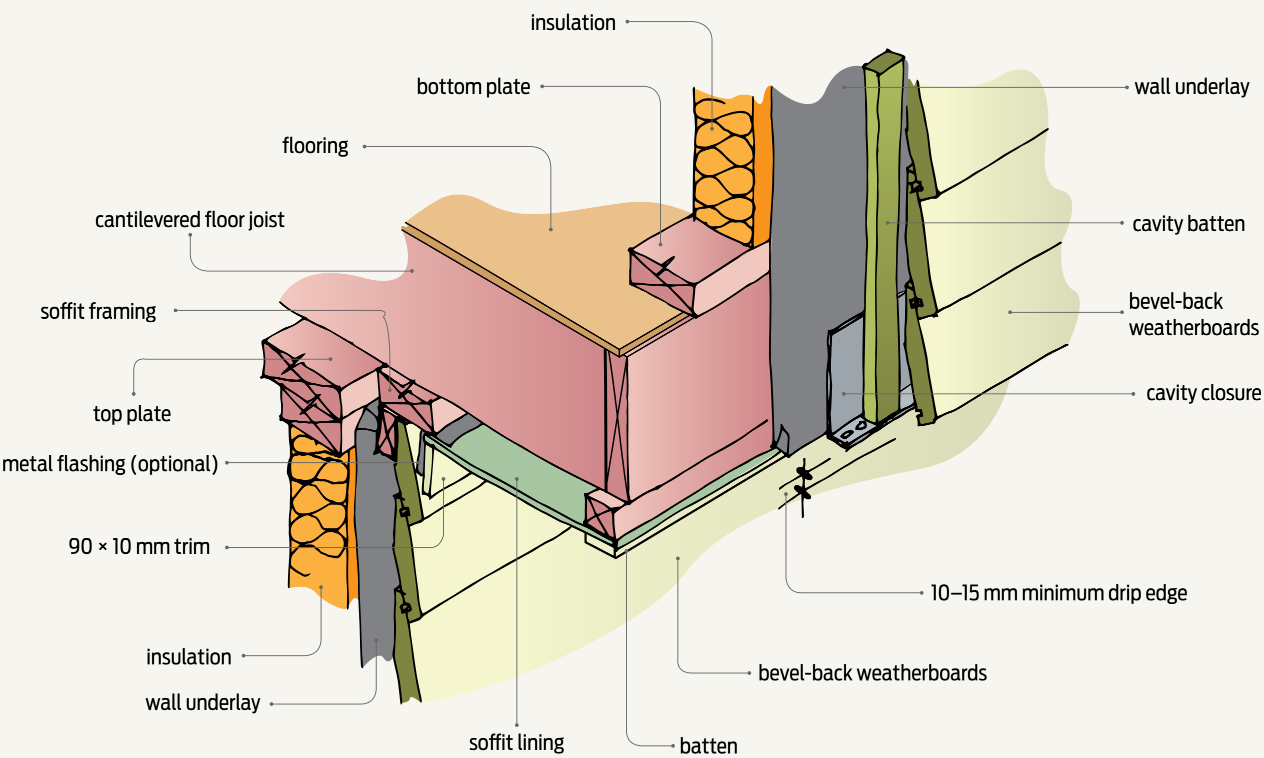



**Figure 70** Cavity closures to cantilevered floor joists.

# 3.15 Detailing cladding penetrations

Penetrations through claddings need to be carefully detailed so they are weathertight. For commercial buildings, they may also need to be seismically restrained to prevent impact damage.

**NEW ZEALAND BUILDING CODE** clause E2 *External moisture* requires that exterior walls must prevent penetration of water that could cause dampness or damage to building elements.

If not appropriately designed and installed, penetrations through external claddings potentially compromise the weathertightness of a building. The requirements of clauses B1 and E2 are at odds with one another and can present detailing problems.

### Timber-frame construction

Acceptable Solution E2/AS1 (paragraph 9.1.9.3 and Figures 68 and 69) describes methods of creating weathertight details using flashing tape and flanges in both cavity and direct-fixed situations.

The E2/AS1 details do not require a significant clearance around pipes, but they can be used as a basis for creating weathertight details that include the clearances required by clause B1.

### Through wall underlay

Where the pipe penetrates through the wall underlay, flexible flashing tape should be used to seal the underlay for at least 100 mm and to the pipe for at least 25 mm (see Figure 71).

A flange with a diameter 20 mm larger than the pipe and with a skirt at least 25 mm deep should be fitted over the pipe. The 10 mm gap between pipe and flange can be filled with sealant applied over a backing rod.

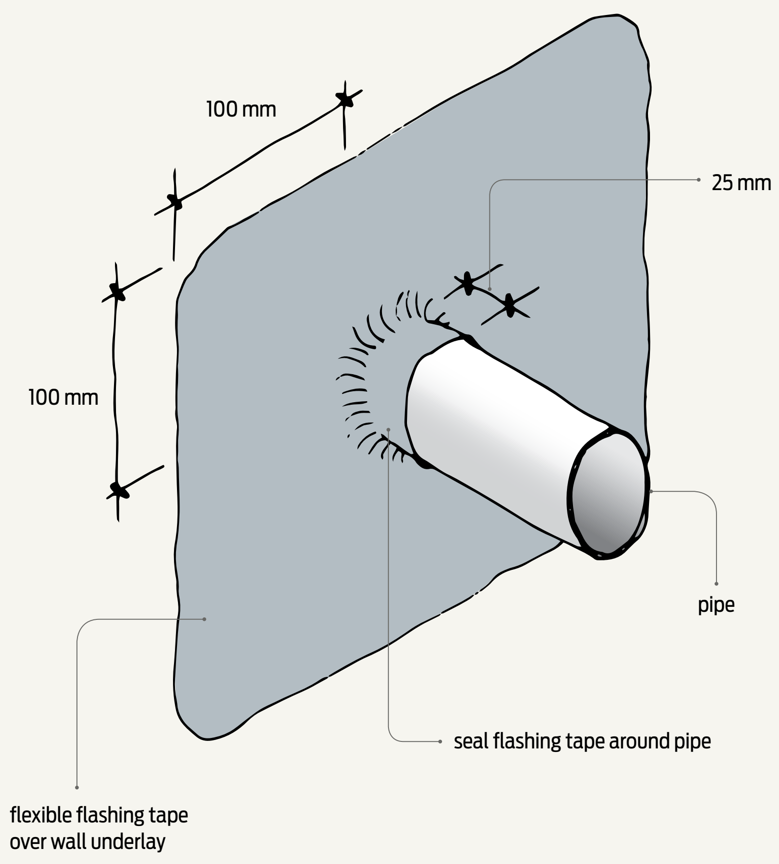



**Figure 71** Sealing underlay and pipe with flexible flashing tape from E2/AS1.

*Coated cladding*

Where cladding finishes are EIFS, monolithic coatings or stucco, finish the coating over the skirt of the flange.

*Weatherboard claddings*

For weatherboard claddings, cut a hole to the correct size (diameter of pipe plus 10 mm all around) through the weatherboard. The penetration should be made through the centre of the board, not at a joint. Prime the cut, then apply sealant over a backing rod into the gap between the hole and the pipe.

A flange may be installed over the sealant joint, and for bevel-back boards, a shaped fillet will be required to provide a flat surface for the flange (see Figure 72).

*Concrete or masonry walls*

Where pipes penetrate concrete or masonry walls, a 50 mm clearance must be allowed between the pipe and the wall structure when following NZS 4219:2009. Apply a waterproof membrane to the opening – at least 50 mm around the face of the opening and at least 50 mm into the opening.

The pipe should go through a flange with a minimum 20 mm larger diameter than the pipe and a skirt at least 100 mm deep. Apply sealant over a backing rod to the gap between the pipe and flange and carry the waterproofing coat applied to the concrete or masonry down over the flange (see Figure 73).

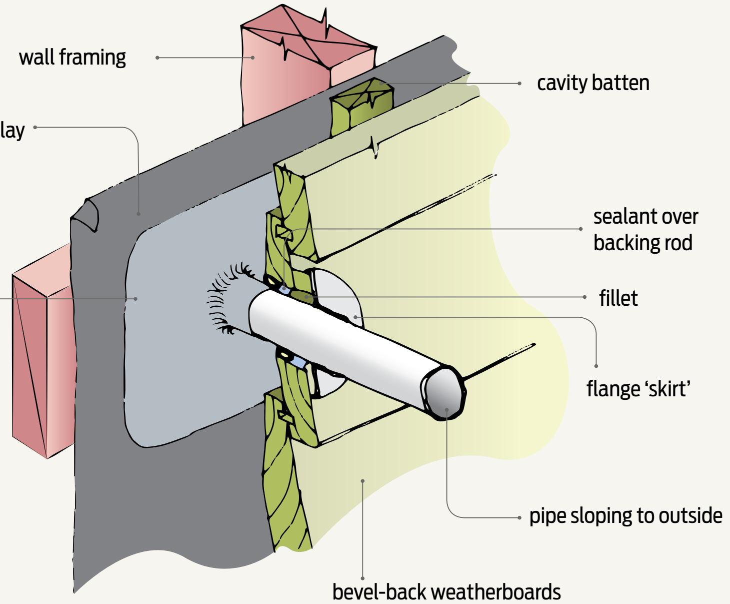



**Figure 72** **Penetration through weatherboard cladding (E2/AS1).**

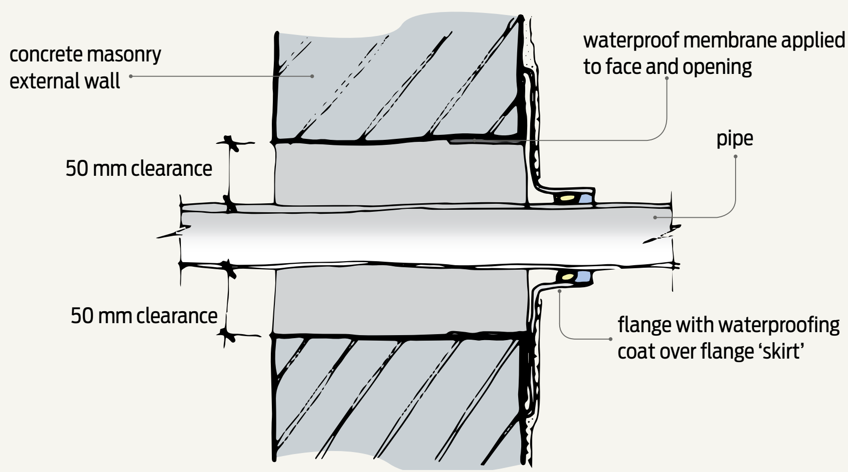



**Figure 73** **Penetration through concrete masonry external wall (NZS 4219:2009). Note that E2/AS3 (CCANZ CP01) does not require a 50 mm clearance.**

# 3.16 Penetrations through existing walls

When a penetration is required through the cladding of an existing building, effective sealing and weatherproofing is more difficult than when a penetration is incorporated during construction.

**FOR NEW CONSTRUCTION**, guidance on sealing and weatherproofing penetrations through external wall claddings is provided in the Acceptable Solution E2/AS1 to Building Code clause E2 *External moisture*.

### *Many things require new penetrations*

Occasionally, a penetration may need to be made through an existing wall cladding. Examples include when installing a heat pump, clothes dryer or rangehood, new plumbing or drainage pipes or cabling for TV, phone or data. In these situations, effective sealing and weatherproofing are more difficult to achieve.

### *Proactively minimise the risk*

Things can be done, however, to mitigate the risk of water and air leakage created by penetrations through existing wall claddings.

#### *Removing cladding best but difficult*

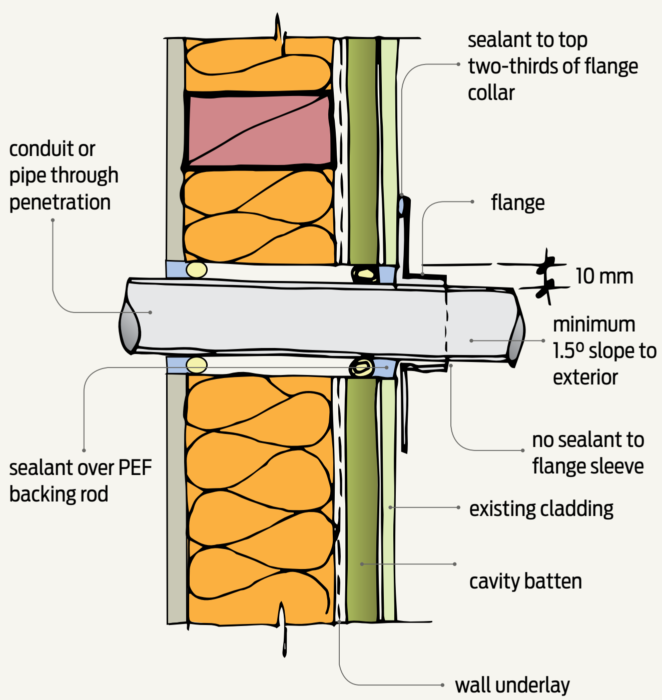
If possible, the best solution is to remove enough of the external cladding to be able to access and fully seal the wall underlay around the penetration in accordance with E2/AS1. This is often not feasible.

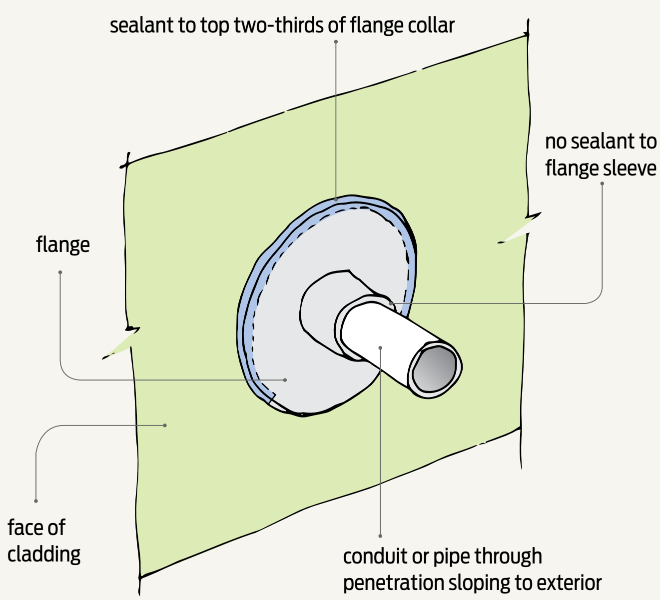
#### *Locate in sheltered position*

When a penetration must be made through external wall cladding, locate the penetration where possible in a sheltered position such as:

- immediately under or through the eaves
- under a veranda or porch
- on the sheltered side of the building.

If it is not possible to locate an outlet in a sheltered part of the building, the penetration




Note: Shaped packers sealed to cladding are required behind flange for profiled claddings.

**Figure 74** **Pipe penetration through an existing exterior wall.**

**Figure 75** **Sealing a pipe flange to cladding.**

should be protected by a cowl or shield. By reducing the amount of water passing over the penetration, the risk of water entering the opening is also reduced.

### *Slope opening to the exterior*

Drill upwards from the exterior when cutting a penetration through the exterior cladding so that any water that gets in the hole is able to drain out again (see Figure 74).

The CCANZ publication CP 01:2014 *Code of Practice for Weathertight Concrete and Concrete Masonry Construction* recommends that a penetration through an external wall has a minimum downward slope of 1.5º to the exterior.

### *Seal around pipe penetrations*

Pipes through a penetration should be firmly fixed so the pipe does not move within the opening. Apply sealant over a PEF backing rod around the opening, cover with a flange and seal around the top two-thirds of the flange collar (see Figures 74 and 75). Do not apply sealant to the flange sleeve, as the sleeve will allow any water that gets past the flange to drain to the outside.

As well as protecting against water entry, the flange will also protect the sealant around the opening from UV radiation or weathering.

Seal around pipes or sleeves where they penetrate interior linings.

### *Install cabling in a conduit*

Cabling and other flexible materials may be subjected to wind movement. This is likely to cause any sealant around the opening to be damaged and eventually fail.

Installing all cabling and flexible material in a conduit when retrofitting through existing cladding means the conduit can be sealed and flanged in the same way as the rigid pipe penetration.

Where wires are not in a conduit:

- drill upwards through the cladding
- protect with an exterior deflector sealed to cladding.

**a. Hoses coming through the top of the exterior wall.**

**b. Applying sealant around pipework.**

**c. Applying sealant to cover.**

**d. Cover in place over penetration and fully sealed to cladding.**

**Figure 76** **Heat pump pipework installation into an existing house.**

## *Relocating meter boxes*

If a meter box needs to be relocated to the outside of the building, rivet a 30 × 30 mm angle to all sides of the meter box and flash over the angle along the top edge in a similar way to the solution shown in E2/AS1 Figure 68.

Alternatively, a relocated meter box may be installed behind a window panel so it is isolated completely from the weather.

## *Sometimes have to avoid penetrations*

Avoid penetrations through a flat or low-pitched roof or deck as these are more difficult to waterproof. If a penetration is required, another location for the penetration should be found.

## *Retrofitting heat pump pipework*

Figures 76a–d show the installation of heat pump pipework into an existing house. The penetration for the pipework through the external cladding is high on the external wall and is under a veranda.

The hole is filled with sealant around the pipework. The proprietary cover has sealant applied to the top edges while the bottom is left open to allow any water that may get in to drain out again.

# Section 4:
# Roof/wall intersections

NEW PRODUCT

Thermakraft™

# ALUBAND XTREME

ALUBAND XTREME


**Aluband Xtreme** is a High Performance self-adhered flashing tape. Suitable for window and door installation and other wall penetrations, no mess, compatible with most sealants[1] installs in a wide range of temperatures.

| CODE | DESCRIPTION |
|---|---|
| ALBCP075025 | Aluband Xtreme Tape 75mm x 25m |
| ALBCP150025 | Aluband Xtreme Tape 150mm x 25m |
| ALBCP200025 | Aluband Xtreme Tape 200mm x 25m |

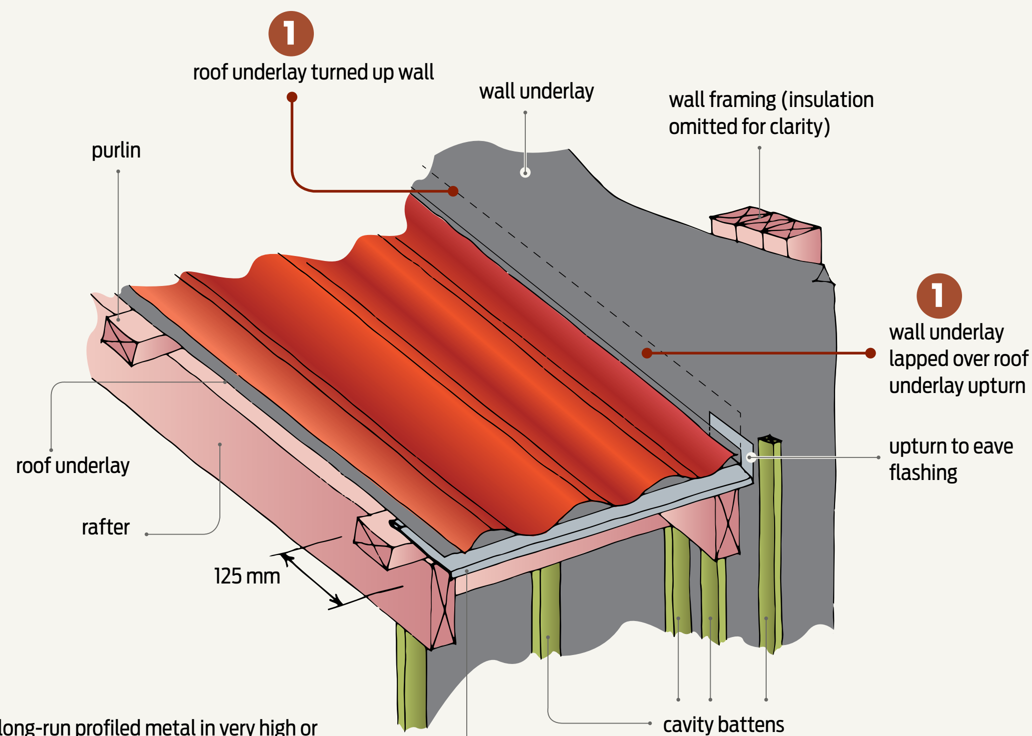
- Ultra Thin
- High Tack
- Easy to install
- Thermakraft 1 Wrap System
- BRANZ appraised

ACCESSORIES

[1] As Thermakraft is not aware of all sealant products and the changes that may be made to the formulation and composition of other suppliers' products a test for final compatibility is advised.

# 4.1 Roof-to-wall junction

BRANZ is sometimes asked how to detail roof-to-wall junctions. The detailing can be tricky, but following the Acceptable Solution and these step-by-step illustrations will help.




Note: Eave flashing required for long-run profiled metal in very high or extra high wind zones for roofs under 10º pitch and where the fascia is 100 mm or less from cladding.

**Figure 77a** **Roof/wall junction construction sequence – Step 1 .**

**NEW ZEALAND BUILDING CODE** clause E2 *External moisture* requires that roofs and external walls must prevent the penetration of water that could cause undue dampness, damage to building elements or both.

The roof/wall junction where a roof finishes within the length of an adjacent wall combines different planes, angles and building materials, requiring careful detailing to ensure water cannot enter the building structure.

### *Apron flashing requirements*

Figure 8B in Acceptable Solution E2/AS1 shows a roof/wall junction detail using an apron flashing and refers to paragraphs 5.1 and 5.2. These describe the requirements for apron flashings at roof-to-wall junctions, including that there must be:

- a 75 mm minimum wall cladding cover over the upstand
- a 35 mm minimum gap between the wall cladding and the roofing
- cover over the roofing as per E2/AS1 Table 7 depending on wind zone and roof pitch

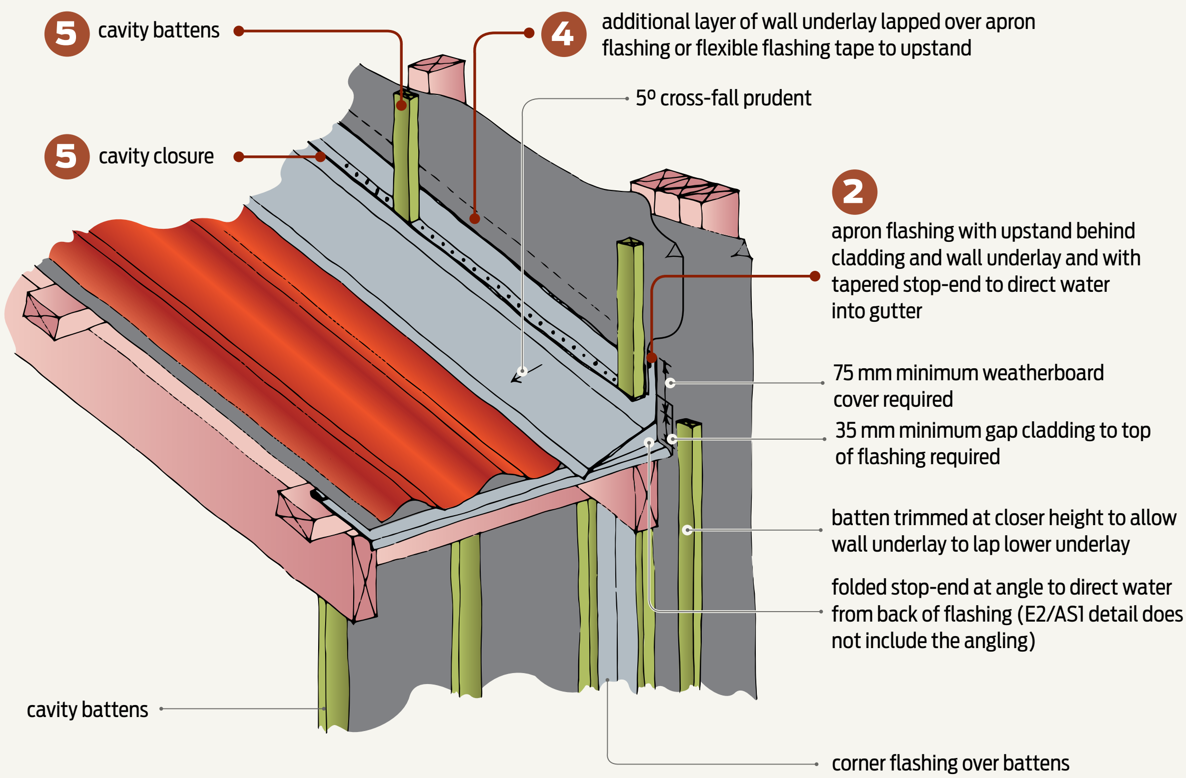



**Figure 77b** **Steps 2–5 (note that Step 3 is omitted for clarity).**

- a kick-out or tapered stop-end to the apron flashing – Figure 8B of E2/AS1 gives one option for folding a metal flashing to direct water to the spouting
- a cross-fall (shown in E2/AS1 figures but angle not specified) to drain water off the apron flashing – 5º is considered prudent.

### *Construction sequence*

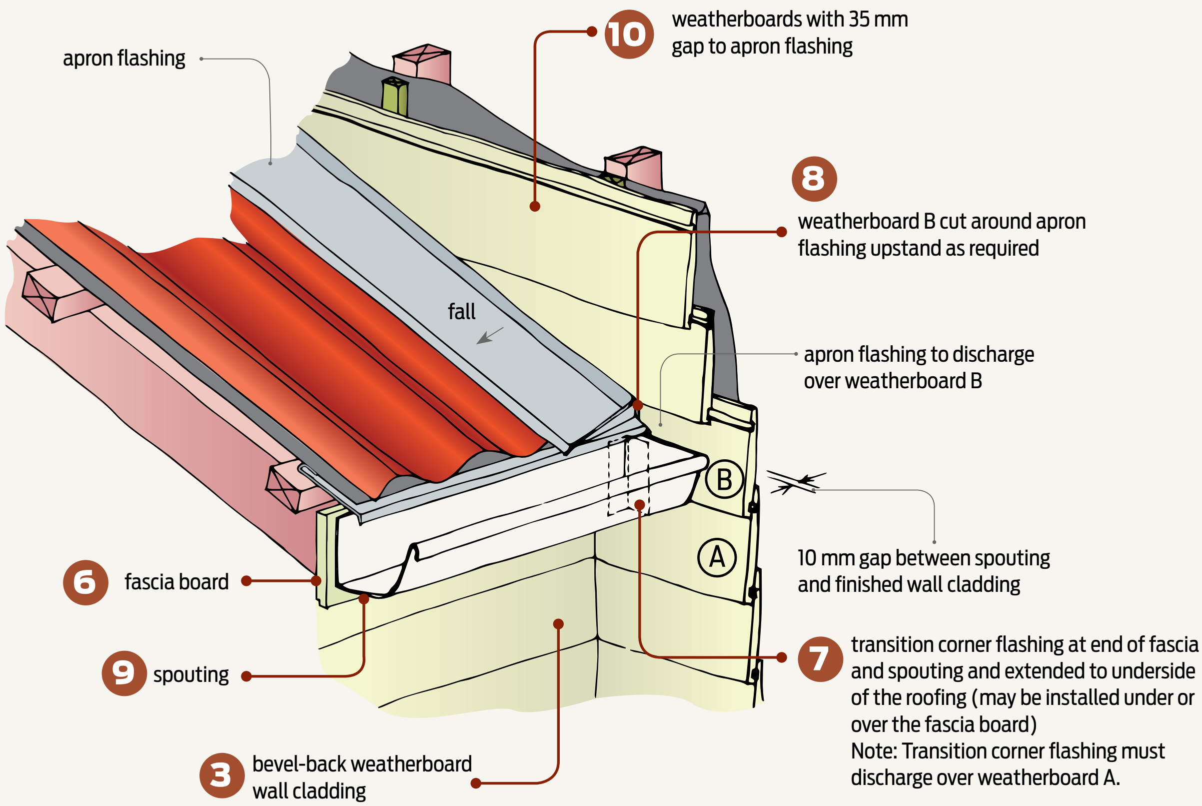
Figures 77a–c illustrate the construction sequence for the detail with bevel-back weatherboards over a drained and vented cavity.

**Step 1** – Install roof underlay and cladding, turning the roof underlay up the adjacent wall.

**Step 2** – Fit the apron flashing with a fall towards the roof and a tapered stop-end – folded on site or proprietary insert – to direct water into the gutter. Ensure it has the required minimum upstand height, roof cover and cross-fall (5º).

**Step 3** – Clad wall up to fascia (weatherboard A in Figure 77c).

**Step 4** – Cover apron flashing upstand with additional wall underlay or flexible flashing tape extending beyond bottom end of apron.




Note: An alternative is to use a proprietary stop-end that is fitted to the end of the underflashing.

**Figure 77c** **Steps 6–9.**

**Step 5** – Install cavity battens and a cavity closure maintaining the minimum required gap – generally 35 mm (Figure 77b).

**Step 6** – Install the fascia board.

**Step 7** – Fit a transition corner flashing either under or over the fascia board to protect the soffit framing by bridging the gap at the end of the fascia board. Extend the transition corner flashing up to the underside of the roofing (Figure 77c) and over weatherboard A.

**Step 8** – Fit weatherboard B over the cavity battens, cutting board to fit around the apron flashing stop-end as required.

**Step 9** – Fit the gutter to fascia board, maintaining a minimum 10 mm gap between the end of the gutter and the weatherboard cladding.

**Step 10** – Continue fitting weatherboards to wall maintaining 35 mm clearance to apron flashing.

# 4.2 Roof junction detail

Getting flashings right between a tight area such as the main gable of a building and the ridge of a smaller gable can be difficult. With these installation pointers, you can make sure this junction is weathertight.

**CORRECTLY INSTALLED** flashings are essential to ensuring weathertightness, but in some locations, detailing and installation can be tricky. This is when it is necessary to achieve a detail that not only keeps out moisture and meets the requirements of Acceptable Solution E2/AS1 but that is also durable and aesthetically pleasing.

One such detail is the junction between the main gable of a building and the ridge from a smaller gable, often a garage (see Figure 78).

### *Sequence of assembly – no eave*

The sequence of assembly of flashing such a junction is critical to achieving a weathertight detail.

Figures 79a–c show the sequence for flashing the junction between the gable and ridge where there is no eave.

Figure 80 shows the shapes of each of the flashings and how they should be folded.

**Step 1** – Flashing 1 is a typical apron roof flashing. The flashing upstand is carried up under the cladding and wall underlay and the

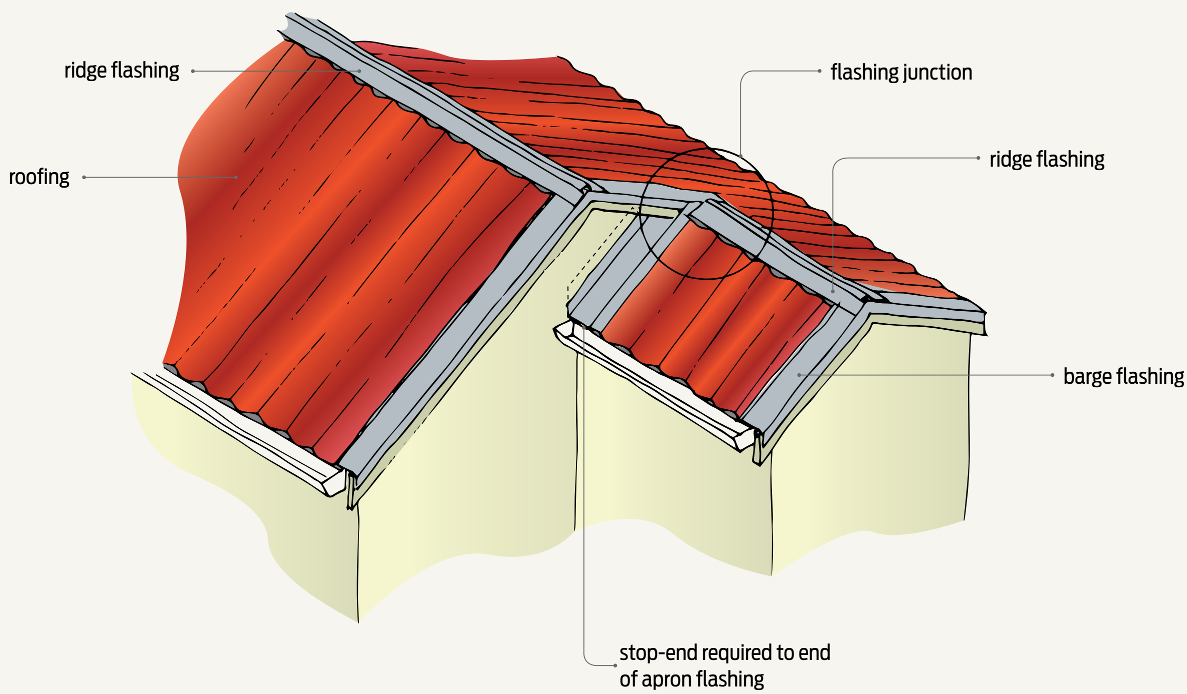



**Figure 78** **Flashing junction of main gable and smaller gable.**

flashing apron is extended over the ridge of the smaller gable (see Figure 79a).

**Step 2** – Flashing 2 covers both the apron flashing upstand and the wall underlay. It is folded over the large gable roof and the apron flashing and also extended over the ridge of the smaller gable (see Figure 79b).

**Step 3** – Fit a butyl rubber patch over flashing 2 (see Figure 79b).

**Step 4** – A ridge flashing is fitted over the smaller gable ridge butting up to the wall cladding, and the bargeboard is installed over the ridge. Flashing 3 is a standard barge flashing that, on the large gable roof, extends beyond the ridgeline of the smaller gable and aligns with the bottom edge of the ridge flashing (see Figure 79c).

### *Roof junction with an eave*

Where there is an eave at the junction between the two gables, the apron and barge flashings are fitted in the same way. However, an undersoaker flashing is required over the soffit, apron flashing and roof (see Figure 80).

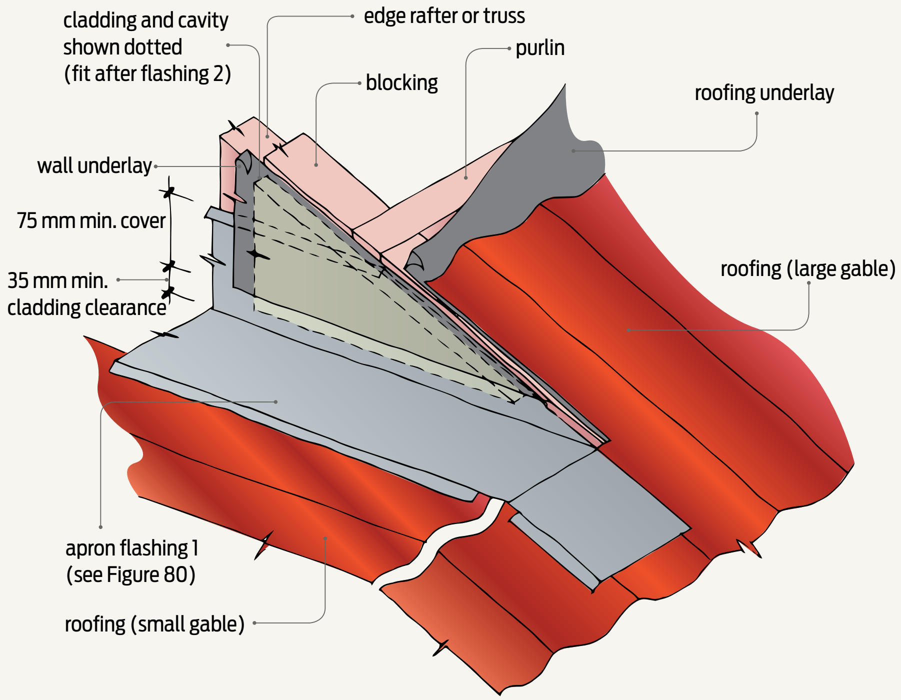



**Figure 79a** Flashing the junction – Step 1.

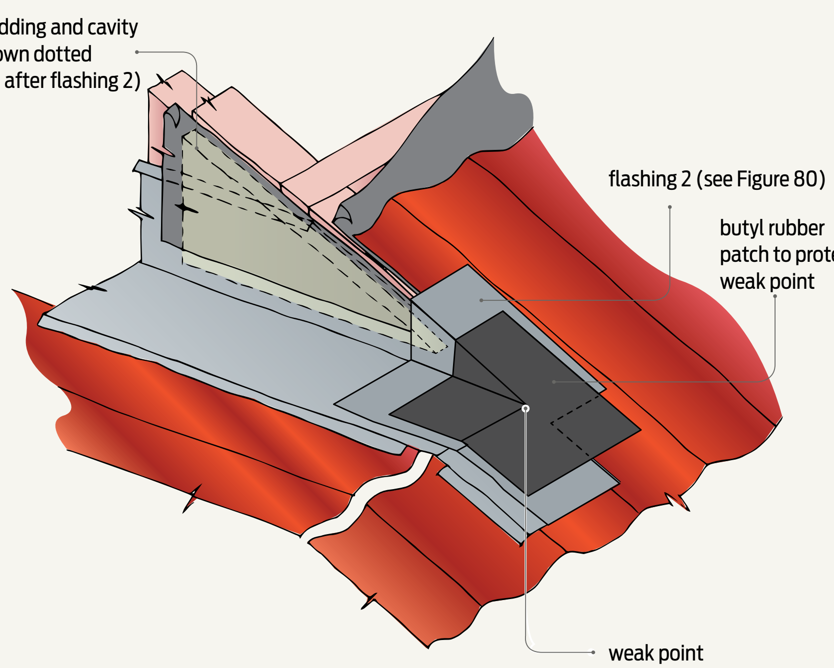



**Figure 79b** Step 2.

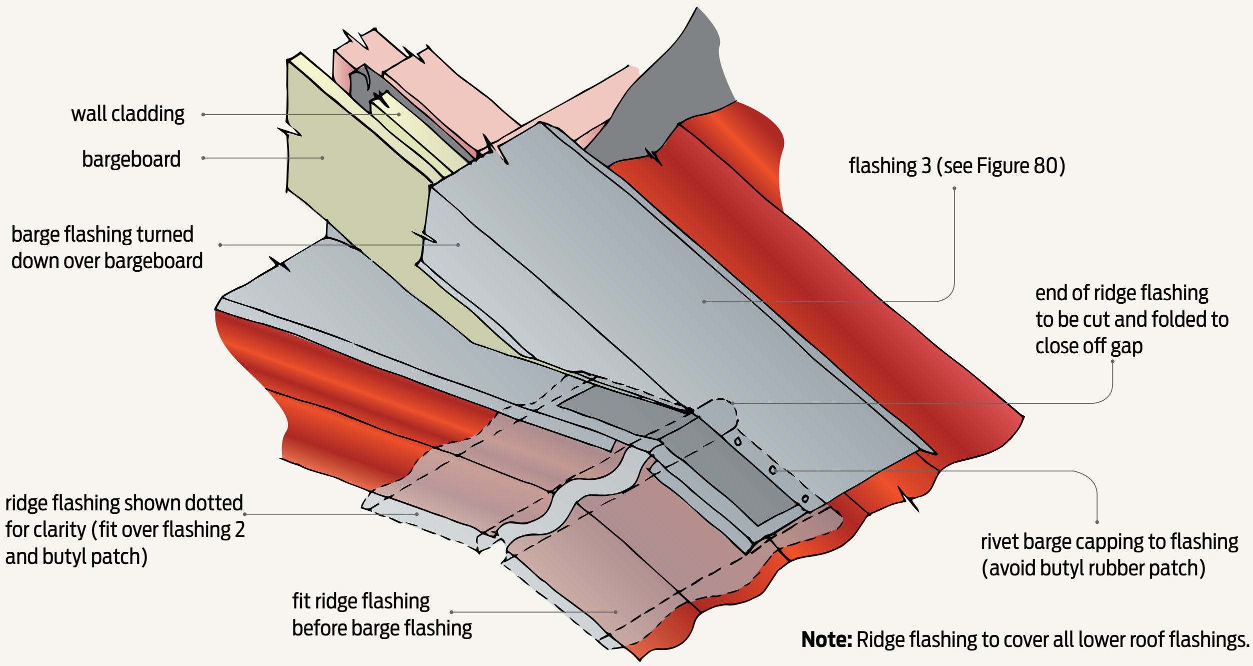
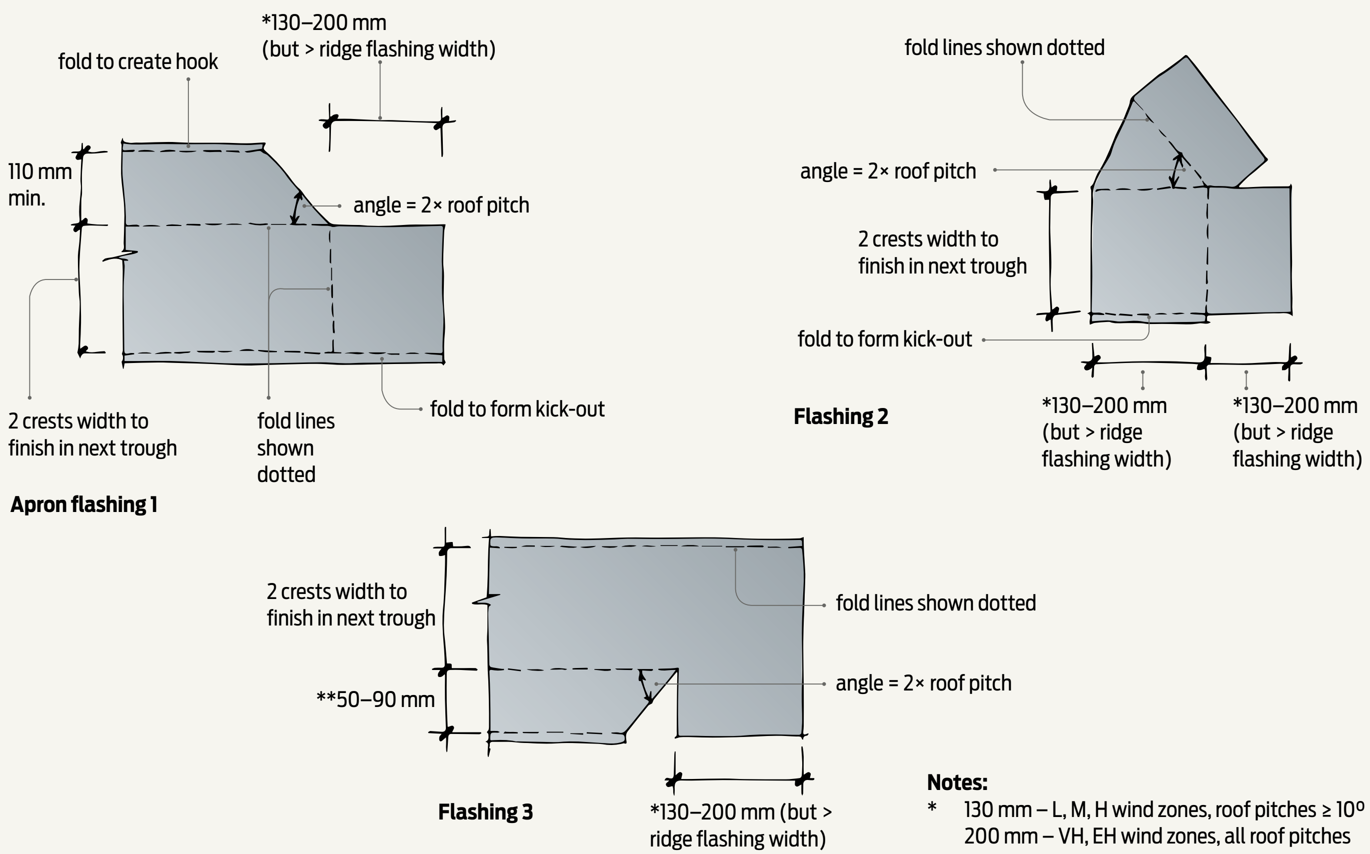



**Figure 79c** Step 3.




**Notes:**

* 130 mm – L, M, H wind zones, roof pitches ≥ 10º
200 mm – VH, EH wind zones, all roof pitches

** 50 mm – L, M, H wind zones, roof pitches ≥ 10º
70 mm – VH wind zone, all roof pitches
90 mm – EH wind zone, all roof pitches

**Figure 80** Flashing shapes.

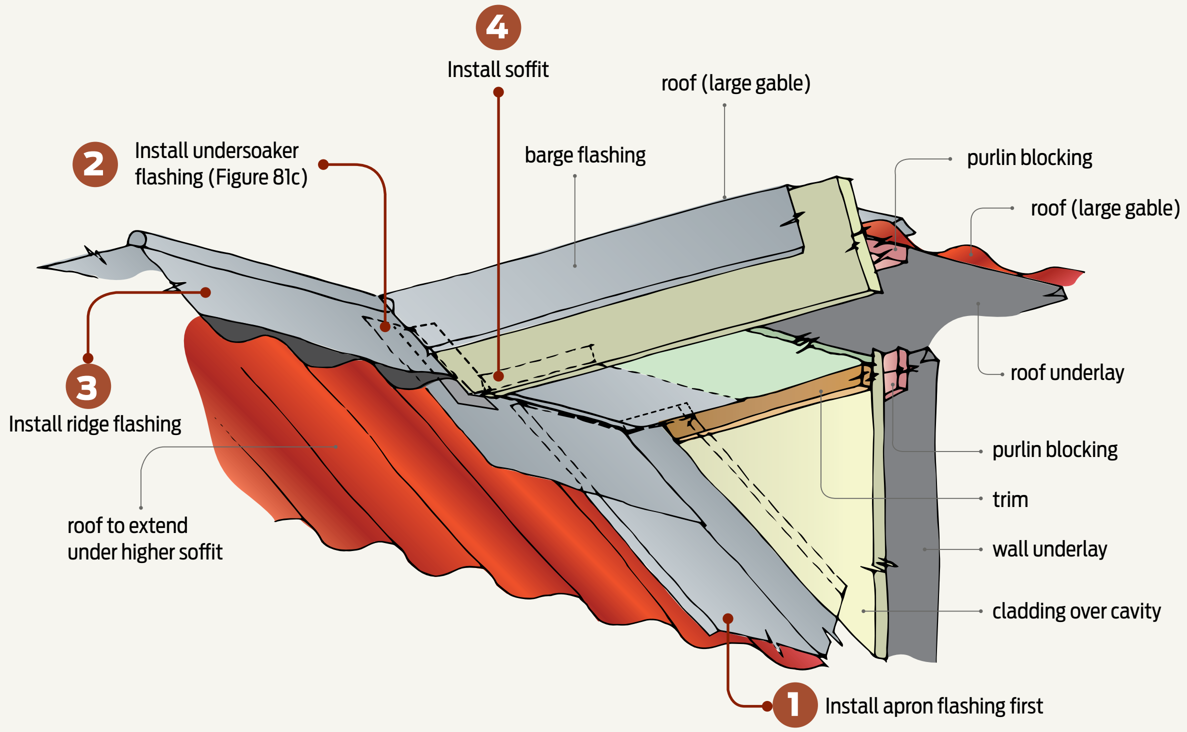
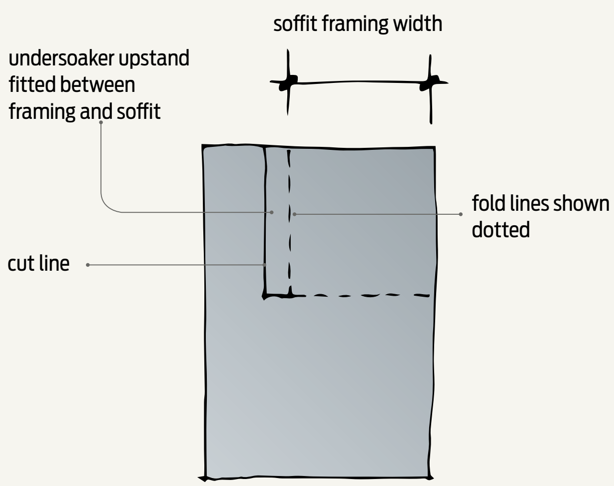



**Figure 81a** **Flashing detail sequence – gable with soffit.**



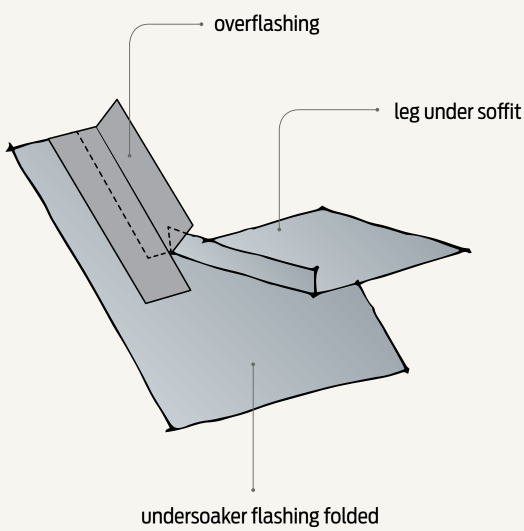




**Figure 81b** **Undersoaker flashing.**

**Figure 81c** **Undersoaker flashing folded.**

# 4.3 Tricky lean-to junction

Good detailing of the roof wall junction for lean-tos is important for the weathertightness of a building, but this junction can present some challenges.

**ROOF WALL JUNCTIONS** can be classed as simple, such as a standard horizontal apron flashing (see A in Figure 82), or complex, such as where the previous apron flashing terminated within the wall area (see B in Figure 82).

Detail A is covered by E2/AS1, but detail B is not.

### *Building up the detail*

Key elements to address with the termination of the flashing at B are:

- preventing wind-blown water getting under the edge of the flashing laid over the roof by downturning the end of the flashing cladding to the lean-to
- backflashing the internal corner and ensuring the backflashing extends up behind the barge-board and the apron flashing upstand.

Figures 83a–f outline the construction sequence for one option for detailing this tricky junction.

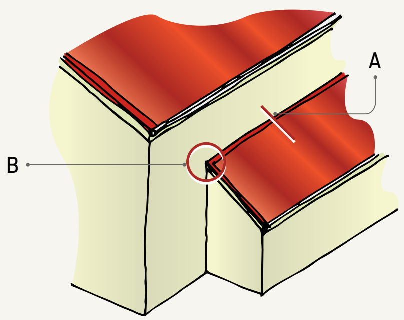



**Figure 82** Lean-to junction.

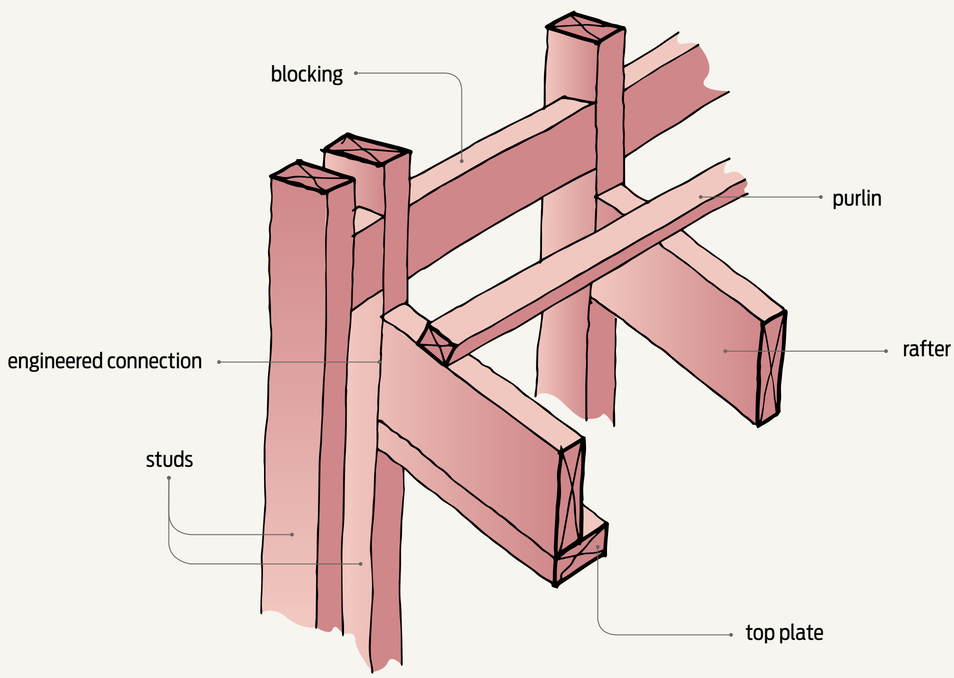



**Figure 83a** Construction sequence Step 1 – Framing.

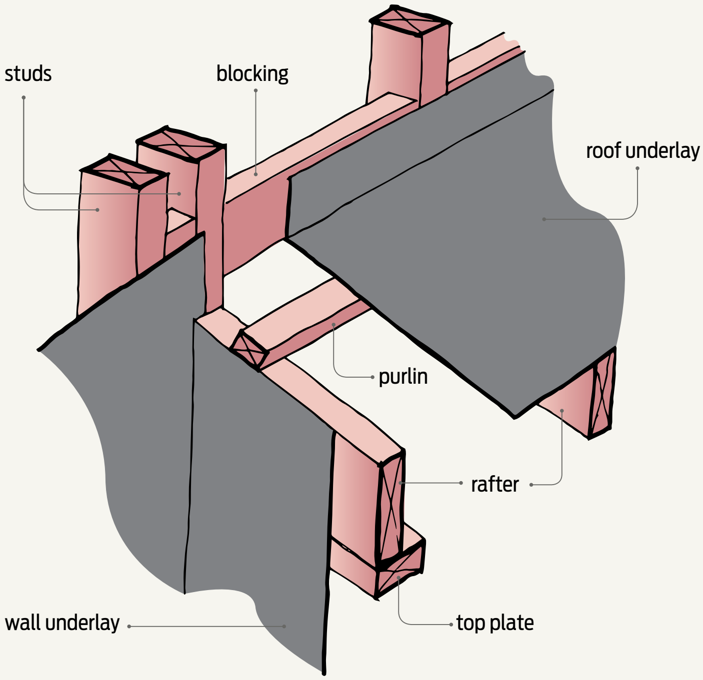



**Figure 83b** **Step 2 – Wall and roof underlay.**

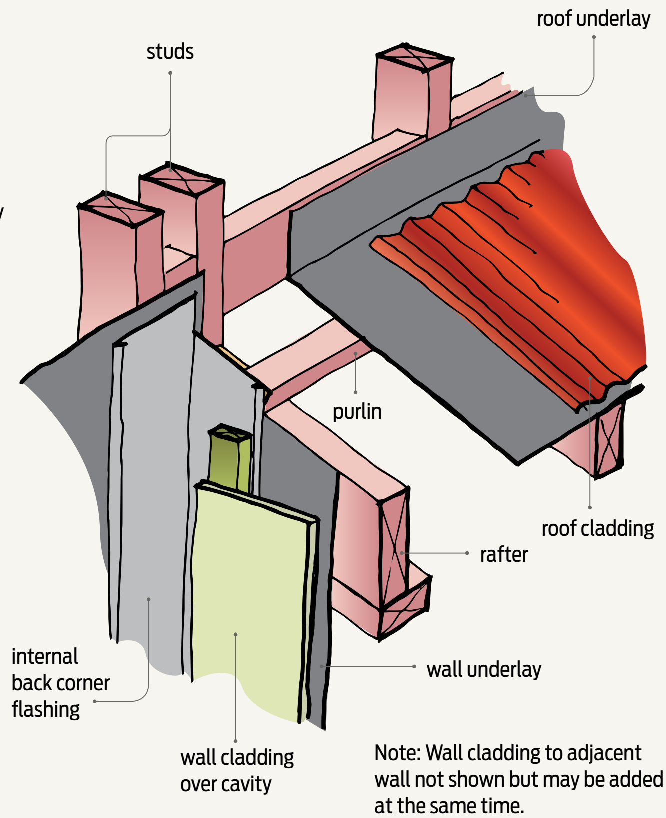



**Figure 83c** **Step 3 – Backflashing internal corner.**

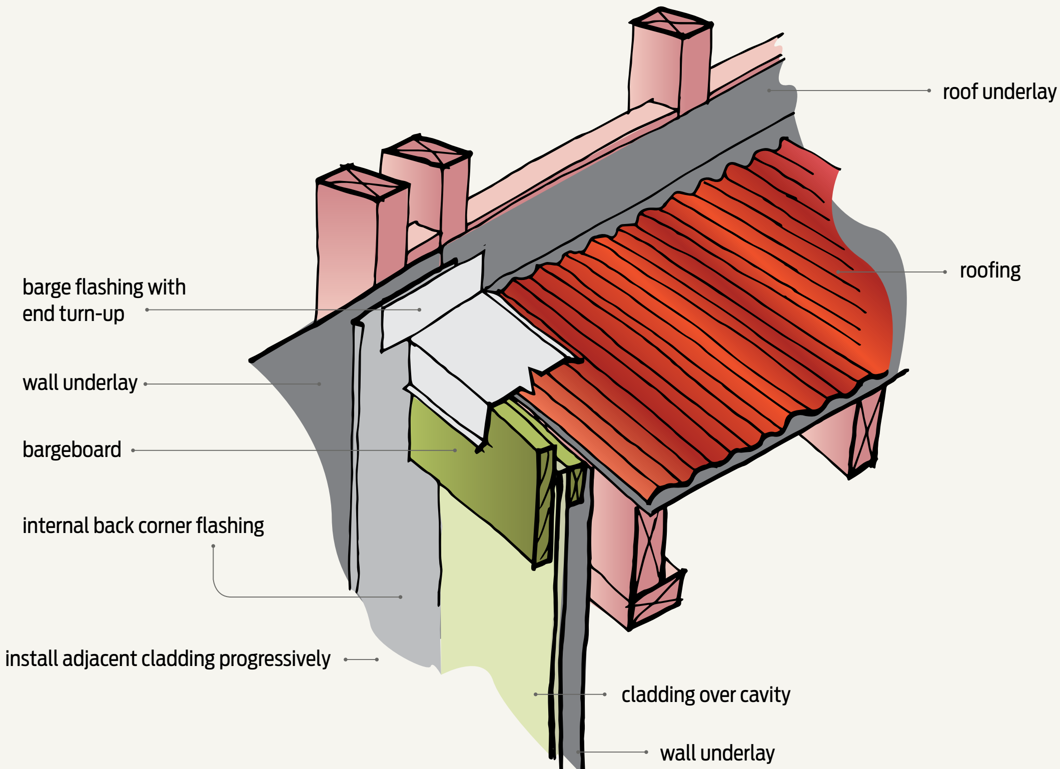



**Figure 83d** **Step 4 – Installing barge flashing.**

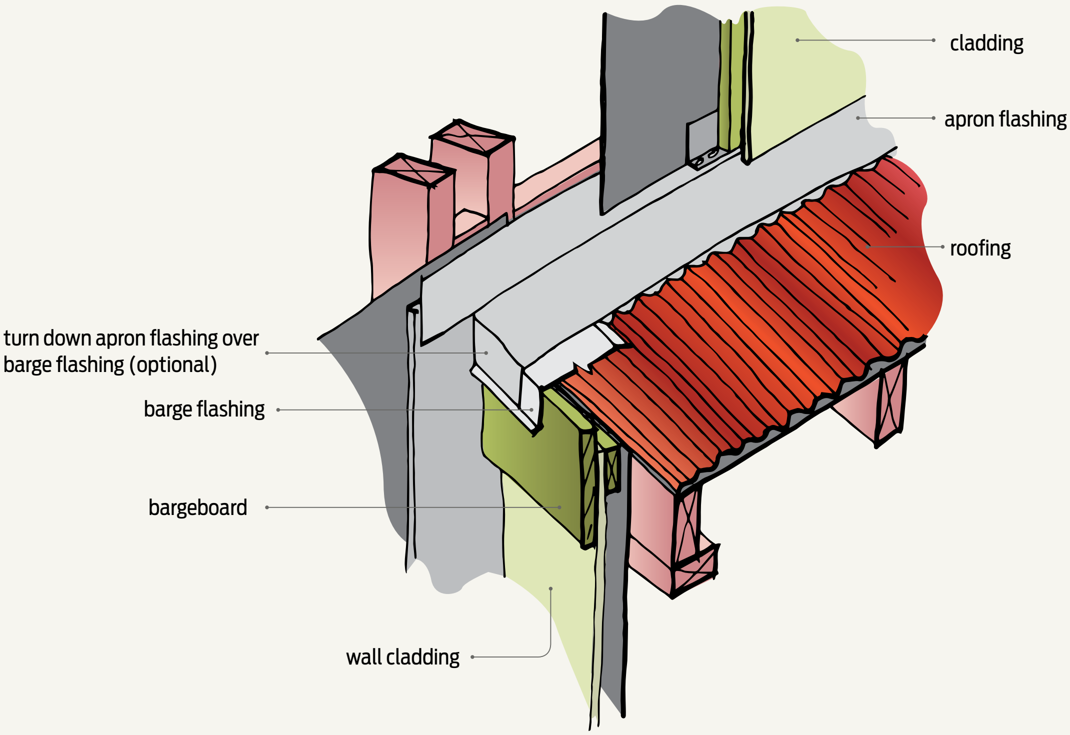



Figure 83e **Step 5 – Install apron flashing.**

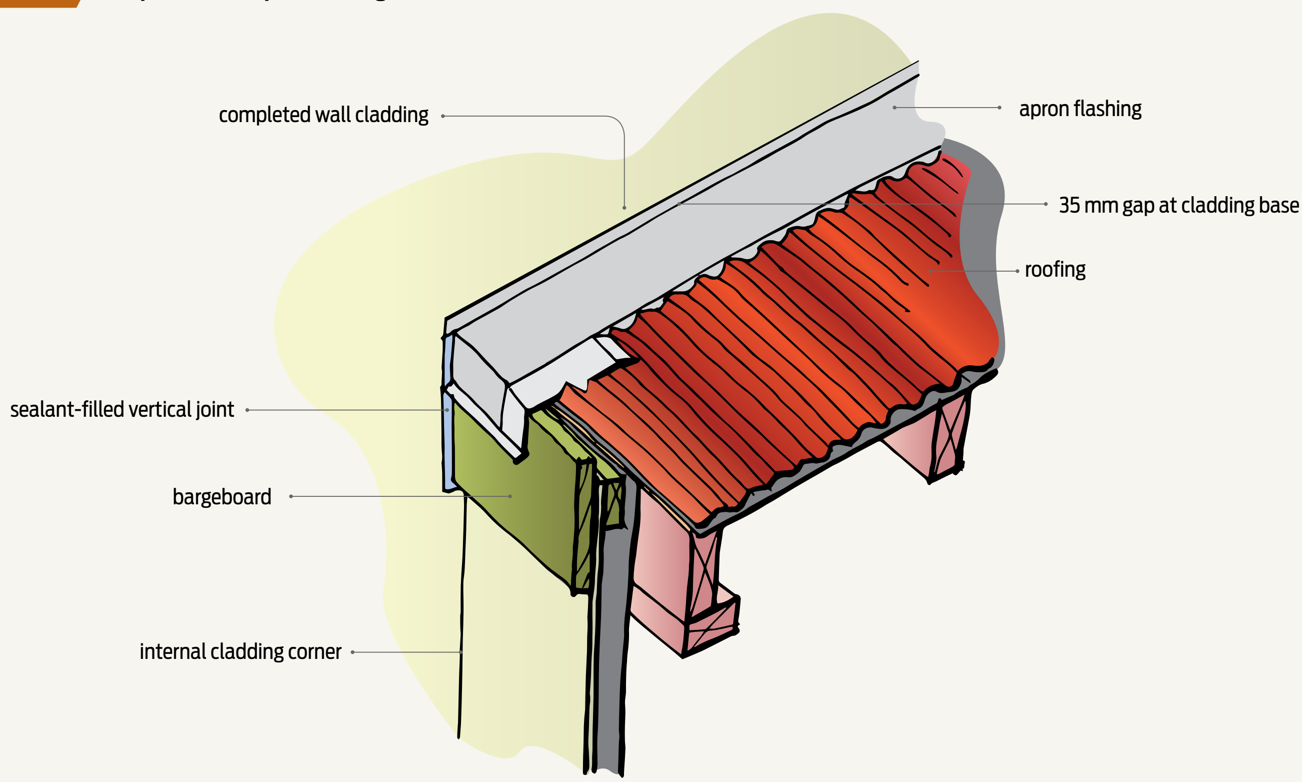



Figure 83f **Step 6 – Completed detail.**

# 4.4 Soffit detail at gable verge

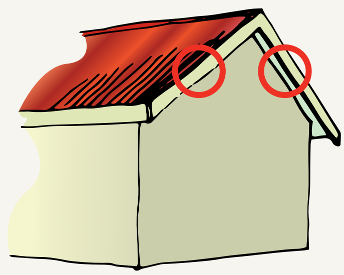
Gables need to be carefully detailed and constructed to prevent wind-driven rain penetrating the junction between the soffit and the wall cladding. Follow this step-by-step guide to achieve a weathertight detail.

**THERE IS A TWOFOLD** weathertightness problem at the junction between the soffit and the wall cladding:

- Gables tend to be higher and more exposed.
- The cladding is cut to the angle of the roof pitch where it intersects with the soffit lining to create a wedge-shaped gap at each end of the boards.

### *Tradition compounds problem*

The traditional way to construct eave and verge details is to install soffit linings before the external cladding. This compounds the weathertightness problem as the cladding is butted to the soffit lining, allowing any water running down the soffit to enter the gap between the lining and the top of the cladding. From there, it will run down behind the cladding.



### *Better to install weatherboards first*

A better way to achieve a weathertight detail is to install weatherboards first. The intersection of the soffit lining and the top of the weatherboards can be effectively flashed and wedges installed to block the gaps between the weatherboards.

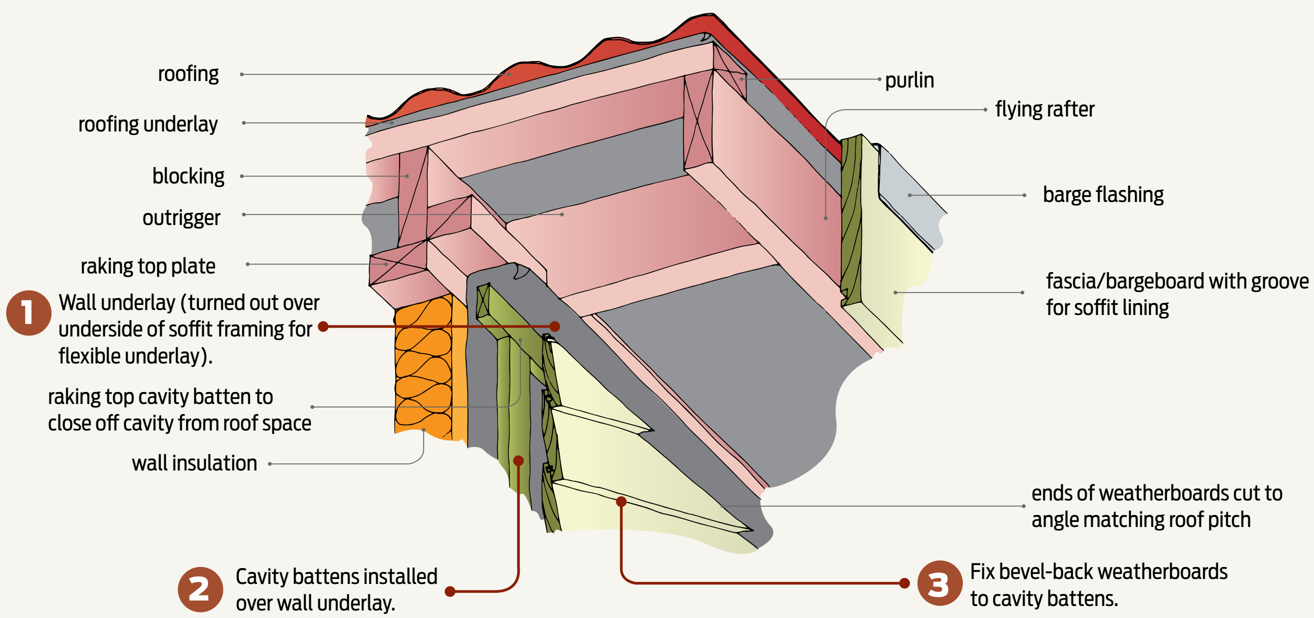



**Figure 84a** Soffit detail at gable verge for weatherboards – Steps 1–3 .

The sequence of construction is described in Steps 1–7 and shown in Figures 84a–b.

**Step 1** – Carry wall underlay up the wall framing and turn out over the underside of the flying rafters/soffit framing.

**Step 2** – Install vertical cavity battens and raking cavity batten to close off the roof space.

**Step 3** – Install bevel-back weatherboards up to the underside of the soffit framing. Ends of weatherboards are cut to match the angle of the roof pitch.

**Step 4** – Fix minimum 45 × 45 mm angle flashing to the underside of the soffit framing and over the weatherboards. For boxed soffit, fold flashing to form a stop-end at the bottom. Fit an additional angle flashing behind the fascia return.

**Step 5** – Install the soffit lining by slotting it into the groove in the bargeboard and fixing to the framing.

**Step 6** – Cut wedges to fit gaps at the junctions of the soffit and the weatherboards.

**Step 7** – Fix a timber trim or cover batten to the intersection between the soffit lining and the weatherboards.

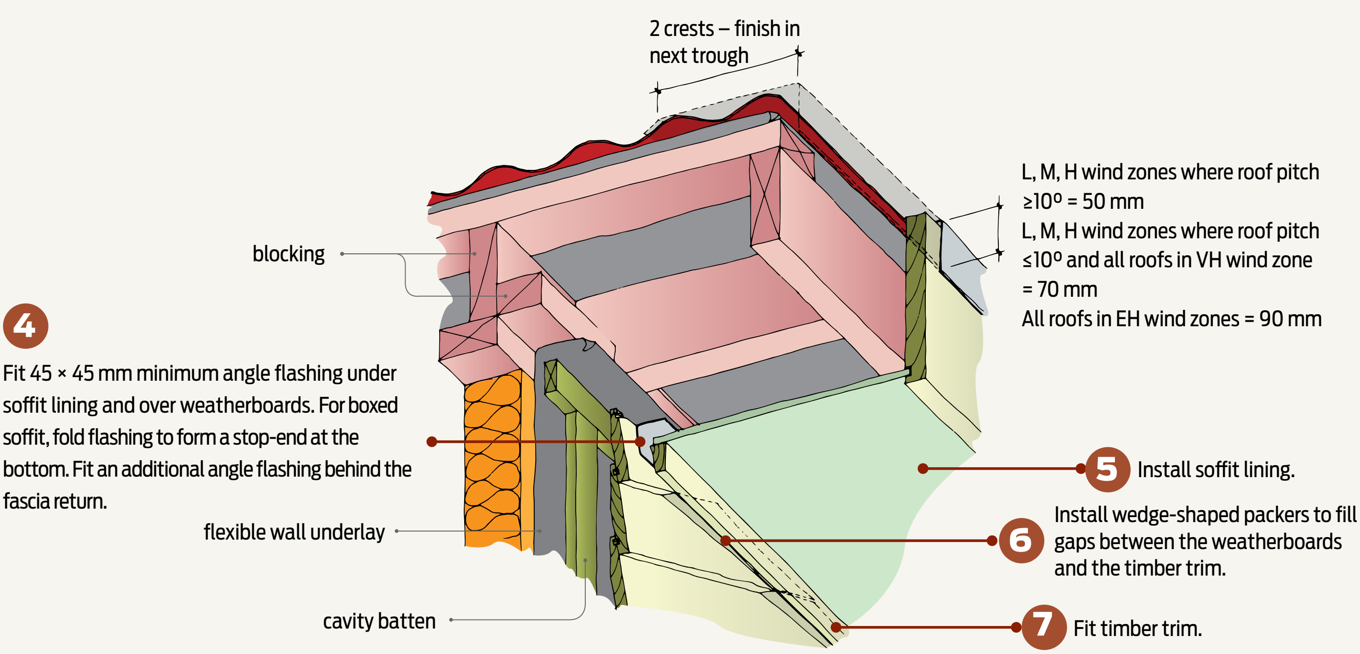



**Figure 84b** **Steps 4–7.**

# 4.5 Parapet or balustrade-to-wall junction

What you need to know about constructing a timber-frame parapet or enclosed balustrade and their junction to a wall junction.

**THE JUNCTION** between a parapet or enclosed balcony and the main wall must be offset from the adjacent walls and flashed with a saddle flashing (see Figure 14) as per E2/AS1 Figures 11 and 12.

E2/AS1 gives no minimum offset dimension between a parapet or enclosed balcony and the main wall. A 200 mm minimum offset allows sufficient space for installing the balustrade or parapet.

E2/AS1 requires at least 150 mm between the trimming stud to a door or window adjacent to the solid balcony wall framing.

Enclosed balustrades and parapets that are continuous and in the same plane as an adjacent wall are outside the scope of E2/AS1.

### *Parapet and balustrade wall construction*

General construction of parapets and enclosed balustrades requires that:

- the framing is fully enclosed with wall or roof underlay
- all claddings on parapets and enclosed balustrades are over drained cavities, except vertical corrugate
- all claddings are installed over a rigid wall underlay, consisting of 7 mm H3 treated plywood or 6 mm fibre-cement sheet overlaid with a flexible wall underlay in extra high (EH) wind zones
- there is a drained cavity with flush-finished, fibre-cement and exterior insulation and finish system (EIFS) claddings in all wind zones and with all claddings except for vertical corrugated steel in EH wind zones
- a sloped capping flashing is fitted across the top of the wall.

### *Parapet and balustrade capping*

All parapets must have either a sloped metal capping, or a butyl or EPDM membrane over the top of the wall and down both sides of the cladding.

Enclosed balustrade walls may have either:

- a metal capping or a butyl or EPDM membrane over the top of the wall and down both sides of the cladding, or
- a waterproofing membrane approved by the supplier of the jointing and finishing system with a textured coating applied over the top of the wall for EIFS and flush-finished fibre-cement claddings. Note: minimum 10º slope to the top of EIFS formed texture coated balustrade.

No penetrations are allowed in the top surfaces of parapets and enclosed balustrade walls. Where rails are required on balustrades, they must be side-fixed through the cladding into the framing as per E2/AS1 Figure 19 (see Figure 85).

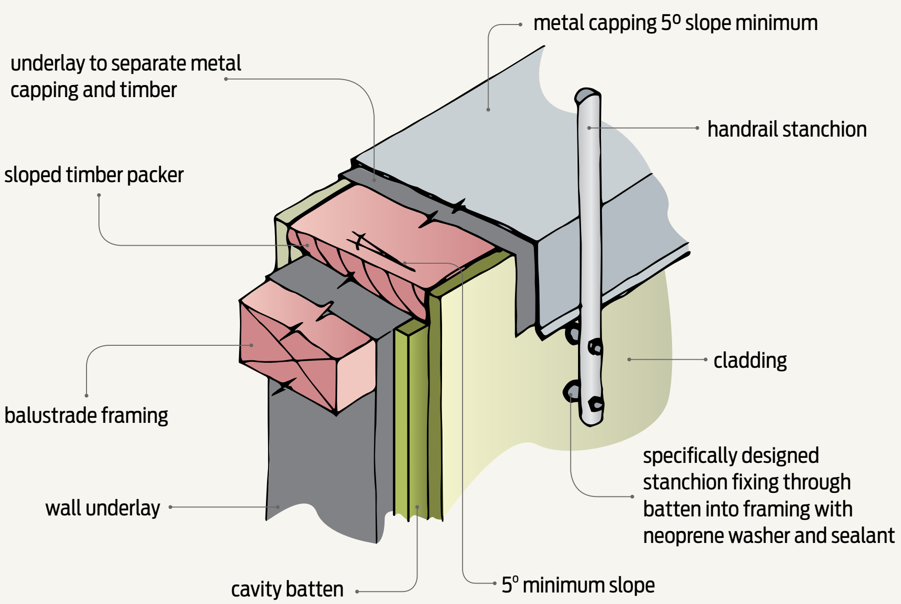



**Figure 85** **Side fixing of handrail.**

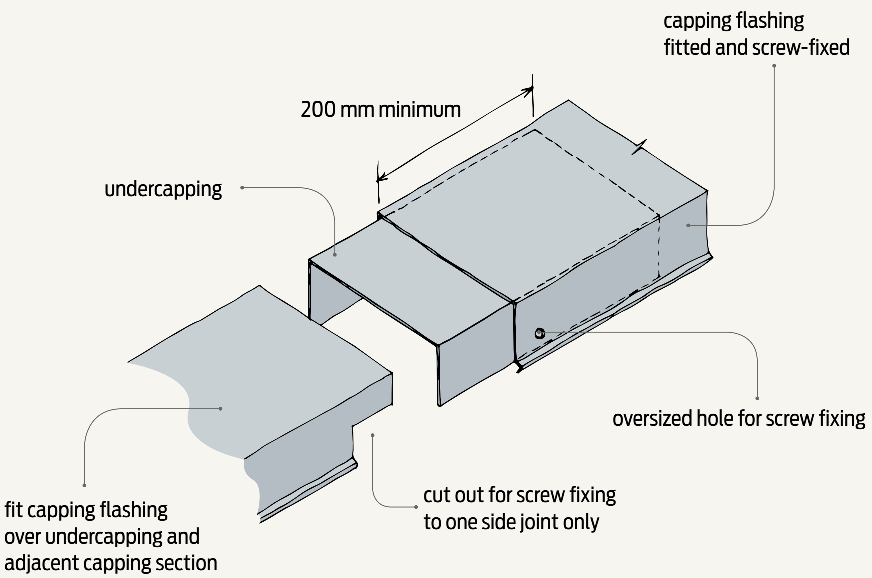



**Figure 86** **Expansion joint.**

The sides of cappings must overlap the cladding laps on both sides as per E2/AS1 Table 7 situation 2, ie ≤10º:

- 70 mm – for L, M and H wind zones
- 70 mm – for VH wind zones
- 90 mm – for EH wind zones.

Considerations for selecting the capping material for parapets and enclosed balustrades include:

- durability
- suitability for the environment
- specific conditions of use compatibility with adjacent materials
- appearance
- location and construction of joints
- fixing type and locations.

Cappings installed over parapets and enclosed balustrades are considered relatively easy to access and replace, so they may have a durability of not less than 15 years. The flashing installed under a plastered finish must have a minimum 15-year durability because of the difficulty in replacing it.

### *Metal cappings*

Metals that may be used for cappings include:

- aluminium – minimum 0.7 mm thick
- galvanised steel – minimum 0.55 mm thick
- aluminium/zinc alloy-coated steel – minimum 0.55 mm thick
- stainless steel – minimum 0.45 mm thick
- copper – minimum 0.5 mm thick
- zinc – minimum 0.7 mm thick.

Installation requirements for metal cappings include:

- a 5º minimum slope across the top of the wall, with the slope to the inside face of the building to prevent water run-off staining the exterior surfaces
- a sloped timber or polystyrene packer or 9 mm H3 plywood on packers to support the capping
- separation of the metal capping from an underlying timber packer by roof or wall underlay
- the bottom edges on both sides must be folded to form a kick-out or bird's beak drip edge
- the drip edge on the inside face of enclosed balustrades must be a bird's beak.

The drip edges must be in addition to the flashing cover dimension.

Joins in the metal cappings may be made using:

- a soaker flashing under the join with a 50 mm minimum overlap on each side of the joint, with sealant or a compressible strip inserted between the soaker flashing and each capping section. The capping sections must be fixed to the structure through the downturns.
- an overlap joint with a 100 mm minimum overlap and sealant under the overlapped sections. The sections are riveted together and sections face screw-fixed to the structure with oversized holes to allow for expansion.
- an expansion joint formed by inserting an undercapping with a 200 mm minimum overlap. Screw-fixing of the capping through the undercapping is one side of the joint only (see Figure 86).

Expansion joints must be provided for joined cappings when:

- the combined length is more than 12 m long for light-coloured and stainless steel
- the combined length is more than 8 m long for dark-coloured steel, copper or aluminium
- both ends of the capping are fixed.

External corners must be flashed using a preformed corner soaker as an underflashing as shown in E2/AS1 Figures 9(e) and (f).

### *Flush-finish topped balustrades*

Where the top to an enclosed balustrade is formed with EIFS or flush-finished fibre-cement, a liquid waterproof membrane must be applied and protected by the textured coating.

E2/AS1 does not permit the use of a concealed flashing with stucco.

The balustrade must:

- have no penetrations in the top
- have a minimum cross-fall slope of 10º provided by a shaped polystyrene packer (BRANZ recommends 15º for rough textures) and overlap the balustrades or parapet wall cladding on both sides as per E2/AS1 Figure 130.

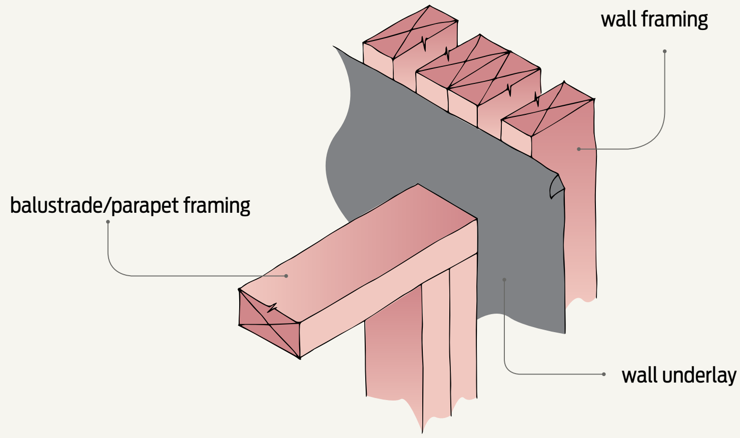



**Figure 87a** **Saddle flashing construction sequence – Step 1.**

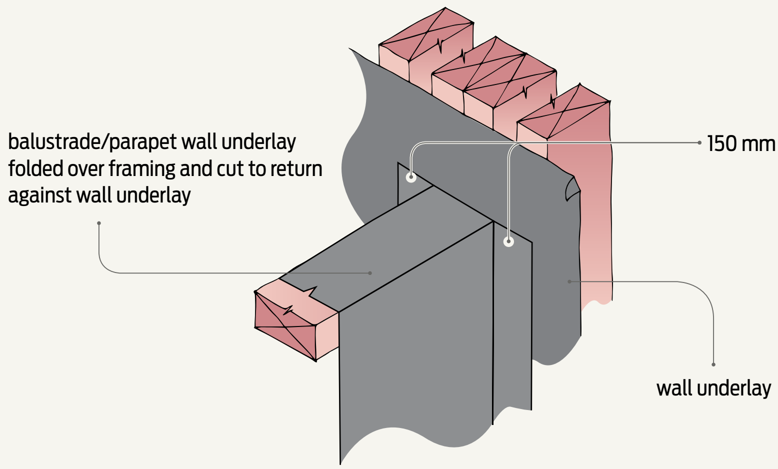



**Figure 87b** **Step 2.**

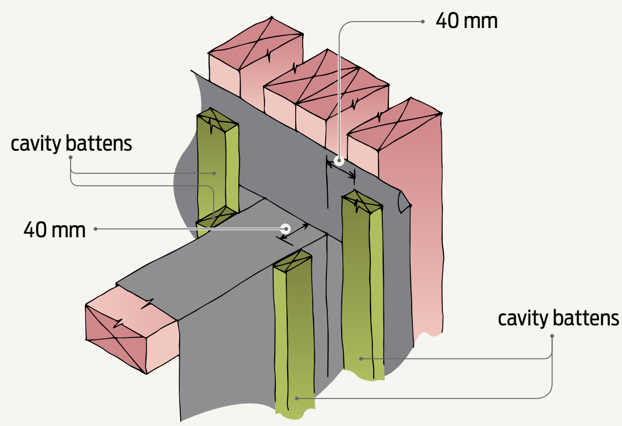



**Figure 87c** **Step 3.**

### *Saddle flashings*

Saddle flashings are required at the junctions between an enclosed balustrade or parapet and the main wall. They must have a minimum 50-year durability, 50 mm minimum upstand and sides and extend at least 100 mm over the top of the balustrade or parapet.

#### *Saddle flashing construction sequence*

The saddle flashing construction sequence is shown in Figures 87a–f as follows:

**Step 1** – Construct the balustrade/parapet framing using double studs to attach it to the main wall framing over the wall underlay (Figure 87a).

**Step 2** – Wrap the balustrade/parapet framing with wall underlay, folding it over the main wall underlay (Figure 87b).

**Step 3** – Install cavity battens to each side of the balustrade/parapet framing and to the main wall on both sides of the balustrade/parapet leaving 40 mm wide vertical channels in the internal corners (Figure 87c).

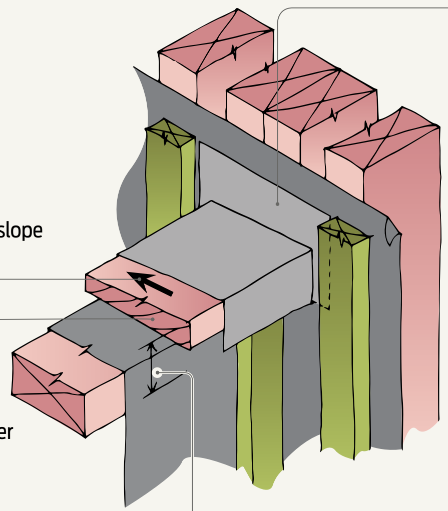



**Figure 87d** **Steps 4–5.**

**Step 4** – Install a sloped packer that is wide enough to fully cover the top of the cavity battens to the balustrade/parapet framing (Figure 87d).

**Step 5** – Apply flexible flashing tape over the packer at the junction between the balustrade or parapet and the main wall, dressing it up the main wall underlay and for a minimum of 50 mm down the face of the balustrade or parapet cavity battens (Figure 87d).

**Step 6** – Overlay timber packer with additional underlay to separate the timber and the metal capping.

**Step 7** – Fix 50 × 50 mm internal corner flashings with hems (or 75 × 75 mm flashings in EH wind zones) over the cavity battens on each side of the balustrade or parapet wall where it meets the main wall (Figure 87e).

**Step 8** – Install cladding to both sides of the balustrade/parapet wall over the corner flashing (Figure 87e).

**Step 9** – Fit a saddle flashing at the junction between the top of the balustrade or parapet

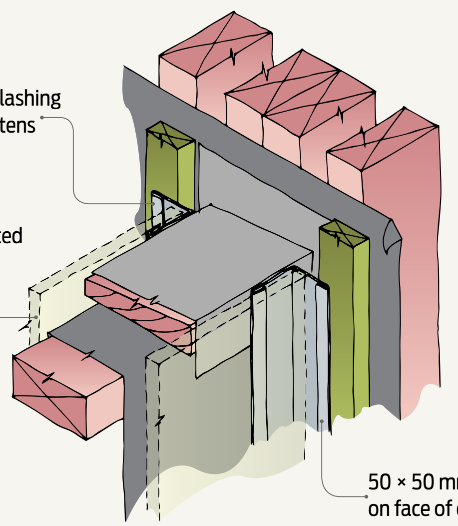



**Figure 87e** **Steps 6–8.**

wall and the main wall so that it goes over the corner flashings and the balustrade or parapet cladding and is fixed to the main wall cavity battens (Figure 87f).

**Step 10** – Cut and fix the main wall cladding around the balustrade/parapet wall and saddle flashing, leaving a 5 mm gap for moisture to be able to drain away (see Figure 87g).

**Step 11** – Fit the metal capping over the top of the parapet/balustrade wall with two rows of sealant between the capping and the saddle flashing (Figure 87g).

**Step 12** – Fix the capping through the sides of the flashing only.

***Base of enclosed balustrade or parapet***

The base of the enclosed balustrade or parapet must have:

- the cladding finishing at least 35 mm above the highest point of the deck surface
- the decking membrane turned up at least 150 mm under the cladding blocking fitted between the stud framing to provide support for the decking membrane upstand
- a triangular fillet so that the membrane can be smoothly turned up.

Where cavity battens are installed, they must stop 10–15 mm above the bottom of the cladding to provide a drip edge and be closed off with a cavity closer.

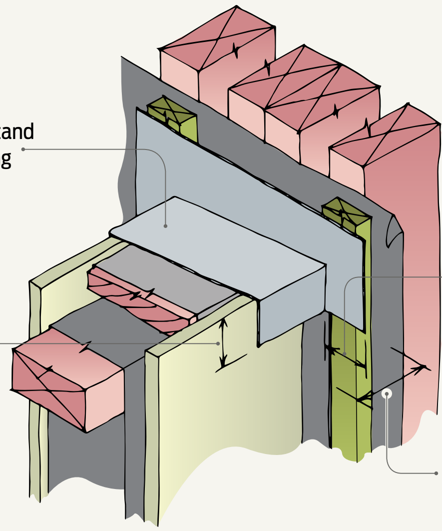



**Figure 87f** **Step 9.**

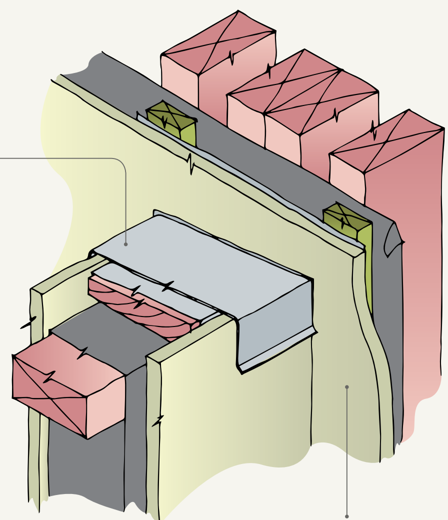



**Figure 87g** **Step 10–11.**

# 5 Glossary

| | |
|---|---|
| **ACCEPTABLE SOLUTION** | A solution that must be accepted by a BCA as complying with the Building Code. |
| **ALTERNATIVE METHOD** | A proposed method that does not follow a Verification Method or Acceptable Solution, but if accepted and consented by the BCA, will become an Alternative Solution. |
| **ALTERNATIVE SOLUTION** | An alternative method that has been accepted and consented by a BCA. |
| **BCA** | Building consent authority. |
| **CLADDING** | The exterior weather-resistant surface of a building. |
| **COMPATIBLE** | When materials can be used together without affecting each other. |
| **EPDM** | (Ethylene propylene diene monomer) – a closed-cell sponge rubber material with good compressibility and resistance to weathering. |
| **TERRITORIAL AUTHORITY (TA)** | City, district or regional council. |
| **WIND ZONES** | Categories of wind force (based on speed) defined in NZS 3604:2011.<br>Wind zone categories are low (L), medium (M), high (H), very high (VH) and extra high (EH). |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