DESIGN RIGHT

Internal gutters and flow capacity

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If an internal gutter that provides drainage from a metal roof overflows, the only place the water can go is into the building below. This is not only inconvenient but can cause damage. How can these problems be avoided?

THE BEST WAY to prevent problems with internal gutters is to avoid them. However, this is not always possible, so where required, internal gutters must be designed and built with care.

Building Code compliance

There are three Building Code clauses relevant to internal gutter design:

- Clause B2 *Durability* requires that internal gutters have a minimum 15-year durability (with normal maintenance) along with the rest of the building elements that make up the building envelope.
- Clause E1 *Surface water* requires that drainage systems must be able to convey surface water to an appropriate outfall or outlet for disposal.
- Clause E2 *External moisture* requires that roofs must shed precipitated moisture such as rain and snow and prevent water penetration into buildings.

Designs can follow the Acceptable Solutions in E1/AS1 and E2/AS1 or be alternative methods.

Some alternative methods available

Alternative methods of sizing gutters are provided in the *NZ Metal Roof and Wall Cladding Code of Practice v3.0*.

This provides a more up-to-date method of calculating internal gutter sizes than E1/AS1 and E2/AS1. It incorporates more factors including the effect of wind and adjacent walls as well as rainfall intensity and roof area and pitch.

Specific requirements of E2/AS1

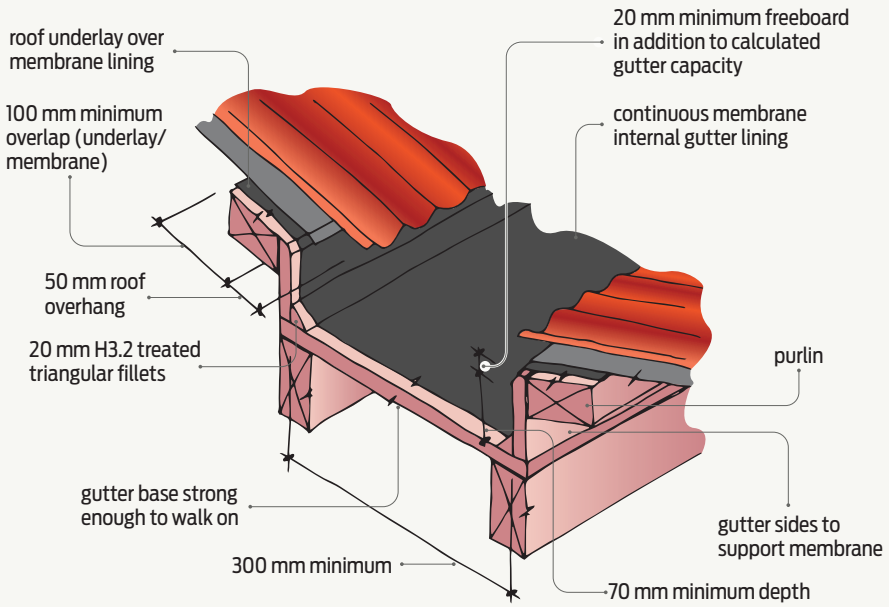
E2/AS1 sets out specific design requirements for internal gutters. They must be lined with a fully supported continuous butyl or EPDM membrane or sheet metal with joints that are welded.

The metals specified include aluminium, copper, stainless steel or zinc. Internal gutters must have a minimum fall of 1:100 and be constructed to at least the dimensions given in E2/AS1 Figure 52 (see Figure 1).

Figure 52 of E2/AS1 gives a minimum width of 300 mm and a minimum depth of 70 mm, but note (2) states that internal gutters must be sized to suit the catchment area and references Acceptable Solution E1/AS1 to calculate the gutter capacity. Where E1/AS1 is used to calculate capacity, an additional freeboard depth of 20 mm minimum must be provided.

Internal gutters with roof claddings other than a membrane must discharge into:

- a rainwater head or
- an internal outlet with overflows provided by a second outlet to a rainwater head or to another



Note: Internal gutters must be sized to suit roof catchment area.

Figure 1 **Minimum dimensions for internal gutter (from E2/AS1 Figure 52).**

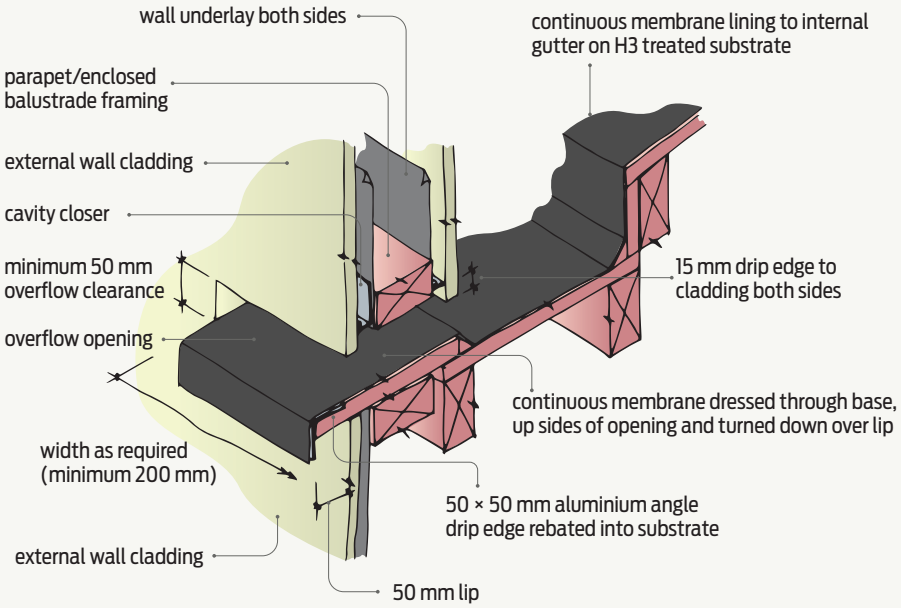


Figure 2 **Overflow outlet positioned below the level of potential overflow into building (from E2/AS1 Figure 63(c)).**

overflow outlet below the level of potential overflow into the building (see Figure 2).

Internal gutters for membrane roofs must discharge into either:

- a roof or gutter outlet with a minimum diameter of 75 mm and an overflow or a second outlet so that each outlet provides the full required water capacity or
- a scupper into a gutter or rainwater head (see Figure 3).

Using E1/AS1 to calculate gutter capacity

For internal gutters that need to have a larger cross-sectional area than that provided by the minimum dimensions given in E2/AS1 Figure 52, Acceptable Solution E1/AS1 may be used to calculate the gutter size.

When sizing gutters in accordance with E1/AS1, factors that must be considered include:

- rainfall intensity
- roof pitch
- roof catchment area
- downpipe and overflow sizes.

Calculate rainfall intensity

Rainfall intensity (I) is determined by measuring the rainfall for a storm with a 10% probability of occurring annually and with a 10-minute duration. It is measured in mm/hour. The rainfall intensity for different parts of the country can be obtained from E1/AS1 Appendix A.

Alternatively, rainfall intensity may be calculated online using the NIWA HIRDS (High Intensity Rainfall Design System) online tool, available on the NIWA website at www.niwa.co.nz.

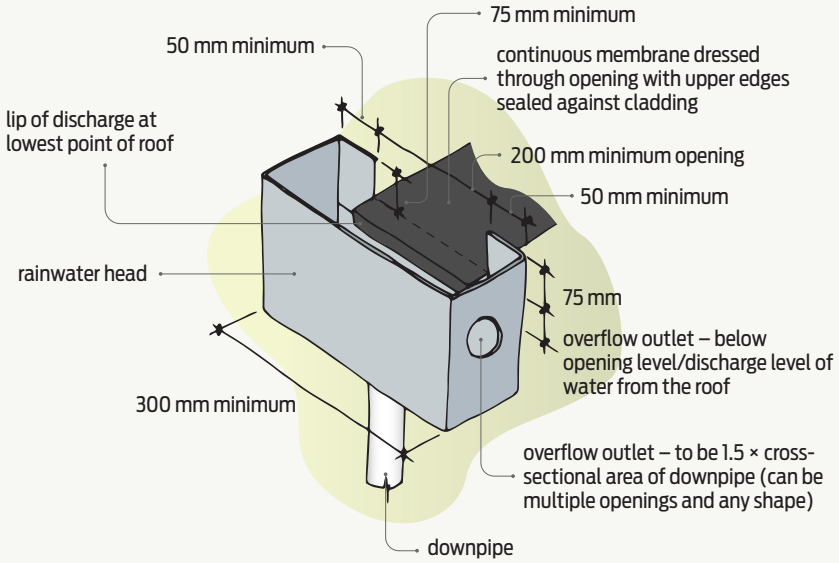


Figure 3 **Rainwater head with scupper opening in membrane roof (from E2/AS1 Figure 63(a)).**

Size gutters using roof plane and pitch

To calculate the cross-sectional area required, the gutter must be divided into sections comprising a length of gutter between a downpipe and the high point of the gutter on one side of the downpipe.

Having determined the square metre catchment area of the roof servicing the gutter and the pitch of the roof and based on a rainfall intensity of 100 mm/hour, the minimum cross-sectional area required for an internal gutter can be determined using the graph in E1/AS1 Figure 16.

Where rainfall intensity is greater than 100 mm/hour, the cross-sectional area of the gutter determined from the graph must be increased by using a multiplying factor of rainfall intensity/100 (I/100).

Size downpipes

E1/AS1 Table 5 (see Table 1) gives downpipe

sizes for both round and rectangular downpipes based on the pitch of the roof and the catchment area serving the downpipe.

Other downpipe shapes are acceptable as long as the cross-sectional area is not less than the cross-sectional area given in Table 5 and a 50 mm diameter sphere can pass freely through the downpipe.

Downpipes and overflows

E1/AS1 requires that all internal gutters have overflow outlets that drain to the exterior of the building. The top of the outlet must be at least 50 mm below the top of the gutter, and the cross-sectional area of the outlet must have at least the same cross-sectional area as the downpipe serving the gutter selected from Table 5.

E1/AS1 recommends that overflow outlets are located where any overflow will be readily noticed by the building owner or occupier.

Table 1

DOWNPIPE SIZES FOR GIVEN ROOF PITCH AND AREA

DOWNPIPE SIZE – MINIMUM INTERNAL SIZE	ROOF PITCH			
	0–25°	25–35°	35–45°	45–55°
	PLAN AREA OF ROOF SERVED BY DOWNPIPE (M^2)			
63 MM DIAMETER	60	50	40	35
74 MM DIAMETER	85	70	60	50
100 MM DIAMETER	155	130	110	90
150 MM DIAMETER	350	290	250	200
65 × 50 MM RECTANGULAR	60	50	40	35
100 × 50 MM RECTANGULAR	100	80	70	60
75 × 75 MM RECTANGULAR	110	90	80	65
100 × 75 MM RECTANGULAR	150	120	105	90

(From Acceptable Solution E1/AS1 Table 5.)