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).

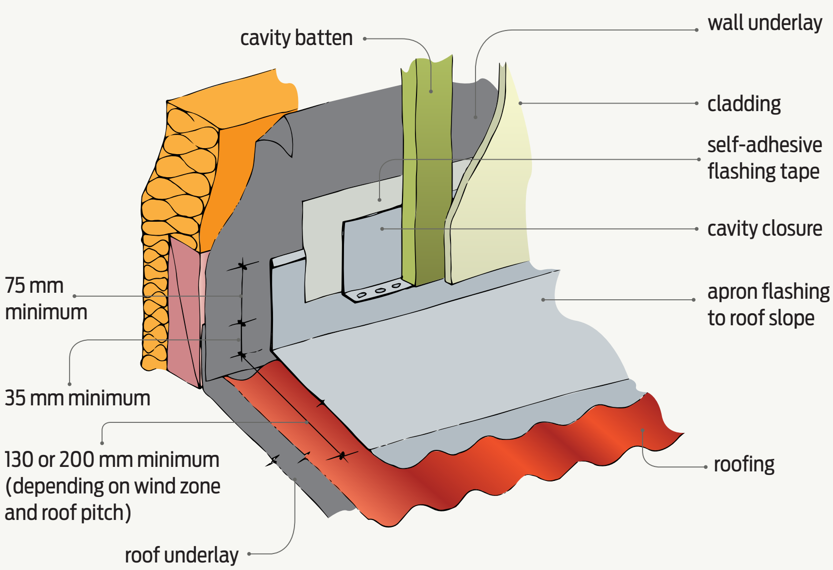


Figure 10 Apron flashing at roof/wall junction – horizontal flashing.

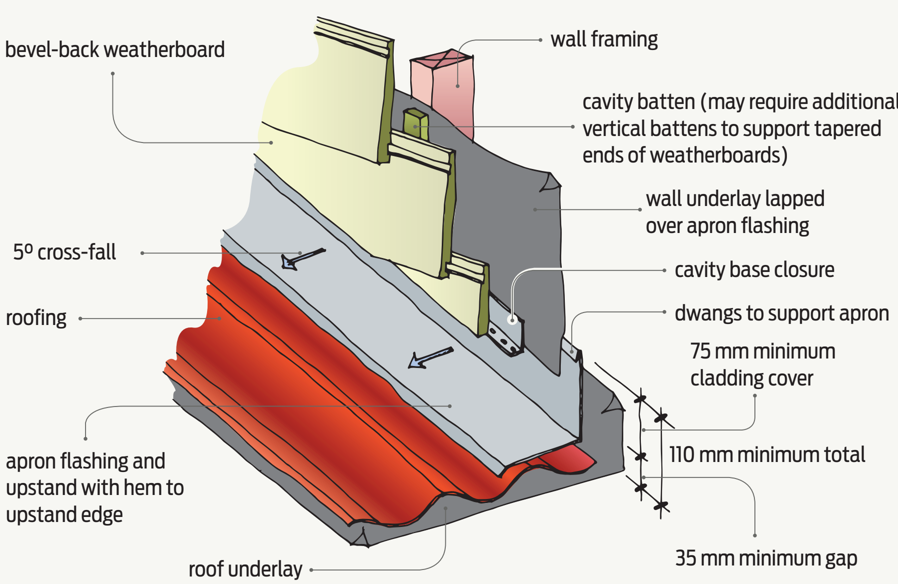


Figure 11 Apron flashing at roof/wall junction – parallel flashing.

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 5º
- drip edges to both sides – use a bird's beak drip edge on the deck side of a balustrade ➤

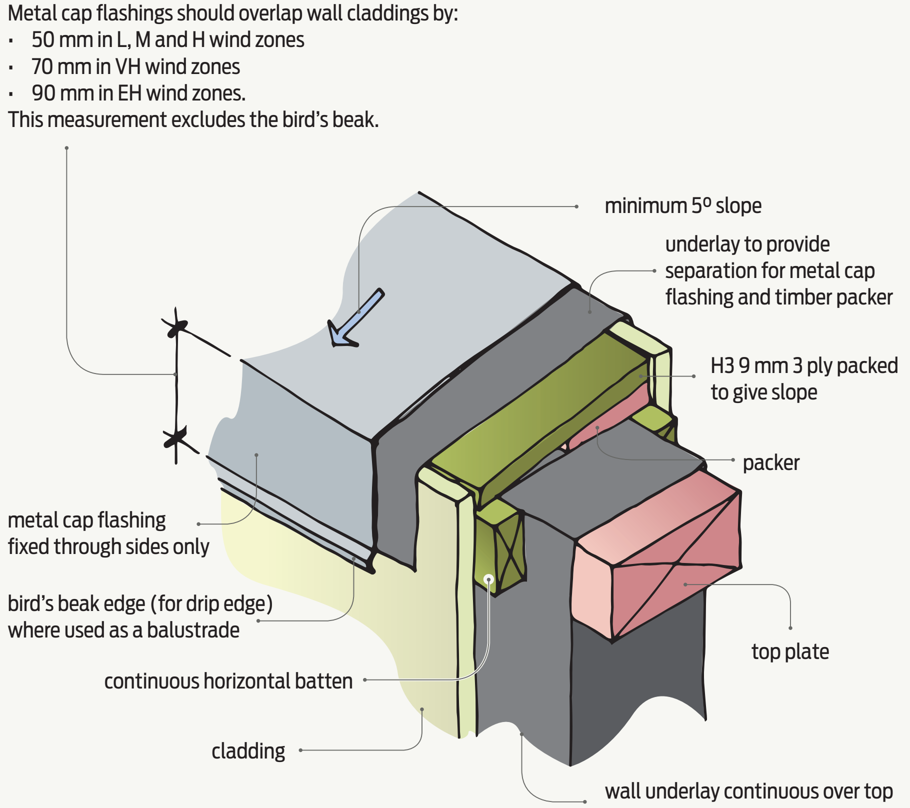


Figure 12 **Metal cap flashing.**

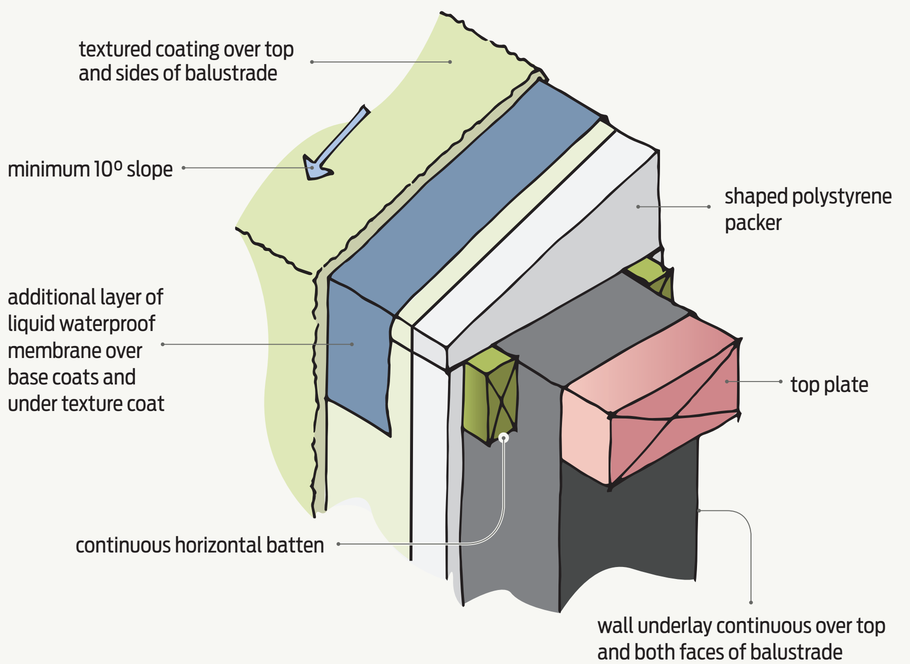


Figure 13 **Membrane underflashing to parapet/balcony wall.**

- 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.

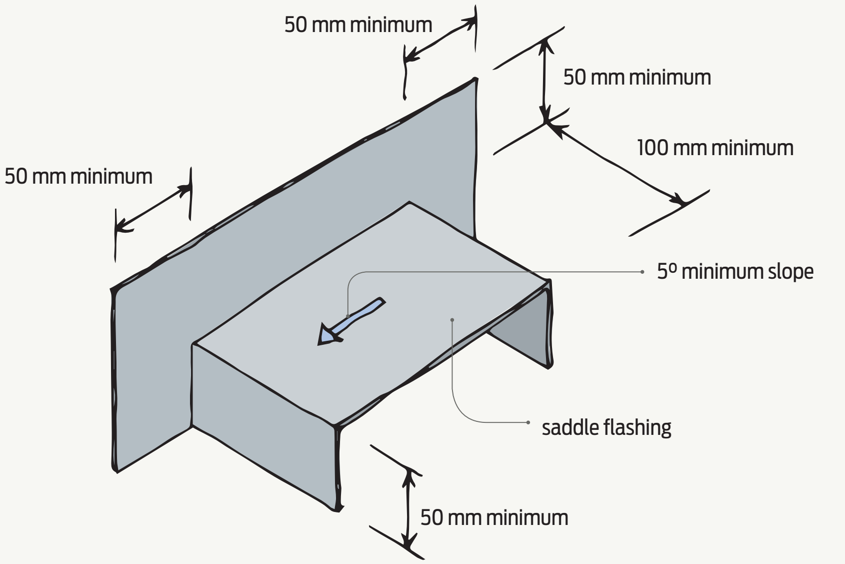


Figure 14 **Fabricated saddle flashing to framed balcony/wall junction or at intersection between different height parapets.**

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.

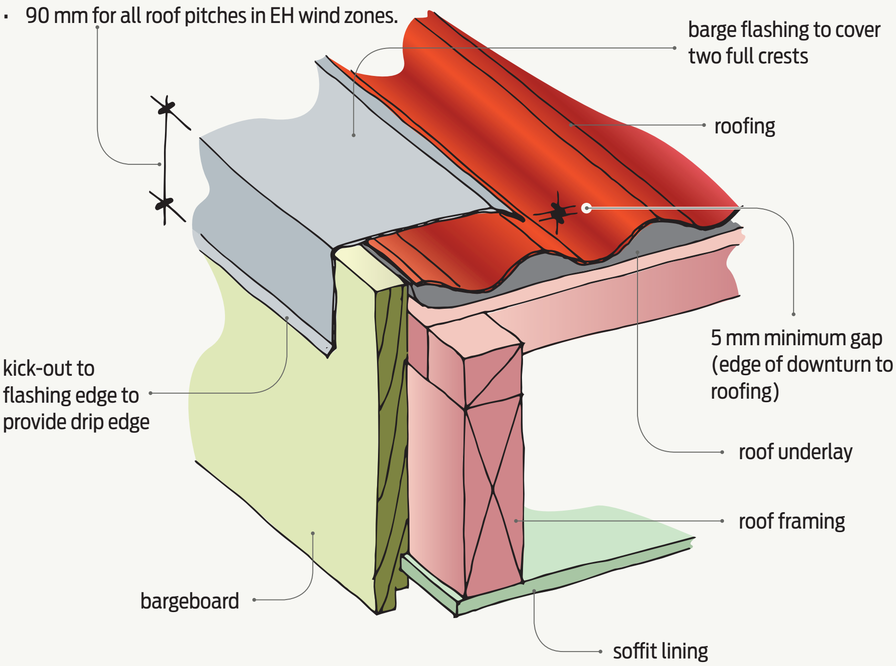


Figure 15 **Barge flashing.**

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 ➤

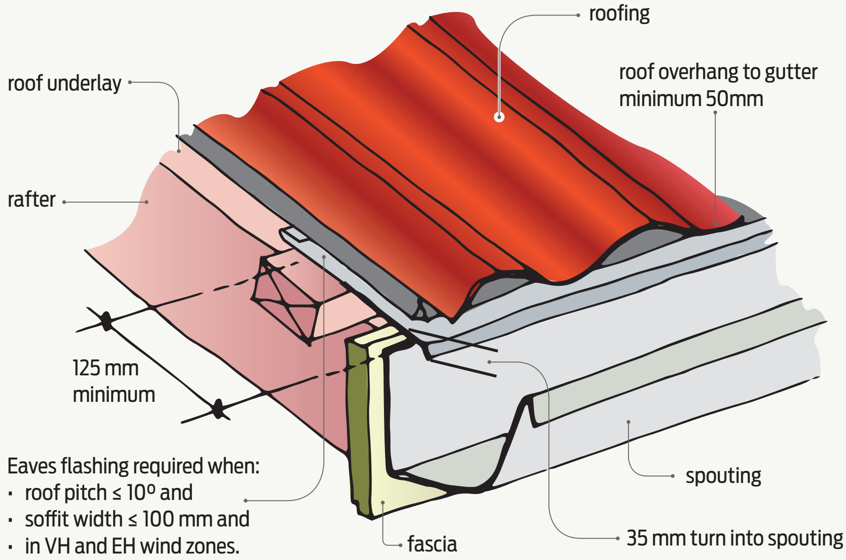


Figure 16 Eaves flashing.

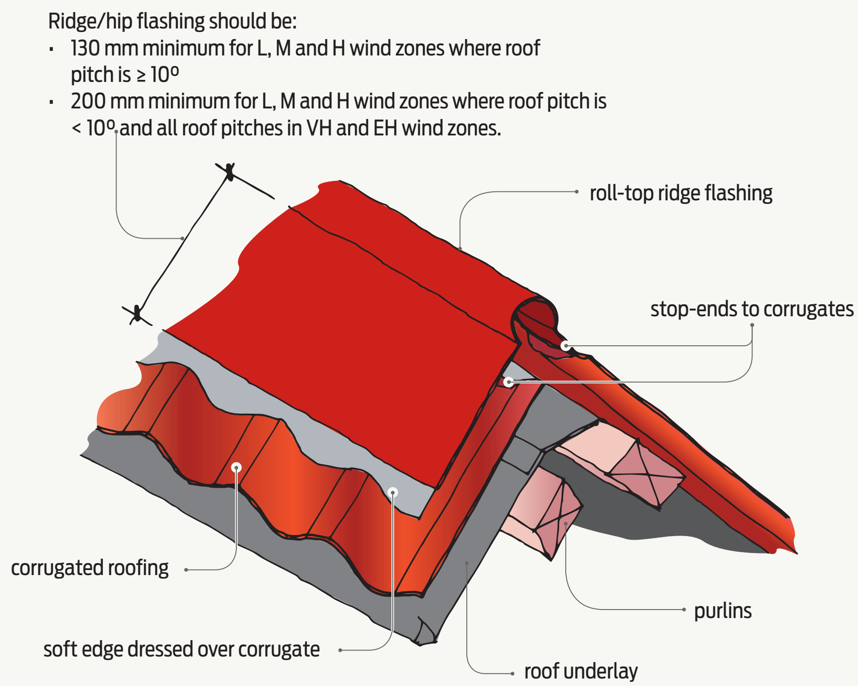


Figure 17 Ridge/hip flashing (non-vented).

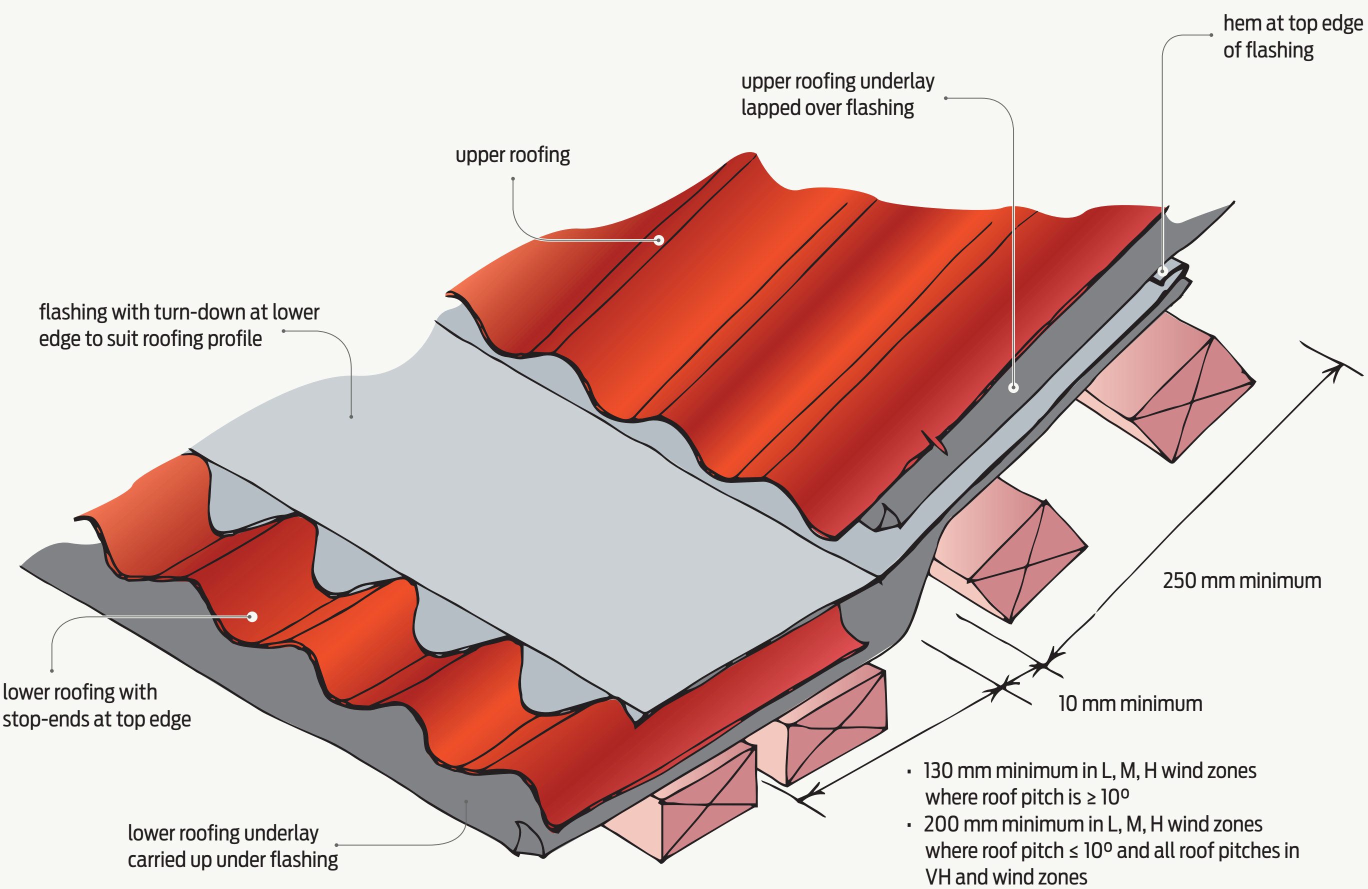


Figure 18 **Apron flashing at change in roof pitch for profiled metal roofing.**

- 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

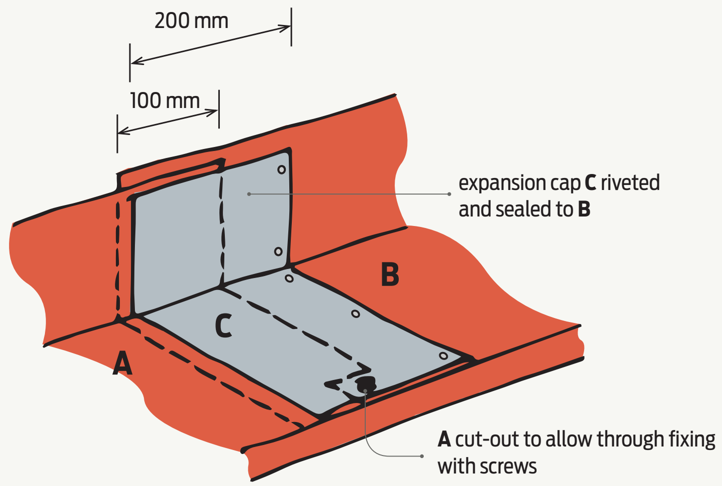
Expansion joints that allow for thermal movement are required wherever both ends of the flashing are constrained (see Figure 19). E2/AS1 requires:

- 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)).

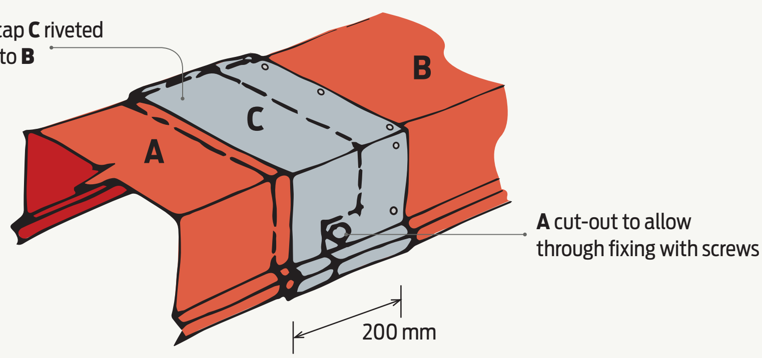
Non-movement control joints

Non-movement control joint laps:

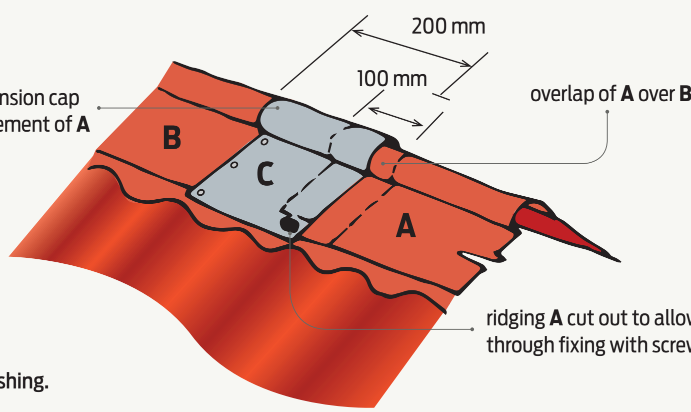
- are mechanically fixed by rivets spaced at 50 mm maximum centres
- are sealed against moisture ingress
- have 100 mm minimum overlap (but 150 mm recommended) except where the pitch of the flashing is 15º or less. In that case, there must be a 100 mm minimum overlap and the flashing underneath the lap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

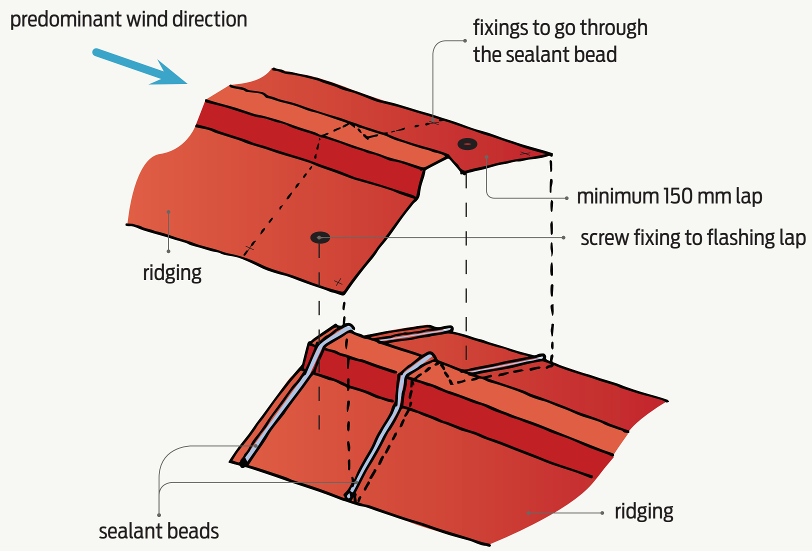


Figure 20 **Ridging lap minimum 150 mm.**

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.

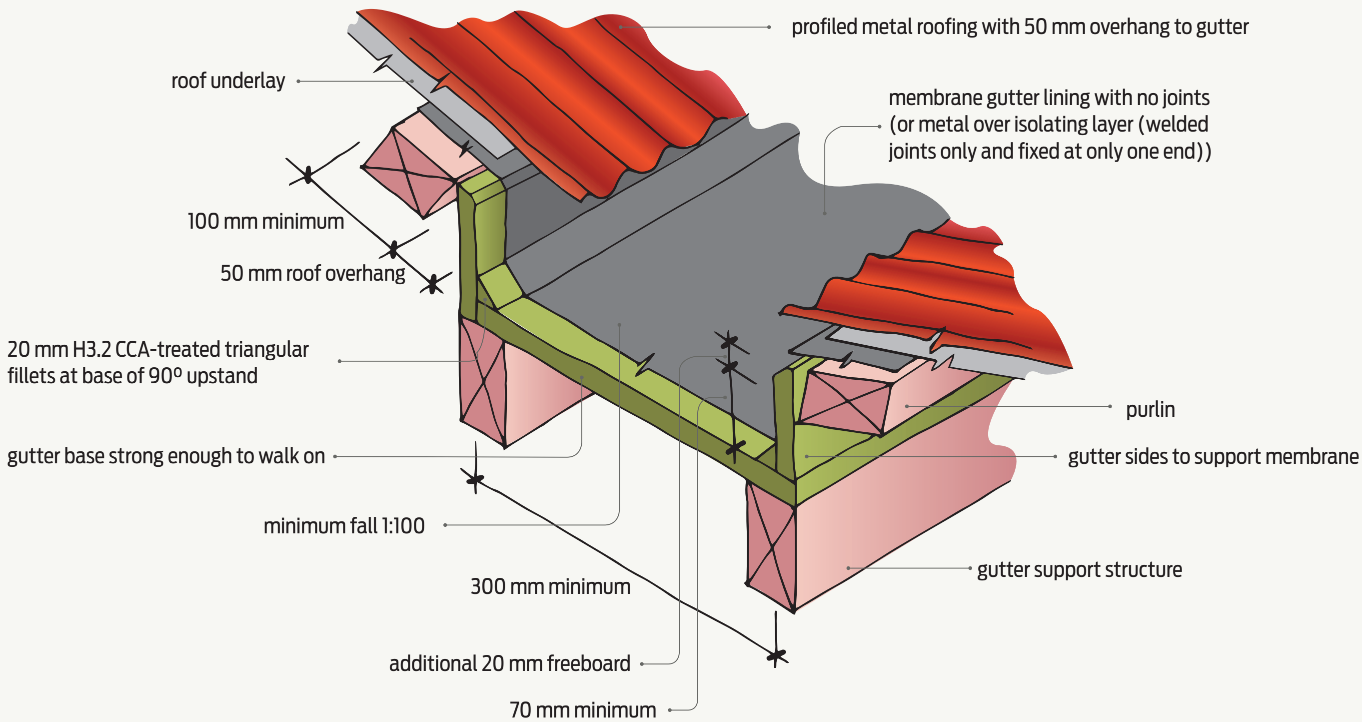


Figure 21 **Internal gutter design.**

Note: Other roof framing not shown for clarity.

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.

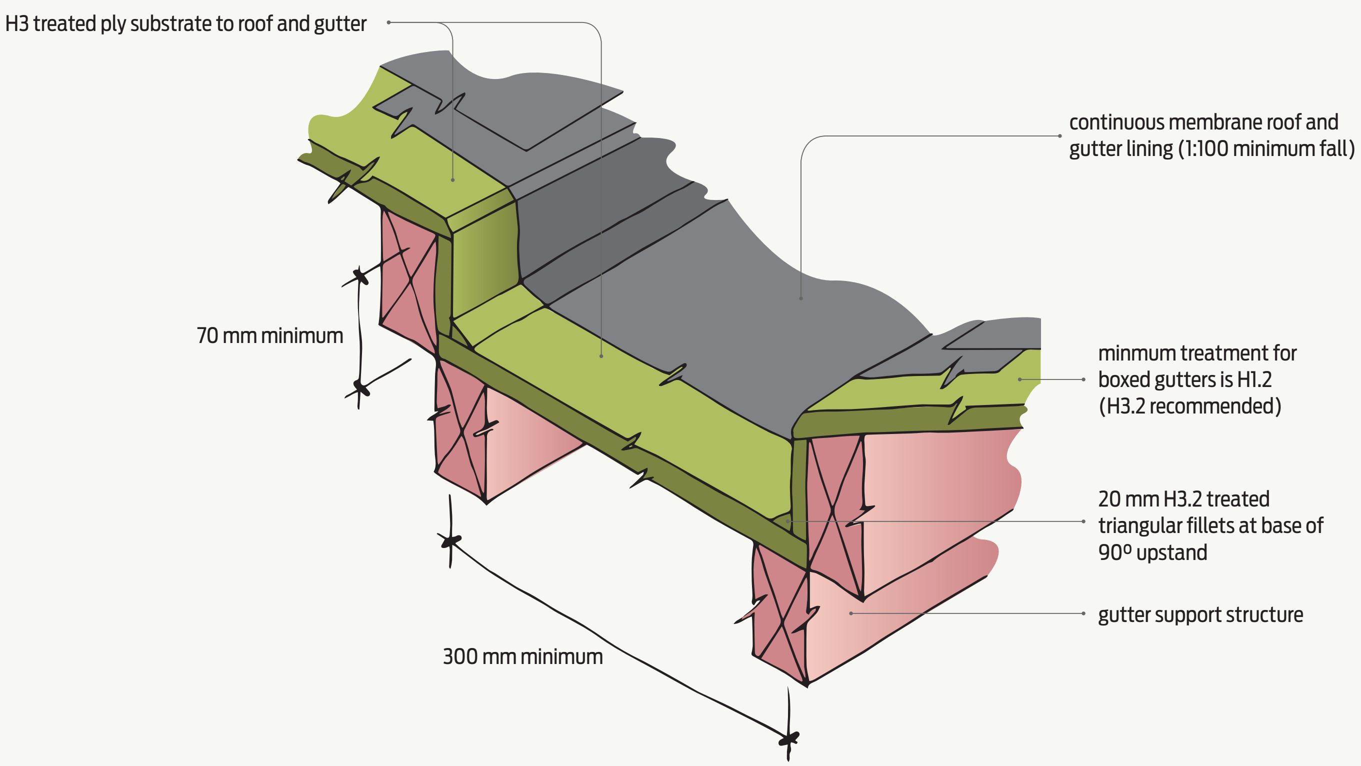


Figure 22 **Membrane roof and gutter design.**

- 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

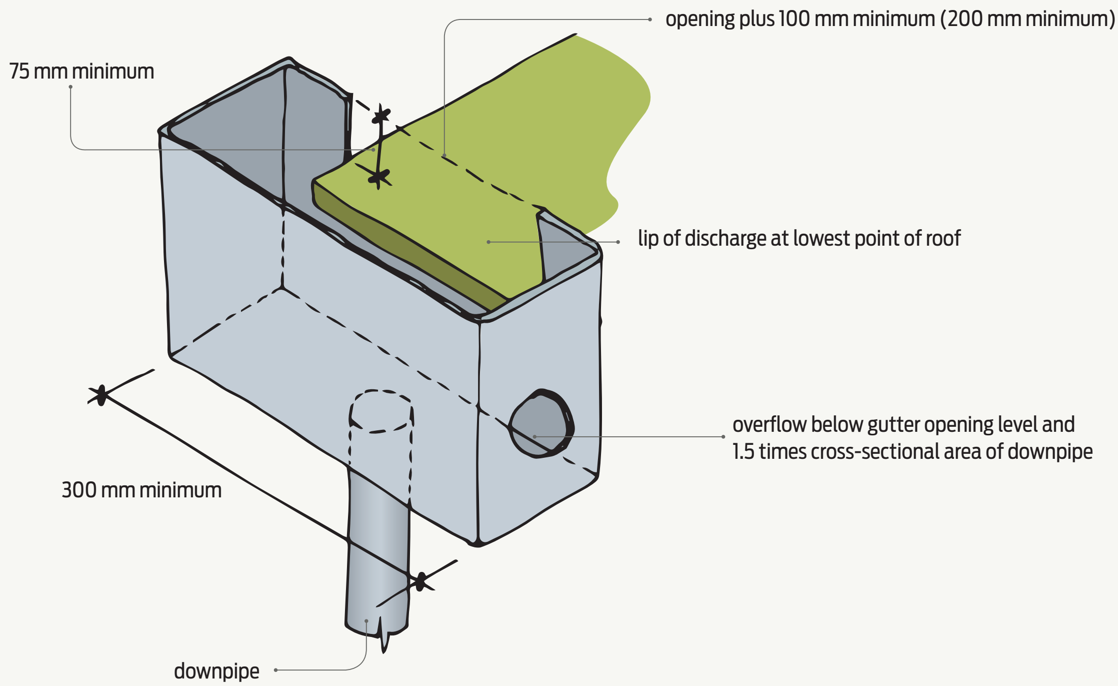


Figure 23 **Rainwater head.**

- 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.

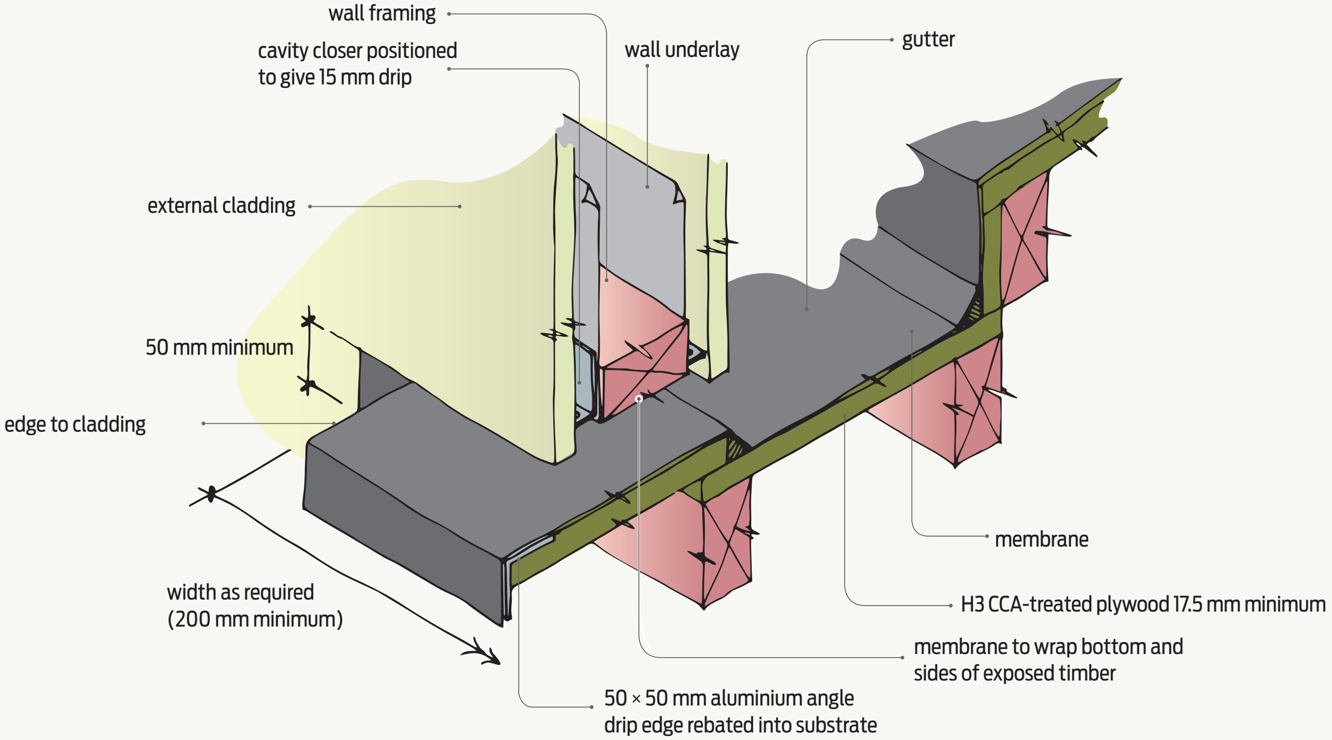


Figure 24 **Overflow located below any potential overflow into building (from E2/AS1).**

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.

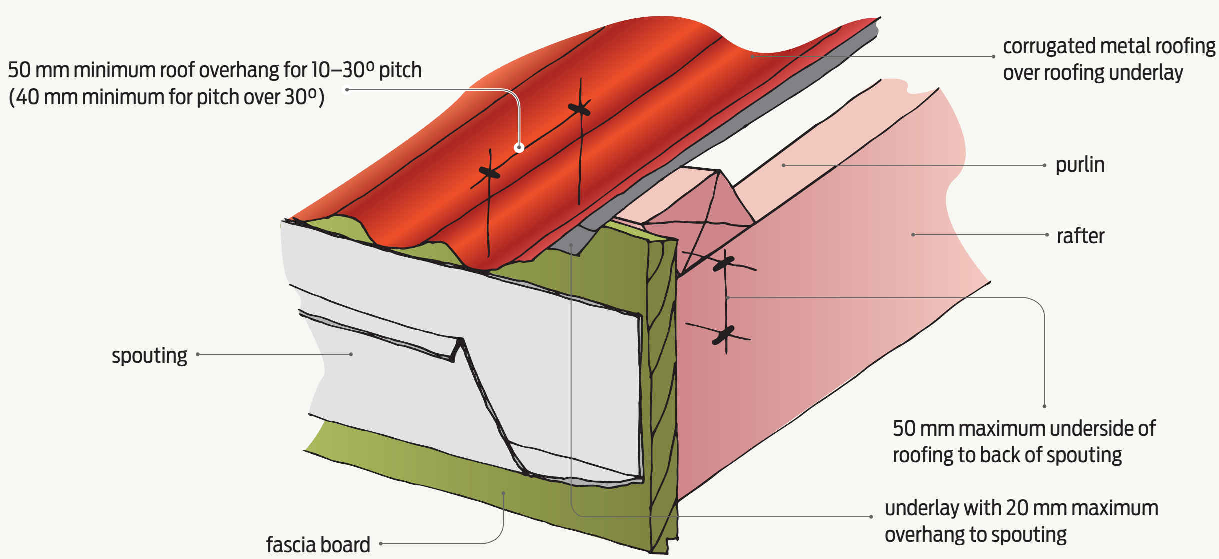


Figure 25 Section A – section through eaves.

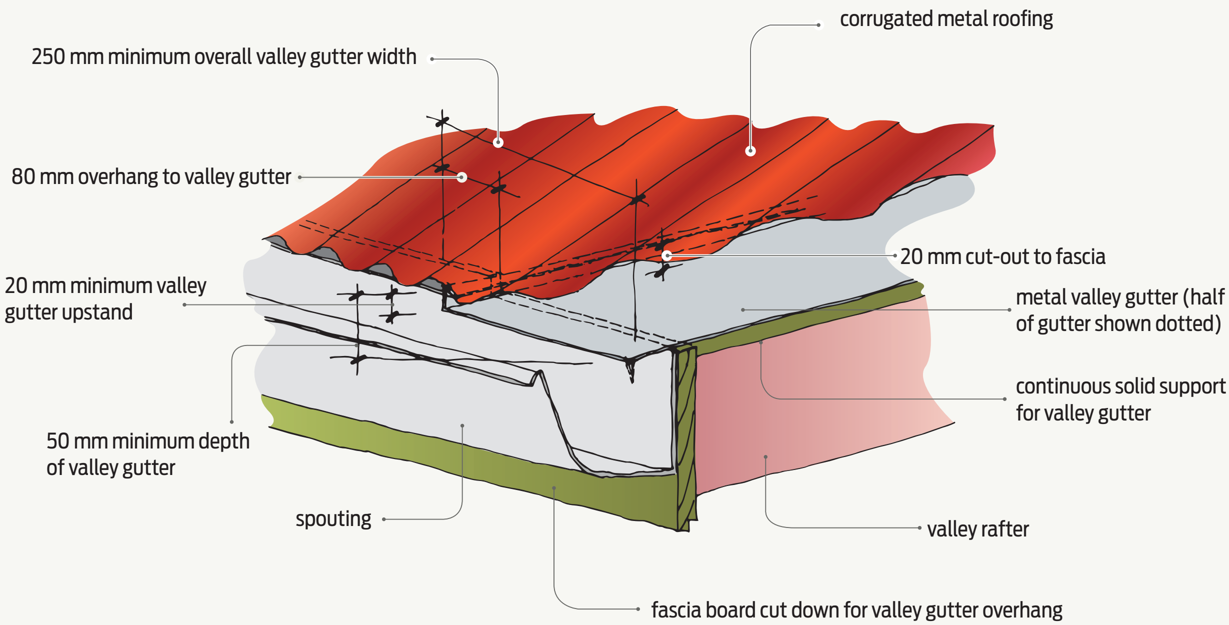


Figure 26 **Section B – longitudinal section through the gutter.**

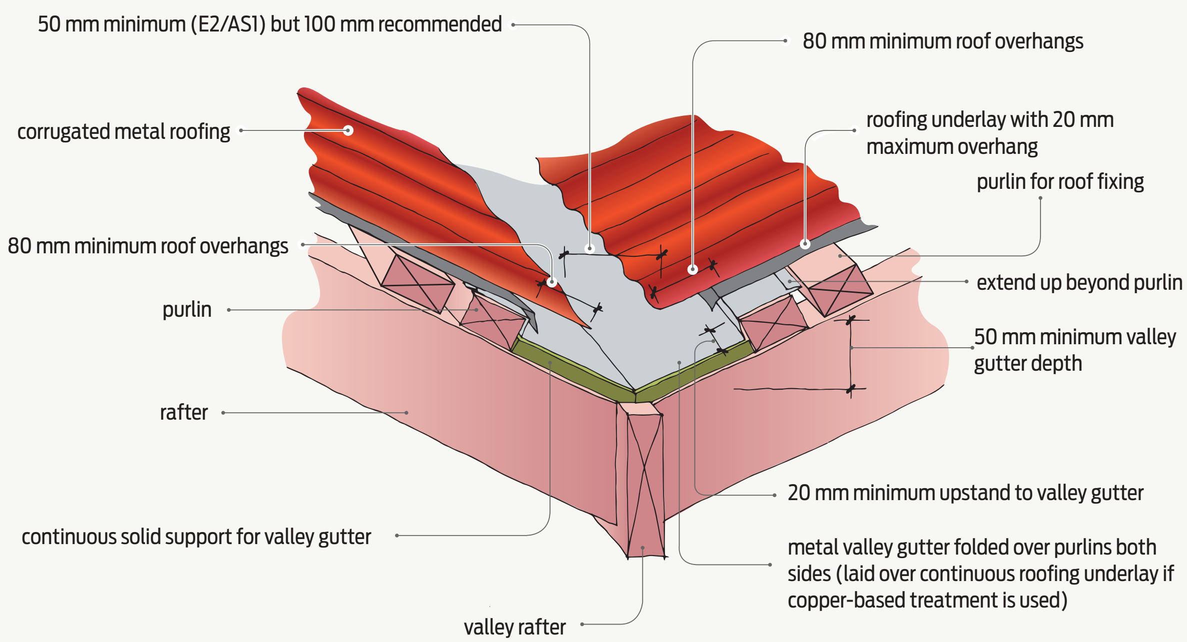


Figure 27 **Section C – cross-section through alternative valley gutter detail to E2/AS1.**

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

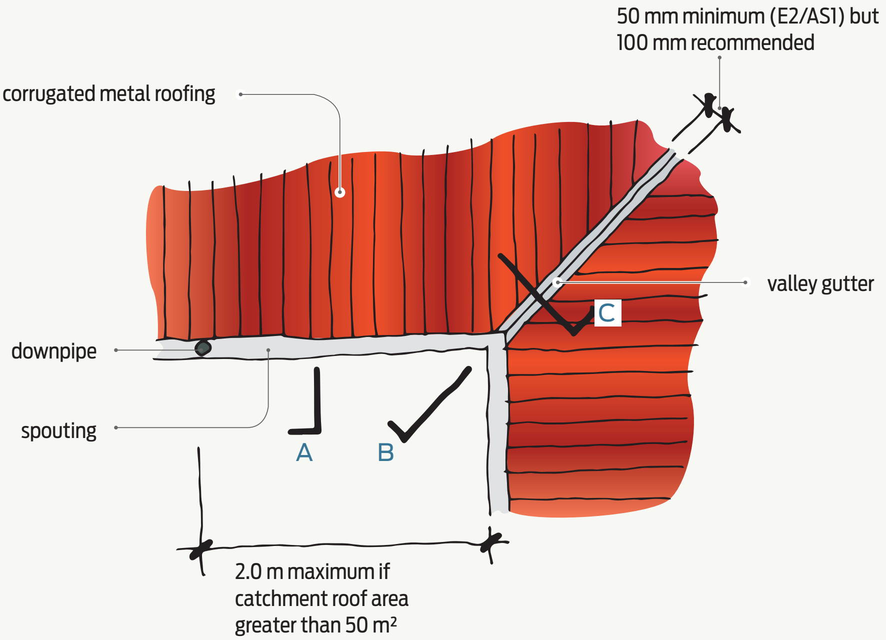


Figure 28 **Plan of valley gutter.**

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.

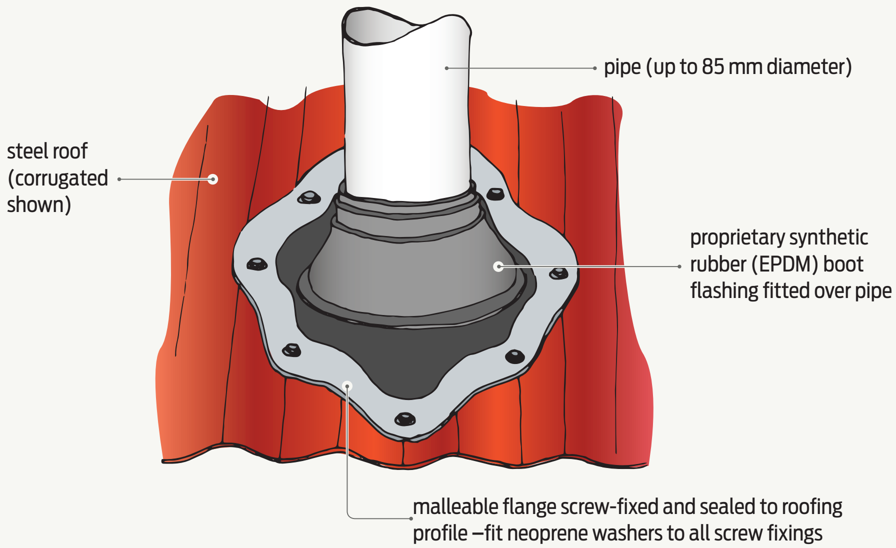


Figure 29 **Pipe flashing.**

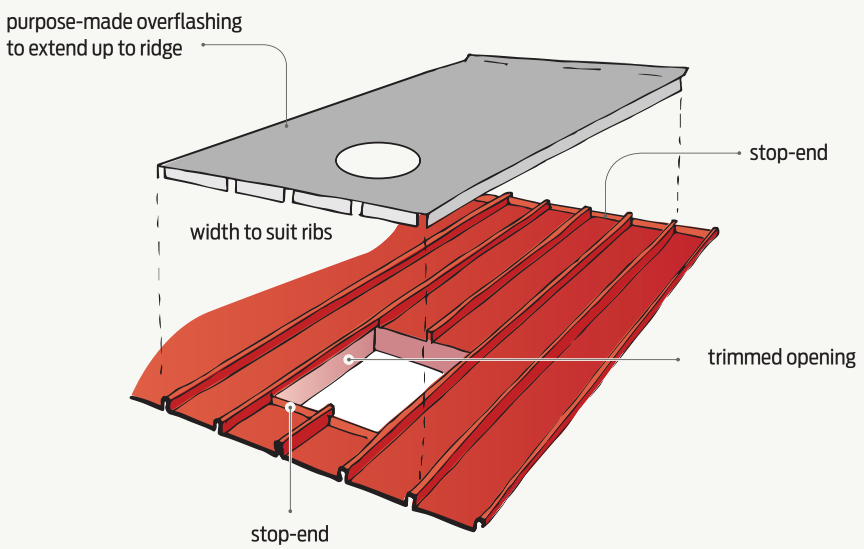


Figure 30 **Detailing option for a larger penetration.**

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.

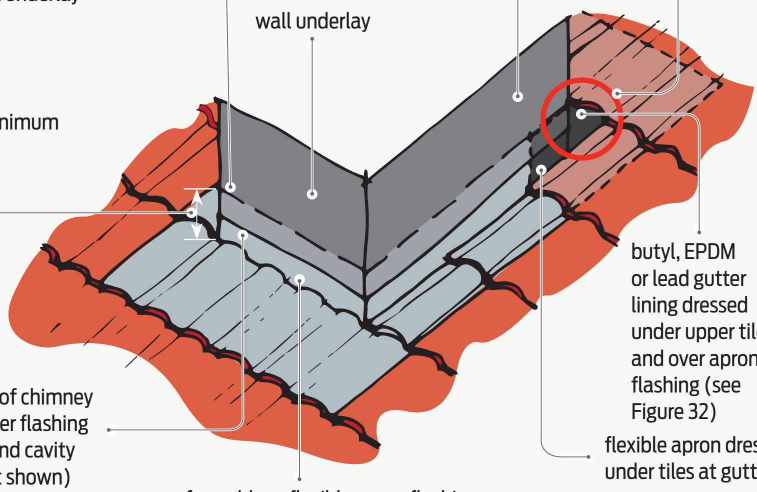


Figure 31 **Chimney flashing for concrete tiles.**

- 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.

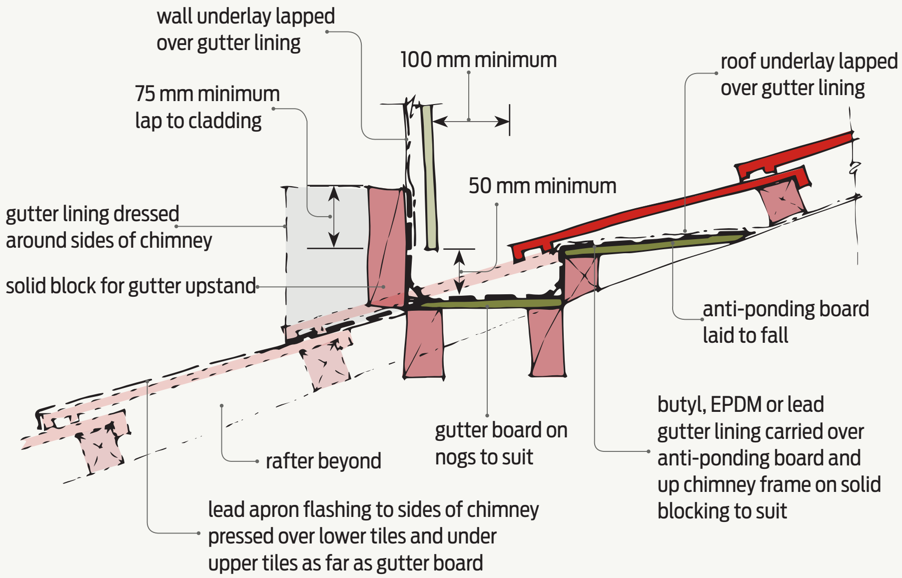


Figure 32 **Section through gutter for concrete tiles.**

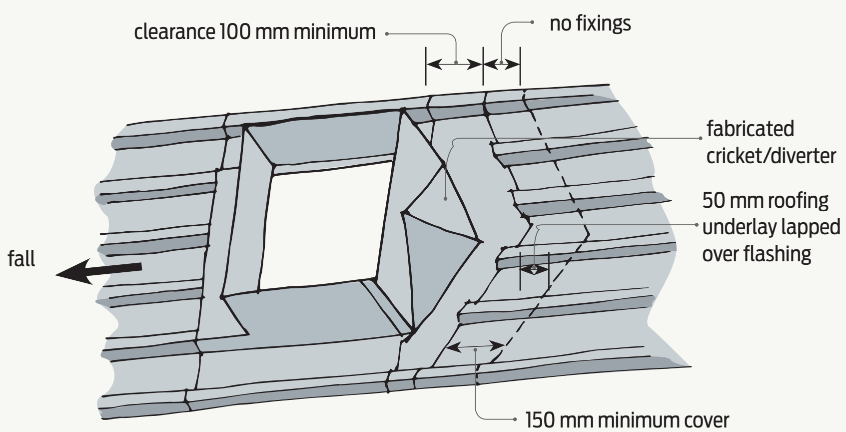


Figure 33 **Cricket flashing.**