DESIGN RIGHT

Internal gutters

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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.

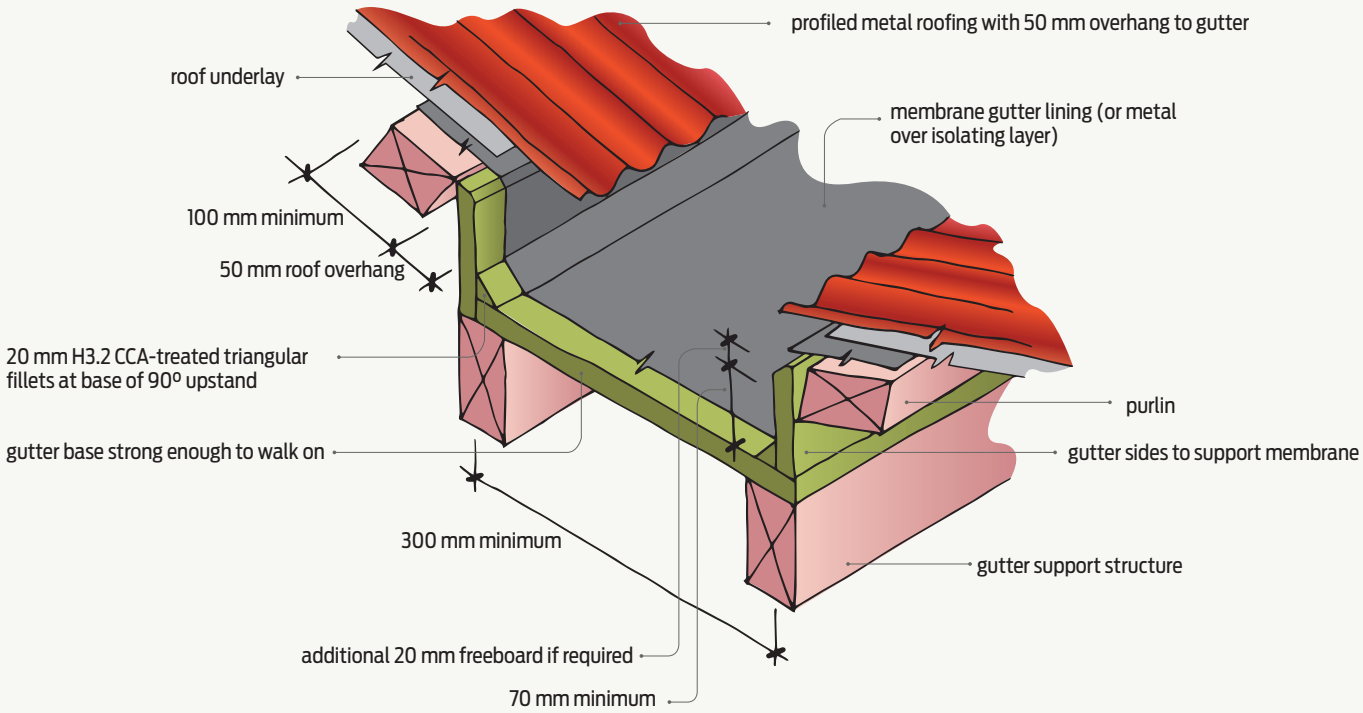

Figure 1 **Internal gutter design.**

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.
- Clause E2 *External moisture* requires that roofs:
  - shed precipitated moisture, hail and melted snow

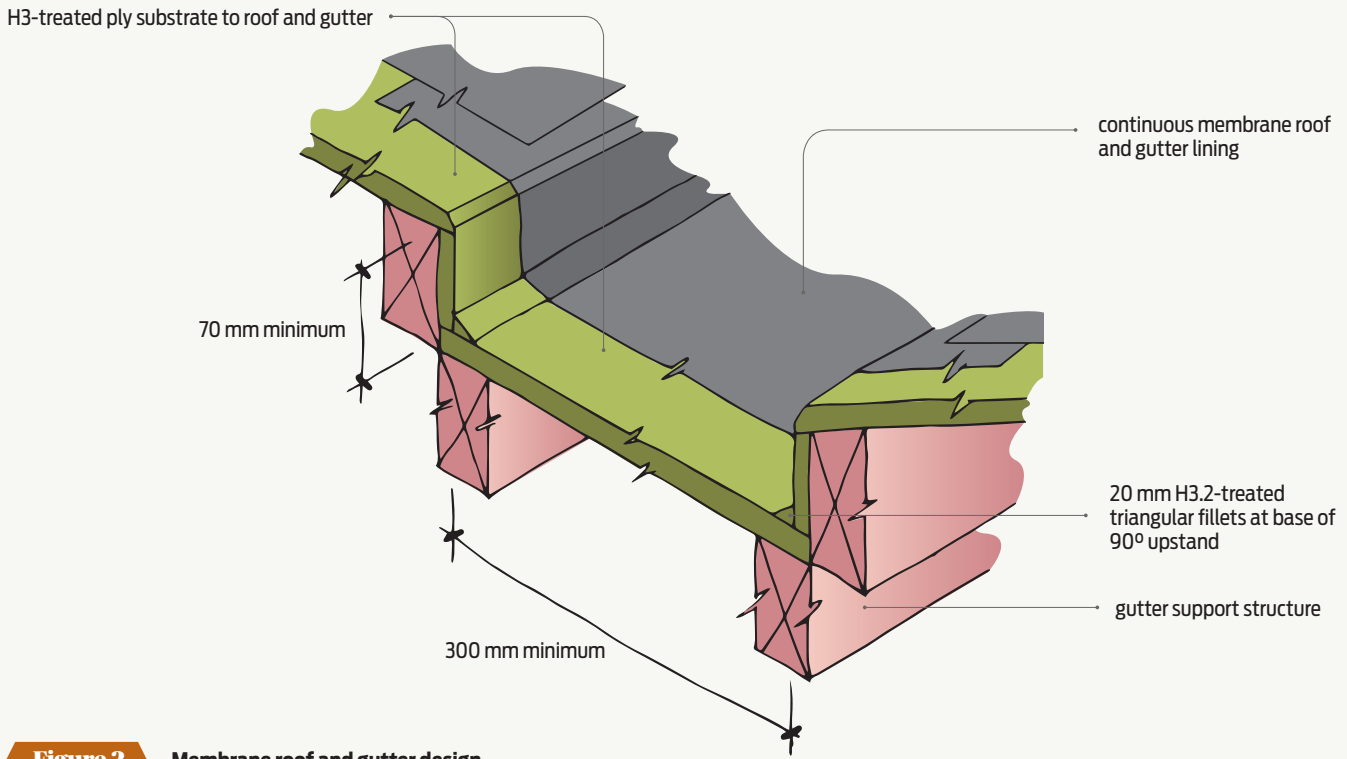

Figure 2 **Membrane roof and gutter design.**

- 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 1 and 2). 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 1 is maintained.

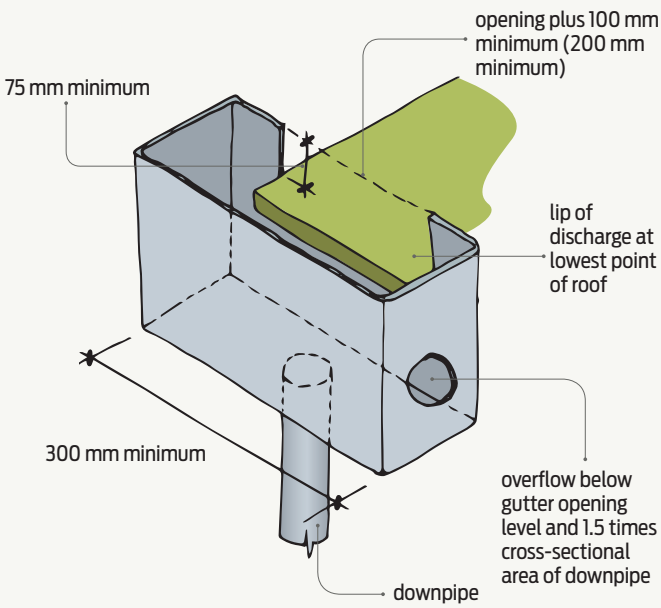

Figure 3 **Rainwater head.**

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.

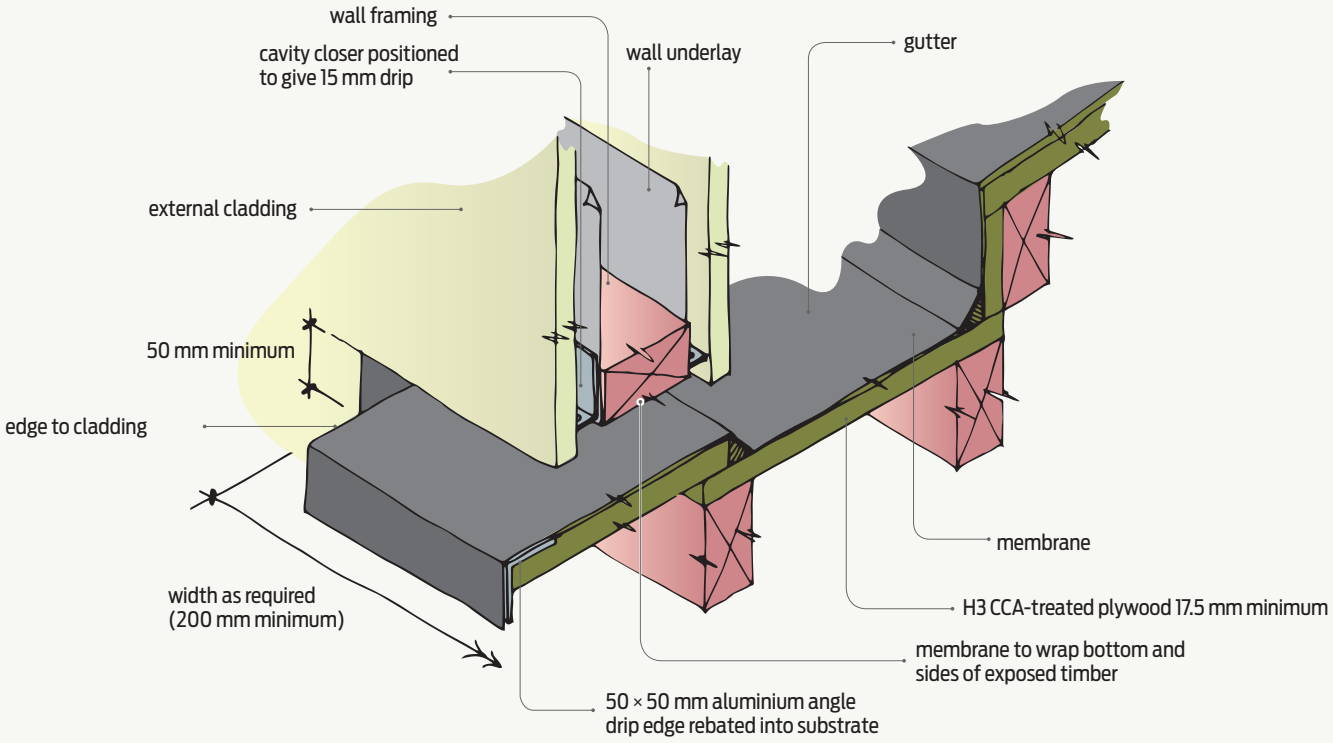

Figure 4 **Overflow located below any potential overflow into building (from E2/AS1).**

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 3). Where an internal gutter discharges to an internal outlet, an overflow must be provided by 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 4).

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
- a scupper discharging into a gutter or rainwater head (as per Figure 63(a) and (b)) (see Figure 3).

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.

BRANZ recommendations

In addition to the Acceptable Solution design requirements, BRANZ has some recommendations.

Design:

- for a rainfall intensity of 200 mm/hour to increase the gutter capacity
- 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.

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.**