

Dear Customer

Please find enclosed Amendment 9, effective 14 February 2014, to the Acceptable Solution and Verification Method for Clause E1 Surface Water of the New Zealand Building Code. The previous amendment to E1 (Amendment 8) was in October 2011.

<b>Section</b>	<b>Old E1</b>	<b>February 2014 Amendment to E1</b>
Title pages	Remove title page and document history page 1/2	Replace with new title page and document history pages 1–2B
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MINISTRY OF BUSINESS,  
INNOVATION & EMPLOYMENT  
HĪKINA WHAKATUTUKI

# Acceptable Solutions and Verification Methods

For New Zealand Building Code Clause  
**E1 Surface Water**



## Status of Verification Methods and Acceptable Solutions

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Users should make themselves familiar with the preface to the New Zealand Building Code Handbook, which describes the status of Verification Methods and Acceptable Solutions and explains alternative methods of achieving compliance.

Defined words (italicised in the text) and classified uses are explained in Clauses A1 and A2 of the Building Code and in the Definitions at the start of this document.

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are available from [www.dbh.govt.nz](http://www.dbh.govt.nz)**

## New Zealand Government

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## Document Status

The most recent version of this document (Amendment 9), as detailed in the Document History, is approved by the Chief Executive of the Ministry of Business, Innovation and Employment. It is effective from 14 February 2014 and supersedes all previous versions of this document.

The previous version of this document (Amendment 8) will cease to have effect on 14 August 2014.

People using this document should check for amendments on a regular basis. The Ministry of Business, Innovation and Employment may amend any part of any Verification Method or Acceptable Solution at any time. Up-to-date versions of Verification Methods and Acceptable Solutions are available from [www.dbh.govt.nz](http://www.dbh.govt.nz)

<b>E1: Document History</b>			
	<b>Date</b>	<b>Alterations</b>	
First published	July 1992		
Amendment 1	September 1993	pp. vi and vii, References p. 14, 3.2.1, Figure 3 p. 16, Table 2 p. 18, 3.7.4 p. 20, Figure 13	p. 21, Figure 14 p. 22, Table 4, Table 5, 5.1, 5.1.1, 5.1.2 p. 23, Figure 15, Figure 16 p. 24, 5.1.3, 5.1.4
Amendment 2	19 August 1994	pp. i and ii, Document History p. vi, NZS 3441 replaced NZS 3403	p. 21, 3.9.8 p. 22, Table 4, Table 5 p. 24, 5.1.3, Table 6
Reprinted incorporating Amendments 1 and 2 – October 1994			
Amendment 3	1 December 1995	p. ii, Document History	p. iii, E1.3.1
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Amendment 4	1 December 2000	p. ii, Document History p. v, Contents pp. vi and vii, References	p. viii, Definitions pp. 1 – 12K, Revised VM1 pp. 27 and 28, Index
Amendment 5		p. 2, Document History, Status p. 7, References p. 31, 9.0.5	p. 39, 3.8.1 p. 42, 4.3.2
Amendment 6	6 January 2002	p. 3 Code Clause E1	
Reprinted incorporating Amendments 4, 5 and 6 – September 2003			
Amendment 7	Published 30 June 2010 Effective from 30 September 2010	p. 2, Document History, Status pp. 7 and 8, References pp. 9 and 10, Definitions p. 34, E1/AS1 Table 1 p. 37, E1/AS1 Table 3	p. 41, E1/AS1 3.9.8 p. 42, E1/AS1 Table 4 p. 44, E1/AS1 Table 6 p. 47, Index
Reprinted incorporating Amendment 7 – 30 September 2010			
Erratum 1	30 September 2010		p. 43, Figure 16
Amendment 8	Effective from 10 October 2011 until 14 August 2014	p. 2, Document History, Status pp. 7 and 8, References p. 9, Definitions	p. 34, E1/AS1 Table 1 p. 37, E1/AS1 Table 3 p. 42, E1/AS1 Table 4
Amendment 9	14 February 2014	p. 2A Document History, Status p. 7 References p. 9 Definitions	p. 41, E1/AS1 3.9.7 p. 44, E1/AS1 5.5.2
<b>Note: Page numbers relate to the document at the time of Amendment and may not match page numbers in current document.</b>			



# References

Amend 1  
Sep 1993

For the purposes of New Zealand Building Code (NZBC) compliance, the Standards and documents referenced in this Verification Method and Acceptable Solution (primary reference documents) must be the editions, along with their specific amendments, listed below. Where these primary reference documents refer to other Standards or documents (secondary reference documents), which in turn may also refer to other Standards or documents, and so on (lower-order reference documents), then the version in effect at the date of publication of this Verification Method and Acceptable Solution must be used.

Amend 8  
Oct 2011Amend 9  
Feb 2014Amend 7  
Sep 2010Amend 9  
Feb 2014

## Standards New Zealand

NZS/BS 970:- Specification for wrought steels for mechanical and allied engineering purposes  
Part 1: 1991 General inspection and testing procedures and specific requirements for carbon, carbon manganese, alloy and stainless steels  
*Amend: 1*

Amend 1  
Sep 1993

AS/NZS 1254: 2010 PVC pipes and fittings for stormwater and surface water applications  
*Amend: 1 (2011)*

Amend 9  
Feb 2014

AS/NZS 1260: 2009 PVC-U Pipes and fittings for drain, waste and vent application  
*Amend: 1 (2011)*

Amend 9  
Feb 2014

AS/NZS 1734: 1997 Aluminium and aluminium alloys – Flat sheets, coiled sheet and plate

Amend 8  
Oct 2011

AS/NZS 2032: 2006 Installation of PVC Pipe Systems  
*Amend: 1*

Amend 8  
Oct 2011

AS/NZS 2033: 2008 Installation of polyethylene pipe systems  
*Amend: 1, 2*

Amend 9  
Feb 2014

AS/NZS 2280: 2012 Ductile iron pipes and fittings

AS/NZS 2566 Buried Flexible pipelines.

Part 1: 1998 Structural Design

Part 2: 2002 Installation

Amend 7  
Sep 2010

NZS 3604: 2011 Timber framed buildings

Amends  
1, 4, 7, 8, 9

AS/NZS 4058: 2007 Precast concrete pipes (pressure and non-pressure)

Amend 7  
Sep 2010

AS/NZS 4130: 2009 Polyethylene (PE) pipes for pressure applications

Amends  
8 and 9

## Where quoted

AS1 Table 4,  
Table 6AS1 Table 1,  
Table 3

AS1 Table 4

AS1 Table 4,  
Table 6

AS1 Table 3, 3.9.8

AS1 Table 3

AS1 Table 1,  
Table 3AS1 3.9.8  
AS1 3.9.8, Table 3Amend 8  
Oct 2011

AS1 3.9.7

Amend 5  
July 2001

AS1 Table 1

AS1 Table 1

		Where quoted
Amends 1 and 4	NZS 4229: 1999 Concrete masonry buildings not requiring specific design <i>Amend: 1</i>	AS1 3.9.7
	NZS 4442: 1988 Welded steel pipes and fittings for water, sewage and medium pressure gas	AS1 Table 1, Table 3
Amend 7 Sep 2010	AS/NZS 5065: 2005 Polyethylene and polypropylene pipe and fittings for drainage and sewerage applications <i>Amend: 1</i>	AS1 Table 1
Amend 8 Oct 2011		
	<b>British Standards Institution</b>	
Amend 7 Sep 2010		
Amend 8 Oct 2011	BS EN 1172: 1997 Copper and copper alloys – sheet and strip for building	AS1 Table 4, Table 6
Amend 7 Sep 2010	BS EN 1759 Part 1: 2004 Flanges and their joints. Circular flanges for pipes, valves, fittings and accessories, class-designated. Steel flanges, NPS 1/2 to 24.	AS1 Table 3
Amend 8 Oct 2011		
Amend 7 Sep 2010		
	<b>Standards Association of Australia</b>	
Amend 7 Sep 2010		
	AS 1273: 1991 Unplasticised PVC (UPVC) downpipes and fittings for rainwater	AS1 Table 4, Table 6
	AS 1397: 2001 Steel sheet and strip – Hot-dipped zinc-coated or aluminium/zinc-coated	AS1 Table 4, Table 6
	AS 1579: 2001 Arc welded steel pipes and fittings for water and waste water	AS1 Table 1
Amend 7 Sep 2010	AS 1646: 2007 Elastomeric seals for waterworks purposes	AS1 Table 3
	AS 1741: 1991 Vitrified clay pipes and fittings with flexible joints – sewerage quality	AS1 Table 1
Amend 7 Sep 2010		
Amend 7 Sep 2010 Amend 4 Dec 2000	AS 3706:- Part 1: 2003 Geotextiles – Methods of test General requirements, sampling, conditioning, basic physical properties and statistical analysis	VM19.0.4
	<b>New Zealand Legislation</b>	
	Resource Management Act 1991	VM12.1.2

# Definitions

Amend 7  
Sep 2010

This is an abbreviated list of definitions for words or terms particularly relevant to this Verification Method and Acceptable Solution. The definitions for any other italicised words may be found in the New Zealand Building Code Handbook.

Amend 9  
Feb 2014

**Access chamber** A chamber with working space at *drain* level through which the *drain* passes either as an open channel or as a pipe incorporating an inspection point.

Amend 7  
Sep 2010

**Building** has the meaning given to it by sections 8 and 9 of the *Building Act 2004*.

**Construct** in relation to a *building*, includes to build, erect, prefabricate, and relocate; and *construction* has a corresponding meaning.

**Drain** A pipe normally laid below ground level including fittings and equipment and intended to convey *foul water* or *surface water* to an *outfall*.

**Inspection chamber** A chamber with working space at ground level through which the *drain* passes either as an open channel or as a pipe incorporating an *inspection point*.

**Inspection point** A removable cap at *drain* level through which access may be made for cleaning and inspecting the drainage system.

**Network utility operator** means a *person* who:

- (a) undertakes or proposes to undertake the distribution or transmission by pipeline of natural or manufactured gas, petroleum, biofuel, or geothermal energy; or
- (b) operates or proposes to operate a network for the purpose of
  - (i) telecommunication as defined in section 5 of the Telecommunications Act 2001; or
  - (ii) radiocommunications as defined in section 2(1) of the Radiocommunications Act 1989; or
- (c) is an electricity operator or electricity distributor as defined in section 2 of the Electricity Act 1992 for the purpose of line function services as defined in that section; or

Amend 7  
Sep 2010

(d) undertakes or proposes to undertake the distribution of water for supply (including irrigation); or

(e) undertakes or proposes to undertake a drainage or sewerage system.

**Other property** means any land or *buildings* or part thereof which are:

- a) Not held under the same *allotment*; or
- b) Not held under the same ownership – and includes any road.

**Outfall** That part of the disposal system receiving *surface water* or *foul water* from the drainage system. For *foul water*, the *outfall* may include a *foul water sewer* or a septic tank. For *surface water*, the *outfall* may include a natural water course, kerb and channel, or a soakage system.

**Rodding point** A removable cap at ground level through which access may be made for cleaning and inspecting the drainage system.

**Secondary flow path** The path over which *surface water* will follow if the drainage system becomes overloaded or inoperative.

**Sewer** A *drain* that is under the control of, or maintained by, a *network utility operator*.

**Sitework** means work on a *building* site, including earthworks, preparatory to or associated with the *construction*, *alteration*, *demolition* or removal of a *building*.

**Sump** A chamber which is installed in the *drain* and incorporates features to intercept and retain silt, gravel and other debris.

**Surface water** All naturally occurring water, other than sub-surface water, which results from rainfall on the site or water flowing onto the site, including that flowing from a *drain*, stream, river, lake or sea.

Amend 8  
Oct 2011

Amend 7  
Sep 2010

**Territorial authority (TA)** means a city council or district council named in Part 2 of Schedule 2 of the Local Government Act 2002; and—

- a) in relation to land within the district of a *territorial authority*, or a *building* on or proposed to be built on any such land, means that *territorial authority*; and
- b) in relation to any part of a coastal marine area (within the meaning of the Resource Management Act 1991) that is not within the district of a *territorial authority*, or a *building* on or proposed to be built on any such part, means the *territorial authority* whose district is adjacent to that part.

Amend 7  
Sep 2010

**Trap** A chamber which is installed in the *drain* and incorporates features to intercept and retain floatable debris.

- d) Spaced at:
- i) 7.5 m centres for trench slopes between 1 in 8 and 1 in 5, or
  - ii) 5.0 m centres for trench slopes greater than 1 in 5.

**COMMENT:**

The anti-scour blocks partition off the trench and prevent ground or *surface water* running along the trench and causing scouring.

**3.9.4 Trench width**

The width B of the trench shall be no less than the pipe diameter D plus 200 mm. Trench width at the top of the pipe shall be no more than 600 mm unless the pipe(s) in the trench are covered with concrete, as shown in Figure 13 (c).

**3.9.5 Acceptable materials**

Acceptable fill materials shown in Figure 13 are:

- a) Bedding material of clean granular non-cohesive material with a maximum particle size of 20 mm, or
- b) Selected compacted fill of any fine-grained soil or granular material which is free from topsoil and rubbish and has a maximum particle size of 20 mm, or
- c) Ordinary fill which may comprise any fill or excavated material.

**3.9.6 Placing and compacting**

- a) Granular bedding and selected fill shall be placed in layers of no greater than 100 mm loose thickness and compacted.
- b) Up to 300 mm above the pipe, compaction shall be by tamping by hand using a rod with a pad foot (having an area of  $75 \pm 25$  mm by  $75 \pm 25$  mm) over the entire surface of each layer to produce a compact layer without obvious voids.
- c) More than 300 mm above the pipe, compaction shall be by at least four passes of a mechanical tamping foot compactor (whacker type) with a minimum weight of 75 kg.

**3.9.7 Proximity of trench to building**

For light timber frame and concrete masonry *buildings* constructed to NZS 3604 or NZS 4229 in accordance with B1/AS1, pipe trenches which are open for no longer than 48 hours shall be located no closer than distance 'V' (see Figure 14) to the underside of any *building* foundation. Where the trench is to remain open for periods longer than 48 hours, the minimum horizontal separation shall increase to 3V in all ground except rock.

Amend 9  
Feb 2014

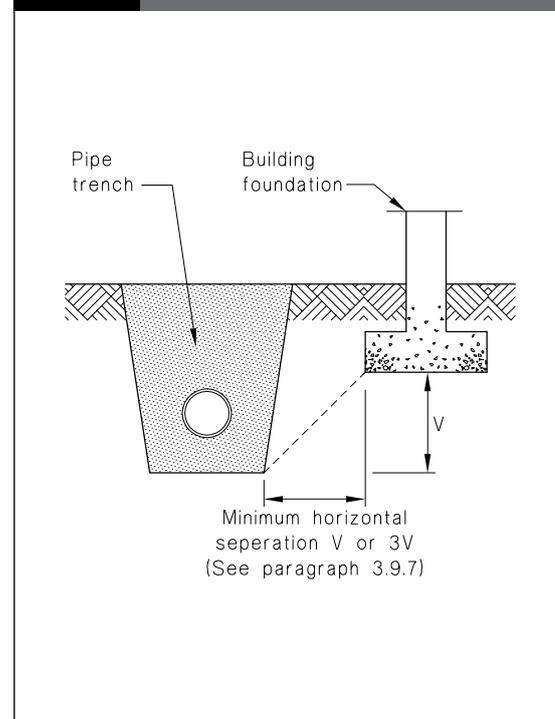
**3.9.8** AS/NZS 2032, AS/NZS 2566.1 and AS/NZS 2566.2 provide other acceptable solutions.

Amend 7  
Sep 2010

**COMMENT:**

These provisions may exceed New Zealand Building Code minimum requirements.

**Figure 14:** Relationship of Pipe Trench to Building Foundation  
Paragraph 3.9.7



Amend 1  
Sep 1993

**4.0 Downpipes**

**4.1 Materials**

**4.1.1** Materials for downpipes shall comply with Table 4.

PVC-U	AS/NZS 1260 or AS/NZS 1254
Galvanised steel	AS 1397
Copper	BS EN 1172
Aluminium	AS/NZS 1734
Stainless steel	NZS/BS 970
Zinc aluminium	AS 1397

Amend 1  
Sep 1993  
Amend 2  
Aug 1994  
Amend 8  
Oct 2011

Amend 7  
Sep 2010

**4.1.2** Downpipes, gutters, roofing, fastenings and all adjoining components shall be of the same or a compatible material to eliminate the risk of galvanic corrosion.

**4.2 Sizing of downpipes**

**4.2.1** Downpipes sized using Table 5 are acceptable. Other downpipes are acceptable provided their cross-sectional area is no less than that required by Table 5, and they permit passage of a 50 mm diameter sphere.

Downpipe size (mm) (minimum internal sizes)	Roof pitch			
	0-25°	25-35°	35-45°	45-55°
<b>Plan area of roof served by the downpipe (m<sup>2</sup>)</b>				
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 x 50 rectangular	60	50	40	35
100 x 50 rectangular	100	80	70	60
75 x 75 rectangular	110	90	80	65
100 x 75 rectangular	150	120	105	90

Amend 1  
Sep 1993

Amend 5  
Jul 2001

Amend 2  
Aug 1994

Amend 2  
Aug 1994

Amend 1  
Sep 1993

Amend 2  
Aug 1994

**4.3 Installation of downpipes**

**4.3.1** Where thermal movement of downpipes cannot be accommodated by movement of the guttering, expansion joints shall be incorporated.

**4.3.2** All internal downpipes shall withstand without leakage, a water test with an applied head of 1.5 m of water, or a high pressure air test as described in E1/MM1 Paragraph 8.3.

**5.0 Roof Gutters**

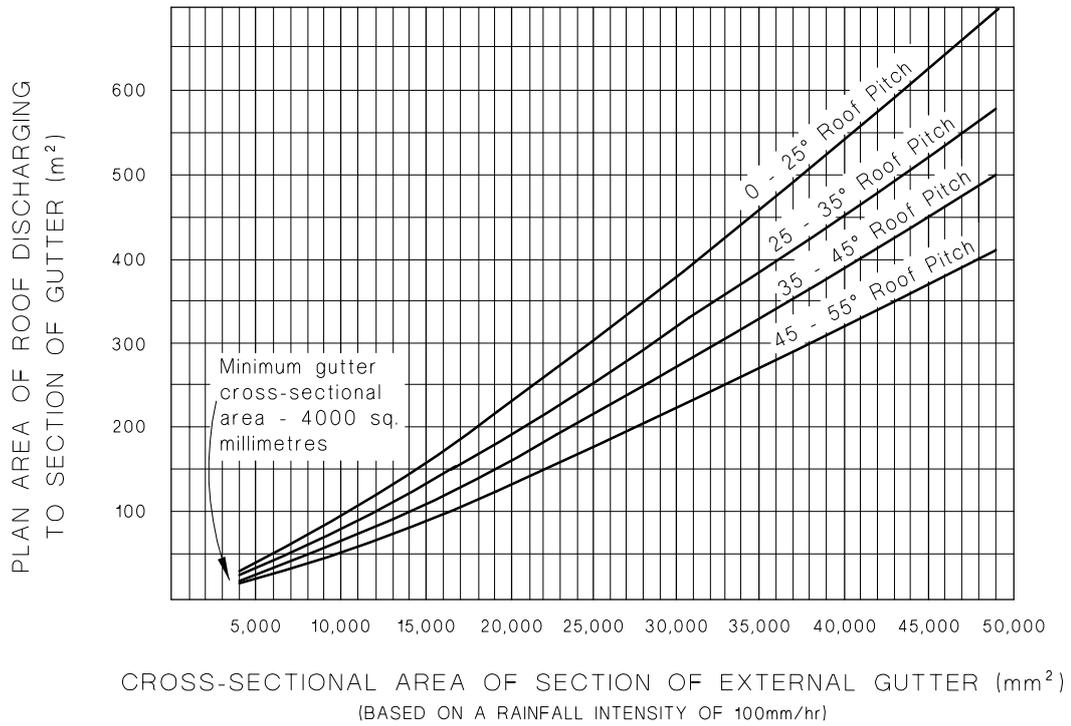
**5.1 Size of roof gutters**

**5.1.1** Roof gutters shall discharge to downpipes that are sized as given in Paragraph 4.2.

**5.1.2** Any gutter under consideration shall be divided into sections and each section shall be sized. A section shall comprise the length of gutter between a downpipe and the adjacent high point on one side only of that downpipe. Each section of gutter shall have a cross-sectional area of no less than that determined from Figure 15 or Figure 16 (depending on whether the gutter is external or internal), and increased where required in accordance with Paragraph 5.1.3.

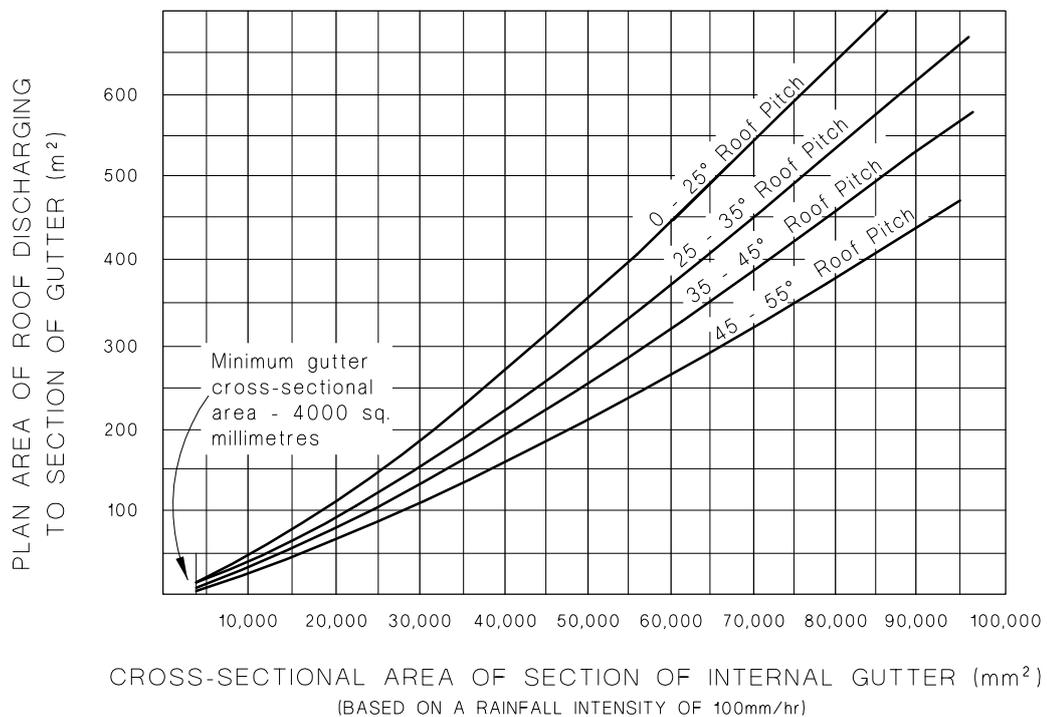
**5.1.3** Figures 15 and 16 are based on a rainfall intensity "I" of 100 mm/hr. Where "I" exceeds 100 mm/hr the required gutter size shall be increased by taking the value read from the figures and multiplying it by the ratio of "I"/100. Paragraph 3.2.2 describes how to determine the value of "I".

**Figure 15: Cross-sectional Area of External Gutter**  
Paragraphs 5.1.2 and 5.1.3



Amend 1  
Sep 1993

**Figure 16: Cross-sectional Area of Internal Gutter**  
Paragraphs 5.1.2 and 5.1.3



Erratum 1  
Sep 2010  
Amend 1  
Sep 1993

Amend 1  
Sep 1993

**5.1.4** In no case shall the cross-sectional area of any gutter be less than 4000 mm<sup>2</sup>.

**5.2 Materials**

**5.2.1** Roof gutter materials shall comply with the standards stated in Table 6.

**COMMENT:**

Proprietary membrane systems using bitumen, rubber or epoxy resins may also be acceptable.

**Table 7: Thermal Expansion of 5 m length over 50°C**  
Paragraph 5.4.1

Material	Expansion (mm)
PVC-U	17.5
Zinc	5.0
Galvanised steel	2.5
Copper	4.5
Aluminium	5.8
Stainless steel	3.8

Amend 7  
Sep 2010

**Table 6: Acceptable Material Standards for Roof Gutters**  
Paragraph 5.2.1

PVC-U	AS 1273
Galvanised steel	AS 1397
Copper	BS 2870
Aluminium	AS/NZS 1734
Stainless steel	NZS/BS 970
Zinc aluminium	AS 1397

Amend 2  
Aug 1994

Amend 7  
Sep 2010

**5.5 Overflow outlets**

**5.5.1** All internal gutters shall be fitted with overflow outlets which drain to the exterior of the *building*. The top of the outlet shall be set at least 50 mm below the top of the gutter. The cross-sectional area of the outlet shall be no less than the cross-sectional area of the downpipes (determined by Paragraph 4.2.1) serving the gutter.

**COMMENT:**

An internal gutter overflow outlet should be located to give an early, conspicuous warning to the *building* occupier that maintenance is required.

**5.5.2** External gutters do not require overflow outlets but shall be installed to ensure any overflow from the gutter spills to the outside of the *building*.

**COMMENT:**

Although specific overflow provision is not necessary it is nevertheless important to ensure any overflowing water cannot track back inside the *building* where it could cause problems.

Amend 9  
Feb 2014

**5.3 Gradients**

**5.3.1** Roof gutters shall fall to an outlet.

**5.4 Thermal movement**

**5.4.1** Allowance shall be made for the thermal expansion and contraction of gutters. Table 7 shows for different materials the change in length of 5.0 m of guttering when subjected to a 50°C change in temperature.

**COMMENT:**

The provision of expansion joints is particularly important where both ends of a gutter are restrained against movement, and on PVC-U guttering due to its relatively high rate of thermal expansion.

Amend 7  
Sep 2010