PART 3.5.2 GUTTERS AND DOWNPIPES

Appropriate *Performance Requirements*:

Where an alternative gutter and downpipe system is proposed as a *Performance Solution* to that described in **Part 3.5.2**, that proposal must comply with—

(a) *Performance Requirement* **P2.2.1**; and

(b) the relevant *Performance Requirements* determined in accordance with **1.0.7**.

Acceptable construction manuals

3.5.2.0

Performance Requirement **P2.2.1** is satisfied for gutters and downpipes if they are designed and constructed in accordance with one of the following:

(a) AS/NZS 3500.3.

(b) Section 5 of AS/NZS 3500.5.

Acceptable construction practice

3.5.2.1 Application

(a) Compliance with this acceptable construction practice satisfies *Performance Requirement* **P2.2.1** for gutters and downpipes provided the roof drainage system is connected to a stormwater drainage system that complies with **Part 3.1.2**.

(b) This Part does not apply to the removal of surface water from a storm having an *average recurrence interval* of 100 years for a Class 10 building where in the particular case there is no necessity for compliance.

Explanatory information:

1. The requirement to install drainage systems from roofs and sub-soil drains should be confirmed with the *appropriate authority*. These provisions need only be applied when drainage systems are necessary.
2. Information on drainage requirements outside the allotment can be obtained from the *appropriate authority*.

3.5.2.2 Materials

Gutters, downpipes and *flashings* must—

(a) be manufactured in accordance with AS/NZS 2179.1 for metal; and

(b) be manufactured in accordance with AS 1273 for UPVC components; and

(c) be compatible with all upstream roofing materials in accordance with **3.5.1.3(c)**; and

(d) not contain any lead if used on a roof forming part of a potable water catchment area.

3.5.2.3 Selection of guttering

The size of guttering must—

(a) for eaves gutters, be in accordance with **Table 3.5.2.2**; and

(b) for box gutters, be in accordance with AS/NZS 3500.3 or Section 5 of AS/NZS 3500.5; and

(c) be suitable to remove rainwater falling at the appropriate 5 minute duration rainfall intensity listed in **Table 3.5.2.1** as follows—

  (i) for eaves gutters — 20 year *average recurrence interval*; and

  (ii) for eaves gutter overflow measures — 100 year *average recurrence interval*; and

  (iii) for box and valley gutters — 100 year *average recurrence interval*.

3.5.2.4 Installation of gutters

(a) Gutters must be installed with a fall of not less than—

  (i) 1:500 for eaves gutters, unless fixed to metal fascias; and

  (ii) 1:100 for box gutters.

(b) Eaves gutters must be—

  (i) supported by brackets securely fixed at stop ends and at not more than 1.2 m centres; and

  (ii) be capable of removing the overflow volume specified in **Table 3.5.2.3**.

(c) Overflow measures in accordance with **Table 3.5.2.4** are deemed to be capable of removing the overflow volume specified in that Table.

(d) Valley gutters on a roof with a pitch—

  (i) more than 12.5 degrees — must have width of not less than 400 mm and be wide enough to allow the roof covering to overhang not less than 150 mm each side of the gutter; or

  (ii) not more than 12.5 degrees — must be designed as a box gutter.

(e) The requirement of **(b)(ii)** does not apply to eaves gutters fixed to a verandah or an eave that is greater than 450 mm in width, which—

  (i) has no lining; or

  (ii) is a raked verandah or a raked eave with a lining sloping away from the building.

Explanatory information:

Worked example — Determining appropriate overflow measures

The location of a proposed building is in Wollongong, NSW. Using **Table 3.5.2.1** the 5 minute duration rainfall intensity for a 100 year average recurrence interval is 308 mm/h. The 5 minute duration rainfall intensities in **Table 3.5.2.3** are provided in 25 mm/h increments, therefore for the purpose of the worked example 325 mm/h will be used.

Table 3.5.2.3 provides *required* overflow volumes in both litres per second for dedicated overflow measures and litres per second per metre for continuous overflow measures. Where both dedicated and continuous measures are proposed, **Table 3.5.2.3b** can be used to determine the *required* overflow volume.

1. Multiple overflow measures are proposed to be used with a roof catchment area of 60 m^2, incorporating a 10 m eaves gutter.
2. Using **Table 3.5.2.3b** for a 325 mm/h 5 minute duration rainfall intensity, the overflow volume in litres per second (L/s) for a roof catchment area of 60 m^2 is 5.4 L/s.
3. Select an acceptable dedicated overflow measure from **Table 3.5.2.4b**.

   The selected dedicated overflow measure is an end-stop weir which provides 0.5 L/s.

   One end-stop weir does not achieve the *required* overflow volume of 5.4 L/s, and additional overflow measures are *required* to remove the overflow volume.
4. To achieve the *required* overflow volume a continuous overflow measure is also selected from **Table 3.5.2.4a**.

   A front face slotted gutter is the selected overflow measure as it provides 0.5 L/s/m. Taking account of the eaves gutter length (10 m), the combined overflow measures (0.5 L/s for the end-stop weir and 0.5 L/s/m × 10 m) will remove up to 5.5 L/s.
5. The 5.5 L/s capacity provided by the selected overflow measures exceeds the *required* 5.4 L/s overflow volume.

3.5.2.5 Downpipes — size and installation

Downpipes must—

(a) not serve more than 12 m of gutter length for each downpipe; and

(b) be located as close as possible to valley gutters; and

(c) be selected in accordance with the appropriate eaves gutter section as shown in **Table 3.5.2.2**.

Explanatory information:

A maximum 12 m gutter length served by each downpipe is to ensure effective fall and adequate capacity to discharge all water anticipated during a storm having an *average recurrence interval* of 20 years.

Where a rainhead overflow device is incorporated in the top of the downpipe, its overflow discharge should be directed away from the building.

Table 3.5.2.1 RAINFALL DURATION INTENSITIES

Locality	5 minute duration rainfall intensity (mm/h)		Locality	5 minute duration rainfall intensity (mm/h)	
	Average recurrence interval, once in—			*Average recurrence interval*, once in—	
	20 years	100 years		20 years	100 years
ACT			**SA**		
Canberra	143	193	Adelaide	124	184
Gungahlin	137	179	Gawler	110	158
Tuggeranong	148	210	Mt Gambier	103	144
			Murray Bridge	120	178
NSW			Port Augusta	133	199
Albury	139	180	Port Pirie	122	181
Broken Hill	143	219	Yorketown	155	166
Goulburn	121	156			
Kiama	226	319	**TAS**		
Newcastle	226	316	Burnie	128	180
Orange	142	186	Flinders Island	122	166
Sydney	200	262	Hobart	85	116
Avalon	206	278	Launceston	90	121
Campbelltown	167	222	Queenstown	94	120
Penrith	180	244	St. Marys	146	203
Windsor	175	233			
Tweed Heads	252	330	**VIC**		
Wollongong	217	308	Ballarat	131	188
			Benalla	146	194
NT			Geelong	102	144
Alice Springs	166	239	Horsham	120	173
Darwin	233	274	Lakes Entrance	145	198
Katherine	216	250	Melbourne	132	187
			Hastings	117	145
			Sorrento	106	140
			Mildura	142	218
QLD			Stawell	130	186
Bamaga	252	298			
Brisbane	234	305	**WA**		

Table 3.5.2.1 RAINFALL DURATION INTENSITIES— continued

Locality	5 minute duration rainfall intensity (mm/h)		Locality	5 minute duration rainfall intensity (mm/h)	
	Average recurrence interval, once in—			*Average recurrence interval*, once in—	
	20 years	100 years		20 years	100 years
Ipswich	211	278	Albany	125	178
Victoria Point	245	320	Broome	232	287
Bundaberg	265	340	Bunbury	147	199
Cairns	229	278	Derby	211	256
			Geraldton	138	193
Cloncurry	218	278	Kalgoorlie	137	204
Innisfail	248	301	Perth	130	172
Mackay	250	316	Joondalup	133	180
Mt Isa	199	260	Midland	122	163
Noosa Heads	258	331	Port Hedland	168	230
Rockhampton	229	300	Tom Price	138	182
Toowoomba	203	268			
Townsville	235	300			
Weipa	239	283			

Note: Locations used in this table are based on the nearest Bureau of Meteorology grid cell latitude and longitude to the central Post Office of each city or town, with the exception of Tom Price in WA, which uses the Police Station.

Table 3.5.2.2 GUTTER AND DOWNPIPE SELECTION

Table a. Gutter sizes for various rainfall intensities and roof catchment areas per downpipe

Design Rainfall Intensity (mm/h) (as per Table 3.5.2.1)	Roof Catchment Area per Downpipe — m^2				
	30	40	50	60	70
	Size of gutter required to drain roof catchment area into one (1) downpipe (A, B, C, D, E and F defined in Table b.)				
90	A or C	A or C	A or C	A or C	A or C
120	A or C	A or C	A or C	A or C	A or D
140	A or C	A or C	A or C	A or D	B or E
160	A or C	A or C	A or C	A or E	B or E
175	A or C	A or C	A or D	B or E	E
200	A or C	A or C	A or D	B or E	F
225	A or C	A or C	A or B	E	F

Table 3.5.2.2 GUTTER AND DOWNPIPE SELECTION— continued

Table a. Gutter sizes for various rainfall intensities and roof catchment areas per downpipe

Design Rainfall Intensity (mm/h) (as per Table 3.5.2.1)	Roof Catchment Area per Downpipe — m^2				
	30	40	50	60	70
	Size of gutter required to drain roof catchment area into one (1) downpipe (A, B, C, D, E and F defined in Table b.)				
255	A or C	A or D	B or E	E	F
275	A or C	A or D	B or E	F	F
325	A or C	B or E	F	F	F
425	A or C	E	F	F	F

Table b. Gutter sizes for various rainfall intensities

Gutter Type (as per Table a.)	Gutter description	Minimum Cross Sectional Area mm^2
A	Medium rectangular gutter	6500
B	Large rectangular gutter	7900
C	115 mm D gutter	5200
D	125 mm D gutter	6300
E	150 mm D gutter	9000
F	Gutter must be designed in accordance with AS/NZS 3500.3 or Section 5 of AS/NZS 3500.5	

Table c. Downpipe selection

Downpipe Section	Gutter Sections — (as per Table b.)				
	A	B	C	D	E
75 mm dia.	Yes	Yes	Yes	Yes	No
100 mm × 50 mm	Yes	Yes	Yes	Yes	Yes
90 mm dia.	Yes	Yes	Yes	Yes	Yes
100 mm × 75 mm	Yes	Yes	Yes	Yes	Yes

Legend: Yes—downpipe is suitable for the eaves gutter selection; and
No—downpipe is not suitable for the eaves gutter selection.

Table 3.5.2.3 OVERFLOW VOLUME

Table a. Overflow volume for continuous measure (L/s/m)								
Design 5 minute duration rainfall intensity (mm/h) (from Table 3.5.2.1)	Ridge to Gutter Length (m)							
	2	4	6	8	10	12	14	16
150	0.08	0.17	0.25	0.33	0.42	0.50	0.58	0.67
175	0.10	0.19	0.29	0.39	0.49	0.58	0.68	0.78
200	0.11	0.22	0.33	0.44	0.56	0.67	0.78	0.89
225	0.13	0.25	0.38	0.50	0.63	0.75	0.88	1.0
250	0.14	0.28	0.42	0.56	0.69	0.83	0.97	1.1
275	0.15	0.31	0.46	0.61	0.76	0.92	1.1	1.2
300	0.17	0.33	0.50	0.67	0.83	1.0	1.2	1.3
325	0.18	0.36	0.54	0.72	0.90	1.1	1.3	1.4
350	0.19	0.39	0.58	0.78	0.97	1.2	1.4	1.6
375	0.21	0.42	0.63	0.83	1.0	1.3	1.5	1.7
400	0.22	0.44	0.67	0.89	1.1	1.3	1.6	1.8

Table b. Overflow volume for dedicated measure (L/s)					
Design 5 minute duration rainfall intensity (mm/h) (from Table 3.5.2.1)	Roof Catchment Area (m^2)				
	30	40	50	60	70
150	1.3	1.7	2.1	2.5	2.9
175	1.5	1.9	2.4	2.9	3.4
200	1.7	2.2	2.8	3.3	3.9
225	1.9	2.5	3.1	3.8	4.4
250	2.1	2.8	3.5	4.2	4.9
275	2.3	3.1	3.8	4.6	5.3
300	2.5	3.3	4.2	5.0	5.8
325	2.7	3.6	4.5	5.4	6.3
350	2.9	3.9	4.9	5.8	6.8
375	3.1	4.2	5.2	6.3	7.3

Table b. Overflow volume for dedicated measure (L/s)					
Design 5 minute duration rainfall intensity (mm/h) (from Table 3.5.2.1)	Roof Catchment Area (m^2)				
	30	40	50	60	70
400	3.3	4.4	5.6	6.7	7.8

Table 3.5.2.4 ACCEPTABLE OVERFLOW MEASURES

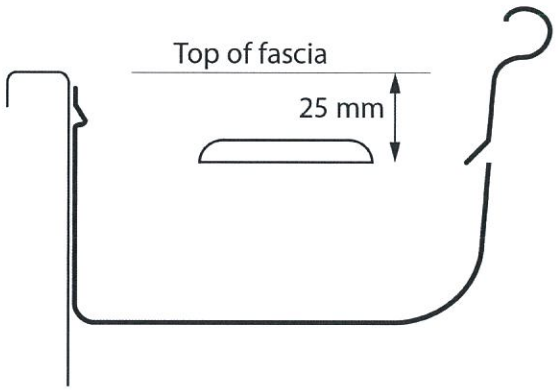
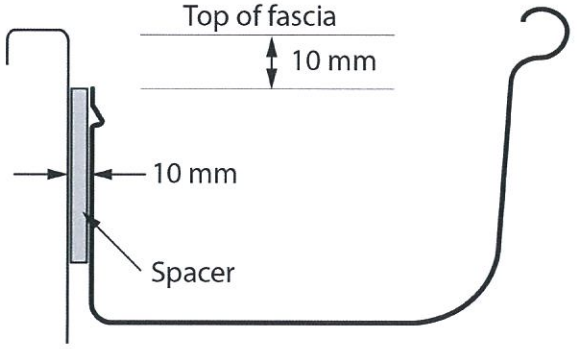
Table a. Acceptable continuous overflow measure		
Description	**Overflow Capacity (L/s/m)**	**Construction**
Front face slotted gutter with— (a) a minimum slot opening area of 1200 mm^2 per metre of gutter; and (b) the lower edge of the slots installed a minimum of 25 mm below the top of the fascia.	0.5	
Controlled back gap with— (a) a permanent minimum 10 mm spacer installed between the gutter back and the fascia; and (b) one spacer per bracket, with the spacer not more than 50 mm wide; and (c) the back of the gutter installed a minimum of 10 mm below the top of the fascia.	1.5	

Table 3.5.2.4 ACCEPTABLE OVERFLOW MEASURES — continued

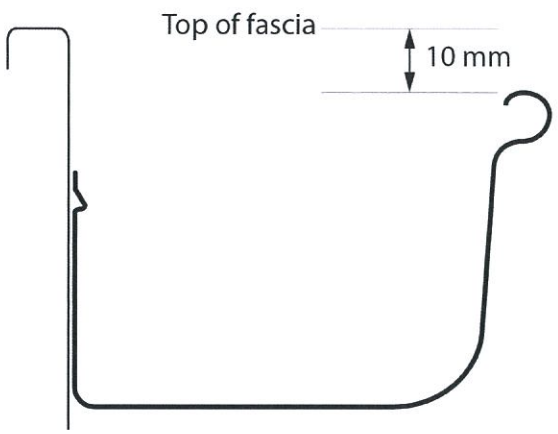
Table a. Acceptable continuous overflow measure		
Description	**Overflow Capacity (L/s/m)**	**Construction**
Controlled front bead height with the front bead of the gutter installed a minimum of 10 mm below the top of the fascia.	1.5	

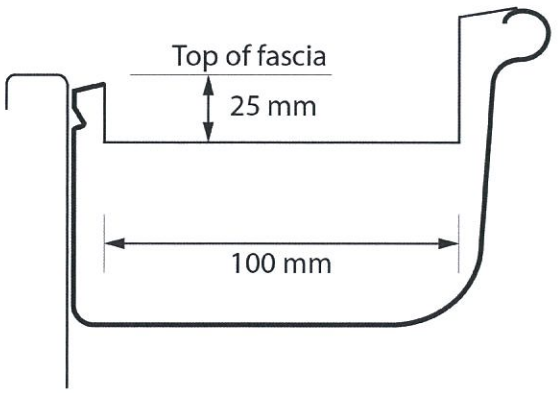
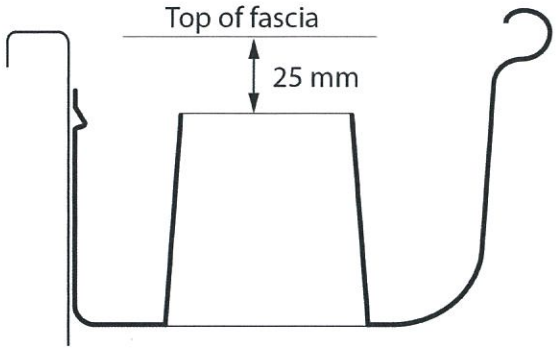
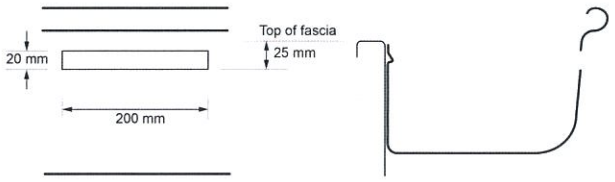
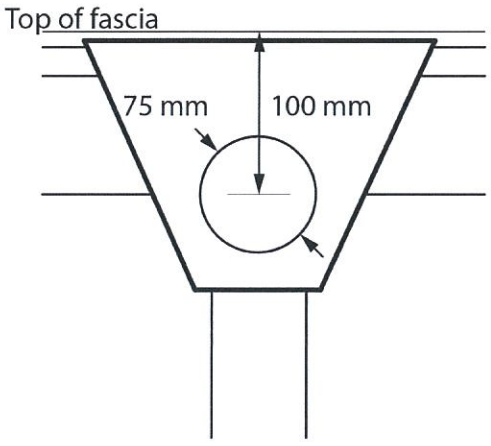
Table b. Acceptable dedicated overflow measure per downpipe		
Description	**Overflow Capacity (L/s)**	**Construction**
End-stop weir[Note 1] with— (a) a minimum clear width of 100 mm; and (b) the weir edge installed a minimum 25 mm below the top of the fascia.	0.5	

Table b. Acceptable dedicated overflow measure per downpipe

Description	Overflow Capacity (L/s)	Construction
Inverted nozzle installed within 500 mm of a gutter high point with— (a) a minimum nozzle size of 100 mm × 50 mm positioned lengthways in the gutter; and (b) the top of the nozzle installed a minimum of 25 mm below the top of the fascia.	1.2	
Front face weir with— (a) a minimum clear width of 200 mm; and (b) a minimum clear height of 20 mm; and (c) the weir edge installed a minimum of 25 mm below the top of the fascia.	1.0	
Rainhead with— (a) a 75 mm diameter hole in the outward face of the rainhead; and (b) the centreline of the hole positioned 100 mm below the top of the fascia.	3.5	

Notes:

Table b. Acceptable dedicated overflow measure per downpipe		
Description	**Overflow Capacity (L/s)**	**Construction**
1. An end-stop weir is not suitable where the end-stop abuts a wall. 2. The rainhead should be detailed to avoid nuisance discharge from the overflow at rainfall intensities below the normal design level.		

Explanatory information:

Stormwater drainage systems specified in the *Housing Provisions* are not designed to remove all water to an appropriate outfall during exceptionally heavy rain, particularly in tropical areas. Specifically, eaves gutter systems are designed to remove water arising from rainfall events with an average recurrence interval of 20 years provided they are not blocked. Accordingly, it is necessary to design and install the system to incorporate overflow measures so that when overflowing occurs, during a rainfall event with an average recurrence interval of up to 100 years, any water is directed away in a manner which ensures it does not pond against, enter or damage the building, even if the stormwater drainage system is blocked.

Insufficient and poorly located downpipes are a frequent cause of poor roof drainage system performance. The installation of downpipes, especially near valley gutters, is designed to ensure rainwater from areas on the roof that have concentrated water flows is adequately removed.

Particular consideration needs to be given to box gutters, valley gutters etc. located above the internal areas of a building.

There are several options available to designers using the requirements of the *Housing Provisions*. The designer will need to choose an overflow system that will cope with the rainfall intensity for the particular location. Consideration needs to be given to the total capacity of overflow measures on lower level roofs where overflow measures adopted for a higher roof catchment will result in overflow to a lower one. Overflow discharge onto lower roofs may also require consideration of sarking, flashing and other weatherproofing precautions to the lower roof area.

The acceptable overflow measures in **Table 3.5.2.3** were calculated using the following formulas:

For continuous slots or rainhead

$$Q = C_d A \sqrt{2gh}$$

Where—

- A = Area (m^2)
- C_d = Discharge coefficient = 0.61
- g = Gravity = 9.81 m/s^2
- h = Effective head (m)
- Q = Flow rate (m^3/s)

For front face weir, end stop weir, inverted nozzle, front bead or controlled gap

$$Q = 0.67\, C_d\, b \sqrt{2g}\, h^{1.5}$$

Where—

- b = Width (m)
- C_d = Discharge coefficient = 0.63
- g = Gravity = 9.81 m/s^2
- h = Effective head (m)
- Q = Flow rate (m^3/s)